STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243
PHONE: 615-532-0191 FAX: 615-532-0686

May 8, 2019

Mr. Michael Morris, PE
Metro Water Services
1600 Second Avenue North
Nashville TN 37208-2206

RE: Metro Water Services (PWSID# 0000494)
Davidson County
Project Number DW 19-0535
Standard Specifications for Water Lines

Dear Mr. Morris:

This letter acknowledges receipt of one set of standard construction specifications for the Metro Water Services. We have reviewed the specifications and found them satisfactory. The specifications have been stamped to indicate our approval. This approval is valid for three years and will expire on May 8, 2022. You must then either resubmit the standard specifications or request in writing for extension of approval.

The approved standard specifications may be referenced on any plans submitted for approval before the expiration date. We are retaining one copy of the specifications for our records, and are returning the remaining copies to you. All addenda, revisions or correspondence concerning these specifications should contain the DW Project Number as referenced. If you have any questions contact us at (615) 532-0191.

Very truly yours,

R. William Hench

R. William Hench, P.E.
Drinking Water Engineering
Division of Water Resources

RWH/ DWS-35

cc: Nashville Field Office – Water Resources

METRO WATER SERVICES SPECIFICATIONS

MWS Water and Sewer Standard Specifications

DW 19 0535

APPROVAL EXPIRES
MAY 08 2022
TENN DEPT OF ENVIRONMENT & CONSERVATION
DIVISION OF WATER RESOURCES

APPROVED FOR CONSTRUCTION
THE DOCUMENT BEARING THIS STAMP HAS BEEN RECEIVED AND REVIEWED BY THE
TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
AND IS HEREBY APPROVED FOR CONSTRUCTION BY THE COMMISSIONER

MAY 08 2019

THIS APPROVAL IS VALID FOR ONE YEAR
THE APPROVAL SHALL NOT BE CONSTRUED AS CREATING A PRESUMPTION OF CORRECT OPERATION OR AS WARRANTING BY THE COMMISSIONER THAT THE APPROVED FACILITIES WILL REACH THE DESIGN GOAL
BY FOR THE COMMISSIONER
TITLE

MICHAEL D. MORRIS
REGISTERED ENGINEER
DEPARTMENT OF AGRICULTURE
COMMERCE
No. 101315
STATE OF TENNESSEE

METRO WATER SERVICES

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243-1102

June 6, 2019

Mr. Michael D. Morris, P. E.
Metro Water Services Nashville
e-copy: mike.morris@nashville.gov
1600 Second Avenue, North
Nashville, TN 37208

Subject: **Nashville**
County: Davidson
Wastewater Project Number: 19.0269
Job Number:
Project: MWS Standard Specification

Dear Mr. Morris:

The Tennessee Department of Environment and Conservation, Division of Water Resources, acknowledges the receipt of your engineering documents on May 7, 2019.

Review of these standard sanitary sewer specifications shows that they are in conformance with our guidelines. Therefore, they have been stamped "APPROVED". This approval will remain in effect until June 6, 2024.

To expedite matters, please reference the assigned wastewater project number 19.0269 on any future correspondence. If we may be of any assistance, please feel free to contact Mr. Mahendra Upadhyaya at (615) 253-3399 or by E-mail at *Mahendra.Upadhyaya@tn.gov*.

Sincerely,

Vojin Janjić
Manager, Water-Based Systems

cc: Water-Based Systems File
Mr. Tim Jennette, Multi-Program Coordinator, TDEC Division of Water Resources, tim.jennette@tn.gov

METRO WATER SERVICES SPECIFICATIONS

MWS Water and Sewer Standard Specifications

APPROVED

TN Dept. of Env. & Conservation
MAY 07 2019
Division of Water Resources

APPROVED FOR CONSTRUCTION
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DIVISION OF WATER RESOURCES
AND IS HEREBY APPROVED FOR CONSTRUCTION BY THE COMMISSIONER

JUN 06 2019

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THE APPROVAL SHALL NOT BE CONSTRUED AS CREATING A PRESUMPTION OF CORRECT OPERATION OR AS WARRANTING BY THE COMMISSIONER THAT THE APPROVED FACILITIES WILL REACH THE DESIGN GOAL
BY _____ FOR THE COMMISSIONER
TITLE _____

TN Dept. of Env. & Conservation
MAY 13 2019
Division of Water Resources

APPROVAL EXPIRES
JUN 06 2024
TENN DEPT OF ENVIRONMENT & CONSERVATION
DIVISION OF WATER RESOURCES

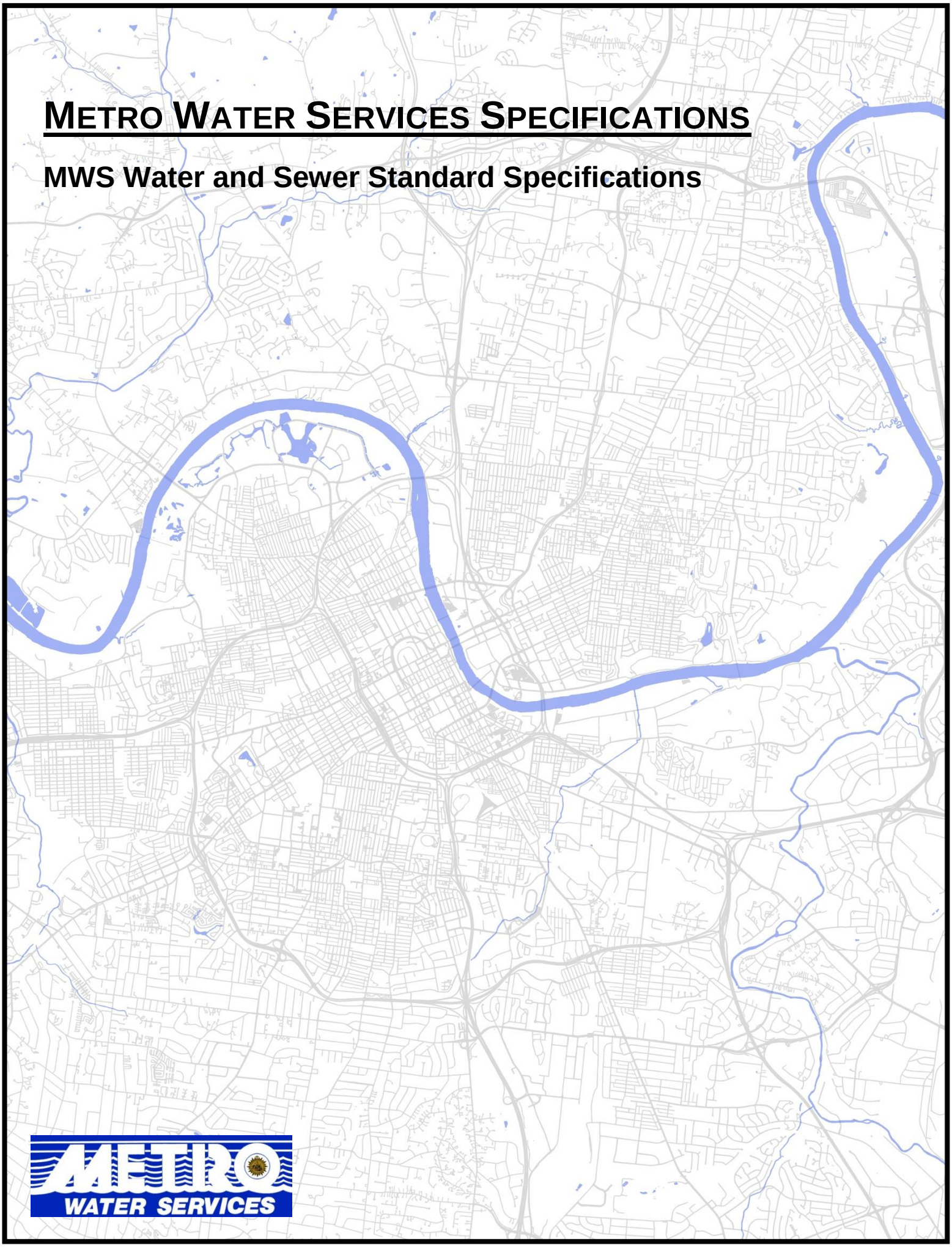
WPN19-0269

MICHAEL D. MORRIS
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 101315
STATE OF TENNESSEE

METRO WATER SERVICES

METRO WATER SERVICES SPECIFICATIONS

MWS Water and Sewer Standard Specifications



METRO WATER SERVICES

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SECTION 01 12 00

CONTRACTOR'S USE OF PREMISES

PART 1: GENERAL

1.01 SCOPE

A. Contractor's Use of Premises

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit agreements with private property owners to access or use property related to the project.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for contractor's use of premises incidental to the Work with no separate payment allowed.

B. If damages occur, restore to pre-construction condition or an approved betterment at no cost to MWS.

1.04 GENERAL

A. Before beginning Work coordinate working hours with the proper agencies.

B. At least forty-eight hours but not longer than two weeks prior to construction in any approved right of entries, notify in writing MWS and the affected properties.

C. Dispose of waste materials at Metro approved sites.

D. Do not burn waste materials on the project site.

1.05 RIGHT-OF-WAYS

A. Confine access, operations, and storage areas to properly approved right of entries; trespassing on abutting property or other areas is not allowed.

B. Maintain access for emergency vehicles including access to fire hydrants.

C. Avoid obstructing drainage ditches or inlets; when obstruction is unavoidable due to requirements of the Work, provide regulatory approved grading and temporary drainage structures to maintain unimpeded flow.

D. Locate and protect private lawn sprinkler systems that may exist on right of entries within the site. Repair or replace damaged systems to condition equal to or better than pre-construction condition.

E. Perform daily cleanup of all disturbed areas. Keep streets, driveways, and sidewalks clean of dirt, debris, and scrap materials. Do not leave buildings, roads, streets, or other construction areas unclean overnight.

1.06 PRIVATE PROPERTY NECESSARY FOR THE WORK

A. Where the Work encroaches upon private property, MWS will obtain necessary permits, approvals, contracts, right of entries, and/or easements.

B. Comply with all stipulations outlined in agreements between the property owner and MWS and the limits shown on the Drawings and/or conditions described.

C. Repair or replace any damages to preconstruction condition or better.

1.07 PRIVATE PROPERTY CONVENIENT FOR THE WORK

A. Obtain written agreements from private property owners for additional areas deemed convenient but not necessary for the Work and submit a copy of the agreement to MWS. Such written agreements shall comply with all Metro ordinances and restrictions.

B. Make arrangements for temporary use of private properties and indemnify and hold harmless MWS against claims or demands arising from use of properties outside of rights-of-way.

C. Repair or replace any damages to preconstruction condition or better.

1.08 LOCAL STREETS AND ALLEYS

A. Secure permits and obtain operation procedures from the Metropolitan Department of Public Works before closing or starting construction within the right-of-way of any street or alley.

B. Construct and maintain temporary detours, ramps, and roads to provide traffic flow when use of local roads or streets is closed by necessities of the Work.

C. Provide mats or other means to prevent overloading or damage to existing roadways from tracked or heavy equipment.

D. Maintain ingress/egress to driveways or entrances at all times.

1.09 STATE AND FEDERAL RIGHT OF WAY

A. Where the Work encroaches upon the right of way under the jurisdiction of Tennessee Department of Transportation (TDOT), MWS will obtain necessary permits, approvals, contracts, and/or easements.

B. Comply with stipulations outlined in agreements between TDOT and MWS and permit conditions.

1.10 RAILROAD RIGHT OF WAY

A. Where the Work encroaches upon the right-of-way of a railroad company, MWS will obtain necessary permits, approvals, contracts, and/or easements.

B. Comply with stipulations outlined in agreements between the railroad company and MWS.

C. Furnish insurance documentation and satisfy requirements of the railroad company prior to entering the railroad right-of-way.

D. Pay expenses and/or charges for the monitoring, flagging, inspection, and/or other services assessed by the railroad company unless specifically indicated as a pay item in the Bid Schedule.

1.11 OTHER UTILITIES AND OTHER ENTITIES

A. Where the Work encroaches upon the right-of-way and/or jurisdictional authorities of other utilities or entities, MWS will obtain necessary permits, approvals, contracts, and/or easements.

B. Comply with stipulations outlined in agreements between other utilities or entities and MWS.

C. Satisfy requirements of other utilities or entities prior to entering the right-of-way.

D. Pay expenses and/or charges for the monitoring, flagging, inspection, and/or other services assessed by other utilities or entities unless specifically indicated as a pay item in the Bid Schedule.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 20 00
MEASUREMENT AND PAYMENT

PART 1: GENERAL

1.01 SCOPE

A. Measurement and payment including conditions for nonconformance and nonpayment for rejected products or workmanship.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit items as described in individual specification sections.

1.03 MEASUREMENT AND PAYMENT

A. Submit actual quantities and measurements installed or performed, verified by MWS, for payment only.

B. Consider quantities on the Bid Schedule estimates; actual quantities may vary.

C. If the actual Work requires more or less quantity indicated on the Bid Schedule, provide the required quantities at the unit prices contracted.

D. Obtain MWS written approval before installing or performing Work that exceeds quantities on the Bid Schedule.

1.04 MEASUREMENT OF THE WORK

A. Measure the Work according to the units indicated on the Bid Schedule and individual specification sections.

B. Use a method to measure the Work that is an accepted standard practice when not specifically outlined in individual specification sections.

C. Supply access to the Work for MWS to verify measurements.

D. Verify measurements of the Work with MWS on a daily basis.

1.05 PAYMENT FOR THE WORK

A. Consider full compensation for the Work the unit price multiplied by the number of items installed complete in place and ready for use including all incidentals as described in individual specification sections.

B. Make claims for compensation only for items specifically included in the Bid Schedule. Claims for compensation of Work not covered in the list of item with unit prices contained in the Bid Schedule will not be accepted.

C. Recognize that a retainage percentage of payments may be withheld by other provisions of the Contract Documents.

1.06 NONCONFORMING OR REJECTED WORK

A. Remove and replace the Work, or portions of the Work, rejected or not, conforming to the Contract Documents at no cost.

B. Generally nonconforming work will not be accepted.

C. If MWS decides it is not practical to remove and replace the nonconforming Work, lower the unit price, provide an extended warranty, and/or modify the nonconforming Work to MWS satisfaction. MWS will provide written official documentation to accept nonconforming work and/or adjustments of payment of nonconforming work. Verbal acceptance of nonconforming or rejected work will not be binding.

1.07 ALLOWANCES AND CONTINGENCIES

A. Consider allowances and contingencies specified in the Bid Schedule a method to pay the cost of items that MWS could not establish accurate quantities, a detailed scope of work, and/or items that may or may not be needed for completion of a project.

B. Submit a written proposal with a cost quote for the need to use an allowance and/or contingencies to MWS and obtain written approval from MWS prior to performing the Work. Fractional use of an allowance and/or contingencies may be utilized.

C. Utilize the following paragraphs for clarification for allowances and/or contingencies appearing in the Bid Schedule and disregard the following paragraphs for allowances and/or contingencies not found in the Bid Schedule. Understand that payment for allowances and/or contingencies not appearing in the Bid Schedule will not be allowed.

