



Construction Specifications
for
Water and Sanitary Sewer

2ND EDITION



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Preface

These Technical Specifications have been prepared to provide engineering and construction data and recommendations applicable to the design and construction of water and wastewater utilities designed and constructed with the intent of ultimate ownership being conveyed to Madison Utilities.



Division 00

00 01 11 – Policy and Procedures

PART 1 - GENERAL

1.1 SUMMARY

- A. The purpose of this document is to assemble in one volume the Policies and Procedures, Standard Specifications, and Standard Details that have been adopted by the Water & Wastewater Board of the City of Madison doing business as Madison Utilities (MU). These Specifications have been adopted to protect the public health, safety, and welfare; and to promote uniformity in the development of MU facilities.
- B. All materials, construction, installation, testing, and project coordination shall be furnished, performed, conducted, and completed in accordance with the most currently adopted revision of the "*Construction Specifications For Water and Sanitary Sewer*" for Madison Utilities. Any material, construction, installation, testing, or project coordination being performed on, or attaching to, MU facilities, that is not currently covered or identified within the previously mentioned specifications, shall be approved by MU prior to installation.
- C. All referenced specifications contained herein, from AWWA, ASTM, ANSI, ASME, etc. shall be representative of the latest version of said specification, whether or not the numeric value does not show as the latest version.
- D. All sanitary sewer and water facilities which will be dedicated to MU's system shall be designed in accordance with all criteria established herein. Also, all materials, construction, and testing of such facilities shall be in accordance with all Sections of this manual, regardless of whether such facilities will be dedicated to MU, and, therefore, shall be subject to inspection by MU as it deems necessary to ensure the requirements contained herein are met.
- E. The work included in these Specifications shall consist of furnishing all materials and equipment and performing all labor and services necessary to install the sanitary sewers and appurtenances completely, as shown on the Plans and as specified herein. It shall include all preparation of the site; excavation and backfill; any necessary shoring and bracing, pumping, drilling, blasting, and pipe cushion; construction of sewers, manholes and inlets; infiltration testing; disposal of surplus materials; maintenance during construction; concrete work; replacing pavements; clean up and revegetation; and all other incidental work necessary to provide complete operating sewer lines.
- F. Any facilities not specifically covered herein shall be presented to MU for its approval. It is recommended MU be contacted prior to detailed design to discuss specific requirements.



- G. Any Contractor and/or Developer performing work on MU facilities or on MU property shall be solely responsible for the safety and wellbeing of personnel under their direction, control, or under the direction or control of their subcontractor.
- H. Any contractor and/or Developer performing work on MU facilities or on MU property shall be solely responsible for maintaining proper and acceptable best management practices to reduce or eliminate erosion and sediment loss from the project area, as well as apply for and maintain any required environmental permits for the project.
- I. The Board has approved the latest revision to the “*Construction Specifications for Water and Sanitary Sewer*” manual.
- J. MU reserves the right to reject any layout or design of any water mains or sanitary sewers within its service areas and will provide a letter of reason for rejection.
- K. Do not interrupt existing utilities without permission and without making prior arrangements to provide temporary utility services.
 - 1. Notify MU’s Representative and MU’s Engineer not less than forty-eight (48) hours in advance of proposed utility interruption.
 - 2. Do not proceed without written permission from MU.
- L. USE OF DOMESTIC STEEL
 - 1. Attention is drawn to ALA.CODE §39-3-4 (1975), requiring the use of steel produced within the United States for municipal construction projects when specifications in the construction contract require the use of steel and do not limit its supply to a sole source. This provision is subject to waiver if the procurement of domestic steel products becomes impractical as a result of national emergency, national strike, or other causes. Violations of the use of domestic steel requirements shall result in a downward adjustment in the Contract price to equal any savings or benefit to the Contractor.

1.2 VARIANCE

- A. Under special conditions beyond the control of parties involved, MU may vary from the specifications herein. The General Manager of MU shall authorize any variance in writing. The Board shall be notified of any variance in writing.
 - 1. Such special condition(s) must be shown to be real and unalterable to MU by means of drawings, maps, documents, calculations, photographs, and if necessary certified by a professional Engineer or Professional Land Surveyor licensed in the State of Alabama to practice Engineering or Land Surveying, that the current specification will not work in the existing and current situation in question.

1.3 AMENDMENTS TO THE SPECIFICATIONS

- A. These Specifications are subject to change, and interested parties are advised to check with MU in the event there are any questions concerning the status of the published



document. Updates to these Specifications are available at the office of MU, or on the website at www.madisonutilities.org/business.

- B. MU shall amend the *Construction Specifications for Water and Sanitary Sewer, 2nd Edition*, as determined necessary to improve the systems' performance and integrity. The Board shall approve amendments in writing.

1.4 CONTRACTOR DOCUMENT SUBMITTAL

- A. All plans and specifications, not produced by MU, shall be stamped by a Registered Professional Engineer licensed to practice engineering in the State of Alabama.
- B. Concurrent with plan submittal, the Design Engineer shall provide a completed Water Distribution/Sanitary Sewer Addition Submittal form. The Water Distribution/Sanitary Sewer Addition Submittal form is included in Section 01 70 00.10.

1.5 TECHNICAL REVIEW

- A. Proposed water distribution system and sanitary sewer system plans shall be reviewed by MU's Representative and MU's Engineer, for technical adequacy and conformance to applicable requirements to determine that the systems are suitable for construction. If plans are not approved by MU, the proposed systems shall not be allowed to connect to existing MU infrastructure.
- B. Upon receipt of a proposed development, MU reserves the right to perform a feasibility study to determine whether the existing MU water distribution system, including booster stations and/or sanitary sewer system, including lift stations, has sufficient capacity. If deemed necessary the following review would need to include:

Water Distribution System

1. The latest 12 months of reported production from the system shall be examined to determine an average monthly production rate. A proposed development, whose supply requirement would cause the system to exceed the Alabama Department of Environmental Management permitted rate, or would adversely affect the system, shall not be connected to MU system.
2. Pressure and flow from the contributing water distribution system shall be examined to determine whether the additional supply requirement will adversely affect the surrounding system. A proposed development, whose supply requirement would adversely affect the surrounding system, shall not be connected to MU system.
3. Exceptions may be made by the Board.

Sanitary Sewer System

1. The latest 12 months of reported discharge from the receiving WWTP shall be examined to determine an average monthly flow rate. A proposed development, whose discharge would cause the receiving WWTP to exceed the ADEM permitted flow rate, shall not be connected to MU system.



2. A capacity study shall be performed to determine whether the discharge from the development would exceed the capacity of the existing receiving sewers. A proposed development, whose discharge would exceed the capacity of the receiving sewers, shall not be connected to MU system.
 3. Exceptions may be made by the Board.
- C. MU review comments shall be marked on Technical Review Checklists and noted on development plans in the color red (Red Line Comments). Technical Review Checklists used during MU review are included in Section 01 70 00.
- D. PLAN PROCESSING – City of Madison Technical Review Process
1. All developments containing extensions to existing infrastructure to be dedicated to MU will be presented to the Board for preliminary approval after plans have been received and vetted through the Technical Review process.
 2. Submission of Construction Plans Required. All plans for the development of land (as defined by the Subdivision Regulations of the City of Madison) within the service area of MU, whether residential, commercial, or industrial, and for which water or sewer services shall be required, must be submitted for the approval of MU in accordance with the City of Madison Technical Review Process. Any developments that are exempt from the City of Madison Technical Review Process should follow the steps outlined in Section 00 01 11, Paragraph 1.5.E.
 3. The Design Engineer will submit complete plans to the Secretary of the Planning Commission as required according to the City of Madison Subdivision Regulations.
 4. The Planning Department will forward one (1) set of plans to MU for review.
 5. MU will review all plans for compliance to the specifications established by MU, and return them to the Planning Department for Technical Review at the City.
 6. The Technical Review Committee will meet to discuss all plans in detail and applicants will be given the opportunity to discuss any issues discovered during staff review. Applicants will be given a list of corrections that are required in order for the project to comply with City regulations and ordinances, as well as MU Construction Specifications.
 7. The issues discussed in the Technical Review meetings must be resolved and corrected plans must be submitted 7 days after the Technical Review meeting. The applicant must submit the appropriate number of complete sets of the corrected plans to the Secretary of the Planning Commission.
 8. The Technical Review Committee will meet again, to verify that all changes have been made. Any remaining comments must be corrected before the final set of plans may be submitted for signatures.
 9. After all corrections have been made, one set of plans must be submitted to the Secretary of the Planning Commission. This set will then be forwarded to MU for signatures.
 10. MU's Representative along with MU's Engineer will submit final proposed plans to the General Manager for signature.
 11. Once signed, MU will return the plans to the Planning Department for presentation to the Planning Commission and/or City Council. The Planning Department will then return one (1) copy of the Final for Development plans and



- one digital PDF version of the Final for Development plans.
12. MU will notify the Design Engineer and the Developer of the amount of fees, if required.
13. The MU Engineering Department will retain the electronic set of drawings (Set 1), and will forward the printed, approved construction drawings to the Inspector (Set 2).

E. NON-CITY OF MADISON DEVELOPMENTS

1. In this specification it is required that when the Developer or Design Engineer are presenting plans for approval, that the following must be submitted.
 - a. Two (2) sets of the plans that are to be reviewed
 - b. The Construction Plans Review fee of four hundred-fifty (450.00) dollars
 - c. Water and Sewer Flow Data
2. The following will be the schedule of submittals and subsequent review meeting(s).
 - a. Submittal Deadline – 4:00 p.m. on the 3rd Tuesday of every month
 - b. Plans Review Period – 7 days, ending on the 4th Tuesday of every month
 - 1) The following are the options that MU has available after the plans have been submitted the review fee paid and the plans have been reviewed.
 - a) List the corrections needed and return one (1) set of the plans to the Design Engineer or Developer. This may involve a request in writing or email for further information from the Design Engineer or Developer
 - b) Reject the plans and request they be resubmitted, if the plans are not ready for review.
 - c) Approve the plans as they are, with written approval to be provided to the Design Engineer or Developer
 - c. Review Meeting – 3 days later (the 4th Friday of every month)
 - 1) Submit 2 sets of corrected plans at the meeting
 - 2) If the plans are correct and all comments have been addressed MU will sign the plans at the conclusion of the review meeting
 - 3) If there are still changes to be made, see Item 4 below
 - d. Second Review Meeting, if necessary
 - 1) 4 days after the review meeting the Developer or the Design Engineer will need to submit a 3rd set of plans, along with the four hundred-fifty (450.00) dollar review fee.
 - 2) MU will have 7 days to review the plans
 - a) If the plans are correct and all comments have been addressed, then MU will sign the plans and return them to the Developer or the Design Engineer
 - b) If the comments have not been addressed, then MU will communicate in writing or via email with the Developer or Design Engineer and let inform them that they will



need to resubmit at the next Submittal Meeting.

3. All plan submittals will be received the Cashier's Area of the front office. A receipt slip for the plans will be completed as well as a receipt for the fees. Fees must be paid at the time of submittal or the plans will not be accepted.
4. If the changes to the plans are the results of the MU Representative requesting a change for the betterment of a portion of the plans that met current MU specification requirements, then there would not be a fee for resubmittal and a secondary review.
5. These procedures will not curtail the design improvements requested by the MU Representatives, if there is an overall more efficient or effective design for the project that benefits MU presently or for future considerations.

F. PERIOD OF PLAN APPROVAL

1. The allowable timeframe for approved water distribution system and/or sanitary sewer system plans to begin construction shall be twelve (12) months. Approved plans that are not initiated or are inactive for a twelve (12) month period, after approval, shall be submitted to the Board for invalidation. Should an approved plan be invalidated, the construction drawings shall be resubmitted to the City of Madison Planning Department for re-review through the Technical Review process.

1.6 FEES

- A. Upon receipt of approved construction ready drawings, MU will create a Fee Sheet based on the plans and the current Fee Schedule as adopted by MU.
- B. All fees must be paid prior to scheduling a pre-construction meeting.

1.7 PRECONSTRUCTION MEETING

- A. Prior to construction beginning, a meeting shall be requested with MU's Inspector and Engineer by the Developer, the Design Engineer, and the Contractor(s).
- B. The agenda will be provided by MU, but will contain similar pertinent information as shown below:
 1. Designation of personnel representing parties.
 2. Minimum Required Inspection Points
 - a. Water
 - b. Sewer
 3. Testing Requirements
 - a. Water
 - b. Sewer
 4. Commercial or Industrial Sites Testing
 - a. Water
 - b. Sewer
 5. Requirement for CO or Dedication/Acceptance



- 6. Other Issues or Concerns specific to this Project
- 7. Disclaimers
- 8. Required Bonds

1.8 PLAT ENDORSEMENT OR SITE PLAN APPROVAL WITHOUT DEDICATION

- A. All Plats submitted for approval to MU, without dedication, in addition to all other endorsements required by the Planning Commission of the City of Madison shall include the following endorsement:

Approval of Madison Utilities

The undersigned, a duly authorized representative of Madison Utilities hereby approves the within plat for the recording of same in the Probate Office of the county in which the property is situated, this the ____ day of _____, ____.

WATER & WASTEWATER BOARD OF THE CITY OF
MADISON DOING BUSINESS AS MADISON UTILITIES

By: _____


Title: _____



1.9 SITE/CONSTRUCTION PLAN APPROVAL WITH DEDICATION

- A. Plan Approval Stamp, shown below, is required on construction plans that are submitted for approval.

WASTEWATER COLLECTION/WATER DISTRIBUTION SYSTEM
REQUIRED SIGNATURES FOR CONSTRUCTION PLANS:

 <p>PROFESSIONAL ENGINEER SEAL</p>	SUBMITTED FOR APPROVAL:	<u>MADISON UTILITIES:</u> APPROVED:
	<div style="border: 1px solid black; width: 200px; height: 30px; margin: 0 auto;"></div> ENGINEER	<div style="border: 1px solid black; width: 200px; height: 30px; margin: 0 auto;"></div> MU ENGINEER
	<div style="border: 1px solid black; width: 200px; height: 30px; margin: 0 auto;"></div> DEVELOPER	<div style="border: 1px solid black; width: 200px; height: 30px; margin: 0 auto;"></div> GENERAL MANAGER

1.10 EASEMENTS AND DEEDED PROPERTY

- A. Components of water distribution systems and sanitary sewer systems, to be owned by MU, shall be situated within streets' rights-of-way or dedicated easements.
- B. The following water distribution system and sanitary sewer system components, to be owned by MU, shall be situated within an easement that is granted to MU, when a street right-of-way is not available.
 - 1. Force main
 - 2. Water main and all components
 - 3. Water meter/check valve assembly
 - 4. Fire hydrant
 - 5. Sewer main
 - 6. Sewer outfall
 - 7. Manhole
 - 8. And any other components required by MU and these Specifications
- C. An easement shall not encroach into or be encumbered by a structure's foundation and shall be clear of all obstructions not associated with the water and/or sanitary sewer system including but not limited to construction debris, retaining walls, and trees.
- D. Property developed and occupied by system appurtenances and/or an access road, to be owned by MU, shall be platted and deeded to MU.



1.11 ON-SITE EASEMENT

- A. "On-site" easements are those easements falling within the boundaries of the current phase of the development that are shown on the plat and are recorded through the process of recording the final plat.
- B. Developer shall grant to MU, the exclusive right to construct, reconstruct, operate, maintain, repair, replace, improve, alter, remove, relocate, and inspect water distribution systems and/or sanitary sewer systems that are situated over, across and under the land wherein the water distribution systems and/or sanitary sewer systems lie on the Developer's property.

1.12 OFF-SITE EASEMENT

- A. "Off-site" easements are those easements falling outside the boundaries of the current phase of the development and shall be provided and recorded by the Developer for each property owner. Easements through property owned by the developer, including water and sewer lines that will be included in later phases of the same project, must be treated as routine off-site easements.
- B. Off-site easements shall be negotiated and acquired by the Developer with the property owner.
- C. Construction of the off-site water distribution systems and/or sanitary sewer systems shall not begin until all off-site easements for system completion are acquired, recorded, and received by MU.

1.13 EASEMENT SIZE

- A. The minimum width of a permanent on-site/off-site easement associated with water distribution system components shall be twenty (20) feet.
- B. The minimum width of a permanent on-site/off-site easement associated with sanitary sewer system components shall be thirty (30) feet. For any sanitary sewer that has the potential to be twenty (20) feet or deeper the Design Engineer and the Developer/Owner will need to discuss with MU's Engineer to determine the width of the proposed easement.
- C. Residential water meters shall be placed in an easement of sufficient size for personnel to maintain them. The easements shall be contiguous to existing easement or ROW as approved by the MU Engineer.
- D. Easement width or size may be increased or decreased at the discretion of the General Manager.

1.14 DEEDED PROPERTY

- A. The minimum size of deeded property associated with a lift station shall be seventy (70)



feet by seventy (70) feet.

- B. The minimum width of deeded property associated with an access road shall be twenty (20) feet.
- C. The size or width of deeded property may be increased or decreased at the discretion of the General Manager.
- D. If applicable, all property and easement deeds shall be turned over to MU. All property and easement deeds shall be recorded and submitted to MU prior to beginning construction or water/sewer service will NOT be rendered.
- E. All proposed easements and property to be deeded to MU shall be approved by MU Legal Council before acceptance.

1.15 CONSTRUCTION/INSTALLATION

- A. The installation of water distribution systems and sanitary sewer systems shall be in accordance with the approved plans and specifications herein.
- B. A current set of plans signed and approved by MU shall be present on the job site whenever work is being performed on the water distribution system and/or sanitary sewer system.

1.16 MU CONSTRUCTION/INSTALLATION

- A. MU may perform the following system components installation at a cost to the Developer/Property Owner.
 - 1. Supply materials and labor to install water meter and check valve assemblies from 5/8 inch in diameter through two (2) inches in diameter.
 - 2. Supply labor to tap water main.
 - 3. Supply materials and labor to install a sewer main tap for a private individual
- B. The installation of residential water service lines, as part of developing a residential subdivision, will be performed by the Developer's Utility Contractor with approval by MU.

1.17 INSPECTION

- A. The MU Inspector shall inspect water distribution systems and sanitary sewer systems during all phases of construction to ensure the systems are being constructed in accordance with the plans approved by MU and specifications herein.
- B. The Developer shall provide the MU Inspector or MU Engineer a 48-hour notice prior to commencing construction on a water distribution system and/or sanitary sewer system.
- C. The Developer/Utility Contractor shall, at all times, permit and facilitate inspection of work by an MU Representative. The presence of an MU Representative on the site of



work shall not be construed to, in any manner, relieve the Developer/Utility Contractor of their responsibility for strict compliance with the approved plans and specifications herein.

- D. MU Inspector shall not make major design changes or modify the approved water distribution and/or sanitary sewer system plans or specifications herein without written approval from the MU Engineer.
- E. MU Inspector shall inform the Developer/Utility Contractor when construction is deficient from the approved plans and specifications herein. Deficiencies shall be relayed onsite to the Contractor and/or Developer and noted in the MU Inspector's Log Book. If needed a punch list will be generated by the MU Inspector. Deficiencies shall be addressed in a timely manner as determined by MU Inspector.
- F. The MU Inspector shall have unimpeded access to perform all inspections.
- G. Deficiencies not addressed in a timely manner shall be justification for MU to stop work on a project. The MU Engineer shall issue a Stop Work Order to the Developer/Utility Contractor in writing. Continued work on a project after being issued a Stop Work Order shall be justification for disconnecting or disallowing service.

1.18 TESTING

- A. Water distribution systems and sanitary sewer systems shall be subjected to testing as detailed in Section 33 01 12 and Section 33 05 05.30. Testing shall be performed at the expense of the developer.
- B. MU shall be given a 48-hour notice prior to any testing. An MU Representative shall witness all testing.
- C. Testing for the compressive strength of concrete and density of compacted soil shall be performed at the expense of the Developer by licensed and qualified geotechnical and material testing companies. Materials not meeting required specification shall be removed, replaced, and retested for compliance at the expense of the Developer or Contractor.
- D. Results of tests performed by testing companies shall be provided to the MU Representative. Testing forms used by MU are included in Section 01 70 00.72.

1.19 CONNECTING TO MU SYSTEMS

- A. Provided the Developer has complied with the terms of these policies and procedures and the installed water distribution system and/or sanitary sewer system is in accordance with the approved plans and specifications herein, MU shall allow the Developer or Contractor to connect the new system(s) into MU system(s).
- B. All new conveyances of wastewater to and/or from an approved or unapproved sanitary sewer system by means of pumping and hauling shall be approved by the MU



Representative.

1.20 CONNECTION TO EXISTING SYSTEMS

- A. MU Representative shall be notified at least 48-hours in advance of connecting to MU systems.
- B. An MU Representative shall be present during connection of the Developer's systems to MU systems. Prior to installation, an MU Representative shall approve all materials supplied by the Developer to be used in making the connection.
- C. Upon completing a water distribution and/or sanitary sewer connection, the Developer's systems shall be valved-off and/or immediately plugged, respectively, until Final Acceptance. For sanitary sewer systems MU will require a bulkhead be built on the sanitary sewer systems that are not currently required to be kept in service. The bulkhead will remain in place until the official testing with MU Representative has been completed.
- D. If an unauthorized connection or connection without the presence of MU Representative be made to MU systems, the Developer shall be subject to refusal of service. The Developer shall expose and thoroughly clean all piping and components of the connection for inspection by MU. Noncompliant connections and/or damage to MU system shall be repaired/ replaced in conformance with the approved plans and specifications herein at the expense of the Developer.

1.21 SYSTEM ACCEPTANCE

- A. Acceptance of the Developer's water distribution system and/or sanitary sewer system shall be considered by MU at such time as the Developer has met all terms and conditions of the specifications herein.

1.22 FINAL INSPECTION

- A. Prior to final acceptance, an MU Representative shall perform a final inspection of the water distribution system and/or sanitary sewer system after all pavements are installed. The final inspection shall determine the proper installation of valves, hydrants, and meter boxes, the integrity of manholes, and the presence of debris in sewers, curb markings, and lateral stand pipes. Deficiencies encountered shall be immediately addressed and an additional final inspection shall be required.

1.23 WARRANTY

- A. The Developer shall warrant the development's water distribution system and/or sanitary sewer system and hold MU harmless against all costs, expenses and losses, including, without limitation, incidental and consequential damages, resulting from any defects in the Developer's water distribution system and/or sanitary sewer system, including without limitation, defects in material and workmanship, which are discovered or arise within a minimum period of eighteen (18) months for water and eighteen (18) months for



sanitary sewer beginning on the date of final acceptance by MU. An extended warranty period may be required on certain material requirements and/or construction standards as indicated in these Specifications.

- B. Performance Bond for Water and Sewer Improvements. In lieu of completing all of the water and sewer improvements in a development prior to Final Plat approval, a developer may provide MU with a bond whereby the developer agrees to complete the improvements pursuant to a Performance Bond for Water and Sewer Improvements. MU may accept cash or a letter of credit (good for not less than twelve (12) months for water or twelve (12) months for sewer). The amount of the bond shall be estimated by the developer and then fixed by the MU Engineer in an amount equal to at least 110% of the cost of the uncompleted improvements provided; however, when water and sewer improvements have been substantially completed but remaining subdivision improvements are incomplete, a performance bond in an amount of not less than 15% of the total cost of the water and sewer improvements must be posted. The water and sewer performance bond must be posted prior to Final Plat approval by the Madison Planning Commission.

Improvements must be completed within one (1) year of Final Plat approval unless this timeframe is extended by agreement of MU.

The responsibility for promptly seeking an extension of time to complete improvements rests entirely with the developer. Failure to seek and obtain an extension (for a period not to exceed one (1) year) shall void the approval of MU. Any extension granted by MU will be granted only upon receipt of a new bond with sufficient security and will be contingent upon extension for the same period of time by the Planning Commission.

In the event of failure by the developer to comply with conditions of the bond, MU may declare the security for the bond forfeited and use the receipts of such security to complete the improvements. Unused portions of the security, if any, will be returned as appropriate. MU's recovery shall not be limited to the amount of the bond if the costs of completing the developer's agreement exceeds said amount.

- C. Maintenance Agreement for Water and Sewer Improvements. At the time of dedication and completion of subdivision improvements, including the water and sewer improvements, the developer shall apply for acceptance of the improvements into the water distribution and sanitary sewer systems of MU on a form to be supplied by MU. The application must be accompanied by the following:

1. A statement signed by the developer and their consulting engineer, including a certification that the required water and sewer improvements are complete and the total construction costs of said improvements, a certification that the improvements were constructed in accordance with standard specifications of MU, and that they have successfully passed all testing required by MU. The statement shall also include a certification that the developer and their engineer know of no defects from any cause in the improvements, and that the improvements are free and clear from any encumbrance or lien;
2. An agreement properly dedicating said improvements to MU;



3. One (1) copy of as-built drawings of the improvement,
 4. One (1) digital copy of the as-built drawings situated utilizing an accurate and correct State Plain Coordinate system (DWG and/or DGN format),
 5. A Water Improvements Maintenance Bond, together with sufficient security deemed acceptable by MU (good for not less than 19 months).
 6. A Sewer Improvements Maintenance Bond, together with sufficient security deemed acceptable by MU (good for not less than 19 months).
- D. The amount of this bond shall be fixed by the MU Engineer in an amount not less than 15% of the cost of the improvements. The Maintenance Agreement shall secure MU against defects or damage to the improvements arising out of defective or inferior materials or defective or negligent workmanship arising, occurring, or becoming apparent within the specified timeframe from the date of acceptance of the improvements. Inspection or acceptance of the water and sewer improvements by MU shall in no way affect the developer's obligation under the bond.
- E. The application for acceptance shall be filed with MU no later than (10) business days prior to the next scheduled meeting of the Board at which acceptance will be requested.

1.24 FINAL ACCEPTANCE

- A. Final acceptance of the Developer's water distribution system and/or sanitary sewer system by MU shall be written, signed, and dated by the General Manager.
- B. Upon issuance of Final Acceptance Letter,
 1. The Developer's new system(s) may be opened to MU system(s).
- C. An MU Representative will turn the water on as soon as the bacteriological sample results are received and show that the new system has passed and met the requirements.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION

00 01 12 – Design Requirements

PART 1 - GENERAL

1.1 SUMMARY

- A. The design and plan preparation of water distribution systems and sanitary sewer systems shall conform to the specifications and details herein.
- B. The following actions are required to be performed by an Alabama Licensed Professional Engineer.
 - 1. Water distribution system and/or gravity flow sanitary sewer system design and plan preparation for a residential subdivision or parts thereof on a Developer's property.
 - 2. Water distribution system and/or gravity flow sanitary sewer system design and plan preparation for property off-site of a Developer's property.
 - 3. Water distribution system and/or gravity flow sanitary sewer system design and plan preparation for commercial/industrial property.
 - 4. Force main and sanitary sewer lift station design and plan preparation.
- C. The professional performing the design and preparing the plans shall stamp each plan sheet with their professional engineering stamp and sign and date their name across the stamp.

1.2 REFERENCE DOCUMENTS AND STANDARD

- A. General methods of design and construction shall conform to the specifications herein and the following. When Specifications conflict with one another, the General Manager shall determine the applicable standard.
- B. ANSI
 - A21.10 Standard for Gray-Iron Ductile-Iron Fittings, 2-inch through 48-inch for Water and Other Liquids
 - A21.11 Standard for Rubber Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings
 - A21.15 Standard for Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flanges
 - A21.50 Standard for Thickness Design of Ductile-Iron Pipe.
 - A21.51 Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids
- C. ASTM
 - A27/A27M-19 Mild to Medium Strength Carbon Steel Castings for General Application Specification for/DOD Adopted
 - A82/A82M-07 Cold-Drawn Steel Wire for Concrete Reinforcement, Spec.
For
 - A123/A123M-17 Zinc (Hot-Galvanized) Coatings on Products



- Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip, Spec. for
- A153/A153M-16A Zinc Coating (Hot-Dip) on Iron and Steel Hardware, Specification for
 - A167-99 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip, Spec. For/DOD Adopted
 - A184/A184M Fabricated Deformed Steel Bars Mats for Concrete Reinforcement, Spec. For
 - A185/A185M-07 Welded Steel Wire Fabric for Concrete Reinforcement, Spec. For
 - A283 Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes, and Bars, Spec. For/DOD Adopted
 - A307-14E1 Carbon Steel Externally Threaded Standard Fasteners, Spec. For
 - A449 Quenched and Tempered Steel Bolts and Studs, Spec. For
 - A563 Carbon and Alloy Steel Nuts, Spec. For
 - A570 Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality, Spec. For/DOD Adopted
 - A615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement Spec. For/DOD Adopted
 - A616 Rail-Steel Deformed and Plain Bars For Concrete Reinforcement Spec. For DOD/Adopted
 - A617 Axle-Steel Deformed and Plain Bars for Concrete Reinforcement Spec. For/DOD Adopted
 - A746 Ductile Iron Gravity Sewer Pipe, Spec. For
 - C31 Making and Curing Concrete Test Specimens in the Field, Method of
 - C33 Concrete Aggregates Spec. For
 - C39 Comprehensive Strength of Cylindrical Concrete Specimens, Test Method For
 - C42 Obtaining and Testing Drilled Cores and Sawed Beams Of Concrete, Method Of
 - C62 Building Brick (Solid Masonry Units made From Clay or Shale) Spec. For
 - C76 Reinforced Concrete, Culvert, Storm Drain And Sewer Pipe, Spec. For
 - C90 Hollow Load-Bearing Concrete Masonry Units, Spec. For/DOD Adopted
 - C94 Ready Mix Concrete
 - C109 Compressive Strengths of Hydraulic Cement Mortars (Using 2 in. or 5MM Cube Specimens), Test Method For Portland Cement, Spec. For
 - C150 Portland Cement, Spec. For
 - C172 Sampling Free Concrete, Method Of, DOD Adopted
 - C173 Air Content of Freshly Mixed Concrete by the Volumetric Method, Method of Test For
 - C216 Facing Brick (Solid Masonry Units Made From Clay or Shale),

- Spec. For
- C260 Air-Entraining Admixtures For Concrete Spec. For
- C309 Liquid Membrane-Forming Compounds For Curing Concrete Spec. For
- C443 Joints For Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
- C478 Precast Reinforced Concrete Manhole Sections Spec. For
- C494 Chemical Admixtures For Concrete Spec. For
- C497 Determining Physical Properties of Concrete Pipe (D-Load Test)
- C828 Low-Pressure Air Test of Vitrified Clay Pipe Lines (4 to 12 in.) Recm Practice For
- D698-12E2 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. Rammer and 12-in. Drop, Tests For
- D2657 Heat Joining of Polyolefin Pipe and Fittings, Practice For

- D. AWWA
 - C105/A21.5-18 Polyethylene Encasement for Gray and Ductile Cast Iron Piping for Water and Other Liquids
 - C115-11 Standard for Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flanges
 - C500-19 Metal-Seated Gate Valves for Water Supply Service
 - C502 Dry-Barrel Fire Hydrants
 - C504 Rubber-Seated Butterfly Valves
 - C515 Resilient Wedge Gate Valves, 3 in. through 12 in. NPS, for Water and Sewer Systems
 - C550 Protective Interior Coatings for Valves and Hydrants
 - C600-17 Installation of Ductile-Iron Water Mains and their Appurtenances
 - C601 Disinfecting Water Mains

1.3 PLAN REQUIREMENTS

- A. All Construction Plans must have a Title Sheet with certain required signatures, including an Alabama Professional Engineer's seal. The format for these signatures is illustrated in Section 00 01 11, Paragraph 1.8. The signatures for MU personnel indicate the following:

“Engineer”: Indicates review of Construction Plans for conformance with the Standard Construction Specifications, as well as hydraulic and flow-carrying capacity of the proposed water and sewer facilities.

“General Manager”: Indicates that the above-described procedures have been executed.

- B. The Title Sheet must contain a location map at a scale not smaller than 1"=1,000', the name of the project, and the name(s), addresses, and telephone numbers of the Developer(s). The Title sheet must also contain an index to all sheets, and the following statement in the lower right-hand corner:

“*Construction Specifications for Water and Sanitary Sewer*”, latest edition as adopted by Madison Utilities (MU), is hereby made a part of these Plans.



Contractor shall contact MU to schedule a pre-construction meeting prior to the start of any water or sewer construction.”

- C. Sanitary Sewer Construction Plans shall contain the following information:
1. Plan and profile of proposed sewer system, drawn at 1" = 50' or 1" = 30' horizontal and 1" = 10' or 1" = 5' vertical scales, with grades (%) indicated on each line segment and invert elevations shown at every manhole.
 2. Location, size, and material of all existing and proposed sewers, with locations of connections to other sewers and locations of service laterals.
 3. Direction of flow in each sewer line.
 4. Horizontal location of all manholes, other system features, and deflection angles at manholes.
 5. MU Construction details are made apart of each set of approved plans by the addition of the note from Paragraph 1.3B of this section. Therefore only construction details for items that are not represented in these Specifications need to be shown in the plans. These additional details will need approval by the MU Engineer.
 6. North arrow on each Plan sheet.
 7. Alabama Professional Engineer's seal on each Plan sheet.
 8. Bench Mark elevation based on USGS horizontal datum NAD '83 and vertical datum NAVD '88.
 9. All topographic features, both existing and proposed.
 10. All property lines including subdivision block and lot numbers, rights-of-way, and required or utilized easements.
- D. Water Distribution Construction Plans shall contain the following information:
1. Plan of proposed water system, drawn at 1" = 50' or 1" = 30', with all critical (high and low) elevations and elevations every 500 feet indicated.
 2. Location, size, and material of all existing and proposed water mains in the subdivision, with locations of connections to other mains, service connections, valves, fire hydrants, and all other appurtenances indicated.
 3. MU Construction details are made apart of each set of approved plans by the addition of the note from Paragraph 1.3B of this section. Therefore only construction details for items that are not represented in these Specifications need to be shown in the plans. These additional details will need approval by the MU Engineer.
 4. North arrow on each Plan sheet.
 5. Alabama Professional Engineer's seal on each Plan sheet.
 6. All topographic features, both existing and proposed.
 7. All property lines including subdivision block and lot numbers, rights-of-way, and required or utilized easements.
- E. Water distribution and/or sanitary sewer system plan sheets shall be prepared and include as a minimum the information detailed on the Technical Review Checklist included in Section 01 70 00.20, 01 70 00.21, 01 70 00.22, or 01 70 00.24.
- F. Concurrent with the initial submittal of water distribution system and/or sanitary sewer



system plans to MU, a completed Water Distribution/Sanitary Sewer Addition Submittal form shall be submitted. MU plan review process shall not commence until the Water Distribution/Sanitary Sewer Addition Submittal form is received. The Water Distribution/Sanitary Sewer Addition Submittal form is included in Section 01 70 00.10.

1.4 MODIFICATION TO PLANS

- A. Water distribution system and/or sanitary sewer system plans approved by MU shall not be modified or deviated from during construction unless the MU Engineer approves modifications or deviations through an Engineering Change Order (ECO) plan submittal. Minor field changes may be approved by the authorized MU Representative.

1.5 AS-BUILT DRAWINGS

- A. As-Built Drawings of the installed water distribution system and/or sanitary sewer system shall be prepared and sealed in accordance with Paragraph 1.3 of this Section.
- B. As-Built Drawings shall be completed before release of the performance bond.
- C. As-Built Drawings shall show all applicable features such as; street names, right-of-way widths, related easements, lot number, location, size, and material of all water distribution system and/or sanitary sewer system components.
- D. As-Built Drawings shall be prepared using a survey performed by a Professional Land Surveyor licensed in the state of Alabama, that ties the development's water distribution system and/or sanitary sewer systems horizontally and vertically to the following state plane coordinate system or as amended by MU.

Horizontal Control: North American Datum 83/94.
Vertical Control: National Geodetic Vertical Data 88.
Grid Zone: Alabama East

- E. The following certification shall be included on the As-Built Drawings and signed by the Design Engineer:

"I certify that the water distribution system and/or sanitary sewer system depicted by this As-Built Drawing was constructed in accordance with the plans approved by MU. The information submitted on this As-Built Drawing is to the best of my knowledge and belief, true, accurate, and complete."

- F. The Developer's water distribution system and/or sanitary sewer system shall not be considered complete until the As-Built Drawings have been reviewed and approved by MU. Submit one (1) paper copy for review and approval. Once approved the developer will submit one (1) digital PDF version of the approved As-Built Drawings and one complete CAD file (DWG) to the MU Engineering Department.



00 01 12.10 – Water Distribution Design

PART 1 – GENERAL

1.1 WATER DISTRIBUTION

- A. All water mains shall be designed in accordance with these criteria, specifications contained in other sections, and the standards of the Alabama Department of Environmental Management (ADEM).
- B. The following section shall be used as a guideline for the design of water mains and service lines that will supply residential, apartment, commercial, and industrial complexes. MU may require some of these referenced complexes to have multiple connection points to existing water mains.
- C. Pressure regulators for individual services are not required by MU; however, they are recommended. They are not part of MU's system for operation and maintenance, and must be placed on the customer's side of the service. A pressure regulator is required by the plumber's code if the pressure is greater than 80 psi.
- D. The following certification shall be made by the Design Engineer and included with Water Distribution System construction notes:

"I certify that the proposed water distribution system has been designed in accordance with MU Specification document titled Construction Specifications for Water and Sanitary Sewer, Latest Edition including all amendments."

1.2 DESIGN USAGE RATES AND HYDRAULICS

- A. Indicate on plans whether structures require fire suppression systems.
- B. The following range of supply pressures shall be assumed when sizing system components. The minimum pressure is 35 psi, and the maximum pressure is 180 psi. A flow test should be scheduled for the location with the Madison Fire and Rescue, for a more exact number to design from nearest the approximate location of the site.
- C. All potential customers shall be provided a minimum of 20 psi residual pressure, at the design flow of:
$$Q = 20 (c)^{0.5}$$

where: Q = flow in gpm
c = total customers served, based on 2.50 persons/customer
- D. Maximum designed velocity shall be 10.0 ft. /sec.



PART 2 - PRODUCTS

2.1 WATER LINE MATERIAL AND SIZE

- A. All water mains shall be ductile iron pipe, Pressure Class 350, minimum. All fire lines three (3) inches or greater in diameter shall be ductile iron pipe, Pressure Class 350.
- B. Water mains shall have five (5) feet horizontal and two (2) feet vertical clearance from sanitary sewers, and shall have three (3) feet horizontal and twelve (12) inches vertical clearance from other underground structures.
- C. Water mains and associated fittings shall be ductile iron with a minimum diameter of eight (8) inches.
- D. Water main pipe assembly shall be push-on joint unless indicated otherwise.
- E. Water main pipe assembly in a bore casing shall be restrained joint unless indicated otherwise.
- F. Service line supplying a single fire hydrant within the right-of way shall be ductile iron with a minimum diameter of six (6) inches.
- G. Service line serving one (1) residential lot shall be Crosslinked Polyethylene (PEX) with a minimum diameter of one (1) inch.
- H. Service line serving two (2) residential meters per lot shall be Crosslinked Polyethylene (PEX) with a minimum diameter of one (1) inch. The service line shall be fitted with a tee. The service lines, coming from the tee, shall have a minimum diameter of three-quarter (3/4) inch.
- I. Service line serving commercial/industrial buildings shall be Crosslinked Polyethylene (PEX) with a minimum diameter of one (1) inch and a maximum diameter of three (3) inches or ductile iron sized as necessary for the demand.
- J. All service lines which cross under streets, highways, or any other paved roads must be placed inside Schedule 40 PVC casing pipe, three (3) inches minimum size, to two (2) feet behind the curb. Size of casing will vary, depending on size of the service line; all casing pipe shall have an inner diameter twice the size of the carrier pipe. All water service lines shall be 1" diameter, minimum.
- K. A property that will have more than two (2) one (1) inch taps must set the meters on a two (2) inch header in a vault with installed meter line setter or a resetter.
- L. Adequate thrust blocking shall be designed for the expected pressures, including the required test pressure, which is using the line pressure times one and one half (1.5) or a 150 psi minimum.
- M. A fire hydrant, flushing hydrant or valve, shall be required at the dead end of any water main to allow for flushing the main at 2.5 ft. /sec., minimum.

2.2 WATER METERS AND BACKFLOW PREVENTERS

- A. All water usage including fire and irrigation shall be metered and have backflow prevention devices. If a fire line has a private hydrant, a full size meter, as approved by



MU, will be required and be supplied with the fire vault and back flow device. The fire meters shall be Fire Meter (FM) rated.

- B. All water usage for multi-family and industrial units shall be metered using a single meter when possible. All commercial suites will have individual meters, unless otherwise approved by MU.
- C. Meters shall be sized according to the anticipated demand and in accordance with MU Specifications. Design Engineers shall submit data supporting the need based on instantaneous and average flows.
- D. Each meter shall have a backflow device consisting of double check valve assembly, or RPZs.
- E. Water meters and backflow devices shall be housed in boxes or vaults.
- F. Water meters and backflow devices shall be situated within the street right-of-way or in an easement area contiguous to the right-of-way or other running easement, with the exception of Fire Line Meters, which must sit on private property. The point of customer responsibility and MU's responsibility shall be the valve at the edge the ROW or easement.
- G. The locations for water meters and vaults should be practical for the access and maintenance of said items by MU personnel. The proposed location for meters and vaults shall be approved by MU.

2.3 WATER SAMPLING STATIONS

- A. Water sampling stations could be required to be installed in all new residential or commercial developments. If a water sampling station is required to be installed, it will be abandoned and capped at completion of project.
- B. The Design Engineer should consult with MU's Inspector or Engineer for the required locations for each of the water sampling stations for each residential or commercial development.

PART 3 – EXECUTION

3.1 WATERLINE LOCATION

- A. Water mains shall be designed for installation under the sidewalk, between 4-6 feet behind curbs, where practical. Dead-end mains shall extend to the last lot or parcel being served so that no service lines are installed in front of adjacent lots or parcels. Service meters shall be located adjacent to property lines, and grouped in pairs where practical. Mains shall be located consistently on the same side of the street within a project or development, and street crossings should be minimized, including the extension of mains at least halfway around cul-de-sacs.



- B. Water mains to be dedicated to MU shall be constructed within dedicated rights-of-way, or easements, at least twenty (20) feet in width.
- C. Water mains constructed parallel to streams shall be located such that the nearest area of disturbed soil is greater than 25 feet from the stream bank.
- D. Service lines supplying a single residential lot shall be located nearest a respective property boundary as practical, and opposite of property lines where electrical transformers are installed, when possible.
- E. Individual services shall be paired at common property lines, on respective sides, in residential subdivisions.
- F. No water main or service line shall be constructed on solid waste landfills.
- G. No water main or service line shall be constructed to serve a structure that is constructed on or to be constructed on a solid waste landfill.
- H. Each water main and service line shall be locatable. Contractor shall provide tracer wire from the main to the meter box.

3.2 FIRE HYDRANT LOCATION AND SPACING

- A. Hydrants shall be situated within the street's right-of-way adjacent to the right-of-way boundary.
- B. A hydrant shall be situated at the end of each cul-de-sac or dead-end street.
- C. Fire hydrants servicing residential areas shall be spaced a maximum of 500 feet as measured along the edge of pavement. No lot shall be greater than 250 feet from a fire hydrant.
- D. Fire hydrants servicing high density, commercial and industrial areas shall be spaced a maximum of 300 feet as measured along the edge of pavement or as otherwise required by the Madison Fire and Rescue Fire Marshall.
- E. Fire hydrants shall be required in close proximity to fire line vaults unless otherwise directed by an authorized representative of the City of Madison Fire Department.
- F. Fire hydrants on County ROW shall be spaced based on the County requirements.

3.3 VALVE SIZE AND LOCATION

- A. All valves related to new construction shall be installed behind curb and gutters, and out of paving.



- B. Valves shall be of the same size as the pipe in which the valve is situated, unless noted otherwise.
- C. A 3-way valve arrangement shall be required at every water main intersection, where feasible. For connections to live mains, check with MU for details on allowable connection features.
- D. A corporation valve shall be situated at the tap location into a water main with a one (1") inch service line.
- E. A resilient seated gate valve shall be situated downstream of a tapping saddle or tapping sleeve when tapping into a water main with a two (2") inch service line. The valve shall be situated within a valve box.
- F. Gate valves shall be situated in-line with water mains as follows, unless noted otherwise:
 - 1. Attach tapping gate valve immediately downstream of tapping saddle or tapping sleeve when tapping into water main with a smaller water main or service line.
 - 2. Situate gate valve downstream of a tee, as directed by the Engineer, when connecting to a water main.
 - 3. Situate gate valve on each immediate side of a three (3)-way connection or four (4)-way connection, as directed by the Engineer.
 - 4. Situate gate valve within the street right-of-way when fire services extends beyond the right-of-way.
 - 5. Gate valve shall be situated outside of vault immediately upstream and downstream of three (3") inch and larger water meter/check valve assemblies.
 - 6. A screw type valve box shall be situated over a gate valve.
- G. A curb stop shall be situated inside of meter box immediately upstream of five-eighths (5/8") inch through two (2") inch water meter/check valve assemblies.
- H. All valves related to new construction shall be installed behind curb and gutters, and out of paving.
- I. Valves that are twelve (12") inches and larger must be butterfly valves.

3.4 WATER LINE DEPTH

- A. Water mains and service lines to fire hydrants shall have a minimum suitable soil cover of thirty (30) inches in unpaved areas and thirty-six (36) inches in paved areas. The depth of from finish grade to top of pipe shall be determined as follows:
 - 1. As measured from edge of pavement (top back-of-curb) when the finish grade elevation of the pipe route is equal to or greater than adjacent pavement elevation.
 - 2. As measured from finish grade elevation of the pipe route when the pipe route elevation is less than the adjacent pavement elevation.
 - 3. Other depth approved by the Engineer.



- B. Water mains crossing under a creek or ditch shall have a minimum suitable soil cover of two (2') feet and the mains shall be encased in concrete.
- C. Water lines which, when completed, will have less than eighteen (18) inches of cover shall be encased in concrete, as shown on the Plans or as directed by the MU Representative.
- D. Service lines under pavement shall have a minimum suitable soil cover of 2.5 feet as measured from top of curb or top of pavement.
- E. Service lines outside of pavement shall have a minimum suitable soil cover of 1.5 feet as measured from the meter.
- F. Water mains 12-inches in diameter and larger shall be checked for buoyancy when submerged in groundwater or situated within the 100-year flood zone.

3.5 THRUST RESTRAINT

- A. See Section 33 14 16 Paragraph 3.6

END OF SECTION



00 01 12.11 – Gravity Sewer Design

PART 1 – GENERAL

1.1 GRAVITY FLOW SANITARY SEWERS

- A. The following section shall be used as a guideline for the design of gravity flow sanitary sewer systems.
- B. Sanitary sewer system design shall incorporate the City of Madison ordinances and utility codes.
- C. The following certification shall be made by the Design Engineer and included with Sanitary Sewer System construction notes:
“I certify that the proposed sanitary sewer system has been designed in accordance with MU Specification document titled “Construction Specifications for Water and Sanitary Sewer”, Latest Edition including all amendments.
- D. All sanitary sewers shall be designed in accordance with these criteria, specifications contained in other sections, and the standards of the Alabama Department of Environmental Management (ADEM).

1.2 SANITARY SEWER DESIGN AND FLOW RATES

- A. Design shall be based on the appropriate typical daily flow rates as listed in Section 3-2 of Wastewater Engineering Treatment and Reuse, latest edition, by Metcalf & Eddy. Daily flow rates may be changed at the discretion of the MU Engineer.
- B. For residential developments, a peaking factor shall be used when determining a “Peak Design Flow”. Design flows shall be based on the correct corresponding flows from the above referenced text, and shall be based on a gallons/unit/day rate where the capita is equal to 2.73 persons; then multiply this flow rate by a peak factor as given below.

$$\text{Peak Factor} = \frac{18 + (P)^{0.5}}{4 + (P)^{0.5}}$$

Where, P = number of persons, thousands

The peaking factor should be calculated as above and may be changed at the discretion of the MU Engineer.

- C. Design of industrial and commercial sanitary sewer flow rates shall be a minimum of 1.5 times that of the design average daily water usage or as approved by the MU Engineer.

1.3 SANITARY SEWER HYDRAULICS



- A. Gravity sewer pipe should be designed to carry “Peak Design Flow” at one-half full.
- B. Gravity sewer pipe shall have straight alignment and consistent grade between manholes.
- C. Sewers shall yield mean velocities of not less than 2.0 feet per second (fps) and not more than 10 fps based on the Manning Formula using an "n" value of 0.013 for ductile iron pipe, and shall accommodate design flow at one-half full.
- D. Recommended and absolute minimum pipe slopes for gravity sewer based on the size of pipe, at full flow, to be installed are summarized in the following table:

Slope Requirements

<u>Diameter</u>	<u>Absolute Minimum</u>	<u>Recommended Minimum</u>
8-inch*		
Less than 10 homes	0.70%	1.00%
10 to 35 homes	0.55%	0.70%
35+ homes	0.44%	0.60%
10-inch	0.30%	0.50%
12-inch	0.25%	0.40%
14-inch	0.22%	0.40%
15-inch	0.15%	0.30%
16-inch	0.15%	0.30%
18-inch	0.12%	0.24%
20-inch	0.12%	0.24%
21-inch	0.10%	0.20%
24-inch	0.08%	0.16%
27-inch	0.07%	0.14%
30-inch	0.06%	0.12%
36-inch	0.05%	0.10%

* - unless on a dead-end line segment with 5 or less service connections whose absolute minimum slope shall be 1.0% (0.0100 ft./ft.) or greater

- E. Sewers larger than 12-inches in diameter shall be designed at an appropriate slope as approved by the MU Engineer.
- F. Sewers with slopes less than the stated minimum may be accepted on a site-by-site basis. An extended warranty will be required for sewers that are accepted; see Section 00 01 11, Paragraph 1.23.A.
- G. Sags are not acceptable in a gravity sewer system. Any sag(s) greater than allowed must be corrected. Sags cannot be corrected with repair clamps. The pipe shall be reinstalled



to the proper grade. In 8-inch and larger pipes, the sag shall not exceed 1/2-inch in depth. The maximum allowable sag length shall be 4 feet in an 8-inch sewer, 6 feet in a 10-inch sewer and 8 feet in a 12-inch sewer. The sag limits (length and depth) for pipes greater than 12 inches shall be determined by the MU Engineer. Check with the MU Engineer as to the limits allowed on pipes greater than 12 inches in diameter. The minimum allowable distance between sags is 60 feet. Any sewers exceeding these sags limits shall be removed and reinstalled from manhole to manhole.

- H. The over sizing of pipe to meet minimum grade requirements shall be prohibited unless approved by the MU Engineer.
- I. A main at a terminal manhole shall have a minimum slope of 1.00%.
- J. Manholes with a flow deflection angle greater than 45° will have a minimum two-tenths of a foot (0.2') fall along the flow line of the manhole. Manholes with flow deflection angle less than 45° will have a minimum of one-tenths of a foot (0.1') fall along the flow line of the manhole.
- K. The maximum slope of a gravity sewer shall be 15.0%. When approved by the MU Engineer, slopes between 15.0% and 20.0% may be used with the addition of concrete anchors (dead man). The Developer's Engineer shall determine the size and spacing of anchors. The MU Engineer shall approve all anchor designs.
- L. When increasing the size of gravity sewer pipe, pipe crowns shall be matched at manholes.
- M. The deflection angle formed by alignment of influent and effluent sewer pipes at manhole shall not less than 90°.
- N. The minimum structural leg, as measured along the inside diameter of the manhole wall shall, in no case, be less than 6-inches and shall be designed to provide adequate structural design.
- O. The surcharging of manholes shall be prohibited.
- P. For in/out invert elevations greater than 2.0 ft., an external drop manhole shall be used. Drop manholes shall be avoided where practical. See Detail 8.240 in Section 99 99 99.
- Q. A vent assembly shall be required on trunk sewers at approximately 1500 ft. intervals and at the end manhole where practical.

PART 2 – PRODUCTS

2.1 SANITARY SEWER MATERIAL AND SIZE

- A. Sanitary Sewer outfall and trunk lines must be Ductile Iron and sanitary sewer main and lateral pipe and associated fittings shall be ductile iron or PVC.



- B. Sanitary sewers 12 inches in diameter and smaller shall be constructed of ductile iron sewer pipe or PVC sewer pipe, except as specified below in Paragraph 2.1.D. Sanitary sewers 14-inches in diameter and larger shall be constructed of Ductile Iron sewer pipe. PVC sewer pipe shall be allowed where the pipe slope is greater than or equal to 0.60% and less than or equal to 12.00% **and** the cut is less than or equal to 14 ft. If the slope is greater than 12.00%, less than 0.60%, **or** the cut is greater than 14 ft., ductile iron sewer pipe shall be used. "Cut" is defined as the vertical distance from the finished ground, or surface, to the invert of the pipe.
- C. In areas which have been filled and the proposed sewer will be within the fill, ductile iron pipe must be specified. If the pipe trench through the filled area is to be undercut to natural ground and refilled to pipe grade with properly compacted crushed stone, PVC pipe may be approved by MU.
- D. When shown on the Plans, sanitary sewers shall be constructed of the material called for on specified at the locations indicated. Casing pipe shall be installed where specified or shown on the plans.
- E. Sewer pipe assembly shall be push-on joint unless indicated otherwise.
- F. Transition coupling used to connect pipes of differing material shall be rigid and made of steel and/or ductile iron or other material approved by the MU Engineer.
- G. Sewer mains shall have a minimum diameter of eight (8") inches.
- H. Commercial and Industrial laterals shall have a minimum diameter of six (6") inches, and must tie to a manhole where practical.
- I. Residential laterals shall have a minimum diameter of four (4") inches.
- J. Sewers of PVC shall not exceed twelve (12") inches in diameter.
- K. Sewers eighteen (18") inches in diameter and larger shall be checked for buoyancy when submerged in groundwater or situated within the 100-year flood zone.
- L. A ball valve and backflow shall be situated upstream of tapping saddle or tapping sleeve when tapping into a force main with a 1-1/2 inch or two (2") inch sewer line. The ball valve and backflow shall be situated within a meter vault.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Situate sewer outfalls and mains at the centerline of a right-of-way when possible or at the centerline of an easement.



- B. Sewer outfalls and mains shall have a minimum five (5') foot horizontal and twenty-four (24) inch minimum vertical separations from any water main.
- C. Lateral from the sewer main to the structure being served shall be located nearest the center of the property as practical.
- D. A separate lateral shall service each property and/or commercial unit. A single header may be used for multiple tenant buildings with the indiv
- E. Sewers shall be designed to serve every lot or parcel adjacent to the sewer, and manufactured 90-degree tees shall be used for connecting service lines to the collector sewer.
- F. When possible, route laterals to manholes rather than direct connection into sewer main and as follows:
 - 1. Lateral connections into an in-line manhole shall be limited to two (2).
 - 2. Lateral connections into a terminal manhole shall be limited to three (3).
 - 3. Invert of a lateral connection at a manhole shall be installed at an elevation not greater than two (2') feet above the invert of the manhole.
- G. Sewer outfalls, mains, and laterals constructed parallel to streams shall be located such that the nearest area of disturbed soil is greater than twenty-five (25) feet from the stream bank.
- H. Sewers shall not be installed under or over any lake, reservoir, or detention pond.
- I. No sewer system component shall be constructed on solid waste landfills.
- J. No sewer system component shall be constructed to serve a structure that is constructed on or to be constructed on a solid waste landfill.
- K. Each sewer outfall, sewer main, and lateral shall be locatable by means of Mylar tape, wire or other method approved by the MU Engineer.

3.2 SEWER DEPTH AND STRUCTURAL INTEGRITY

- A. All sanitary sewers shall have a minimum of thirty (30) inches of cover in non-traffic areas and thirty-six (36) inches in paved subject to vehicular traffic.
- B. Sewer main shall be situated at a depth as to allow lateral to be constructed at a minimum two (2) percent slope from sewer main to probable structure location on each lot to be served assuming lateral is three (3) feet in depth at probable structure location.
- C. Vertical connection of a lateral into a sewer main shall be prohibited.
- D. Top of pipe shall be two (2) feet below any stream or ditch when crossed or paralleled. Concrete encasement shall be provided for a minimum distance including ten (10) either



side of the top of bank, as defined by the Army Corp of Engineers (ACoE), when crossing a stream or ditch with less than five (5) of cover below the flow line.