1. Contingency for Unforeseen Work Elements: This contingency, not shown or specified on the Drawings and Specifications bid and not included by another item in the Bid Schedule, may be required in the event the MWS approves the need for additional work deemed to be necessary for the successful completion of the Work.

2. Allowance for Additional Traffic Control: This allowance has been established as a means of payment for traffic control or special flagging that is required by a regulatory agency and approved by MWS that is above and beyond the baseline traffic control that is specified in the Special Provisions and/or Bid Schedule. If this allowance is specified in

the bid schedule but a baseline traffic control has not been specified, the allowance may only be utilized with MWS written approval.

3. Allowance for Permits: This allowance has been established as a means of payment for permits fee cost that are required for the completion of the Work. This allowance will be directly reimbursed with presentation of an invoice from the regulatory agency. Regulatory fines will not be paid by this allowance.

4. Allowance for Water Usage to Test and Disinfect Water Mains: This allowance has been established as a means to reimburse for water usage necessary to test and disinfect water mains. This allowance will not be permitted when re-disinfection and refilling is required due to a noncompliant sample. This allowance will not be permitted when refilling is necessary due to a failed hydrostatic pressure test or other retest done for acceptance testing for water mains. This allowance will directly reimburse, with no markup, for metered water utilizing a Water Services issued water meter and backflow prevention device directly associated with this project upon the presentation of an invoice from Water Services.

A. Submit evidence of payment for services resulting from the use of an allowance and/or contingency to MWS prior to its inclusion in the invoice for the progress payments.

B. When using allowances and/or contingencies, only receive payment for completed work authorized by MWS.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 31 00
COORDINATION AND MEETINGS

PART 1: GENERAL

1.01 SCOPE

A. Coordination and Meetings

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit items related to this Section as found described in the other sections of the Specifications.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for coordination and meetings incidental to the Work with no separate payment allowed.

1.04 COORDINATION

A. Coordinate with other utilities in a manner that promotes an efficient and orderly sequence of construction.

B. Perform a TN One Call in accordance with TCA 65-31-101 through TCA 65-31-113 before starting construction.

C. Contact other entities identified at the Preconstruction Meeting before starting construction including, but not limited to: Satellite Cities, other Metro Departments, property owners, residents, etc.

1.05 MEETINGS

A. Preconstruction Meeting

1. Attend a MWS held Preconstruction Meeting after a purchase order is issued and before any portion of the Work is started.
2. Route correspondence related to the project through the MWS Representative(s) identified at the preconstruction meeting.
3. Discuss and coordinate the Work with other entities involved with the project.
4. Provide contact information, general approach to the work, schedule information, submittals, proposed Construction Start Date, Quality Control Plan, Safety and Health Plan.
5. Identify availability for Construction Kickoff Meeting attendance.

B. Construction Kickoff Meeting

1. After MWS issues the Notice to Proceed, attend a MWS administered

Construction Kickoff Meeting.

2. Make preparations to attend the Construction Kickoff Meeting either offsite, onsite, or both.

C. Progress Meetings

1. Attend progress meetings as scheduled and administered by MWS.

D. Special Meetings

1. MWS reserves the right to require other project meetings, including but not limited to, pre-installation meetings for specific components of the work.

2. Be prepared to attend, during the course of the Work, additional meetings to discuss specific elements of the Work.

E. Substantial Completion Review / Final Walkthrough Reviews

1. Near the end of the project attend the substantial completion meeting for MWS to generate the punch list for remaining contract items to be completed.

2. Upon completion of all punch list items, attend a MWS scheduled Final Walkthrough Review to ensure project completion.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1: GENERAL

1.01 SCOPE

A. Construction Progress Schedule and Recovery Schedule if warranted

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 – Submittal Procedures.

B. Submit one digital initial Construction Progress Schedule in PDF format for review by MWS before beginning the work.

C. After review by MWS, and if edits are requested, submit revised Construction Progress Schedule.

D. Submit an updated Construction Progress Schedule with every Application of Payment of the same number of copies.

E. If requested by MWS, or if a critical path milestone has not been achieved, submit a Recovery Schedule.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for creating and/or revising Construction Progress/Recovery Schedules incidental to the Work with no separate payment allowed.

1.04 GENERAL

A. Plan, schedule, execute, and report the Work with a Construction Progress Schedule using a critical path method format with a work breakdown structure.

B. Identify work in separate stages and other logically grouped activities.

C. Show sequence of construction by activity with dates for beginning and completion of each element of construction.

D. Provide sub-schedules if applicable to define critical portions of the Work.

E. Show accumulated percentage of completion for each construction activity.

F. Consider and include typical seasonal weather conditions in the planning and scheduling of the Work.

G. Include the date approved submittals are needed in the Construction Progress Schedule. Allow ten MWS business days for review of all submittals.

H. Identify modifications or changes for updated Construction Progress Schedules.

I. Provide a narrative report to define problem areas, anticipated delays, and impact on schedule including corrective actions taken or recommendations.

J. If an updated Construction Progress Schedule indicates the project or a required

milestone is ten or more workdays behind schedule and there is no change to support a time extension or when requested by MWS, prepare and submit a Recovery Schedule within five calendar days.

K. Include in the Recovery Schedule proposed revisions to the Construction Progress Schedule demonstrating intensions to achieve all contractual milestones (including contract completion dates) within the remaining Contract Time including a narrative describing the cause for the problems and the actions planned to recover lost time.

L. Recovery Schedule shall include all activities required to complete the contract.

M. Recovery Schedule will become the Construction Progress Schedule when approved by MWS.

N. Promptly undertake appropriate action to recover lost time at no additional cost to MWS.

O. MWS may consider the refusal or failure to take appropriate recovery action, and/or submit a Recovery Schedule a lack of due diligence of the work and withhold some or all of any payment due and terminate the contract.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 32 33
PHOTOGRAPHIC DOCUMENTATION

PART 1: GENERAL

1.01 SCOPE

A. Photographic Documentation

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit digital color pictures and/or videos to MWS by email and/or two copies on a MWS approved media within 5 days taken with the Project Name, Project Number, date taken, and brief description including, if applicable, house number and street name.

C. Submit pictures in an approved MWS format and resolution.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for photographic documentation incidental to the Work with no separate payment allowed.

PART 2: PRODUCTS

2.01 PRECONSTRUCTION

A. Prior to starting construction, take digital color photographs and/or video of the entire route of the project or project site.

B. Provide photographs and/or videos showing the preconstruction condition of the following:

1. Streets and Roads;
2. Sidewalks, Curbs and Gutters, and Driveways;
3. Surface features (lights, fences, manholes, valve boxes, sprinkler heads, mail boxes, utilities, etc.);
4. Landscaping (lawns, trees, shrubs, grass, flower gardens, etc.);
5. Preexisting damage within or near the Work;
6. Any other item deemed important to document.

2.02 POST CONSTRUCTION

A. After completion of construction, provide photographs and/or videos of public or private property that has been repaired, restored, or were the subject of complaints during construction.

B. Submit post construction photographic documentation in the same format as preconstruction photographic documentation.

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1: GENERAL

1.01 SCOPE

A. Submittal Procedures

1.02 SUBMITTALS

A. Find specific submittals required in each individual specification section.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for submittals incidental to the Work with no separate payment allowed including, but not limited to, samples.

1.04 GENERAL

A. Within a minimum of ten calendar days after the date of the Notice to Proceed letter, submit a Submittal Log and submittals for approval.

B. Submittals shall be numbered sequentially as outlined on the Submittal Log.

C. Present submittals to MWS in advance of when they are needed and allow ten MWS business days for review.

D. Submit a construction schedule in the critical path method format.

E. Identify project name and number, Contractor, Subcontractor or Supplier, and specification section number on each submittal including identification of variations from Contract Documents, products, and/or systems.

F. Submit the number of copies indicated in each individual specification section, and if the number of copies is not listed, submit five paper copies.

G. Submit a digital copy in a MWS approved format.

H. Sequentially number initial submittals and include a letter suffix for resubmittals following the original initial submittal number; also, identify all changes made from the previous submittal.

I. Apply a project manager or company official signed and dated stamp certifying that submittals are in accordance with the requirements of the Contract Documents and clearly denote item intended for use.

J. After MWS approval of submittals, distribute copies of approved submittals for construction.

K. MWS reserves the right to reject a supplier from submitting future products if multiple submittals have not conformed to project requirements.

L. MWS approvals shall not relieve requirements to meet project specifications.

M. Furnish submittals in accordance with MWS published Approved Materials.

N. MWS reserves the right to approve and/or disapprove product substitutions.

O. Rejected submittals do not warrant additional contract time or damage claims.

P. Submit Record Drawings upon completion of the Work. MWS reserves the right to request additional information on the Record Drawings.

PART 2: PRODUCTS

(Not Used)

PART 3: EXECUTION

(Not Used)

END OF SECTION 01 33 00

SECTION 01 35 23
HEALTH AND SAFETY

PART 1: GENERAL

1.01 SCOPE

A. Health and Safety

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit a Safety Program as an informational submittal. MWS will not issue an approval of the Safety Program.

C. Submit an Emergency Response Plan, Accident Notification, and Claim Notifications.

D. Submit the proper report for any incident that results in damage, injury, or loss.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for health and safety incidental to the Work with no separate payment allowed.

1.04 GENERAL

A. Familiarize and comply with the provisions and requirements of the Occupational Safety and Health Act (OSHA) and TOSHA and other applicable federal, state, county, local laws, ordinances, codes, relating to the safety of persons, property, and protection of persons or property from damage, injury, or loss. Ignorance of any provision or requirement shall not relieve responsibilities of compliance, fines, or penalties.

B. Address provision or requirement conflicts related to safety by contacting the conflicting agencies for resolution. If resolution cannot be achieved, follow the more stringent requirement.

C. Supply, erect, and maintain all necessary safeguards for health, safety, and protection.

D. Initiate, maintain, and supervise all safety precautions and programs in connection with the Work with sole responsibility. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

E. Take all necessary precautions for health and safety and provide the necessary protection to prevent damage, injury, or loss to the following:

1. All persons inside or outside the project limits who may be affected by the Work;
2. All the materials, and equipment to be incorporated inside or outside the project limits;
3. Other property inside or outside the project limits including, but not limited to: trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and underground facilities not designated for removal, relocation, or replacement in the course of construction.

F. Anticipate and meet the specific health and safety requirements of the project.

G. Require workers to use personal protective equipment (PPE) and observe proper hygienic precautions in accordance with the Construction Safety Program.

H. Take measures to ensure that workers observe proper safety precautions when working in hazardous areas including, but not limited to: confined spaces, detrimental gases, oxygen deficiencies, flowing fluid with high velocities, and soil instability.

I. Notify owners of adjacent property and facilities prior to starting activities that may have adverse effects.

J. Provide at all times proper facilities for safe access to the work by MWS and their authorized representatives including testing personnel and authorized government officials.

K. MWS reserves the right to suspend any activity or situation it deems unsafe without compensation.

1.05 Construction Safety Program

A. Before starting the Work, develop and implement a Construction Safety Program with a plan indicating an understanding of the specific safety and health dangers of the project and demonstrate the experience and qualifications to perform the work in a safe manner. Include within the plan, but not limited to:

1. Safety organization and representatives
2. Employee training and orientation
3. Blood-borne pathogen exposure prevention
4. PPE requirements including OSHA and TOSHA compliant serviceable hardhats with company logos required for employees and subconsultants
5. Procedure for mandatory initial and refresher confined space training for all Contractor and subcontractor onsite personnel and develop and

maintain a program for confined space entry

6. Procedures for electrical and mechanical Lock-Out/Tag-Out
7. Procedures for Hot Works in hazardous areas
8. General site safety regulations
9. Record keeping and reporting requirements
10. Safety promotion programs or incentive goals
11. Documentation incorporated into the Contractor's safety manual whereby its personnel have been informed about and know what health precautions should be taken when working with water or wastewater systems
12. List with emergency phone numbers that allows MWS to obtain responses to an emergency at any time day or night

B. Emergency Response Plan including, but not limited to:

1. Emergency evacuation procedures
2. Emergency notification plan
3. Emergency supplies
4. Disaster supply kit

C. Accident Notification Procedures including, but not limit to:

1. Report all accidents causing death, serious injuries, or serious damage to MWS immediately by telephone. No later than 24 hours after the occurrence of the accident, meet with MWS.
2. Submit a written report to MWS providing full details and witness statements no later than 7 days after the accident.
3. Follow this procedure for all accidents resulting from or in conjunction with performing the Work, whether on or off project site.

D. For claim notification procedures, report the facts giving full details in writing to MWS and if anyone makes any claims including subcontractors due to an accident, notify MWS within 24 hours after receiving notice of the claim.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 41 00
REGULATORY REQUIREMENTS

PART 1: GENERAL

1.01 SCOPE

A. Regulatory requirements.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 – Submittal Procedures.

B. Submit agreements, permits, or other documents for regulatory requirements pertaining to the project.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for regulatory requirements incidental to the Work with no separate payment allowed.

B. Violations resulting in regulatory fines / penalties will not be paid by MWS.

1.04 GENERAL

A. Comply with private, local, state, and federal regulatory requirements.

B. Immediately notify MWS where conflict exists between regulatory requirements and/or specifications.

C. Take full responsibility for actions that violate project regulatory permits or Federal, State or local environmental regulations including, but not limited to: U.S. Army Corps of Engineers 404 Permits; TDEC Aquatic Resource Alteration Permits; TDEC Construction General Permits; any State or Federal permits/approvals related to Threatened and Endangered Species; Metro Individual NPDES permits; Stormwater Management Manual, Volume 1, Section 6.9, and/or Metro Code 15.64.205 Non-stormwater Discharges.

D. Take responsibility for, but not limited to, payment of all fines, assessments, and/or civil penalties, actions, design, and/or installation and payment of mitigation measures required due to the violation and cleanup associated with any violation.

E. Upon discovery of archeological artifacts within the project limits, immediately stop the Work and notify MWS. MWS shall have and retain all right, title, and interest to such artifacts and shall have the further right, during the course of the contract to examine, or cause to have examined, the site of the Work for any artifacts and perform or have performed archeological excavations and all other related work to explore, discover, recover, and remove artifacts from the work

site. In the event an archeological examination delays the Work, a time extension may be granted.

F. Obtain from MWS and keep onsite during construction original Tennessee Department of Environment and Conservation (TDEC) Division of Water Supply and/or Water Pollution Control approved construction drawings and letter.

G. Obtain and comply with Metro Public Works Excavation, Sidewalk, and/or Street Closure Permits requirements.

H. Obtain building permits from Metro Codes when required.

I. Obtain from MWS and comply with the conditions of the Tennessee Department of Transportation (TDOT) Right of Way Permit when working within state routes.

J. Obtain from MWS and comply with conditions of the Tennessee Department of Transportation (TDOT) Bridge Approval when working near or on bridges of the state.

K. Comply with requirements and/or permit conditions of other private or public entities having jurisdiction such as but not limited to: railroads, gas companies, and power companies.

L. Comply with the Safe Drinking Water Act.

M. Comply with the Clean Water Act and Metro Stormwater Management Regulations.

N. Comply with the American with Disabilities Act (ADA).

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 45 00

QUALITY ASSURANCE AND CONTROL

PART 1: GENERAL

1.01 SCOPE

A. Quality assurance and quality control

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 – Submittal Procedures.

B. Submit a Quality Assurance/Quality Control Plan (QA / QC Plan) including at a minimum the following:

1. Quality management and responsibilities;
2. Qualifications of Employees;
3. Project quality plan;
4. Inspections and testing;
5. Control and prevention of nonconformance;
6. Training required for the Work;
7. Project documentation;
8. Closeout of the Project.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for quality assurance and quality control incidental to the Work with no separate payment allowed.

1.04 GENERAL

A. Perform Work in accordance with Drawings, Specifications, and manufacturer's instructions.

B. Request clarification in writing from MWS if a conflict is discovered between the Drawings, Specifications, and/or manufacturer's instructions.

C. Immediately notify MWS of irregularities or deficiencies of the Work.

D. Cooperate with MWS and provide access to the Work.

E. Furnish copies of test reports and certificates of materials to MWS.

F. Furnish material and labor to provide MWS access to the Work for observations, handling samples, and testing.

G. Sign and acknowledge reports and quantities sheets from MWS.

H. Notify MWS Field Representative 48-hours prior to expected time for operations requiring services or observations with a 24-hour notice of change-of-time or cancellation.

I. Pay for a third party firm's observation services for the following:

1. Re-observation of nonconforming Work.
2. Observation of additional work caused by errors, faulty equipment, or incompetence.
3. Insufficient notification of cancellation of Work.

J. Provide the services of a manufacturer's representative on-site during installation, testing, and startup for portions of the Work as recommended by the manufacturer or requested by MWS.

1.05 OBSERVATION SERVICES

A. MWS may perform testing of the Work or observe tests of any portion of the Work to ascertain compliance with the Drawings, Specifications, and manufacturer's instructions.

B. MWS reserves the right to employ and pay for a third party firm to provide supplemental observational services.

C. MWS and/or a third party firm may produce reports indicating observations and compliance or non-compliance with the Drawings, Specifications, and the manufacturer's instructions.

D. MWS observations, commentaries, or refraining from testing or observing the Work shall not relieve obligations to perform the Work in full compliance with the Drawings, Specifications, and manufacturers' instructions including all safety requirements.

E. MWS may compare actual materials used for the Work with test reports and certifications and report conflicts.

F. MWS Field Representative is not authorized, without written approval of MWS, to:

1. Revoke, alter, enlarge, or waive requirements of the Drawings, Specifications, or manufacturer's instructions.
2. Approve or accept any portion of work beyond the approved Work detailed in the Drawings and Specifications.
3. Perform any duties of Contractor.

G. MWS has the authority to stop the Work at any time.

1.06 TESTING

A. Perform testing of the Work and/or materials in conformation with the Drawings, Specifications, and manufacturer's instructions.

B. Pay for testing the portions of the Work required to be tested by an independent third party materials testing firm.

C. Pay for testing by an independent third party materials testing firm for portions of the Work that MWS considers deficient and is found to be deficient.

D. Increase testing frequencies beyond industry standards if requested by MWS.

E. MWS reserves the right to retest samples, specimens, or portions of the Work previously tested by the Contractor or an independent third party materials testing firm.

F. Reports and/or observations by a testing laboratory do not relieve obligations to perform work in full compliance with the Drawings, Specifications, and manufacturer's instructions.

G. Comply with recognized industry standards for testing when none are specified in the Drawings, Specifications, or manufacturer's instructions.

H. Provide copies of testing results and reports to MWS.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 51 00

TEMPORARY UTILITIES

PART 1: GENERAL

1.01 SCOPE

A. Temporary Utilities for Temporary Facilities not including by-pass pumping, temporary water mains, or any other temporary utilities used for public services.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit sketch indicating temporary utility connections.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for temporary utilities incidental to the Work with no separate payment allowed.

1.04 GENERAL

A. Arrange for authorities having jurisdiction to test and examine each temporary utility before use. Obtain required certifications and permits.

B. Protect, operate, and maintain existing utilities regardless of previously assigned responsibilities. Do not disrupt or interfere with services of existing permanent utilities or violate regulatory codes.

C. Temporary Water Service - Make arrangements with MWS to obtain metering and backflow devices. Connections to MWS water supply require a meter and backflow device. Supply necessary pipe or hose extensions to convey the water to the use points. Comply with applicable regulations and code requirements including metering and backflow prevention. If outside MWS water service area, coordinate with the appropriate water utility. MWS reserves the right to limit, suspend, or terminate supplying water at any time should it consider such action to be necessary due to distribution system damage, the need to conserve water, or other emergency. In this event, no additional payment shall be made for delays or added expenses to the Contractor.

D. Temporary Sewer Service – Provide and maintain adequate number of temporary prefabricated chemical type toilets with proper enclosures secluded if possible from public observation for use of workers during construction. Comply with local and state health requirements and sanitary regulations. Maintain the sanitary facilities in a satisfactory and sanitary condition at all times and enforce their use. If using MWS existing sewer service, provide service connection

appurtenances as required. Make arrangements and pay costs associated with tying sanitary system into an approved disposal system or alternative sanitary service.

E. Temporary Electricity Service - Make necessary arrangements and pay for temporary electric service and lighting required during construction. Install necessary temporary wiring, panel boards, outlets, switches, lamps, fuses, controls and accessories. Comply with NECA, NEMA, NFPA 70, and UL standards and regulations for temporary electric service.

F. Temporary Heating / Air Conditioning - Provide temporary heating, including costs of equipment and installation, fuel, and attendance, whenever and for such periods as heating may be required. Observe and take precautions against general weather conditions to prevent freezing and retarding of curing of concrete. Maintain suitable working conditions for workers.

G. Restore site when removing Temporary Utilities to equal or better condition.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 52 00
TEMPORARY FACILITIES

PART 1: GENERAL

1.01 SCOPE

A. Temporary Facilities

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit site plan indicating temporary facility size, locations, staging areas, and parking areas for construction personnel.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for temporary facilities incidental to the Work with no separate payment allowed.

1.04 GENERAL

A. Provide temporary facilities to properly complete the Work as required and as specified.

B. Provide temporary facilities in compliance with all regulatory agencies.

C. Provide temporary facilities to cause least inconvenience possible to the public.

D. Protect all temporary facilities from adverse weather.

E. Obtain MWS approval before transporting or locating temporary facilities within construction site.

F. Temporary Contractor Field Office - At the discretion of MWS, provide, equip, and maintain a temporary field office at a suitable location near the Work.

1. Maintain copies of all contract documents in the contractor field office.
2. Maintain support facilities until MWS schedules substantial completion review. Remove before final completion review unless otherwise directed by MWS.
3. Allow other entities to use temporary services and facilities without cost including personnel related to the project and/or having jurisdiction.

G. Temporary MWS Field Office – If required in the Special Provisions, provide, equip, and maintain a temporary field office at a suitable location near the Work for exclusive use by MWS Project Representative.

H. Emergency Contact List - at each telephone, office exit doors and Emergency Response station, post a list with important telephone numbers.

1. Police and fire departments.

2. Ambulance service.
3. Contractor's home office.
4. Contractor’s emergency after-hours telephone number.
5. MWS Field Representative offices.
6. Metro office – Public Information Officer.
7. Principal subcontractors’ field and home offices.
8. Others as required.

I. Site Security - take positive measures to prevent entry of unauthorized persons to work site and storage areas at all times.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 55 26
TRAFFIC CONTROL

PART 1: GENERAL

1.01 SCOPE

A. Traffic Control

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit a vehicular and pedestrian traffic control plan for review to the appropriate agencies including but not limited to MWS, MPW, ADA, and/or TDOT. MWS will not issue an approval of a traffic control plan.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for traffic control incidental to the Work with no payment allowed unless a traffic control bid item is specifically indicated on the Bid Schedule.

1.04 GENERAL

A. Assume sole responsibility of traffic control operations and associated vehicular and pedestrian safety.

B. Provide traffic control processes needed to create a safe work zone and maintain the safety of vehicular and pedestrian traffic.

C. Provide traffic control for Work within local roads in accordance with MPW latest standards and permit provisions.

D. Provide traffic control for Work within state route and interstate right of ways in accordance with TDOT latest standards and permit provisions.

E. Provide certified flaggers, temporary signage, traffic control devices, and other incidentals necessary for the traffic control operations.

F. Ensure roadways are fully accessible to traffic during non-working hours.

G. Provide temporary ingress and egress to properties during working hours.

H. Coordinate and receive permit approval from MPW prior to roadway or lane closures for local roadways.

I. Coordinate and conform to the stipulations of TDOT permit requirements for Work within state route and/or interstate right of ways.

J. Utilize traffic control in accordance with of latest revision of Metropolitan Code of Laws including but not limited to Sections 13.20.030 and 13.20.090.

PART 2: PRODUCTS

2.01 TRAFFIC CONTROL

A. Provide traffic control devices in conformance with the latest revision of the Manual on Uniform Traffic Control Devices (MUTCD).

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 57 19
ENVIRONMENTAL CONTROLS

PART 1: GENERAL

1.01 SCOPE

A. Environmental Controls: Air Pollution, Noise Pollution, Construction and Site Waste, and Erosion/Sediment and Storm Water Pollution.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Air Pollution - Submit dust plan consisting of a sketch and narrative indicating the dust control measures proposed for use, proposed locations, and proposed timeframe for their operation.

C. Noise Pollution - Submit noise plan consisting of a sketch and narrative indicating the noise control measures proposed for use, proposed locations, and proposed timeframe for their operation and Identify further options if proposed measures are later determined to be inadequate.

D. Construction and Site Waste - Submit plans, permits, and certifications.

E. Erosion/Sediment and Storm Water Pollution - Submit plans, permits, and certifications. At a minimum, prepare, submit, and comply with: Notice of Intent (NOI) and Storm Water Pollution Prevention Plan (SWPPP).

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for environmental controls incidental to the Work with no separate payment allowed.

B. Consider additional environmental controls required by MWS or other agencies having jurisdiction during the course of the Work incidental with no separate payment allowed.

1.04 GENERAL

A. Maintain onsite and offsite work areas free from environmental pollution that violates federal, state, local regulations and/or generates complaints from the Public.

B. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

C. Notify MWS immediately of any violations of noncompliant or complaints concerning environmental controls.

D. MWS reserves the right to stop construction activities that cause or are likely to cause harm to the environment. Time extensions and payments for non-compliant acts will not be granted.

E. Dispose of waste materials at Metro approved sites

F. Do not burn waste materials on the project site.

1.05 AIR POLLUTION CONTROL

A. Comply with air pollution control requirements that conform with rules, regulations, laws and/or ordinances of all regulatory agencies.

B. Maintain dust control using standard practices acceptable to MWS.

C. Minimize air pollution by requiring properly operating combustion emission control devices be used on construction vehicles and equipment and encourage shutting down motorized equipment when not in use.

D. Do not burn material on the construction site.

E. Minimize air pollution from fumigate chemicals used in construction processes by requiring ventilation devices and equipment be used.

1.06 NOISE POLLUTION CONTROLS

A. Minimize noise pollution from vehicles, equipment, and activities to conform to latest TOSHA standards and abide by local codes, ordinances, regulations, rules, and laws.

B. Schedule and conduct the work in a manner which minimizes the noise level escaping the site, especially at night and on weekends to cause the least annoyance to residents and businesses.

C. Equip construction equipment with mechanical devices necessary to minimize noise.

D. If pile driving is required, use only pile driver hammers with mufflers able to significantly reduce noise and use noise barriers or shielding techniques to comply with applicable federal, state and local ordinances.

E. MWS reserves the right to determine when excessive noise is being generated and require additional noise control measures at no additional cost.

1.07 CONSTRUCTION AND SITE WASTE

A. Use chemicals such as herbicides, pesticides, disinfectants, polymers, reactants or other chemicals needed for the Work that are approved by USEPA, U.S. Department of Agriculture or any other applicable regulatory agency.

B. Use and dispose of chemicals per the manufacturer's instructions.

C. Comply with local, state, and federal regulations concerning transporting and storing chemicals and/or site waste.

D. Keep motorized equipment in good working order and remove damaged or leaking equipment from project site.

E. Identify and use appropriate areas for fuel storage, fuel equipment, and containment provisions.

F. Do not change oil on equipment or store or dispose solvents, lubricants, or other potentially hazardous materials onsite.

G. Do not store more than a weekly usage volume for fuels or dispose fuels onsite.

H. Report spills or leaks from fueling equipment or construction equipment to MWS and proper authorities. Clean up and mitigate spills as required by local, state or federal regulations.

I. Remove and properly dispose of trash and debris resulting from construction activities.

J. Properly dispose of excess excavated material not required or not suitable for backfill and other waste material in accordance with regulatory requirements at regulated disposal sites.

K. Provide watertight container for liquid, semiliquid or saturated solids which tend to bleed during transport.

L. Properly dispose of concrete waste material at regulated disposal sites.

1.08 EROSION/SEDIMENT AND STORM WATER POLLUTION

A. Comply with the following statement:

"All activities performed in under this solicitation and resulting contract/PO shall be conducted in full compliance with Metro Code of Law §§ 15.64 et al (Storm water Management) including §§ 15.64.205 (http://www.nashville.gov/Water-Services/Pollution-Prevention/Illicit-Discharge-Ordinance.aspx). This requirement pertains to Unlawful/Prohibited Discharges to the Metro Storm Sewer System/Community Waters. It prohibits the discharge of "wastewater" and "non-stormwater" discharges such as wash water, process wastewater, etc. into the Municipal Storm Sewer System (MS4) or into Community Waters. Any questions relating these provisions should be routed to the Metro Water Services NPDES Office at (615) 880-2420. This requirement shall apply to all Metro construction projects in the service area, including areas outside Davidson County. Contractor shall bear responsibility for all of Contractor's actions that cause MWS to violate project regulatory permits or Federal,

State or local environmental regulations. Such permits and regulations may include, but are not limited to: U.S. Army Corps of Engineers 404 Permits; TDEC Aquatic Resource Alteration Permits; TDEC Construction General Permits; Any State or Federal permits/approvals related to Threatened and Endangered Species; Metro Individual NPDES permits; Metro Code §15.64.205 - Metro Illicit Discharge Ordinance; Metro Stormwater Management Manual. Contractor's responsibility shall include, but not be limited to, payment of all fines, assessments and/or civil penalties incurred due to Contractor's work, actions, design or installation and payment for any mitigation measures required due to the violation and cleanup associated with any violation."

B. Reference and comply with procedures outlined in the latest revisions of the following:

1. United States Environmental Protection Agency (USEPA): USEPA-72-015: Guidelines for Erosion and Sedimentation Control Planning and Implementation;
2. USEPA 43019-73-007: Processes, Procedures, and Methods to Control Pollution Resulting from All Construction Activity for Environmental Controls;
3. Tennessee Department of Environment and Conservation (TDEC): TDEC General NPDES permit for Storm Water Discharged Associated with Construction Activities;
4. TDEC Erosion & Sediment Control Handbook; and
5. Metropolitan Government of Nashville and Davidson County, Department of Water and Sewerage Services (MWS) - Stormwater Management Manual for environmental controls.