- E. DIP shall be used for the following conditions for mains and laterals:
1. Where depth of soil cover is less than four (4) feet before or after sanitary sewer installation
 2. Where depth of soil cover is greater than fourteen (14) feet before or after sanitary sewer installation.
 3. Where sanitary sewer crosses over or under a storm drain pipe.
 4. Where sanitary sewer crosses with less than two (2) feet of separation, under a water main.
 5. Where sanitary sewer crosses over or under a stream or ditch.
 6. Other locations deemed necessary by the MU Engineer.
 7. Sanitary sewers over a water main are prohibited unless approved by the MU Engineer.
- F. When a sewer crosses above a stream, a minimum of two (2) cast-in-place concrete collars shall be installed on the pipe, on opposite sides the stream.
- G. Check dams shall be installed in the bedding and backfill of ALL new or replaced sewer lines to limit the drainage area subject to the french drain effect of gravel bedding. Dams shall consist of compacted clay bedding and backfill at least three (3) feet thick to the top of the trench and cut into the walls of the trench two (2) feet. Alternatively, concrete may be used, keyed into the trench walls. Dams shall be placed no more than one thousand (1000) feet apart. The preferred location is up stream of each manhole. All stream crossings will include check dams on both sides of the crossing.
- H. An impervious clay ditch check shall be required on the downstream side of all stream crossings. This ditch check shall be constructed for a length of fifteen (15) feet as measured along the centerline of the pipe and for the full width and depth of the trench excavation. See Detail 8.330 in Section 99 99 99.

END OF SECTION



00 01 12.12 – Grease Interceptor Requirements

PART 1 - GENERAL

1.1 SUMMARY

- A. Grease interceptors shall be installed when required according to the Utility Code of the City.
- B. Interceptors shall be designed with a minimum 10-minute detention period based on calculated peak flow through the tank.
- C. Tank shall be designed in accordance with Rules of Alabama State Board of Health, the Standard Building Code, and Standard Drawing 8.390. Minimum tank size shall be 1,000 gallons.
- D. All tanks shall contain structural reinforcement which shall be approved by MU.
- E. Grease interceptors shall be shown on the Construction Plans and approved by MU.
- F. Variances for full-size 1000 gallon grease interceptors may be approved by the Board on a case-by-case basis. Requests for variance must be made by a Registered Professional Engineer in writing to the MU Engineer with information supplied regarding the nature and extent of proposed flows and the substitute grease removal device being proposed.
- G. All tanks should be inspected by a MU Representative when delivered and before being unloaded from truck.
- H. Tanks shall be tested for water tightness by filling the tanks to the top of the castings, once at finished grade, and monitored for 15 min. to insure that there is no drop in the water level, and no visible seepage is seen on the exterior of the tanks. Backfilling around the tanks is not allowed until the test is completed and passed.

PART 2 – PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION

00 01 12.13 – PVC Pressure Pipe for Low Flow Pressure Applications

PART 1 - GENERAL

1.1 SUMMARY

- A. The work covered by this section includes furnishing all labor, equipment, and materials required to install and test PVC pressure pipe, including valves, unions, fittings, couplings, adapters, and accessories, as shown on the Drawings and /or specified herein.
- B. The Contractor's attention is called to the fact that all PVC piping and accessories are not necessarily shown completely on the drawings which are more or less schematic. However, the Contractor shall furnish all install all piping indicated or required for proper operation of the equipment or services requiring such piping.
- C. For four (4) inch or smaller pipe, PVC is allowable, for six (6) inch or larger pipe only ductile iron pipe or HDPE (High Density Polyethylene) pipe is allowed.

1.2 QUALITY ASSURANCE

- A. The Contractor, at MU's request, shall furnish a certificate from the manufacturer of the pipe and fittings that the manufacturer is fully competent and capable of manufacturing PVC pipe and fittings of uniform texture and strength that will fully comply with these specifications and have so manufactured this class of pipe in sufficient quantities to be certain that it will meet all normal field conditions of usage. The manufacturer must have adequate equipment and quality control facilities to be sure that each extrusion of pipe is uniform in texture, dimensions, and strength.
- B. All pipes shall be tested and inspected at the place of manufacture for all requirements of the latest ASTM and Commercial Standard test and certified copies of the test reports covering each shipment shall be submitted to MU, upon request.
- C. Each length of pipe and each fitting shall have the following data clearly marked on each piece:
 - 1. Nominal Size
 - 2. Type and grade of material and ASTM standard
 - 3. SDR, Class or Schedule Rating
 - 4. Manufacturer
 - 5. National Sanitation Foundations seal of approval
 - 6. Manufacture Date

1.3 STORAGE AND PROTECTION

- A. PVC pipes and fittings shall be stored under cover
- B. All pipe and accessories shall be stored above ground and fully supported so as not to bend or deflect excessively under its own weight. Height of stacked pipe shall not exceed four (4) feet. Bundled pipe shall not be stacked more than two (2) bundles high.
- C. Kinked, flattened, buckled, broken, or otherwise defective pipe and fittings shall not be used and shall be removed from the site.
- D. Pipe shall be handled using nylon slings. Wire rope slings or chains shall not be used.



PART 2 – PRODUCTS

2.1 MATERIAL

- A. The pipe and fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties.
- B. The manufacturer shall provide water stops, acceptable to MU, which shall be applied to the outside of the plastic pipe when the pipe is to be enclosed in any structure where concrete or mortar is used, which will prevent leakage along the outer wall of the barrel of the pipe.
- C. No single piece of pipe shall be laid on any project covered by this specification unless it is found to be generally straight. Such pipe shall have a maximum ordinate as measured from the concave side of the pipe not to exceed one-sixteenth (1/16) inch per foot of length. If the deviation from straightness exceeds this requirement, then the particular piece of pipe shall be rejected for use until it can comply with this provision.

2.2 PIPE

- A. Pipe shall meet ASTM D 2241, “Standard Specification of Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR)”, Class 200, SDR 21, and the length shall be 20 feet.
- B. Gasket shall be ASRM F 477, “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.” Gaskets for pipe 6 inches and larger shall be supplied with retainer rings.
- C. Push-on joint shall be ASTM D 3139, “Standard Specification for Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals.”
- D. PVC material 12454-B (PVC 1120) shall be ASRM D 1784, “Standard Specification for Rigid Polyvinyl Chloride (PVC) Compound and Chlorinated Polyvinyl Chloride (CPC) Compounds
- E. Fittings for pressure sewers one and one-half (1 1/2) inch through four (4) inches in diameter shall be Class 200 PVC with solvent weld joints.

2.3 PLASTIC VALVES

- A. All thermoplastic Ball Valves shall be True Union type constructed from PVC Type 1 Cell Classification 1244-B. All O-rings shall be EPDM. All Valves shall have stem and double stop polypropylene handle. All valve union nuts shall have buttress threads. All valve components shall be replaceable. All valves shall be listed for potable water use by the National Sanitation Foundation (NSF). All one-half (1/2) inch through two (2) inch valve shall be pressure rated at 235 psi and two and one-half (2 1/2) inch through four (4) valves shall be pressure rate at 150 psi for water at 73° F. All valves shall be connected to the pipe with solvent weld joints.
- B. All thermoplastic Check Valves shall be True Union Ball type constructed from PVC Type 1 Cell Classification 12454-B. All O-rings shall be EPDM. All valve union nuts shall have buttress threads. All valve components shall be replaceable. All valves shall be listed for potable water use by the National Sanitation Foundation (NSF). All one-half (1/2) inch through two (2) inch valve shall be pressure rated at 235 psi and two and one-half (2 1/2) inch through four (4) valves shall be pressure rate at 150 psi for water at 73° F. All valves shall be connected to the pipe with solvent weld joints.

2.4 CUSTOMER SERVICE LINE CONNECTION BOXES



- A. Install each service line from the low pressure sewer main to the individual customer at the edge of the right-of-way, property line, or easement as indicated on the Drawings. Service line connections shall include a true union ball check valve and isolation ball valve installed in a meter box. Meter Box shall be rectangular, high density polypropylene with a green bolt down lid, NDS Standard Series 17" x 30", or approved equal.

2.5 AIR RELEASE/VACUUM VALVES

- A. All air release/vacuum valves shall be ARI manufactured valves, or approved equal.
- B. Valves shall be designed with a working pressure of 0 to 10 psi.
- C. Sewage valves shall have a two (2) inch NPT threaded end and be equipped with a two (2) inch brass shut off valve and two (2) inch metal pipe saddle with gasket for connection to the sewer line. All components shall be rated at 150 psi.
- D. Install all low pressure cleanouts, air release valves, and service connection boxes in rectangular, high density, polypropylene meter box with a green bolt down lid, NDS Standard Series 17" x 30", or approved equal.

PART 3 – EXECUTION

3.1 PIPE INSTALLATION

- A. Proper and suitable tools and appliances for safe and convenient handling and laying of pipe and fittings shall be used. Care shall be taken to prevent the pipe from being damaged.
- B. Detection wire shall be a #12 gauge copper wire installed with all low pressure pipe and service lines.
- C. A magnetic marking tape, green in color, imprinted with the words, "Warning – Buried Sewer Line Below", shall be installed twelve (12) inches above all low pressure lines.
- D. All pipe and fittings shall be carefully examined by the Contractor for defects just before laying and no pipe or fitting shall be laid which is defective. If any defective pipe or fitting is discovered after having been laid, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the Contractor.
- E. All pipes and fittings shall be thoroughly cleaned before they are laid and shall be kept clean until they are used in the completed work. Open ends of pipe shall be kept plugged with bulkhead during construction.
- F. PVC valves shall be installed with flow arrow in the proper direction. Union nuts on PVC valves shall be tightened only hand tight in accordance with manufacturer's instructions. Spare O-ring seals and seats shall be furnished with each PVC valve.
- G. Pipe laid in trenches shall be laid true to line and grade on a firm and even bearing for its full length at depth and grades as shown on the Drawings. Install the pipe line so that positive or negative grade is maintained between major high points and low points. Adequate precautions shall be taken to prevent flotation of pipelines prior to backfilling. Installation of pipe in underground pressure piping systems shall conform to the requirements of AWWA C900-16. Excavation of trenches and backfilling shall comply with these Specifications.
- H. All elbows, tees, branches, crosses and reducers in pressure piping systems shall be adequately restrained against thrust. Underground pressure piping containing unharnessed push-on or mechanical joints or expansion joints shall be restrained by thrust



blocks. Thrust blocks shall consist of Class B concrete and shall conform to Section 03 33 00 of these Specifications, and shall be the size and shape shown on the Drawings. The Contractor may use forms or earth wall to mold the thrust blocks. When earth walls are used they shall be cut true to shape in undisturbed earth, and all excess earth removed. The work shall be cut true to shape in undisturbed earth, and all excess earth removed. The work shall be conducted so that no loose earth will become missed with the concrete. At the end of twenty-four (24) hours, damp earth may be placed over the concrete to retain moisture.

- I. PVC pipe laid underground shall have a minimum of three (3) feet of cover in traffic areas and thirty (30) inches of cover in non-traffic areas.

3.2 PIPE FIELD TESTING

- A. Acceptance tests for pressure pipe lines shall be based on hydrostatic pressure tests.
- B. Conduct pressure test in the presence of the MU Representative.
- C. Do not test until at thirty-six (36) hours have elapsed after the last concrete thrust block has been cast.
- D. Conform to AWWA C600-17 procedures
 - 1. As modified herein
 - 2. Shall apply to all pipe materials specified.
- E. Prior to test Contractor and Engineer shall inspect valves within the test section to make sure they are fully open.
 - 1. Test between sectionalized valves, between a sectionalizing valve and a test plug, or between test plugs.
 - 2. Contractor shall furnish and install test plugs, including all anchors, braces, and other devices to withstand hydrostatic pressure on plugs.
- F. Pressure Test for Low Pressure Service Lines
 - 1. Slowly fill pipe with water:
 - a. Limits fill rate of line to available venting capacity, not to exceed a velocity when flowing full of one (1) foot per second.
 - b. Contractor shall make necessary arrangement to provide water for testing.
 - 2. Remove all air:
 - a. Install corporation cocks at high points to evacuate air if permanent air vents are not located there.
 - 3. Conduct at test pressure of seventy (70) psig at the lowest elevation of the section of the line being tested.
 - 4. Maintain the test pressure within five (5) psig, for two (2) hours if the line is completely uncovered and six (6) hours if the line is covered.
- G. Hydrostatic Test for Force Mains
 - 1. Slowly fill pipe with water:
 - a. Limits fill rate of line to available venting capacity, not to exceed a velocity when flowing full of one (1) foot per second.
 - b. Contractor shall make necessary arrangement to provide water for testing.
 - 2. Remove all air:
 - a. Install corporation cocks at high points to evacuate air if permanent air vents are not located there.



3. Conduct at test pressure of ninety (90) psig at the lowest elevation of the section of the line being tested.
 4. Maintain the test pressure within five (5) psig, for two (2) hours if the line is completely uncovered and six (6) hours if the line is covered.
- H. The Contractor shall bear the complete cost of the tests, including set-up, labor, temporary piping, blocking, gauges, bulkheads, water, air, soap solution, and any other materials required to conduct the tests.
- I. The Contractor shall take all precautions necessary to protect any equipment that might be damaged by the pressures used in the tests. Delicate equipment shall be valved off, removed, or otherwise protected.
- J. Acceptance
1. Acceptance shall be based on the basis of the hydrostatic pressure test results.
 2. Locate and repair defective materials and joints if the test discloses leakage greater than that specified.
 3. All visible leaks are to be repaired regardless of the amount leakage.
 4. Repeat test as necessary until satisfactory performance of test.
 5. MU Representative must be present at the test.

3.3 VALVE INSTALLATION

- A. Install all valves in strict conformance with the Drawings and manufacturer's instructions.
- B. Install valves in such a way that operators and packing are easily accessible, Valves with field placement seats shall be installed with sufficient clearance to permit removal of valve bonnet and stem without removing valve from the line.

3.4 VALVE FIELD TESTING

- A. Following installation, test all valves under the anticipated operating conditions. The ability of the valves to operate properly without leakage, binding, sticking, fluttering, or excessive operating torque shall be demonstrated to the satisfaction of the MU Representative. Any defective valve must be replaced.

3.5 CLEANUP

- A. After completing each section of the sewer line, remove all debris and construction materials and equipment from the site of the work, grade, and smooth over the surface of both sides of the line, and leave the entire right-of-way or easement area in a clean and neat condition. Unless otherwise called for on the Drawings, restore all disturbed areas to as close to its original condition as possible. Restoration shall include, but not be limited to, grassing and replacing shrubbery, trees, fences, and other items, which have been disturbed.

END OF SECTION



Division 01

01 42 16 – Acronyms and Definitions

PART 1 - GENERAL

1.1 SUMMARY

- A. Document Includes:
 - 1. Acronyms
 - 2. Definitions

1.2 ACRONYMS

- a. AASHTO American Association of State Highway and Transportation Officials
- b. ACI American Concrete Institute
- c. ADEM Alabama Department of Environmental Management
- d. ALDOT State of Alabama Department of Transportation
- e. ANSI American National Standards Institute
- f. APA/EWA Engineered Wood Association
- g. ASA American Standards Association
- h. ASTM American Society for Testing and Materials
- i. AWWA American Water Works Association
- j. BMP Best Management Practice
- k. CAD Computer Aided Drawing
- l. CIP Cast-In-Place
- m. CY Cubic Yard
- n. DOD Department of Defense
- o. DOT Department of Transportation
- p. EPA U.S. Environmental Protection Agency
- q. FOG Fats, Oils, and Grease



- r. MU Madison Utilities
- s. NEMA National Electrical Manufacturer's Association
- t. NPDES National Pollutant Discharge Elimination System
- u. NPS Nominal Pipe Size
- v. NTP Notice to Proceed
- w. OSHA Occupational Safety and Health Administration
- x. USGS United States Geologic Survey

1.3 DEFINITIONS

- A. **BOARD:** The five-member body appointed by the Madison City Council to oversee the workings of the Water and Wastewater Board of the City of Madison, Alabama, doing business as Madison Utilities.
- B. **CITY:** The City of Madison, within Madison and Limestone Counties, within the State of Alabama.
- C. **CITY ENGINEER:** The person hired or contracted to be the City Engineer.
- D. **COUNTY:** The County of Madison, within the State of Alabama.
- E. **DESIGN ENGINEER:** Engineer of record performing detail design of Plans submitted to MU for approval of water and wastewater facilities.
- F. **DEVELOPER:** The legal or beneficial owner or owners of all the land proposed to be included in a given development, or authorized agent thereof. In addition, the holder of an option or contract to purchase, a lessee having a remaining term of not less than thirty (30) years, or other persons having an enforceable proprietary interest in such land shall be deemed to be a developer for the purpose of these Specifications.
- G. **EMPLOYEE:** Any person working on the project to which these Specifications apply and who is under the direction or control of, and receives compensation from, Madison Utilities.
- H. **EQUIPMENT:** All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the work.
- I. **FOG (Fats, Oils, and Grease)** is organic polar compounds derived from vegetable, plant, or animal sources that are composed of long chain triglycerides.
- J. **GENERAL MANAGER:** General Manager of Madison Utilities.
- K. **INSPECTOR:** An authorized representative of Madison Utilities assigned to make all necessary inspections and/or tests of the work performed, or of the materials furnished or being furnished by the Contractor.



- L. LABORATORY: The official testing laboratories of Madison Utilities or such other laboratories as may be designated by Madison Utilities.
- M. MADISON UTILITIES: The Water and Wastewater Board of the City of Madison, Alabama.
- N. MADISON UTILITIES ENGINEER: The person hired or contracted to be the Engineer for Madison Utilities.
- O. MADISON UTILITIES REPRESENTATIVE: An authorized representative of Madison Utilities assigned to observe the construction of the work and advise Madison Utilities of the Work's prosecution.
- P. MATERIALS: Any substance specified for use in the work and its appurtenances.
- Q. OR EQUAL: Wherever a particular process, material, device, detail, or part is specified herein, followed by these words or by similar or equivalent expressions, such words or expressions shall be understood to mean and permit the use of another process, material, device, detail, or part that the MU Engineer shall determine is fully equal in suitability, quality, durability, performance, and in all other respects, to the process, material, device, detail, or part herein specified for such use, and shall approve for such use in the work.
- R. OWNER: The term "Owner" shall mean Madison Utilities.
- S. PLANS: The official construction drawings or exact reproduction thereof which show and describe the work to be done.
- T. PUBLIC WORKS PROJECT: A public works project shall be any work as defined by the Code of the State of Alabama.
- U. MU REPRESENTATIVE: An individual employed by MU that is appointed to act or speak for Madison Utilities, in certain situations.
- V. SANITARY SEWER: A pipe which carries wastewater.
- W. SPECIAL CONDITIONS: Additions and revisions to the standard Specifications applicable to an individual project. The special conditions are intended to supplement, modify, or delete items covered in the standard Specifications. Special conditions shall prevail over General Conditions.
- X. SPECIFICATIONS: A part of the documents containing the written directions, provisions, and requirements for completing the work. Standards for specifying materials or testing which are cited in the contract Specifications by reference shall have the same force and effect as if included in the contract physically.
- Y. STATE: The State of Alabama.
- Z. STATION: A specific point on the centerline of a sewer or water main or on the survey baseline designating some specific distance from the point of origin. Stations are numbered in terms of one hundred linear feet measured horizontally.
- AA. STORM SEWER: A pipe which carries surface runoff and subsurface waters.



- BB. STRUCTURES: Facilities such as bridges, culverts, catch basins, inlets, retaining walls, cribbing, storm and sanitary sewer lines, water lines, underdrains, electrical ducts, manholes, handholds, lighting fixtures and poles, transformers, flexible and rigid pavements, buildings, vaults, and other manmade features that may be encountered in the work and not otherwise classified herein.
- CC. WASTEWATER: The liquid collected in sanitary sewers and routed to municipal sewage treatment plants.
- DD. WORK: The furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor's performance of all duties and obligations imposed by the contract, Plans, and Specifications.
- EE. WRITTEN NOTICE: Any notice to any party of the contract relative to any part of the contract in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the work.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



01 60 00 – Product Requirements

PART 1 - GENERAL

1.1 PRODUCTS

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.
- B. Do not use materials and equipment removed from existing premises.
- C. Furnish interchangeable components from same manufacturer for components being replaced.

1.2 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.3 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.



PART 2 - PRODUCTS- Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION



01 70 00.10 – Water Distribution/ Sanitary Sewer Addition Submittal

The Developer/Owner or authorized representative shall provide the following information.

General Information

1. Project/Development name: _____
2. Developer's/Owner's name: _____
3. Developer's Engineer or Surveyor: _____
Alabama P.E. No.: _____ Expiration Date: _____
Alabama P.L.S. No.: _____ Expiration Date: _____
4. Proposed service area (acres): Immediate: _____ Ultimate: _____
5. Type of Development (Check those that apply):
Residential: _____ Commercial: _____ Industrial: _____ Other: _____
(If other, explain) _____
6. List population to be served: _____ density/acre: _____

Water Distribution Information

1. List design water use for Development (gallons/day): _____
(Provide Detail) _____

2. List pipe diameters, pipe material and pipe lengths:

3. List number of fire hydrants: _____
4. List number of valves: _____
5. List type, number, and size of meters: _____



6. Contractor Utility Contractor License No.: _____

Sanitary Sewer Information

1. Does or will the Development contain any of the following services? (Check those that apply):
Food Service: _____ Automotive Service: _____ Carwash Service: _____

For checked services, provide proposed capacity of oil/grease interceptor and/or

Sand/grit interceptor to be installed (gallons): _____

Existing and proposed Developments shall comply with the MU Construction Specifications for Water and Sanitary Sewer.

2. List average daily sewer usage rate (gallons/day): _____

(Provide Detail) _____

3. If producing industrial wastewater, describe waste characteristics:

Gallons/day produced: _____ Describe pretreatment received: _____

4. List sewer design flow (gallons/day): Average: _____ Peak: _____

5. If Commercial or Industrial Design biochemical oxygen demand (BOD) (lbs. /day):
Average: _____

6. List pipe diameters, pipe material, and pipe lengths: _____

7. List number of manholes: _____

8. List number and size of service connections:



Lift Station Information (if Applicable)

1. List number and size (hp) of motors/pumps: _____
2. List pump operating duty point flow rate (gallons/minute): _____
3. List inside diameter of wet well (ft.): _____

Force Main Information (if Applicable)

1. List pipe diameter, pipe material and pipe length: _____
 2. List flow velocity (feet/second): _____
 3. List number and type of combination air/vacuum release valve(s): _____
-



01 70 00.20 – Technical Review Checklist – General

General Submittal Information

1. Development Name: _____
2. Water Distribution / Sanitary Sewer Addition Submittal form received: Yes _____ No _____
(Plan review shall not begin until the submittal form is received.)
3. Have copies of DOT / ADEM / Utility rights-of-way permits and drawings been received:
Yes _____ No _____ NA _____
(Plans shall not be approved until all permits and drawings are received.)
4. Have all off-site easements been received: Yes _____ No _____ NA _____
If No, are easements to be dedicated during the Plat process? Yes _____ No _____ NA _____
(Final Plat and Certificate of Occupancy (CO) shall not be approved until all off-site easements are received.)

Notes to Design Engineer

1. Four (4) sets of plans are required to initiate the plan review process.
2. One (1) set of plans are required for plan approval and signatures.
3. Items marked “No” shall be submitted and/or corrected as indicated on checklist.
4. Items marked (redlined) on the plans shall be submitted and/or corrected as indicated.
5. Items marked “Yes” or “NA” (Not Applicable) requires no further action.
6. Return redlined plans with each re-submittal.
7. As-built drawing shall be provided in digital format (AutoCAD 2015 version or earlier) one (1) hard copy for review and one (1) digital PDF version for archiving.

Review by Engineering

Date



General Plan Set Submittal Requirements

1. Yes ___ No ___ : Two (2) sets of plans submitted.
2. Yes ___ No ___ : Plans submitted with Cover Sheet.
3. Yes ___ No ___ : Utility Locate Note on every sheet including the cover sheet.
4. Yes ___ No ___ : Site Plan submitted showing the overall Development including all phases.
5. Yes ___ No ___ NA ___ : Grading Plan submitted.
6. Yes ___ No ___ NA ___ : Storm Water System Plan submitted.
7. Yes ___ No ___ NA ___ : Water Distribution System Plan submitted.
8. Yes ___ No ___ NA ___ : Sanitary Gravity Sewer System Plan submitted.
9. Yes ___ No ___ NA ___ : Sanitary Gravity Sewer System Profile submitted.
10. Yes ___ No ___ NA ___ : Lift Station Site Plan submitted.
11. Yes ___ No ___ NA ___ : Lift Station Electrical Site Plan submitted.
12. Yes ___ No ___ NA ___ : Lift Station Details and construction notes submitted.
13. Yes ___ No ___ NA ___ : Force Main Plan and Profile submitted.
14. Yes ___ No ___ NA ___ : Force Main Details and construction notes submitted.
15. Yes ___ No ___ : Design Engineer/Surveyor seal with their signature across seal on every sheet including detail sheets.

Cover Sheet Requirements

1. Yes ___ No ___ : Project Title shown on Cover Sheet.
2. Yes ___ No ___ : Developer/Owner name, address, telephone, and email shown.
3. Yes ___ No ___ : Design Engineer name, address, telephone, and email shown.
4. Yes ___ No ___ : Name, e-mail, and telephone number of Contact Person shown.
5. Yes ___ No ___ : Source of Project Funding, agency name, and project number shown if not a private developer.
6. Yes ___ No ___ : Detailed Project Site Location Map with street names and North Arrow shown.
7. Yes ___ No ___ : Drawing Sheet Index shown.



8. Yes ___ No ___ NA ___: Symbol Legend shown.
9. Yes ___ No ___: Land Lot(s), District, and City shown.
10. Yes ___ No ___: MU required specifications note, preconstruction meeting note, and signature block/certificate shown.

Site Plan Sheet Requirements

1. Yes ___ No ___: North Arrow shown.
2. Yes ___ No ___ NA ___: Symbol legend shown.
3. Yes ___ No ___: Drawing scale shown.
4. Yes ___ No ___: Drawing to scale as shown.
5. Yes ___ No ___: Property owners' names adjacent to Development shown.
6. Yes ___ No ___: Number of lots or development units shown.

END OF SECTION



01 70 00.21 – Technical Review Checklist – Water Distribution

Water Distribution System Plan Sheet Requirements

1. Yes ___ No ___ NA ___ : Following statement included in water distribution system and/or sanitary sewer system notes: “The water distribution system and/or sanitary sewer system shall be installed in accordance with the approved plans and specifications contained within the Madison Utilities document titled, *Construction Specifications for Water and Sanitary Sewer*, Latest Edition.
2. Yes ___ No ___ NA ___ : Plans indicated prepared using the following state plane coordinate system. Horizontal: NAD 83, Vertical: NGVD 1988, Grid Zone: AL EAST.
3. Yes ___ No ___ : North Arrow shown.
4. Yes ___ No ___ : Drawing scale shown.
5. Yes ___ No ___ : Drawing to scale as shown.
6. Yes ___ No ___ NA ___ : Symbol legend shown.
7. Yes ___ No ___ NA ___ : Grading Plan.
8. Yes ___ No ___ NA ___ : Storm Water System Plan shown in gray scale.
9. Yes ___ No ___ : Street(s) right(s)-of-way and easements shown.
10. Yes ___ No ___ NA ___ : 100-year flood plain contour and associated elevation shown.
11. Yes ___ No ___ NA ___ : 25-foot State Waters Buffer shown.
12. Yes ___ No ___ NA ___ : 50-foot State Water Quality Critical Area shown.
13. Yes ___ No ___ NA ___ : Wetlands area shown.
14. Yes ___ No ___ NA ___ : The proposed system is not situated on a legally or illegally established landfill.
15. Yes ___ No ___ NA ___ : The proposed system will not service a structure situated over a legally or illegally established landfill.

Water Distribution System Requirements

1. Yes ___ No ___ : Existing water main route shown and correct.

2. Yes ___ No ___: Existing water main pipe size shown and correct.
3. Yes ___ No ___ NA ___: Proposed water main/distribution system route shown.
4. Yes ___ No ___ NA ___: Proposed water design usage rate indicated for each connection.
5. Yes ___ No ___ NA ___: Structures requiring fire sprinkler systems are indicated.
6. Yes ___ No ___ NA ___: Fire sprinkler system design usage rate indicated.
7. Yes ___ No ___ NA ___: Connecting location of Development's proposed water main to existing water main shown and correct.
8. Yes ___ No ___ NA ___: Connecting location of Development's proposed single service connection to existing water main shown and correct.
9. Yes ___ No ___ NA ___: Note stating "Connection to existing water main to be provided and installed by Developer."
10. Yes ___ No ___ NA ___: Proposed bore location(s) shown and correct.
11. Yes ___ No ___ NA ___: Proposed bore casing type, size, thickness and length shown and correct.
12. Yes ___ No ___ NA ___: Proposed water main located on north and/or east side(s) of street(s) and inside right(s)-of-way.
13. Yes ___ No ___ NA ___: Proposed water main pipe size, pipe material, and pipe class shown and correct.
14. Yes ___ No ___ NA ___: Proposed water main depth indicated and correct.
15. Yes ___ No ___ NA ___: Proposed water main separated from sanitary sewer as follows.
Horizontal separation: 5 foot min. Vertical separation: 24 inch min.
16. Yes ___ No ___ NA ___: Total length of pipe indicated and correct.
17. Yes ___ No ___ NA ___: Total number of fire hydrants indicated and correct.
18. Yes ___ No ___ NA ___: Note stating "Water main pipe shall not be tested until curb and gutter is installed" shown.
19. Yes ___ No ___ NA ___: Proposed water meter/backflow assembly and associated easement for single service shown and correct. Must have a twenty (20) feet by thirty (30) feet minimum easement if assembly not within street right-of-way.
20. Yes ___ No ___: Structure(s) not within proposed easement(s). Structures shall not be located in any easement.



21. Yes ___ No ___ NA ___ : Proposed service connection(s) location(s) to proposed water main shown and correct.
22. Yes ___ No ___ NA ___ : Note indicating “Water service connections to water main and service lines to be installed by the Developer”.
23. Yes ___ No ___ NA ___ : Existing fire hydrant(s) shown and location(s) correct.
24. Yes ___ No ___ NA ___ : Proposed fire hydrant(s) shown and location(s) correct.
25. Yes ___ No ___ NA ___ : Proposed fire hydrant(s) spacing correct as measured along edge of pavement and as follows. Residential maximum spacing: five hundred (500) feet, Commercial maximum spacing: three hundred (300) feet. County Road ROW maximum spacing: one thousand (1000) feet.
26. Yes ___ No ___ NA ___ : Proposed fire hydrant in cul-de-sac shown and location correct.
27. Yes ___ No ___ NA ___ : Gate valves shown and valve size correct at proposed fire hydrants.
28. Yes ___ No ___ NA ___ : Private hydrants shown and labeled to be silver in color.
29. Yes ___ No ___ NA ___ : Proper hydrant lead pipe size, pipe material, and pipe class from water main.
30. Yes ___ No ___ NA ___ : Proper location and number of valves at proposed main intersections shown.

END OF SECTION



01 70 00.22 – Technical Review Checklist – Sanitary Sewer

Sanitary Gravity Sewer System Plan Sheet Requirements

1. Yes ___ No ___ NA ___ : Following statement included in water distribution system and/or sanitary sewer system notes: “The water distribution system and/or sanitary sewer system shall be installed in accordance with the approved plans and specifications contained within the Madison Utilities document titled, *Construction Specifications for Water and Sanitary Sewer*, Latest Edition.
2. Yes ___ No ___ NA ___ : Plans indicated prepared using the following state plane coordinate system. Horizontal: NAD 83, Vertical: NGVD 1988, Grid Zone: AL EAST.
3. Yes ___ No ___ : North Arrow shown.
4. Yes ___ No ___ : Drawing scale shown.
5. Yes ___ No ___ : Drawing to scale as shown.
6. Yes ___ No ___ NA ___ : Symbol legend shown.
7. Yes ___ No ___ NA ___ : Grading Plan.
8. Yes ___ No ___ NA ___ : Storm Water System Plan shown in gray scale.
9. Yes ___ No ___ NA ___ : Street(s) right(s)-of-way shown.
10. Yes ___ No ___ NA ___ : Existing easement(s) shown.
11. Yes ___ No ___ NA ___ : Proposed easement(s) shown.
12. Yes ___ No ___ NA ___ : 100-year flood plain contour and associated elevation shown.
13. Yes ___ No ___ NA ___ : Wetlands area shown.
14. Yes ___ No ___ NA ___ : The proposed system is not situated on a legally or illegally established landfill.
15. Yes ___ No ___ NA ___ : The proposed system will not service a structure situated over a legally or illegally established landfill.

Sanitary Gravity Sewer System Requirements

1. Yes ___ No ___ : Existing sanitary gravity sewer system route shown and correct.
2. Yes ___ No ___ : Existing sanitary sewer gravity main size shown and correct.
3. Yes ___ No ___ NA ___ : Proposed Development with food service facility, car wash, and/or auto repair facility shown with grease/grit/oil interceptor.
4. Yes ___ No ___ NA ___ : Proposed sanitary sewer gravity main route shown.



5. Yes ___ No ___ NA ___ : Connecting location of Development's proposed sanitary gravity sewer main to existing sanitary sewer manhole shown and correct.
6. Yes ___ No ___ NA ___ : Connecting location of Development's proposed sanitary single service lateral connection to existing sanitary sewer manhole shown and correct.
7. Yes ___ No ___ NA ___ : Connecting location of Development's proposed sanitary single service lateral connection to existing sanitary gravity sewer main via cut in Tee and correct.
8. Yes ___ No ___ NA ___ : Proposed bore location(s) shown and correct.
9. Yes ___ No ___ NA ___ : Proposed bore casing type, size, and length shown and correct.
10. Yes ___ No ___ NA ___ : Proposed sanitary single service lateral routes shown.
11. Yes ___ No ___ NA ___ : Proposed sanitary gravity sewer main located at the centerline of the street(s) right(s)-of-way and/or easement(s).
12. Yes ___ No ___ NA ___ : Proposed sanitary gravity sewer main pipe size, pipe material, and pipe class shown and correct.
13. Yes ___ No ___ : Structure(s) not within proposed easement(s). Structures shall not be located in any easement.
14. Yes ___ No ___ : Proposed sanitary sewer does not cross a lake, reservoir, pond, or detention pond.
15. Yes ___ No ___ : Proposed sanitary sewer does not cross over a water distribution main.
16. Yes ___ No ___ NA ___ : Proposed dumpster pad drain does not discharge to sanitary sewer system.
17. Yes ___ No ___ NA ___ : Slope of sewers between manholes shown and are calculated correctly.
18. Yes ___ No ___ NA ___ : Slopes of sewers are within minimum and maximum MU specifications.
19. Yes ___ No ___ NA ___ : Ending sewer tangent(s) slopes are = or > 1.00%.
20. Yes ___ No ___ NA ___ : Angle between influent and effluent sewers at manhole = or > 90°.
21. Yes ___ No ___ NA ___ : Ductile iron pipe used at depths less than four (4) feet and greater than fourteen (14) feet.



22. Yes ___ No ___ NA ___ : Ductile iron pipe used over and under storm water sewers and water distribution piping.
23. Yes ___ No ___ NA ___ : Proposed min. sanitary sewer separation from water main as follows. Horizontal separation: five (5) feet; Vertical separation: two (2) feet
24. Yes ___ No ___ NA ___ : A minimum coverage of three (3) feet of soil exists when crossing a stream.
25. Yes ___ No ___ NA ___ : A minimum coverage of three (3) feet of soil exists when crossing a ditch.
26. Yes ___ No ___ NA ___ : Flow arrows are shown along the proposed sewer main.
27. Yes ___ No ___ : Existing manholes labeled.
28. Yes ___ No ___ NA ___ : Proposed manholes numbered correctly.
29. Yes ___ No ___ NA ___ : Sewer stubs to service adjacent properties shown.
30. Yes ___ No ___ NA ___ : Manhole covers elevations shown and accurate to vertical scale.
31. Yes ___ No ___ NA ___ : Manhole cover in paved area indicated to be set flush with finished pavement.
32. Yes ___ No ___ NA ___ : Manhole cover in non-paved area indicated to be set a minimum of two (2) feet inches above finished grade. Anything above two (2) feet requires a rotating lid.
33. Yes ___ No ___ NA ___ : Manhole cover in 100-year flood plain above flood plain elevation or cover shown as being swing away style with gasket and bolted down.
34. Yes ___ No ___ NA ___ : Manholes not situated in detention pond.
35. Yes ___ No ___ NA ___ : Manhole spacing is = or < four hundred (400) feet.
36. Yes ___ No ___ NA ___ : Manhole inlet and outlet invert elevations shown.
37. Yes ___ No ___ NA ___ : Inlet and outlet elevations accurate and accurate to vertical scale.
38. Yes ___ No ___ NA ___ : Inside drop manholes are not be allowed!
39. Yes ___ No ___ NA ___ : Outside drop manholes must be constructed of ductile iron pipe and fittings and all anchored with stainless steel rods, nuts, bolts, and straps.
40. Yes ___ No ___ NA ___ : Dog house style manholes?



41. Yes ___ No ___ NA ___ : Is the following note indicated: “Detection wire shall be installed above all non-ferrous pipe and all ferrous pipe having a bury depth of six (6’) feet or more. Ferrous wire shall be installed a minimum of two (2’) feet below finished grade such that sewer and/or lateral can be detected after burial.”

END OF SECTION



01 70 00.24 – Technical Review Checklist – Force Mains

1. Yes ___ No ___ : Proposed force main route shown and acceptable.
2. Yes ___ No ___ : Proposed force main twenty (20') foot easement shown, if not installed road right-of-way.
3. Yes ___ No ___ : Structure(s) not within proposed easement(s). Structures shall not be located in any easement.
4. Yes ___ No ___ : Force main depth indicated and correct.
5. Yes ___ No ___ : Force main profile shown and correct.
6. Yes ___ No ___ : Proper location and minimum spacing of combination air/vacuum release valve(s).
7. Yes ___ No ___ : Proper type, size, and model number of combination air/vacuum release valve(s) indicated.
8. Yes ___ No ___ : Proposed discharge point shown.
9. Yes ___ No ___ NA ___ : Proposed bore location(s) shown and correct.
10. Yes ___ No ___ NA ___ : Proposed bore casing type, size and length shown and correct.
11. Yes ___ No ___ : Proposed force main pipe size, pipe material and pipe class shown and correct.
12. Yes ___ No ___ : Pipe Depth at Edge of Pavement Detail shown and conforms to MU Specifications.
13. Yes ___ No ___ : Pipe Bedding Detail shown and conforms to MU Specifications.
14. Yes ___ No ___ : Thrust Block Dimensions Detail shown and conforms to MU Specifications.
15. Yes ___ No ___ NA ___ : Thrust Restraint at Fitting Detail shown and conforms to MU Specifications.
16. Yes ___ No ___ NA ___ : Combination Air/Vacuum Release Valve shown and conforms to MU Specifications.
17. Yes ___ No ___ NA ___ : Manhole at force main discharge point and next downstream manhole shown to be lined or coated.

END OF SECTION



Division 02

02 42 00 – Removal and Salvage of Construction Materials

PART 1 - GENERAL

1.1 SUMMARY

- A. All items of material and equipment designated on the Plans to be salvaged shall be the property of the Board. The Contractor shall carefully remove, clean, inspect, and transport salvaged items to the place designated by the MU Representative. Salvaged materials are not to be used in the new work unless called for on the Plans or authorized in writing by the Board.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



Division 03

03 30 00 – Cast-In-Place Concrete

PART 1 - GENERAL

1.1 SUMMARY

- A. The work described by this Section consists of furnishing all materials and equipment, and performing all labor necessary for the complete construction of all concrete work, including all work and appurtenances thereto, as shown or specified, or both.
- B. Work shall include the installation of all sleeves, inserts, piping, hangers, anchors, frames, plastic liner plates, and other items to be built into the concrete work, and all other work and appurtenances specified or required, or both, for proper execution of the work.
- C. All items shall be correctly positioned in form work, and must be inspected and approved by the Engineer before concrete is placed.
- D. The Contractor has the option of selecting fly ash or slag cement. Once this option has been selected, the Contractor shall use the same mix throughout the project.
- E. Concrete shall be either Class A or Class B. In general, Class A concrete shall be reinforced concrete masonry, cast-in-place in forms for foundations, pipe collars, footings, piers, headwalls, and similar structures; Class B concrete shall be plain concrete and shall be used for trench bottom stabilization, pipe protection, anchors, massive sections, and similar work.
- F. In general Class A concrete shall be formed reinforced concrete having a 28 day minimum compressive strength of 3000 pounds per square inch. In general Class B concrete shall be non-formed, non-reinforced concrete having a 28 day minimum compressive strength of 3000 pounds per square inch. Other classes, types or design for cast-in-place concrete may be specified in the Plans or approved by the MU Representative as circumstances require.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 226.1R – Ground Granulated Blast Furnace Slag as a Cementitious Constituent in Concrete.
 - 2. ACI 301 - Specifications for Structural Concrete.
 - 3. ACI 305 - Hot Weather Concreting.
 - 4. ACI 306.1 - Standard Specification for Cold Weather Concreting.
 - 5. ACI 308.1 - Standard Specification for Curing Concrete.
 - 6. ACI 318 - Building Code Requirements for Structural Concrete.



7. ACI 350 – Building Code Requirements for Environmental Engineering Concrete Structures.
- B. ASTM International:
1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 2. ASTM C33 - Standard Specification for Concrete Aggregates.
 3. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 4. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
 6. ASTM C109/C109M - 08 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens)
 7. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
 8. ASTM C150 - Standard Specification for Portland Cement.
 9. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
 10. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 11. ASTM C191 - Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle
 12. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 13. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 14. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
 15. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
 16. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
 17. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 18. ASTM C685/C685M - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
 19. ASTM C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
 20. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
 21. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
 22. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 23. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
 24. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 25. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.

26. ASTM C1218/C1218M - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
27. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
28. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
29. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
30. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
31. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
32. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
33. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
34. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
35. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 QUALITY ASSURANCE

- A. Imperfect and damaged work shall be satisfactorily removed; new work and materials, which are in accordance with the requirements of the Drawings and Construction Specifications, shall be furnished and installed at no additional expense to MU.
- B. Removal of concrete work and installation of subsequent work and materials shall be accomplished in a manner which will not impair the strength of the structure.
- C. Perform Work in accordance with ACI 318 and ACI 350.
- D. Conform to ACI 305 when concreting during hot weather.
- E. Conform to ACI 306.1 when concreting during cold weather.
- F. Acquire cement and aggregate from one source for Work.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Maintain concrete temperature after installation at minimum fifty (50) degrees F for minimum seven (7) days.

1.5 COORDINATION

- A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.



PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Portland Cement:
 - 1. Cement shall satisfy the requirements of ASTM C 150, as amended to date. Cement for normal Class "A", "B", and "C" concrete shall be Type I.
- B. Coarse Aggregates:
 - 1. Coarse Aggregates shall be washed gravel or crushed stone consisting of hard, strong, durable, and uncoated particles; and shall contain neither vegetable matter nor soft, friable, thin, and elongated particles in quantities considered deleterious by the Engineer. Coarse aggregates shall satisfy the requirements of ASTM C 33, as amended to date, and shall not have a specific gravity of less than 2.56.
- C. Water
 - 1. Water shall be potable, fresh, clean, and free of injurious amounts of oil, acid, alkali, and organic materials.
 - 2. Water shall not contain more than 1,000 parts per million of chlorides calculated as Cl, nor more than 1,000 milligrams per liter of sulfates calculated as SO₄.
- D. Sand
 - 1. Sand used in concrete shall be natural sand consisting of clean, hard, durable, uncoated grains. Sands containing lignite are not acceptable for exposed architectural concrete.

2.2 ACCESSORIES

- A. Grout:
 - 1. Grout shall have a minimum strength of 4,000 psi and shall be tested in accordance with ASTM C109.
 - 2. Grout for bonding new concrete to existing concrete shall be composed of 1 part Portland cement to 3 parts sand to those parts of water which will produce a grout having a consistency approved by the Engineer.
- B. Non-Shrink Grout
 - 1. Must conform to ASTM C1107/C1107M
 - 2. Non-shrink grout shall contain only pre-measured, prepackaged materials supplied by the manufacturer.

2.3 CONCRETE MIX

- A. General
 - 1. Concrete shall be composed of cement, slag cement (if required), fly ash (if required), admixtures (if required), fine aggregate, coarse aggregate, and water proportioned and mixed to produce a plastic workable mix in accordance with the



requirements of this Section, and shall be suitable for the specific conditions of placement.

2. The Contractor shall select the source of the concrete aggregates which he proposes to use in the work.

B. Pump Concrete

1. Pumped concrete is allowed, and may be necessary in some cases where concrete is heavily reinforced or inaccessible.
2. The MU Engineer shall review the pumping equipment and methods.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify requirements for concrete cover over reinforcement.
- B. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent at vertical construction joints, and grout at horizontal construction joints. Remove laitance, coatings, and unsound materials.
- B. Bonding:
 1. Before placing new concrete work on, and against, concrete work which has recently set, the surfaces of recently set concrete work shall be thoroughly roughened and made free from all foreign matter and laitance, the forms placed and tightened, and the surfaces of that concrete slushed with grout.
 2. New concrete shall be placed before grout has attained its initial set.
 3. Bonding work shall be accomplished in a manner that will ensure complete bonding.
 4. Two (2) inches to four (4) inches of grout shall be applied to all horizontal construction joints.
- C. Time:
 1. When concrete is loaded onto a truck at the central mix plant, the time that the loading occurs shall be stamped on the load/batch ticket.
 2. If the elapsed time between the time stamped on the load/batch ticket and discharge of the concrete from the truck exceeds 60 minutes, the MU Representative may require that the truck and contents of the truck be removed from the project.
 3. If the elapsed time between the time stamped on the load/batch ticket and discharge of the concrete from the truck exceeds 90 minutes, the truck shall be rejected and the concrete will be deemed unacceptable for use in this project.



4. This rejected truck shall leave the site and all concrete contents from the truck shall be removed prior to batching another load in this truck.
- D. Accumulated water and debris shall be removed from excavations and from formwork into which concrete is to be placed.
 1. Flow of water into those places shall be diverted into side drains or sumps and be removed without disturbing newly placed concrete.
- E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout unless otherwise shown on the Drawings.
- F. Remove debris and ice from formwork, reinforcement, and concrete substrates.
- G. Forms, unless lined, shall be thoroughly wetted with water before concrete is placed so as to tighten joints and prevent leakage of the mix.
- H. Concrete Floor Surfaces and Slabs:
 1. Before constructing concrete slabs on earth, all piping that will be under these slabs shall be successfully tested.
 2. The sub-grade shall provide solid bearing, and shall be brought to a true and even plane.
 3. All pipes, except perforated pipe shall be encased in concrete.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 318.
- B. Notify testing laboratory, if applicable, and/or MU Engineer minimum twenty-four (24) hours prior to commencement of operations.
- C. Before concrete is placed, the depth and character of the foundations, the adequacy of forms and false-work, and the placing of steel and appurtenant work shall be inspected, and must be accepted by the MU Engineer or MU Representative.
 1. That acceptance, however, shall not relieve the Contractor from the responsibility to produce the finished work
- D. Ensure reinforcement, inserts, embedded parts, formed expansion, and contraction joints are not disturbed during concrete placement.
- E. Transporting From Mixer:
 1. Concrete shall be transported from the mixer to the point of deposit by a pump, a crane handled bottom dump concrete bucket, with concrete buggies, or with wheelbarrows.
 2. Runways for buggies and wheelbarrows, if used, shall not be supported by formwork.
 3. Concrete shall be conveyed in a manner that will not disturb forms.



4. In the event the quality of the concrete as it reaches the form, and the method and placing thereof, in the opinion of the MU Engineer, is not satisfactory, the Contractor shall change his method of operation so as to place concrete in a manner suitable to the MU Engineer.
- F. Concrete shall be placed in a manner which will prevent the possibility of segregating aggregates, displacing reinforcing, and coating and splattering the reinforcing steel which is in place.
1. Troughs, pipes, hoppers, chutes, and canvas tremies shall be arranged and used in a manner that will ensure that the concrete is placed in the manner specified.
 2. The maximum distance between the end of the concrete hopper, chute, tremie, pump hose, etc. shall not exceed five (5) feet above the fresh concrete.
- G. The placing of concrete within formwork shall be regulated in a manner that will ensure that the pressure within the formwork caused thereby shall not exceed the design pressure of the formwork.
- H. Concrete shall be placed in continuous horizontal layers, the thickness of which, in general, shall not exceed twelve (12) inches.
- I. Care shall be used to fill each part of the forms; concrete shall be deposited to as near final position as possible. After the concrete has taken its initial set, care shall be used to avoid jarring the formwork, and placing strain and vibration on the ends of projecting reinforcing bars.
- J. When placing concrete, each batch, and each layer shall be placed following the preceding batch or layer so closely that there will be no "cold joints" in the work.
- K. If concrete must be dropped more than five (5) feet, it shall be deposited through a tremie.
- L. Consolidating Concrete:
1. Concrete, when placed, shall be compacted with mechanical, internal vibrating equipment supplemented with hand spading with a slicing rod.
 2. Vibrating shall not be used to transport concrete within forms. Vibrating equipment shall maintain an impulse rate of not less than 5,000 impulses per minute, when submerged in concrete.
 3. Not less than one (1) spare vibrator shall be maintained on the job site as a relief.
 4. The duration of vibration shall be limited to that time necessary to satisfactorily consolidate the concrete without causing objectionable segregation.
 5. The vibrator shall not be inserted into lower layers that have begun to set.
- M. Thin Section Work:
1. Thin section work shall be thoroughly worked with a steel rod; faces shall be shaped and mortar flushed to the surface of the form.
 2. Small diameter holes shall be drilled in formwork beneath large wall sleeves and inserts to prevent the entrapment of air beneath those sleeves and inserts when concrete is placed.



- N. The placement of concrete within units of the work between construction joints, once begun, shall continue without interruption so that the unit will be monolithic in construction.
- O. Concrete shall be placed and compacted in a manner that will form a dense, compact, impervious structure having smooth faces on exposed surfaces. Sections of concrete work found to be porous, plastered, or otherwise defective, in the opinion of the MU Representative shall be removed and replaced in whole, or in part, as directed by the MU Representative, at no additional expense to MU.
- P. Concrete shall be placed in daylight. Placing of concrete in a portion of the work shall not be started if that portion of the work cannot be completed during daylight, unless an adequate lighting system is provided
- Q. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.4 PLACEMENT IN COLD WEATHER

- A. Concrete shall not be placed when the atmospheric temperature is below thirty-five (35) degrees F or the temperature of the concrete is below fifty-five (55) degrees F.
- B. Methods for obtaining proper concrete temperature for mixing and placing concrete are listed under Cold Weather Concreting in ACI 306.
- C. If, after placing concrete, the atmospheric temperature becomes lower than thirty-five (35) degrees F, the Contractor shall enclose, heat, and protect the concrete in a manner which will keep the air surrounding the fresh concrete at a temperature above forty-five (45) degrees F for a period of 6 days after concrete is placed.
- D. The Contractor shall assume all risk connected with the cold weather placing and protecting of concrete and, should that concrete be unsatisfactory, it shall be rejected and replaced.

3.5 PLACEMENT IN HOT WEATHER:

- A. When the ambient temperature is ninety (90) degrees F or above, special precautions shall be taken during mixing, placing, and curing.
- B. At times when the temperature exceeds ninety (90) degrees F, the MU Engineer may require that placement of the concrete be at night or during early morning hours.
- C. In no case should the temperature of the concrete, when placed, be above ninety (90) degrees F.
- D. Methods of lowering concrete temperature are listed under Hot Weather Concreting in ACI 305R.

- E. Attention shall be given to coordinating the dispatching of trucks with the rate of placement to avoid delays in delivery.
- F. When elapsed time from batching to placement is so long as to result in significant increases in mixing water demand, or in slump loss, mixing in the trucks should be delayed until only sufficient time remains to accomplish mixing before the concrete is placed.
- G. On truck arrival at the job site, addition of water is allowed to achieve specified slump but shall not exceed that shown on the batch ticket. The forms and reinforcing steel should be cooled to a temperature of not more than ninety (90) degrees F, by spraying with fog nozzles.
- H. The concrete shall be cured with water.

3.6 WATER TIGHTNESS

- A. All concrete structures for holding and transporting water, and pits below ground level, shall be watertight;
 - 1. A drop in the water level of more than 1/4 inches within twenty-four (24) hours will not be permitted when water holding structures are filled.
- B. All exposed surfaces of water-holding structures, and interiors of pits below ground water level, shall be free from visible damp spots and seepage before acceptance.

3.7 CONCRETE FINISHING

- A. Exterior concrete surfaces shall be finished to levels not shallower than twelve (12) inches below finish grade levels; interior concrete surfaces, and other concrete surfaces exposed-to-view, shall be finished.
- B. Interior of basins shall be finished to a level not less than twelve (12) inches below normal water level.
- C. Concrete not exposed to view shall have rough edges tooled off and shall be pointed and spot finished to fill any irregularities.
- D. Depressions resulting from removal of form ties, and all other holes and rough places, shall be thoroughly wetted with water and pointed with non-shrink sand cement mortar.
- E. Pointing and surface repair shall commence immediately after forms are removed.
- F. All imperfect concrete shall be removed to dense solid concrete and repairs made as directed by the MU Engineer.
- G. Concrete Rubbing:
 - 1. Rubbing of finished surfaces shall begin immediately after pointed surfaces and surface repairs have set sufficiently to allow rubbing to commence.



2. Chamfered surfaces shall be rubbed only once, and this shall not be done during the first rubbing.
3. The surface of the curing, moist, concrete shall be kept wet with water and rubbed with a medium coarse carborundum stone or equal abrasive, bringing a paste to the surface.
4. The rubbing shall continue until all form marks and projections are removed and a smooth, dense surface having no pits or irregularities is produced.
5. The material that has been ground to a paste in the process shall be carefully and uniformly spread over the entire surface and allowed to rest.
6. The entire concrete surface shall be kept moist during rubbing to assure adequate curing.
7. The first rub shall be applied at the time specified herein.
8. If the Contractor postpones the finishing beyond this time or has insufficient labor to keep it up to date, MU will order them to stop any other work until the progress of finishing is satisfactory.
9. The final rub may be given to the structure no earlier than twenty-four (24) hours after the first rub, and it shall be done with a fine carborundum stone or equal abrasive leaving a smoothly textured surface, uniform in color.
10. The final rub shall be accomplished prior to the application of any Protective Surface Treatment which the Drawings or Specifications may require. "White washing" of the finished areas by the use of separately mixed grout or paste on the rubbing stone or spread on the surface to be rubbed will not be allowed.
11. All areas of structures disfigured by drip from concrete placement or from the rubbing process shall be thoroughly cleaned and blended into the surrounding surfaces

3.8 CURING AND PROTECTION

- A. Freshly placed concrete shall be protected from rain and flowing water. Concrete shall not be allowed to dry out from the time it is placed until the expiration of the specified curing period.
- B. Methods of curing, unless otherwise approved by the MU Engineer, shall be as follows:
 1. Curing with Water:
 - a. Concrete slabs in water holding structures shall be kept wet with clean water and burlap for a period of 7 days after placing.
 - b. Walls, beams, and columns shall be cured with burlap continuously soaked or cured with the forms in place continuously wet for a period of 7 days.
 2. Membrane Curing:
 - a. For non-water holding structures above grade, in lieu of curing with water, the Contractor at his option may use a membrane curing compound to seal in the water in the concrete except for surfaces which are to receive future concrete or mortar.
 - b. The membrane shall be of a type, which shall conform to ASTM C 309, as amended to date and shall be submitted to the MU Engineer for review.



- c. It shall be applied in accordance with the manufacturer's directions and in sufficient thickness to effectively hold the water in the concrete.
- d. The curing compound shall have a record of successful use for at least two years.

3.9 TESTING

A. Tests for Concrete Materials:

- 1. Fine aggregate shall satisfy the requirements of ASTM C 33, as amended to date. Coarse aggregate shall satisfy the requirements of ASTM C 33, as amended to date.
- 2. Cement shall have normal setting characteristics and satisfy the requirements of ASTM C 150 for Type I cement, as amended to date (Cement which has been stored for more than four months after being tested shall be re-tested before use).
- 3. Slag Cement shall be Grade 120 and shall satisfy the requirements of ASTM C 989 and ACI 233R as amended to date.
- 4. Fly Ash, if required, shall satisfy the requirements of ASTM C 618 Class F, as amended to date, except loss-on-ignition shall be not more than 6%.

B. Strength Tests During The Work

- 1. The Contractor will make three concrete test cylinders for each 50 cubic yards poured or for each days pour, whichever amount of concrete is smaller. Cylinders will be made and testing in accordance with ASTM C31, ASTM C172 and ASTM C39. The standard age of the test shall be 28 days. The first cylinder will be broken at 7 days. If the 7 day break exceeds the specified strength, then no further tests will be made until the 28th day. If the 7 day break does not meet the specified strength, then the second cylinder will be tested at the 14 day. In either event, the remaining cylinder(s) will be tested at the 28th day. When the test cylinders fail to conform to the compressive strength requirements, the MU Representative shall have the right to order a change in the concrete mix for the remaining portions of the work at no additional cost to the Board. The Contractor may wish to make additional cylinders at his own expense as verification.