C. Comply with provisions of Metro Water Services Stormwater Management guidance documents with Best Management Practices and TDEC regulations.

D. Notify MWS and take immediate corrective action for notifications of noncompliance of stormwater pollution control or any environmentally objectionable acts from federal, state, or local regulatory agencies. Failure to promptly address notifications of noncompliance may result in a stop work order until satisfactory corrective actions have been completed with no claims for time, expense, or damage considered.

E. Comply with rules, regulations and permit requirements from local, state, and federal government agencies prohibiting pollution in lakes, streams, rivers,

wetlands, sewers, or storm sewers by dumping refuse, rubbish, spoils, chemicals, wastewater, stormwater, dredge material, or debris.

F. Keep SWPPP and related documents onsite during construction available for review by regulatory authorities.

G. Make corrections or repairs to erosion control devices when non-functional or at the request of MWS or other agencies having jurisdiction.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 58 00

TEMPORARY PROJECT IDENTIFICATION

PART 1: GENERAL

1.01 SCOPE

A. Temporary Project Identification: Project Sign

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit information to be placed on the project sign and proposed location for review and approval before fabrication.

C. Identify and submit deviations from the detail for review and approval.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for project signs incidental to the Work with no separate payment allowed.

1.04 PROJECT SIGN

A. Furnish, erect, and maintain near the work limits a project sign(s) sized and lettered as shown on the details found at the end of this section.

B. Provide project sign(s) at a minimum of 72 hours prior to staring the Work.

C. Do not erect other commercial or advertising signs on the work site or on public property in the vicinity of the work.

D. Provide signs as indicated on the following details.

E. Maintain quality sign appearance throughout the life of the project. Replace signs as warranted or as directed by MWS.

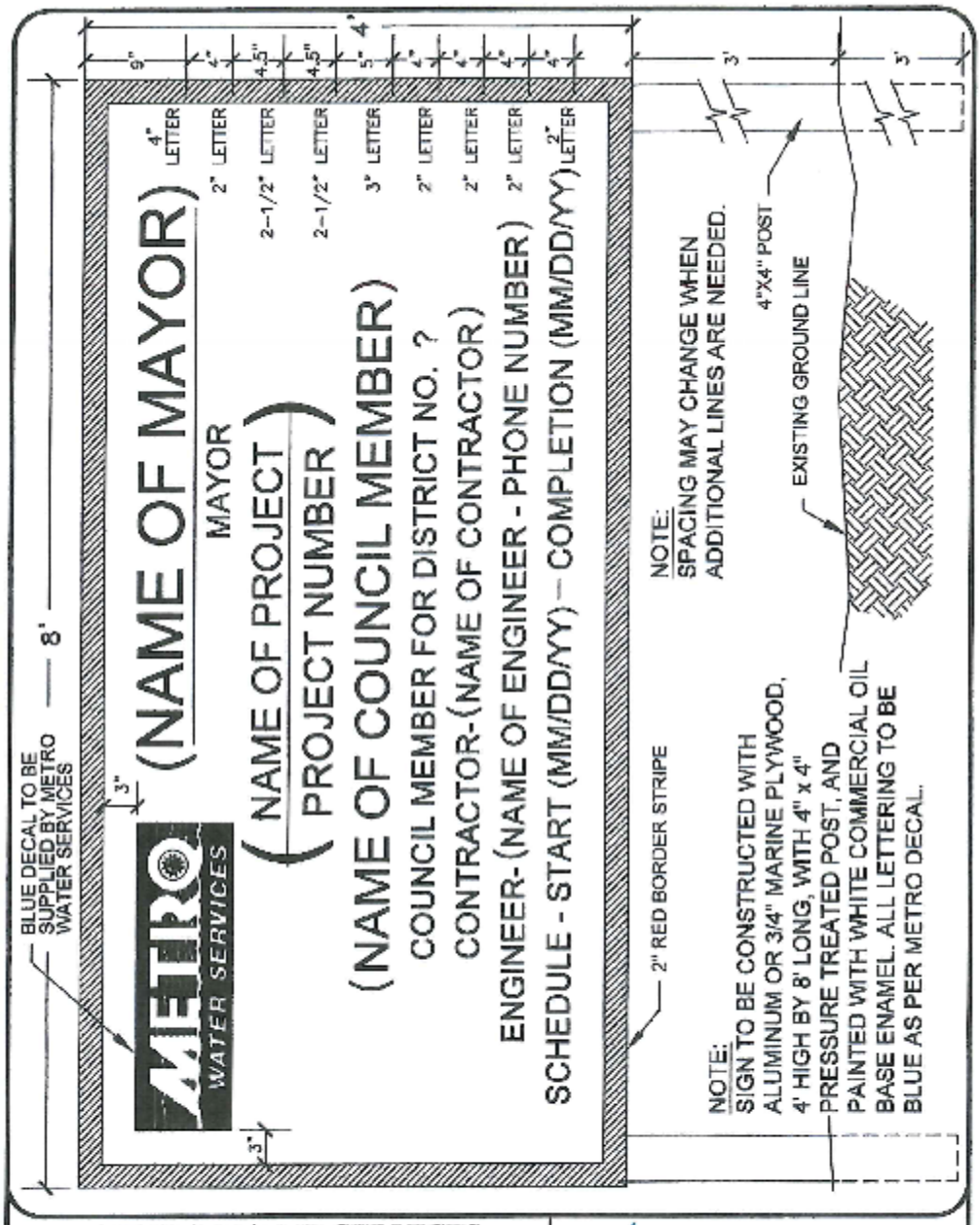
F. Provide a number of signs to adequately identify all work zones. MWS reserves the right to require multiply signs.

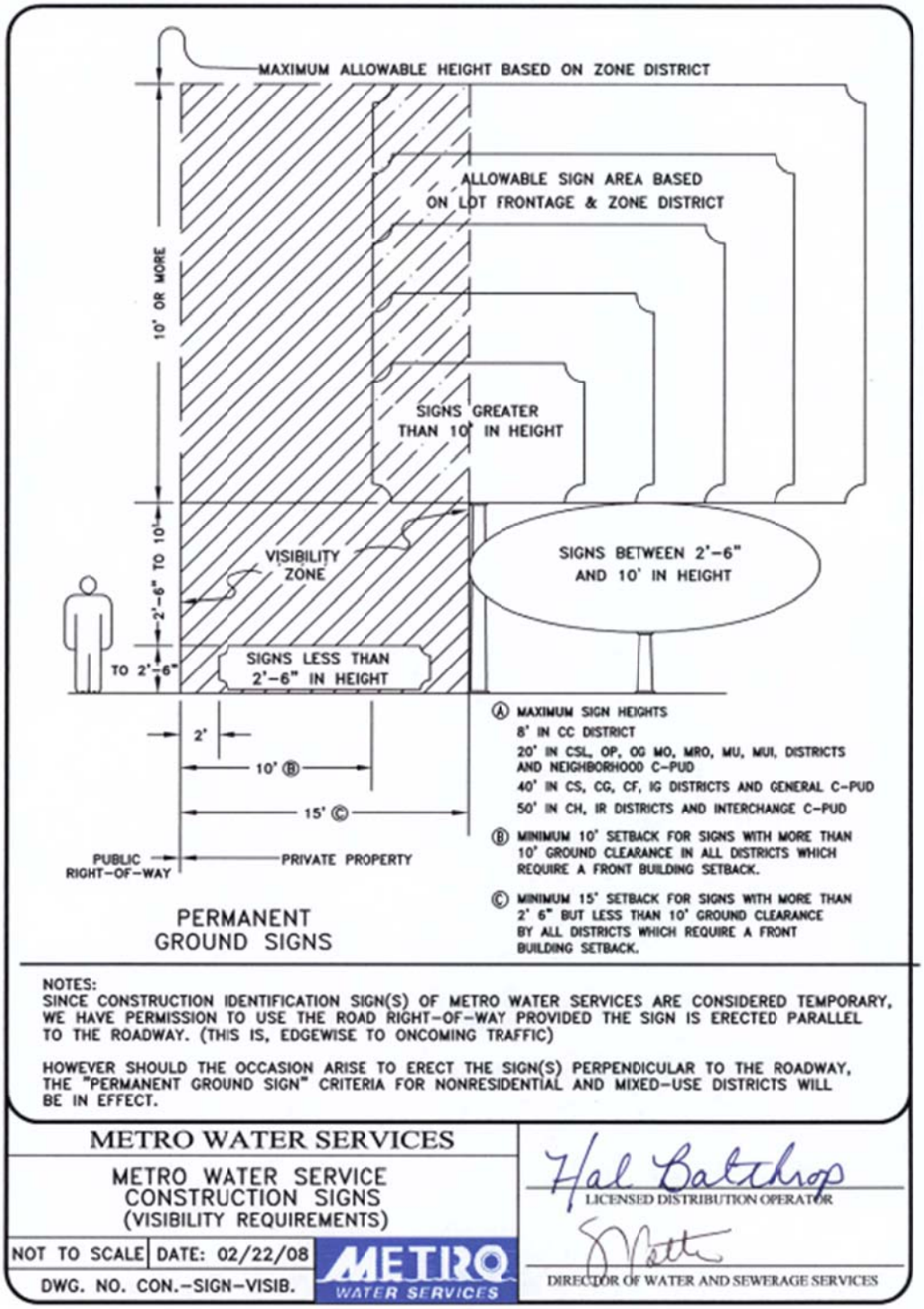
PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED


BLUE DECAL TO BE SUPPLIED BY METRO WATER SERVICES
8'
3"
METRO WATER SERVICES
(NAME OF MAYOR)
MAYOR
(NAME OF PROJECT)
PROJECT NUMBER
(NAME OF COUNCIL MEMBER)
COUNCIL MEMBER FOR DISTRICT NO. ?
CONTRACTOR-(NAME OF CONTRACTOR)
ENGINEER-(NAME OF ENGINEER - PHONE NUMBER)
SCHEDULE - START (MM/DD/YY) – COMPLETION (MM/DD/YY)
4" LETTER
2" LETTER
2-1/2" LETTER
2-1/2" LETTER
3" LETTER
2" LETTER
2" LETTER
2" LETTER
2" LETTER
9"
4"
4.5"
4.5"
5"
4"
4"
4"
4"
4"
4'
3'
3'
2" RED BORDER STRIPE
NOTE:
SIGN TO BE CONSTRUCTED WITH ALUMINUM OR 3/4" MARINE PLYWOOD, 4' HIGH BY 8' LONG, WITH 4" x 4" PRESSURE TREATED POST, AND PAINTED WITH WHITE COMMERCIAL OIL BASE ENAMEL. ALL LETTERING TO BE BLUE AS PER METRO DECAL.
NOTE:
SPACING MAY CHANGE WHEN ADDITIONAL LINES ARE NEEDED.
4"X4" POST
EXISTING GROUND LINE
METRO WATER SERVICES
CONSTRUCTION SIGN
NOT TO SCALE
DATE: 10/20/15
DWG. NO. CON-SIGN
METRO WATER SERVICES
LICENSED DISTRIBUTION OPERATOR
DIRECTOR OF WATER AND SEWERAGE SERVICES



END OF SECTION

SECTION 01 66 00

PRODUCT STORAGE AND HANDLING

PART 1: GENERAL

1.01 SCOPE

A. Product storage and handling

1.02 MEASUREMENT AND PAYMENT

A. Consider expenses for product storage and handling incidental to the Work with no separate payment allowed.

1.03 PACKING, TRANSPORTATION, AND HANDLING

A. Require supplier/vendor to package products in manufacturer's recommended shipping, handling, and/or storage containers.

B. Transport, store, and handle products in accordance with the manufacturer's instructions.

C. Protect sensitive products against exposure to the elements and moisture.

D. Protect equipment and finishes against impact, abrasion, and other damages.

E. Provide the proper equipment and personnel to handle products, including any products furnished by MWS, to prevent damages.

1.04 DELIVERY

A. Schedule the delivery of products in accordance with the Construction Progress Schedule allowing sufficient time for MWS examination prior to installation.

B. Deliver products to designated MWS approved and accessible locations.

C. Clearly mark product deliveries for installation and MWS examination and inventory.

D. Promptly examine delivered products in the presence of MWS to ensure items comply with project requirements.

E. Reject damaged or incorrect products at no cost to MWS.

1.05 STORAGE

A. Properly store products immediately upon delivery in accordance with the manufacturer's instructions.

B. Arrange products to provide reasonable access for examinations.

C. Provide platforms or other means to prevent soiling, staining, or corrosion of stored product.

D. Provide adequate ventilation to avoid condensation when storing items vulnerable to moisture.

E. Maintain stored products in accordance with the manufacturer's instructions.

F. Do not store PVC products in sunlight.

G. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign materials.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1: GENERAL

1.01 SCOPE

A. Closeout procedures including final submittals such as operation and maintenance data, warranties, spare parts, and maintenance materials.

1.02 MEASUREMENT AND PAYMENT

A. Consider expenses for closeout procedures incidental to the Work with no separate payment allowed.

1.03 CLOSEOUT PROCEDURES

A. Start closeout procedures after substantial completion of the Work.

B. Remove all paint markings from the project area that were originated for this Work, regardless of who applied the markings.

C. Accompany MWS for an initial walkthrough to generate a punch list.

D. Complete or correct punch list items.

E. Accompany MWS for a final walkthrough and correct any deficient items.

F. Comply with the Contract Documents General Conditions as it relates to final completion and final payment when the Work is complete.

G. Discovery of new items not on the original punch list or arise after the punch list and final review have been completed are considered warranty items and must be addressed within less than 30 calendar days of notification by MWS during the warranty period.

H. Provide Project Record Documents prior to project closeout.

I. MWS reserves the right to initiate close out procedures for portions of the Work.

J. Submit operation and maintenance information.

K. Provide required contract documents prior to final closeout.

1.04 WARRANTIES

A. Provide the originals of each warranty from subcontractors, suppliers, and/or manufacturers.

B. Provide warranties prior to final application for payment.

C. Guarantee all Work for a 1-year warranty period unless a longer warranty period is specified for the entire Work or portions of the Work.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1: GENERAL

1.01 SCOPE

A. Project Record Documents

1.02 MEASUREMENT AND PAYMENT

A. Consider expenses for project record documents incidental to the Work with no separate payment allowed.

1.03 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit clean, legible, red line, Record Drawings signed by a responsible party of the actual work installed varying from the Drawings, standards, and/or Specifications.

C. Submit Change Authorizations, Field Authorizations, and/or Change Orders modifying the original documents.

D. Submit field testing records, video tapes, and project-related testing documents.

E. Submit third party, independent laboratory, and/or inspection certificates.

F. Submit operation and maintenance manuals in labeled three-ring binders and a digital copy.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 03 30 00
CAST IN PLACE CONCRETE

PART 1: GENERAL

1.01 SCOPE

A. Cast in place concrete for structures requiring reinforcement.

B. This Section does not include Metro Public Works and TDOT above grade concrete elements within the right of way, flowable fill, precast concrete, and standard thrust blocking.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit a certification from the concrete producer that the concrete is suitable for the application and conforms to the compressive strength needed for the proposed component of the Work.

C. Submit manufacturer's product data with application and installation instructions for proprietary materials and items.