C. Test of Hardened Concrete In, or Removed From the Structure

- 1. When the results of the strength tests of the control specimens indicate the concrete as placed does not meet specification requirements or where there is other evidence that the quality of the concrete is below specification requirements, core-boring tests shall be made in conformance with ASTM C42. Core specimens will be tested by a certified testing laboratory approved by the Board. All deficiencies shall be corrected; or, if the Contractor elects, he may submit a proposal, for approval, that load tests be made. If the proposal is approved, the load test shall be made by the Contractor and the test results evaluated by the MU Representative. If any concrete shows evidence of failure during the load test, or fails the core test as evaluated, the deficiency shall be



corrected. Any deficiency shall be corrected in a manner approved by the MU Representative and at no additional cost to the Board.

3.10 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by MU Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of MU Engineer for each individual area.

3.11 CLEANING

- A. Upon completion of work, all forms, equipment, protective covering, and rubbish resulting there from shall be removed from the premises.
- B. Finished concrete surfaces shall be left in a condition satisfactory to the MU Engineer.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION

Division 31

31 11 00 – Clearing and Grubbing

PART 1 – GENERAL – NOT USED

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to starting construction operations, the Contractor shall remove all vegetable growth, debris, and other objectionable matter standing or lying on the surface within the limits of the areas to be excavated or filled; and shall demolish and remove there from such buildings and other structures as are specifically designated on the Plans for removal.
- B. The site shall have all stumps and roots 2 inches and larger removed to a depth of not less than 6 inches below the original ground surface. Areas of structural excavation shall have all visible stumps and roots 2 inches and larger removed.
- C. Topsoil shall be removed, generally 2 to 6 inches, from all areas to be excavated or filled.
- D. Test holes are to be made when necessary for locating underground obstructions. Where utilities are to be crossed, they shall be uncovered by hand excavation methods before other excavation near them is started. Every pipe for water, gas, drainage, or other use, and every conduit, foundation, or other underground structure encountered shall be carefully protected from damage or displacement.
- E. The site shall be graded during construction to eliminate unnecessary ponding of water and provide as dry as possible work site.
- F. No waste material shall remain on the job site except as authorized in writing by the Board and approved by the City Engineer.

END OF SECTION



31 22 19 – Finish Grading

PART 1 – GENERAL – NOT USED

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.1 PREPARATION

- A. The finish grading shall be accomplished after placement of three (3) inches of topsoil in all disturbed areas. The finished grade shall be within 0.10 feet of the grade shown on the Plans in areas within ten (10) feet of any structure or paved area. The finished grade within other areas shall be within 0.15 feet of the grade shown on the Plans.
- B. Topsoil is not to be used in the finished grading process in areas that are to be paved, graveled. Topsoil is to only be used in areas that are to be vegetated, and not paved or graveled at a later date.
- C. Finish grading may be accomplished by mechanical means. Failure to achieve the grades specified above will result in the MU Representative requiring the Contractor to use hand tools and labor.

END OF SECTION



31 23 16 – Excavation

PART 1 - GENERAL

1.1 SUMMARY

- A. Bell holes for bell-and-spigot pipe shall be excavated at proper intervals so that the barrel of the pipe will rest for its entire length upon the bedding material. Bell holes shall be large enough to permit proper installation of joints in the pipe. Bell holes shall not be excavated more than five (5) joints ahead of pipe laying.
- B. Excavation for manholes and other structures shall not be greater in horizontal area than that required to allow two (2) feet in the clear between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevations shown on the Plans. Should the Contractor excavate below the elevations shown or specified, he shall fill the void thus made with pipe cushion, at his own expense. No earth backfilling will be permitted under structures, unless specifically shown on the Plans.
- C. Excavation for structures shall be sufficiently large for the proper placing of forms and concrete and for dewatering purposes, but shall not be excessively large in the horizontal area. Banks may be sloped at a safe angle provided that such excavation does not endanger or damage existing or proposed structures, pipelines, etc. The bottom of the excavation shall be true to the required shape and elevations shown on the Plans. No earth backfilling will be permitted under structures unless specifically shown on the Plans. Should the Contractor excavate below the elevations shown or specified, they shall fill the void thus made with foundation backfill (crushed limestone or dolomite), thoroughly compacted, as specified in Section 31 23 33, or Class B concrete.
- D. When muck, quicksand, soft clay, swampy, or other material unsuitable for foundations or subgrade are encountered which extend below the limits of the excavation, such material shall be removed and replaced with Foundation Backfill (crushed limestone or dolomite), thoroughly compacted, as specified in Section 31 23 33 Paragraph 2.5.A, or Class B concrete. Foundation Backfill shall be used only at the direction of the MU Representative and only on a case-by-case basis. Volume of Foundation Backfill shall be calculated by multiplying trench width W (the distance between the vertical planes passing 12 inches beyond the outer vertical surface of the structure, or beyond the outer edge of the structure footing, whichever is greater) times the horizontal distance along the survey centerline times the vertical thickness of the Foundation Backfill material.
- E. All streets, sidewalks, and crossings are to be kept open and in a safe condition for their intended use unless written approval to close the street is obtained from the authority having jurisdiction. While the work is steadily advancing, one cross street at a time, for each pipe laying crew, may be cut across its roadway and foot crossings. Any additional streets which the Contractor elects to cut shall be provided with suitable bridges and handrails. Excavated material is to be removed from the street so as to occasion the least



practicable inconvenience to public traffic and to neighboring residents. To prevent obstructing traffic, only as much of the materials of construction as are actually needed are to be piled along the line. If at any time public traffic cannot be properly maintained when materials are stored upon the street, as much material as necessary is to be removed from the street and stockpiled. Suitable stockpiled materials are to be returned to backfilling as necessary and when appropriate. Where work involves existing public right-of-way, notification shall be given to the City of Madison Community Development Department and Public Works Department at least one (1) working day in advance of starting such work.

- F. All fire hydrants, water valve, and other similar public utilities are to remain accessible for their intended use. The Contractor must notify the Fire Department involved if any hydrant is made temporarily inaccessible.
- G. Surface drainage shall be maintained at all times. Temporary diversion of surface drainage may be permitted if approved by the MU Representative.
- H. Pipe installation shall be accomplished by boring or tunneling methods for crossing major streets, highways, railroads, or other facilities, where shown on the Plans. The methods and procedures are subject to approval by the Board and by the railroad, City of Madison, Madison County, State Highway Department, or other authority having jurisdiction.
- I. The sides of all excavation shall be sufficiently sheeted, shored, and braced whenever necessary to prevent slides, cave-ins, settlements or movement of the banks and to maintain the excavation clear of obstructions that would in any way endanger the workmen or hinder or delay the progress of the work. When wood or steel sheet piling, shoring, and bracing is used, it shall be of ample design and type to have sufficient strength and rigidity to withstand the pressures exerted and to maintain the walls of the excavation properly in place and protect all persons and property from injury or damage. Sheet piling, shoring, or bracing should be designed by a registered Alabama Professional Engineer. The Contractor shall repair, at no cost to the Board, all damage resulting from failure to provide adequate support. The Contractor shall be responsible for damage to property and injury to persons caused directly or indirectly by inadequate sheeting or shoring.
- J. Where excavations are made adjacent to existing buildings or other structures or in paved streets or alleys, the Contractor shall take particular care to sheet, shore, and brace the sides of the excavation adequately so as to prevent any undermining of or settlement beneath such structures or pavement. Underpinning of adjacent structures shall be done where and as directed by the MU Representative or MU Engineer.
- K. Sheeting, shoring, or bracing materials shall be removed unless otherwise directed by the MU Representative. Such materials shall be removed in a manner that will not endanger or damage the new structure or any existing structures or property, either public or private, in the vicinity, and so as to avoid cave-ins or slides. Trench sheeting and bracing shall not be removed until the trench has been backfilled one (1) foot above the top of the pipe.



- L. Where the excavation area shown on the Plans falls under the water surface or near the banks of a flowing stream or other body of water, the Contractor may adopt and carry out any method he may deem feasible for the performance of the excavation work and for the protection of the work thereafter, provided the method and equipment to be used results in completed work which complies with these Specifications and have received prior approval of the MU Representative. In such cases, the excavation area shall be effectively protected from damage during the excavation period and until all contemplated construction work therein has been completed to the satisfaction of the Board.

1.2 OWNERS INSTRUCTIONS

- A. All materials removed by excavation which are suitable for the purpose shall be used whenever practicable for backfilling and for such other purposes as may be shown on the Plans or directed by the MU Representative. All materials not used for such purposes shall be considered as waste materials and disposed of by the Contractor in an approved manner.
- B. Waste materials may be deposited in spoil banks at locations to be obtained by the Contractor. Such materials shall not be left in unsightly piles, but shall be spread in uniform layers and neatly leveled and shaped to the satisfaction of the property owner. Spoil banks shall be provided with adequate openings to permit surface drainage of adjacent lands. No waste or surplus materials shall be placed or permitted to be used at points below the flow line neither of open channels nor within the flood plain.
- C. On completion of any part of the work, proper disposal shall be made of all surpluses or unused materials left within the construction limits of such work and the surface of the work left in a neat and workmanlike condition.
- D. All excavated areas, backfills, embankments, trenches, access road grading, and ditches shall be maintained by the Contractor in good condition at all times until final acceptance of the work by the Board and the City of Madison.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



31 23 16.26 – Rock Removal

PART 1 - GENERAL

1.1 SUMMARY

- A. Drilling and blasting methods used in rock excavation shall be optional with the Contractor, but shall be conducted with due regard to the safety of persons and property in the vicinity of the work and in strict conformity with all laws, ordinances, and regulations governing blasting and the use of explosives. Rock excavation near structures of all types shall be conducted with the utmost care, and every precaution shall be taken to prevent damage to adjacent pipes or structures. The Contractor or his insurer shall conduct a pre-blast survey of all structures to determine the existing or pre-blasting condition, such survey being a written description with special emphasis on defects and documented with appropriate photographs. This survey is intended to serve as a basis of comparison for any post-blast claims that may arise. The Contractor will furnish the MU Representative with a complete copy of said survey prior to initiation of any blasting. The Contractor or his insurer shall obtain the services of a competent vibration or seismologist consultant to conduct blast noise, vibration and overpressure surveys at periodic intervals during the progress of the blasting operations. Any damage or injury of whatever nature to persons or property caused directly or indirectly by blasting operations shall be promptly repaired, replaced, or compensated for by the Contractor at his own expense and to the satisfaction of the persons injured or the owners of the property damaged. It is the intent of this Section to serve as protection to the Contractor to minimize the post-blast claims and not to require unwarranted work. The Contractor shall use every precaution available and practical to minimize ground vibration, noise, and overpressure. The Contractor and his insurer shall indemnify and save harmless the Board and all his representatives from all claims for damages arising out of the use, transportation, or storage of explosives.
- B. Rock encountered in trench excavation for sewers shall be removed for the overall width of trench and to a depth below the bottom of the barrel of the pipe. The space excavated below the barrel and bell of the pipe shall be backfilled with pipe bedding, as specified in Section 33 05 05 Paragraph 1.1.A. All overshot rock must be removed by the Contractor before placing the bedding. If the Contractor excavates below the required trench bottom, the excess space must be filled with acceptable material at no additional expense to the Board. All of the applicable provisions of the above Specifications for excavation and sheeting, shoring, and bracing shall apply to rock excavation.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION

31 23 33 – Trenching and Backfilling

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. The work under this Section consists of furnishing all labor, equipment, and materials, and performing all operations in connection with the trench excavation and backfill required to install the pipelines shown on the Drawings and as specified.
2. Excavation shall include the removal of any trees, stumps, brush, debris, or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.
3. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.
4. The pipe zone area of the trench is divided into five specific areas;
 - a. Foundation: The area beneath the bedding sometimes also referred to as trench stabilization
 - b. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.
 - c. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
 - d. Initial Backfill: The area above the haunching material and below a plane 18-inches above the top of the barrel of the pipe.
 - e. Final Backfill: The area above a plane 18-inches above the top of the barrel of the pipe.
5. Backfill around all valves, fire hydrants, 2-inch blow offs, and water meters shall be tamped using light power tamping equipment such as a jumping jack in 6-inch layers to a minimum 95% of the maximum dry density.
6. The choice of method, means, techniques, and equipment rests with the Contractor.
 - a. The Contractor shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, and the amount of space available for operation of equipment, storage of excavated material, proximity of man-made improvements to be protected, available easement or right-of-way and prevailing practice in the area.
7. If the trench extends along or across existing paved streets, roadways, alleys or sidewalks, the remainder of the trench shall be backfilled with Crushed Stone according to the Standard Details.



8. If the trench is along or across a proposed street or roadway, the remainder of the trench shall be backfilled with Crushed Stone or select earth material, as specified in Paragraph 2.4.E of this section, deposited in uniform layers not to exceed 6 inches in compacted thickness, and compacted to a minimum of 95% Standard Proctor Density. Such compaction shall be verified through appropriate testing methods, conducted by a soil testing laboratory approved by the MU Representative. Frequency of tests will be at the sole discretion of the MU Representative to ascertain that this requirement is being met; however, testing will be limited to one passing test per layer per 100 linear feet of trench. The number of failing tests shall be unlimited.
9. For trenches which do not extend along or across paved streets, roadways, alleys, or sidewalks, backfill material from a height of one (1) foot above the top of the pipe upward will not require tamping unless otherwise specified. Backfill material not specified to be tamped shall be as herein before specified, except that a broken stone content of not more than fifty (50) percent by volume of stones not exceeding six (6) inches maximum dimension, will be allowed, if thoroughly mixed with the earth.
10. Where excavation has been within the limits of easements across private property, the top one (1) foot of backfill materials shall consist of fine, loose earth free from large clods, vegetable matter, debris, stones, and/or other objectionable materials.
11. Immediately following the lowering of the pipe into the trench, each joint or section shall be center-filled to prevent floating of pipe in case water enters the ditch from any cause. The remaining backfill shall be placed as soon as possible thereafter so that a minimum amount of trench wherein the pipe has been lowered shall remain open at any time. It shall be carefully placed so as to not cause damage to the pipe coating.
12. Terraces and drainage ditches shall be built in such places as the MU Representative may deem necessary on hillside or steep inclines so as to keep the backfill and the right-of-way from eroding or washing. On hillsides, breakers built of suitable material such as sacks or poles shall be placed in the ditch before backfilling to prevent water washing down the trench. These breakers are to be furnished and placed by the Contractor without cost to the Board. Backfill shall be completed in such a manner as to conform to the general drainage and improvements of the adjoining and existing right-of-way.
13. Where tamping is not required for the full depth, the backfill shall be neatly rounded over the trench to a sufficient height to allow for settlement to grade after consolidation. Any deficiency in the quantity of materials for backfilling the trenches, or for filling depressions caused by settlement, shall be supplied by the Contractor.



14. Where pipe trenches are cut across or along improved streets or roadways, the Contractor shall construct a temporary surface over the cut in accordance with these specifications which will not disintegrate under traffic, and which shall be maintained in good condition under traffic until the permanent pavement has been constructed, or for unpaved streets until the work has been accepted by the MU Representative. The pavement shall be spread and rolled to accurately conform to the grade of the existing street surface. The trench backfill shall be crushed stone if required by the MU Representative, MU Representative, City Engineering Inspector, or shown on the Plans. See Section 32 12 16.19 Cold Mix Asphalt Paving for further information.
15. Backfilling around structures located in paved streets shall be done in the manner specified above for pipe trenches by tamping for the full depth of cut from the bottom to the finished grade.
16. All backfilling shall be done in such manner as will not disturb or injure the pipe or structure over or against which it is being placed. Any pipe or structure injured, damaged, or moved from its proper line or grade during backfilling operations shall be replaced or repaired and then re-backfilled as herein specified, at the expense of the Contractor.
17. The Contractor shall replace all surface material and shall restore paving, curbing, sidewalks, gutters, and other surfaces disturbed, to a condition equal to that before the work began, furnishing all labor and material incident thereto, as described in these specifications.
18. An impervious clay ditch check shall be required on the downstream side of all stream crossings. This ditch check shall be constructed for a length of fifteen (15) feet as measured along the centerline of the pipe and for the full width and depth of the trench excavation. See the Standard Details.
19. Check dams shall be installed in the bedding and backfill of ALL new or replaced sewer lines to limit the drainage area subject to the french drain effect of gravel bedding. Dams shall consist of compacted clay bedding and backfill at least three (3) feet thick to the top of the trench and cut into the walls of the trench two (2) feet. Alternatively, concrete may be used, keyed into the trench walls. Dams shall be placed no more than one thousand (1000) feet apart. The preferred location is up stream of each manhole. All stream crossings will include check dams on both sided of the crossing.
20. Trench excavation or excavation for pipe lines shall consist of the excavation necessary for the construction of sewers and other pipe lines and all appurtenant facilities therefor, including manholes, inlets, outlets, concrete saddles, pipe cushion, and pipe protection as called for on the Plans. It shall include clearing and grubbing where necessary, backfilling and tamping of pipe trenches and around structures, and the disposal of waste materials, all of which shall conform to the applicable provisions set forth in these Specifications. The Contractor must comply with all federal, state, and local safety rules and regulations including those of OSHA. MU will not inspect for compliance with safety regulations, and disclaims any responsibility to ensure the safety of workers.



21. The controlling elevation for measuring depths described in these Specifications shall be the pipe invert (flow line) elevation as shown on the Plans. The horizontal distance between such planes, or the overall width of trench, shall be as specified on the Plans. From the top of the trench to a horizontal plane one (1) foot above the top of the pipe, the Contractor shall use appropriate excavation methods to ensure safe working conditions within the trench, which may require the use of sheeting, shoring, and/or bracing, and/or laying back the slopes, provided that such excavation does not damage adjacent structures. The width of trench shall be as shown on the Plans.
22. Pipe trenches shall not be excavated more than 300 feet in advance of pipe laying. All work shall be performed so as to cause the least possible inconvenience to the public. Temporary bridges or crosswalks shall be constructed where required to maintain vehicular or pedestrian traffic. Plans for all such temporary bridges shall be prepared by a registered Alabama Professional Engineer and submitted to the Board for approval prior to any construction. Crosswalks and bridges shall have handrails and/or other features necessary for safe use by the public.
23. In all cases where materials are deposited along open trenches, they shall be placed so that in the event of rain, no damage will result to the work and/or to the adjacent property.
24. Trench excavation shall be true to the lines shown on the Plans or established by the MU Representative. The normal dimensions of trenches for the pipeline to be constructed shall be, for width, twelve (12) inches greater than the outside diameter of the coated pipe, and such depth as to provide thirty-six (36) inches minimum cover below normal ground level. This is the minimum allowable depth as measured from the normal ground level to the top of pipe. The Contractor shall have the right to dig the ditch deeper than the above-specified depth to facilitate construction.
25. Trench excavation shall be made in open cut unless otherwise specified on the Plans. When shoring, sheeting, and/or bracing is used, the distance between vertical planes shall be measured from the inside faces of the sheeting. When vertical banks for trench excavation are not practical to construct or create conditions dangerous to workers, the banks may be sloped, provided that such excavation does not damage adjacent structures. When trench banks are sloped, such banks shall be cut to vertical planes as specified above for that part of the ditch below the level of twelve (12) inches above the top of the pipeline. The bottom of the trench shall be level in cross section and shall be cut to the depth necessary to properly place the bedding and lay the pipe to grade as shown in the Plans and in the Standard Details, except where concrete cradles or pipe encasement materials are indicated on the Plans or required by the MU Representative, in which case the excavation shall extend to the bottom of the cradle or pipe encasement materials.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb.) Rammer and a 457-mm (18-in.) Drop.



- B. ASTM International:
 - 1. ASTM D698-12e2 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
 - 2. ASTM D1556/D1556M-15e1 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 3. ASTM D1557-12e1 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
 - 4. ASTM D2167-15 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 5. ASTM D2922-05 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 6. ASTM D2937-17e2 - Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
 - 7. ASTM D3017-05 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

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

1.4 QUALITY ASSURANCE

- A. Density:
 - 1. All references to "maximum dry density" shall mean the maximum dry density defined by the "Maximum Density Optimum Moisture Test", ASTM D 698-12e2.
 - 2. Determination of the density of foundation, bedding, haunching, or backfill materials in place shall meet with the requirements of ASTM D1556/D1556M-15e1, "Density of Soil In Place by the Sand Cone Method", ASTM D 2937-17e2, "Density of Soil In Place by the Drive Cylinder Method" or ASTM D 2922-05, "Density of Soil and Soil Aggregate In Place by Nuclear Methods (Shallow Depth)."

1.5 SAFETY

- A. Safety is the sole responsibility of the contractor.

PART 2 - PRODUCTS

2.1 TRENCH FOUNDATION MATERIALS

- A. Where called for in the plans or specifications for a project, crushed stone shall be utilized for trench foundation (trench stabilization) and shall meet the requirements of the Alabama Department of Transportation Specification 801.03; Stone size shall be between No. 57 and No. 78, inclusive.



- B. Where crushed stone is not to be utilized for backfill, dirt clear of deleterious materials, vegetation, rocks, slag, or debris shall be utilized and compacted in lifts to the specified density.

2.2 BEDDING AND HAUNCHING MATERIALS

- A. Unless specified otherwise, bedding and haunching materials shall be earth materials for Type 2 bedding and crushed stone for Type 4 and Type 5 bedding as specified in Part B of this section.
- B. Crushed stone utilized for bedding and haunching shall meet the requirements of the Alabama Department of Transportation Specification 801.03; Stone size shall be No. 57.
- C. Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench.
 - 1. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other deleterious materials.
 - 2. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements.
 - 3. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping.
 - 4. If materials excavated from the trench are not suitable for use as bedding or haunching material, the contractor must provide select material conforming to the requirements of this Section.

2.3 INITIAL BACKFILL

- A. Initial backfill material shall be crushed stone or earth materials as specified for bedding and haunching materials. The backfilling of sewer or other pipe line trenches shall be started immediately after the work has been inspected and approved by the MU Representative. The initial backfill material as specified later in this section shall be carefully deposited in 6-inch layers (before compaction) on each side of the pipe and then thoroughly and carefully tamped or rammed around the pipe with approved vibratory compactors or other power tools approved by the MU Representative to a minimum compaction of 95% of Standard Proctor Density (ASTM D698-12E2) where applicable, until enough material has been placed and compacted to provide a cover of not less than one (1) foot over the top of the pipe. Care shall be taken to ensure that material under haunches of pipe is consistently placed, leaving no voids.
- B. All sanitary sewer pipe shall be bedded on stone aggregate meeting the requirements of this Section or as approved by the MU Representative and as specified in Section 99 99 99 Details, or as specifically modified in the Plans. Aggregates used for pipe bedding shall be either crushed limestone or crushed dolomite. The use of slag will not be allowed. Gradations of aggregates shall be as specified on the Plans. Where concrete bedding is required on the Plans or by the MU Representative, the concrete shall be Class B conforming to the requirements of 03 30 00 Paragraph 2.4.E.

The amount of deleterious substances in coarse aggregates shall not exceed the following limits:

1. Soft Particles 5.00%
 2. Coal and Lignite 0.25%
 3. Coal Lumps 0.25%
 4. Material Passing the No. 200 Sieve 1.00%
 5. Thin or Elongated Pieces (length greater than 5 times avg. thickness) 10.00%
 6. Other Deleterious Substances (Shale, Mica, highly absorbent particles and Marcasite, etc.) 2.00%
 7. Total (1) - (6), excluding (5) above 6.00%
- C. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench.
1. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other deleterious materials.
 2. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements.
 3. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping.
 4. If materials excavated from the trench are not suitable for use as initial backfill material, provide select material conforming to the requirements of this Section.

2.4 FINAL BACKFILL

- A. Final backfill material shall be general excavated earth materials, shall not contain more than one third broken rock, of which no stone or boulder shall weigh more than 50 pounds, cinders, stumps, limbs, man-made wastes and other deleterious materials.
1. If materials excavated from the trench are not suitable for use as final backfill material, the contractor must provide select material conforming to the requirements of this Section.
 2. Where excavation has been within the limits of easements across private property, the top one (1) foot of backfill materials shall consist of fine, loose earth free from large clods, vegetable matter, debris, stones, and/or other objectionable materials.
- B. Backfilling of sanitary sewer pipe shall be accomplished using the specific backfill material specified in the Plans, the Proposal, the Special Conditions, the Standard Details, or as approved by the MU Representative. Alternate materials for backfill may be used if approved by the MU Representative.
- C. Stone aggregate backfill shall be crushed limestone, dolomite aggregate, or other suitable material; as approved by the MU Representative, in the gradation specified in the Plans or by the MU Representative.



- D. Crusher run stone backfill shall be crusher run limestone or dolomite unless a substitute material is approved in writing by the Board. Crusher run stone is a local term and may be obtained at any of the local quarries. The maximum sizes screening shall be 2.0 inches (95% to 100% passing a 2.0 inch screen).
- E. Earth backfill shall consist of suitable native materials of low organic content. Stumps, roots, topsoil, and other highly organic materials are not acceptable for use as backfill. Earth backfill shall not contain any rocks, stones, or boulders which might be large enough to damage or endanger the sanitary sewer pipe. The decision regarding the suitability of a particular material for use as earth backfill will be at the sole discretion of the MU Representative.

2.5 FOUNDATION BACKFILL

- A. Foundation Backfill is a term used to describe a coarse stone aggregate which may be used at the direction of the MU Representative to stabilize the bottom of the pipe trench prior to placement of pipe bedding material. Foundation Backfill shall be either crushed limestone or crushed dolomite, unless a substitute material is approved in writing by the MU Representative. The Developer's Engineer shall determine the gradation(s) to be used, and it must be approved by the MU Representative.

2.6 SELECT BACKFILL

- A. Select backfill shall be materials that meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

2.7 CONCRETE

- A. Concrete for bedding, haunching, initial backfill, or encasement shall be Class "C" concrete as defined in Section 03 30 00.
- B. Ready mixed concrete shall be mixed and transported in accordance with ASTM C 94.

PART 3 - EXECUTION

3.1 TRENCH EXCAVATION

- A. The contractor shall properly backfill pipe trenches so as to maintain a clean jobsite and minimize traffic hazards
- B. Topsoil and grass shall be stripped a minimum of 6-inches over the trench excavation site and stockpiled separately for replacement over the finished grading areas.
- C. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of trenches on the centerlines of the pipes and to the dimensions which provide the proper support and protection of the pipe and other structures and accessories.



- D. Width:
1. The sides of all trenches shall be vertical to a minimum of one foot above the top of the pipe.
 - a. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.
 2. Excavate the top portion of the trench to any width within the construction easement or right-of-way, which will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees, or private property.
 - a. Where necessary to accomplish this, provide sheeting and shoring.
 3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of nine (9) inches clearance between the rock and any part of the pipe or appurtenance.
 4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher class (load factor) of bedding and haunching for the full trench width as actually cut.
 - a. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over excavation, intentional over excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of MU.
- E. Depth:
1. The trenches shall be excavated to the required depth or elevation, which allow for the placement of the pipe and bedding to the thickness shown on the Drawings.
 2. Water Mains and Force Mains:
 - a. Excavate trenches to provide the minimum required cover or as shown on the plans.
 - 1) In areas that are subject to vehicular traffic a minimum of thirty-six (36) inches of cover is required for water.
 - 2) In non-traffic areas a minimum of thirty (30) inches of cover is required for water.
 - 3) Excavate trenches to provide a minimum cover of thirty-six (36) inches for all force mains, unless specifically detailed otherwise on the drawings.
 - b. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.
 3. Depths of sewer lines shall be as detailed on the drawings. Provide a minimum cover of thirty-six (36) inches for all gravity sewers, unless specifically detailed otherwise on the drawings.
 4. Where rock is encountered in trenches, excavate to the minimum depth, which will provide clearance below the pipe barrel of 8-inches for pipe 12-inches in diameter and smaller and 12-inches for larger pipe, valves, and manholes.
- F. Excavated Materials:
1. Excavated materials shall be placed adjacent to the work to be used for



- backfilling as required.
- 2. Topsoil shall be carefully separated and lastly placed in its original location.
- 3. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems.
 - a. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.
- G. The contractor shall place the proper amount of concrete behind each fitting (for thrust blocking) prior to backfilling. It is unacceptable for the contractor to backfill, return, and excavate to install blocking at a later date. Blocking shall be given twenty-four (24) hours to set-up before commencing backfilling operations. Blocking shall be installed and required set-up time met, prior to any scheduled testing can begin.
- H. If in the opinion of the MU Representative, that pipe trenches are not properly backfilled or are left open too long, the contractor will be ordered to stop excavating and installing pipe and start proper backfilling operations to the satisfaction of MU.

3.2 TRENCH FOUNDATION AND STABILIZATION

- A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding.
 - 1. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.
- B. If the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the Developer/Contractor shall then submit plans for approval to MU for trench stabilization.
- C. Should the undisturbed material encountered at the trench bottom constitute, in the opinion of MU, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper sub grade with crushed stone
- D. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 95 percent of the maximum dry density, unless shown or specified otherwise
- E. Where the replacement of unsuitable material with crushed stone does not provide an adequate trench foundation, the trench bottom shall be excavated to a depth of at least two (2) feet below the specified trench bottom.
 - 1. Place filter fabric in the bottom of the trench and support the fabric along the trench walls until the trench stabilization, bedding, haunching, and pipe have been placed at the proper grade. The ends of the filter fabric shall be overlapped above the pipe

3.3 BEDDING AND HAUNCHING



- A. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation.
 - 1. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings, and the pipe shall be placed thereon and brought to grade by tamping the bedding material or by removal of the slight excess amount of the bedding material under the pipe.
 - 2. Adjustment to grade line shall be made by scraping away or filling with bedding material.
 - 3. Wedging or blocking up of pipe shall not be permitted.
 - 4. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted.
 - 5. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint.
 - 6. All bedding shall extend the full width of the trench bottom.
 - 7. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders, or large dirt clods.

- B. After the pipe section is properly placed, add the haunching material to the specified depth.
 - 1. The haunching material shall be shovel sliced, tamped, vigorously chinked, or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole.
 - 2. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders, or dirt clods.

- C. Excessive Width and Depth:
 - 1. Water Mains and Force Mains: If the trench is excavated to excess width, provide the next higher type or class of pipe bedding, but a minimum of Type 4, as detailed on the Drawings.
 - 2. If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.

- D. Compaction:
 - 1. Bedding and haunching materials under pipes, manholes, and accessories shall be compacted to a minimum of 95 percent of the maximum dry density, unless shown or specified otherwise.

3.4 INITIAL BACKFILL

- A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill, and ensure the uniform distribution of the loads over the top of the pipe.
- B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least eighteen (18) inches above the pipe barrel.
- C. Layer depths shall be a maximum of 6-inches for pipe 18-inches in diameter and smaller and a maximum of 12-inches for pipe larger than 18-inches in diameter.



- D. Backfill on both sides of the pipe simultaneously to prevent side pressures.
- E. Compact each layer thoroughly with suitable hand tools or tamping equipment.
- F. Initial backfill shall be compacted to a minimum 95 percent of the maximum dry density, unless shown or specified otherwise.
- G. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

3.5 CONCRETE ENCASUREMENT

- A. Where concrete encasement is shown on the Drawings or ordered by MU, excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe.
- B. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 6-inches above the pipe bell.
- C. Do not backfill the trench for a period of at least twenty-four (24) hours after concrete is placed.

3.6 FINAL BACKFILL

- A. Backfill carefully to restore the ground surface to its original condition.
- B. The top 6-inches shall be topsoil obtained as specified above in this Section, under paragraph 3.1.
- C. Excavated material, which is unsuitable for backfilling, and excess material, shall be disposed of.
 - 1. Surplus soil may be neatly distributed and spread over the site, if approved by MU.
 - 2. If such spreading is allowed, the site shall be left in a clean and sightless condition and shall not affect pre-construction drainage patterns.
 - 3. Surplus rock from the trenching operations shall be removed from the site.
- D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.
- E. After initial backfill material has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows;
 - 1. In 6-inch layers, if using light power tamping equipment, such as a "jumping jack".
 - 2. In 12-inch layers, if using heavy tamping equipment, such as hammer with tamping feet.
 - 3. In 24-inch layers, if using a hydra-hammer.



- F. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.
- G. Final backfill shall be compacted to a minimum 95 percent of the maximum dry density, unless specified otherwise.

3.7 BACKFILL UNDER ROADS

- A. Compact backfill underlying sidewalks and under dirt and gravel roads to a minimum 95 percent of the maximum dry density.
- B. The top 12-inches shall be compacted to a minimum of 98 percent of the maximum dry density.
- C. Backfill under paved area shall be 100% gravel per City of Madison Specifications.

3.8 BACKFILL WITHIN ALABAMA DOT RIGHT-OF-WAY

- A. Backfill within the Alabama DOT right-of-way shall meet the requirements stipulated in the Alabama DOT specifications.

3.9 TESTING AND INSPECTION

- A. Soil samples from the proposed construction area shall be analyzed for maximum dry density in accordance with ASTM 698 – Method C.
- B. The extent of testing required shall be depended upon soil conditions, Contractor's methods of construction and regulatory requirements.
- C. The soil testing shall be performed by an independent testing laboratory.
 - 1. The soil testing laboratory is responsible for the following;
 - a. Compaction tests in accordance with this specification.
 - 2. The Contractor's duties relative to testing include;
 - a. Notifying laboratory of conditions requiring testing.
 - b. Coordinating with laboratory for field-testing.
 - c. Paying for all testing costs including initial testing, re-testing where initial testing reveal non-conformance with specified requirements.
 - d. Providing excavation as necessary for laboratory personnel to conduct tests.

END OF SECTION



Division 32 – Exterior Improvements

32 12 16 – Asphalt Paving

PART 1 - GENERAL

1.1 SUMMARY

- A. Pavements removed or damaged by the Contractor beyond the specified construction limits shall be replaced in accordance with these Specifications at the Contractor's expense.
- B. Where chert, gravel, slag, or other unpaved street or driveway surfaces are removed or damaged, they shall be replaced with the same type of materials that were removed.
- C. In replacing pavements and unpaved surfaces, the materials used and the construction methods employed shall comply with the applicable requirements of the City of Madison Constructions Specifications Manual, or the appropriate governing body.
- D. Where shown on Plans service lines and small diameter pipe, eight (8) inches in diameter or less, located across paved surfaces shall be installed by boring, or other approved methods that will not require cutting or removing the pavement where feasible.
- E. Prior to trenching, the Contractor shall pre-cut all pavements to be removed to widths shown on the Plans. The Contractor shall make every effort to minimize the amount of pavement removed.
- F. 100% crushed stone backfill shall be deposited in twelve (12) inch layers and thoroughly compacted at locations shown on the Plans or as directed by the MU Representative.
- G. Base shall be at least 5 inches thick, or the same thickness as the original base material, if greater than 5 inches, or as shown on the Plans. If the base is more than 5 inches thick, it shall be installed in two (2) layers.
- H. Bituminous binder course: hot mixed bituminous pavement shall meet the current applicable standard from the City of Madison Constructions Specifications Manual.
- I. Bituminous wearing course: hot mixed bituminous pavement shall meet the current applicable standard from the City of Madison Constructions Specifications Manual.
- J. All pavements shall conform to the City of Madison.
- K. Other pavements shall be replaced in kind to a condition equal to or better than the original pavement and to the original thickness.



- L. Pavements replaced shall be the same type of construction as was removed, except that no asphalt surface replaced shall be less than three inches thick consisting of two inches of binder and one inch of wearing surface.
- M. The Contractor shall backfill the trench and restores traffic as quickly as possible. The Contractor shall both install a temporary bituminous pavement or the binder course, and maintain the temporary surface under traffic for at least 30 days. After subjecting to traffic, he shall remove the temporary pavement and install the wearing course accurately finished to the street grade.
- N. In replacing pavements and unpaved surfaces, the materials used and the construction methods employed shall comply with the applicable requirements of the City of Madison Construction Specifications Manual, or the appropriate governing authority.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



32 12 16.19 – Cold Mix Asphalt Paving

PART 1 - GENERAL

1.1 SUMMARY

- A. Temporary cold or permanent hot asphalt patching will be required for both transverse and longitudinal roadway cuts upon completing backfilling requirements at the end of each day's work if the road is to be opened for local traffic while work has stopped, if required by the MU Representative.
- B. Temporary paving shall be maintained for at least thirty (30) days before installation of the permanent paving.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



32 13 13 – Concrete Paving

PART 1 - CONCRETE PAVING

1.1 SUMMARY

- A. All concrete pavement replaced shall be not less than 4 inches thick or equal to the original if greater than 4 inches.
- B. Concrete for pavement shall be Class A.
- C. Concrete for curb, curb and gutter or valley gutter shall be Class A.
- D. Concrete for sidewalks shall be Class A.
- E. Concrete for driveways shall be Class A.
- F. If the concrete to be installed or replaced is within the City of Madison Right-of-way or a City of Madison Public Utility and Drainage Easement then the concrete, its installation, and all parts of the concrete shall meet the City of Madison Construction Specification Manual, latest edition.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



Division 33 – Utilities

33 01 10.58 – Disinfection of Water Utility Piping Systems

PART 1 – GENERAL

1.1 SUMMARY

- A. The Contractor shall disinfect all pipe, pipe fittings, valves, hydrants, and other appurtenances installed in the system. In general, all disinfection shall be in accordance with the latest revision of AWWA C601. The MU Representative shall be notified at least twenty-four (24) hours prior to disinfection.
- B. After the mains are laid and pressure tested, they shall be thoroughly flushed, either through fire hydrants or by means of taps at the ends of the mains (the taps shall be large enough to insure a velocity of at least 2.5 feet-per-second (fps) in the mains), in accordance with Section 33 01 12; Paragraph 1.1.F.
- C. After flushing, the mains shall be chlorinated with sufficient liquid chlorine, sodium hypochlorite, or calcium hypochlorite to provide 50 ppm available chlorine to the water in the mains. The chlorine solution shall remain in the pipe for at least twenty-four (24) hours, and then the main shall be flushed until it is filled with water having normal chlorine residual. Flushed water shall not be allowed to enter the existing distribution system. After the applicable retention period, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use.
- D. If the water quality does not meet the standard of the Health Department, the disinfection process shall be repeated until satisfactory water is obtained. Samples shall be taken at each one thousand two hundred (1,200) foot sections of new line and at the ends of all new lines. More sampling sites can be requested at the discretion of the MU Representative.
- E. The environment to which the chlorinated water is to be discharged shall be inspected and if there is any question that the chlorinated discharge will cause damage to the environment, then a reducing agent, such as sulfur dioxide, sodium bisulfite, sodium sulfite, or sodium thiosulfate, shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water.
- F. The Contractor shall furnish all chemical feed pumps, generator sets, valves, connections, materials, labor, and other equipment required for proper disinfection of the mains. The Contractor shall bear all costs of disinfecting the water mains. The Board will furnish, at its expense, enough water to fill the new main two (2) times; afterwards the Contractor shall pay, at the Board's standard rates, for all water used.



1.2 SUBMITTALS

- A. Bacteriological Report:
 - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.
 - 3. Name of person collecting samples.
 - 4. Test locations.
 - 5. Initial and twenty-four (24) hour disinfectant residuals in ppm for each outlet tested.
 - 6. Coliform bacteria test results for each outlet tested.
 - 7. Certify water conforms, or fails to conform, to bacterial standards of MU.
- B. Water Quality Certificate: Certify water conforms to quality standards of MU, suitable for human consumption.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.

1.4 MU REQUIREMENTS

- A. All newly installed water distribution piping and piping affected during construction shall be disinfected in accordance with AWWA C651.
- B. All disinfection procedures shall be coordinated with the MU Inspector they shall be notified at least twenty-four (24) hours prior to disinfection.
- C. MU Representative shall operate existing valves during disinfection procedures.
- D. MU shall be informed of all disinfecting of the following in-place piping;
 - 1. Water mains.
 - 2. Service connections up to and including water meters and back flow prevention devices.
- E. Collection and testing of water samples shall be performed by the MU Representative. Samples are sent to lab for testing selected by MU.
- F. No water piping system shall be placed in service until written approval is received from MU.



PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify piping system has been cleaned, inspected, and pressure tested.
- B. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting, and balancing, demonstration procedures, including coordination with related systems.

3.2 INITIAL FLUSHING

- A. Prior to disinfection, the Contractor shall flush piping system with sufficient water to create a minimum velocity in the pipe of two and one half (2.5) ft./sec.
- B. Flushing shall be performed by pushing water through a laid section of pipe with one end of section open to the atmosphere above existing grade. After the mains are laid and pressure tested, they shall be thoroughly flushed, either through fire hydrants or by means of taps at the ends of the mains.
- C. All piping and components associated with service connections shall be thoroughly flushed with fresh potable water prior to installation.
- D. Upon completion of flushing, laid pipe with one end open to atmosphere shall be re-laid to depth indicated in Construction Drawings, unless it is a temporary blow-off per MU Specifications.
- E. Flushing shall be accomplished such that there is no soil erosion due to flushing activities. The contractor shall be responsible for providing the means and methods to properly and adequately flush the pipes without eroding soil.

3.3 CHLORINATION AND FLUSHING

- A. The contractor shall introduce a chlorine solution having a concentration of fifty (50) to one hundred (100) milligrams per liter (mg/l) into the water main. After flushing, the mains shall be chlorinated with fifty (50) ppm available chlorine to the water in the mains.
- B. Upon introducing the chlorine solution, all valves associated with the water main shall be fully operated to ensure complete disinfection.
- C. All piping and components associated with service connections shall be thoroughly flushed.



- D. Water main shall have minimum twenty-five (25) mg/l chlorine residual after a twenty-four (24) hour retention period.
- E. Flushing shall continue until water in main has a residual chlorine concentration at a minimum of one (1) mg/l.

3.4 DISINFECTION TESTING

- A. After chlorination and flushing is complete, MU shall collect water samples from the system and perform 24-hour analyses in accordance with ADEM requirements.
- B. At least one set of samples shall be collected from each 1200 foot section of new line, plus one set at the end of each line and the number of samples taken must be representative of the water in the newly constructed mains
- C. All samples shall be tested for bacteriological quality in accordance with *Standard Methods for the Examination of Water and Waste Water* (Co-Published by American Public Health Assoc., Water Environment Federation, and American Water Works Association; Latest edition), and shall show the absence of total coliform organisms.
 - 1. The chlorine residual must also be measured and reported.
 - 2. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported.
 - a. If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated.
- D. If the bacteriological tests do not pass, the procedure shall be repeated until they are successful.
- E. After the 24-hour analysis is complete and acceptable, the water main may be put into service.

3.5 CONNECTIONS

- A. After the pipe and appurtenances have been flushed, tested, chlorinated, have passed the bacteriological test and have been approved to be placed in service, they may be connected to the existing system.
 - 1. Connections Equal to or Less than One Pipe Length (18 feet): The new pipe, fittings, and valves required for the connections shall be spray disinfected or swabbed with a minimum 1 % solution of chlorine just prior to being installed, if the length of connection from the new main to the existing main is equal to or less than 18 feet.
 - 2. Connections Greater Than One Pipe Length: The pipe required for the connection must be set up above ground, chlorinated and bacteriological samples taken as described above if the length of the connection is greater than 18 feet. After the bacteriological tests have proven satisfactory, the new pipe can be used in connecting the new main to the existing system. After the samples have been



taken, the ends of the new pipe must be closed with water-tight plugs or caps until the connections are made.

3.6 FIELD QUALITY CONTROL

A. Disinfection, Flushing, and Sampling:

1. Cross connections shall be allowed during testing, flushing, chlorinating, or dechlorinating of the new lines, but to only fill the untested line with potable water and there shall be a valve separating the two lines. The MU Representative is the only individual allowed to operate the valve. The valve shall remain in the off position except when filling and flushing of the undedicated line.

END OF SECTION



33 01 12 – Inspection and Testing of Water Lines

PART 1 - GENERAL

1.1 SUMMARY

- A. Upon completion of all or part of a water line, the Contractor will be required to test said water line for acceptability. The Contractor shall provide all necessary water, equipment, and instrumentation for flushing and testing. Source and quality of water, test procedures, and disposal of water shall all be approved by the MU Representative. The method(s) of testing shall be as specified herein.
- B. All tests shall be conducted in the presence of the MU Representative, and preliminary tests not observed by the MU Representative will not be accepted. The MU Representative shall be notified at least twenty-four (24) hours before any work is to be inspected or tested. The MU Representative is available to witness tests from 8:00 a.m. to 3:00 p.m., Monday through Friday. If the developer/contractor wishes to conduct testing outside these hours, they shall contact the General Manager concerning charges which will be levied for the MU Representative to be available for witnessing the tests, as required.
- C. All defective water lines shall be repaired, or replaced, and retested until acceptable by the MU Representative. Repairs shall be made to the standard of quality specified for the entire system.
- D. Sections of the system may be tested separately. However, any defect which may develop in a section previously tested and accepted shall be promptly corrected and retested until acceptable by the MU Representative. Pressure tests shall be made between valves to demonstrate the ability of the valve to sustain pressure.
- E. All piping systems shall be tested in accordance with these test methods. Any tests required by local plumbing codes or building authorities shall also be conducted.
- F. Prior to any testing, all lines shall be cleaned of debris and flushed clean with water as necessary. Debris shall be caught and removed from the line and shall not be flushed into existing water lines. All flushing shall be coordinated with the MU Representative, in such a way so that existing customers' service is not infringed upon. This may necessitate testing during off-peak usage hours, as directed. Water used for flushing shall be expelled from the new main(s) and not allowed to enter the existing distribution system.
- G. Foreign material left in the pipelines during installation often results in valve or hydrant seat leakage during pressure tests. Every effort shall be made to keep lines clean during installation. Thorough flushing is recommended prior to a pressure test; flushing should be accomplished by partially opening and closing valves and hydrants several times under expected line pressure with flow velocities adequate to flush foreign material out of the valves and hydrants.



1.2 TESTING OF WATER MAINS

- A. All water lines shall be pressure tested in accordance with one, or both, of the following procedures, as permitted or directed by the MU Representative.
- B. Before testing, at least thirty-six (36) hours shall elapse after the last concrete thrust block or reaction backing has been cast with high-early-strength cement, and at least seven (7) days shall elapse after the last concrete thrust block or reaction backing has been cast with standard cement.
- C. **PRESSURE TESTING BEFORE BACKFILLING**
 - 1. Water mains shall be pressure tested before backfilling over and around joints except in locations where traffic safety or the provisions for access to residences or businesses require backfilling over a joint. Sections of main placed under test shall be approximately five thousand two-hundred (5,200) feet in length; but lengths of sections to be placed under test may be increased to seven thousand (7,000) feet provided that the permission of the MU Representative is first secured. Sections of mains to be placed under test shall be isolated by means of valves or test plugs. Test pressure shall be 1.5 times the working pressure at the point of testing or one hundred-fifty (150) psi minimum, as determined by the MU Representative. The duration of the test shall not be less than two (2) hours. The allowable leakage shall not be greater than the appropriate value in AWWA C600-17, Table 6.
- D. **PRESSURE TESTING AFTER BACKFILLING**
 - 1. Backfilling over and around pipe joints before the main is tested shall not be performed unless the permission of the MU Representative is first secured. In the event that the permission of the MU Representative is secured and the mains are backfilled throughout their entire length, the test pressure shall be one and one-half (1.5) times the working pressure at the point of testing or one hundred-fifty (150) psi minimum, as determined by the MU Representative, in excess of the gauge pressure indicated at the point of testing (after the line has been filled but before test pressure has been applied). The duration of the test shall not be less than six (6) hours. The allowable leakage shall not be greater than the appropriate value in AWWA C600-17, Table 6.
- E. Whichever of the two (2) procedures is followed, all visible leaks for which evidence is noted shall be repaired even though the measured leakage may be less than allowable, as determined herein above. Should the measured leakage exceed the allowable leakage, the line shall be repaired and retested until the measured leakage does not exceed the allowable leakage. Any blown fittings, plugs, hydrants, etc., shall be replaced, rebraced and retested.
- F. The Contractor shall furnish all meters, gauges, chart recorders, pumps, plugs, valves, couplings, pivot gauges, compressors, receivers, water, labor, tools, materials, and equipment necessary for pressure testing the pipe lines. The Contractor shall make all



connections necessary to perform the required tests. The Contractor shall bear all costs associated with testing, retesting, and any placement work required.

- G. Pressure test system in accordance with AWWA C600-17 and the following:
1. Fill section to be tested with water slowly, expel ALL air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled. Raise pressure to specified test pressure.
 2. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure. Differential pressure at valves and hydrants shall equal the maximum possible, but shall not exceed manufacturer's pressure rating.
 3. Provide an accurate pressure gage with graduation not greater than 5 psi to be used during pipe testing.
 4. Leakage shall be defined as the quantity of water that must be pumped into the test section: equal to the sum of the water to maintain pressure within 5 psi of the specified test pressure for the test duration plus water required to return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter.
 5. Allowable Leakage test will not be performed until all joints, connections, valves, fittings have been exposed and monitored for the duration of a 2 hour Pressure Test.
 6. No test section shall be accepted if the leakage exceeds the limits determined under Section 4 of AWWA C600-17 - Installation of Ductile Iron Water Mains and Their Appurtenances
 7. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and perform a complete retest (including a blocking test) until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



33 01 30.11 – Television Inspection of New Sewers

PART 1 - GENERAL

1.1 SUMMARY

- A. Internal television inspection of all new sewers will be performed by the Developer or Contractor as part of the required testing and acceptance procedure, at the expense of the Developer or Contractor.
- B. Television inspection by the Developer/Contractor will be required. The television inspection shall be reviewed by the MU Representative.
- C. All photographs and digital recordings made in performance of said television inspection shall become the property of the Board and shall be delivered to the MU Representative immediately upon completion of said inspections. The MU Representative must be notified at least forty-eight (48) hours prior to any testing or inspecting.
- D. The Contractor shall furnish the mobile television inspection equipment, and other necessary types of equipment, and all materials, electricity, labor, technicians, as may be needed to perform the closed circuit television inspection of the sewers for final inspection. The television inspection shall be conducted in such a manner that the television control technician, the MU Representative can determine that the sewer line is clean, so that all leaking joints, pipe breaks, line sags, line dips, or service connections can be accurately seen and located within and along the sewer line.
- E. Digital Camera: the camera used for the sewer line inspection shall be one specifically designed and constructed for such inspection work. Lighting for the camera shall be adequate, suitable, and adjustable to allow a clean picture of the entire periphery of the pipe. The camera shall be water proof and shall be operative in 100 percent humidity conditions. The camera, or cameras, shall be small enough to pass through and clearly televise the interior of a six (6) inch diameter sewer and all larger sewer sizes up to and including a thirty-six (36) inch diameter sewer. The camera focal length or distance shall be adjustable through a range of six (6) inches to infinity. The television camera shall be capable of transmitting a picture having not less than 600 lines of resolution.
- F. Digital Camera Monitor: The view seen by the television camera shall be transmitted to a monitor of not less than eleven (11) inches in size. The television monitor shall be capable of receiving and displaying a picture having not less than 600 lines resolution. The picture shall be free at all times of electrical interference and shall provide a clear stable image having the number of lines of resolution specified.
- G. Digital Photographs: The Contractor shall furnish all equipment required for taking instant digital still shots of the view which appears on the monitor. A camera having the proper lenses and mountings as required to properly frame the monitor shall be available for making these photographs. Pictures which include less than the total screen area, or



which extend appreciably beyond the total screen in width or height will not be acceptable.

- H. **Operation of Television Equipment:** The operation of the television equipment shall be controlled by a skilled technician or supervisor who shall be located at the control panel in the mobile television inspection equipment. The control technician shall, at all times, be able to move the television camera through the sewers in either direction without loss of quality in the video presentation of the monitor. The image on the monitor shall, at all times, be free of electrical interference and shall provide a clear, stable image and picture. When directed to do so by the MU Representative, the digital camera shall be stopped and/or backed-up as required so the MU Representative or control technician can view and analyze and take a still shot when so directed any features or conditions that appear unusual or uncommon in a good sound sewer. The travel speed of the television camera (through the sewer) shall be uniform and shall not exceed that maximum speed directed by the MU Representative (30 feet per minute under normal conditions). Any means of propelling the camera through the sewer which produces non-uniform rates of speed or which results in a speed faster than that specified by the MU Representative will not be acceptable. The control technician shall be able to adjust the brilliance of the lighting system (built into the digital camera) and be able to change the focus of the digital camera by remote control. Measurement of the exact location of any sewer line defects. (i.e., breaks, sags, leaks, obstructions, etc.) shall be at the ground level by means of a metering device. Markings on a cable, or the like, which would require interpolation for the depth of manhole, will not be allowed. Measurement meters shall be accurate to two-tenths (0.2) of a foot. A measuring target shall be used as an exact measurement reference point, and the meter reading shall show the exact location of this measurement reference point.
- I. **Obstructions:** Where obstructions within the sewer line prevent the passage of equipment (i.e., digital camera and other equipment), the Contractor shall reset his equipment to pass through the section from the other end and thereby complete the inspection of that section when possible. When section having obstructions that prevent completion of the inspection are encountered, the crew shall abandon this section and go on the next section. After the obstruction has been removed, the inspection crew shall return and complete the inspection.
- J. **Photographs:** During the course of the inspection the MU Representative shall select the specific views which are to be still shot. These images shall be a quality and definition comparable to the monitor display. The still shot record shall include the image number, the location of the image in the identified manhole section (to the nearest foot), date of image, and the corresponding TV inspection report number.
- K. **Digital Recording:** Continuous digital recordings of the inspection view as it appears on the monitor shall be taken. It is intended that a digital recording will be made of the complete television inspection of all the sewer lines constructed as a part of this project. Where the television inspection shows that the sewer line has occasional bad features or items, it is identified that said occasional bad features be still shot and that these images shall be used as the permanent record of said bad features. The digital recording shall be used as the permanent record of said bad features. The digital recorder shall be one on



which both sound and digital video information can be reproduced with a video image equal to or better than the quality of the original picture on the monitor. The replay of the recorded video information, when reviewed on a monitor-receiver, shall be free of electrical interference and shall produce a clear, stable image with a horizontal resolution equal to that of the television monitor in the television inspection studio. The digital recording equipment shall be continuously connected to the inspection or monitoring equipment. The digital recording and monitoring equipment shall have the built-in capability to allow the MU Representative and technician to instantly review both video quality of the digital recording at all times during the television survey. Playback speed shall be continuously adjustable from one-third normal speed for slow-motion viewing to normal playback speed. Digital recordings shall be kept on zip drive or CD.

- L. The Contractor will keep a daily log or record covering the television inspection work and the information acquired therefrom. This daily log or record will contain at least the following data:
 - 1. Date and Time
 - 2. Sewer Line Location (Street Name and Manhole-to Manhole Numbers, Etc.)
 - 3. Size and Length of Line, Type of Material Line is made of, etc.
 - 4. Name of Television Control Technician or Supervisor in charge.
 - 5. Cleanliness and general condition of pipe.
 - 6. Sewer service line location, type (Y or T), position on the periphery of the pipe, condition.
 - 7. Pipe damage and character, type and location of such damage.
 - 8. Any infiltration points location from manhole, location non periphery of the pipe, estimate of the amount of infiltration in gallons per minute (GPM) and a description of the infiltration point (i.e., joint, break, hole, etc.).
 - 9. Still shots acquired (photo, location, etc.)

- M. Digital Recordings - One copy of the log and digital recording shall be submitted to the MU Inspector upon completion of the work.

- N. MU Representative to be notified immediately of any potential defects.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION

33 01 30.86 – Manhole Rim Adjustments

PART 1 - GENERAL

1.1 REFERENCES

- A. ASTM International:
 - 1. ASTM A48/A48M-03 - Standard Specification for Gray Iron Castings.
 - 2. ASTM C531 -Standard Test Method for Linear Shrinkage and Coefficient Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - 3. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete.
 - 4. ASTM C672 - Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
 - 5. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
 - 6. ASTM D395 - Standard Test Method for Rubber Property - Compression Set.
 - 7. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - 8. ASTM D573 - Standard Test Method for Rubber-Deterioration in an Air Oven.
 - 9. ASTM D575 - Standard Test Methods for Rubber Properties in Compression.
 - 10. ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness.
 - 11. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - 12. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

1.2 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in undamaged, unopened container, bearing manufacturer's original labels. Inspect for damage.
- C. Protect materials from damage by storage in secure location.

1.3 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.4 COORDINATION

- A. Provide schedule of manhole grade adjustment.



PART 2 - PRODUCTS

2.1 RISER RINGS

- A. Accessories:
 - 1. Joint Sealant: ASTM C990.
 - 2. Bolts: Stainless steel ASTM F593; galvanized ASTM F1554.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of existing conditions before starting work.
- B. Verify and locate manholes requiring grade adjustment.

3.2 EXISTING WORK

- A. Saw cut existing paving.
- B. Excavate.
- C. Clean manholes.
- D. Remove existing manhole frames and covers.
- E. Repair waterproofing.

3.3 RAISING MANHOLE FRAMES AND COVERS

- A. Locate and raise manholes to grade as indicated on Drawings.
- B. Use Engineer approved manhole rings to achieve elevation indicated for frame and cover.
- C. Do not adjust elevation more than 8 inches with approved manhole rings.
- D. Seal joints between manhole top, rubber rings, and frame with sealant.
- E. Reinstall removed manhole frame and cover, if the frame is 26 inches in diameter or greater.

3.4 REPLACING MANHOLE FRAMES AND COVERS

- A. Remove existing manhole frames and covers to enable reuse.
- B. Deliver removed manhole frames and covers to MU as maintenance materials, if required by MU.
- C. Install new frames and covers for manholes as indicated on Drawings. Adjust to match finished grade as indicated on Drawings. Seal joints between manholes and manhole frames.

3.5 PAVING RESTORATION

- A. Restore bituminous paving areas in accordance with Section 32 12 16. Reference the City of Madison's Paving Spec.



3.6 LANDSCAPING RESTORATION

- A. If applicable, restore grassed and vegetated areas to similar state as prior to construction, with like for like vegetation.

END OF SECTION



33 05 05 – Buried Piping Installation

PART 1 - GENERAL

1.1 SUMMARY

- A. Other utilities such as water lines, steam lines, electrical lines, telephone lines, television cable, and telegraph lines, whether overhead or underground, shall be carefully preserved by the Contractor.
- B. In the event that interference with any existing utilities is imminent, the Contractor shall so notify the MU Representative of the utility 72 hours in advance of any construction activities so that service may be relocated or otherwise preserved and protected. The Contractor shall contact the MU Main office in the event conflict with a water line appears imminent.
- C. The Contractor is to cooperate fully with the representative of the utility company to the extent necessary to satisfactorily accomplish the work.

PART 2 – PRODUCTS

2.1 DELIVERY, STORAGE AND HANDLING

- A. Pipe shall be stored or strung along the route of the work only in such quantity as will be sufficient to maintain continuous laying operations and prevent delays due to shortages of materials. The Contractor shall avoid stringing or storing pipe in locations that might cause inconvenience to the public operation of businesses, or hindrance to traffic such as across driveways, entrances, fire lanes, or adjacent to fire hydrants, and shall avoid stringing pipe in locations that would interfere with drainage.
- B. Where pipe lines are to be constructed in easements, the Contractor shall confine his operations to such easements or temporary work strips as might be made available adjacent to the easements. The Contractor may obtain information regarding such easements and/or work strips from the MU Representative. The Contractor shall make his own arrangements for storage of pipe or other materials on property outside of public ways, easements, or temporary work strips; and use of such areas shall be at the Contractor's own responsibility.
- C. The Contractor shall keep the City, Board, County, and the State well-informed on his construction schedule progress, and any changes in the schedule. The Contractor shall consult with the respective Engineering and Traffic Departments of the authorities mentioned herein above before beginning work. The work located in public ways under the jurisdiction of such Departments shall follow the recommendations of the respective Departments relative to work on public ways, and shall make such provisions for maintenance of traffic flow, regulation of traffic, and protection of traffic and the public as required by the respective Departments.



- D. The Contractor shall furnish and install all pipe, valves, fittings, accessories, and appurtenances; shall furnish and install all other pipeline materials required in the work; shall furnish and install all materials required for bracing of pipe and fittings; and shall construct the transmission and distribution system complete in accordance with the Plans and these Specifications.

2.2 PIPE PROTECTION

- A. Sewer pipe which, when completed, will have less than 18 inches of cover shall be constructed of ductile iron pipe or encased in concrete, as shown on the Plans or as directed by the MU Representative.
- B. Where foundation conditions are not satisfactory, as determined by the MU Representative, water lines shall be either laid on a concrete cradle, on Class A bedding as shown in the Standard Details, or on Foundation Backfill as specified in Section 31 23 16 Paragraph 1.1.E of these Specifications, or shall be constructed of ductile iron pipe with proper pipe protection as shown on the Plans or as directed by the MU Representative.
- C. Polyethylene pipe protection shall be installed where called for on the Plans or as directed by the MU Representative. Polyethylene material specifications and installation procedures shall be in accordance with ANSI/AWWA C105/A21.5-18/A21.5.
- D. Plain concrete ditch checks may be required by the MU Representative on steep slopes and other locations to prevent erosion of the backfilled trench.

PART 3 – EXECUTION

3.1 PIPE BEDDING

- A. Pipe bedding shall be placed below the barrel of the pipe, across the full width of the trench, to the minimum depth indicated on the Standard Details. Bedding shall be compacted to the exact grade for the full length of the pipe barrel and for the full width of the trench before each pipe is laid. Backfill material shall be thoroughly compacted by use of pneumatic or mechanical tamping equipment or by other approved methods. Where appropriate, sling or cable grooves shall be excavated at proper intervals to facilitate installation of pipe.
- B. Pipe bedding material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks or stones, or other material that, in the opinion of the MU Representative, is unsuitable. When the subgrade is found to include unsuitable material, such material shall be removed to a minimum of at least 3" or to the depth ordered by the MU Representative, and replaced under the direction of the MU Representative with clean, stable backfill material. The bedding shall be consolidated and leveled in order that the pipe may be installed in accordance with these Specifications.



3.2 PIPE LAYING

- A. The Contractor is responsible for accurately placing pipe to the exact line and grade called for on the Plans. The control of vertical and horizontal alignments shall be accomplished by the use of a laser beam instrument. When a laser is used, the elevation and alignment of the pipe shall be checked by transit and level rod every 50 feet for smaller pipe and every joint for pipe 48 inches and larger. Other approved methods of controlling vertical and horizontal alignments may be used if specifically authorized by the MU Representative. The pipe section may be adjusted by use of “come-along” of approved design and anchorage. The practice of bumping or snatching (with backhoe or crane, etc.) to adjust pipe after placement in the trench, will not be permitted. The Contractor shall furnish all labor and materials necessary for controlling the line and grade. At the end of each working day the Contractor shall plug all ends of lines with a water-tight plug.
- B. Each piece of pipe and special fitting shall be carefully inspected before it is placed. No defective pipe shall be laid in the trench. Before sewer pipe is placed in position in the trench, the bottom and sides of the trench shall be carefully prepared. Pipe laying shall proceed up-grade, starting at the lower end of the grade and with the bells up-grade. Trench bottoms found to be unsuitable for foundations shall be undercut and brought to exact line and grade with foundation material in accordance with Section 31 23 33 Paragraph 2.5.
- C. For bell and spigot pipe, bell holes shall be of sufficient size to allow ample room for properly making the pipe joints. Bell holes shall be cut not more than five (5) joints ahead of pipe laying. The bottom of the trench between bell holes shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length. Each joint shall be laid so that it will form a close concentric joint with adjoining pipe and so as to avoid sudden offsets or inequalities in the flow line.
- D. Water shall not be allowed to run or stand in the trench while pipe laying is in progress or before the trench has been backfilled. The Contractor shall not open up at any time more trench than their available pumping facilities are able to dewater. Movement of water that would tend to erode or affect the trench walls or bottom will not be allowed. Ground water will not be allowed to be pumped or discharged into the existing sewer system.
- E. As the work progresses, the interior of all pipe in place shall be thoroughly cleaned. After each line of pipe has been laid, it shall be carefully inspected and all earth, trash, rags, and other foreign matter removed from the interior.
- F. The interior of the pipefittings and accessories shall be kept clean and free from dirt. The pipe shall be cleaned before installation, and shall be protected during installation to prevent earth from entering the pipe. When pipe laying is not in progress, open ends of laid pipe shall be protected by means of a watertight plug or other means approved by the MU Representative. All joints of pipe in a trench shall be made up tightly before stopping work.



- G. At any draw, creek, gully crossing, or other location where rough terrain prevails, requiring a sag-bend or deflection of pipe greater than 2.5°, the trench shall be graded to avoid the use of bends or deflections in excess of 2.5° unless otherwise authorized by the MU Representative. The minimum allowable cover for overbends shall be thirty-six (36) inches.
- H. Where pipe is laid within the right-of-way limits of highways, roads, or railroads, the minimum cover shall be as specified in the permit issued by the proper authorities controlling the right-of-way should said cover exceed that specified herein.

3.3 INSTALLING BELL-and-SPIGOT JOINTS

- A. For push-on joint ductile iron pipe, the inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the socket. A thin coating of gasket lubricant shall be applied to either the inside surface of the gasket or the outside surface of the spigot, or both. Both gasket and gasket lubricant shall be as supplied by the manufacturer and approved by the MU Representative.
- B. All joints shall be sealed within 8 hours of joining pipe in the trench, and sealing shall be done with pipe joint completely dry and free of moisture. Any joints that do not bend properly shall be removed and the above procedure repeated until an acceptable joint is built. After the joints have been completed, they shall be inspected by the MU Representative before they are covered up. Any leaks or defects discovered at any time after completion of work shall be repaired immediately. All pipe in place shall be carefully protected from damage until the backfilling operations have been completed. Any pipe which has been disturbed after jointing shall be taken up, the joint cleaned and remade and the pipe re-laid at the Contractor's expense.

3.4 INSTALLING PUSH-ON JOINTS

- A. The joining of push-on joint and mechanical joint ductile iron pipe shall be performed in accordance with ANSI/AWWA C600-17. The procedure for assembly of push-on joints may vary according to the particular manufacturer. The procedure for joining pipe equipped with push-on joints must therefore be in accordance with the instructions of the manufacturer of the particular joint furnished.

3.5 RIGHTS-OF-WAY and SPECIAL CONSTRUCTION

- A. In the event the proposed sewer or water line crosses, runs parallel to, or alongside of any state highway, county road, city street, or railroad rights-of-way, the Contractor shall obtain a utility permit from the governing body affected.
- B. A City Construction License is required for the installation of a sanitary sewer.



- C. Where the work requires special stream or railroad crossings or any other extraordinary conditions, or where alternate types of construction are used that are not covered by these Specifications, the materials and construction methods shall be as shown on the Plans.
- D. After the sewer or water line is installed and backfilled and a sufficient amount of time has elapsed for backfill to settle, the disturbed area shall be machined to a smooth surface matching the adjacent or adjoining ground surfaces and the ground profile on the Plans.
- E. Solid sod may be used if approved by the MU Representative. The preparation of the ground will be the same as for seeding. The sod will be placed so as to give a smooth and uniform surface that is being sodded.
- F. The contractor shall remove all stumps, fallen trees, uprooted trees, dead trees and debris from the edge of the R.O.W.
- G. All right-of-way cleanup and grassing on property owned by the City, either in fee or easement interest, shall be approved by the City Engineer or City Engineering Inspector.

END OF SECTION



33 05 05.30 – Testing for Acceptance of Sanitary Sewer Lines

PART 1 - GENERAL

1.1 SUMMARY

- A. Upon completion of all or part of a sanitary sewer line, the Contractor will be required to test said sewer for acceptability. The Contractor shall provide all necessary water, equipment, and instrumentation for flushing and testing. Source and quality of water, test procedures, and disposal of water shall all be approved by the MU Representative. If test water is required from the Board's potable water system, the Board will furnish, free of charge, sufficient water to fill the new sewers two (2) times, after which additional water will be available at the Board's standard rates. The method(s) of testing shall be as specified herein.
- B. All tests shall be conducted in the presence of the MU Representative, and preliminary tests not observed by the MU Representative will not be accepted. The MU Representative shall be notified at least 48 hours before any work is to be inspected or tested. The MU Representative is available to witness tests from 8:00 a.m. to 3:00 p.m., Monday through Friday. If the developer/contractor wishes to conduct testing outside these hours, they shall contact the General Manager concerning charges which will be levied for the MU Representative to be available for witnessing the tests, as required.
- C. All defective sewer lines shall be repaired or replaced and retested until acceptable by the MU Representative. Repairs shall be made to the standard of quality specified for the entire system.
- D. Sections of the system may be tested separately. However, any defect which may develop in a section previously tested and accepted shall be promptly corrected and retested until acceptable by the MU Representative.
- E. All piping systems shall be tested in accordance with these test methods. Any tests required by local plumbing codes or building authorities shall also be conducted.
- F. Testing of sewer lines shall include internal television inspection as called for in Section 33 01 30.11.
- G. Prior to any testing, all lines shall be cleaned of debris and flushed clean with water as necessary. Debris and flush water shall be caught and removed from the line and shall not be allowed into existing live sanitary sewers. Before sewers are placed into service, the MU Representative shall inspect the sewers for line and grade. All sewer lines shall be air tested in accordance with ASTM C828, and as further described in Section 33 05 05.41.
- H. All manholes which fail the test or that have visible leaks, even if they pass the test, shall be repaired or replaced at the expense of the Contractor until the manholes pass the test,



to the complete satisfaction of the MU Representative. Manholes which have any visible leaks will not be accepted.

- I. All manholes shall be tested by the Vacuum Testing method as described in Section 33 05 05.36. If the contractor proposes to test any manhole using the Manhole Exfiltration Test as described in Section 33 05 05.33, it must be pre-approved by MU Sanitary Sewer Department Head.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



33 05 05.33 – Infiltration and Exfiltration Testing

PART 1 - GENERAL

1.1 SUMMARY

- A. All manholes constructed shall be watertight and show no visible sign of infiltration, and shall be tested in accordance with this Specification. The test shall be conducted by the Contractor in coordination with and at the direction of the MU Representative. All incoming and outgoing sewer lines shall be plugged and the manhole filled with water to a level above the highest section joint, to include the ring and cover. If the water level drop exceeds 1/8" per vertical foot of manhole depth in 5 minutes, the manhole shall have failed the test.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



33 05 05.36 – Vacuum Testing of Manholes

PART 1 - GENERAL

1.1 SUMMARY

- A. The test shall be conducted by the Contractor in coordination with and at the direction of the MU Representative. The manhole shall be tested, after assembly, as follows: All pipe opening shall be sealed by installing suitable plugs that completely isolate the manhole structure; any other openings, such as lifting holes, shall be permanently sealed. A suitable vacuum pump shall be connected to the manhole, and a vacuum of 10" of Hg drawn. The pump shall then be isolated from the manhole by valving, and the test period begun. The test shall be successful if the vacuum remains at 9" of Hg or greater according to the following table:

VACUUM TEST TIMETABLE (24' MAXIMUM DEPTH)		
DIAMETER	ELAPSED TIME	ADDITIONAL TIME PER 2' OVER 24' DEEP
48 inches	60 seconds	5.0 seconds
60 inches	90 seconds	6.5 seconds
72 inches	120 seconds	8.0 seconds

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



33 05 05.41 – Air Testing of Sanitary Sewer Lines

PART 1 - GENERAL

1.1 SUMMARY

A. The sewer lines to be tested shall be tested between manholes. The line shall be sealed at each end. The seal at one end shall have an orifice through which to pass air into the pipe. An air supply shall be connected to the orifice. The air supply line will contain an on/off valve and a pressure gauge with a range from 0 to 10 psi. The gauge shall have minimum divisions of 0.10 psi, and shall have an accuracy of +/- 0.04 psi. A digital gauge may be permitted, but must be cleared by the MU Representative.

B. The pipeline being tested shall be pressurized to 4 psig. The line will be allowed to stabilize between 4 psig and 3.5 psig for a period of no less than 5 minutes. If necessary, air should be added to the line to maintain pressure above 3.5 psig. After the stabilization period, the valve shall be closed. When the line pressure drops to 3.5 psig, timing with a stop watch should begin. The stop watch shall run until the pressure drops to 2.5 psig. Then the stop watch shall be stopped and the time lapse compared with the allowable time lapse in the table below for the pipe size and leakage allowance specified by the MU Representative.

C. Air Leakage Chart

Size of Pipe (inches)	Minutes: Seconds per 100 ft.
4	1:00
6	1:00
8	1:30
10	2:00
12	2:30
18	3:00
21	3:30
24	4:00
27	4:30
30	5:00
36	6:00

D. If the pipeline to be tested is beneath the groundwater level, the test pressure shall be increased 0.433 psi for each foot the groundwater level is above the invert of the pipe.

E. Deflection tests of pipe may be required. Tests, as well as tolerances, shall be in accordance with the manufacturer's recommendations or as directed by the MU Representative, and shall be conducted in the presence of the MU Representative. An acceptable method of testing the deflection would be that the pipe shall pass a vertical floating pin-type go/no-go mandrel (or effective equivalent) sized to 95% of the pipe diameter of the actual pipe used with the pipe placed and covered. The appropriate allowable deflection of the flexible pipe when installed (must be less than 5%) may be



calculated using the pipe stiffness formula in ASTM D2321. Deflection tests shall be performed not less than twenty-four (24) hours after backfilling.

- F. Infiltration and exfiltration of groundwater or other leakage into and out of the sewer (including manholes) shall not exceed 100 gallons per mile of sewer per inch of outside diameter of the sewer per twenty-four (24) hours in any section of the completed work, and in no case shall it exceed 2500 gallons per mile per twenty-four (24) hours. Infiltration flow shall be measured in wet weather by a "V-notch" weir with free discharge or other means acceptable to the MU Representative. Weirs shall be furnished, installed, and removed by the Contractor.
- G. The Contractor will be required to test lines to ascertain compliance with these Specifications. Air tests will not begin until after the asphalt binder is down and the MU Representative has been given proper notification of the test and its start time. Any visible or audible leaks in the sewer that can be located shall be repaired or corrected as directed by the MU Representative, regardless of infiltration test results.
- H. If the pipe size is no listed in the chart above, the test will be performed at the next listed larger pipe size, (i.e. 16" must test at the 18" limit).

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



33 05 07 – Trenchless Installation of Utility Piping

PART 1 - GENERAL

1.1 CASING PIPE

- A. Casing pipe shall be provided to enclose water or sanitary sewers where shown on the Plans. Gauge shall be as shown on the Plans. The diameter of the casing pipe shall be not less than 2x (times) the size of the water or sanitary sewer pipe, bell, or joints. The casing pipe shall be coated steel pipe meeting the minimum requirements of ASTM A36, with minimum yield strength of 35,000 psi. Pipe shall have a wall thickness of 0.250", minimum.

1.2 CARRIER PIPE

- A. In general carrier pipe for tunnels and bores will be ductile iron pipe in accordance with Section 33 05 19. Carrier pipe will be push-on joint type or mechanical joint type as specified in the Plans.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



33 05 07.33 – Tunneling

PART 1 - GENERAL

1.1 SUMMARY

- A. Tunneling operations and installation of liner plates shall be conducted in accordance with the recommendations of the liner plate manufacturer. Tunneling operations shall begin at the low end of the water or sanitary sewer line and proceed up-grade, care being exercised to install the liner to the proper line and grade as shown on the Plans. Care shall be taken to avoid loss of ground beyond the tunnel lining and to insure bearing against the ground all around the tunnel. Any spaces between the liner plates and the earth or rock surface of the tunnel shall be pressure grouted as the work progresses. Brick bulkheads shall be erected at each end after completion of the tunnel and insertion of the carrier pipe. The carrier pipe shall be bedded and restrained within the tunnel in accordance with the Plans and the Special Conditions.
- B. Only personnel thoroughly experienced in performing jacking and tunneling operations shall be employed for this work. Construction operations must not interfere with highway or railway traffic.
- C. The Contractor shall use tunnel liner plate as specified in this section. The tunnel and carrier pipe shall be installed in accordance with the Plans.
- D. Tunnels under railroads may involve special insurance requirements by the railroad company. The Contractor's attention is directed to any agreements between the Board and the railroad company.
- E. The Contractor shall notify the railroad company, highway department, or other utility affected prior to beginning any work so that said utility may have a representative present if desired.
- F. The excavation or pit at each end of the tunnel or bore shall be stabilized by the Contractor using sheeting, shoring, bracing or other means to prevent slides, settlement, movement, or erosion of the embankment being tunneled or bored.

PART 2 - TUNNEL LINER PLATE

2.1 FABRICATION

- A. Tunnel liner plates shall be the standard plates manufactured by Armco Drainage and Metal Products, Inc. or Republic Steel Corporation or approved equal. Unless otherwise specified on the Plans, in the agreement with the railroad company (or other government or utility) "Armco" plates shall be a minimum thickness of 12 gauge material and "Republic Steel" plates shall be a minimum thickness of 10 gauge material. A minimum section modulus of 0.0608 inches cubed per inch of plate width, average, is required.



- B. The pipe shall be circular and shall consist of a series of steel liner plates assembled in circular rings with staggered longitudinal joints. The plates shall be fabricated in such a manner as to provide for the complete erection to be performed from inside the pipe. A sufficient number of plates shall be fabricated with two inch diameter grouting holes with plugs so that the grouting may be done as the tunnel progresses. The shop fabrication shall include the punching of the plate for bolting on both longitudinal and circumferential joints. No field cutting, punching, drilling or reaming will be allowed. All plates shall be of uniform fabrication and those intended for one size tunnel shall be interchangeable.
- C. Plates shall be galvanized in accordance with ASTM A123/A123M-17 after they have been formed, punched and curved. After being galvanized the plates shall be dipped in a hot asphaltic bath at the factory to completely cover the inside and the outside of the plate.
- D. Bolts, nuts and washers shall be galvanized in accordance with ASTM A153/A153M-16A.
- E. Galvanized plates, bolts, nuts, and washers shall be handled in such a manner as to prevent bruising, scaling or breaking of the spelter coating. All plates that are damaged during handling or placing or with damaged spelter coating shall be replaced by the Contractor at his expense except that small areas with minor damage or with field welds may be repaired by the following method. The loose and/or cracked coatings are to be completely removed and the damaged areas shall be painted with at least two coats of Zinc dust-Zinc oxide paint conforming to Federal Specification TT P 641.
- F. Circumferential joints shall be flanged. Longitudinal joints may be flanged or lapped. The Manufacturer's Specifications concerning bolt sizes and strengths, bolt spacing, minimum number of bolts per joint, etc. shall be strictly adhered to.
- G. The base metal for the tunnel liner plates shall conform to the Manufacturer's Specifications with which his standard plates are produced. The mechanical requirements for Tensile Strength, Yield Strength and Elongation that formed the basis of design for the Manufacturer's standard plates shall be met. Tension test specimens shall be prepared and tested in accordance with ASTM A245 for sheets and ASTM A283 for plates. Mill test reports for each heat and gauge shall be available to the MU Representative for review upon request.
- H. The Manufacturer shall provide a certificate of compliance stating that the materials furnished comply in all respects to these Specifications. They shall provide written instruction for the assembly of the liner plates. They shall furnish, for the MU Representative's approval, a drawing showing a typical section of the tunnel, details of the plates, longitudinal and circumferential seam details, sizes, strengths, and lengths of all bolts and the section modulus (inches cubed per inch of width, average) for one ring of plates.

2.2 INSTALLATION



- A. The pipe shall be installed by the tunnel method. Open trench methods will not be permitted.
- B. The inside diameter of the completed ring shall be as specified in the Plans. No part of the plate or reinforcing ribs will be allowed to extend inside this net diameter.
- C. Assembly shall be in accordance with the Manufacturer's written instructions.
- D. At the end of each eight-hour turn, or more often if specified by the MU Representative, the void between the liner plates and the tunnel wall shall be force grouted. The grout shall consist of 5 sacks of Portland cement, one cubic yard of sand, 50 pounds of diatomaceous earth and 90 to 100 gallons of water. The sand shall conform to the following grading:

Sieve Size	Percent Passing Sieve
No. 4	100
No. 8	90-100
No. 16	90-100
No. 50	20-30
No. 200	0-3

- E. The grouting equipment shall be able to maintain enough pressure to completely fill the void.

PART 3 - EXECUTION – Not Used

END OF SECTION



33 05 19 – Ductile Iron Pipe

PART 1 - GENERAL

1.1 SUMMARY

- A. All materials used in the construction of water and sanitary sewer lines shall be new and unused.
- B. Ductile iron pipe shall be centrifugally cast and manufactured and tested in accordance with ANSI/ASTM A746. Pressure class (wall thickness) will be as indicated on the Plans or as specified by the MU Representative. Each pipe shall be hydrostatically tested before shipment to a minimum pressure of 500 pounds per square inch.
- C. All ductile iron pipe and fittings shall have a cement-mortar lining of standard thickness conforming to the requirements of ANSI/AWWA C104/A21.4-16/A21.4, unless otherwise specified. External coating shall be standard 1-mil bituminous coating.
- D. Joints for ductile iron pipe shall be push-on type such as Fastite, Tyton, Super Bell-Tite, or approved equal. In certain locations, however, pipe equipped with mechanical joint ends may be indicated, such as for highway crossings, railroad crossings, creek crossings, and in other specific locations as indicated on the Plans. Pipe shall be equipped with retainer glands where indicated on the Plans. All push-on and mechanical joints shall be manufactured and tested in accordance with ANSI/AWWA C111/A21.11-17.
- E. Where mechanical joints are required for ductile iron pipe, they shall conform to ANSI/AWWA C111/A21.11-17.
- F. Unless otherwise specified, push-on joint fittings shall be used for service tees, and shall be manufactured in accordance with ANSI/AWWA C110-12/A21.10. As an alternate, mechanical joint fittings may be used conforming to the requirements of ANSI/AWWA C111/A21.11-17.
- G. For ball and socket joints, the bell, ball and retainer shall be ductile iron, Grade 70 50 05, conforming to the requirements of ANSI A21.11.
- H. Joints for flanged pipe shall conform to the requirements of ANSI A21.11.
- I. Polyethylene encasement for ductile iron pipe shall conform to the requirements of ANSI/AWWA C105/A21.5-18/A21.5. Installation of the polyethylene encasement shall be by Method A or Method B; Method C installation will not be allowed.

1.2 WATER

- A. All water lines shall be constructed of ductile iron pipe, unless otherwise specified by the MU Representative.



- B. Each length or piece of pipe shall be clearly marked in accordance with ANSI/AWWA C151-09/A21.51. Where the Plans indicate that between specified stations a particular class of pipe will be required, the Contractor will not be permitted to store or string pipe of classes other than that specified for the particular section of the water main.
- C. All ductile iron pipe used for water mains shall be minimum eight (8) inch diameter.
- D. Where flanged joints are specified and allowed by MU, such joints shall conform to the requirements of ANSI/AWWA C115-11/A21.15. Flanged fittings shall conform to ANSI/AWWA C110-12/A21.10. Flanged ductile iron pipe and fittings to be installed above ground or exposed shall be cement-lined inside, but shall not have an exterior asphaltic coat. Such pipe and fittings and other exposed cast iron pipe shall receive exterior shop coat or rust inhibitive primer.
- E. Unless otherwise specified, all fittings shall be restrained mechanical joint. Mechanical joint fittings shall be manufactured in accordance with ANSI/AWWA C110-12/A21.10. Mechanical joint fittings for pipe sizes through 24" shall be Class 350, and for pipe sizes 30" - 48" shall be Class 250.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers:
 - 1. American
 - 2. US Pipe
 - 3. McWane

2.2 GENERAL REQUIREMENTS

- A. All pipe and fittings shall be carefully examined for cracks and other defects prior to shipment. All defective pipe and fittings shall be rejected and replaced.
- B. All pipes and equipment shall be supported in accordance with the details in the Plans and requirements of these specifications.

2.3 DUCTILE IRON PIPE AND FITTINGS

- A. General: Ductile iron pipe shall meet AWWA and ANSI Specifications C-150, C-151 and A 21.50, A 21.51, respectively. In general, ductile iron pipe shall be furnished with push-on joints for buried applications and flanged joints for exposed, above-grade applications, unless shown otherwise on the Drawings. Restrained joint pipe shall generally be required in critical buried applications such as highway crossings, creek crossings, railroad crossings, and in other locations as identified on the Drawings. Unless indicated in the Plans to be restrained joint, buried fittings shall be mechanical joint.
- B. Thickness: Class of ductile iron pipe shall be as noted in the Plans. If not indicated minimum class shall be as follows:



1. Gravity (Sewer) Class 350 (4"-12"), Class 250 (> 12")
 2. Pressure (Sewer) Class 350 (4"-12"), Class 250 (> 12")
 3. Pressure (Water) Class 350; All fire lines three (3) inches or greater in diameter shall be ductile iron pipe, Pressure Class 350
 4. Thickness shall comply with ANSI/AWWA A21.50/C150 for minimum pipe wall thickness for threaded flanges. Grooved couplings are available through twenty-four (24) inches. Larger sizes require cast-on or threaded-on shoulders.
- C. Fittings: Ductile iron fittings shall meet AWWA Specifications C-153/A21.53. Fittings, unless indicated otherwise, shall be Class 350 through twenty-four (24) inches, and Class 250 for pipe sizes thirty (30) inches- forty-eight (48) inches. Coating and lining shall match piping requirements as outlined above. Flanges shall be 125 pounds, or equal to those required for connections to equipment unless specified otherwise. Ductile iron pipe with mechanical or push-on joints shall conform to the requirements of ANSI A21.11-17 (AWWA -111). Ductile iron pipe with flanged joints shall conform to the requirements of ANSI A21.15. Flanges shall be ductile iron and shall conform to the properties specified for ductile iron fittings in ANSI A21.10.
- D. Bolting shall conform to Table 10.14 of ANSI A21.10/AWWA C110-12 or ANSI A21.15/AWWA C115-11 as applicable. Bolts for use with flat ring type gaskets between gray iron flanges shall conform to the requirements of ASTM A307-14e1, Grade B, hex head; and nuts shall be hex type of same grade and finish as the bolts. Bolts for use with flat full face type gaskets between either gray iron flanges or ductile iron flanges shall conform to the requirements of ASTM A449-84a, Type 1 hex head; and nuts shall be hex type of same grade and finish as the bolts. Bolts shall conform to the requirements of ANSI B18.2.1, and nuts shall conform to the requirements of ANSI B18.2.2.
- E. Gaskets for flanged, mechanical joint restrained joint, and push-on ductile iron pipe shall meet the requirements of ANSI/AWWA Specification ANSI A21.11-17/AWWA C111, latest revision. Unless indicated otherwise, gasket materials for various service conditions shall be as follows:
1. Wastewater Service – SBR (Synthetic Rubber)
- F. All ductile iron pipe and fittings shall be furnished with interior lining. The types of lining required for the various conditions of service are listed herein below.
1. Wastewater service – Cement lining per above or ceramic epoxy as noted in the Plans.
 2. Pressure wastewater service – Cement lining in accordance with ANSI A21.4/AWWA C104/A21.4-16, latest revision, standard thickness with an asphaltic seal coat or ceramic epoxy as noted in the Plans.
- G. All buried ductile iron pipe shall, unless indicated otherwise, be tar coated outside. Pipe and fittings to be installed in buildings, galleries, basins, other locations where such pipe and fittings will be permanently "exposed" shall have an exterior coat of rust inhibitive primer. Wall pipes, sleeves, fittings, etc., to be installed through concrete walls shall be furnished bare or the exterior coatings removed before installing.



- H. Couplings for use with grooved end joints, only where specifically called for in the Plans, shall be ductile iron in accordance with ASTM 536, Grade 65-45-12. Gaskets shall be the center leg design manufactured of a nitrile compound. Bolts shall be track head design and manufactured in accordance with ASTM A-183, minimum tensile 110,000 psi. Couplings shall be Vitaulic or equivalent.

2.4 RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

- A. General: Where required by the Plans, restrained joint pipe and fittings shall meet specifications in the Ductile Iron Pipe and Fittings sections and shall be a boltless restrained connection to protect against separation due to thrust. Restrained joint pipe shall be flexible restrained push-on type, unless otherwise indicated.
- B. Joints shall incorporate ductile iron locking segments, inserted through slots in the bell face, providing a positive axial lock between the bell interior surface and a retainer weldment on the spigot end of the pipe. Restrained push-on joint to be equal to American "Flex-Ring", U.S. Pipe "TR Flex", or McWane equivalent restraining products.
- C. Restraining or "Gripper" gaskets to be used to restrain slip joint pipe shall only be allowed when specifically called for in the Plans. Restraining gaskets shall contain stainless steel locking segments vulcanized into the gasket which shall in all other respects meet the requirements of standard push-on gaskets in ANSI/AWWA C111/A21.11-17. Restraining gaskets shall be UL listed for a minimum working pressure of 250 psi. Gaskets shall be equal to American Fast-Grip or U.S. Pipe Field Lok Gasket.

2.5 RESTRAINT FOR MECHANICAL JOINT VALVES AND FITTINGS

- A. When required in the Plans, mechanical joint restraint shall be provided for valves and fittings. Joint restraint shall be incorporated in the design of the follower gland and shall be suitable for the type pipe being installed. Flexibility of the joint shall be maintained after burial.
- B. Glands shall be manufactured of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA C111/A21.11-17 and ANSI/AWWA C153-11/A21.53, latest revision. Restraining follower glands utilizing wedging action against the face of the pipe for restraint shall incorporate torque limiting twist-off nuts to ensure proper torques of the restraining devices.



- C. Restraint devices for cast iron and ductile iron shall consist of a follower gland, which when actuated, imparts multiple wedging action against the pipe wall, increasing its resistance as the pressure increases. Unless required otherwise by the manufacturer for large diameter pipe, a standard mechanical joint gasket shall be used with the restraining follower gland. The restraint devices for cast iron and ductile iron shall have a minimum working pressure of at least 250 psi with a minimum safety factor of 2:1 and be as manufactured by EBAA Iron, Inc.; Romac Industries, Inc.; The Ford Meter Box Co.; or equal.

2.6 BOSSES ON DUCTILE IRON PIPE

- A. Bosses shall be ductile iron and welded to the pipe by the pipe company in the foundry.
- B. For pipe sizes 6 inch through 12 inch in diameter, a minimum of Class 52 pipe shall be used unless the pipe manufacturer recommends a higher class pipe.
- C. For pipe sizes 14 through 54 inch in diameter, Class 51 pipe shall be used unless a higher class pipe is recommended by the pipe manufacturer.
- D. Bosses shall be drilled and tapped for proper connection in accordance with the Standard Specifications.

PART 3 - EXECUTION

3.1 HANDLING

- A. Pipe, fittings, and accessories shall be handled in a manner that will insure installation in sound, undamaged condition.
- B. Pipe and fittings with cement mortar or glass lining shall be handled with rubber covered hooks or other type of equipment to prevent damage to the cement lining.
- C. Bare fork lift arms, hooks, or chains shall not be inserted into open ends.
- D. Pipe and fittings in which the lining has been damaged shall be immediately removed from the job site and replaced.

3.2 STORAGE

- A. All pipe and fittings shall be stored off the ground.
- B. Pipe ends shall be covered to prevent foreign matter from entering the pipe during storage.
- C. Pipe shall be stacked using suitable lumber between rows to prevent damage to pipe.
- D. Any pipe that becomes damaged or unidentifiable due to improper storage shall be rejected and immediately removed from the job site.



3.3 REPAIR OF CEMENT MORTAR LINING

- A. When approved and witnessed by the INSPECTOR, small and readily accessible damaged areas of cement mortar lining may be repaired in conformance with ANSI/AWWA C104/A21.4-16/A21.4 and the following:
 - 1. Cut out the damaged lining to the metal, with square edges.
 - 2. Thoroughly wet the cut out area and adjoining lining.
 - 3. With the damaged area cleaned and the adjoining lining wet, spread the mortar evenly over the area to be patched.
 - 4. After the lining patch has become firm and adheres well to the surface, finish it with a wet 3" or 4" paint brush or similar soft bristle brush.
 - 5. The repaired lining shall be kept moist by tying canvas wet burlap over the ends of the pipe or fitting for twenty-four (24) hours
 - 6. After the lining patch is dry and hard, the asphaltic coating shall be replaced using approved coating material.
- B. Repair mortar shall be in conformance with ANSI/AWWA C104/A21.4-16/A21.4 and the following formula:
 - 1. Cement Mortar mix by volume:
 - a. 3 parts Portland Cement
 - b. 2 parts clean sand
 - c. Necessary clean water for 5" to 8" slump
 - 2. Sand shall be clean, free of clay, and screened through a No. 20 screen.
- C. If the damaged area of the pipe is not accessible then the entire piece of pipe is required to be replaced.

3.4 CUTTING PIPE

- A. Cutting of pipe shall be done in a neat manner, without damage to the pipe or the lining.
- B. Cuts shall be smooth, straight, and at right angles to the pipe axis.
- C. Pipe shall be cut using a portable guillotine saw, abrasive wheel "cut-off" saw, or milling cutter only. Use of gas torches for cutting pipe will not be permitted.
- D. Field cut holes for saddles shall be with mechanical cutters. Gas torch cutting will not be permitted.
- E. After cutting, the end of the pipe shall be dressed with a file or power grinder to remove all roughness and sharp edges.
- F. All damaged or removed cement mortar lining shall be repaired in accordance with Section 3.03 of these specifications.

3.5 CLEANING



- A. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign matter prior to installation, and shall be kept clean until the work has been accepted.
- B. Before jointing, all joint contact surfaces shall be wire brushed, wiped clean, and kept clean until jointing is completed.
- C. Flange faces shall be wire brushed and cleaned to remove all oil, grease, loose primer, mill scale, or any other foreign matter which could affect the proper seating of the gasket.
- D. When pipe installation is stopped, precautions shall be taken to prevent foreign material from entering the pipe.
- E. Prior to testing, the entire pipeline shall be flushed until the flushing water runs clear and clean.

3.6 ALIGNMENT

- A. Piping shall be installed to the lines and grades indicated on the contract drawings.
- B. Pipelines intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the values stipulated in Table 5 of ANSI/AWWA C600-17, unless specially designed approved bells and spigots are provided.
- C. Batter boards, laser beam equipment, or survey shall be used in all pipe installations to maintain alignment and grade.
- D. Batter boards, if used, shall be erected at intervals not to exceed 25 feet.
- E. All pipe subgrades shall be determined and checked by survey.
- F. If laser equipment is used, periodic elevation measurements shall be made with survey equipment to verify accuracy of grade or elevation. If such measurements indicate thermal deflection of the laser due to differences between ground temperature and the air temperature within the pipe, steps shall be taken to prevent further thermal deflections.

3.7 FIELD JOINTS

- A. All joints in buried locations shall be grooved-end type "flexible" joints unless otherwise indicated in these specifications or on the contract drawings.
- B. All joints of piping above ground outside, in tunnels, galleries, or inside buildings shall be grooved-end type "rigid" joints unless otherwise indicated in these specifications or on the contract drawings.
- C. All buried ductile iron pipe joints shall be field coated with a minimum 12 mils of an approved thixotropic coal tar coating. The coating shall cover the entire joint, including fasteners.



- D. When specified or indicated on the contract drawings, bells on flush mounted wall castings and wall sleeves shall be mechanical joint type with tapped holes for tie rods or stud bolts.
- E. When specified or indicated on the contract drawings, all wall castings other than flush mounted castings and wall sleeves shall be standard mechanical joint flanged joints as indicated.

3.8 GROOVED END JOINTS

- A. Only where specified or indicated specifically on the contract drawings. Grooved end couplings shall be installed in accordance with AWWA C606 and the manufacturer's recommendations and instructions.
- B. Completed joints in piping above grade or within tunnels, galleries, or buildings shall be rigid and shall not allow angular deflection or longitudinal movement.
- C. Completed joints in buried piping shall be flexible and shall allow limited angular deflection and longitudinal movement, in accordance with the coupling manufacturer's recommended tolerances.
- D. Except for closure pieces approved by the INSPECTOR, field grooving of pipe will not be permitted.
- E. All field grooving allowed will be in strict accordance with AWWA C606.
- F. Only grooving tools designed for cut-grooving of ductile iron pipe will be allowed for field grooving. Roll-grooving of field grooved pipe will not be allowed.
- G. Cut-grooving tools shall be designed to be driven around a stationary pipe, shall have integral pipe stop to provide proper groove depth, and stops in the tool to provide proper dimension from the pipe end to the groove ("A" dimension).
- H. Prior to beginning field grooving operations, the CONTRACTOR shall submit for approval the grooving tools intended for use.
- I. The outside surface of the pipe between the groove and the pipe end shall be smooth and free from deep pits or swells.
- J. All rust, loose scale, oil, grease, and dirt shall be removed prior to installation of the coupler.
- K. Following installation and before backfill or encasement, all joints in buried piping shall be thoroughly coated with a minimum of 12 mils of approved coal tar coating.
- L. Joints may be wrapped with a minimum of 40 mils of approved pipe tape wrap.

3.9 MECHANICAL JOINTS



- A. When specified or indicated on the contract drawings, mechanical joints shall be carefully assembled in accordance with ANSI/AWWA C110-12/A21.10 and ANSI/AWWA C111/A21.11-17 and the manufacturer's recommendations.
- B. If effective seating is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled.
- C. Bolts shall be uniformly tightened to the torque values listed in Appendix A of ANSI/AWWA C111/A21.11-17.
- D. Over tightening of bolts to compensate for poor installation will not be permitted.
- E. Holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods.
- F. In flange and mechanical joint pieces, holes in the mechanical joint bells and the flanges shall straddle the top (or side for vertical piping) centerline. The top centerline shall be marked on each flange and mechanical joint piece at the foundry.

3.10 PUSH-ON JOINTS

- A. When specified or indicated on the contract drawings, joints shall be installed in conformance with ANSI/AWWA C111/A21.11-17 and the pipe manufacturer's instructions and recommendations for proper jointing operations.
- B. All joint surfaces shall be properly lubricated with approved heavy vegetable soap solution immediately before the joint is completed.
- C. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean at all times.
- D. Each spigot end of the pipe shall be suitably beveled to facilitate assembly.

3.11 FLANGED JOINTS

- A. When specified or indicated on the contract drawings, flanges shall conform to ANSI B16.1, B16.2, and B21.10.
- B. Bolts shall be tightened gradually and at a uniform rate to facilitate uniform gasket compression.
- C. Care shall be taken when connecting to pumping equipment to insure that pipe stresses are not transmitted to the pump flanges.
- D. All flanged piping connecting to pumping equipment shall be permanently supported so that accurate matching of bolt holes and uniform contact over the entire surface of abutting pump and piping flanges are obtained before the installation of any bolts in these flanges.



- E. Pump connection piping shall be free to move parallel to its longitudinal centerline while the bolts are being tightened.
- F. Each pump shall be leveled, aligned, and placed into position, but shall not be grouted until the initial fit-up and alignment of the pipe is completed.
- G. Each pump shall be grouted before final bolting of the connecting piping.

3.12 FLANGED COUPLING ADAPTERS

- A. When specified or indicated on the contract drawings, flanged coupling adapters shall be installed in strict accordance with manufacturer's recommendations and instructions.

3.13 MECHANICAL COUPLINGS

- A. When specified or indicated on the contract drawings, mechanical couplings shall be installed in accordance with the manufacturer's recommendations and instructions.
- B. A space of at least 1/4", and not more than 1", shall be left between the pipe ends.
- C. All assembly bolts shall be uniformly tightened so that the coupling is free from leaks and all parts of the coupling are square and symmetrical with the pipe.
- D. Following installation of the coupling, damaged areas of shop coatings of the pipe and coupling shall be repaired.

3.14 REDUCERS

- A. Reducers, adjacent to flowmeters and pumps or in other locations as specified or indicated on the contract drawings, shall be eccentric pattern, installed with the straight side on top so that air traps are not formed. All other reducers shall be concentric pattern.

3.15 OUTLETS

- A. Where a 12" or smaller branch outlet is specified or indicated on the contract drawings, and the diameter of the line pipe is at least twice the diameter of the branch, either a tee or factory welded-on boss shall be used.
- B. Connections of gauges to 6" and smaller pipe shall be made using a tee complete with blind flange drilled and tapped to accept the gauge piping specified.
- C. Connections of gauges to 8" and larger piping shall be made by means of a factory welded-on boss.
- D. Tapping saddles shall be used for "hot taps" in specified instances or as shown on the contract drawings. Use of tapping saddles must be approved in writing by the MU Engineer prior to use in every instance.



3.16 CONNECTIONS TO EXISTING PIPING

- A. Each connection to existing pipe shall be made at a time and under conditions which will least impact normal plant operations, and as authorized in writing by the MU Engineer.
- B. The CONTRACTOR is responsible for making provisions for cutting of existing pipe when necessary, using approved mechanical means. Flame cutting of pipe will not be allowed.
- C. The CONTRACTOR is responsible for making provisions for dewatering existing lines and for disposal of water from the dewatering operation.
- D. Prior to construction, the CONTRACTOR shall submit for review and approval detailed procedures for pressure testing and the making of final connections to existing lines.
- E. When connecting to existing fresh and potable water lines, all new piping and fittings shall be cleaned and disinfected prior to making the connection.
- F. Provisions shall be made to prevent any cross-connection and contamination of existing lines.
- G. Trench water, mud, or other contaminants shall not be allowed to enter the lines.
- H. The CONTRACTOR is responsible for disinfection and chlorination of all fresh and potable water lines after connections are made in conformance with these specifications.

3.17 REACTION ANCHORAGE

- A. All buried piping shall have thrust blocks placed at all changes of direction, tees, y-branches, valves, and at ends of pipe runs.
- B. All piping with mechanical couplings or mechanical joints subject to internal pressure shall be anchored to prevent separation of joints.
- C. When placing thrust blocks, the concrete shall extend from the pipe to solid, undisturbed earth, and all joints shall remain accessible for repair.
- D. The minimum dimensions of all concrete blocking shall be as generally indicated on the contract drawings, or as required to accommodate field conditions.
- E. If adequate support against undisturbed earth cannot be obtained, metal harness anchorages shall be provided.
- F. Metal harness anchorages shall consist of steel rods extending across the joint and securely anchored to the pipe.
- G. All reaction anchorage shall be installed prior to pressure testing of any pipe.



- H. Piping installed above ground in buildings, galleries, tunnels, piping trenches, and chases shall be supported and braced as indicated on the Drawings and specified herein. Where pipes are braced or supported above ground piping by means of concrete piers or thrust blocks, the concrete used by construction of such piers or thrust blocks shall be a 4,000 psi mix as specified in these Specifications; reinforced; and anchored to slabs and/or walls by dowels. Such concrete supports or blocks shall be finished to match adjacent concrete surfaces or finished surfaces of adjacent walls or floors, whichever is applicable.

END OF SECTION



33 05 30 – Utility Identification Trace Wires

PART 1 - GENERAL

1.1 REFERENCES

- A. American Society of Testing and Materials (ASTM):
 - ASTM B1 - Standard Specification for Hard-Drawn Copper Wire.
 - ASTM B227 - Standard Specification for Hard-Drawn Copper-Clad Steel Wire.
 - ASTM D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

PART 2 - PRODUCTS

2.1 TRACER WIRE

- A. Tracer wire shall be a #12 AWG (0.0808" diameter) fully annealed, high carbon 1055 grade steel, high strength solid copper clad steel conductor (HS-CCS), insulated with a 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts.
- B. HS-CCS conductor must be at 21% conductivity for locate purposes. HDPE insulation shall be RoHS compliant and utilize virgin grade material.
- C. Insulation color shall meet the APWA color code standard for identification of buried utilities.
- D. Manufacturers supplying copper clad steel tracer wire must have available detailed performance data including 5 years of underground testing in terms of durability related to damage of protective insulation and effects of potential corrosion of the specific copper clad steel used. Origin of copper clad steel manufacturer is required and steel core must be manufactured in the United States. If manufacturer has not completed 5 year corrosion testing, a 5 year warranty must be provided.
- E. Tracer wire shall be Copperhead High Strength HS-CCS HDPE 30 mil or district pre-approved equal and made in the USA.
- F. Tracer wire may be manufactured by Copperhead Industries or an approved equal.
 - 1. Open Trench - Trace wire shall be High Strength with a minimum 450 lb. break load.
 - 2. Directional Drilling/Boring - Trace wire shall be SoloShot Extra High Strength (EHS) with a minimum 1,150 lb. break load.
- G. Tracer wire shall be continuous and without splices, breaks, or cuts except for spliced-in connections as approved by the MU Engineer. Where any approved spliced-in connections occur, 3M DBR watertight connectors, or approved equal, shall be used to provide



electrical continuity. All spliced connections must be inspected by the MU Engineer before being buried.

- H. Tracer wire shall be brought to the surface at all junctions and terminals, including at all valve boxes for water valves and fire hydrant legs. DryConn Waterproof Direct Bury Lugs as manufactured by King Innovation, or approved equal, shall be used to splice into the main line tracer wire. The main line tracer wire shall not be broken or cut. Tracer wire shall be spiral-wrapped around the exterior of the valve box riser pipe and brought into the valve box top section. Provide 5 feet minimum of additional wire neatly coiled within each valve box.
- I. Access boxes shall be Copperhead Snakepit Tracer Wire Access Box with 2' x 2' concrete pad and aluminum label.

2.2 GROUNDING

- A. Tracer Wire for PVC and HDPE Pipe Tracer wire shall be grounded at all dead ends, except fire hydrant legs, using a 24- inch long minimum copper clad grounding rod. A grounding clamp approved for direct burial use shall be used to connect the tracer wire to the grounding rod. Direct burial grounding clamps shall be EK17 as manufactured by Erico or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Trace wire shall be installed in the same trench and inside bored holes and casing with nonmetallic pipe during pipe installation. Trace wire shall have a minimum of 6" clearance from the pipe. The trace wire shall be securely bonded together at all wire joints with an approved watertight connector to provide electrical continuity, and it shall be accessible at all new water valve boxes, water meter boxes, fire hydrants, sewer manholes, sewer cleanouts, gas valves and gas meter risers as applicable to the utility line being installed. At manholes, the wire shall be installed from the exterior of the manhole to the interior by installing the wire underneath the manhole frame. For lines with more than 5 feet of cover, the wire shall be installed directly over the pipe at a depth of 5 feet. If the spacing of valves and meters is greater than one mile, the trace wire shall be looped up in a 2" PVC pipe to be located at the right-of-way fence line or at a cross fence line, as applicable, for protection. A cap shall be placed on the 2" pipe when used, but it shall not be solvent welded onto the pipe. Where access points for trace wire on gas lines exceeds 1000', install test lead boxes such that maximum access point spacing is 1000'.

3.2 TESTING

- A. A continuity test shall be performed on tracer wire with MU Representative or MU Engineer present to verify that the trace wire is continuous and allows for the proper tracing of the piping. If the MU Representative or MU Engineer identifies locations where the trace wire is not continuous, to include all connection points between new and



existing water mains, the Contractor shall make necessary repairs/corrections. Continuity testing shall be conducted prior to repaving roadways.

END OF SECTION



33 05 31.11 – Polyvinyl Chloride (PVC) Gravity Sewer Pipe

PART 1 - GENERAL

1.1 SUMMARY

- A. All polyvinyl chloride (PVC) pipe shall meet the requirements of ASTM specification D3034 (SDR 26), Type PSM. Gaskets shall meet the requirements of ASTM F477-14. Pipe joints shall meet the requirements of ASTM D3212.
- B. The pipe shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13364-B, with a minimum tensile modulus of 500,000 psi as defined in ASTM D1784. Fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13343-C as defined in Specification D1784.
- C. PVC sewer pipe shall be available in standard laying lengths of 13' and 20'.
- D. Pipe and fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties.
- E. PVC pipe shall be made and joined with an integral bell, bell-and-spigot rubber-gasketed joint. Each integral bell joint shall consist of a formed bell complete with a single rubber gasket.
- F. Pipe shall be clearly marked as follows at intervals of 5 ft. or less:
 - 1. Manufacturer's name or trademark and code
 - 2. Nominal pipe size
 - 3. PVC cell classification; for example, 12454-B
 - 4. The legend "Type PSM SDR-26 PVC Sewer Pipe"
 - 5. The designation "Specification D3034"
- G. Fittings shall be clearly marked as follows:
 - 1. Manufacturer's name or trademark
 - 2. Nominal size
 - 3. The material designations "PVC", Type PSM
 - 4. The designation "Specification D3034"
- H. Pipe shall be stored in such a manner as to be protected from direct sunlight and heat, and shall not be subjected to trench loads when temperature of the piping material is above 80° F.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used



END OF SECTION



33 05 33 – Polyethylene Service Tubing

PART 1 - GENERAL

1.1 SUMMARY

- A. Service lines shall be minimum 3/4", and maximum 2"; Rehau PEXa (PEX) plumbing pipe or other approved equal.
- B. All service lines which cross under streets, highways, or any other paved roads, must be placed inside Schedule 40 PVC casing pipe to behind the curb, three (3) inch minimum size. Size may vary depending on the size of the service line or as instructed by an MU representative.
- C. No solder joints shall be allowed on services; joints must be brass compression type or other approved equal.
- D. PEX pipe shall be made from crosslinked high density polyethylene pipe having a standard material designation of PEX 3306, be for use in underground water service lines and meeting the ANSI/AWWA C904 standard.
- E. PEX pipe shall conform to a standard dimension ratio of SDR9 and conform to ASTM F876, ASTM F877 CSA B137.5, NSF/ANSI 14 and NSF/ANSI 61.
- F. Pipe shall carry the following markings every three (3) feet (0.9 meters): Manufacturer's name or trademark, nominal size, PEXa 3306 (material designation) SDR9 (standard dimension ratio), ASTM F876/ F877 / F2080, CSA B137.5, NSF-pw, U.P. Code, 160 psi @ 73.4°F / 100 psi @ 180°F / 80 psi @ 200°F, POTABLE TUBING, manufacturing date and footage mark.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION



33 05 61 – Concrete Manholes

PART 1 - GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
- B. American Society for Testing and Materials (ASTM):
 1. ASTM A48 - Standard Specification for Gray Iron Castings.
 2. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 3. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
 4. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
 5. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
 6. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Section Precast Concrete Water and Wastewater Structures.
 7. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
 8. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
 9. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
 10. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

PART 2 - PRODUCTS

2.1 UTILITY STRUCTURES

- A. Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, with provision for sealant joints.
 1. Diameter: 48 inches minimum unless otherwise indicated.
 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor. Base shall be 12-inch minimum for structure over 10 feet deep.
 4. Riser Sections: 4-inch minimum thickness, and of length to provide depth indicated.
 5. Top Section: Concentric-cone type; with top of cone of size that matches grade rings.
 6. Admixture: All manholes shall have Xypex C 1000 Red admixture.



7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 8. Joint Wrap: 12-inch wide butyl after priming with ConSeal CS-75 primer.
- B. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
1. "A-LOK Premium" flexible connectors as manufactured by A-Lok Products, Inc., Tullytown, Pennsylvania 19007.
 2. Kor-N-Seal S106 or S206 flexible connectors as manufactured by Trelleborg.
- C. Steps: Individual FRP steps wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 16-inch intervals.
- D. Retain "Grade Rings" Subparagraph below only if required.
- E. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
- F. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch- diameter cover. Include MU logo design with lettering cast into cover.
1. Material: ASTM A 536, Grade 60-40-18 ductile iron or ASTM A 48, Class 35 gray iron unless otherwise indicated.
 2. All manholes not surrounded by pavement shall have East Jordan 24" Revolution swing away lids (Product Number NPR16-4014A), or approved equal with the MU logo unless otherwise indicated.
- G. Riser sections and top cones shall have manufacture-installed steps in accordance with ASTM A283, unless otherwise noted.
- H. All bases shall have monolithically-cast bottoms.
- I. Portland cement concrete used in the precast reinforced concrete manholes shall have a minimum compressive strength in the range 4000-4750 psi at 28 days. Limestone aggregate for concrete, except for maximum size and gradation, shall be as specified inapplicable sections of these Specifications. The concrete of the manholes shall be cured by spraying with water or other equally effective means for a period of two weeks.
- J. Reinforcing steel shall be bars of intermediate grade, open hearth, billet steel, conforming to ASTM A615, or Cold-Drawn Steel Wire for Concrete Reinforcement, ASTM A82/A82M-07; or of wire fabric conforming to ASTM A185/A185M-07. The circumferential reinforcement in the riser and conical top sections shall have an area of not less than 0.12 square inches per linear foot.
- K. The interior and exterior surface of the manhole shall have smooth hard finish, and shall be free from cracks, chips, and spalls.