D. Submit actual design mix including admixtures with test cylinder breaks for 7 and 28 days.

E. Submit reinforcing schedule and drawings including fabrication, bending, and placement with a minimum scale of 3/8" = 1' 0".

F. Submit affidavit indicating the heat numbers and origin of reinforcement.

G. Do not submit reproduction of structural drawings for shop drawings.

H. Submit laboratory test reports for concrete materials to MWS on same day that tests are made.

I. Submit Manufacturer's letter of certification that curing compound will not adversely affect the adhesion of subsequent materials to be applied to concrete.

J. Submit concrete truck tickets upon delivery.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing cast in place concrete at the contract unit price on the Bid Schedule.

B. Include all cost in the unit price for cast in place concrete for reinforcement, form work installation and removal, finishing, third party testing, and all incidentals necessary for a complete and operable installation.

1.04 GENERAL

A. Perform the Work in accordance and comply with the latest revision of American

Concrete Institute (ACI), Concrete Reinforcing Steel Institute (CRSI), and American Society of Testing Materials (ASTM) standards.

B. Obtain materials from same source throughout Work.

C. Notify MWS not less than 24 hours after reinforcement has been placed for examination and 24 hours prior to pouring concrete.

PART 2: PRODUCTS

2.01 CONCRETE MIXES

A. Use ready-mixed concrete in conformance with the latest requirements of ASTM C 94.

B. Provide a concrete mix with a minimum 28-day compressive strength of 4,000 psi.

2.02 CONCRETE MATERIALS

A. Provide Type II Portland Cement in conformance with the latest requirements of ASTM C 150, unless otherwise approved in writing by MWS.

B. Provide American manufactured Type II Portland Cement with an equivalent alkali content of less than 0.60 percent that has been shipped from a single manufacturer throughout the Work milled not more than three months prior to incorporation.

C. Provide Portland cement in complete unbroken sacks for job site mixing.

D. Add air entraining agent to entrain 4½ percent air ± 1 percent with all other ingredients as recommended by approved manufacturers in conformance with the latest requirements of ASTM C 260.

E. Use aggregates from a single source in conformance with the latest requirements of ASTM C 33.

F. Use fine aggregates with clean, hard, durable, uncoated particles, free of lumps of clay, soft or flaky material, loam, and organic matter, frozen material of any type, appreciable quantities of mica, shale, slate, or other soft grains.

G. Use fine aggregate that will not contain more than two percent by weight of material that may be removed by elutriation testing.

H. Use sands that pass the color metric tests unless the failure to pass is caused by lignite or coal particles.

I. Provide sand that limits alkali reactivity as defined in the latest requirements of ASTM Designations C 33, Appendix IX and C 289.

J. Use natural river sand or specially approved manufactured sand. Use of

mountain sand will not be permitted.

K. Use fine aggregates with 95 to 100 percent passing a No .4 screen size and a minimum of 2 to 10 percent passing a No. 100 screen size.

L. Use coarse aggregates with 100 percent passing a 1½-inch sieve and a minimum of 0 to 5 percent passing No. 4 screen size.

M. Use ¼ to ½ inch pea gravel for sections less than 3-inches in thickness.

N. Use potable water clean and free from injurious amounts of oils, acids, alkalis, organic materials, or other deleterious substances in conformance with the latest requirements of ASTM C 94.

O. Do not use water containing more than 500 mg/L of chlorides or sulfates.

P. Use chemical admixtures and Class F fly ash in conformance with the latest requirements of ASTM C 494 and ASTM C 618.

Q. If fly ash is acceptable for the application as an admixture, only use Class F in conformance with ASTM C 618.

2.03 CONCRETE REINFORCEMENT

A. Use uncoated deformed reinforcing bars of billet steel grade with 60,000 psi minimum yield strength in conformance with the latest requirement of ASTM A 615, Grade 60.

B. Use new reinforcing bars of new stock, free from rust, scale, or other coatings that could reduce bonding.

C. Use welded wire mesh, plain type in flat sheets or coiled rolls with uncoated finish, in conformance with the latest requirement of ASTM A 185.

D. Provide steel tie wire, minimum 16 gage annealed type, in conformance with the latest requirements of ASTM A 82, plain, cold drawn steel.

E. Use supports for reinforcement wire bar type supports complying with CRSI recommendations, unless otherwise approved.

F. Use supports with sand plates or horizontal runners where base material will not support chair legs for slabs on grade.

G. Provide supports with plastic protected legs, (CRSI, Class I) or stainless steel protected legs (CRSI, Class II) for exposed to view concrete surfaces where legs of supports are in contact with forms.

H. Use concrete masonry units to support reinforcement to obtain proper clearance from earth.

2.04 CONCRETE JOINTS

A. Provide watertight expansion joints.

B. For watertight joints utilizing steel plates, provide:

a. a steel slide recess clip;

b. expansion joint filler and sealant;

c. uncoated steel bar stock in conformance with the latest requirements of ASTM A36;

d. fabricated slide recess clip of 20 gauge steel with a hot dipped galvanized coating; and

e. an asphalt type expansion joint filler in conformance with the latest requirements of ASTM D994.

C. For watertight expansion joints utilizing rubber, provide a two part polysulfide rubber joint sealant in conformance with the latest requirements of ASTM C920.

D. Where indicated on the Drawings or directed by MWS, use pre-molded expansion joint material in conformance with the latest requirements of ASTM D1751.

E. Provide joint filler for exposed control joints in slabs on ground with a semi-flexible, 100% solids epoxy designed for nonmoving control joints, with a minimum shored hardness of 50.

2.05 MISCELLANEOUS

A. Provide non-shrink grout for pipe penetrations, field repairs, and other applications as directed by MWS to insure water tightness.

B. Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

C. Provide on the leading edge of stairs, steps, and landings non-skid cast aluminum nosing.

PART 3: EXECUTION

3.01 INSTALLATION

A. Provide concrete truck tickets with each truck or load of concrete delivered to the project site for placement with the following information listed on each ticket:

1. Project name,

2. Classification of concrete,

3. Time of the batching of material,

4. Batch weights of each material including water,
5. Additional materials added to concrete mix,
6. Initials of the concrete supplier's weight man or independent third party inspection service representative, and
7. Signature of a responsible party of the vendor certifying the truck conforms to the approved design mix for the Work.

B. Understand failure of supplying truck ticket is grounds for rejection of the load.

C. Protect concrete from the drying action of the sun; freezing weather; wash from rain or flowing water; muddy conditions; and other damaging conditions.

D. When concrete is mixed or delivered by truck mixer, place concrete within the time recommended by the manufacturer or 90 minutes, whichever is less.

E. Consider weather, including temperature, when placing concrete in accordance with the latest requirements of ACI 305 and ACI 306.

F. Mix and place concrete when the temperature is 40 degrees Fahrenheit and rising or not to exceed 85 degrees Fahrenheit, unless MWS approved means are employed.

G. Prevent segregation and loss of ingredients when conveying concrete from the mixer to the forms by controlling the speed and drop height of placement.

H. Do not drop concrete into forms from a height greater than 5 feet.

I. Avoid coating of reinforcement or form surfaces with concrete paste that could dry before coverage of concrete.

J. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness.

K. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints.

L. Pour each layer of concrete while the preceding layer is still plastic to avoid cold joints.

M. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping.

N. Avoid the use of vibrators to transport concrete inside forms or into lower layers of concrete that have begun to set.

O. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

P. Pour concrete to the grades and slopes as indicated on the Drawings.

Q. Check and level surface plane to a tolerance not exceeding 5/16-inch in 10 feet when tested with a 10 feet straight edge.

3.02 REINFORCEMENT

A. Comply with CRSI recommended practice for placing reinforcing bars, for details and methods of reinforcement placement and supports.

B. Position, support, and secure reinforcement against displacement by formwork, construction or concrete placement operations.

C. Provide a minimum of four extra diagonal bars in each face of the wall or slab of the same size of the largest bar in the wall or slab for openings 12 inches and larger.

D. Provide a minimum area of steel reinforcing equivalent to 0.0018 times the cross sectional area of the concrete work performed for Class A concrete walls, slabs and other concrete work if through an omission no reinforcement.

E. Lap all bars a minimum of 40 diameters at splices unless a greater lap is indicated on the Drawings.

F. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

G. Place reinforcement to obtain at least 2-inch coverage.

H. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.

I. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

J. Bend reinforcing bars cold and do not heat bars with a torch.

K. Install welded wire fabric in as long of lengths as practicable.

L. Lap adjoining welded wire pieces at least one full mesh opening and lace splices with wire.

M. Offset end laps of welded wire pieces in adjacent widths to prevent continuous laps in either direction.

N. Place wire mesh in the top third of the slab thickness.

3.03 FORMWORK AND ACCESSORIES

A. Construct and erect concrete formwork in accordance with the latest requirements of ACI 301 and ACI 347.

B. Remove forms when concrete has attained strength sufficient for support of the

superimposed loads.

C. Removal of cold weather forms will not be permitted when the danger of freezing or damaging of the concrete surface exists.

D. Provide openings in concrete formwork to accommodate work of other trades.

E. Coat contact surfaces of forms in compliance with manufacturer's instructions with a form coating compound before reinforcement is placed.

F. Furnish form material in largest practicable sizes to minimize number of joints and to conform to joint system as required.

G. Provide ties that leave no metal within 1-1/2-inch of the surface and exhibit a cone shaped depression at least 1-1/2-inch deep to allow filling and patching.

H. Use form coatings inside clearwells that are approved by the waterproofing manufacturer and MWS.

3.04 JOINTS

A. Provide construction joints as indicated on the Drawings but no more than 30 feet in each direction or more than 900 square feet.

B. Provide vertical construction joints at 30 feet intervals or less from corners or above grade water holding basin walls and below grade dry spaces.

C. Provide horizontal construction joints at 30 feet intervals or less in walls enclosing dry spaces below grade.

D. Provide for all joints, except expansion joints, reinforcing steel extending into subsequent sections of construction to make the work a monolith.

E. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.

F. Place construction joints perpendicular to the main reinforcement.

G. Continue reinforcement across construction joints.

H. Locate construction joints in footings and walls across areas of low shearing stress and provide keyways, water stops, and/or expansions joints as indicated on the Drawings.

I. Locate construction joints near the middle of spans of slabs, beams, or girders unless a beam interests a grinder at this location, in which case offset the joints in the girder a distance equal to twice the beam width. Make a provision for shear with the use of inclined reinforcement.

J. Construct isolation joints in slabs on grade at points of contact between slabs on

ground and vertical surfaces, such as columns, foundation walls, grade beams and elsewhere as indicated.

K. Construct control joints in slabs on ground to form panels of patterns as indicated on the Drawings.

L. Use control joint inserts of ¼ inch wide by ¼ of the slab depth or saw cuts to ¼ of slab depth, unless otherwise indicated.

M. Provide spacing of control joints in slabs on grade at distances not exceeding 15 feet.

3.05 CONCRETE CURING AND PROTECTION

A. Protect freshly placed concrete from premature drying and temperatures harmful to the concrete in accordance with ACI 308 procedures and avoid rapid drying at end of final curing period.

B. Interior Floor Slabs

1. Apply by means of a roller or spray gun a membrane curing compound designed to cure, seal, harden, and is dustproof within 30 minutes of the completion of finishing operations and/or immediately after the disappearance of the surface moisture sheen.
2. Apply the coating to slab surfaces uniformly at the manufacturer's recommended rate.
3. Cover with curing sheets meeting the latest requirements of ASTM C171 if the floor slab is completed prior to the building envelope.
4. Secure, maintain, and anchor in place for a minimum of seven days.

C. Exterior Slabs and Water Holding Basin Floor Slabs

1. Apply and seal with a hydrocarbon, resin-based compound meeting the latest requirements of ASTM C309 within 30 minutes of the completion of finishing operations in accordance with the manufacturer's instructions.
2. Apply coatings uniformly at the manufacturer's recommended rate.
3. Use as an alternate means of curing, a burlap covering system to completely cover the exterior slab and continuously soak with a potable water sprinkler system for four days only with MWS approval.

3.06 CONCRETE SURFACE REPAIRS

A. Conform to applicable requirements of ACI 301 for concrete repair.

B. Repair and patch defective areas with cement mortar immediately after removal of forms to match color, shape, grade, slope, and texture of surrounding repaired

areas for exposed to view surfaces when dry.

C. Cut out, perpendicular to the concrete surface and expose reinforcing steel with at least 3/4-inch clearance all around: honeycomb, rock pockets, voids over 1/4-inch in any dimension, down to solid concrete but, in no case to a depth of less than 1-inch.

D. Thoroughly clean, dampen with water, brush-coat the area to be patched with the appropriate bonding compound, and place patching mortar after bonding compound has dried.

E. Flush out form tie holes and fill with dry pack mortar or precast cement cone plugs secured in place with bonding agent.

F. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete.

G. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

H. Use epoxy-based adhesive and/or mortar for structural repairs where directed by MWS.

I. Remove and replace concrete having defective surfaces if defects cannot be repaired to the satisfaction of MWS.

3.07 CONCRETE FINISHING OF FORMED SURFACES

A. Conform to applicable requirements of ACI 301 for concrete finishing.

B. Coordinate final finish with MWS before application.

C. Provide concrete finish as indicated on the Drawings or as directed below:

1. Smooth form finished for concrete to receive membrane waterproofing;
2. Scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile;
3. Float finish to monolithic slab surfaces to receive trowel finish and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing;
4. Trowel finish to monolithic slab surfaces to be exposed to view, and slab surfaces to be covered with resilient flooring, paint or other thin film finish coating system;
5. Monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded;

6. Float finish of all water holding basin floor slabs;
7. Non-slip broom finish to exterior concrete platforms, steps and ramps;
8. Hand trowelled at the edges of floor slabs, around building columns, and other surface interruptions.
9. Provide a smooth trowel finish for slab recesses intended to receive equipment or furnishings.
10. Provide a minimum of three trowellings of interior floor slabs.

D. Refloat surface after cutting down high spots and filling low spots and uniformly slope surfaces to drains.

3.08 QUALITY CONTROL AND TESTING

A. Obtain third party material testing firm, approved by and at no cost to MWS.

B. Assume responsibility for ensuring that all concrete and concrete placements meet the project requirements. Failure of MWS or third party testing laboratory to detect defective work, workmanship, or materials will in no way prevent rejection.

C. Perform material testing meeting the latest requirements of ACI 301, ASTM E 329 and ASTM C 172 or C 94; for the following:

1. Slump – ASTM C 143; one test for each concrete load at point of discharge and one test for each set of compressive strength test specimens;
2. Air Content – ASTM C 173, volumetric method for lightweight concrete; ASTM C 231, pressure for normal weight concrete; one for each set of compressive strength test specimens;
3. Concrete Temperature - Test hourly when air temperature is below 40 degrees Fahrenheit or greater than 80 degrees Fahrenheit; and each time a set of compression test specimens is made. Take and test one additional test cylinder during cold and hot weather cured onsite.
4. Compression Strength Test – Sample, store, and cure specimens in accordance with ASTM C 31. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required. Test specimens in accordance with ASTM C 39. Test one set, five specimens, for each concrete class of 25 cubic yards placed in any one day or for each 5,000 square feet of surface area placed. Test two specimens at 7 days, two specimens at 28 days, and one specimen retained in reserve for later testing if required.