- L. Precast manhole riser joints shall be of the “push-on” type, and shall be equipped with “O”-Ring rubber gaskets meeting the requirements of ASTM C443. Alternatively, gaskets may be of the prelubricated lip and compression seal type meeting the requirements of ASTM C443 and C361 such as the F-114 joint manufactured by Forsheda Pipe Seal Corporation, or of the butyl sealant type meeting the requirements of ASTM C-990 such as the ConSeal CS-202 joint manufactured by Concrete Sealants, Inc. All joints shall have either a butyl sealant material in rope form such as Ramnek, and an external joint wrap such as ConWrap CS-212.
- M. Standard manholes of precast concrete construction, and other manholes of precast concrete construction having entering sewers of 24" diameter or smaller shall have precast openings in the manhole walls for incoming or outgoing sewers as indicated on the Plans, and all openings shall be equipped with flexible rubber boots.
- N. All components of a manhole for a particular location shall be clearly marked in order that the manhole may be correctly assembled to suit construction conditions existing at that particular location.
- O. The flexible rubber boot shall be similar to Kor-N-Seal or equal and conform to ASTM Specification C923 and shall be made from ethylene propylene rubber (EPDM). Manhole boots shall be secured to pipe by stainless steel clamp and bolt assembly conforming to ASTM Specifications C923 and ASTM A167-99.
- P. Manhole frames and covers shall be made from American iron and made in the United States of America
- Q. Frames and covers shall be made of cast iron. All castings shall be made accurately to the required dimensions and shall be sound, smooth, clean, and free from blisters and other defects. Defective castings which have been plugged or otherwise treated shall be rejected. Manhole frames and covers for sanitary sewers shall conform to the Madison standard frame and cover as shown in the Standard Details. Manhole castings shall comply with the standard drawings or as called for in the Plans. The contact surfaces between the cover and its corresponding supporting ring in the frame shall be machined so that the cover will rest on the ring for the full perimeter of the contact surfaces. Castings shall be thoroughly cleaned of foreign matter and rust and shall be painted with a bituminous coating.
- R. Manhole frames and covers shall meet the requirements of AASHTO M306. Frames and covers shall be as manufactured by John Bouchard & Sons Company. Model 1150 or Model 1154 “Low Profile” if needed due to site conditions, East Jordan Iron Works Model V-1355, or approved equal, as called for on the Plans.
- S. Manhole and inlet steps shall be made of steel reinforced plastic. Plastic manhole steps shall be polypropylene coated steel reinforcing rods in accordance with the Standard Details with rod and pull-out ratings meeting OSHA standards. Steps shall be Model PS-1, as manufactured by M.A. Industries, or approved equal.
- T. Swing away lids are required if the lid is over 2' off the ground.



2.2 SULFIDE PROTECTION

- A. Gravity systems receiving pumped flows shall be protected against sulfide attack as directed by the MU Engineer. Coatings shall meet the requirements of Division 09 Painting and Coatings.

2.3 MANHOLE SIZE

- A. Manhole size shall conform to the following table:

Conditions	Minimum Manhole Diameter	Minimum Wall Thickness	Base Thickness
Depth of Manhole < 10' ⁽¹⁾ with the largest main entering the manhole less than 15"Ø	4'	5" – Precast 6" – C.I.P.	6"
Depth of Manhole > 10' ⁽¹⁾ with the largest main entering the manhole < 15" Ø	4'	6" – Precast 8" – C.I.P.	12"
Manholes with the largest main entering 15" Ø to 21" Ø	5'	6" – Precast 8" – C.I.P.	12"
Manholes with largest main entering 24" Ø to 30" Ø	6'	8"	As Required by the MU Engineer
Larger or deeper main and other special conditions not covered above	As Required by the MU Engineer	As Required by the MU Engineer	As Required by the MU Engineer

⁽¹⁾ Top of ring to flow line of lowest main

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Remove and keep all water clear from the excavation during construction and testing operations.
- B. Place imported pipe base material on undisturbed earth; thoroughly compact with a mechanical vibrating or power tamper.
- C. Manholes shall be constructed to the sizes, shapes, and dimensions as detailed in the Standard Details and at the locations shown on the Plans. At all locations the cover (or lid) shall be at the finished grade of the pavement or ground surface, or as otherwise indicated on the Plans. In undeveloped or rural areas, manholes shall be furnished to a height of approximately two (2) feet above ground. The invert shall be placed at the elevation shown on the Plans. Eccentric cone sections will not be allowed; only concentric cones will be used, as detailed in the Standard Details.



- D. The design of manhole base sections shall be approved by the MU Representative prior to manufacture, and shall facilitate a proper lid elevation when the manhole is completely assembled. Openings in walls for incoming and outgoing sewers shall be precast, and the annular space between the pipe and opening filled with non-shrinking grout. Bases shall be set on a foundation of No. 57 or 67 compacted stone aggregate, 12 inch minimum thickness, covering the entire bottom of the excavation, as shown in the Standard Details. Aggregate size may be adjusted by the MU Engineer based on field conditions.
- E. Flexible manhole sleeves (“boots”) will be used for sealing the space between the manhole wall and the pipe, and are required for all incoming and outgoing pipes. Boots shall be secured to pipe by stainless steel clamp and bolt assembly conforming to ASTM Specifications C923 and ASTM A167-99.
- F. Precast concrete manholes for sewers 48 inches in diameter and larger shall be as specified above, except that they shall be installed on a saddle constructed on the barrel of the sewer. Precast concrete manholes for sewers 30, 36, and 42 inches shall be saddle-types or precast base types as specified in the Plans. General details of the precast manhole bases and the saddles for various pipe sizes are given in the Standard Details. Reinforcing steel in the saddle shall be welded to the reinforcing steel of the pipe. The design of these saddles shall be approved by the MU Representative prior to manufacture.
- G. Where the difference in the invert elevation of 2 or more sewers, 18 inches in diameter or smaller, intersecting in one (1) manhole is 2 feet or more, a Memphis Tee Manhole (drop manhole) shall be constructed in the manner shown in the Standard Details. They shall be similar in construction to the standard manhole, except that a drop connection of a pipe and fittings of the proper size and material shall be constructed outside the manhole and supported by Class B concrete. The manhole and the drop connection shall be placed on a 12 inch reinforced concrete base as detailed in the Standard Details. The drop connection piping assembly shall be bolted to the barrel of the manhole riser using four (4) 5/8 inch diameter stainless steel (316) bolts with suitable washers to prevent failure caused by pulling the bolt head through the manhole wall.
- H. Manhole inverts shall be constructed of cement mortar and shall have the same cross-section as the invert of the sewers which they connect. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit.
- I. All water standing in the excavation shall be removed before the manhole base is placed, and the foundation maintained in a dry condition.
- J. Manholes shall be constructed using precast risers, in 16", minimum, sections.
- K. Shallow manholes shall be constructed to the sizes, shapes, and dimensions as detailed in the Standard Details and at the locations shown on the Plans. They shall be constructed of precast concrete sections as shown on the Plans or as directed by the MU Representative.



- L. Manhole frames and covers shall be of the type shown in the Standard Details, and shall be suitable for use under service conditions applicable for locations shown in the plan assembly. Iron castings shall conform to requirements of Paragraph 1, below. Cast iron spacers will not be accepted as a means of making minor adjustments of the frame and cover to the proper elevation.
 - 1. Gray iron castings shall conform to the requirements of ASTM A48. All castings shall be clean and free of scale, adhesions, or inclusions. They shall be completely coated as required. Gray iron castings for manhole or inlet frames and covers or gratings shall be cast from Class 30B cast iron. Bearing surfaces between manhole or inlet frames and covers or gratings shall be such that the cover or grating shall seat in any position onto the frame without rocking. Bearing surfaces for standard manhole frames and covers shall be machined.
- M. Manhole frames shall be set on a butyl gasket and properly bonded to the manhole cone. Metal plates shall be used to hold the frame to the manhole as shown in the Standard Details.
- N. The top elevation of manhole frames must be adjusted to finished grade in areas such as streets, alleys, and parking lots, or where indicated on Plans. Adjustment of frames will be allowed concrete adjusting rings ("donuts"). However, adjustments equal to or greater than 8" must be made by changing precast sections and all possible combinations of precast riser sections and cones shall be utilized prior to the use of adjusting rings.
- O. The following information shall be clearly marked on each manhole section:
 - 1. MH and specification designation
 - 2. Date of manufacture
 - 3. Name or trademark of the manufacturer

3.2 LOCATION AND SPACING

- A. Provide a manhole at each change in grade, pipe size, alignment, intersection, and at terminal point of sewer.
- B. Space manholes a maximum of 400 feet of continuous run for pipes 18 inches in diameter and smaller.
- C. Space manholes a maximum of 500 feet of continuous run for pipes 24 inches in diameter and larger.
- D. Manholes situated within the 100-year flood elevation zone shall have top of cover elevations above the 100-year flood elevation or cover shall be with gasket and bolted down. Water tight frames and swing away lids shall be required where the proposed manholes are subject to inundation.
- E. Manholes situated within the 100-year flood elevation zone and/or the groundwater table shall be checked for buoyancy.
- F. Manholes situated in pavement shall have top of covers level with finished grade.



- G. Manholes located in an offsite easement or Right-of-Way shall have top of covers a minimum of twenty-four (24") inches above finished grade. Covers shall be swing away style, approved by the MU Engineer.
- H. Manholes situated in non-paved areas, such as residential or commercial lots, shall have top of covers a minimum of twenty-four (24") inches above finished grade. Variances for manhole top of covers elevations and lid style in residential and commercial lots may be considered on a case-by-case basis.

3.3 INSTALLATION OF PRECAST MANHOLES

- A. Concrete Base:
 - 1. Place on compacted imported base material.
 - 2. Properly locate, ensure firm bearing throughout, and plumb first section.
- B. Sections:
 - 1. Thoroughly clean ends of sections to be joined.
 - 2. Thoroughly wet joint with water prior to placing butyl.
 - 3. Locate precast steps in line with each other to provide a continuous vertical ladder.
- C. Preformed Plastic Gaskets (In lieu of mortar joints):
 - 1. Carefully inspect precast manhole sections to be joined.
 - 2. Do not use sections with chips or cracks in the tongue.
 - 3. Use only pipe primer furnished by gasket manufacturer.
 - 4. Install gasket material in accordance with manufacturer's instructions.
 - 5. Completed Manholes shall be rigid and watertight.
- D. Rubber Gasket Joints: Install in accordance with manufacturer's instructions.
- E. Extensions:
 - 1. Provide on manholes in streets or other locations where a subsequent change in existing grade may be likely.
 - 2. Install to height not exceeding eight (8) inches.
 - 3. Lay grade rings in butyl with sides plumb and tops level.

3.4 MANHOLE INVERT

- A. Construct with smooth transitions to ensure an unobstructed flow through manhole. Remove sharp edges or rough sections which tend to obstruct flow.
- B. Where full section of pipe is laid through manhole, break out top section as shown and cover exposed edge of pipe completely with mortar. Trowel mortar surfaces smooth.

3.5 MANHOLE FRAMES AND COVERS

- A. Set frames in butyl, with mortar carried over flange.



- B. Set tops of covers flush with surface of adjoining pavement or ground surface, unless otherwise shown or directed.

3.6 WATERTIGHT MANHOLES

- A. Install frame fasteners and riser connection brackets at locations shown on the Drawings. Submit design details of brackets to MU Engineer for approval.

3.7 MANHOLE PIPING

- A. Flexible Joints:
 1. Provide in all pipe not more than 1-1/2 feet from manhole walls.
 2. Where the last joint of pipe is between 1-1/2 and 6 feet from manhole wall, provide a flexible joint in the manhole wall.

3.8 CONNECTIONS TO EXISTING MANHOLES

- A. Core drill neat hole in manhole.
- B. Clean all surfaces and apply a bonding agent.
- C. Install boot.
- D. RegROUT to provide smooth flow into and through manholes.
- E. Provide diversion facilities and perform work necessary to maintain flow during connection.

3.9 FIELD QUALITY CONTROL

- A. Hydrostatic Testing:
 1. When, in MU's Engineer opinion, the groundwater table is too low to permit visual detection of infiltration leaks, hydrostatically test all project manholes.
 2. Procedure: Plug inlets and outlets and fill manhole with water to height determined by MU Engineer.
 3. A manhole may be filled twenty-four (24) hours prior to time of testing, if desired, to permit normal absorption into the pipe walls to take place.
 4. Leakage in each sanitary sewer manhole shall not exceed 0.1 gallon per hour per foot of head above the invert.
 5. Test shall last twenty-four (24) hours.
 6. Leakage is not permitted in primary sludge manhole.
 7. Repair manholes that do not meet the leakage test, or do not meet specified requirements from visual inspection.
- B. Testing Cast-In-Place Manhole Steps:
 1. Test each step for a horizontal pullout load of 400 pounds with the load applied over a width of 3-1/2 inches and centered on the rung.
 2. Apply the load at a uniform rate until the required test load is reached.



3. Provide suitable hydraulic jacks and gauges to perform the test.
 4. Steps will be considered acceptable if they remain solidly embedded after application of the test load and if no cracking or fracture of the step nor spalling of the concrete, masonry, or mortar is evident.
 5. Replace, or reset and retest, steps failing to withstand required load.
- C. Precast Concrete Finish
1. Smooth Form Finish: For interior, non-architectural formed concrete surfaces or pits, wet wells, pipe vaults, etc. exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp proofing, veneer plaster, painting, or other similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed. Fill all holes and seams with grout.

END OF SECTION



33 12 13 – Water Service Connection

PART 1 GENERAL

1.1 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME B16.18-2018 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASME B16.22-2018 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

- B. American Society of Sanitary Engineering:
 - 1. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent.
 - 2. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.

- C. ASTM International:
 - 1. ASTM A48/A48M-03 - Standard Specification for Gray Iron Castings.
 - 2. ASTM B62-17 - Standard Specification for Composition Bronze or Ounce Metal Castings.
 - 3. ASTM B88-16 - Standard Specification for Seamless Copper Water Tube.
 - 4. ASTM D698-12E2 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m<sup>3 - 5. ASTM D1557-12e1 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m<sup>3 - 6. ASTM D1785-15e1 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 7. ASTM D2466-17 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - 8. ASTM D2855-15 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
 - 9. ASTM D2922-05 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 10. ASTM D3017-05 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).</sup></sup>

- D. American Welding Society:
 - 1. AWS A5.8M/A5.8:2011-AMD 1 - Specification for Filler Metals for Brazing and Braze Welding.

- E. American Water Works Association:
 - 1. AWWA C600-17 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
 - 2. AWWA C700-15 - Cold-Water Meters - Displacement Type, Bronze Main Case.
 - 3. AWWA C706-96 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.



4. AWWA C800-14 - Underground Service Line Valves and Fittings.
5. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

PART 2 - PRODUCTS

2.1 WATER PIPING AND FITTINGS

- A. See Section 33 05 33 and Section 33 11 13 Paragraph 2.1.

2.2 CORPORATION STOP ASSEMBLY

A. Corporation Stops:

1. Brass or red brass alloy body conforming to ASTM B62-17.
2. Inlet end threaded for tapping according to AWWA C800-14.
3. Outlet end suitable for service pipe specified.
4. Manufacturer:
 - a. AY McDonald 4101 B-22
 - b. Ford Meter Box Company, Inc. equivalent.
 - c. Hayes Fluid Controls, Inc. equivalent
 - d. Substitutions: Allowable but must be approved by MU.

B. Service Saddles:

1. Service saddles are required when service main pipe wall thickness does not permit sufficient thread depth (at least 3 threads) for tapping and when service main is plastic.
2. Service saddles shall be Tapping Saddles as specified under this section.

2.3 CURB STOP ASSEMBLY

A. Curb Stops:

1. Brass or red brass alloy body conforming to ASTM B62-17.
2. Ball valve.
3. Positive pressure sealing.
4. Curb stops must be locking type with a meter coupling. Ball valves shall be minimum 3/4", and shall be as manufactured by Ford Meter Box Company, Hayes, or approved equal.

B. Meter Boxes

1. See Paragraph 2.7 of this section

2.4 RECONNECTING EXISTING SERVICES

- A. For existing resetter installations: Install AY McDonald Model Number 6100MW-22 or Ford Meter Box Company, Inc. equivalent curb stop.

- B. For existing setter installations: Install AY McDonald 4753-22 & 6102W-22 or Ford Meter Box Company, Inc. equivalent compression nut assembly (pack nut with gasket, friction ring, and curb stop).



2.5 METER SETTING EQUIPMENT

- A. Outside Meter Setting:
 - 1. Meter Yokes: Copper or iron, riser type assembly with bronze inlet inverted key angle valve expansion type outlet connection and Ell fitting; flared copper tubing connections both ends.
 - 2. Meter Yokes: Copper or iron, inlet and outlet horizontal or vertical setting with matching couplings, fittings, and stops.

2.6 WATER METERS, BACKFLOWS, and BOXES

- A. Meter assemblies ranging in size from 5/8 inch to two (2) inches shall be housed in meter boxes manufactured from concrete.
- B. Meter box lids shall be concrete. Minimum outside dimensions of the lid shall be 16-5/8 inches by 11-7/16 inches. Down legs on each corner shall be a minimum of 1-1/2 inches long.
- C. Meter boxes shall be Brooks Number 36 Series concrete meter boxes, or approved equal, and shall be supplied by the Contractor.
- D. All water usage including fire and irrigation shall be metered and have backflow prevention devices. If a fire line has a private hydrant, a full size meter, as approved by MU, will be required and be supplied with the fire vault and back flow device. The fire meters shall be Fire Meter (FM) rated and U/L rated.
- E. All water usage for multi-family and industrial units shall be metered using a single meter when possible. All commercial suites will have individual meters, unless otherwise approved by MU.
- F. Meters shall be sized according to the anticipated demand and in accordance with MU Specifications. Design Engineers shall submit data supporting the need based on instantaneous and average flows.
- G. Each meter shall have a backflow device consisting of double check valve assembly, or RPZ, if deemed necessary by the MU Representative.
- H. Water meters and backflow devices shall be housed in boxes or vaults.
- I. Water meters and backflow devices shall be situated within the street right-of-way or in an easement area contiguous to the right-of-way or other running easement, with the exception of Fire Line Meters, which must sit on private property. The point of customer responsibility and MU's responsibility, for a fire vault, shall be the gate valve at the edge the ROW or easement.
- J. The locations for water meters and vaults should be practical for the access and maintenance of said items by MU personnel. The proposed location for meters and vaults shall be approved by MU.



2.7 BACKFLOW PREVENTERS

- A. See Standard Detail No. 8.460, 8.461a and 8.461b.
- B. Double-check backflow preventers shall be AMES Model 3000SS, or approved equal. Meters shall be Sensus Technologies, Inc. 5/8 x 3/4 SRII with TR/PL, or approved equal.

2.8 BACKFLOW PREVENTER AND DETECTOR CHECK METER ASSEMBLY ON FIRE LINES

- A. The device shall consist of two (2) independently operating, spring-loaded cam check valves, required test cocks, bypass assembly with electronic encoded register meter, and inlet and outlet resilient seat gate valves, as shown on Standard Detail 8.460.
- B. Device characteristics:
 - 1. Rated Working Pressure: 175 PSI
 - 2. Hydrostatic Pressure: 350 PSI
 - 3. Temperature Range: 32 deg. – 110 deg. F
 - 4. Flange dimensions in accordance with AWWA with Class D
 - 5. Assembly shall be ASSE 1048 approved for vertical installation
- C. The bypass assembly will contain the electronic encoded register meter, a double check including shut-off valves and required test cocks. Each cam shall be internally loaded and provide a positive drip tight enclosure against reverse flow. Cam-check includes a stainless steel cam arm and spring, rubber faced disc, and a replaceable seat. The body shall be manufactured from 300 series stainless steel, 100% lead free, through the waterway, with a single tow-bolt grooved style access cover. No special tools shall be required for servicing.
- D. Electronic Encoded Register Meter shall be suitable for cold water service and shall conform to the requirements of AWWA C700-15, latest revision, and to the requirements contained within these specifications. It shall be free from defects in material and workmanship for a period of twenty-five (25) years from date of shipment. Registers will be guaranteed to be free from defects in material and workmanship from the date of shipment as follows: 5/8"-2" Positive Displacement Standard Direct Read Register – 25 years; 5/8"-2" Positive Displacement Absolute Encoder Register – 10 years. A statically controlled sample of each meter shipment will be tested at the MU Representative's discretion to insure shipment meets the MU Representative's performance and materials specifications.

2.9 GENERAL VAULT SUMMARY

- A. The assembly vault shall be a precast reinforced concrete vault, as shown on Standard Detail 8.460. Concrete shall have a minimum 28-day compressive strength at 4,000 psi with mix proportions determined by ACI 318, Chapter 5. Reinforcement shall conform to ASTM A184/A184M, A615/A615M, A616, A617, or A706/A706M. Vault shall be 6400V utility Vault as manufactured by Hughes Supply, Inc. or approved equal.



- B. Design Loads shall consist of dead load, live load, and impact load, water table hydrostatic load, and any other special loads that may be imposed upon the structure. Live loads are designed for pedestrian loads (350 psf), H-10 traffic loads (8,000 lb. Wheel Load), H-20 and/or H20-40 traffic loads (16,000 lb. Wheel Load) depending upon the governing live load that produces the maximum shears and bending moment in a given structure. The dead load is to be considered to be the worst condition with the water table located at 3'-0" below the grade.
- C. The access hatch shall be trough frame, pedestrian loading – (350 psf), double-door configuration overall size 54"x78", and opening size of 46"x70". Door leafs shall be ¼ inch thick aluminum floor plate and the channel with a continuous integral anchor flange. Frame shall drain water out through a 1.5" pipe coupling. The hatch door shall be equipped with a flush aluminum drop handle which does not protrude above the cover, and an automatic hold open arm with red vinyl grip on a release handle. Hinges shall be all stainless steel with tamper-proof stainless steel bolts and nuts, and be removable for maintenance after the access door is cast or grouted into place. The wing of the hinges shall not cut through the bearing edge of the channel seat. For security, the access door shall be equipped with a staple for padlock. Access hatch shall be a mill finish. Hatch shall be Type TPD as manufactured by USF or approved equal.
- D. The assembly shall be located within a public right-of-way or appropriate utility easement.
- E. The concrete shall have a minimum 28-day compressive strength at 4,000 psi with fiber mesh added for strength. Reinforcing shall be cast in the center of the wall and floor slabs and include #4 bars spaced at 6" Center to Center, Each Way. Four steel lifting hooks shall be imbedded in the floor. A 4-inch drain shall be precast into the floor. Reinforcing bar support shall be provided at all lifting points and around penetrations. Pipe penetrations shall be sleeved and grouted to maintain structural integrity. Such penetrations may be located per customer request. The option to pour on a slope to match existing terrain may be acceptable if pre-approved by the MU Engineer.
- F. An access hatch shall be provided of a size that provides a clear opening to the inside of the vault with no more than 2 inches of internal space blocked on any side. The door leaves shall be made of ¼ - inch thick aluminum checker or diamond plate design reinforced to support a 300 p.s.f. live load. The hatch shall be provided a stainless steel thumb latch cab lock for inside escape and T handle keyed for outside entry. For security, the access hatch shall be equipped with a staple for MU supplied padlock. Stainless steel or aluminum hinges with tamperproof bolt shall be supplied with a water raceway inside and a minimum 1" drain hole. Gas shocks or stainless steel springs shall be provided to compensate for weight of door with either a kickstand or springs designed to keep the covers in their upright, open positions. Means for internal anchoring of the hatch to the concrete vault sidewalls at a minimum of four locations shall be provided.
- G. Bollards may be required for protection of the vault's structural integrity at the discretion of the MU Engineer either upon review of the site plan or during construction where actual constructed field conditions warrant such. Where required, the bollard must be constructed of minimum 6-inch diameter galvanized steel pipe, set at least 3 feet below



the finished grade with a vertical height of at least 4 feet above finished grade visible upon completion. The pipe shall be filled with concrete and capped by either forming the concrete to a smooth, rounded finish above the pipe or with a PVC cap. The entire assembly shall be painted to provide maximum visibility with enamel paint in either safety yellow or red, as appropriate to site conditions for maximum contrast with surroundings.

- H. Medium Meter Vault (for use with 2-in meters and larger, as practicable)
 - 1. The medium meter vaults shall be a precast reinforced concrete vault with standard dimensions that are generally about 3 feet by 5 feet (3'x5' nominal size), most often used for 2-inch meter assemblies.
 - 2. The vault shall be as manufactured by Eagle Wholesale, Consolidated Pipe & Supply Company, or approved equal. Determination of equal products will be made by the MU Engineer following review of complete shop drawing submittal and any other information deemed necessary for the complete review of a proposed substitute product.

- I. Large Meter Vaults (for use with 3-inch meters and larger)
 - 1. The larger meter vaults shall be a precast reinforced concrete vault with standard dimensions that generally fall into one of two typical size ranges:
 - a. 4 feet by 6 feet (4'x6' nominal size), most of used for 3-inch meter assemblies
 - b. 5 feet by 8 feet (5'x8' nominal size), most for 6-inch and 8-inch meter assemblies

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of existing conditions before starting work.
- B. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION - CORPORATION STOP ASSEMBLY

- A. Make connection for each different kind of water main using suitable materials, equipment, and methods approved by the MU Engineer.



- B. Provide service clamps for mains other than of cast iron or ductile iron mains.
- C. Screw corporation stops directly into tapped and threaded iron main at 10 o'clock and 2 o'clock positions on main's circumference; locate corporation stops at least 12 inches apart longitudinally and staggered.
- D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2 inches width of bearing area; exercise care against crushing or causing other damage to water mains at time of tapping or installing service clamp or corporation stop.
- E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the MU Engineer.
- F. Corporation stops shall be as manufactured by Ford Meter Box Company or Hayes.

3.4 INSTALLATION - PIPE AND FITTINGS

- A. Group piping with other site piping work whenever practical.
- B. Route pipe in straight line.
- C. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- D. Install access fittings to permit disinfection of water system performed under Section 33 13 00.
- E. Establish elevations of buried piping with not less than four (4) feet of cover for water mains, and eighteen (18) inches for service lines smaller than one and one-half (1-1/2) inch diameter.
- F. Backfill trench in accordance with Section 31 23 33.

3.5 INSTALLATION - BACKFLOW PREVENTERS

- A. Install backflow preventer where indicated on the Contract Drawings and in accordance with manufacturer's instructions.
- B. Comply with local water company requirements and plumbing codes in regards to testing and installation requirements.

3.6 SERVICE CONNECTIONS

- A. Install water service in accordance with the details shown on the Drawings.

END OF SECTION



33 14 13 – Public Water Utility Distribution Piping

PART 1 GENERAL

1.1 SUMMARY

- A. The work included in these specifications shall consist of furnishing all materials and equipment and performing all labor and services necessary to install the water lines and appurtenances complete, as shown on the Plans and as specified herein. It shall include all preparation of the site; excavation and backfill; any necessary shoring and bracing, pumping, drilling, blasting, and pipe cushion; construction of water lines; disposal of surplus materials; maintenance during construction; concrete work; replacing pavements; clean up and revegetation; and all other incidental work necessary to provide complete operating water lines.

- B. All Materials will be furnished by the Contractor, unless otherwise indicated on the Plans.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

- B. ASTM International:
 - 1. ASTM A36/A36M-17 - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A123/A123M-17 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM A307-14E1 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 4. ASTM D698-12E2 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 5. ASTM D1557-12E1 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 6. ASTM D1785-15E1 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 7. ASTM D2922-05 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 8. ASTM D3017-05 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 - 9. ASTM D3139-98 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 10. ASTM F477-14 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

- C. American Water Works Association:



1. AWWA C104/A21.4-16 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 2. AWWA C105/A21.5-18 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 3. AWWA C110-12 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1,219 mm), for Water.
 4. AWWA C111/A21.11-17 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 5. AWWA C115-11 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 6. AWWA C151-09 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
 7. AWWA C153-11 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service.
 8. AWWA C500-19 – Metal-Seated Gate Valves for water Supply Service.
 9. AWWA C600-17 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
 10. AWWA C605-13 - Water Treatment - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
 11. AWWA C700-15 - Cold-Water Meters - Displacement Type, Bronze Main Case.
 12. AWWA C706-96 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
 13. AWWA C900-16 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 12 In. (100 mm through 300 mm), for Water Distribution.
 14. AWWA C905-88 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 36 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution.
 15. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
- D. Manufacturer’s Standardization Society of the Valve and Fittings Industry:
1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.
- E. National Fire Protection Agency:
1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
- 1.3 QUALITY ASSURANCE
- A. Valves: Mark valve body with manufacturer's name and pressure rating.
- B. Perform Work in accordance with most currently adopted revision of “CONSTRUCTION SPECIFICATIONS FOR WATER AND SANITARY SEWER” for MU.
- C. Certification
1. The manufacturer of iron pipe and fittings shall furnish MU’s Representative with certified reports stating that inspection and specified tests have been made



and that the results thereof comply with the applicable ANSI/AWWA Specifications for each.

2. Testing of ductile iron pipe shall include hydrostatic, tensile and impact tests as specified in ANSI/AWWA C151-09/A21.51.
3. Testing shall include physical testing of ductile iron fittings as specified in ANSI/AWWA C110-12/A21.10.
4. Written transcripts of test results shall be furnished to MU's Representative after pipe and fitting fabrication.
5. Maintain one copy of each document on site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Addendum; requirements for transporting, handling, storing, and protecting products.
- B. Deliver and store valves in shipping containers with labeling in place.
- C. Block individual and stockpiled pipe lengths to prevent moving.
- D. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
- E. Store polyethylene materials out of sunlight.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 WATER PIPING

- A. Ductile Iron Pipe: AWWA C151-09. Bituminous outside coating: AWWA C151-09. Pipe Mortar Lining: AWWA C104/A21.4-16, standard thickness.
 1. Pipe Class:
 - a. Ductile Iron (push-on) pipe four (4) inches and six (6) inches in diameter shall be Pressure Class 350 in accordance with AWWA C 151, ANSI A21.51.
 - b. Ductile Iron (push-on) pipe eight (8) inches and larger shall be Pressure Class 350 in accordance with AWWA C 151, ANSI A21.51.
 - c. Ductile Iron pipe shall have a minimum pressure rating of 250 psi in accordance with AWWA C110-12 and C115-11, ANSI A21.10 and A21.15.
 2. Fittings: Ductile iron, AWWA C153-11
 - a. Fittings shall have standard mechanical or flanged joints as called for or shown on the Drawings.
 - b. Mechanical joint fittings for size 3-inch through 24-inch shall be Class 350 for Ductile Iron.



- c. Mechanical joint fittings for size 30-inch through 48-inch shall be Class 250 for Ductile Iron.
 - d. Flanged fittings up to twelve (12) inches in size shall have a minimum pressure rating of 350 psi. Flanged fittings over twelve (12) inches in size shall have a minimum pressure rating of 250 psi.
3. Coating and Lining:
- a. Pipe and fittings that are not to be painted shall be coated on the exterior with bituminous coating. Lining and coating shall be in accordance with AWWA C104/A21.4-16 and ANSI A21.4.
 - b. Pipe and fittings shall be cement-lined (standard thickness), with a bituminous seal coat: AWWA C104/A21.4-16, standard thickness.
 - c. Ductile iron pipe and fittings placed on or beneath the ground surface shall have an exterior coating of asphalt in accordance with AWWA C151-09 and ANSI A21.10.
 - d. Ductile iron pipe and fittings placed above the ground shall be factory primed and field coated as required in these Specifications or as noted on the plans.
 - (1) Submit primer data sheets with shop drawings.
 - (2) Finish coat of paint must be compatible with primer coat. The contractor shall provide written documentation that finish coat is compatible with the primer coat of the pipe.
 - (3) Finish coat shall be applied to meet the requirements of the paint manufacturer's printed instructions.
 - e. Ductile iron pipe that crosses or runs parallel to a gas transmission main, which may be cathodically protected, shall be encased in polyethylene tubing, eight (8) mil minimum thickness, and taped in accordance with AWWA C105/A21.5-18 and ANSI A21.5.
 - f. Ductile iron fittings in lieu of an asphalt coating and cement lining maybe coated and lined with eight (8) mills of fusion bonded epoxy in accordance with AWWA C550 and C121 and ANSI A21.16. Fittings shall be listed by a certifying agency that the coating complies with NSF 61.
4. Weights of Pipe:
- a. Weights of pipe and fittings shall conform strictly to the requirements of ANSI/AWWA Specifications.
 - b. The weights and class designations for all pipes and fittings shall be plainly and conspicuously painted and/or labeled on the outside of each joint of pipe and each fitting after the exterior coating has hardened.
 - c. For pipe 16" and smaller in diameter, pipe will not be accepted in which the weight is less than the standard weight by more than five percent (5%).
 - d. For pipe, which is more than 16" in diameter, pipe will not be accepted in which the weight is less than the standard weight by more than 4%.
5. Joints:
- a. Mechanical and Push-On Joints: AWWA C111/A21.11-17. Yard piping shall be furnished with mechanical or Push-On joints and mechanical joint fittings, as shown on the Drawings.



- b. Flanged Joints: AWWA C115-11.
 - (1) Interior piping shall be furnished with mechanical joints or flange connections, as shown on the Drawings. Flanges for pipe and fittings shall be Class 125 flanges, unless otherwise shown on the Drawings or specified, and shall be in accordance with ANSI A21.10 (AWWA C 115), drilled and faced in accordance with American Standard B17.1.
 - (2) Flanges for ductile iron pipe and fittings shall be ductile iron.
- c. Restrained Joints:
 - (1) Concrete blocking is to be shown on the Drawings at the desired locations. Where concrete blocking is not possible to be used for joint restraint, restrained joints shall be installed for ALL pressure pipe and fittings.
 - (2) Restrained joint fittings shall have a minimum pressure rating of 250 psi.
- d. Slip Joint:
 - (1) Manufacturers:
 - (a) American Cast Iron Pipe Company. "Fast Grip" Gaskets for pipe diameters of 4" to 12". Restrained joint pipe having a diameter of 14" to 36" shall be "Flex Ring". And "Lok-Ring" for piping with diameter larger than 36".
 - (b) U.S. Pipe. "Field Lok" Gaskets for pipe diameters of 4" to 12". Restrained joint pipe having a diameter of 14" and larger shall be "TR. Flex".
 - (c) Substitutions: Allowable but must be approved my MU.
- e. Mechanical Joint:
 - (1) The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1.
 - (2) Retaining gland "MEGALUG" for use with standard mechanical joint fittings shall include gripping wedges with torque limiting twist-off nuts and shall be in accordance with AWWA C 110 through C 153 and ANSI A21.10 through A21.53.
 - (3) Retaining gland "MJ FIELD LOK" for use with standard mechanical joints fittings shall be in accordance with AWWA C 110 through C 153 and ANSI A21.10 through A21.53.
 - (4) Manufacturers:
 - (a) EBAA Iron, Inc., "MEGALUG"
 - (b) U.S. Pipe, "MJ Field Lok".
 - (c) Substitutions: Allowable but must be approved by MU.
- f. Gaskets and Bolted Connections
 - (1) Gaskets for Push-On and standard mechanical joints shall be plain rubber (Styrene Butadiene Copolymer) in accordance with AWWA C111/A21.11-17 and ANSI A211.
 - (2) Gaskets (Field Lok) and (MJ Field Lok) used to restrain Push-On joint pipe and/or standard mechanical joint fittings, respectively, shall be plain rubber (Styrene Butadiene Copolymer) modified



- with stainless steel teeth in accordance with AWWA C111/A21.11-17 and ANSI A211.
- (3) Gaskets for restrained joint pipe of the flex-ring type and restrained joint fittings of the flex-ring type shall be plain rubber (Styrene Butadiene Copolymer) modified with ductile iron segments in accordance with AWWA C111/A21.11-17 and ANSI A211.
 - (4) Gaskets for flanged joints shall be 1/8-inch thick, full-faced, clothed reinforced rubber in accordance with AWWA C110-12 and C115-11, ANSI A21.10 and A21.15.
- g. Retaining Glands and Adapter Couplings:
- (1) Retaining gland for use with standard mechanical joint fittings where joint restraint is not required shall be in accordance with AWWA C110-12 through C153-11 and ANSI A21.10 through A21.53.
 - (2) Adapter “Foster Adapter” coupling shall be a bolt-through positive restraining connector between two standard mechanical joints. Adapter coupling shall be in accordance with AWWA C 153 and ANSI A21.53.
 - (3) Manufacturers:
 - (a) INFAC T Corporation, “Foster Adapter”.
 - (b) Substitutions: Allowable but must be approved by MU.
- h. Bolts for Ductile Iron Piping
- (1) Bolts and nuts used for standard mechanical connections shall be tee head type with heavy hex nut conforming to ASTM A563 in accordance with AWWA C111/A21.11-17.
 - (2) Bolts and nuts used for flanged connections shall be hex type of low carbon steel; cadmium plated or zinc plated conforming to ASTM A307-14E1 in accordance with AWWA C110-12 and C115-11.
6. Concrete Blocking:
- a. All pressure pipes shall be restrained either using concrete blocking or installed with restrained joints. The MU Engineer shall determine the number of restrained joints before and after each fitting.
7. Manufacturers:
- a. American Cast Iron Pipe Company.
 - b. U.S. Pipe
 - c. McWane
 - d. Tyler Union (Ductile Iron Fittings)
 - e. Sigma (Ductile Iron Fittings)
 - f. Star Pipe Products (Ductile Iron Fittings)
 - g. Substitutions: Allowable but must be approved by MU.
- B. Two Inch Main Connections
- 1. Tapping Saddles shall be used for all 2-inch connections to new ductile iron pipe regardless of size. Tapping saddles shall be Series 3826 as manufactured by AY McDonald or Ford Meter Box Company, Inc. equivalent. No substitutions permitted.



2. Connections shall be made as detailed on the Drawings.
3. The 2-inch pack joint by male adapter to connect the 2-inch Corporation Stop to the 2-inch PEX pipe shall be AY McDonald 4753-44 or Ford Meter Box Company, Inc. equivalent. The pack joint shall have the restraining nut incorporated into it. No substitutions permitted.
4. The 2-inch pack joint by pack joint compression coupling to connect the new 2-inch PEX pipe to the existing 2-inch PVC pipe shall be AY McDonald 4758-44 or Ford Meter Box Company, Inc. equivalent. The pack joint shall have the restraining nut incorporated into it. No substitutions permitted.

2.2 TAPPING SLEEVES AND VALVES

- A. Tapping Sleeves for Ductile or Cast Iron Pipe:
1. Tapping sleeves shall be of the split type and manufactured of ductile iron.
 2. Tapping sleeves shall conform to requirements of AWWA C223.
 3. Gaskets shall be virgin nitrile (Buna-N, NBR).
 4. Sleeve outlet shall be flanged or mechanical joint in accordance with AWWA C110-12. Outlet Flange Dimensions and Drilling: ASME B16.1, Class 125 and MSS SP-60.
 5. All tapping sleeves shall be hydrostatically test to the same test pressure of the new pipe.
 6. Manufacturers:
 - a. U.S. Pipe Model T28 on ductile iron main only.
 - b. Substitutions: Allowable but must be approved by MU.
- B. Tapping Saddle for Ductile or Cast Iron Pipe:
1. Tapping saddles shall be ductile iron or stainless steel, type 304 (18-8).
 2. Tapping saddles shall be double-strap type with ductile iron bodies meeting ASTM A536 and steel straps meeting AISI C1018 electrogalvanized with Dichromate seal. Saddles shall be Style F202 as manufactured by Ford Meter Box Company, Inc., or equal.
 3. Stainless steel saddles shall be used when tapping for 1 inch service lines or 2 inch mains lines.
 4. Tapping saddle shall seal with pipe by an O-ring gasket virgin nitrile (Buna-N, NBR).
 5. Saddle outlet to pipe shall be flanged or tapped with pipe threads.
 6. Saddle must have double stainless steel strap option
 7. Manufacturers:
 - a. Smith Blair - 317 with 015 stainless steel bales (4" to 16") for 2" iron pipe threads.
 - b. Smith Blair - 366 with 015 stainless steel straps (18" to 40") for 2" iron pipe threads.
 - c. Smith Blair - 372 for pipe diameters 4 inches through 12 inches.
 - d. Power Seal - 3412AS for pipe diameters 3 inches through 12 inches.
 - e. Power Seal - 3416AS for pipe diameters 14 inches through 36 inches.
 - f. Romac Industries - 306 for pipe diameters 3 inches through 12 inches.
 - g. Romac Industries - 305 for pipe diameters 14 inches through 24 inches.
 - h. Substitutions: Not permitted.



- C. Tapping Sleeves for PVC Pipe:
 - 1. Tapping sleeves for PVC Water Mains are not allowed.
 - 2. A mechanical joint tee must be cut in
 - a. Split Rings and Gripper Gaskets for the PVC Pipe
 - b. Sleeves must be installed
 - c. Mechanical Joint Tee must be installed

- D. Tapping Valves:
 - 1. AWWA C509, iron-body, resilient-seated gate valve with non-rising stem. Inlet flanges shall conform to ANSI B16.1, Class 125 and MSS SP-60. Mechanical joint outlets shall conform to AWWA C111/A21.11-17.
 - 2. Manufacturers:
 - a. Mueller Co.
 - b. American Darling
 - c. M&H
 - d. Clow
 - e. U.S. Pipe Company
 - f. Substitutions: Allowable but must be approved by MU.

2.3 UNDERGROUND PIPE MARKERS

- A. Pipe Marking:
 - 1. The following information shall be cast in or stamped on each pipe.
 - a. Weight, Class or nominal thickness.
 - b. Casting period
 - c. Manufacturer's identifying mark.
 - d. Year the pipe was manufactured.
 - e. The letters "DI" or "DUCTILE" for ductile iron pipe.

- B. Detectable Underground Utility Marking Tape.
 - 1. Required for ALL buried PVC pipe installations, regardless of length.
 - 2. Wire shall have a minimum overall gage of 10 ga. mils.
 - 3. Tape shall be color coded in accordance with AWWA as follows;
 - a. "Blue" for potable water and associated lines.

2.4 PIPE SUPPORTS AND ANCHORING

- A. Metal for pipe support brackets: stainless steel.

- B. Metal tie rods and clamps or lugs: stainless steel.

2.5 CONCRETE ENCASEMENT AND CRADLES

- A. Concrete: Conforming to Section 03 30 00, Class "C" concrete.

2.6 BEDDING AND COVER MATERIALS

- A. Bedding as specified in Section 31 23 33.



- B. Cover as specified in Section 31 23 33.
- C. Soil Backfill from Above Pipe to Finish Grade as specified in Section 31 23 33.

2.7 ACCESSORIES

- A. Concrete for Thrust Restraints: Conform to details shown on Drawings and requirements of Section 03 30 00 for Class "A" concrete.
- B. Steel rods, bolt, lugs, and brackets: stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of existing conditions before starting work.
- B. Verify existing utility water main size, location, and inverts are as indicated on Drawings.

3.2 PREPARATION

- A. Pre-Construction Site Photos:
 - 1. Take photographs along centerline of proposed pipe trench; minimum one photograph for each 50 feet of pipe trench.
 - 2. Show mail boxes, curbing, lawns, driveways, signs, culverts, and other existing site features.
 - 3. Include project description, date taken and sequential number on back of each photograph.
- B. Prior to starting construction operations, the Contractor shall remove all vegetable growth, debris, and other objectionable matter standing or lying on the surface within the limits of the areas to be excavated or filled; and shall demolish and remove there from such buildings and other structures as are specifically designated on the Plans for removal.
- C. Test holes are to be made when necessary for locating underground obstructions. Where utilities are to be crossed, they shall be uncovered by hand excavation methods before other excavation near them is started. Every pipe for water, gas, drainage, or other use, and every conduit, foundation, or other underground structure encountered shall be carefully protected from damage or displacement.
- D. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.
- E. Remove scale and dirt on inside and outside before assembly.



- F. Prepare pipe connections to equipment with flanges or unions.
- G. Should the construction of the water line require or result in removal or damage to an existing fence, the Contractor shall replace the fence in kind to the satisfaction of the fence owner.
- H. If a proposed street, roadway, driveway, bike path, or sidewalk crosses an existing water main, the trench backfill for that pipeline shall meet the requirements of Section 31 23 33 Paragraph 2.3. That is, the trench shall be filled completely with properly compacted select earth material or with crushed stone. Alternatively, the trench may be bridged as shown on Standard Detail No. 8.140, "Pavement Trench w/Concrete Bridge." The method proposed by the Design Engineer or Developer will be reviewed by the MU Representative, and approved according to the Board's best interests.

3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 33. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.
- B. Where MU Representative considers the existing material beneath the bedding material unsuitable, Contractor shall remove and replace it with select backfill.
- C. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- D. Provide sheeting and shoring in accordance with Section 31 23 33.

3.4 INSTALLATION - PIPE

- A. Install pipe in accordance with AWWA C600-17 for ductile iron pipes and fittings.
- B. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated on Drawings.
- C. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.
- D. Flanged Joints: Not to be used in underground installations except within structures.
- E. Route pipe in straight line. Relay pipe that is out of alignment or grade.
- F. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, notify the MU Engineer, as air release valves and/or blow-offs may be required.
- G. Install pipe to have bearing along entire length of pipe.
- H. Do not lay pipe in wet or frozen trench.



- I. Prevent foreign material from entering pipe during placement.
- J. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- K. Close pipe openings with watertight plugs during work stoppages.
- L. Install access fittings to permit disinfection of water system performed under Section 33 01 10.58
- M. Situate water mains outside of pavement, within street right-of-way when possible, between four (4') and six (6') feet beyond the back of curb or edge of pavement or at location approved by the MU Engineer.
- N. At a minimum, mains shall be located consistently on the same side of the street within a project or development, and street crossings should be minimized.
- O. Dead-end mains shall extend to the last lot or parcel being served so that no service lines are installed in front of adjacent lots or parcels, including the extension of mains at least halfway around cul-de-sacs.
- P. Water mains constructed parallel to streams shall be located such that the nearest area of disturbed soil is greater than 25 feet from the stream bank.
- Q. Service lines supplying a single residential lot shall be located nearest a respective property boundary as practical, and opposite of property lines where electrical transformers are installed, when possible.
- R. Individual services shall be paired at common property lines, on respective sides, in residential subdivisions.
- S. No water main or service line shall be constructed on solid waste landfills.
- T. No water main or service line shall be constructed to serve a structure that is constructed on or to be constructed on a solid waste landfill.
- U. Each water main and service line shall be locatable. Contractor shall provide tracer wire from the main to the meter box.
- V. Water mains and service lines to fire hydrants shall have a minimum suitable soil cover of three (3') feet. The depth of three (3') feet from finish grade to top of pipe shall be determined as follows:
 - 1. As measured from edge of pavement (top back-of-curb) when the finish grade elevation of the pipe route is equal to or greater than adjacent pavement elevation.
 - 2. As measured from finish grade elevation of the pipe route when the pipe route elevation is less than the adjacent pavement elevation.
 - 3. Other depth approved by the MU Engineer.



- W. Water mains crossing under a creek or ditch shall have a minimum suitable soil cover of two (2') feet and the mains shall be encased in concrete.
- X. Water mains shall have a minimum 24-inch vertical and 5-foot horizontal separation from any sewer, and shall have 3 ft. horizontal and 12" vertical clearance from other underground structures.
- Y. Service lines under pavement shall have a minimum suitable soil cover of 2.5 feet as measured from top of curb or top of pavement.
- Z. Service lines outside of pavement shall have a minimum suitable soil cover of 1.5 feet as measured from the meter.
- AA. Water mains 12-inches in diameter and larger shall be checked for buoyancy when submerged in groundwater or situated within the 100-year flood zone.
- BB. Water lines which, when completed, will have less than eighteen (18) inches of cover shall be encased in concrete, as shown on the Plans or as directed by the MU Representative.

3.5 INSTALLATION - TAPPING SLEEVES AND VALVES

- A. Install tapping sleeves and valves in accordance with Drawings and in accordance with manufacturer's instructions.
- B. The existing PVC water lines will be required to be wet tapped in order to connect the new ductile iron water lines to them.
 - 1. The contractor shall provide a schedule as to the start date and time, location and duration for each wet tap. MU shall review and approve this schedule.
 - 2. MU shall be notified at least twenty-four (24) hours prior to the contractor making a wet tap.
 - 3. MU's Representative shall be present for each wet tap. The contractor cannot proceed without MU's Representative present.
 - 4. The contractor shall inventory, in the presence of MU's Representative, all materials required for the wet tap prior to commencing installation.
 - 5. The contractor shall excavate around the existing PVC water line and clean and prepare the pipe for wet tapping.
 - 6. Prior to installing the tapping sleeve, MU's Representative shall inspect and approve this work up to this point.
 - 7. After the tapping sleeve and valve are installed, the contractor shall make a pressure test on the complete assembly.
 - a. All pressure tests must be scheduled with MU.
 - b. All pressure tests made by the contractor shall be logged in a pressure test form suitable to MU.
 - 8. After wet tap is complete, the contractor shall notify and show the complete and entire coupon over to MU's Representative.
 - a. If the contractor does not notify or show and cannot produce upon request the complete and entire coupon to MU's Representative, the



contractor is responsible for retrieving the coupon from the existing water lines, immediately.

9. The wet tap pit shall be properly backfilled in the same day the tap was made.
- C. If during a wet tap, the existing PVC water line splits or fails the contractor shall repair the PVC water line with two (2) ductile iron solid sleeves with transition gaskets and install a suitable length of ductile iron pipe between the two sleeves.
1. The MU Engineer shall determine the suitable length of ductile iron pipe.
 2. The contractor shall be responsible for all costs for these repairs.
 3. The contractor shall maintain and properly store at all times on site at least four (4) of these sleeves for this purpose.

3.6 THRUST RESTRAINT

- A. Adequate thrust blocking shall be designed for the expected pressures, including the required test pressure, which is using the line pressure times one and one half (1.5) or a 150 psi minimum.
- B. Provide valves, tees, bends, caps, and plugs with concrete thrust blocks.
- C. Pour concrete thrust blocks against undisturbed earth.
- D. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair.
- E. Install tie rods, clamps, set screw retainer glands, or restrained joints. Protect metal restrained joint components against corrosion by applying a bituminous coating, or by concrete mortar encasement of metal area. Do not encase pipe and fitting joints to flanges.
- F. Install thrust blocks, tie rods, and joint restraint as detailed on the Drawings.
- G. Thrust restraint shall be installed at all fittings, hydrants, valves, and other locations deemed necessary by the MU Engineer.
- H. Thrust restraints at hydrants and valves shall be accomplished by installing a minimum of two (2) eyebolts on the hydrant or valve and tying to an adjacent fitting or concrete tie-back using three-quarter (3/4") inch stainless steel threaded rod, or utilizing of anchor couplings or fittings. For pipe twelve (12) inches or larger, the number of eyebolts and amount of all thread used will be at the discretion of the MU Representative. If anchor couplings or fittings are not to be used a thrust block will need to be utilized behind the fire hydrant.
- I. Where changes of direction occur in the water main or where branches are installed from mains, the pipe and fittings shall be securely braced against hydraulic thrust. Bracing shall be constructed of concrete, plain and/or reinforced as indicated on the Plans. All concrete used in construction of bracing shall be Class A concrete, see Section 03 30 00. General purpose bracing shall be in accordance with typical details shown on the Plans.



Special bracing shall be in accordance with details shown on the Plans, and shall be complete with reinforcing steel and miscellaneous iron work.

- J. Thrust restraint at fittings shall be accomplished by using one of the following methods.
 - 1. Restrained joint pipe and fittings installed upon approval by the MU Engineer.
 - 2. Cast-in-place concrete blocking installed to dimensions as shown on thrust block detail 8.400.

3.7 SERVICE CONNECTIONS

- A. Install service connections in accordance with Section 33 12 13 and as shown on the Drawings.

3.8 BACKFILLING

- A. Backfill around sides and to top of pipe in accordance with Section 31 23 33.
- B. Maintain optimum moisture content of bedding material to attain required compaction density.

3.9 FIELD QUALITY CONTROL

A. WATER SAMPLING STATIONS

- 1. Water sampling stations for approval of water line
 - a. Water sampling stations could be required to be installed in all new residential or commercial developments. If a water sampling station is required to be installed, it will be abandoned and capped at completion of project.
 - b. The Design Engineer should consult with MU's Inspector or MU Engineer for the required locations for each of the water sampling stations for each residential or commercial development.
- 2. Water sampling stations for post development monitoring of water lines
 - a. Three (3) water sampling stations shall be installed in all new residential developments.
 - b. The Design Engineer should consult the MU Engineer for the required locations for each of the water sampling stations for each residential development. The water sampling stations provided should be one of the following pre-approved options: the Model 1500 as manufactured by the Water Plus Corporation, or the #94WM as manufactured by the Kupferle Foundry Company.

END OF SECTION



33 14 17 – Site Water Utility Service Laterals

PART 1 - GENERAL

1.1 SUMMARY

- A. It shall be the responsibility of the Contractor to install and mark the location of all service lines. Marking shall be accomplished by placing a two (2) inch diameter circular metal marker etched with the letter “W”, or a one and one-half (1.5) inch diameter blue colored circular plastic marker, in the top of curb, with the top of the marker flush with the top of the curb.

END OF SECTION



33 14 19 – Valves and Hydrants for Water Utility Service

PART 1 – GENERAL - VALVES

1.1 REFERENCES

- A. American Water Works Association:
 - 1. AWWA C500-19 - Metal-Seated Gate Valves for Water Supply Service.
 - 2. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
 - 3. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
 - 4. AWWA C600-17 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
- B. National Sanitation Foundation:
 - 1. NSF 61 - Drinking Water System Components - Health Effects

1.2 QUALITY ASSURANCE

- A. The following information shall be cast in or stamped on each gate valve.
 - 1. Manufacturer's identifying mark.
 - 2. Pressure rating.
 - 3. Place of manufacturing.
- B. Manufacturer to provide certification stating that valve is manufactured per applicable AWWA standard for each valve type and size.

1.3 QUALIFICATIONS

- A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum 5 years' experience.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Prepare valves and accessories for shipment according to AWWA Standards and seal valve and ends to prevent entry of foreign matter into product body.
- B. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

PART 2 - PRODUCTS

2.1 EQUIPMENT



- A. Gate valves larger than 2" in size shall be cast iron body, bronze mounted, double disc, parallel seat, resilient seated, non-rising stem, O-ring seal type; and shall meet AWWA C500-19 Specifications. Valves shall be equipped with flanged or mechanical joint ends as required or indicated; and shall be furnished with hand-wheels or operating nuts as required or indicated. Valves shall be as manufactured by Mueller Co., Dresser Industries, Inc., American Valve and Hydrant Company, or approved equal.
- B. All 3" through 12" resilient-seated gate valves must be manufactured in accordance with AWWA C509 and AWWA C550. Sealing mechanism must provide zero (0) leakage at the water working pressure against line flow from either direction and be designed so that no exposed metal seams, edges, screws, etc., are within the waterway in the closed position. Anti-friction washers must be provided at the stem collar for inside screw design. Outside screw and yoke style valves must have asbestos-free packing with bronze packing gland. All internal and external ferrous surfaces of the valve, including the interior of the gate, must be coated with epoxy having a minimum thickness of eight (8) mils. Mechanical joints must be in accordance with ANSI/AWWA C111/A21.11-17. Valve must be seat tested at the rated working pressure of 200 psi with no leakage. A shell test at 400 psi must be applied to the valve body with the valve in the open position, with no leakage through the metal, flanged joints, or stem seals.
- C. All valves, mainline or bypass, shall be equipped with valve boxes of proper size and height, complete with cover.
- D. Valves shall be of the same size as the pipe in which the valve is situated, unless noted otherwise.
- E. Valves that are twelve (12") inches and larger must be butterfly valves.

2.2 COMPONENTS

- A. Butterfly valves shall be tight-closing, resilient seated, stainless steel to rubber type, with seal achieved by rubber seats which are bonded to or mechanically retained in the valve body, or rubber seats which are retained on the disc with an 18-8 stainless steel clamp ring and stainless steel bolting. Valves shall be bubble-tight at rated pressures with flow in either direction and shall be satisfactory for application involving rate-of-flow control, throttling service and/or frequent operation, and for application involving valve operation after long periods of inactivity. Valve discs shall rotate 90E from the full requirements of AWWA Specification C504, Class 150B. Butterfly valves shall be as manufactured by Henry Pratt Co., American-Darling Valve and Manufacturing (purchased by Val-Matic), Allis-Chalmers (purchased by Rodney Hunt), Crispin, DeZuirk, Mueller, or approved equal.



- B. Valve bodies shall be constructed of cast iron ASTM A126, Class B, and shall have integrally cast mechanical joint or flanged ends. Unless otherwise shown on the Plans, butterfly valves installed underground shall have mechanical joint ends, and exposed valves shall have flanged ends. Mechanical joints shall conform to the requirements of AWWA C111/A21.11-17. Flanged joints shall conform to the requirements of AWWA C115-11. Two (2) trunnions for shaft bearings shall be integral with each valve body. Where the rubber seat is mounted on the vane, the valve body shall be fitted with a 360E stainless steel seat offset from the shaft, mechanically retained.
- C. Valve discs shall be constructed either of alloy cast iron ASTM A436, Type 1 (NiResist), or of ductile iron ASTM A536, Grade 65-45-12. Where the rubber seat is mounted in the body, the mating edge of the disc shall be 18-8 stainless steel, Type 304 or Type 316.
- D. Valve shafts shall be turned, ground, and polished. Shafts shall be constructed of 18-8 stainless steel, Type 304, and shall be either a one (1) piece unit extending full size through the valve disc and valve bearing, or may be the stub shaft design, where a solid ductile iron disc is used.
- E. Valve seats shall be of natural rubber or synthetic rubber compound. Seats may be installed on either the valve disc or the valve body. Seats installed in valve bodies in valve sizes 20" and smaller may be vulcanized to the body or mechanically retained. Seats in valve bodies in valve sizes 24" and larger shall be mechanically retained. Seats installed on the valve disc shall be mechanically retained. Seats vulcanized to the valve body shall be simultaneously molded in, vulcanized, and bonded to the valve body, and seat bond shall withstand a 75 lb. pull under test procedure ASTM D429, Method B. Valve seats which are mechanically retained shall be field adjustable and replaceable without dismantling the valve disc or shaft and without removing the valve from the line. Retaining segments and adjusting devices shall be of corrosion-resistant materials, and shall be capable of a 1/8" adjustment.
- F. Valve bearings shall be of the sleeve types which are corrosion-resistant and self-lubricating. Bearing load shall not exceed 20% that of the compressive strength of the bearing or shaft material, and shall not exceed 2,500 psi.
- G. Valve operators shall be manual, hydraulic cylinder, or electric type, as shown on the Plans and as specified herein. Extension stems and bonnets and support brackets shall be provided where shown on the Plans.
- H. Manual operators for butterfly valves shall be totally enclosed worm gear or traveling nut type. Worm gear and traveling nut type operators shall conform to the requirements of AWWA C504. Manual operators shall be designed to hold the valve in any intermediate position without creeping or fluttering. Valves shall close with a clockwise rotation of the handwheel. Units for underground service shall be fully gasketed, grease packed, watertight, and shall be provided with extension stem and operating nut, cast iron valve box, and tee wrench operator.

2.3 FINISHES



- A. Valve interior surfaces, except seating surfaces, shall be evenly coated with a suitable primer to inhibit rust, or a black asphalt varnish.

2.4 SOURCE QUALITY CONTROL

- A. Hydrostatic and leakage tests shall be conducted on butterfly valves in accordance with AWWA C504, Section 12.

2.5 RESILIENT WEDGE GATE VALVES

- A. All gate valves shall be resilient seated. Resilient seated gate valves size 2-inch through 20 inch shall comply with AWWA C 509 as amended to date, and 24 inch valves shall conform to AWWA C-509 and AWWA C-550 as amended to date and shall be equipped with O-ring packing.
- B. Valves shall be equipped with flanged or mechanical joint ends as required or indicated; and shall be furnished with hand-wheels or operating nuts as required or indicated. – see “J” below.
- C. Sealing mechanism must provide zero (0) leakage at the water working pressure against line flow from either direction and be designed so that no exposed metal seams, edges, screws, etc., are within the waterway in the closed position. Anti-friction washers must be provided at the stem collar for inside screw design.
- D. All internal and external ferrous surfaces of the valve, including the interior of the gate, must be coated with epoxy having a minimum thickness of eight (8) mils.
- E. Outside screw and yoke style valves must have asbestos-free packing with bronze packing gland. Mechanical joints must be in accordance with ANSI/AWWA C111/A21.11-17.
- F. Gate valves shall be used for buried service in sizes 2-inch through 12-inch except as noted on the drawings.
- G. General Construction:
 - 1. Resilient seated gate valves shall embody the best class of workmanship and finish, and shall open and close freely and easily.
 - 2. With the valve open, an unobstructed waterway shall be afforded, the diameter, which shall not be less than the full nominal diameter of the valve.
 - 3. If guides or guide lugs are used, the design shall be such that corrosion in the guide area does not affect sealing.
 - 4. Resilient seats may be applied to the body or gate and shall seat against a corrosion-resistant surface. The surface may be either metallic or non-metallic.
 - 5. Resilient seats shall be bonded or mechanically attached to either the gate or valve body.
 - 6. The mating surface of the resilient seat shall be machined to a smooth even finish.
 - 7. All stems shall be forged bronze stems.



8. All exposed fasteners, nuts and bolts shall be stainless steel.
 9. Two inch valves shall be female by female threads, or an approved equal.
- H. Working Pressure:
1. Water working pressure for valves shall be minimum 200 psi.
- I. Test Pressure:
1. Test pressure for valves shall be a minimum of 250 psi.
- J. Operation:
1. All valves shall open left (counterclockwise).
 2. Valves shall be operated by nut. Operating nuts shall conform to the present standard of MU, and shall have an arrow cast on them, indicating the direction for opening the valve.
 3. Extend operating nut to within 6" of the valve box lid using an extension stem. Extension stem shall be of carbon steel.
- K. Marking:
1. Each valve shall be plainly marked with the manufacturer's name or particular mark, the year of manufacture, the size of the valve, and designation indicating working pressure, all cast on the bonnet or body.
- L. Jointing:
1. All gate valves shall be furnished with mechanical joints or flanges and necessary bolts, glands and gaskets unless otherwise shown on the Drawings or specified.
 2. Gate valves used in conjunction with tapping sleeves shall be flanged at the end connecting to the tapping sleeve. End connection to accept pipe shall be mechanical joint
- M. Coating: AWWA C550; interior/exterior.
- N. Manufacturers:
1. American Darling.
 2. U.S. Pipe Company.
 3. Mueller Company (2-inch valves shall be CAT A-2360-8).
 4. Clow (2-inch valves shall be Type 2640)
 5. M&H Valve Company (2-inch valves shall be Type 4067-07).
 6. Substitutions: Allowable but must be approved by MU.

2.6 BUTTERFLY VALVES

- A. Butterfly valves shall be furnished with valve operators and accessories as specified and indicated on the Drawings.
- B. All valves shall comply with AWWA C504 as amended to date.
- C. General:



1. Butterfly valves shall be Class 150 designed for 16 fps maximum velocity unless otherwise shown.
2. Valves shall be bubble-tight at rated pressures and shall be satisfactory for applications involving throttling service and/or frequent operation and for applications involving valve operation after long periods of inactivity.
3. Valve disc shall rotate 90 degrees from full open position to the tight shut position.
4. Wafer type valves are not acceptable.

D. Valve Body:

1. Valve bodies shall be ductile iron conforming to ASTM A536, Grade 65-45-12, as amended to date. Valve bodies shall be constructed of cast iron ASTM A126, Class B.
2. Valves shall be furnished with mechanical joints or flanges and necessary bolts, glands and gaskets unless otherwise shown on the Drawings or specified.
3. Valves shall have integrally-cast mechanical joint or flanged ends. Unless otherwise shown on the Plans, butterfly valves installed underground shall have mechanical joint ends, and exposed valves shall have flanged ends. Mechanical joints shall conform to the requirements of AWWA C111/A21.11-17. Flanged joints shall conform to the requirements of AWWA C115-11.
4. The body shall be designed to withstand the internal forces acting directly and forces resulting from the thrust of the operating mechanism. Trunnion bosses shall be located at diametrically opposite points in the valve body which shall be accurately bored to accept permanently self-lubricated shaft bearing bushings.
5. The trunnion box at the operator end shall be furnished with an integral packing box and the other trunnion shall include a factory set two-way bronze thrust bearing and a cast iron thrust bearing cover.

E. Valve Shafts:

1. Valve shaft may consist of a one piece unit or may be the "stub-shaft" type.
2. Valve shafts shall be turned, ground and polished.
3. Valve shafts shall be constructed of 18-8 Type 304 stainless steel conforming to ASTM A276 as amended to date.
4. Shaft diameters shall meet requirements established by AWWA C504 as amended to date.
5. Valve shafts shall be securely attached to the valve disc by means of taper pins. Taper pins shall be mechanically secured.

F. Valve Disc:

1. Valve discs 20" and smaller shall be constructed of alloy cast iron ASTM A436, Type 1 (Ni-Resist), ductile iron ASTM A536, Class 65-45-12 or cast iron ASTM A48.
2. Valve discs 24" and larger shall be constructed of ductile iron ASTM A536, Class 65-45-12 or cast iron ASTM A48, with 18-8 Type 304 stainless steel seating edges.
3. The valve disc shall be designed to withstand bending and bearing loads resulting from the pressure load and operating forces.
4. The faces of the discs shall be smooth and free of external projections.



5. All retaining or pinning hardware in contact with water shall be made of type 316 stainless steel.

G. Valve Seats:

1. Valve seats shall be natural rubber or Buna "N" rubber designed for tight shutoff in both directions with 150 psi upstream and 0 psi downstream pressure.
2. Rubber seats in the valve body shall be retained by 18-8 stainless steel mechanical means, or bonded, without retaining hardware in the flow stream.
3. Seats installed in valve bodies in valve sizes 20" and smaller may be vulcanized to the body or mechanically retained. Seats in valve bodies in valve sizes 24" and larger shall be mechanically retained.
4. Seats vulcanized to the valve body shall be simultaneously molded in, vulcanized, and bonded to the valve body, and seat bond shall withstand a 75 lb. pull under test procedure ASTM D429, Method B.
5. Rubber seats attached to the disc shall be retained by an 18-8 stainless steel clamp ring and stainless steel bolting.
6. Retaining ring cap screws shall pass through the rubber seat and be self-locking.
7. Mating seat surfaces for resilient seats shall be 18-8 stainless steel.
8. Seats shall be full 360-degrees without interruption.
9. Valve seats shall be designed to permit removal and replacement in the field for valves 30" in diameter and larger. Valve seats which are mechanically retained shall be field adjustable and replaceable without dismantling the valve disc or shaft and without removing the valve from the line.
10. Retaining segments and adjusting devices shall be of corrosion-resistant materials, and shall be capable of a 1/8" adjustment.

H. Valve Bearings:

1. The valve shall be fitted with sleeve type bearings.
2. Bearings shall be corrosion resistant and self-lubricating.
3. Bearing load shall not exceed one fifth (1/5) of the compressive strength of the bearing or shaft material.
4. Bearing material must have coefficient of friction no greater than 0.25, which must be maintained regardless of wear.

I. Valve Operators:

1. Valve operator shall conform to AWWA C504 and shall be equipped with adjustable mechanical stop-limiting devices to prevent over travel of the disc in the open and closed positions.
2. All valves shall open left (counterclockwise)
3. The manual operator shall be the enclosed type, suitable for buried service, full gasket, grease packed or oil lubricated and designed to withstand submersion in water to 10 psi.
4. The manual operator for valve size 20" and smaller shall be the traveling-nut type with threaded steel reach rods and bronze or ductile-iron nut with internal threads.
5. The manual operator for valves size 24" and larger shall be worm-gear type having a self-locking worm gear of high tensile bronze and worm of hardened alloy steel.



6. The valve and actuator shall be assembled and tested by the valve manufacturer.
7. Valve operators shall hold valve in any intermediate position between full open and full close without creeping or fluttering.
8. Valves for buried service shall be furnished with a ground level valve position indicator.
9. Valves for above ground service shall be furnished with a valve position indicator arrow to give valve position at any point from full open to full close.

J. Coating:

1. Valve placed on or beneath the ground surface shall have an exterior coating of asphalt (one mil) in accordance with ANSI/AWWA C151-09/A21.10, latest revisions.
2. Valve in lieu of an asphalt coating may be coated with six (6) to eight (8) mils of fusion bonded epoxy in accordance with AWWA/ANSI C550 and C121/A21.16.
3. Valve placed above the ground surface shall have an exterior manufacturer applied universal phenolic primer (one mil) capable of accepting an epoxy coating.
4. Valve interior surfaces, except seating surfaces, shall be evenly coated with a suitable primer to inhibit rust, or a black asphalt varnish.

K. Valve Testing:

1. Performance, leakage and hydrostatic tests shall be conducted in strict accordance with AWWA C504.
2. The manufacturer shall provide an Affidavit of Compliance per AWWA C504.

L. Extension Stems:

1. Extension stems for the butterfly valves shall be furnished and installed with position indicators.
2. Extend operating nut to within 6" of the valve box lid using an extension stem.
3. Extension stem shall be of carbon steel.

M. Manufacturers:

1. M&H Valve Company.
2. Henry Pratt Company.
3. American Darling Valve and Manufacturing.
4. Substitutions: Allowable but must be approved by MU.

2.7 VALVE BOXES

- A. Valve boxes shall be of the two-piece type and manufactured of cast iron. Valve boxes shall be screw type, with extension pieces as required to make up length of box from surface of ground to top of valve body
- B. Valve boxes shall have an internal diameter of 5.25 inches.
- C. Cast iron lid marked "Water".
- D. Manufacturers:



1. Bingham-Taylor.
2. M&H Valve Company
3. Substitutions: Allowable but must be approved by MU.

2.8 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03 30 00.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of existing conditions before starting work.
- B. Determine exact location and size of valves from Drawings; obtain clarification and directions from MU's Engineer prior to execution of work.
- C. Verify invert elevations of existing work prior to excavation and installation of valves.

3.2 PREPARATION

- A. Identify required lines, levels, contours and datum locations.
- B. Locate, identify, and protect utilities to remain from damage.
- C. Perform trench excavation, backfilling and compaction in accordance with Section 31 23 33.

3.3 INSTALLATION

- A. Install valves plumb with valve stems in the vertical direction.
- B. Valves 12" in size and smaller shall be installed in a vertical position, with valve stems extending to within 24" of the surface of the finished ground; valves larger than 12" shall be installed in a horizontal position, with valve stems extending to within 24" of the surface of the finished ground. The top of operating nut of valve stem shall not, however, be closer than 20" to surface of the finished ground.
- C. It shall be the responsibility of the Contractor to make such variations in depths of trench as necessary to secure proper bury for the valves. The Contractor will not be permitted to make a sudden or local dip in the trench that would deviate from a constant downgrade or constant upgrade to an air release valve. Where depth of bury is such that the operating nut is not at the specified depth below the surface of the finished ground, extension stems shall be furnished and installed by the Contractor.



- D. Valve boxes shall be installed plumb, centered over operating nut, and securely positioned while backfill is placed and tamped in such a manner that plumb and concentric position will be maintained. Valve boxes shall be brought to ground level with a concrete collar poured around the valve box lid.
- E. Provide buried valves with valve boxes installed flush with finished grade as shown on the Drawings.
- F. A 3-way valve arrangement shall be required at every water main intersection, where feasible. For connections to live mains, check with MU for details on allowable connection features.
- G. A corporation valve shall be situated at the tap location into a water main with a one (1") inch service line.
- H. A resilient seated gate valve shall be situated downstream of a tapping saddle or tapping sleeve when tapping into a watermain with a two (2") inch service line. The valve shall be situated within a valve box.
- I. Gate valves shall be situated in-line with water mains as follows, unless noted otherwise:
 - 1. Attach tapping gate valve immediately downstream of tapping saddle or tapping sleeve when tapping into water main with a smaller water main or service line.
 - 2. Situate gate valve downstream of a tee, as directed by the MU Engineer, when connecting to a water main.
 - 3. Situate gate valve on each immediate side of a three (3)-way connection or four (4)-way connection, as directed by the MU Engineer.
 - 4. Situate gate valve within the street right-of-way when fire services extends beyond the right-of-way.
 - 5. Gate valve shall be situated outside of vault immediately upstream and downstream of three (3") inch and larger water meter/check valve assemblies.
 - 6. A screw type valve box shall be situated over a gate valve.
- J. A curb stop shall be situated inside of meter box immediately upstream of five-eighths (5/8") inch through two (2") inch water meter/check valve assemblies.
- K. All valves related to new construction shall be installed behind curb and gutters, and out of paving. Placement shall be approved by the MU Engineer during review of submitted plans.
- L. The Contractor shall be responsible for filling of the gear case with lubricants as recommended by the manufacturer; and lubricant level shall be checked and the valve operated in the presence of the MU Representative before the trench is backfilled.
- M. All buried valves, including bypass valves and geared valves, shall be equipped with valve boxes.

3.4 FIELD QUALITY CONTROL



- A. Perform pressure test on domestic site water distribution system in accordance with AWWA C600-17.

PART 1 – GENERAL - HYDRANTS

1.1 REFERENCES

- A. American Water Works Association:
 - 1. AWWA C502 - Dry-Barrel Fire Hydrants.
 - 2. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
 - 3. AWWA C600-17 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
- B. National Sanitation Foundation:
 - 1. NSF 61 - Drinking Water System Components - Health Effects
- C. National Fire Protection Association:
 - 1. NFPA 281 - Recommended Practice for Fire Flow Testing and Marking of Hydrants

1.2 QUALITY ASSURANCE

- A. Provide uniform color scheme for fire hydrants in accordance with NFPA 281.

1.3 QUALIFICATIONS

- A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum 5 years of experience.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Prepare hydrants and accessories for shipment according to AWWA Standards and seal hydrant and ends to prevent entry of foreign matter into product body.
- C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.



1.6 COORDINATION

- A. Coordinate work with MU and utilities within construction area.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS - DRY BARREL BREAK-AWAY FIRE HYDRANTS

- A. Fire hydrants shall be of the compression type, closing with line pressure, complying with AWWA C502 for 150 psi working pressure and NFPA, 1993 edition.
- B. Hydrants shall have a 5-1/4 inch main valve and a non-freeze design with an automatic drain that closes fully when main valve is opened.
- C. Hydrants shall be furnished having factory burying depths of 3'-0".
 - 1. Deeper burying depths shall be accomplished using extension kits provided by same manufacturer.
 - 2. Break-away device shall be situated \pm three (3") inches above finished grade.
- D. Hydrant standpipe, fittings and upper barrel shall be ductile iron. Parts designed to break away may be cast iron.
- E. Hydrant bolts below ground level shall be stainless steel.
- F. Hydrant lead to main line connection shall be mechanical joint.
- G. The means of attaching the barrel to the standpipe shall permit 360° rotation of the barrel.
- H. Hydrant barrel shall break away from the standpipe at an elevation above ground level without causing damage to the standpipe and stem.
 - 1. When barrel is broken away, internal valve shall function and repairs shall be permitted without excavating or turning off water supply
- I. Hydrants shall be bronze mounted and all internal working parts shall be bronze. Valve seat shall screw into retainer. However, stainless steel is preferred.
- J. Internal working parts shall be removable without disturbing the barrel.
- K. Hydrants shall have all stainless steel stems.
- L. Operation:
 - 1. The size of the operating nut shall be 1-1/2".
 - 2. The operating nut situated atop the hydrant shall be pentagon shaped.
 - 3. The operating nut shall be constructed of ductile iron or cast iron.
 - a. Bronze operating nut are acceptable provided they are supplied with a ductile iron weather cap.
 - 4. It shall open in a counter clockwise direction.



5. The threads shall be enclosed in an operating chamber separated from the hydrant barrel by a rubber O-ring stem seal lubricated by a grease or oil reservoir
- M. Connections and Nozzles:
1. Hydrant shall be equipped with two 2-1/2 inch threaded (7.5 threads per inch) hose connections and one 4-1/2 inch threaded (4 threads per inch) hose connection.
 2. Hose and pump connections shall be threaded and pinned to seal the connection to the barrel.
 3. Threads shall comply with National Standard Threads.
 4. Each connection shall be equipped with a cap and chain.
- N. Finish and color shall be as selected by MU.
- O. Fire hydrant shoe shall have epoxy-coated interior.
- P. Manufacturers:
1. American Darling, Model B-84-B
 2. M&H, Reliant Model
 3. Mueller Company, Centurion Model
 4. Or approved equal

2.2 COMPONENTS

- A. Hydrants must have 30" to 36" bury. Operating threads should be permanently lubricated and sealed away from fluid and weather. Hydrants must have a sealed, anti-friction thrust washer, and a heavy-duty spring-loaded multi-port drain mechanism. Hydrants must have a stop in the operating head to prevent rod buckling and twisting. Hydrants must have bronze to bronze seat threads. The lower end of the rod must be sealed off from water in the base. Easy field-replaceable nozzles and provision for servicing all working parts from top of hydrant with short lightweight seat wrench. Rated water working pressure shall be minimum 150 psi.
- B. Fire hydrants shall meet or exceed AWWA C502. Hydrants shall be equipped with: two (2) 2-1/2" hose nozzles, and one (1) 4-1/2" steamer nozzle with 3-way nozzle arrangement, traffic model National Standard Hose Coupling Threading, complete with caps and chains, not less than 5-1/4" valve opening, 4" inlet opening, mechanical joint glands fitting with set screws, and National Standard Pentagon operating nut. The fire hydrant setup piping shall be all ductile iron pipe.
- C. Main valve closure must be of compression type, opening against the pressure and closing with the pressure. Traffic feature should be designed to allow the nozzle section of the hydrant to be rotated (by degree) to a full 360E circle during field installations.



- D. Main valve opening shall not be less than 5-1/4", and must be designed so that the seat, drain valve mechanism, internal rod, and all working parts can all be removed through the top of the hydrant. Parts removal should not disturb the ground line joint or nozzle section of the hydrant. Bronze seat shall be threaded into the mating threads of bronze for easy removal.
- E. Draining systems should be bronze and activated by the main stem without use of auxiliary rod, toggles, pins, etc.
- F. There must be a minimum of two (2) inside ports and four (4) drain port outlets to the exterior of the hydrant. Drain shut-off must be by direct compression closure. Sliding drain seals or not considered to be equal.
- G. Operating nut, main stem, coupling main valve assembly must be capable of withstanding input torque of 200 ft.-lbs. in opening and closing directions.
- H. Hydrants must have an internal top housing with triple O-rings to seal operating threads from the waterway and accommodate an anti-friction washer.

2.3 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03 30 00.
- B. Aggregate: Aggregate for hydrant drainage as shown on Drawings.

2.4 FABRICATION

- A. The nozzle section should be designed to allow field replacement of damaged threads without special tools, excavation, or disturbing the ground line joint. Bronze nozzles are to be locked into the hydrant barrel with locking lugs and be sealed by a heavy-duty O-ring.

2.5 FINISHES

- A. Fire hydrant shoe shall have epoxy-coated interior.

2.6 SOURCE QUALITY CONTROL

- A. Friction loss through hydrants shall not exceed 3.0 psi at 1000 gpm through the pumper nozzle. Flow testing and certification of this feature must be conducted by a testing laboratory and be in accordance with AWWA C502, latest edition.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of existing conditions before starting work.



- B. Determine exact location and size of hydrants from Drawings; obtain clarification and directions from MU's Engineer prior to execution of work.
- C. Verify invert elevations of existing work prior to excavation and installation of fire hydrants.

3.2 PREPARATION

- B. Identify required lines, levels, contours and datum locations.
- C. Locate, identify, and protect utilities to remain from damage.
- D. Perform trench excavation, backfilling and compaction in accordance with Section 31 23 33.

3.3 INSTALLATION

- A. Hydrants shall be set so that bury line is at the surface of the finished ground. Length of barrel below the bury line may vary, but shall be such length that hydrant setting will conform to depth of trench and surface of finished ground at location of particular hydrant. All hydrants shall be set plumb and true. Hydrants shall be braced with concrete in accordance with details shown in the Standard Drawings. Broken stone (gradation 1-1/2" to 2-1/2") shall be placed around hydrant drainage openings to permit effective drainage of barrel. Volume of stone shall not be less than two (2) cubic feet.
- B. Install fire hydrants; provide support blocking and drainage gravel; do not block drain hole.
- C. Set hydrants plumb with pumper nozzle facing roadway; set hydrants with centerline of pumper nozzle 18 inches above finished grade and safety flange not more than 6 inches or less than 2 inches above grade.
- D. Hydrants shall be situated within the street's right-of-way adjacent to the right-of-way boundary.
- E. A hydrant shall be situated at the end of each cul-de-sac or dead-end street to allow for flushing the main at 2.5 ft. /sec., minimum.
- F. Fire hydrants servicing residential areas shall be spaced a maximum of 500 feet as measured along the edge of pavement. No lot shall be greater than 250 feet from a fire hydrant.
- G. Fire hydrants servicing commercial and industrial areas shall be spaced a maximum of 300 feet as measured along the edge of pavement or as otherwise required by the fire marshal.
- H. Fire hydrants shall be required in close proximity to fire line vaults unless otherwise directed by an authorized representative of the City of Madison Fire Department.



- I. Fire hydrants on County ROW shall be spaced based on the County requirements.
 - J. Paint hydrants in accordance with local color scheme.
 - 1. Madison Utilities are red
 - 2. Private Lines are silver
 - K. After hydrostatic testing, flush hydrants and check for proper drainage.
- 3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM
- A. Flush and disinfect system in accordance with Section 33 01 10.58.
- 3.5 FIELD QUALITY CONTROL
- A. Perform pressure test on domestic site water distribution system in accordance with AWWA C600-17.

END OF SECTION



33 31 11 – Public Sanitary Sewerage Gravity Piping

PART 1 - CONSTRUCTION SEQUENCE CONSTRAINTS

1.1 SUMMARY

- A. Sections of sewer under construction upstream of an existing or recently accepted sewer shall be kept isolated, by means of a semi-permanent bulkhead, until the section under construction has been fully tested and accepted by the MU Representative. The plug or bulkhead may be removed only with the permission of the MU Representative.
- B. New sections of sewer shall be constructed, when feasible, from the lower end to the higher end so that testing and acceptance can proceed in a logical sequence and new sections placed into service.
- C. Sanitary sewage may not be discharged into any section of sewer upstream of uncompleted or unaccepted sections, unless special arrangements have been made to divert the flow into the existing MU system. Such special arrangements must be approved by the MU Representative prior to implementation.
- D. If a proposed street, roadway, driveway, bike path, or sidewalk crosses an existing sanitary sewer line, the trench backfill for that pipeline shall meet the requirements of Section 33 01 10 Paragraph 1.6. That is, the trench shall be filled completely with properly compacted select earth material or with crushed stone. Alternatively, the trench may be bridged as shown on Standard Detail No. 8.140, "Pavement Trench w/Concrete Bridge." The method proposed by the Design Engineer or Developer will be reviewed by the MU Representative, and approved according to the Board's best interests.
- E. Should the construction of the sewer require or result in removal or damage to an existing fence, the Contractor shall replace the fence in kind to the satisfaction of the fence owner.

PART 2 - CONNECTING NEW SEWERS TO EXISTING SEWERS

2.1 SUMMARY

- A. Connections shall be made to all existing sewer lines in the vicinity of the work, as shown on the Plans or as directed by the MU Representative, and with the written approval of the Board. Connections shall be made by the construction of a manhole or utilization of an existing manhole.
- B. Connections to existing manholes shall be made by boring an opening in the wall of the existing structure, installing a flexible manhole sleeve ("boot") in the opening, inserting a minimum length of eighteen (18) feet of ductile iron sewer pipe into the hole, and sealing around same with non-shrinking grout. Construction requirements are the same as given in Section 33 05 13.
- C. Connections of new sewers to existing manholes shall be sealed with a bulkhead, and



shall remain sealed until final acceptance by the Board.

PART 3 - EXECUTION – Not Used

END OF SECTION



33 31 16 – Site Sanitary Sewerage Gravity Service Laterals

PART 1 - SERVICE LINES

1.1 SUMMARY

- A. Service lines shall be installed from the sanitary sewer to all adjacent lots and individual properties; additional connections shall be installed when directed by the MU Representative.
- B. House service lines shall consist of four inch (4") diameter sewer pipes, and service lines for multiple dwelling units or non-residential units served by a single line shall consist of six inch (6") diameter sewer pipes, constructed as specified herein. If the plumbing code in effect at the time of construction specifies larger pipe then the larger pipe shall be installed. Service line stubouts shall be installed from the tee in the sewer to a point five (5) feet beyond the right-of-way line or to a utility easement line, whichever is farther from the tee, as shown on Standard Detail No. 8.370. Service lines shall not be more than seven (7) feet below the top of curbs or pavement edges. The open end of such stubouts shall be closed with approved stoppers properly restrained. It shall be the responsibility of the Contractor to install and mark the location of all stubouts. Marking shall be accomplished by placing a 2" diameter circular metal marker etched with the letter "S", or a 2" diameter green colored circular plastic marker, in the top of curb, with the top of the marker flush with the top of the curb.
- C. Pipe material shall be the same as specified for the collector, as specified in Section 33 05 19.
- D. Cleanouts shall be installed for each continuous run of 100 feet and at each change in horizontal or vertical direction. Cleanouts shall be constructed in accordance with the Standard Details. Cleanouts shall be plugged with approved stoppers in accordance with the local Plumbing Code. Stoppers shall be properly restrained.
- E. Backfilling for service lines shall commence immediately upon acceptance by the Board. Backfill materials shall be as specified in Section 33 23 33 Part 2 and shall be compacted to the equivalent density of the surrounding undisturbed material.

PART 2 – PRODUCTS

2.1 TEE CONNECTIONS

- A. Tee branches shall be installed in sanitary sewer lines at all points shown on the Plans. If such branches are not to be used immediately, they shall be closed with approved stoppers and shall be physically restrained.
- B. If the work consists of the construction of a sewer that is to replace an existing sewer, all existing service lines shall be connected to the new sewer.



- C. Tees shall be installed in sanitary sewers so as to properly serve each existing house and each vacant lot facing or abutting on the street or alley in which the sewer is being laid and at such other locations as may be designated by the MU Representative. The exact location of each connection shall be recorded by the Contractor before backfilling, and indicated on the As-Built Plans.
- D. Tees for new sewer pipe shall be standard manufactured tees.

2.2 SEWER LATERALS

- A. Where shown on the Plans or directed by the MU Representative, and where the depth of cut is over 8 feet or where the grade of a sanitary sewer is lower than necessary to drain abutting property, and at such other locations as may be designated by the MU Representative, sewer laterals shall be installed to serve each existing house and each vacant lot facing or abutting on the street on which the sewer is being laid.
- B. Sewer laterals shall be sized in accordance with the plumbing code in effect at the time of construction but shall not be smaller in size than shown on the Plans. Risers shall be installed from a tee connection to the elevation shown on the Plans, or as directed by the MU Representative. The tee connection shall be installed at the location shown on the Plans, and in accordance with the Standard Details. Open ends of sewer laterals shall be closed with approved stoppers and be physically restrained. Backfilling shall be carefully done around these risers using materials specified in Section 31 23 33, compacted to the equivalent density of the surrounding undisturbed material. The MU Representative may direct that sewer laterals be constructed of ductile iron pipe when, in their opinion, such materials are necessary because of special or unusual conditions. Risers shall not be constructed on an angle exceeding 60 degrees as measured from the horizontal.

PART 3 - EXECUTION – Not Used

END OF SECTION



33 31 33 – High Density Polyethylene (HDPE) Pipe

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The work performed under this section includes, but is not limited to, the supply and installation of High Density Polyethylene (HDPE) Pipe as shown.
- B. Provide HDPE pipe complete with all necessary jointing facilities and materials, specials, mechanical joint adapter kits, and other appurtenances required for installation in and completion of the water pipelines to be constructed.

1.2 QUALITY ASSURANCE

- A. Contractor's Qualifications:
 - 1. CONTRACTOR or SUBCONTRACTOR performing any fusion (heat or electrofusion) on the HDPE pipe shall be able to provide evidence and references for satisfactory service in at least 3 projects of similar pipe diameter and with similar service types. These references may be asked for and shall be subject to the MU's approval before the contract is awarded.

1.3 MANUFACTURERS

- A. HDPE pipe shall be as manufactured by:
 - 1. Performance Pipe
 - 2. Charter Plastics
 - 3. W. L. Plastics
 - 4. Flying W. Plastics
 - 5. J.M. Eagle.
 - 6. Pipeline Plastics

1.4 APPLICABLE STANDARDS

- A. PPI's Handbook of PE Pipe, 2nd Addition
- B. AWWA M55 – PE Pipe Design and Installation
- C. ASTM F2164 – Standard of Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping System Using Hydrostatic Pressure

PART 2 - PRODUCTS

2.1 PIPE MATERIAL

- A. HDPE pipe shall conform to the latest edition of ANSI/AWWA C901 and C906. Material used in the manufacture of HDPE pipe shall conform to the HDPE Standard



Code PE4710. All HDPE pipe SDR17 shall have the same outside diameter as ductile iron pipe.

- B. Dimensions. The pipe shall have ductile iron pipe (DIP) equivalent outside dimensions for the nominal size indicated.
- C. Working Pressure Rating (WPR). The pipe shall have a wall thickness dimension ratio (DR) 17 for pipe 6-inch through 24-inch in diameter.
- D. Pipe Identification. Each pipe length shall be marked in accordance with AWWA C906 and shall be black in color with extruded green striping.
- E. Pipe Section Lengths. Pipe sections proposed to be fused together shall be a minimum of 20 feet in length unless otherwise approved by MU.

2.2 FITTINGS

- A. HDPE fittings shall be fabricated with the minimum number of segments as noted in plans. Fittings shall be fabricated by a HDPE manufacturer or shop with sufficient experience. Fittings shall not be field fabricated or fabricated by the Contractor.
- B. Stainless Steel Insert/Stiffener. All non-fused connections shall require the use of stainless steel inserts inside the end of the HDPE pipe. Inserts shall be as follows:
 - 1. At HDPE pipe connections to fittings and/or other pipe materials, the inside of the HDPE pipe shall be reinforced by inserting a two piece wedge style stainless steel stiffener/insert. Insert shall be properly sized and approved by the manufacturer for actual HDPE pipe diameter and wall thickness (DR) being utilized.

2.3 PIPE AND FITTING JOINTING/CONNECTIONS

- A. The Butt (or Heat) Fusion technique shall be used to join all HDPE pipe sections and connect HDPE fittings to the HDPE pipe. The joints shall conform to ASTM D2657 and shall be performed in strict accordance with the pipe manufacture's recommendations. The fusion shall also conform to the Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe, Technical Report TR-33/2012, published by the Plastic Pipe Institute (PPI). The butt fusion equipment should be capable of meeting all conditions recommended by the manufacturer, including but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 psi. The fusion joining shall produce a joint weld strength equal to or greater than the tensile strength of the pipe itself.
- B. Sidewall Fusion. The Sidewall (or Heat) Fusion technique shall be used to connect HDPE fittings to the HDPE pipe. The joints shall conform to ASTM D2657 and shall be performed in strict accordance with the pipe manufacture's recommendations. The sidewall fusion heating irons shall have an inside diameter equal to the outside diameter of the HDPE pipe and shall be 1/4 inch wider than the size of the fitting being attached. The



fusion joining shall produce joint weld strength equal to or greater than the tensile strength of the pipe itself.

- C. Pipe Mechanical Joining. Mechanical joining shall be used to make connections to ductile iron fittings and/or non HDPE pipe. Permitted methods of HDPE joining are listed below.
 - 1. HDPE to be joined using mechanical joint adapter kits.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The HDPE pipe shall be installed using the horizontal directional drilling method or open cut as shown in the plans.
- B. Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before installation, and no piece shall be installed which is found to be defective. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (5%) of the wall thickness, shall not be used and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with procedures stated above. In addition, any section of pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the MU Engineer and/or the project representative shall be discarded and not used.
- C. Under no circumstances shall the pipe or accessories be dropped into the trench or forced through a directional bore upon “pull-back”.
- D. Ropes, fabric, or rubber protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used.
- E. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects, which could damage the pipe. Stacking of the pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. When necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as to not allow deformation of the pipe at the point of contact.
- F. Force mains shall be installed at the lines and grades shown in the Plans unless modified in the field due to conflicts with other utilities, structures, etc. All changes in the lines and grades shall be approved by the MU’s Representative and/or MU’s Engineer in advance of the work. The pipe shall slope continuously between high and low points to eliminate the formation of air pockets and move air to the proposed air relief valve assemblies.
- G. HDPE pipe shall be at the temperature of the surrounding soil at the time of backfilling and compaction.



- H. Backfilling and compaction shall be accomplished to avoid inducing bending stresses resulting from both backfilling itself and from differential settling of the fill materials subsequent to the backfilling operation. Pipe shall be continuously supported beneath its entire length with clean, firm backfill materials. Intermittent blocking shall not be used to support pipe-excavated sections. Backfill to at least 12" over the pipe shall hand compacted and be free from rocks or materials that could damage the pipe. Heavy rollers and large mechanical tampers such as hydrohammers shall only be used to consolidate the final backfill after a minimum of 24" of compacted backfill cover has been obtained.
- I. At the conclusion of the work, thoroughly clean all of the new pipe lines to remove all dirt, stone, pieces of wood, or other materials which may have entered during the construction period.
- J. Precautions shall be taken to prevent flotation of the pipe in the trench.

3.2 Pipe Joining

- A. The HDPE pipe shall be assembled and joined at the site using the buttfusion method to provide a leak proof joint. Heat fusion joints shall be as outlined in ASTM D2657 and conform to the Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe, Technical Report TR-33 (latest revision), published by the Plastic Pipe Institute. Threaded or solvent-cement joints and connections shall not be permitted.
- B. All equipment and procedures used shall be used in strict compliance with the manufacturer's recommendations. Fusing shall be accomplished by personnel trained as fusion technicians by a manufacturer of polyethylene pipe and/or fusing equipment.
- C. Square the pipe ends by using the fusion machine facing tool. In the fusion machine, pipe ends shall meet squarely so that the entire area to be fused is covered. The pipe ends shall make firm contact without applying pressure to the heat plate. The heat plate temperature shall be as required by the pipe manufacturer's recommendations. The melt bead shall be according to pipe diameter and as recommended by the pipe manufacturer. Pipe ends shall be carefully moved away from heat plate once the appropriate melt bead is achieved. The pipe ends shall be joined quickly without slamming. The butt-fused joint shall be true alignment and shall have uniform roll back beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure. The fused joint shall be watertight and shall have tensile strength equal to that of the pipe. All joints shall be subject to acceptance by the MU Engineer prior to insertion.
- D. All defective joints shall be cut out and replaced at no cost to MU.
- E. Butt fusion equipment shall be equipped with a Data Logger to record and document key parameters of each fusion process including heater temperature, fusion pressure, melt time, hold time, etc. Information from the Data Logger shall be collected and filed daily. A record of each fused joint including a graph of the fusion cycle shall be submitted to the MU Engineer. Joints shall be referenced to approximate pipe Station.

3.3 Pressure Testing



- F. As required by “ASTM F 2164 – 02 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure” following this Section.

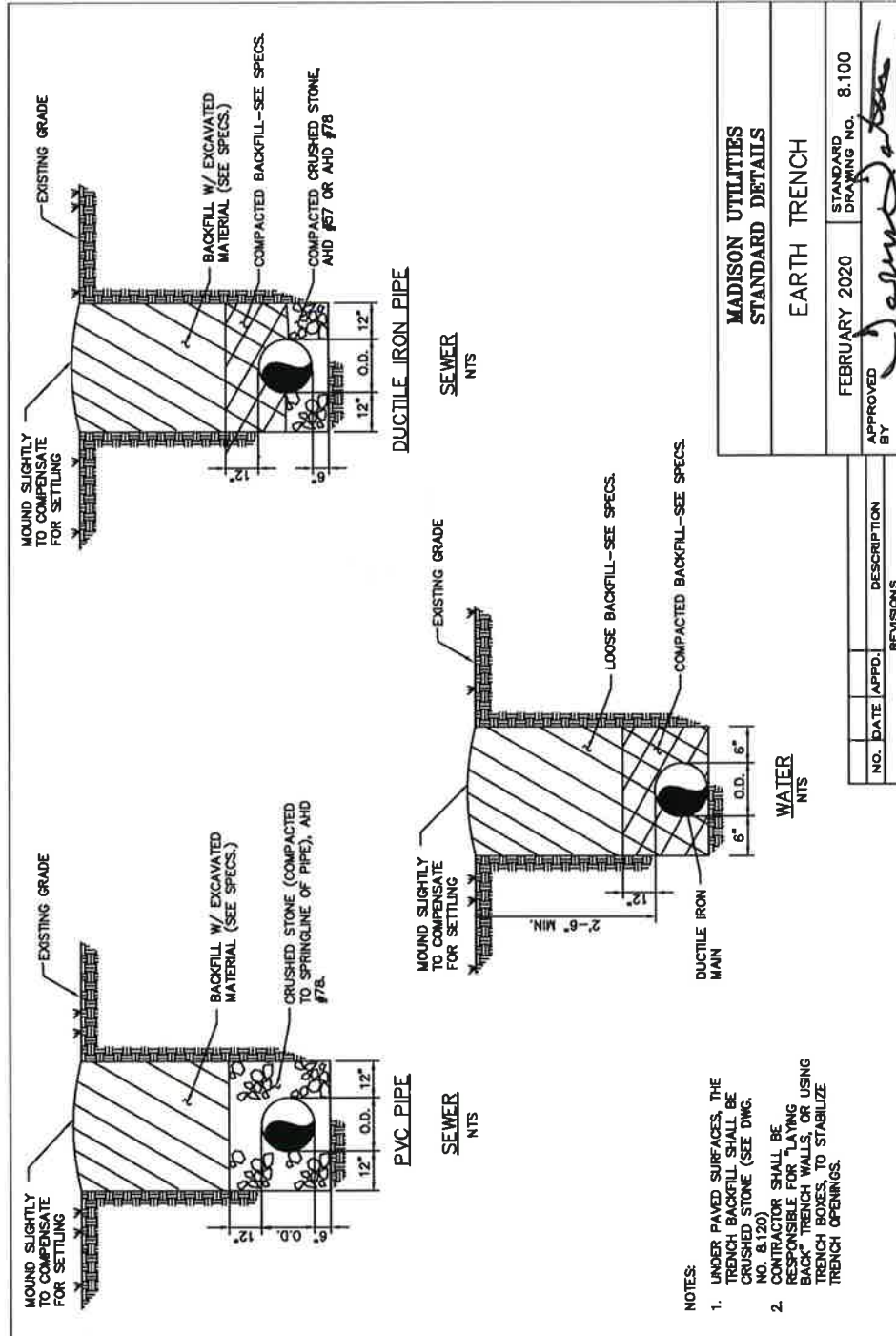
END OF SECTION



Division 99
99 99 99 - Details



8.100 Earth Trench

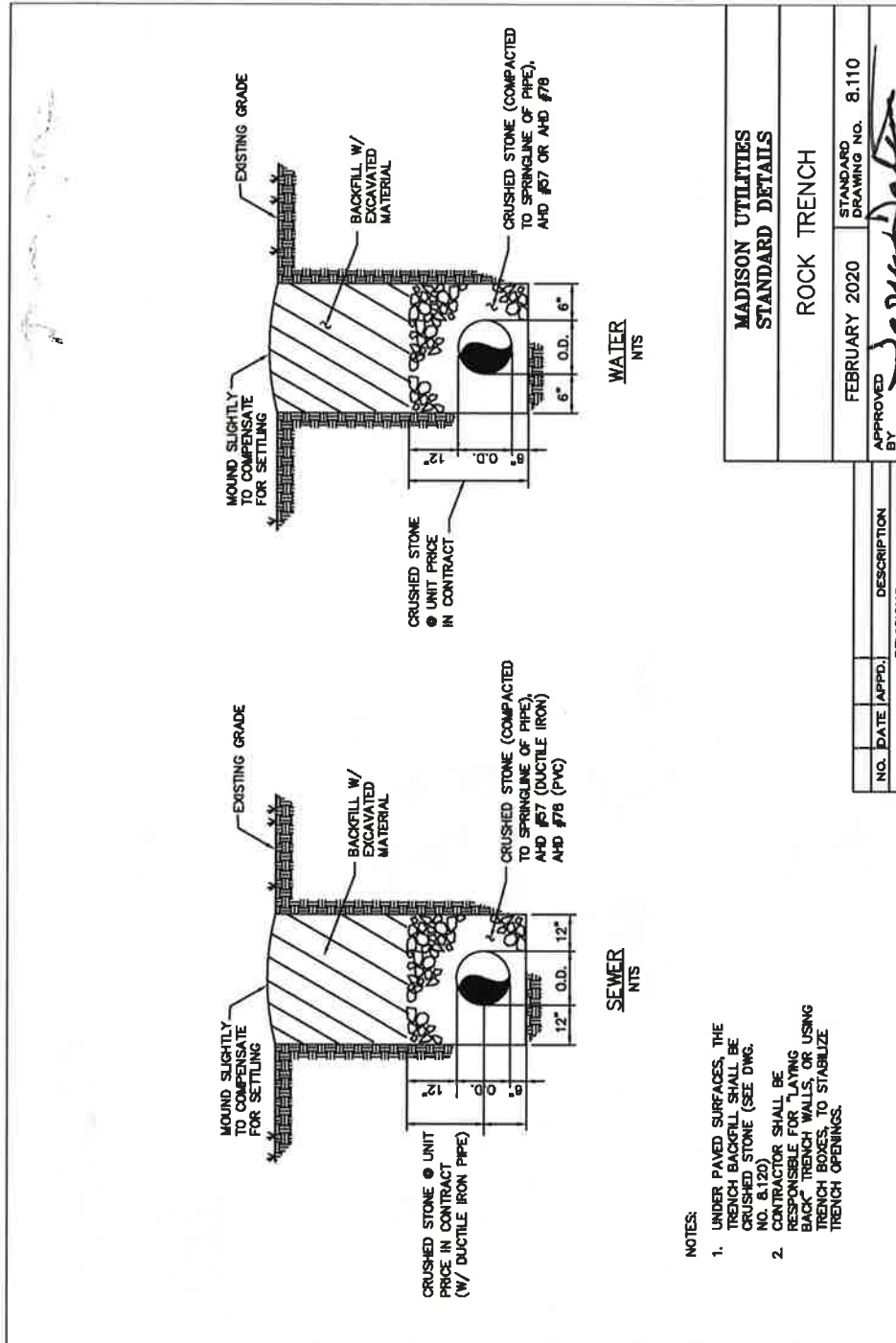


MADISON UTILITIES STANDARD DETAILS	
EARTH TRENCH	
FEBRUARY 2020	STANDARD DRAWING NO. 8.100
APPROVED BY	<i>[Signature]</i>

NO.	DATE	APPD.	DESCRIPTION
REVISIONS			



8.110 Rock Trench



NOTES:

1. UNDER PAVED SURFACES, THE TRENCH BACKFILL SHALL BE CRUSHED STONE (SEE DWG. NO. 8.120)
2. CONTRACTOR SHALL BE RESPONSIBLE FOR "LAYING BACK" TRENCH WALLS, OR USING TRENCH BOXES, TO STABILIZE TRENCH OPENINGS.

MADISON UTILITIES STANDARD DETAILS	
ROCK TRENCH	
FEBRUARY 2020	STANDARD DRAWING NO. 8.110
APPROVED BY	



8.120 Pavement Trench

PAVEMENT REPLACEMENT:

1. TYPICALLY WILL BE 1" SURFACE TREATMENT (AHD 416), 2" BLACK BASE (AHD 411), AND 10" DENSE GRADED BASE (AHD #57).
2. WILL BE AS DIRECTED BY GOVERNING AUTHORITY, IF DIFFERENT THAN ABOVE.
3. IN NO CASE SHALL THICKNESS BE LESS THAN EXISTING PAVEMENT.
4. CONCRETE PAVEMENT SHALL SUBSTITUTE FOR SURFACE TREATMENT AND BLACK BASE, WHERE APPROPRIATE. THICKNESS SHALL MATCH EXISTING, BUT SHALL BE 6" MINIMUM. STEEL REINFORCEMENT SHALL BE REPLACED AND WELDED TO EXISTING.

WIDTH TABLE
FOR PAVEMENT & CRUSHED STONE BACKFILL

PIPE SIZE	WIDTH TABLE	
	DEPTH < 6'	12' < DEPTH
3"φ	2.4'	4.4'
4"φ	2.4'	4.4'
6"φ	2.6'	4.6'
8"φ	2.7'	4.7'
10"φ	2.9'	4.9'
12"φ	3.1'	5.1'
14"φ	3.3'	5.3'
16"φ	3.4'	5.4'
18"φ	3.6'	5.6'
20"φ	3.8'	5.8'
24"φ	4.1'	6.1'

NOTE: SUBTRACT 1" FOR WATER MAIN INSTALLATION.

**MADISON UTILITIES
STANDARD DETAILS
PAVEMENT TRENCH**

FEBRUARY 2020 STANDARD DRAWING NO. 8.120
APPROVED BY: *[Signature]*

NO.	DATE	APPD.	DESCRIPTION
REVISIONS			

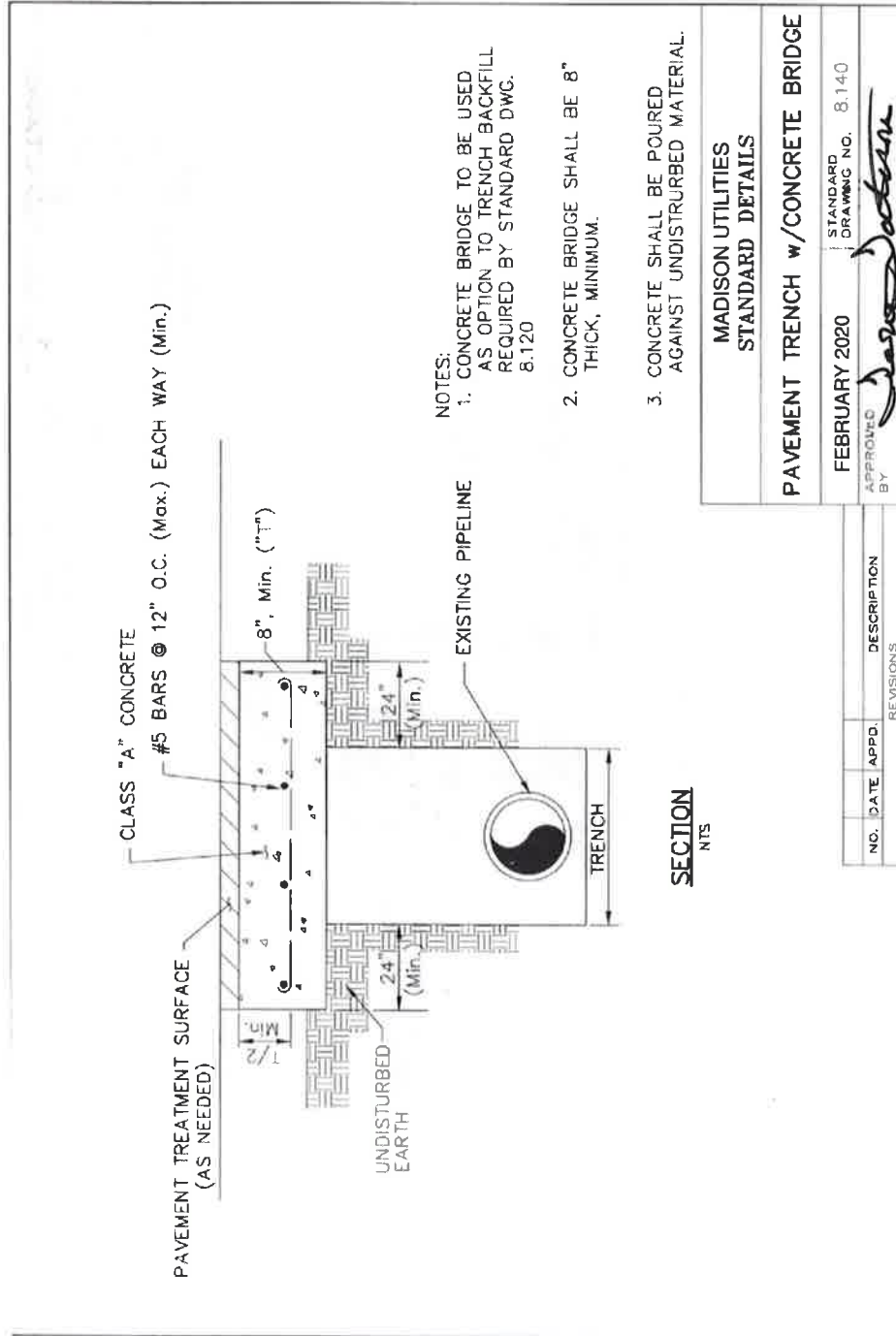
NOTES:

1. THIS CRUSHED STONE AT O.D. 14" (SEWER) OR O.D. + 12" (WATER).
2. THIS CRUSHED STONE PER TABLE
3. FOR WATER, CRUSHED STONE
4. IF PAVEMENT IS PROPOSED (NOT EXISTING) OVER THE TRENCH EXISTING, SURFACE TREATMENT, CRUSHED STONE OR COMPACTED MATERIAL (SEE SPECS.).

**SECTION
NTS**



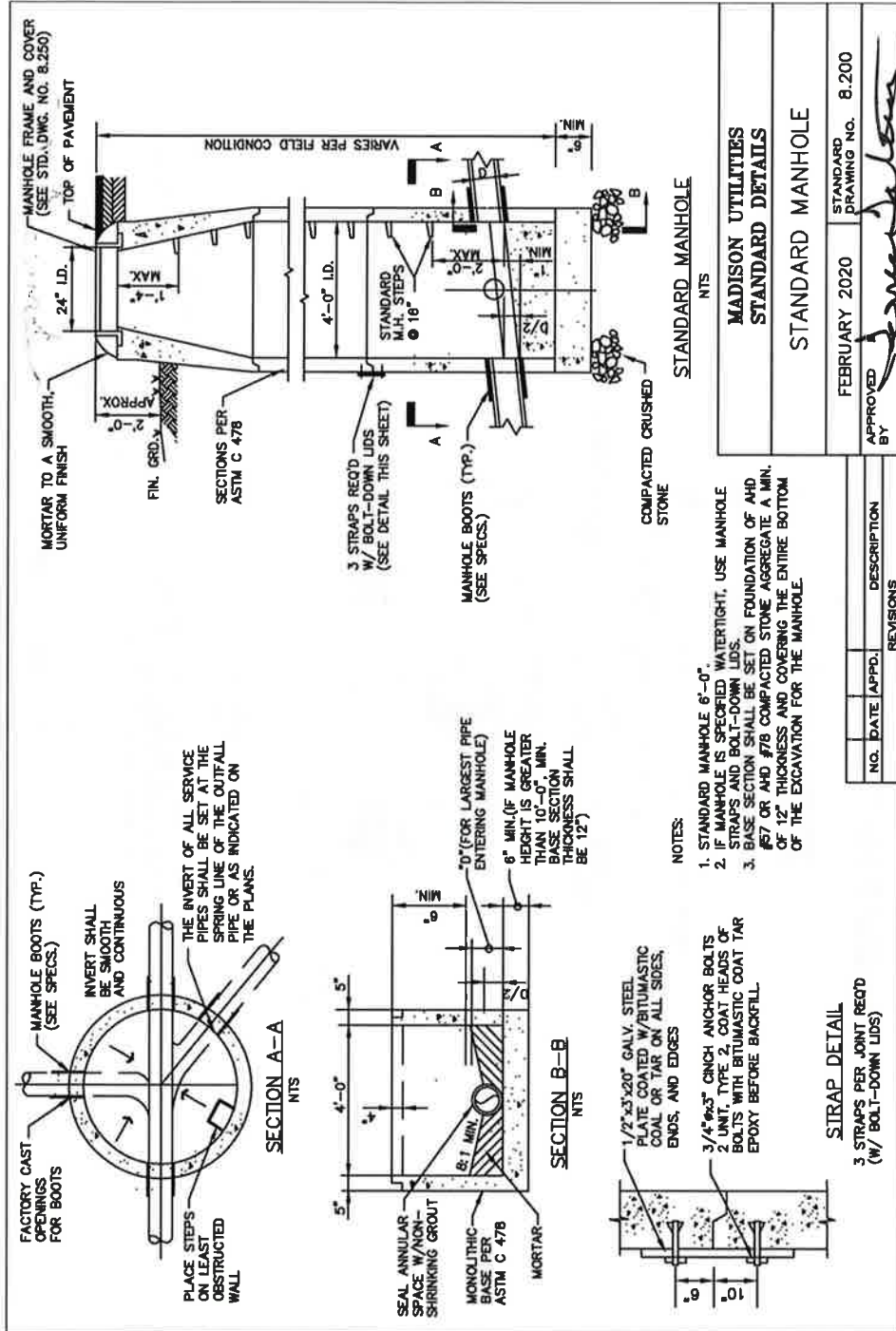
8.140 Pavement Trench with Concrete Bridge



MADISON UTILITIES STANDARD DETAILS	
PAVEMENT TRENCH w/CONCRETE BRIDGE	
FEBRUARY 2020	STANDARD DRAWING NO. 8.140
APPROVED BY <i>[Signature]</i>	

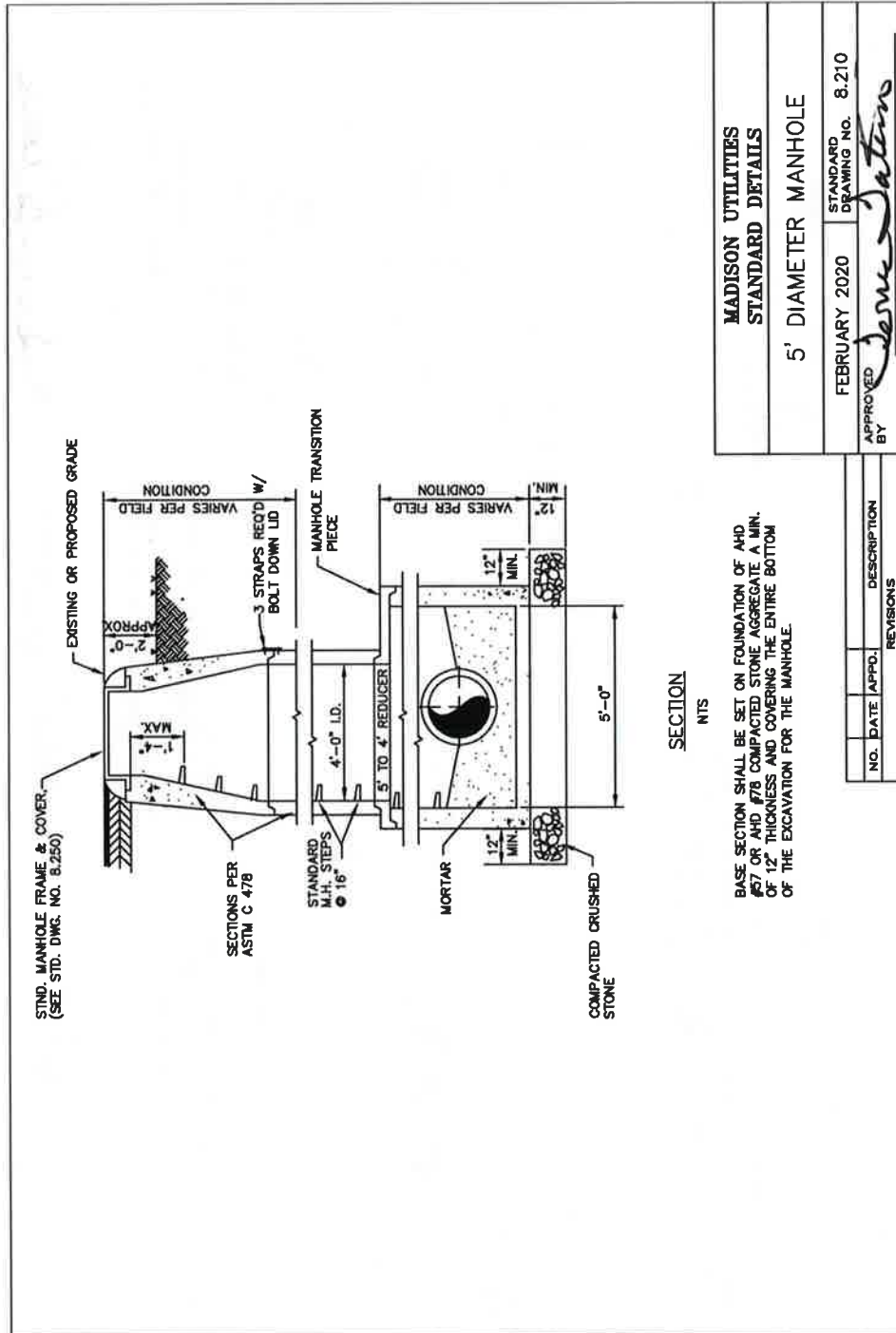
NO.	DATE	APPD.	DESCRIPTION
REVISIONS			

8.200 Standard Manhole





8.210 5' Diameter Manhole





8.220 Shallow Manhole

PLAN
IN

NOTES:

1. ALL BASES TO BE POURED MONOLITHIC.
2. ANY DUAL SITUATION TO HAVE THIS DETAIL EXTENDED TO ANY INCOMING LINES AND THE RESULTING BASE IS TO BE POURED MONOLITHIC.
3. BASE SECTION SHALL BE SET ON FOUNDATION OF AHD #67 OR AHD #78 COMPACTED STONE AGGREGATE A MIN. OF 12" THICKNESS AND COVERING THE ENTIRE BOTTOM OF THE EXCAVATION FOR THE MANHOLE.