D. Materials, including cement and aggregates, and operations shall be tested and examined as work progresses. Failure to detect defective work will not prevent rejection when defective concrete is discovered, nor will it obligate MWS for final acceptance.

E. Remove and replace concrete not meeting specified strengths and/or parameters at no cost to MWS. MWS may elect to allow the following tests to demonstrate in place concrete meets specifications instead of removal and replacement:

1. Cored cylinders in conformance with the latest requirements of ASTM C 42 when test results indicate specified concrete strengths and other characteristics have not been attained in the structure.
2. Load testing in conformance with the latest requirements of ACI 318 when after additional testing evidence indicates low strength concrete still exists.

F. Take approved corrective action when such defects are discovered. MWS or the third party testing laboratory will not be obligated to make a final acceptance until corrective action is completed.

G. Testing and/or retesting of materials and installed work, as directed by MWS, may occur at any time during work progress. Allow free access to material stockpiles and facilities.

H. Pay for testing, not specifically indicated to be done at MWS expense, including retesting of rejected materials and installed work.

3.09 MISCELLANEOUS CONCRETE ITEMS

A. Provide machine and equipment bases and foundations, as indicated on Drawings. Set anchor bolts and imbeds for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

B. Grout all column base plates, equipment bases, and other locations noted on the Structural Drawings with specified non-shrink grout.

C. Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as indicated on Drawings. Install all joint types, keyways, and expansion anchors as indicated on the Drawings.

END OF SECTION

SECTION 31 50 00
TRENCH SAFETY SYSTEMS

PART 1: GENERAL

1.01 SCOPE

A. Trench Safety Systems

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 - Submittal Procedures.

B. Submit a trench safety systems program and identify the TOSHA and OSHA competent person for the program. MWS will not issue an approval of the Trench Safety System Program.

C. Understand MWS does not assume any responsibility for acceptance and/or review of a submitted trench safety systems program.

D. Submit the design drawings and calculations for special shoring sealed by a registered TN Professional Engineer when required per TOSHA and OSHA standards.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for trench safety systems, operations, and designs incidental to the Work and no separate payment allowed.

1.04 GENERAL

A. Provide trench safety systems necessary to complete the Work in accordance with TOSHA and OSHA standards.

B. Assume sole responsibility for the implementation of the trench safety systems.

C. Provide maintenance and daily examinations of trench safety systems for the duration of the Work. Maintain records of daily examinations of the trench safety systems program.

D. Protect existing structures, streets, walkways, utilities, and other improvements against damages during excavation.

E. Take responsibility for damages and assume expenses for direct or indirect injury caused by the trench safety system activities to above ground facilities or below ground facilities.

F. Install and operate necessary dewatering and surface water control measures.

G. Cease Work immediately if evidence of potential cave-ins or slides are observed and move personnel to safe locations until the necessary precautions have been taken to safeguard personnel.

H. Indemnify and hold harmless MWS concerning trench safety systems including but not limited to failure to issue a stop work order for unsafe conditions.

PART 2: PRODUCTS

2.01 GENERAL

A. Provide suitable trench safety systems materials.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install and maintain trench safety systems in conformance with TOSHA and OSHA standards.

B. Verify the field conditions encountered during the Work are compatible with the trench safety systems program.

C. Verify trench safety program components are certified for conditions present.

D. Coordinate and provide safe access at all times within excavation for MWS to access the Work.

END OF SECTION

SECTION 32 10 00

PAVING AND ROADWAY RESTORATION

PART 1: GENERAL

1.01 SCOPE

A. Paving and Roadway Restoration

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit data confirming materials that meet specified requirements.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for paving and roadway restoration at the contract unit price on the Bid Schedule for the following items:

1. Asphalt milling measured in square yards - MWS will compensate for asphalt milling calculated by the specified milling thickness and limits indicated on the Drawings.

2. Asphalt paving measured in square yards - MWS will compensate for asphalt paving calculated by the specified paving thickness and limits indicated on the Drawings.

B. Consider expenses for temporary and permanent pavement markings, traffic detection loop repairs, water box adjustments, manhole casting adjustments, catch basin adjustments, other casting adjustments, and all other items necessary for a complete paving and roadway restoration incidental to the Work with no separate payment allowed.

1.04 GENERAL

A. Before performing any Work, secure required permits from Metro Public Works and/or TDOT. MWS will obtain TDOT permits.

B. For pavement and roadway restoration within local roads, conform to permit conditions and current Metro Public Works specifications.

C. For pavement repairs within state routes, refer to TDOT Standard Specifications for Road and Bridge Construction and TDOT permit conditions.

D. Provide temporary and permanent pavement markings to preconstruction alignments unless otherwise indicated on the drawings or directed by MWS.

E. Remove and replace at no extra cost nonconforming pavement materials.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 32 16 13

CONCRETE CURB AND GUTTER

PART 1: GENERAL

1.01 SCOPE

A. Concrete Curb and Gutter

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit data confirming materials meet specified requirements.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for installing concrete curb and gutters at the contract unit price on the Bid Schedule.

B. Include all cost in the unit price for concrete curb and gutters for form work, labor, equipment, material, and all incidentals necessary for a complete and operable installation.

1.04 GENERAL

A. Before performing any Work in the right-of-way, secure required permits from Metro Public Works and/or TDOT. MWS will obtain TDOT permits.

B. For construction of concrete curb and/or gutter within local roads, conform to permit conditions and current Metro Public Works specifications and standard details.

C. For construction of concrete curb and/or gutter within state routes, refer to TDOT Standard Specifications for Road and Bridge Construction and TDOT permit conditions.

D. Remove and replace at no extra cost nonconforming materials.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 32 16 23

CONCRETE SIDEWALK, DRIVEWAY, AND MEDIAN

PART 1: GENERAL

1.01 SCOPE

A. Concrete Sidewalk, Curb Ramp, Driveway, Driveway Ramp, and Median

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit data confirming materials used meet specified requirements.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for installing sidewalks, driveways, and ramps at the contract unit price on the Bid Schedule.

B. Include all cost in the unit price for sidewalks, driveways, and driveway ramps for form work, labor, equipment, material, and all incidentals necessary for a complete and operable installation.

1.04 GENERAL

A. Before performing any Work, secure required permits from Metro Public Works and/or TDOT. MWS will obtain TDOT permits.

B. For concrete sidewalks, driveways, ramps, and medians within local roads, conform to permit conditions and current Metro Public Works specifications and standard details.

C. For concrete sidewalks, driveways, ramps, and medians within state routes, refer to TDOT Standard Specifications for Road and Bridge Construction and TDOT permit conditions.

D. Remove and replace at no extra cost nonconforming materials.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 32 17 26

DETECTABLE WARNINGS

PART 1: GENERAL

1.01 SCOPE

A. Detectable Warnings

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit data confirming materials meet specified requirements.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing detectable warnings at the contract unit price per square foot for the unit installed complete and ready for operation.

B. Include all cost in the unit price for dateable warnings for preparing the surface to receive the detectable warnings and all incidentals necessary for a complete and operable installation.

PART 2: PRODUCTS

2.01 GENERAL

A. Conform to current Metro Public Works guidelines, standards and specification for detectable warnings.

B. Conform to the latest ADA requirements.

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 32 90 00
LANDSCAPING

PART 1: GENERAL

1.01 SCOPE

A. Topsoil, topsoil modifiers, sod, seeds, plants, trees, irrigation, miscellaneous, and warranty

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. If requested by MWS, provide samples and/or tags of the landscape components to be used for approval prior to installation.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for landscaping incidental to the Work with no separate payment allowed unless specifically included as a bid item on the Bid Schedule.

B. Furnish all landscaping components, labor, material, tools, appliances, and equipment required as part of landscaping with no separate payment allowed.

C. Perform rough and finish grading a part of landscaping with no separate payment allowed.

1.04 GENERAL

A. Comply with all local, state, and federal regulatory requirements concerning landscaping.

B. Plant or install materials during normal planting seasons for each type of landscape work required.

C. Match existing terrain contours by uniformly grading topsoil with a sufficient thickness (typically minimum of 4 inches thick) to promote vegetation growth and long term sustainability.

D. Protect topsoil from wind and water erosion until suitable growth has been established.

E. Protect existing landscaping components and grasses from damage during construction.

F. Obtain appropriate permits and receive written approval from MWS before removing any trees or shrubs.

G. Protect trees and shrubs designated to remain.

1.05 WARRANTY

A. Provide one year warranty, starting after final completion, on landscaping

components and grasses.

B. Replace dead and/or damaged landscaping components and grasses during the warranty period.

C. Periodically examine landscaping components and grasses for proper watering and spraying during the warranty period.

D. Consider damage caused by natural hazards such as hail, high winds, or storms included in the warranty.

E. Consider plants, trees, and grasses which die due to insects or diseases included in the warranty.

1.01 FINAL ACCEPTANCE

A. Request a final acceptance review from MWS at the end of the 1-year warranty period.

B. Request approval of grasses when the following conditions are met: no bare spots larger than 1 square foot and the total area of bare spots does not exceed 5 percent of the entire grass area.

C. Expect no partial acceptance of grasses.

PART 2: PRODUCTS

2.01 LANDSCAPING

A. Restore disturbed areas with similar components unless otherwise specified.

B. Supply topsoil that is fertile, friable, natural sandy loam surface soil and reasonably free of clay lumps, brush, weeds, non-soil materials, contamination, roots, stumps, and/or stones.

C. Obtain topsoil from local sources having similar characteristics found at the project site; do not obtain topsoil from bogs, marshes, or wetlands.

D. Provide an inorganic commercial fertilizer which is uniform in composition, dry and free flowing, in original unopened containers, each bearing the manufacturer's guaranteed analysis. Do not use caked, damaged or otherwise unsuitable fertilizer. Use the proper fertilizer mixes based on the manufacturer’s recommendations for the type of application.

E. Identify and provide soil modifiers as needed to topsoil to promote healthy growth and satisfy warranty conditions.

F. Provide grass seed, sod, trees, shrubs, hydro seeding, grass mats, etc. to match the existing vegetation of the surrounding area unless type is specified elsewhere.

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 33 00 01
WATER MAINS

PART 1: GENERAL

1.01 SCOPE

A. Water Mains, Temporary Water Mains, Water Main Taps and Connections, Abandonment of Water Mains, and Excavation and Backfill for Water Mains.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed water main pipe, joints, joint materials, specials, coatings, paint for exterior piping, and fittings for approval.

C. Submit crushed stone bedding and envelope material sieve analysis and compaction methods.

D. Submit asphaltic binder information certifying material is in conformance with the latest revision of Metro Public Works standard specification Section 02575 if the water main is to be installed within a Metro Public Works roadway or the latest revision of the applicable TDOT asphaltic binder specification if water main is to be installed within a TDOT roadway

E. Submit flowable fill information certifying material is in conformance with the latest revision of Metro Public Works standard specification Section 02225 if the water main is to be installed within a Metro Public Works roadway or the latest revision of the applicable TDOT flowable specification if water main is to be installed within a TDOT roadway.

F. Submit outside roadway backfill material source, quality information, and compaction methods.

G. Submit Proctor Density Test results in accordance with the latest revision of ASTM D698 or ASTM D1557 when required by MWS.

H. Submit compaction field testing results in accordance with the latest revision of ASTM D6938 or other approved method when required by MWS.

I. Submit manufacturer's product data for proposed temporary water mains if utilized.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing water mains at the contract unit price per linear foot for the water main installed complete and ready for operation. Measure the water main horizontally along the centerline of the pipe in

place including valves, bends, reducers, and offsets.

1. Include cost in the unit price for water mains for labor, equipment, material, cutting, laying, joints, lowering, raising, other offsets necessary to avoid obstructions, field adjustments of alignment, rodding, temporary sampling/filling/flushing caps, standby time and delay in MWS isolation of existing water mains, hydrostatic testing and other testing required, disinfection and all incidentals necessary for a complete and operable installation.
2. Include cost in the unit price for water mains for fittings whether fittings and/or offsets are indicated on the Drawings or not.
3. Include cost in the unit price for water mains for excavation. Excavation is unclassified with no distinction made between rock and/or dirt excavation. Rock excavation beyond anticipated or indicated in a provided geotechnical report will not be considered basis for additional payment.
4. Include cost in the unit price for water mains for crushed stone bedding, crushed stone envelope, and additional crushed stone used as backfill material when water main exceeds minimum depths.
5. Include cost in the unit price for water mains for outside of roadway backfill material.
6. Include cost in the unit price for water mains for dewatering operations including but not limited to water filtration systems for groundwater, obtaining permits with appropriate agencies on dewatering activities, and appropriately filtering and properly disposing of groundwater in accordance with permits.
7. Undercutting of undesirable material at the trench base and approved refill material to be paid with Unforeseen Work Elements allowance bid item.

B. MWS will compensate for furnishing and installing taps and connections at the contract unit price per each for each taps and connection complete and ready for operation.

1. Include all cost in the unit price for taps and connections for labor, equipment, excavation, material, rodding, backfilling, and all incidentals necessary for a complete and operable installation.

C. MWS will compensate for cutting and capping in order to abandon a water main at the contract unit price of each for each cutting and capping operation.

1. Include all cost in the unit price for cutting and capping for labor, equipment,

materials, permanent solid water main cap, removing valve boxes over valves on abandoned water mains, and all incidentals necessary for a complete water main abandonment operation.

D. MWS will compensate for furnishing and installing flowable fill at the contract unit price per theoretical cubic yard calculated utilizing the specified trench width per water main size, the length of water main installed, and the specified flowable fill depth; not the actual amount of flowable fill if more material is installed.

1. Include all cost in the unit price for flowable fill for excavation, material, labor, and all incidentals necessary for a complete installation.

E. MWS will compensate for furnishing and installing asphalt binder at the contract unit price per theoretical cubic yard calculated utilizing the specified trench width per water main size, the length of water main installed, and the specified asphalt binder depth; not the actual amount of asphalt binder if more material is installed.

1. Include all cost in the unit price for asphalt binder for excavation, material, labor, and all incidentals necessary for a complete installation.

F. MWS will compensate for furnishing and installing miscellaneous concrete at the contract unit price per cubic yard for concrete installed between a proposed water main traversing perpendicular and below an existing sewer main.

1. Include all cost in the unit price for miscellaneous concrete for excavation, materials, labor, and all incidentals necessary for a complete installation.

G. MWS will compensate for furnishing and installing temporary water mains at the contract unit price per linear foot for the temporary water main installed complete and ready for operation if indicated on the Bid Schedule. MWS will not compensate for furnishing and installing temporary water mains if being installed for contractor's ease of construction and convenience, or being installed due to contractor's negligence. Measure the temporary water main horizontally along the centerline of the pipe in place including valves, bends, reducers, and offsets.

1. Include all cost in the unit price for temporary water mains for labor, equipment, excavation, material, cutting, laying, temporary fittings, temporary valves, backfill, testing, disinfection, temporary connections to water system, temporary service connections, and all incidentals necessary for a complete and operable installation.

1.04 GENERAL

A. Calculate Bid Schedule payment items of flowable fill and asphalt binder by the

following table. If a wider than indicated trench width is utilized during construction, payment will only be compensated based on the trench width limits detailed in the following table.

Nominal Pipe Diameter (inches)	Trench Width (feet)
12 and smaller	2.5
14	3.0
16	3.0
18	3.0
20	3.5
24	4.0
30	4.5
36	5.0
42	6.0
48	6.5
54	7.0
60	8.0
64	8.5

B. Bury water main and backfill trench in roadways in accordance with the following table. Bury pipe at minimum depths unless additional depth is required to avoid an obstruction. Utilize crushed stone material compacted in maximum 8-inch lifts at the proper moisture content as the supplementary trench backfill material when water main must be installed below the minimum depths.

	MPW Roadway		TDOT Roadway
Nominal Pipe Size	Smaller than 12”	12” and Larger	All Pipe Sizes
Asphalt Binder above Flowable Fill to Grade	8”	8”	11”
Flowable Fill above Crushed Stone Envelope	14”	20”	24”
Crushed Stone Envelope above Top of Pipe	8”	8”	8”
Total Cover (Min Depths)	30”	36”	43”
Crushed Stone Bedding Below Bottom of Pipe	6”	6”	6”

C. Bury water main and backfill trench outside of roadways in accordance with the following table. Bury pipe at minimum depths unless additional depth is required to avoid an obstruction. Utilized native backfill material compacted in 12 inch lifts

as the supplementary trench backfill material when water main must be installed below the minimum depths.

Nominal Water Main Size	Total Cover (Minimum Depth)	Crushed Stone Bedding below Bottom of Pipe	Crushed Stone Envelope above Top of Pipe	Native Soil above Crushed Stone Envelope to Finished Grade
Smaller than 12”	30”	6”	8”	22”
12” and Larger	36”	6”	8”	28”

D. Maintain existing water services throughout construction.

E. Request shut down isolation times and durations in writing to MWS 48 hours in advance for approval.

F. Provide water customers at least 24 hour notice prior to an interruption of water service.

G. Do not operate valves on the existing system and/or new water mains placed in service.

H. MWS will make every reasonable effort to isolate and shut off the flow of water when required for the Work. Circumstances may prevent timely water shut offs such as but not limited to faulty valves, water main breaks, and lack of forces due to higher priority situations. Consider standby time due to these types of delays incidental to the Work will no separate payment allowed.

I. Do not make connections to the existing water system until applicable tests including; disinfection and hydrostatic testing have been performed and reported to MWS and found to be in compliance.

J. Install temporary caps on new water mains and tap sampling caps with a pluggable outlet of adequate size to be utilized as a sampling, filling and/or flushing location.

K. Install a solid permanent water main cap on the end of an existing water main when performing a cutting and capping operation for abandonment of a water main.

L. Remove valve boxes over valves on abandoned water mains.

M. Perform Proctor Density Test in accordance with the latest revision of ASTM D698 or ASTM D1557 when required by MWS. Test to be performed by an independent MWS approved materials testing firm. Pay for test if Work is found to be noncompliance.

N. Perform compaction field testing results in accordance with the latest revision of

ASTM D6938 or other approved method when required by MWS. Compaction tests to be performed by an independent MWS approved materials testing firm. Pay for test if Work is found to be noncompliance.

PART 2: PRODUCTS

2.01 GENERAL

A. Provide water main products and accessories from manufacturers in accordance with MWS published Approved Materials List.

B. Provide pipe, pipe fittings, plumbing fittings, and fixtures, including but not limited to, coated or uncoated brass or bronze materials that could come in contact with drinking water in accordance with the 2011 Reduction of Lead in Drinking Water Act that amends the Safe Drinking Water Act Section 1417 effective January 4, 2014. The following link provides further clarification and direction on the requirement: http://nepis.epa.gov/Adobe/PDF/P100GRDZ.pdf.

C. Provide ductile iron restrained joint pipe for water mains unless otherwise indicated on the Drawings.

D. Provide No. 57 or No. 67 crushed stone for pipe bedding, pipe envelope, and additional backfill material when water main exceeds minimum buried depths.

E. Provide asphaltic binder in conformance with the latest revision of Metro Public Works standard specification Section 02575 when the water main is to be installed within a Metro Public Works roadway and provide asphaltic binder in conformance with the latest revisions of the applicable TDOT specification when the water main is to be installed within a TDOT roadway.

F. Provide excavatable flowable fill in conformance the latest revision of Metro Public Works standard specification Section 02225 when a water main is to be installed within a Metro Public Works roadway and provide excavatable flowable fill in conformance with the latest revisions of the applicable TDOT specification when the water main is to be installed within a TDOT roadway.

G. Provide Certa-Lok Yelomine restraint joint pipe and fittings or approved equal for temporary water mains. Provide a temporary water main and fittings with a pressure rating equal to 1.5 times the working pressure and adequately sized to maintain the existing level of water service to the customers.

PART 3: EXECUTION

3.01 GENERAL

A. Deliver water main products and accessories to job site free of damages and/or

defects. If damages or defects are discovered, provide new material at no cost to MWS.

B. Store materials on site in enclosures or under protective above ground coverings.

C. Keep interiors of water main products free of dirt and debris.

D. Install water main, joints, and fittings per manufacturer's recommendations.

E. Install water main to maintain minimum cover as specified.

F. Install water main pipe in crushed stone gravel bedding in the dry.

G. Install dewatering systems, if necessary, for excavation and water main installation. Provide water filtration systems for groundwater, obtain permits with appropriate agencies for dewatering activities and appropriately filter and properly dispose of groundwater in accordance with permits.

H. Do not deflect water mains in excess of the manufacturer's recommendations.

I. Clean the inside of the bell and the outside of the plain end of the pipe with a wire brush wipe clean prior to joint assembly.

J. Clean all gaskets prior to joints and/or fittings assembly.

K. Grind all rough edges of the plain end of a field cut pipe.

L. Maintain a minimum of 10 feet horizontal separation when installing a water main sharing a parallel alignment with a sewer main or sewer service line.

M. If sufficient cover is available, install the water main over existing sewer mains or sewer service lines when sharing perpendicular alignments. Maintain a minimum vertical separation of 18 inches from the bottom of the water main to the top of the existing sewer mains or sewer service lines.

N. If sufficient cover is not available, install the water main under the existing sewer mains or sewer service lines when sharing perpendicular alignments. Maintain a minimum vertical separation of 24 inches from the bottom of the sewer main or sewer service to the top of the water main. Center the water main pipe at the point of the crossing to keep the joints at equal distances and as far as possible from the sewer main or sewer service line. Install concrete material between the water and sewer crossing for the entire width of the distance between the utilities and for a length of at least 6 feet centered at the point of crossing.

O. Disinfect water mains, valves, fittings, temporary water mains, and appurtenances in accordance with Section 33 13 10 Disinfection of Water Mains.

3.02 EXCAVATION

A. No blasting will be permitted.

B. MWS may limit the method of excavation if conditions warrant such as trenching within areas of high concentration of utilities.

C. Contact Tennessee One Call Center (1-800-351-1111) the location of buried facilities pursuant to TCA 65-31-101 through TCA 65-31-133; however, take sole responsibility for the location of all affected underground utilities.

D. Locate and preserve existing utilities. The types and locations of known existing utilities as indicated on the Drawings are approximate. Repair or replace damaged utilities, whether shown on the Drawings or not, at no cost to MWS.

E. Notify MWS immediately, stop the Work, and wait for MWS direction before resuming the Work if solvents, petroleum products, or any unknown chemical substance is discovered during excavation.

F. Do not remove any structures unless the structure is indicated to be removed on the Drawings or written approval is received by MWS.

G. Consider all excavation material unclassified, whether a geotechnical report is provided or not.

H. Saw cut pavement to trench width limits when excavation is within a roadway.

I. Excavate trench width to permit a minimum of 6 inches between the edge of the trench and the outside of the water main.

J. Excavate to allow for a minimum of 6 inches of crushed stone bedding below the bottom of the water main.

K. Remove unstable soil at the trench bottom if discovered and refill area with appropriate material. Notify and receive approval from MWS prior to undercutting and removing undesirable material at the trench base and utilizing approved refill material.

L. Remove all loose material from the trench bottom. Do not lay water mains and accessories directly on rock.

M. Excavate to allow minimum water main cover per water main size and roadway conditions as indicated.

N. Excavate in accordance with Trench Safety Systems, TOSHA and OSHA regulations, and permits.

O. Dispose of surplus excavated material at a Metro approved permitted site. Do not place excavated material on private property.

3.02 BACKFILL WITHIN ROADWAY

A. Take precautions not to damage the water main and water main accessories

during backfill operations. Replace damaged items at no cost to MWS.

B. Install specified backfill material for the full width of the excavated trench and to specified depths.

C. Install No. 57 or No. 67 crushed stone compacted to 95% Standard Proctor Density in 8-inch lifts for pipe bedding and pipe envelope. Place crushed stone bedding 6 inches below the bottom of the water main. Place crushed stone envelope to a height of 8 inches above the top of the water main. Utilize crushed stone material compacted in maximum 8-inch lifts at the proper moisture content as the supplementary trench backfill material when water main must be installed below the minimum depths.

D. Install flowable fill above crushed stone envelope at indicated depths.

E. Install asphalt binder above flowable fill at the indicated depths compacted flush with the roadway surface elevation. Maintain smooth driving surface until final paving is complete.

F. Remove the indicated thickness of asphalt binder as part of the milling operations when preparing to pave the roadway.

G. Install the indicated thickness of asphaltic surface mix as part of the paving operations in accordance with Metro Public Works or TDOT specifications.

H. Remediate any settlement of backfill material for a period of one year after final completion and final acceptance of the Work by MWS.

3.03 BACKFILL OUTSIDE OF ROADWAY

A. Take precautions not to damage the water main and water main accessories during backfill operations. Replace damaged items at no cost to MWS.

B. Install specified backfill material for the full width of the excavated trench.

C. Install No. 57 or No. 67 crushed stone compacted to 95% Standard Proctor Density in 8-inch lifts for pipe bedding and pipe envelope. Place crushed stone bedding 6 inches below the bottom of the water main. Place crushed stone envelope to a height of 8 inches above the top of the water main.

D. Install native soil compacted to 90% maximum Proctor Density in 12-inch lifts above the crushed stone envelope to finished grade. Utilize native soil material as the supplementary trench backfill material when water main must be installed below the minimum depths. Do not utilize rock greater than 8 inches as backfill.

E. Remediate any settlement of backfill material for a period of one year after final completion and final acceptance of the Work by MWS.

F. Seed and straw disturbed area to reestablish growth. Replace trees and vegetation removed during clearing and excavation with trees and vegetation of equal size or larger.

END OF SECTION

SECTION 33 05 16.17

VALVE BOXES, METER BOXES, AND VAULTS

PART 1: GENERAL

1.01 SCOPE

A. Precast valve boxes, meter boxes, and vaults.

B. This Section does not include Metro Public Works and TDOT structures.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed valve boxes, meter boxes, and vaults for approval.

C. Furnish five sets of notarized shop drawings and certificates of inspection, stating that the valve boxes, meter boxes, and/or vaults were constructed and satisfactorily tested for the conditions present on-site as to loadings in full compliance with these Specifications.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for furnishing, installing, and/or adjustment of boxes and vaults incidental to the Work with no separate payment allowed unless specifically included as a bid item on the Bid Schedule.

B. Include in the installation and/or adjustment of boxes and vaults the labor, equipment, materials, box or vault, footing blocks, box casting including lid, excavation, bedding, backfill, and incidentals necessary for a complete installation.

C. For vaults, if undesirable base material is discovered, undercutting undesirable material at the base and approved refill material to be paid with Unforeseen Work Elements allowance bid item.

PART 2: PRODUCTS

2.01 GENERAL

A. Furnish valve boxes and meter boxes in accordance with MWS published Approved Materials List.

B. Provide a minimum 4000 psi, 28-day compressive strength precast concrete sections of the sizes and configurations indicated on the Drawings, complete with reinforcement to support an AASHTO H-20 vehicle loading for valve boxes, meter boxes, and vaults.

C. For valve boxes and meter boxes, provide precast concrete footing blocks of the size, configuration and quantity indicated on the Drawings and provide Portland cement in conformance with the latest revision of ASTM C-150 Type 1 for use in establishing a full mortar bed to set the casting..

D. Provide sound, smooth, blemish free cast iron castings in conformance with the latest revision of ASTM A48, Class 30 with support of an AASHTO H-20 loading for vehicles and of the sizes and configurations indicated on the Drawings.

E. Provide hand ground contact surfaces for the covers and frames so that the cover rests securely on the frame without movement and is in contact with the frame for the entire perimeter of the contact surface.

F. Provide casting covers with the required identification indicated on the Drawings.

G. Provide vaults and vault lids indicated on the Drawings.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install valve boxes, meter boxes, and vaults plumb and flush with existing ground surface unless otherwise indicated on the Drawings.

B. For vaults, remove unstable soil at the base if discovered and refill area with appropriate material. Notify and receive approval from MWS prior to undercutting and removing undesirable material at the base and utilizing approved refill material.

END OF SECTION

SECTION 33 11 00.11

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1: GENERAL

1.01 SCOPE

A. Polyvinyl chloride (PVC) pipe and fittings

B. PVC pipe, joints, and fittings for low pressure sanitary sewers and gravity sewer mains.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittals Procedures.

B. Submit manufacturer's product data for proposed PVC pipe, joints, and fittings for approval.

C. Furnish five sets of shop drawings and a statement from the factory inspector, stating that the pipe was constructed and satisfactorily tested in full compliance with these specifications.

D. When required by MWS, furnish five sets of shop drawings and a statement from the factory inspector, stating that the joints, joint materials, specials, and fittings were constructed and satisfactorily tested in full compliance with these specifications.

E. Submit a certificate of inspection, sworn to by the factory inspector stating the number of and lengths of pieces of pipe making up the shipment.

F. Provide MWS with the access to observe all testing, if requested, and submit certified copies of all test results prior to pipe and fitting shipment.

G. Submit certification from the manufacturer verifying conformance with the latest revision of the applicable ASTM Standards.

1.03 MEASUREMENT AND PAYMENT

A. Compensation for PVC pipe and fittings is not addressed in this section; refer to gravity sewer mains and/or low pressure sanitary sewers specification sections.

B. Consider all requirements in this section incidental to the Work with no separate payment allowed.

PART 2: PRODUCTS

2.01 GENERAL

A. Provide PVC pipe laying nominal lengths of 14 or 20 feet for gravity sewer mains and 20 feet for low pressure sanitary sewers.

B. Provide PVC pipe with Styrene Butadiene Rubber (SBR) gaskets in conformance with the latest revision of ASTM F477.

C. Provide Cell Classification 12454 A or 12454 B PVC manufactured in conformance with the latest revision of ASTM D1784.

D. Provide piping marked with diameter, manufacture's name or trademark, pressure pipe type, grade and class to be clearly visible.

E. Provide Green Type P solvent cement conforming to the latest revision of ASTM D2564.

2.02 GRAVITY SEWER MAINS

A. Furnish PVC pipe, fittings, and accessory materials for gravity sewer mains in accordance with MWS published Approved Materials List.