SECTION
IN

PIPE DIAMETER	VARIABLE DIMENSIONS				
	MANHOLE DIAMETER	WALL THICKNESS	BASE THICKNESS	MIN. RISER HEIGHT	MAX. RISER HEIGHT
D	a	b	c	d	d
< 24"	4'-0"	5"	6"	2'-8"	5'-8"
30"	4'-0"	5"	6"	4'-0"	7'-0"
36"	5'-0"	6"	7"	4'-4"	7'-4"
42"	6'-0"	7"	8"	4'-9"	7'-9"

MADISON UTILITIES
STANDARD DETAILS

SHALLOW MANHOLE

FEBRUARY 2020

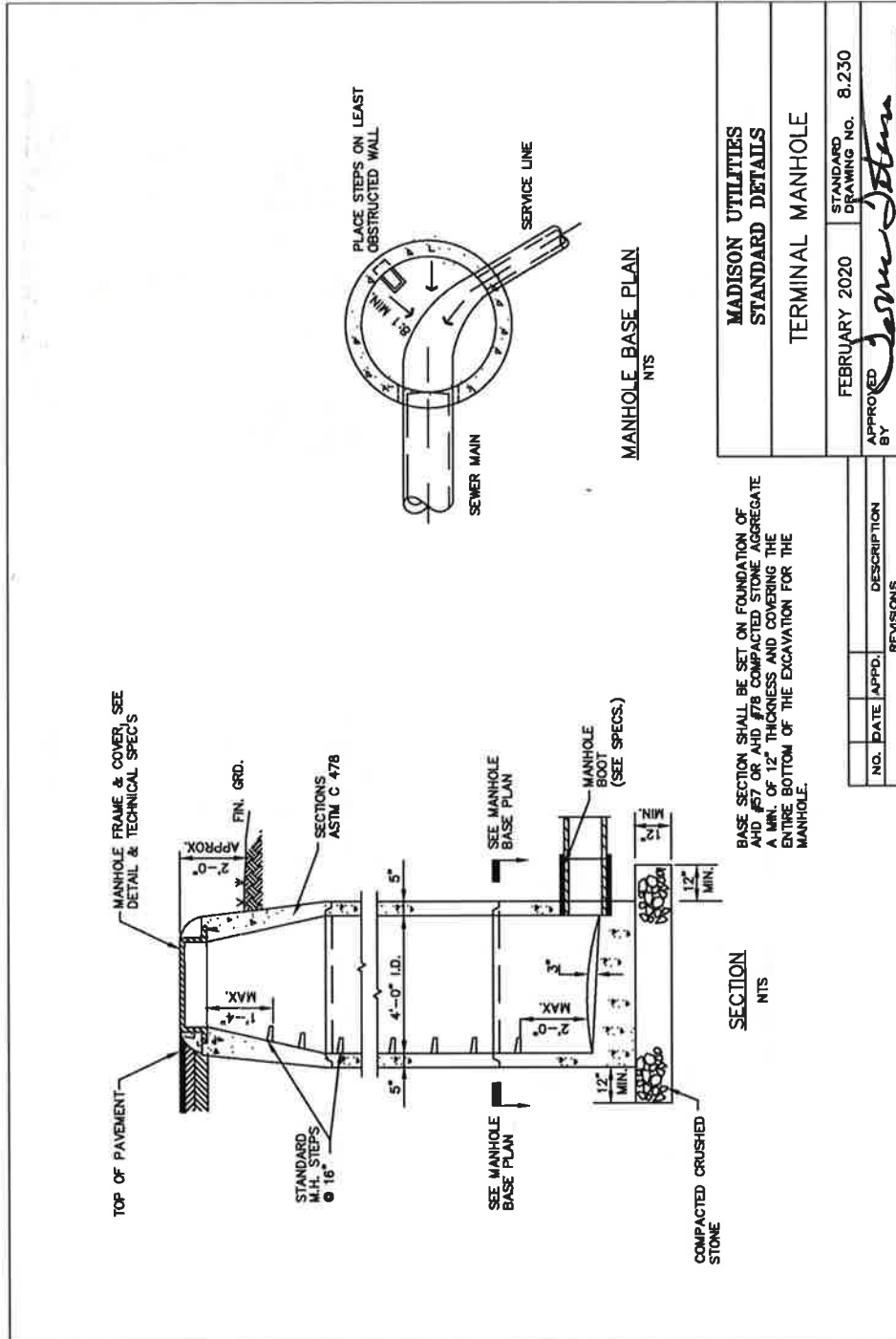
APPROVED BY: *[Signature]*

STANDARD DRAWING NO. 8.220

NO.	DATE	APPD.	DESCRIPTION
REVISIONS			

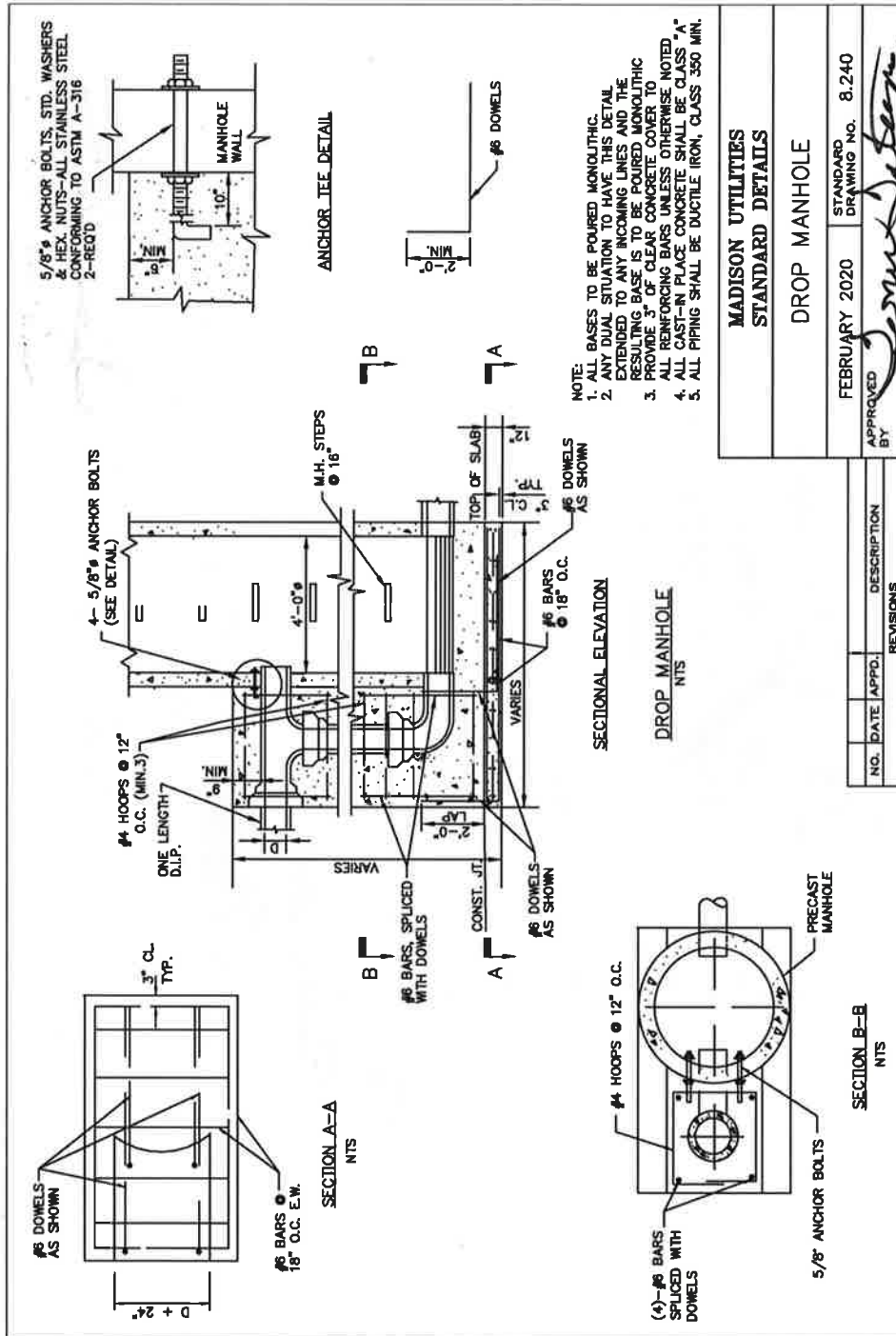


8.230 Terminal Manhole





8.240 Drop Manhole

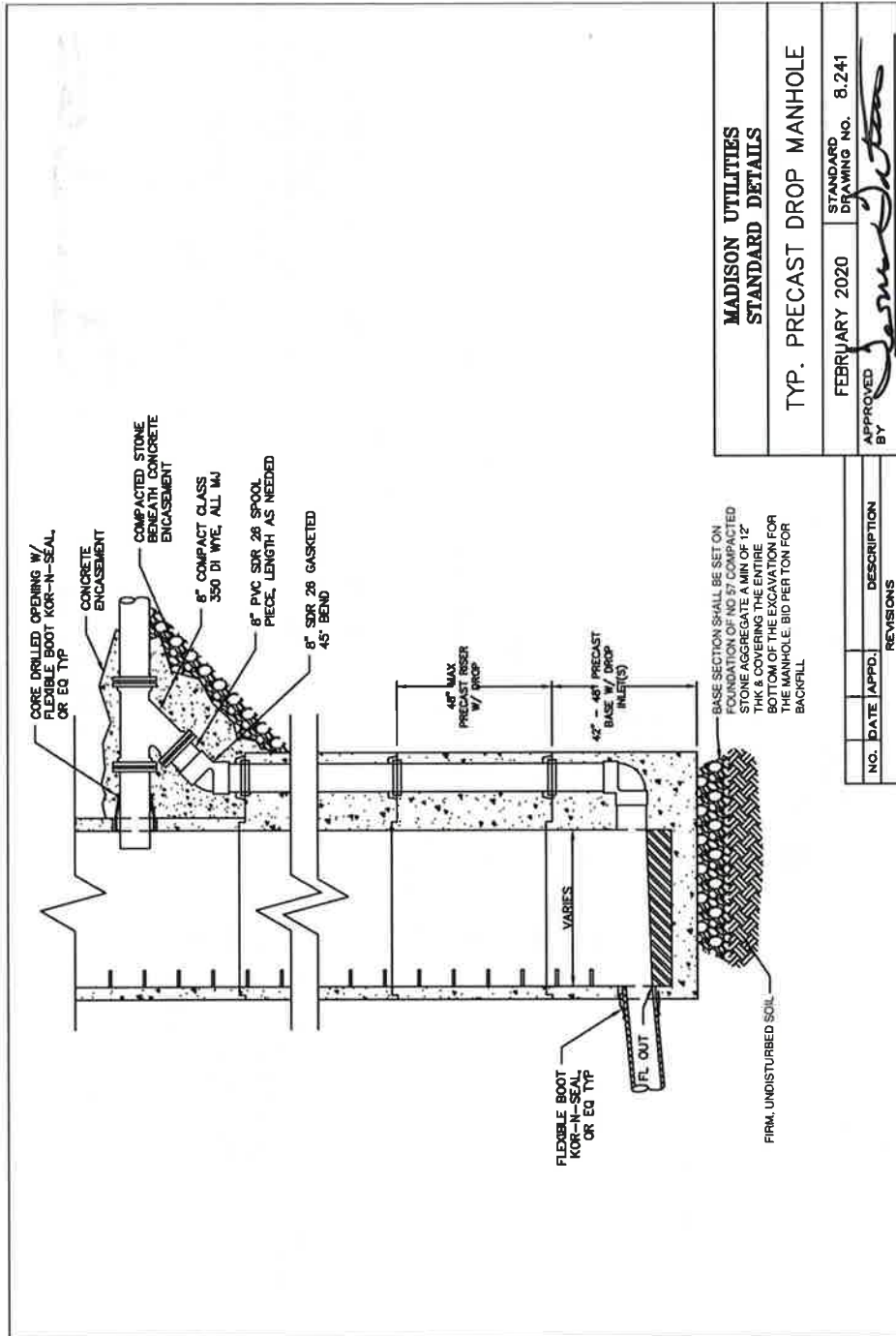


MADISON UTILITIES STANDARD DETAILS	
DROP MANHOLE	
FEBRUARY 2020	STANDARD DRAWING NO. 8.240
APPROVED BY	<i>[Signature]</i>

NO.	DATE	APPROD.	DESCRIPTION
REVISIONS			

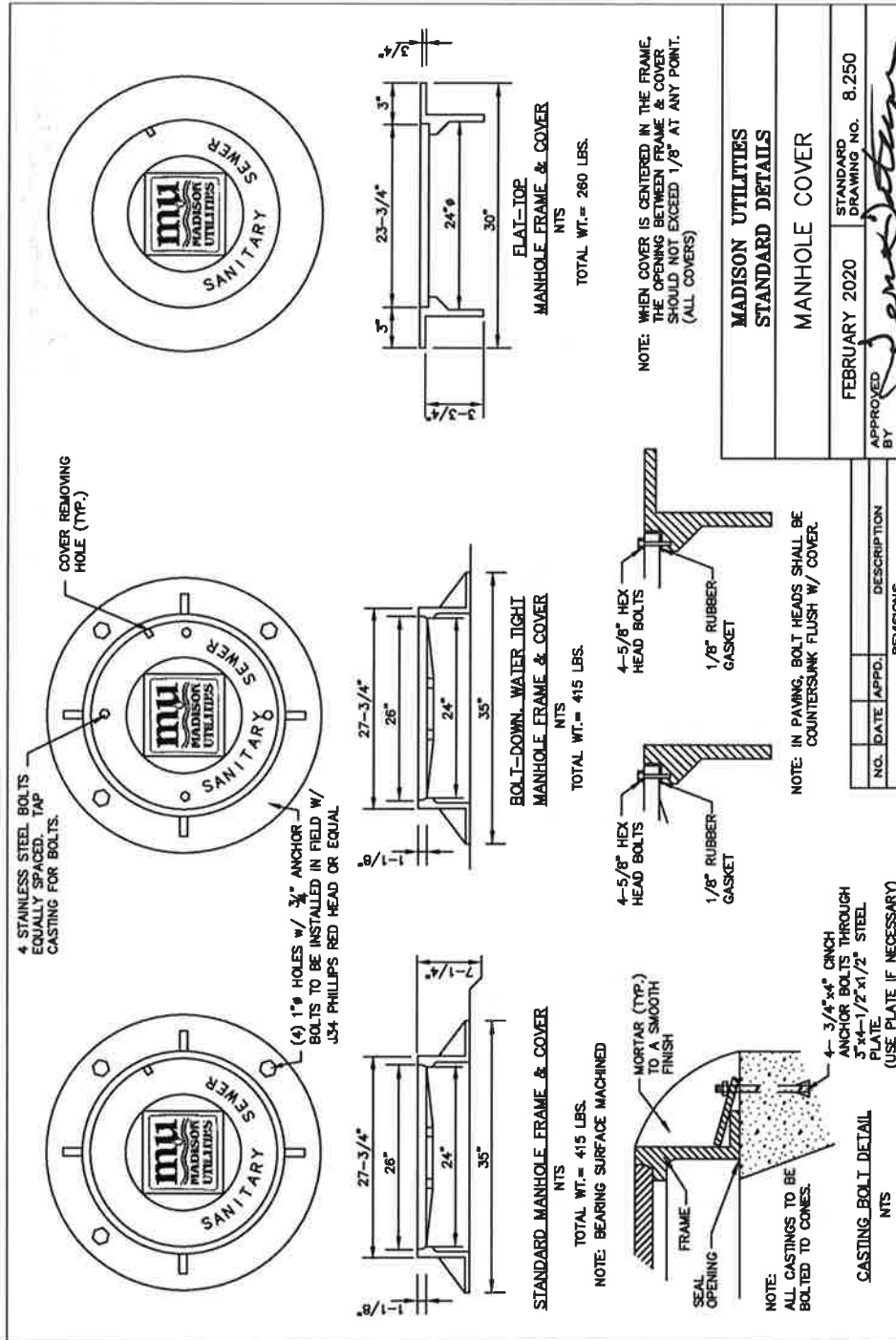


8.241 Drop Manhole



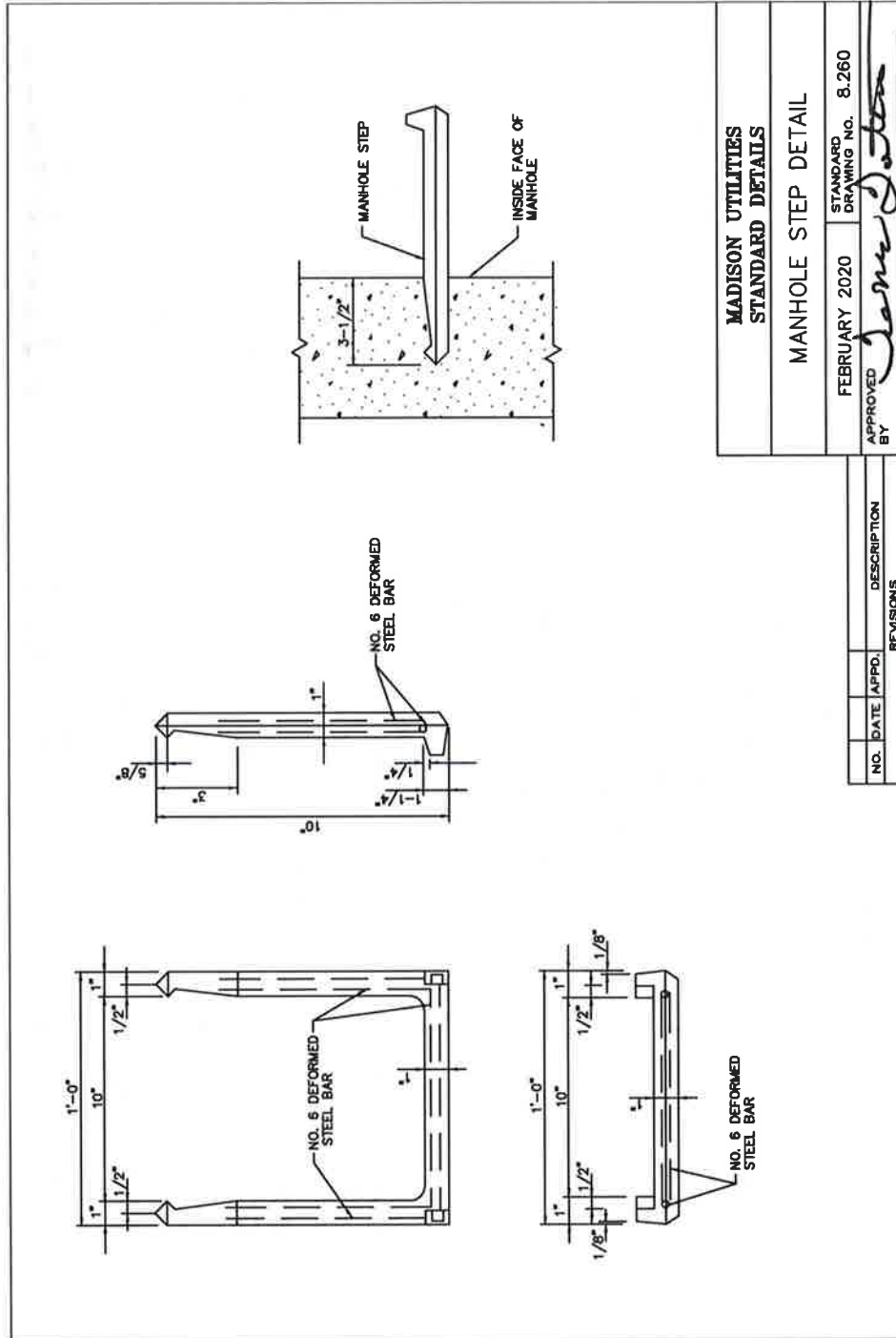


8.250 Manhole Cover





8.260 Manhole Step Details

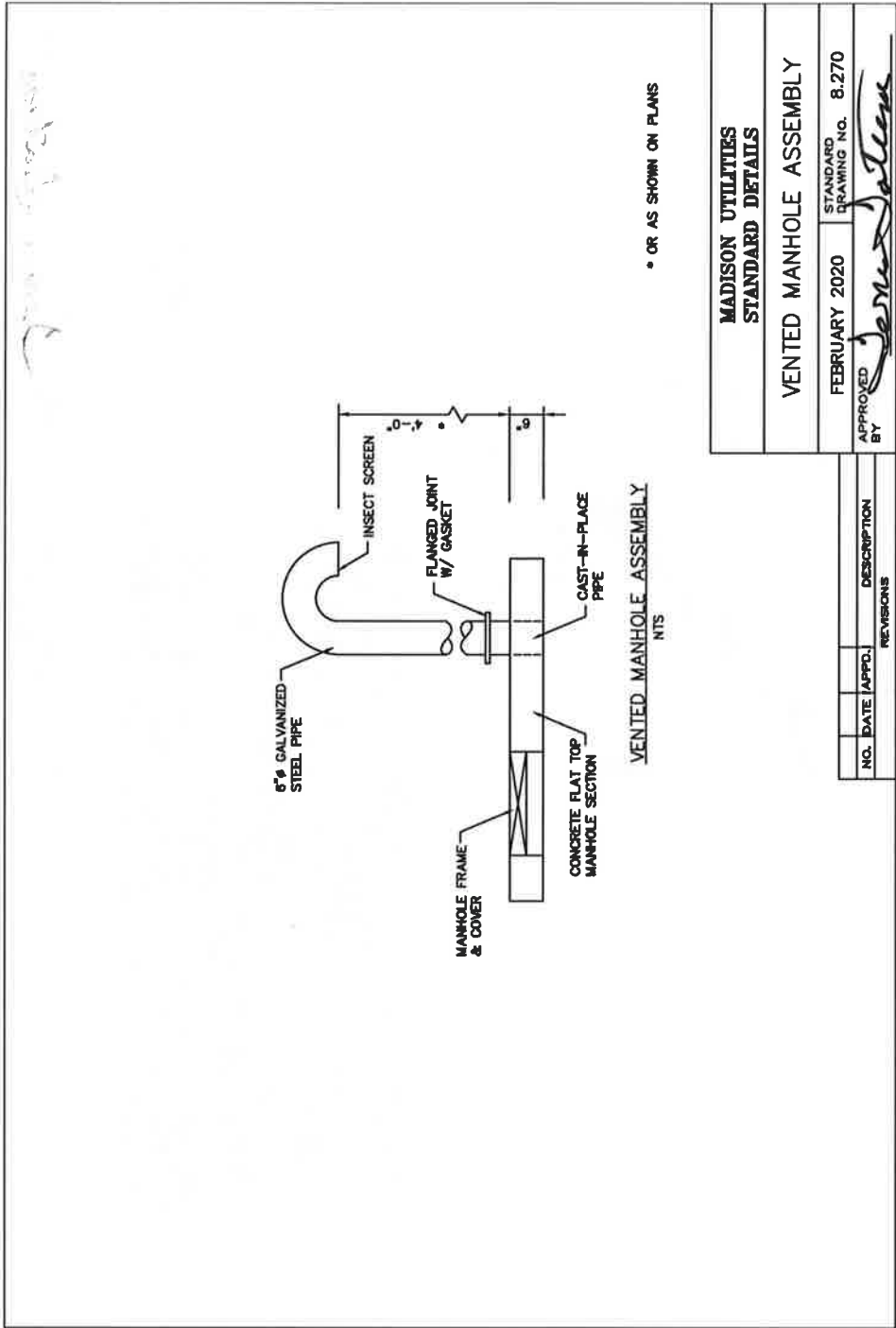


MADISON UTILITIES STANDARD DETAILS	
MANHOLE STEP DETAIL	
FEBRUARY 2020	STANDARD DRAWING NO. 8.260
APPROVED BY	<i>James J. [Signature]</i>

NO.	DATE	APPR.	DESCRIPTION	REVISIONS



8.270 Vented Manhole Assembly



MADISON UTILITIES STANDARD DETAILS	
VENTED MANHOLE ASSEMBLY	
FEBRUARY 2020	STANDARD DRAWING NO. 8.270
APPROVED BY	<i>[Signature]</i>

REVISIONS	
NO.	DESCRIPTION



8.300 Typical Rip Rap Slope Protection

TYPICAL RIP RAP SLOPE PROTECTION
NTS

NOTES:

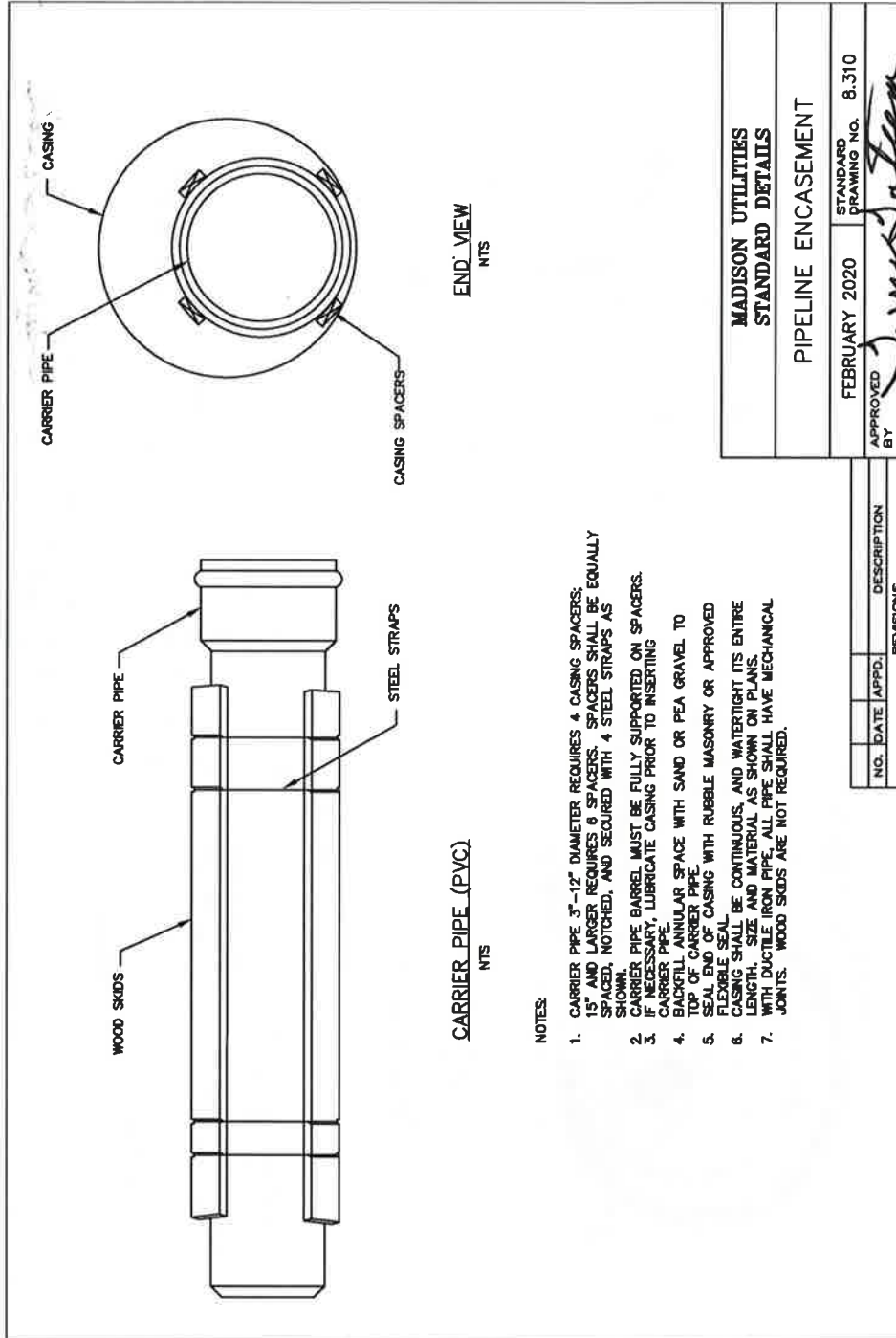
- SPECIAL SLOPE PROTECTION OF VARIOUS POINTS ALONG EXISTING STREAM BANKS MAY BE REQUIRED AT THE OPTION OF THE ENGINEER TO INSURE THE STABILITY OF THE UTILITY LINE. THE COST FOR STONE FOR RIP RAP SHALL BE SELECTED FROM ROCK CUTS OR OTHER APPROVED SOURCES OR PIECES OF CONCRETE. IT SHALL CONSIST OF WELL GRADED STONES WEIGHING FROM 10 POUNDS TO 200 POUNDS EACH WITH AT LEAST 50% WEIGHING OVER 80 POUNDS. BOTH WIDTH AND THICKNESS SHALL BE AT LEAST 1/3 THE LENGTH FOR EACH STONE. NOT MORE THAN 10% BY TOTAL WEIGHT IT SHALL WEIGH LESS THAN 10 POUNDS AND NOT MORE THAN 10% BY WEIGHT SHALL WEIGH MORE THAN 200 POUNDS.
- THE PLASTIC FILTER CLOTH SHALL BE A PERVIOUS SHEET WOVEN OF POLYPROPYLENE MONOFILAMENT YARNS. AFTER WEAVING, THE CLOTH SHALL BE CALENDERED AND PALMERED SO THAT THE FILAMENTS RETAIN THEIR RELATIVE POSITIONS WITH RESPECT TO EACH OTHER. THE EQUIVALENT OPENING SIZE (E.O.S.) SHALL BE U.S. STANDARD SIEVE NO.40 ALL EDGES OF THE CLOTH SHALL BE SELVAGED AND/OR SERGED. THE PLASTIC FILTER CLOTH SHALL BE FREE OF DEFECTS OR PLANS WHICH SIGNIFICANTLY AFFECT ITS PHYSICAL AND/OR FILTERING PROPERTIES. THE PLASTIC FILTER CLOTH SHALL HAVE A SERVICE RECORD OF NOT LESS THAN 10 YEARS IN A MEDIUM OF WATER AND SOIL. THE SUPPLIER OF THE FILTER CLOTH SHALL SUBMIT AN ENGINEERING ANALYSIS AND DESIGN REPORT WHICH DOCUMENTS THE USE OF THEIR CLOTH OR THESE INSTALLATIONS. THE SANITARY SEWER CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE NECESSARY PERMITS AND ALL OTHER CONTRACTORS SHALL BE RESPONSIBLE FOR OBTAINING THE NECESSARY PERMITS. THE FINAL DECISION FOR THE CHOICE OF THE VINYL FABRIC OR VARIATIONS THEREOF SHALL BE MADE BY THE ENGINEER.

MADISON UTILITIES	
STANDARD DETAILS	
TYPICAL RIP RAP SLOPE PROTECTION	
FEBRUARY 2020	STANDARD DRAWING NO. 8.300
APPROVED BY	

NO.	DATE	APPD.	DESCRIPTION
REVISIONS			

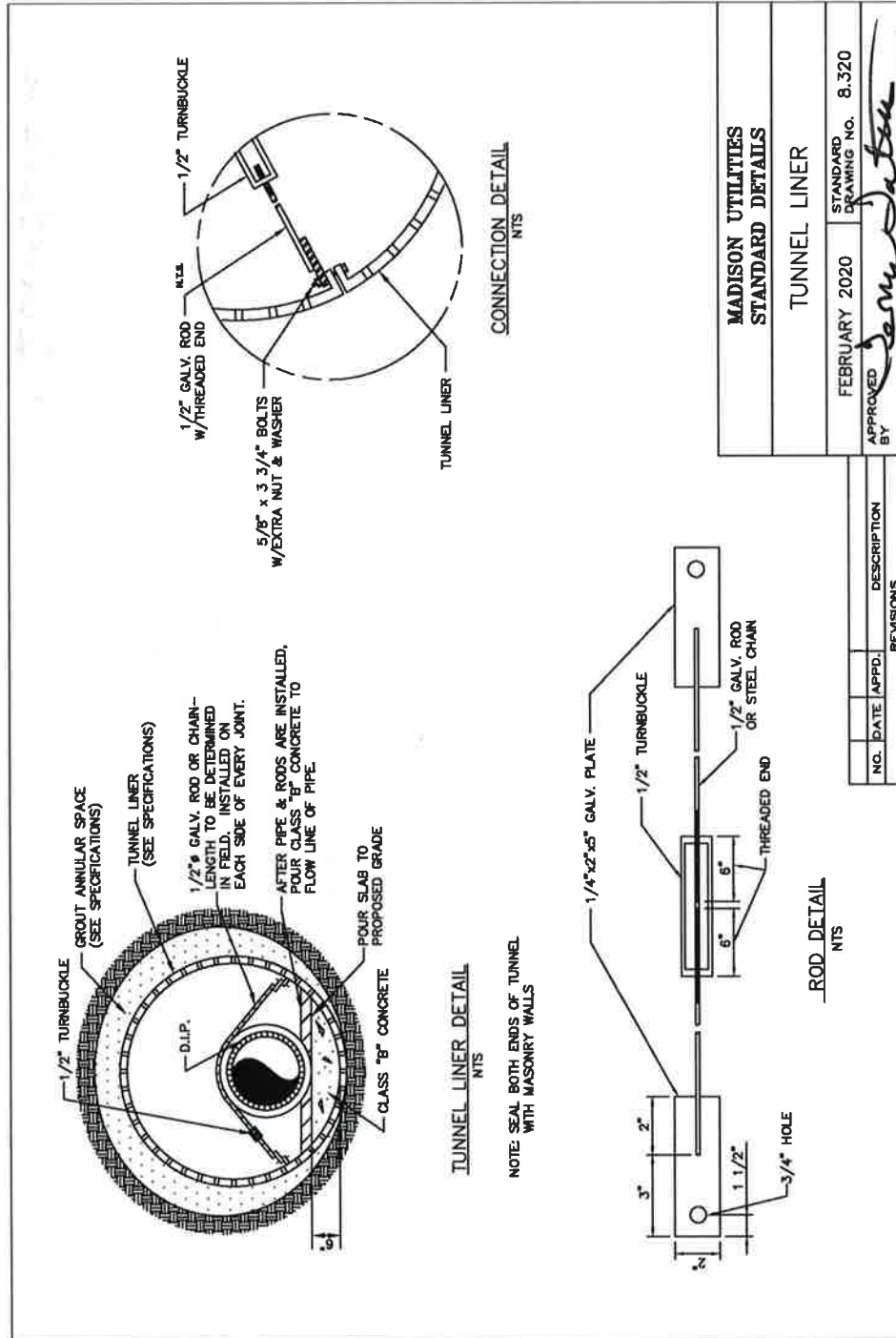


8.310 Pipeline Encasement



- NOTES:
1. CARRIER PIPE 3"-12" DIAMETER REQUIRES 4 CASING SPACERS. 15" AND LARGER REQUIRES 6 SPACERS. SPACERS SHALL BE EQUALLY SPACED, NOTCHED, AND SECURED WITH 4 STEEL STRAPS AS SHOWN.
 2. CARRIER PIPE BARREL MUST BE FULLY SUPPORTED ON SPACERS.
 3. IF NECESSARY, LUBRICATE CASING PRIOR TO INSERTING BACKSET.
 4. BACKSET SHALL BE 12" MINIMUM SPACE WITH SAND OR FEA GRAVEL TO TOP OF CARRIER PIPE.
 5. SEAL END OF CASING WITH RUBBLE MASONRY OR APPROVED FLEXIBLE SEAL.
 6. CASING SHALL BE CONTINUOUS, AND WATERTIGHT ITS ENTIRE LENGTH. SIZE AND MATERIAL AS SHOWN ON PLANS.
 7. WITH DUCTILE IRON PIPE, ALL PIPE SHALL HAVE MECHANICAL JOINTS. WOOD SKIDS ARE NOT REQUIRED.

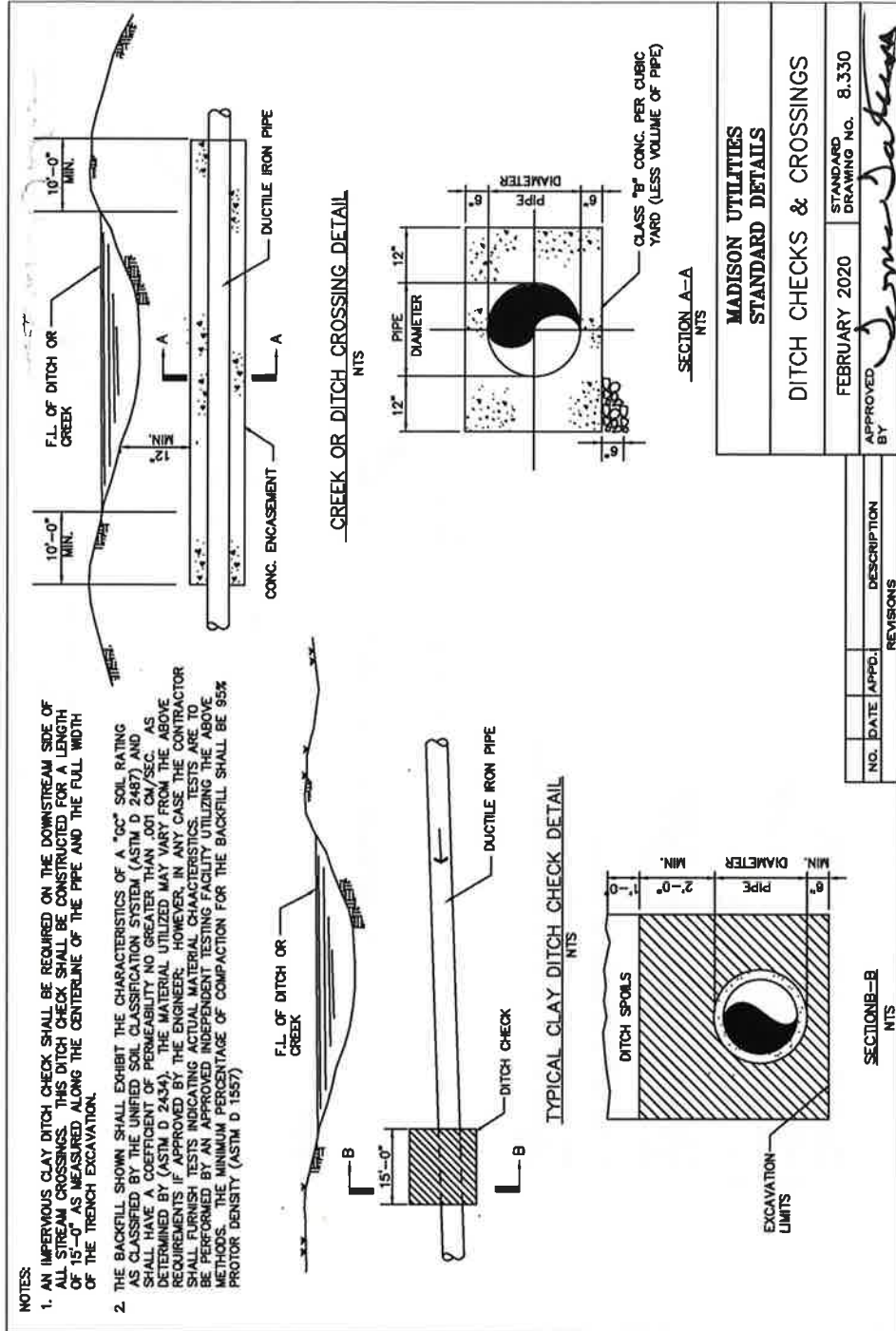
8.320 Tunnel Liner



MADISON UTILITIES STANDARD DETAILS	
TUNNEL LINER	
FEBRUARY 2020	STANDARD DRAWING NO. 8.320
APPROVED BY	<i>[Signature]</i>

NO.	DATE	APPD.	DESCRIPTION
REVISIONS			

8.330 Ditch Checks and Crossings





8.340 Typical Pipeline Installation Along Paved Road

- ① WHERE POSSIBLE, INSTALL PIPELINE APPROXIMATELY 7' INSIDE R.O.W. LINE, OR 5' INSIDE OTHER UTILITIES.
- ② WHERE POSITION ① IS NOT POSSIBLE, INSTALL PIPELINE 3' MINIMUM BEYOND TOP OF FILL SLOPE, OR 3' MINIMUM OUTSIDE OF ROADSIDE DITCH.
- ③ PIPELINE IS NOT TO BE INSTALLED IN ROADWAY PRISM WITHOUT SPECIAL PERMISSION OF ENGINEER.
- ④ PIPELINE IS TO BE INSTALLED WITH 30" COVER, MINIMUM. NO EXTRA PAYMENT SHALL BE ALLOWED FOR DEEPER INSTALLATION FOR CONVENIENCE OF CONTRACTOR, OR NECESSITY CAUSED BY SPECIFIC SITE CONDITION.
- ⑤ WHERE PIPELINE IS INSTALLED JUST OUTSIDE OF DITCH, PIPELINE SHALL BE 30" MINIMUM BELOW DITCH ELEVATION.
- ⑥ SEE PLAN SHEETS FOR SPECIFIC DIRECTIONS CONCERNING HORIZONTAL LOCATIONS OF PIPELINE INSTALLATIONS. THOSE DIRECTIONS SHALL GOVERN OVER GENERAL DIRECTIONS SHOWN HERE.

**SECTION
NTS**

NO.	DATE	APPD.	DESCRIPTION	REVISIONS

**MADISON UTILITIES
STANDARD DETAILS**

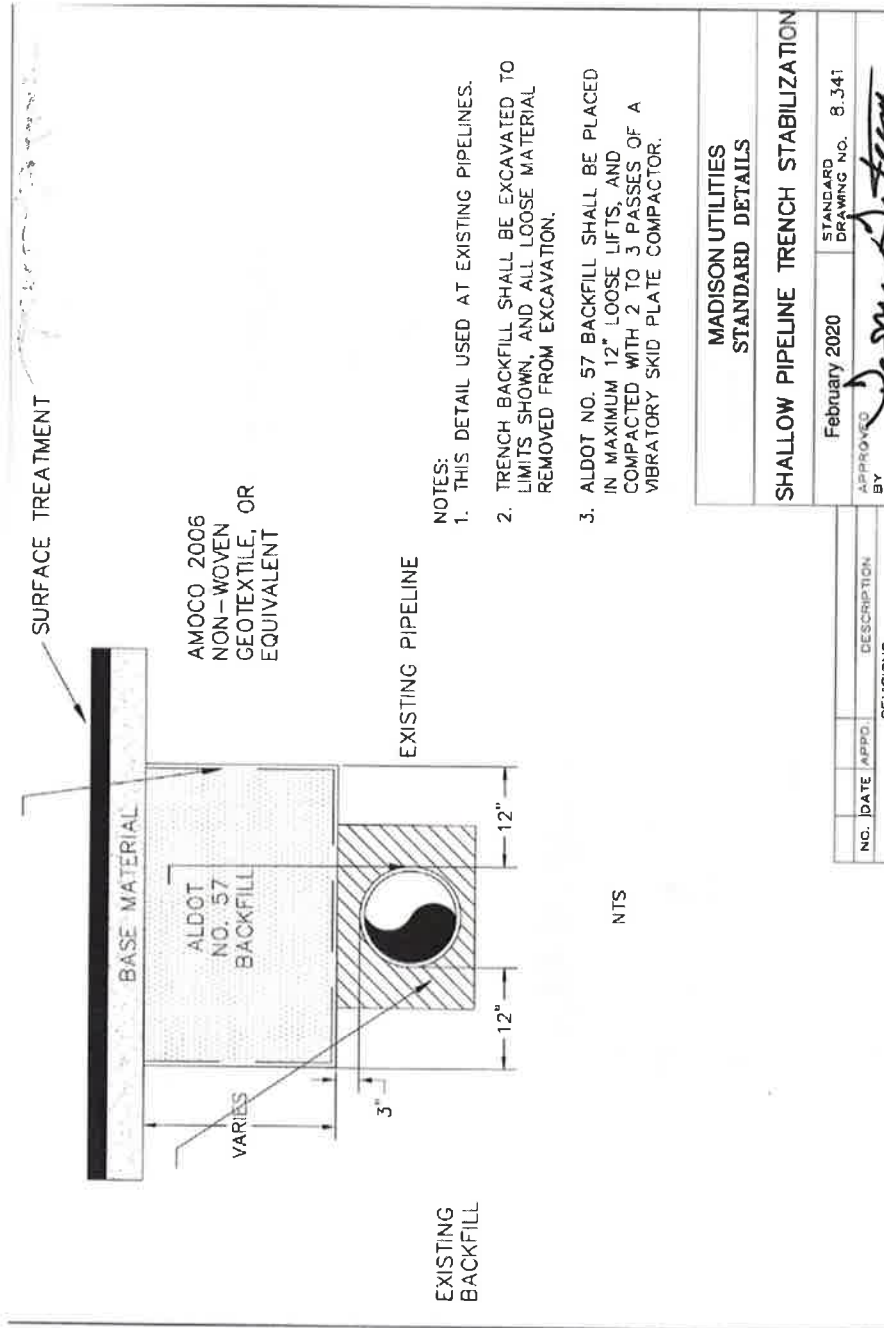
**TYPICAL PIPELINE INSTALLATION
ALONG PAVED ROADS**

FEBRUARY 2020 STANDARD DRAWING NO. 8.340

APPROVED BY *[Signature]*



8.341 Shallow Pipeline Trench Stabilization



- NOTES:
1. THIS DETAIL USED AT EXISTING PIPELINES.
 2. TRENCH BACKFILL SHALL BE EXCAVATED TO LIMITS SHOWN, AND ALL LOOSE MATERIAL REMOVED FROM EXCAVATION.
 3. ALDOT NO. 57 BACKFILL SHALL BE PLACED IN MAXIMUM 12" LOOSE LIFTS, AND COMPACTED WITH 2 TO 3 PASSES OF A VIBRATORY SKID PLATE COMPACTOR.

NTS

MADISON UTILITIES STANDARD DETAILS	
SHALLOW PIPELINE TRENCH STABILIZATION	
February 2020	STANDARD DRAWING NO. 8.341
APPROVED BY	<i>Desm...</i>

NO.	DATE	APPRO.	DESCRIPTION
REVISIONS			



8.350 Typical Transitions and Repairs

**TYPICAL CONCRETE COLLAR TRANSITION
w/ MISSION COUPLING
(ALTERNATE TRANSITION METHOD)**
N/S

**TYPICAL CONCRETE COLLAR TRANSITION
PIPE SIZES 18" OR LARGER**
N/S

**SOLID SLEEVE TRANSITION
(TYPICAL TRANSITION METHOD)**
N/S

NOTES:

- TRANSITION SLEEVES SHALL BE SOLID, MECHANICAL JOINT, LONG FITTINGS.
- BOARD SHALL APPROVE ANY ALTERNATE TRANSITION METHODS.

MADISON UTILITIES
STANDARD DETAILS

TYPICAL TRANSITIONS & REPAIRS

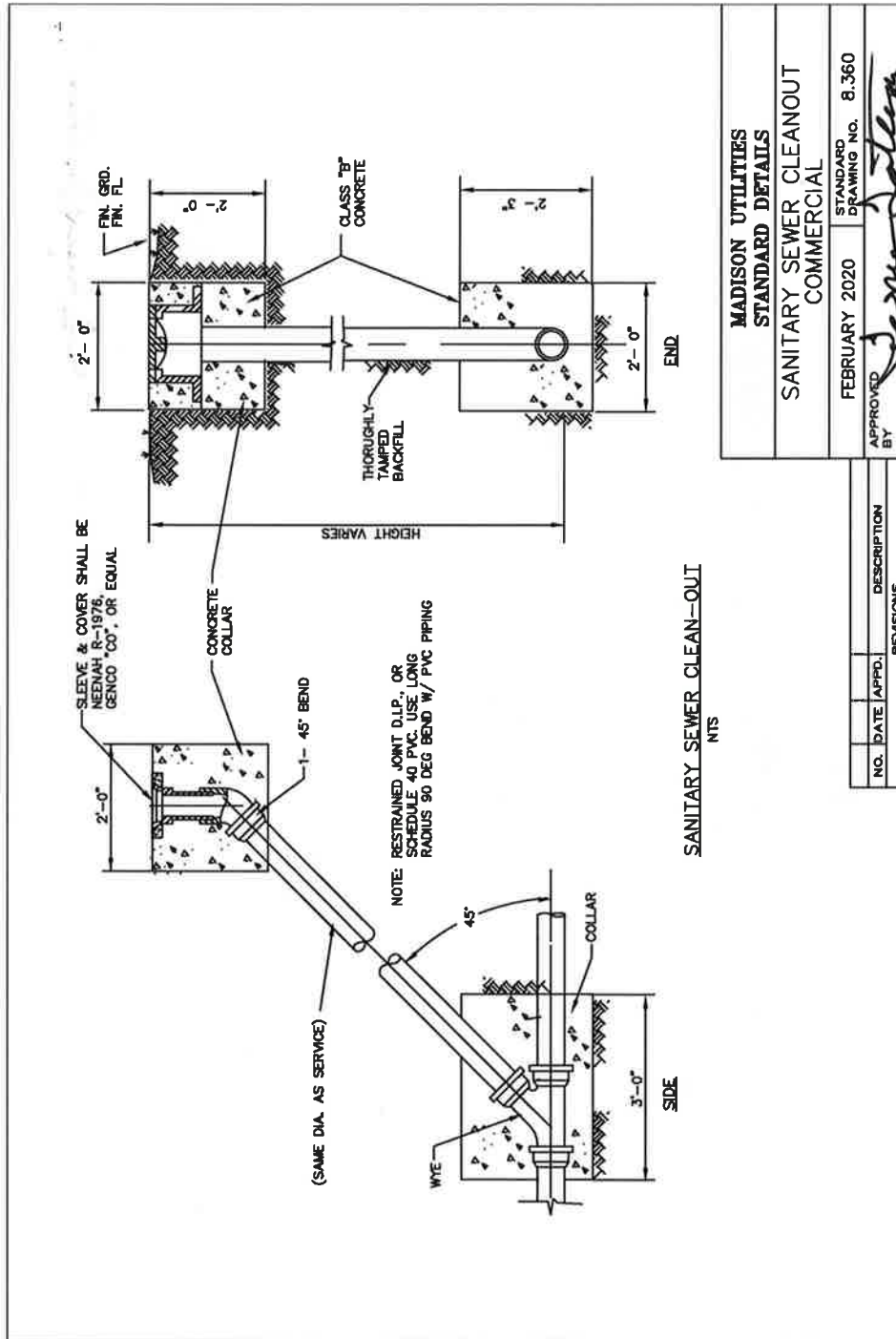
FEBRUARY 2020 STANDARD DRAWING NO. 8.350

APPROVED BY *James Jelen*

NO.	DATE	APPD.	DESCRIPTION	REVISIONS

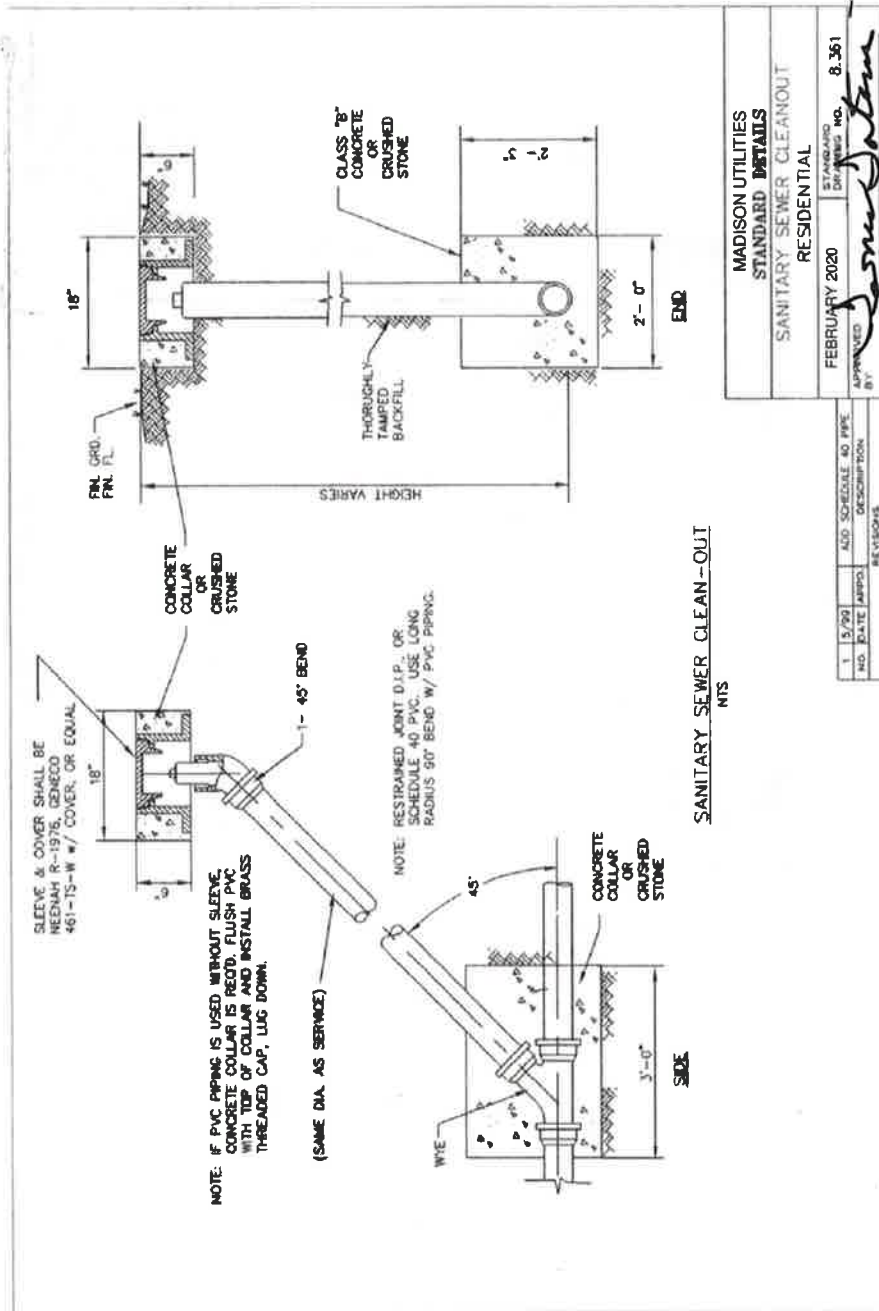


8.360 Sanitary Sewer Cleanout - Commercial



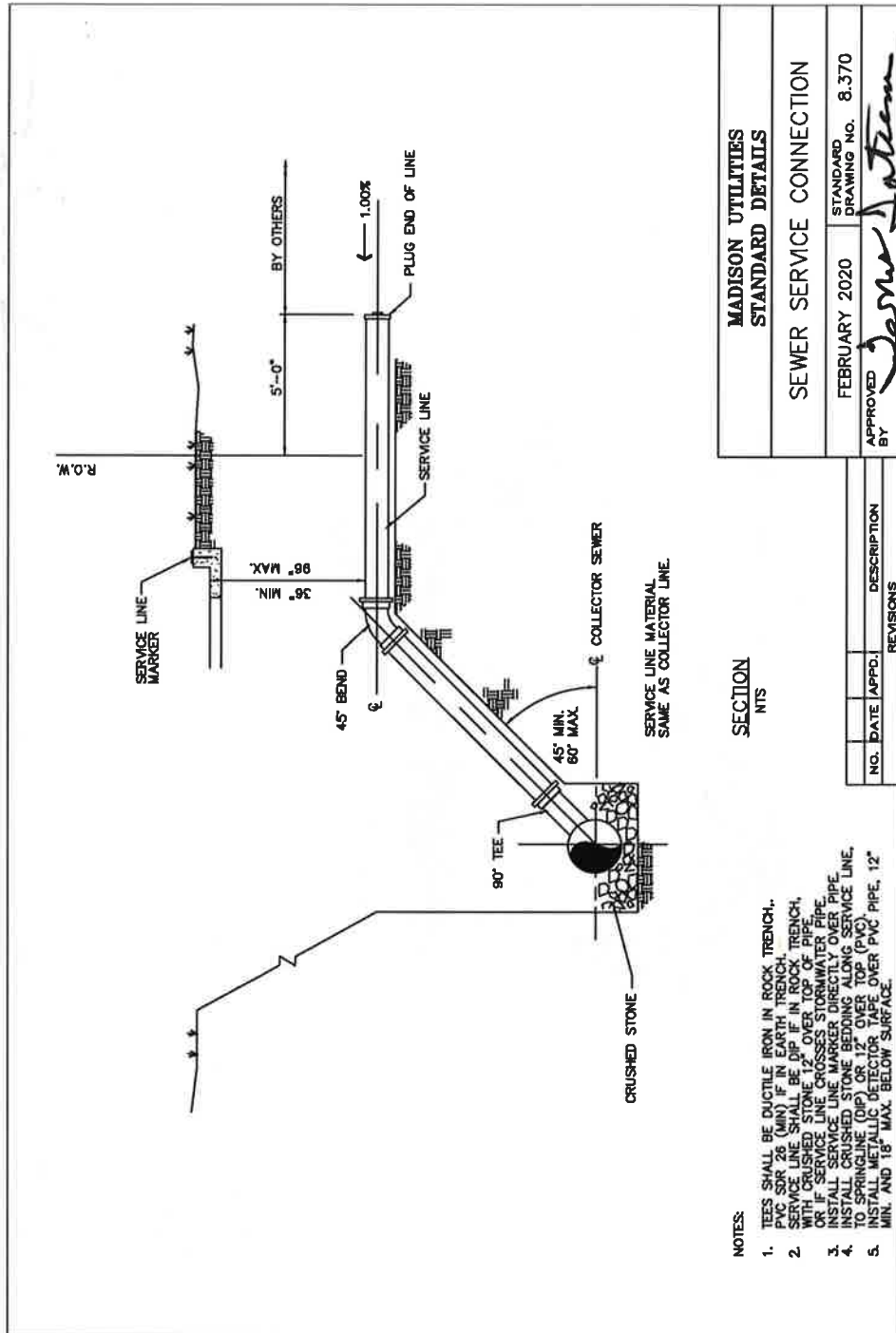


8.361 Sanitary Sewer Cleanout - Residential





8.370 Sewer Service Connection



NOTES:

1. TEES SHALL BE DUCTILE IRON IN ROCK TRENCH, PVC OR 72 LB MIN. IN EARTH TRENCH.
2. SERVICE LINE SHALL BE DIP IN ROCK TRENCH, OR WITH CRUSHED STONE 12" OVER TOP OF PIPE.
3. OR IF SERVICE LINE CROSSES STORMWATER PIPE, INSTALL SERVICE LINE MARKER DIRECTLY OVER PIPE.
4. INSTALL CRUSHED STONE BEDDING ALONG SERVICE LINE TO SPRINGLINE (DIP) OR 12" OVER TOP (PVC).
5. INSTALL SERVICE LINE OVER PVC PIPE, 12" MIN. AND 18" MAX. BELOW SURFACE.

SECTION
NTs

MADISON UTILITIES
STANDARD DETAILS

SEWER SERVICE CONNECTION

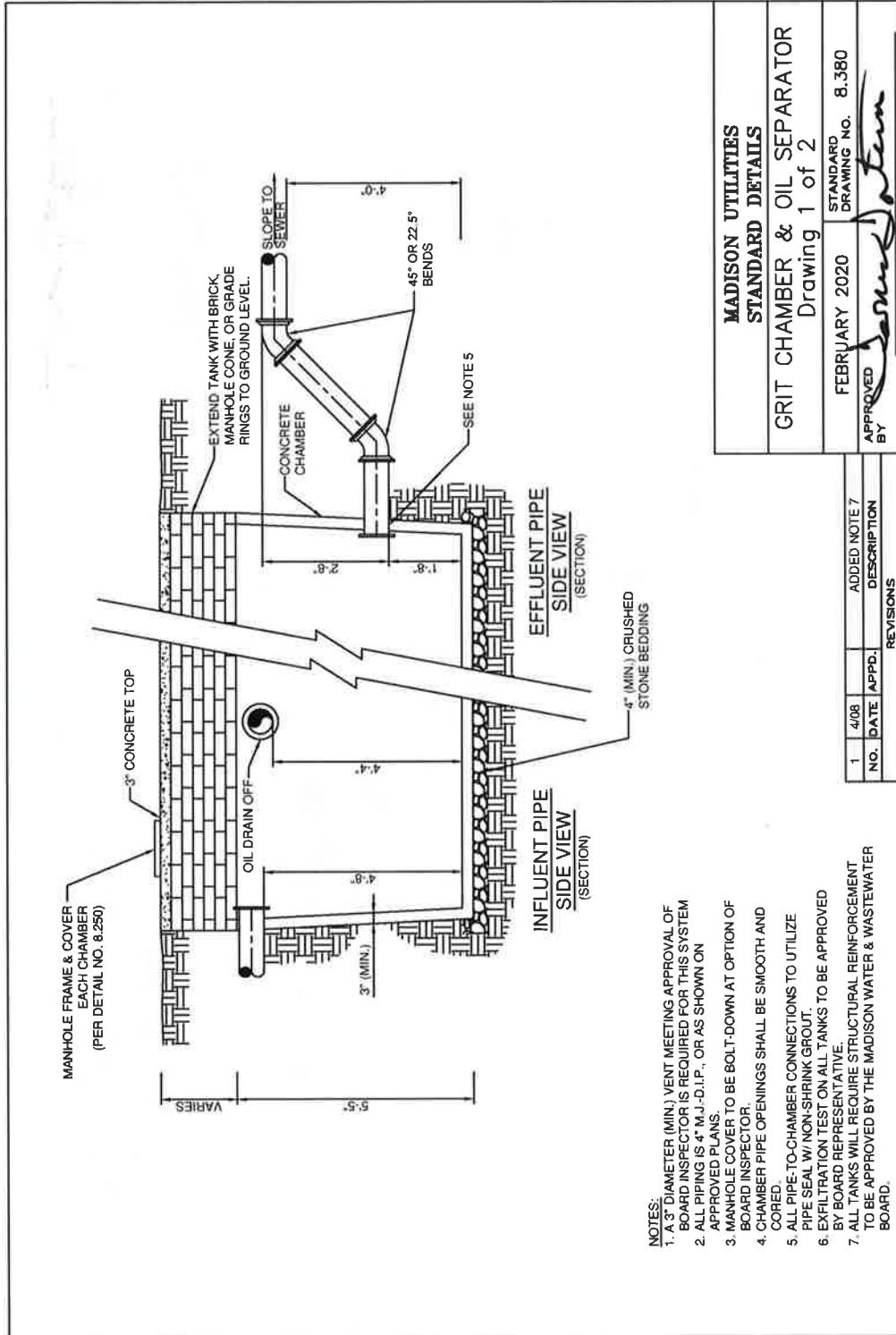
FEBRUARY 2020 STANDARD
DRAWING NO. 8.370

APPROVED BY *Jasme Jation*

NO.	DATE	APPD.	DESCRIPTION
REVISIONS			



8.380 Grit Chamber and Oil Separator



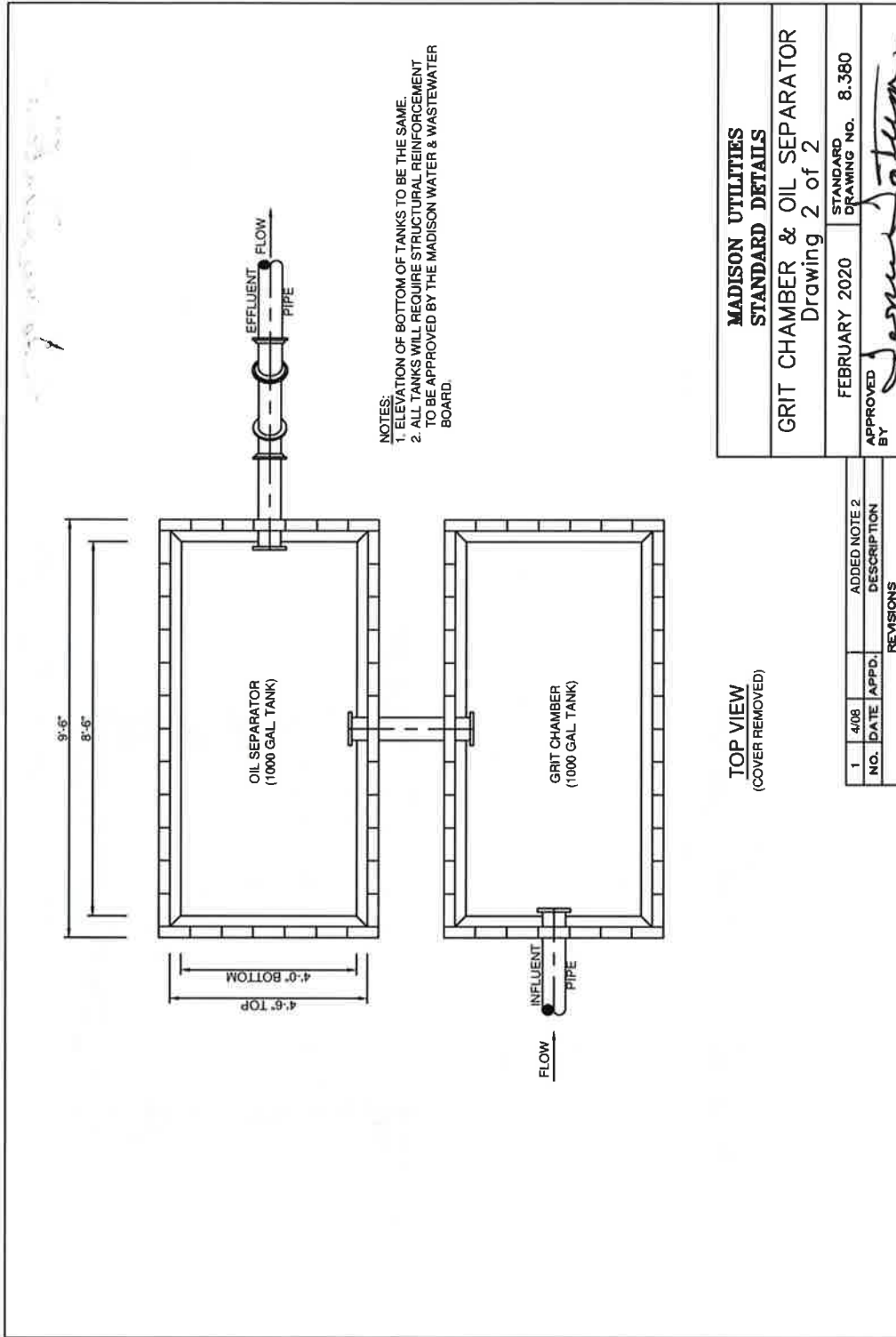
MADISON UTILITIES STANDARD DETAILS	
GRIT CHAMBER & OIL SEPARATOR Drawing 1 of 2	
FEBRUARY 2020	STANDARD DRAWING NO. 8.380
APPROVED BY <i>[Signature]</i>	

REVISIONS		
NO.	DATE	DESCRIPTION
1	4/08	ADDED NOTE 7

- NOTES:
1. A 3" DIAMETER (MIN.) VENT MEETING APPROVAL OF BOARD INSPECTOR IS REQUIRED FOR THIS SYSTEM
 2. ALL PIPING IS 4" M.J.-D.I.P., OR AS SHOWN ON APPROVED PLANS.
 3. MANHOLE COVER TO BE BOLT-DOWN AT OPTION OF BOARD INSPECTOR.
 4. CHAMBER PIPE OPENINGS SHALL BE SMOOTH AND COURED.
 5. ALL PIPE-TO-CHAMBER CONNECTIONS TO UTILIZE PIPE SEAL W/ NON-SHRINK GROUT.
 6. EXFILTRATION TEST ON ALL TANKS TO BE APPROVED BY BOARD REPRESENTATIVE.
 7. ALL TANKS WILL REQUIRE STRUCTURAL REINFORCEMENT TO BE APPROVED BY THE MADISON WATER & WASTEWATER BOARD.

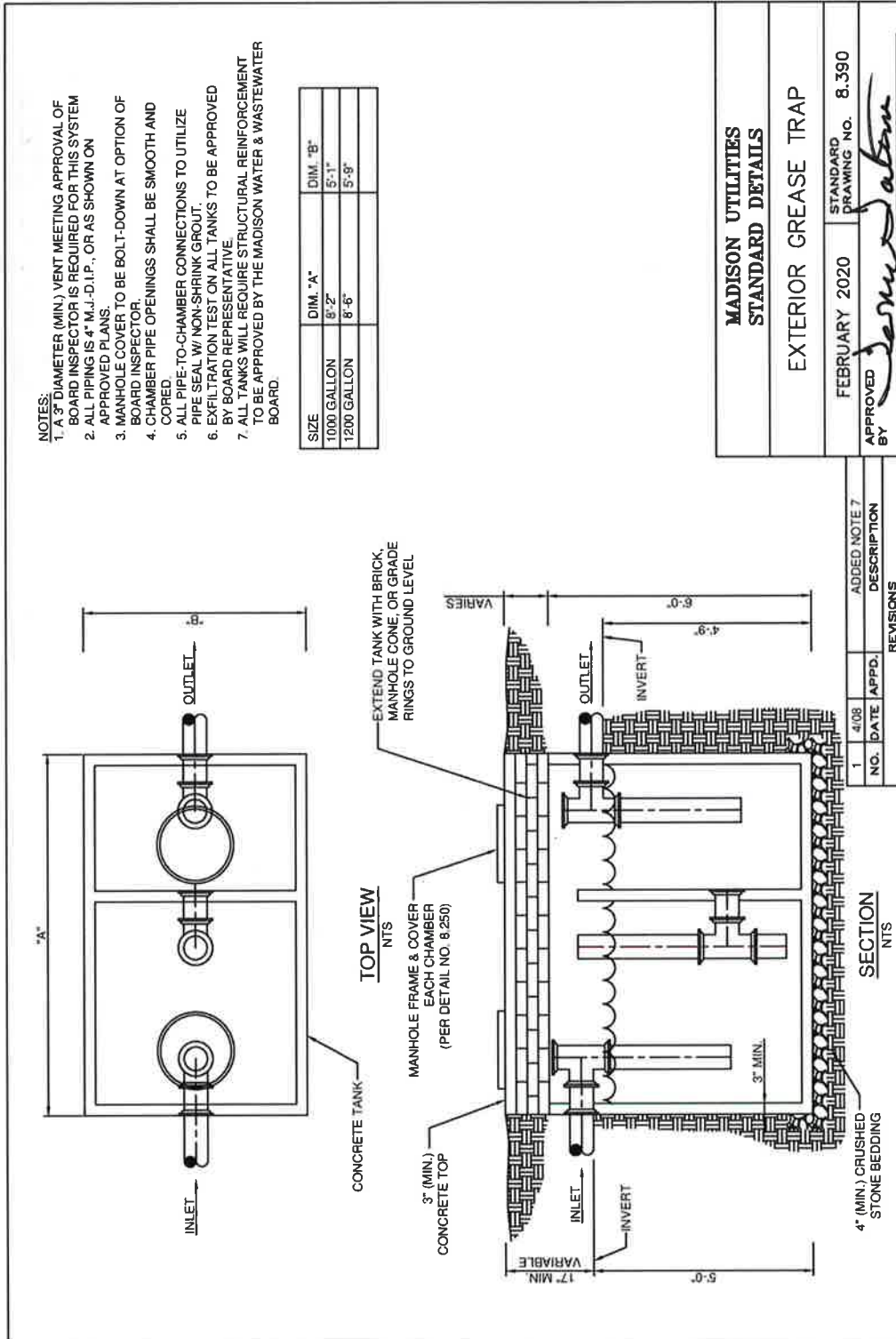


8.380b Grit Chamber and Oil Separator





8.390 Exterior Grease Trap



- NOTES:
1. A 3" DIAMETER (MIN.) VENT MEETING APPROVAL OF BOARD INSPECTOR IS REQUIRED FOR THIS SYSTEM
 2. ALL PIPING IS 4" M.J.-D.I.P., OR AS SHOWN ON APPROVED PLANS.
 3. MANHOLE COVER TO BE BOLT-DOWN AT OPTION OF BOARD INSPECTOR.
 4. CHAMBER PIPE OPENINGS SHALL BE SMOOTH AND CORED.
 5. ALL PIPE-TO-CHAMBER CONNECTIONS TO UTILIZE PIPE SEAL W/ NON-SHRINK GROUT.
 6. EXFILTRATION TEST ON ALL TANKS TO BE APPROVED BY BOARD REPRESENTATIVE
 7. ALL TANKS WILL REQUIRE STRUCTURAL REINFORCEMENT TO BE APPROVED BY THE MADISON WATER & WASTEWATER BOARD.

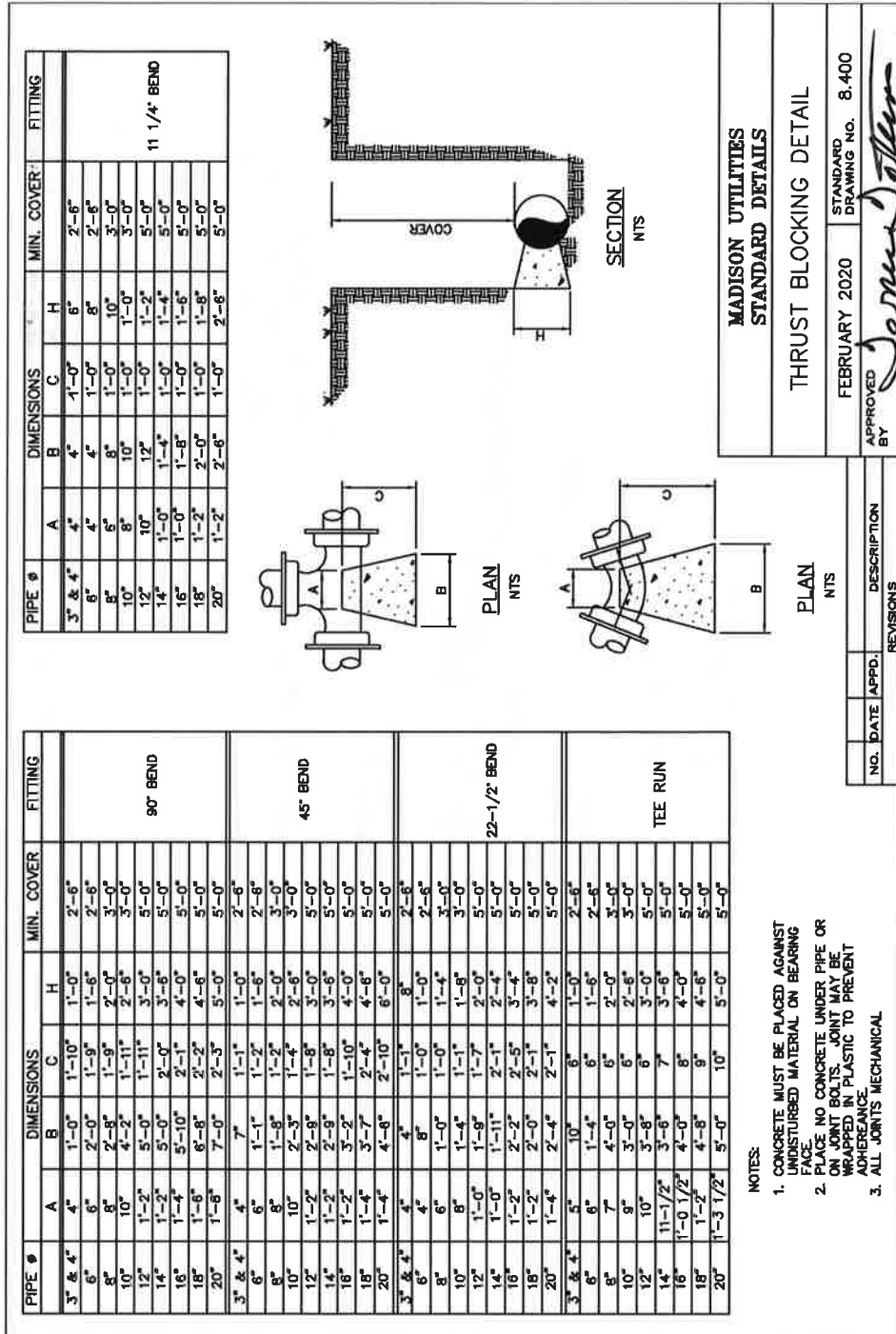
SIZE	DIM. "A"	DIM. "B"
1000 GALLON	8'-2"	5'-1"
1200 GALLON	8'-6"	5'-8"

MADISON UTILITIES STANDARD DETAILS	
EXTERIOR GREASE TRAP	
FEBRUARY 2020	STANDARD DRAWING NO. 8.390
APPROVED BY <i>Jenny Saban</i>	

NO.	DATE	APPD.	DESCRIPTION	REVISIONS
1	4/08		ADDED NOTE 7	

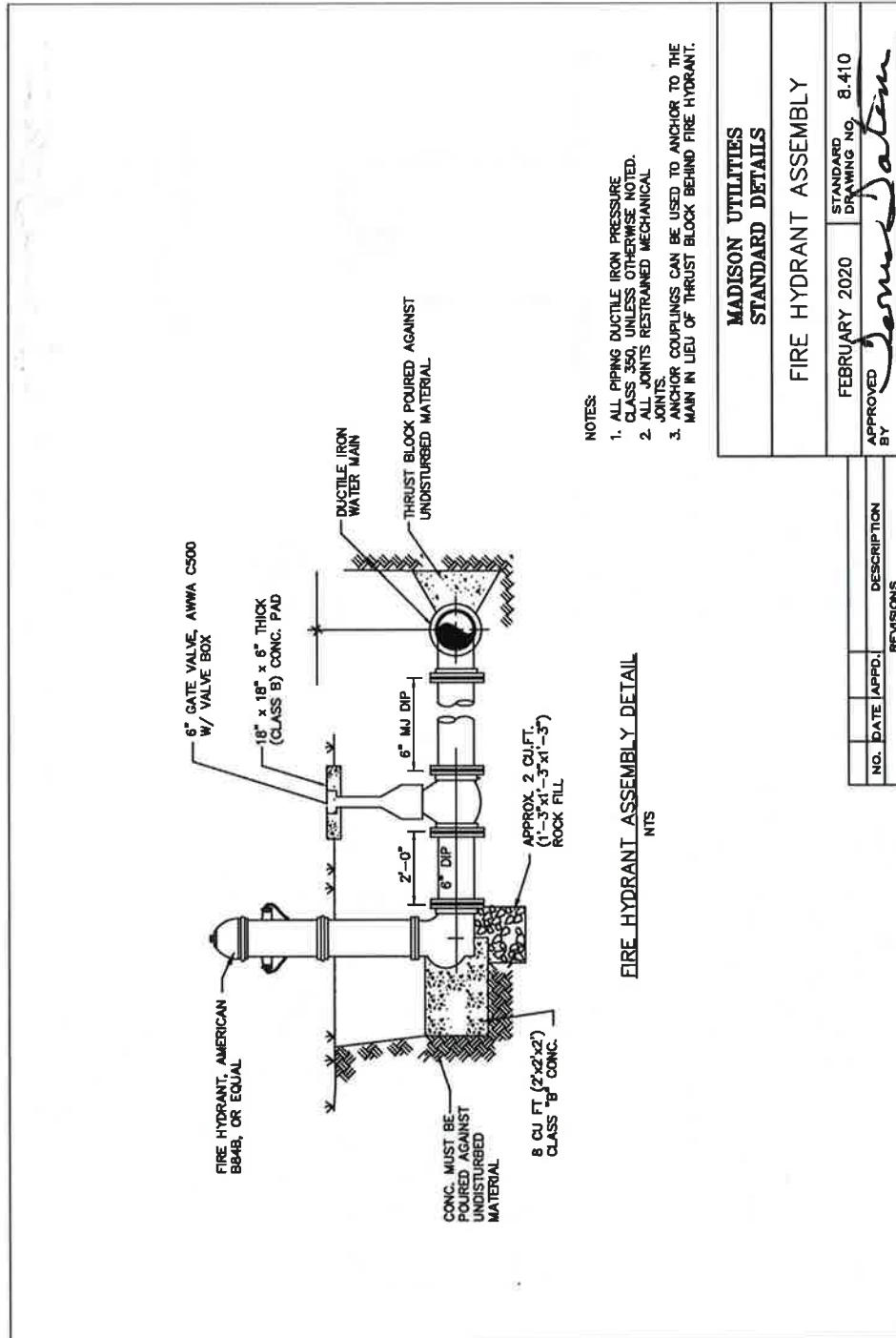


8.400 Thrust Block Detail





8.410 Fire Hydrant Assembly



- NOTES:
1. ALL PIPING DUCTILE IRON PRESSURE CLASS 350, UNLESS OTHERWISE NOTED.
 2. ALL JOINTS RESTRAINED MECHANICAL.
 3. ANCHOR COUPLINGS CAN BE USED TO ANCHOR TO THE MAIN IN LIEU OF THRUST BLOCK BEHIND FIRE HYDRANT.

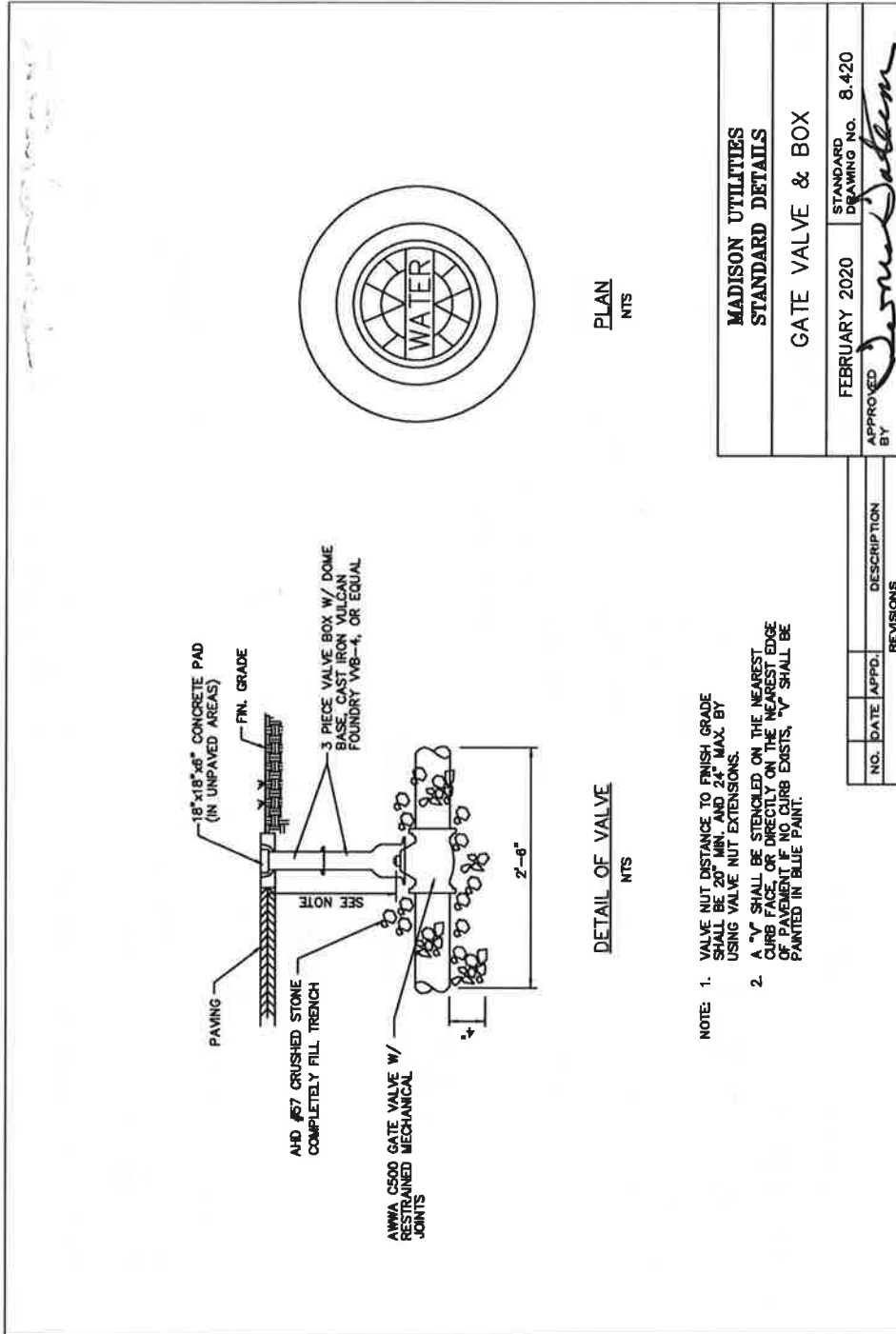
FIRE HYDRANT ASSEMBLY DETAIL
NTS

MADISON UTILITIES STANDARD DETAILS	
FIRE HYDRANT ASSEMBLY	
FEBRUARY 2020	STANDARD DRAWING NO. 8.410
APPROVED BY	<i>[Signature]</i>

REVISIONS	
NO.	DATE / APPD.
	DESCRIPTION



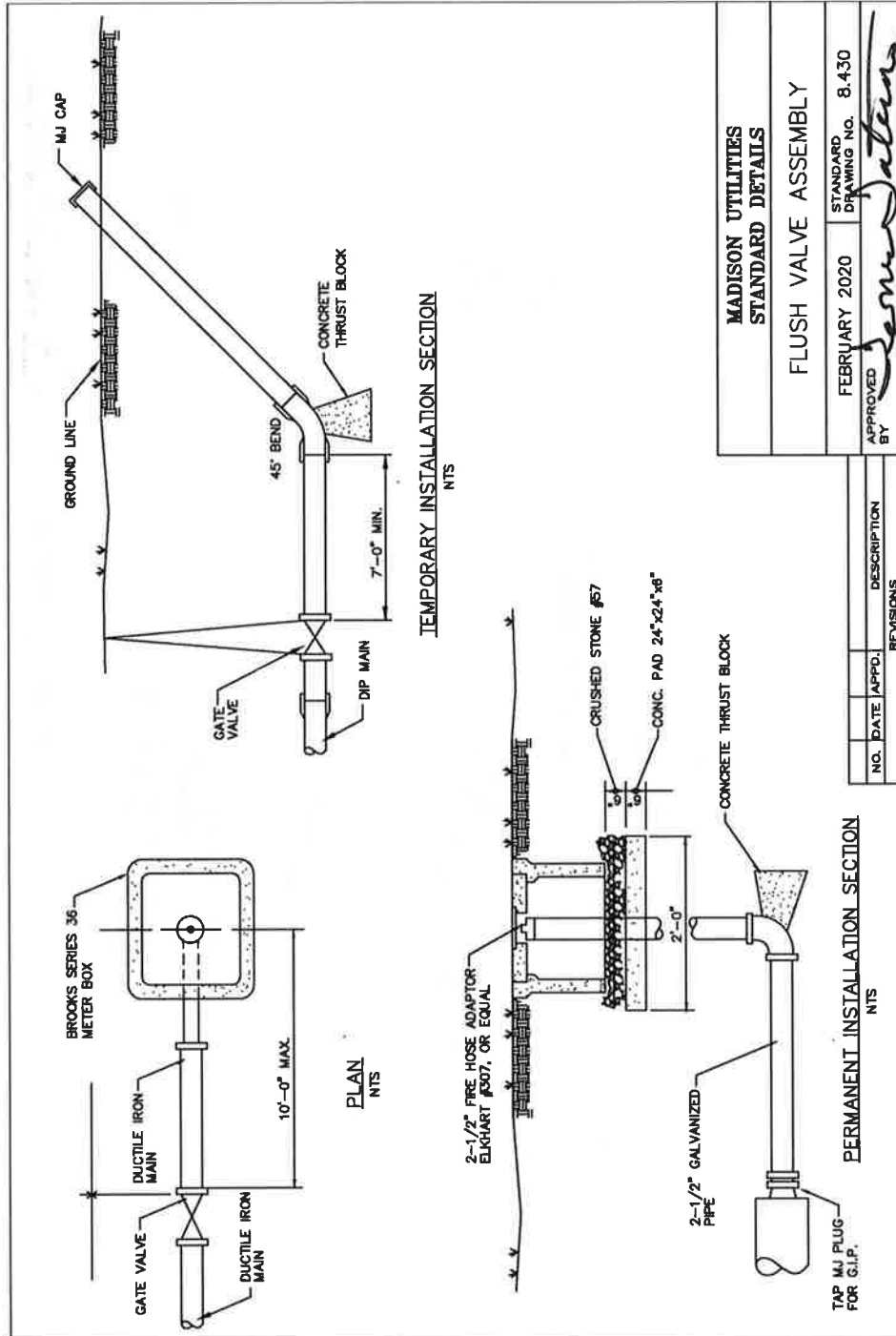
8.420 Gate Valve and Box



MADISON UTILITIES STANDARD DETAILS	
GATE VALVE & BOX	
FEBRUARY 2020	STANDARD DRAWING NO. 8.420
APPROVED BY	<i>James Dalton</i>

NO.	DATE	APPD.	DESCRIPTION
REVISIONS			

8.430 Flush Valve Assembly

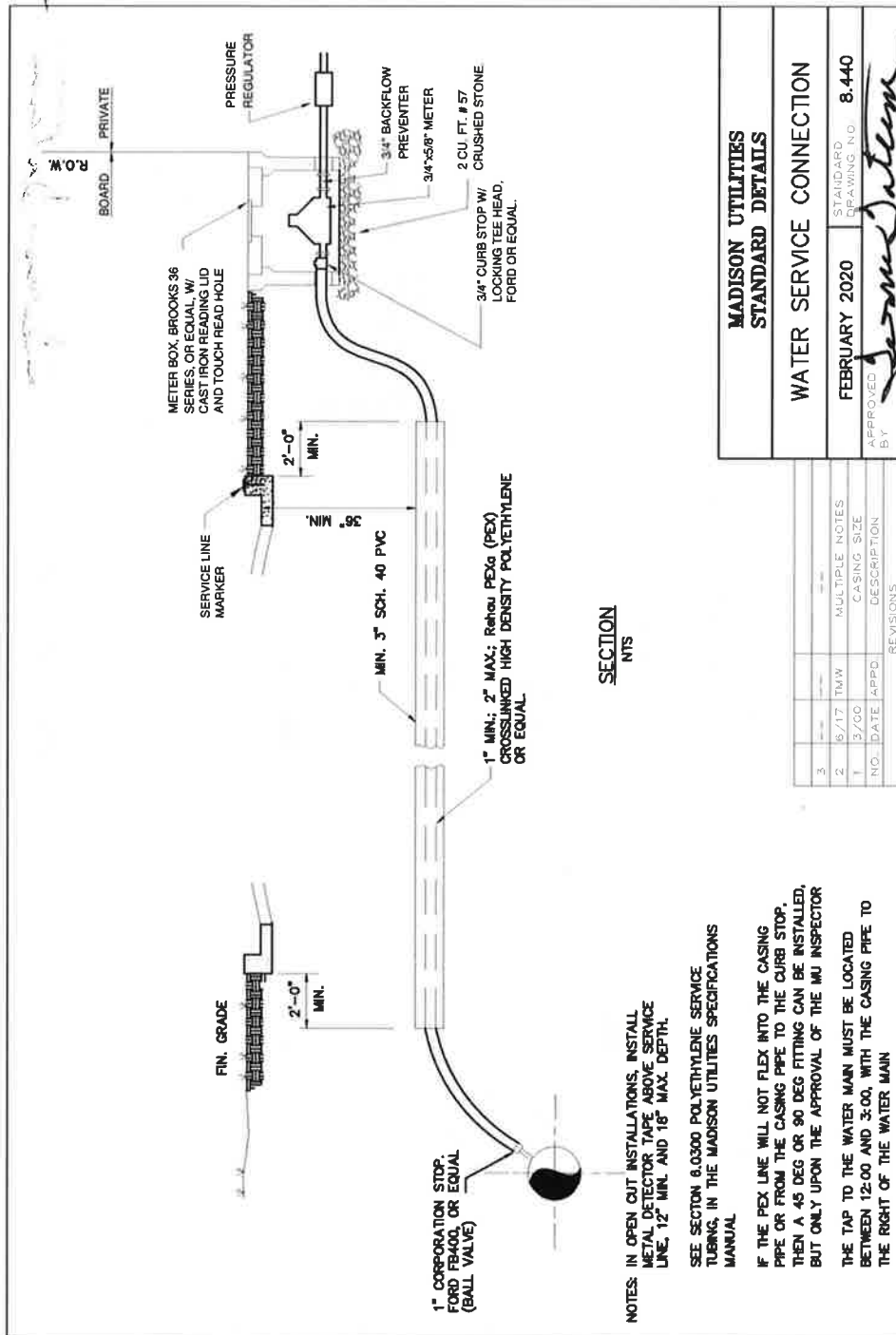


MADISON UTILITIES STANDARD DETAILS	
FLUSH VALVE ASSEMBLY	
FEBRUARY 2020	STANDARD DRAWING NO. 8.430
APPROVED BY	<i>J. M. [Signature]</i>

NO.	DATE	APPROD.	DESCRIPTION	REVISIONS



8.440 Water Service Connection



SECTION NTS

NOTES: IN OPEN CUT INSTALLATIONS, INSTALL METAL DETECTOR TAPE ABOVE SERVICE LINE, 12" MIN. AND 18" MAX. DEPTH.

SEE SECTION 6.0300 POLYETHYLENE SERVICE TUBING, IN THE MADISON UTILITIES SPECIFICATIONS MANUAL

IF THE PEX LINE WILL NOT FLEX INTO THE CASING PIPE OR FROM THE CASING PIPE TO THE CURB STOP, THEN A 45 DEG OR 90 DEG FITTING CAN BE INSTALLED, BUT ONLY UPON THE APPROVAL OF THE MU INSPECTOR

THE TAP TO THE WATER MAIN MUST BE LOCATED BETWEEN 12:00 AND 3:00, WITH THE CASING PIPE TO THE RIGHT OF THE WATER MAIN

MADISON UTILITIES	
STANDARD DETAILS	
WATER SERVICE CONNECTION	
FEBRUARY 2020	STANDARD DRAWING NO. 8.440
APPROVED BY <i>[Signature]</i>	

REVISIONS		
NO.	DATE	DESCRIPTION
3		
2	6/17	TAW MULTIPLE NOTES
1	3/00	CASING SIZE



8.450 Service Locator Marker

FRONT VIEW
NTS

SIDE VIEW
NTS

TOP VIEW
NTS

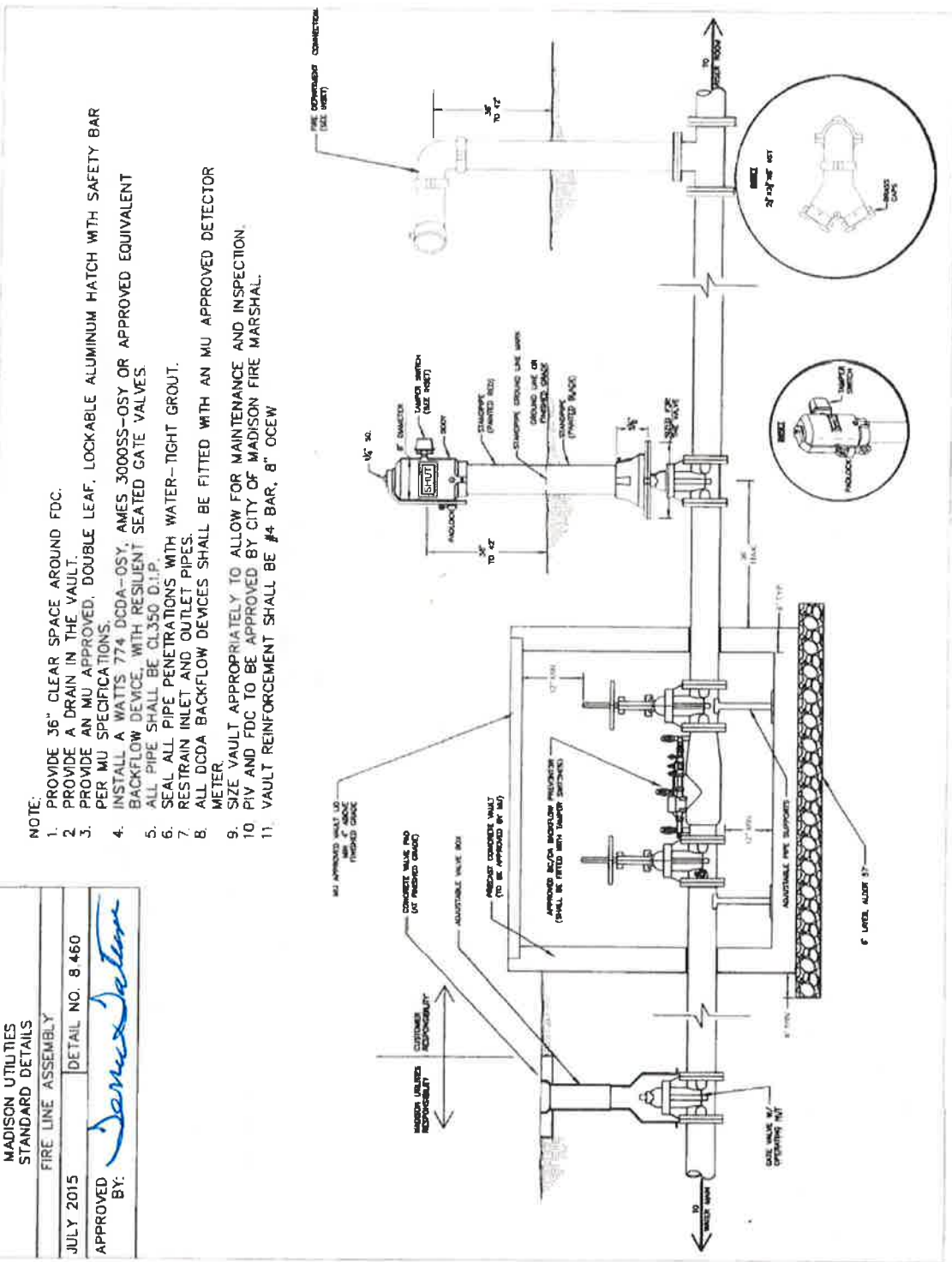
NOTES:

1. WATER MARKER COLOR: BLUE
- SEWER MARKER COLOR: GREEN
2. CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING MARKERS WHEN CURBS ARE POURED.
3. INSTALL MARKER FLUSH WITH TOP OF CURB, DIRECTLY OVER SERVICE LINE.
4. MATERIAL - EXTRUDED THERMOPLASTIC.

MADISON UTILITIES	
STANDARD DETAILS	
SERVICE LOCATION MARKER	
FEBRUARY 2020	STANDARD DRAWING NO. 8.450
APPROVED BY	

NO.	DATE	APPD.	DESCRIPTION
REVISIONS			

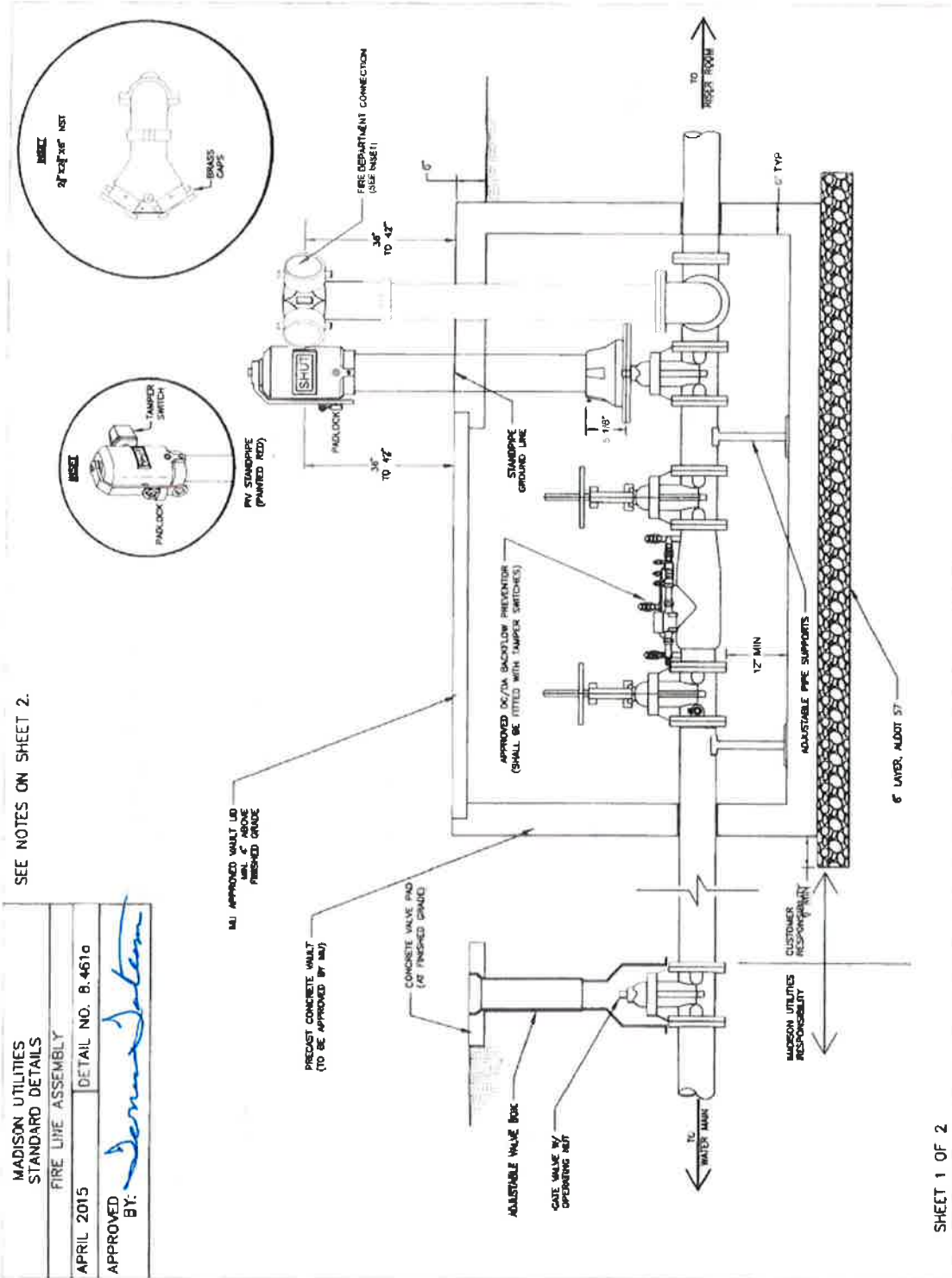
8.460 Fire Line Assembly



- NOTE:**
1. PROVIDE 36" CLEAR SPACE AROUND FDC.
 2. PROVIDE A DRAIN IN THE VAULT.
 3. PROVIDE AN MU APPROVED, DOUBLE LEAF, LOCKABLE ALUMINUM HATCH WITH SAFETY BAR PER MU SPECIFICATIONS.
 4. INSTALL A WATTS 774 DCCA-OSY, AMES 3000SS-OSY OR APPROVED EQUIVALENT BACKFLOW DEVICE, WITH RESILIENT SEATED GATE VALVES.
 5. ALL PIPE SHALL BE CL350 D.I.P.
 6. SEAL ALL PIPE PENETRATIONS WITH WATER-TIGHT GROUT.
 7. RESTRAIN INLET AND OUTLET PIPES.
 8. ALL DCCA BACKFLOW DEVICES SHALL BE FITTED WITH AN MU APPROVED DETECTOR METER.
 9. SIZE VAULT APPROPRIATELY TO ALLOW FOR MAINTENANCE AND INSPECTION.
 10. PIV AND FDC TO BE APPROVED BY CITY OF MADISON FIRE MARSHAL.
 11. VAULT REINFORCEMENT SHALL BE #4 BAR, 8" OCEW

MADISON UTILITIES STANDARD DETAILS	
FIRE LINE ASSEMBLY	
JULY 2015	DETAIL NO. 8 460
APPROVED BY:	<i>James Johnson</i>

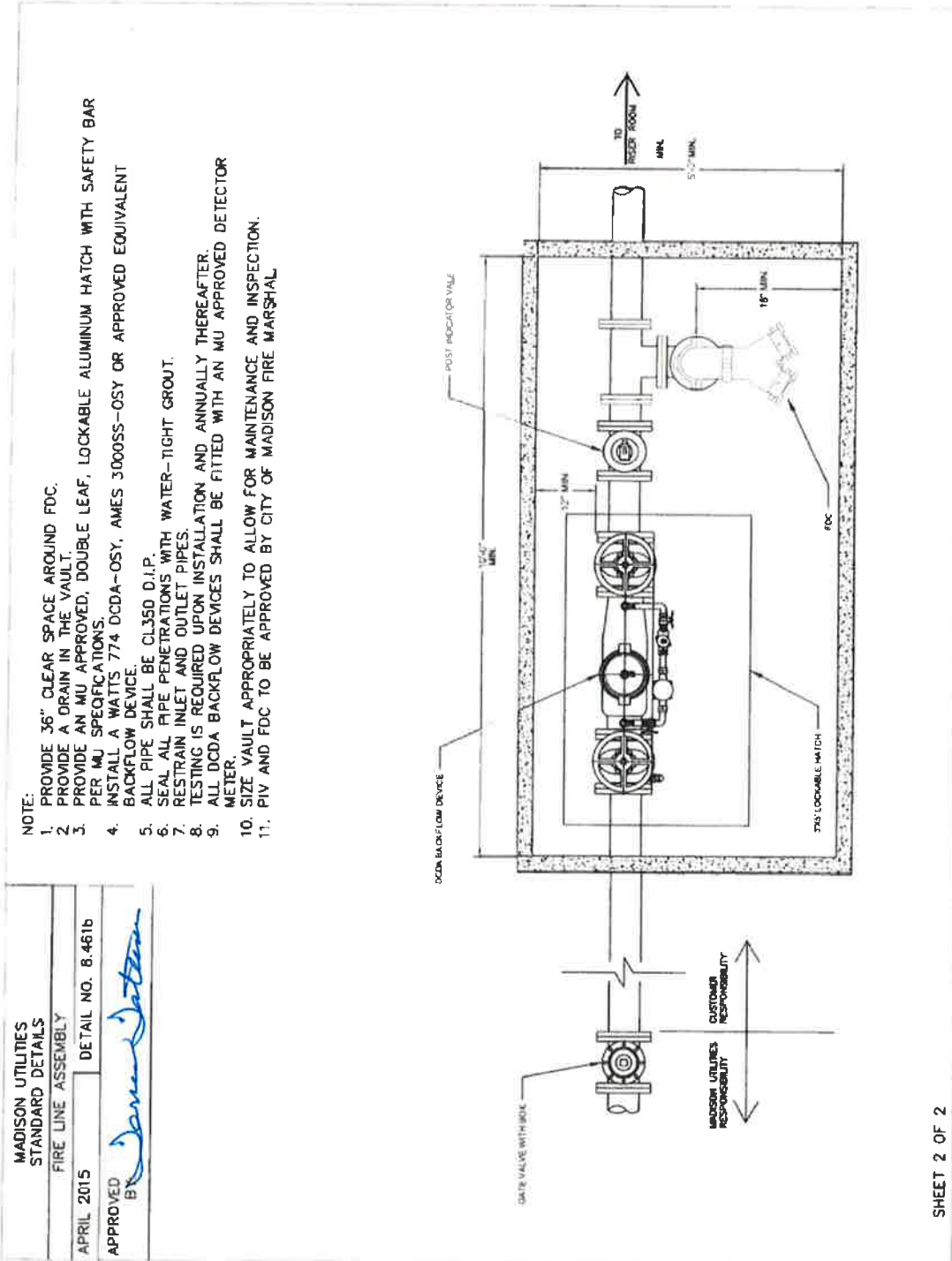
8.460a Fire Line Assembly- Compact Version 1



SHEET 1 OF 2



8.460b Fire Line Assembly- Compact Version 2



- NOTE:
1. PROVIDE 36" CLEAR SPACE AROUND FDC.
 2. PROVIDE A DRAIN IN THE VAULT.
 3. PROVIDE AN MU APPROVED, DOUBLE LEAF, LOCKABLE ALUMINUM HATCH WITH SAFETY BAR PER MU SPECIFICATIONS.
 4. INSTALL A WATTS 774 DCDA-OSY, AMES 3000SS-OSY OR APPROVED EQUIVALENT BACKFLOW DEVICE.
 5. ALL PIPE SHALL BE CL350 D.I.P.
 6. SEAL ALL PIPE PENETRATIONS WITH WATER-TIGHT GROUT.
 7. RESTRAIN INLET AND OUTLET PIPES.
 8. TESTING IS REQUIRED UPON INSTALLATION AND ANNUALLY THEREAFTER.
 9. ALL DCDA BACKFLOW DEVICES SHALL BE FITTED WITH AN MU APPROVED DETECTOR METER.
 10. SIZE VAULT APPROPRIATELY TO ALLOW FOR MAINTENANCE AND INSPECTION.
 11. PIV AND FDC TO BE APPROVED BY CITY OF MADISON FIRE MARSHAL.

MADISON UTILITIES STANDARD DETAILS	
FIRE LINE ASSEMBLY	
APRIL 2015	DETAIL NO. 8.461b
APPROVED BY <i>[Signature]</i>	

MADISON UTILITIES RESPONSIBILITY
 CUSTOMER RESPONSIBILITY

SHEET 2 OF 2