B. Provide SDR 35 or SDR 26 PVC pipe and fittings as indicated on the Drawings.

C. For pipe 15 inches and smaller, provide pipe and fittings in conformance with the latest revision of ASTM D3034, with a pipe stiffness in conformance with the latest revision of ASTM D 3412 and a pipe joint in conformance with the latest revision of ASTM D3212.

D. For pipe 18 inches and larger, provide pipe and fittings in conformance with the latest revision of ASTM F679, with a pipe stiffness in conformance with the latest revision of ASTM D3412 and a pipe joint in conformance with the latest revision of ASTM D3212 for 18-inch and larger.

E. Provide SDR 35 or SDR 26 PVC full body injection molded or factory fabricated fittings and cleanout assemblies.

2.03 LOW PRESSURE SANITARY SEWERS FOR SIZES EQUAL TO OR LESS THAN 1 ¼"

A. Provide PVC Solvent Weld Pressure SDR 21 pipe manufactured in strict accordance with the latest revision of ASTM D2241 for physical dimensions and tolerances.

B. Provide fittings with the same pressure rating required for the pipe.

C. Provide each production run of pipe manufactured exceeding the test requirements for materials, workmanship, burst pressure, impact resistance, flattening, and extrusion quality conforming to the latest revision of ASTM D2241.

D. Provide belled end pipe with tapered sockets to create an interference type fit meeting dimensional requirements and the minimum socket length for pressure-type belled sockets conforming to the latest revision of ASTM D2672.

E. Provide pipe in nominal lengths of 20 feet.

F. Provide piping with a #12 AWG, high strength copper clad steel conductor with HDPE insulation rated for direct burial. Provide wire to be brought up into the valve box at 1,000 feet maximum intervals and taped to the top of the force main at minimum 10-foot intervals.

2.04 LOW PRESSURE SANITARY SEWER FOR SIZES GREATER THAN 1 ¼"

A. Provide Type 1, Grade 1 or 2 PVC SDR 21 pipe manufactured in strict accordance with the latest revision of ASTM D2241 for physical dimensions and tolerances and joints in accordance with the latest revision of ASTM-D3139.

B. Provide fittings with the same pressure rating required for the pipe.

C. Provide each production run of pipe manufactured exceeding the test requirements for materials, workmanship, burst pressure, impact resistance, flattening, and extrusion quality conforming to the latest revision of ASTM D2241.

D. Provide pipe in nominal lengths of 20 feet.

E. Provide single rubber gasket push-on (bell and spigot) joints designed so that the pipe and fittings may be connected without the use of solvent cement or any special equipment.

F. Provide solvent welded type joints for clean out assemblies.

G. Provide piping with a #12 AWG, high strength copper clad steel conductor with HDPE insulation rated for direct burial. Provide wire to be brought up into the valve box at 1,000 feet maximum intervals and taped to the top of the force main at minimum 10-foot intervals.

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 33 11 13.13

DUCTILE IRON PIPE AND FITTINGS

PART 1: GENERAL

1.01 SCOPE

A. Ductile Iron Pipe (DIP), Joints, and Fittings

B. Ductile iron pipe, joints, and fittings for water mains, sewer force mains, and gravity sewer mains.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed pipe, joints, joint materials, specials, coatings, paint for exterior piping, and fittings for approval.

C. Furnish five sets of shop drawings and a statement from the factory inspector, stating that the pipe was constructed and satisfactorily tested in full compliance with these specifications.

D. When required by MWS, furnish five sets of shop drawings and a statement from the factory inspector, stating that the joints, joint materials, specials, and fittings were constructed and satisfactorily tested in full compliance with these specifications.

E. Submit a certificate of inspection, sworn to by the factory inspector stating the number of and lengths of pieces of pipe making up the shipment.

F. Provide MWS with the access to observe all testing, if requested, and submit certified copies of all test results prior to pipe and fitting shipment.

G. Submit a certificate of inspection stating the pipes were hydrostatically tested to a minimum of 500 psi for a minimum of 5 seconds in conformance with the latest revision of AWWA Standard C151.

H. For pipes 30 inches and larger submit a certificate of inspection stating the pipes were subjected to a pressure equal to 75% of the 42,000 psi minimum yield strength for ductile iron pipe.

I. Submit certification from the manufacturer verifying conformance with the latest revision of the applicable AWWA Standards.

1.03 MEASUREMENT AND PAYMENT

A. Compensation for ductile iron pipe and fittings is not addressed in this section; refer to water mains, gravity sewer mains, and/or sewer force mains specification sections.

B. Consider all requirements in this section incidental to the Work with no separate payment allowed.

PART 2: PRODUCTS

2.01 GENERAL

A. Provide ductile iron pipe, fittings, and accessory materials that meet the requirements of NSF 61, Drinking Water System Components – Health Effects.

B. Provide ductile iron pipe laying nominal lengths of 18 or 20 feet.

C. Furnish ductile iron pipe and fittings from manufacturers in accordance with MWS published Approved Materials List.

D. Provide gasket lubricant in accordance with the manufacturer's instructions, NSF 61, and in conformance with the latest revision of AWWA Standard C111.

E. Gray iron fittings are not allowed.

2.02 DUCTILE IRON PIPE AND FITTINGS FOR WATER MAINS

A. Provide Pressure Class 350 ductile iron pipe for all pipe sizes in conformance with the latest revision of AWWA Standard C151.

B. Provide an interior cement mortar lining with asphaltic seal coating for all pipe, joints, and fittings in conformance with the latest revision of AWWA Standard C104.

C. For buried pipe, provide an exterior asphaltic coated surface, joints, and fittings in accordance with the latest revision of AWWA Standard C151.

D. For non-buried pipe, provide an exterior protective coating in accordance with the latest revisions of AWWA Standard C151 with the following:

1. Clean, dry, remove all existing paint and black coating, and sandblast with non-silica media for surface preparation in accordance with NAPF 500-3 Standard.
2. Apply TNEMEC N69(F) - Hi-Build Epoxoline II or approved equal at 4.0-6.0 mils for 1st coat.
3. Apply TNEMEC N69 - Color Hi-Build Epoxoline II or approved equal at 4.0-6.0 mils for intermediate coat.
4. Apply TNEMEC 1074/1075 Endura Shield Dark Blue or approved equal at 2.0-3.0 mils for finished coat.
5. Do not coat nameplates, brass, or stainless steel surfaces.

E. For sizes 24" and below, provide restrained joints and fittings with a minimum pressure rating of 350 psi in conformance with the latest revisions of AWWA

Standard C110, AWWA Standard C111, and AWWA Standard C153.

1. Provide Fast-Grip® joints, Field Flex-Ring® joints, Field LOK 350® joints, or approved equal for buried pipe in sizes 4” to 24”.
2. Provide Fast-Grip® fittings, Field Flex-Ring® fittings, Field LOK 350® fittings or mechanical joint fittings with Mega-Lug® or approved equal restraint for buried pipe in sizes 4” to 24”.
3. For fittings at fire hydrants and valves provide mechanical joint fittings with Mega-Lug® or approved equal restraint.
4. Provide flanged joints and fittings in above ground or vault applications.

F. For sizes above 24”, provide restrained joints and fittings with a minimum pressure rating of 250 psi in conformance with the latest revisions of AWWA Standard C110, AWWA Standard C111 and AWWA Standard C153.

1. Provide HP LOK® joints, TR Flex® joints, Flex-ring® joints, LOK-Ring® joints or approved equal for buried pipe in sizes greater than 24”.
2. Provide HP LOK® fittings, TR Flex® fittings, Flex-ring® fittings, LOK-Ring® fittings or mechanical joint fittings with Mega-Lug® or approved equal restraint for buried pipe in sizes greater than 24”.
3. For fittings at fire hydrants and valves, provide mechanical joint fittings with Mega-Lug® or approved equal restraint.
4. Provide flanged joints and fittings in above ground or vault applications.

2.03 DUCTILE IRON PIPE AND FITTINGS FOR GRAVITY SEWERS

A. Provide Pressure Class 350 ductile iron pipe for all pipe sizes in conformance with the latest revision of AWWA Standard C150 and AWWA Standard C151.

B. Provide interior 40 mil dry film thickness Protecto 401 Ceramic Epoxy or approved equal for all pipe and fitting sizes in conformance with the latest revision of ASTM E 96 Method A; ASTM B 117; ASTM G 95; ASTM G 22; ASTM D 714; An abrasion resistance test using European Standard EN 598:1994, Section 7.8; and a thickness test using SSPC-PA2.

C. Provide an exterior asphaltic coated surface on all buried pipe and fittings in accordance with the latest revision of AWWA Standard C151.

D. For sizes 24” and below, provide push-on type single joints with styrene butadiene rubber (SBR) gaskets with a minimum pressure rating of 350 psi in conformance with the latest revision of AWWA Standard C110, AWWA Standard C111, AWWA Standard C150, AWWA Standard C151, and AWWA Standard

C153.

E. For sizes above 24”, provide push-on type single joints with styrene butadiene rubber (SBR) gaskets with a minimum pressure rating of 250 psi in conformance with the latest revision of AWWA Standard C110, AWWA Standard C111, AWWA Standard C150, AWWA Standard C151, and AWWA Standard C153.

F. Within casing pipe, for sizes 24” and below, provide Fast-Grip® joints, Field Flex-Ring® joints, Field LOK 350® joints, or approved equal restrained joints with a minimum pressure rating of 350 psi in conformance with the latest revisions of AWWA Standard C110, AWWA Standard C111, and AWWA Standard C153.

G. Within casing pipe, for sizes above 24”, provide HP LOK® joints, TR Flex® joints, Flex-ring® joints, LOK-Ring® joints or approved equal restrained joint with a minimum pressure rating of 250 psi in conformance with the latest revisions of AWWA Standard C110, AWWA Standard C111, and AWWA Standard C153.

2.04 DUCTILE IRON PIPE FOR WASTEWATER FORCE MAINS

A. Provide Pressure Class 350 ductile iron pipe for all pipe sizes in conformance with the latest revision of AWWA Standard C151.

B. Provide interior 40 mil dry film thickness Protecto 401 Ceramic Epoxy or approved equal for all pipe and fitting sizes in conformance with the latest revision of ASTM E 96 Method A; ASTM B 117; ASTM G 95; ASTM G 22; ASTM D 714; An abrasion resistance test using European Standard EN 598:1994, Section 7.8; and a thickness test using SSPC-PA2.

C. For buried pipe, provide an exterior asphaltic coated surface, joints, and fittings in accordance with the latest revision of AWWA Standard C151.

D. For non-buried pipe, provide an exterior protective coating in accordance with the latest revisions of AWWA Standard C151 with the following:

1. Clean, dry, remove all existing paint and black coating, and sandblast with non-silica media for surface preparation in accordance with NAPF 500-3 Standard.
2. Apply TNEMEC N69(F) Hi-Build Epoxoline II or approved equal at 4.0-6.0 mils for 1st coat.
3. Apply TNEMEC N69 Color Hi-Build Epoxoline II or approved equal at 4.0-6.0 mils for intermediate coat.
4. Apply TNEMEC 1074/1075 Endura Shield Dark Blue or approved equal at 2.0-3.0 mils for finished coat.

5. Do not coat nameplates, brass, or stainless steel surfaces.

E. For sizes 24” and below, provide restrained joints and fittings with a minimum pressure rating of 350 psi in conformance with the latest revisions of AWWA Standard C110, AWWA Standard C111, and AWWA Standard C153

1. Provide Fast-Grip® Joints, Field Flex-Ring® Joints, Field LOK 350® Joints, or approved equal for buried pipe in sizes 4” to 24”.
2. Provide Fast-Grip® Fittings, Field Flex-Ring® Fittings, Field LOK 350® Fittings or Mechanical Joint Fittings with Mega-Lug® or approved equal restraint for buried pipe in sizes 4” to 24”.
3. Provide flanged joints and fittings in above ground or vault applications.

F. For sizes above 24”, provide restrained joints and fittings with a minimum pressure rating of 250 psi in conformance with the latest revisions of AWWA Standard C110, AWWA Standard C111 and AWWA Standard C153.

1. Provide HP LOK® Joints, TR Flex® Joints, Flex-ring® Joints, Lok-Ring® Joints or approved equal for buried pipe in sizes greater than 24”.
2. Provide HP LOK® Fittings, TR Flex® Fittings, Flex-ring® Fittings, Lok-Ring® Fittings or Mechanical Joint Fittings with Mega-Lug® or approved equal restraint for buried pipe in sizes greater than 24”.
3. Provide flanged joints and fittings in above ground or vault applications.

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 33 12 13

WATER SERVICE LINES AND CONNECTIONS

PART 1: GENERAL

1.01 SCOPE

A. Water Service Lines and Service Connections

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed pipe, joints, joint materials, specials, valves, and fittings for approval.

C. Furnish five sets of notarized shop drawings, stating that the piping, joints, joint materials, specials, valves, and fittings were constructed and satisfactorily tested in full compliance with these specifications.

1.03 MEASUREMENT AND PAYMENT

A. For service connections, MWS will compensate for furnishing and installing the connections or taps with the corporation stop and required fittings to the proposed or existing water main per each for the unit installed complete and ready for operation. Include all costs in the unit price for furnishing, installing, and testing the connection including but not limited to labor, materials, equipment, service, excavation, bedding, backfill, tapping the water main, corporation stop, fittings, and all incidentals necessary for a complete and operable installation.

B. For service lines, MWS will compensate for furnishing and installing water service line inside and outside of roadways horizontally along the centerline of the pipe in place from the water service connection location to the water main to the water meter box location and/or where construction ends per linear foot installed with no deductions in length for fittings, valves, corporation stops, and/or boxes. Include all costs in the unit price for furnishing, installing, and testing water service line, including but not limited to: labor, materials, equipment, excavation, backfill, pipeline, fittings, corporation stops, curb stops, and all incidentals necessary for a complete and operable installation. Consider the requirement of bored/jacked services lines to be incidental to the service line bid item with no separate payment allowed.

C. Compensate MWS for wet tap of service lines connections.

D. MWS will compensate, in addition to the contract unit price per linear feet of

copper water service line, a lump sum value of $250.00 for all lead service line replacements for the additional coordination efforts, proper disposal, and delays that may occur. The Contingency for Unforeseen Work Elements will be utilized to compensate for the additional lump sum amount of $250.00 for each lead service line replacement. There will be no other compensation for this effort.

1.04 GENERAL

A. Reconnect all existing service lines to the new water main, whether shown on the Drawings or not.

B. Jack and/or bore water service lines under existing pavement.

C. For water service lines 2-1/2 inches in diameter and smaller, the contractor shall replace galvanized and/or damaged water service lines from the water main to the meter with copper. Connections to include flared fittings at the water main with a minimum 12 inch long flexible gooseneck and with either compression or flanged fittings for connections at the meter.

D. Contact MWS if lead services are discovered. Replace lead service lines from the water main to the meter with copper only after timing of replacement has been coordinated with MWS and the customer. This may cause some delays and additional coordination. Replacement of lead service lines requires an additional sampling protocol that will delay the replacement of the service line until the protocol can be coordinated with the customer. Replacement of lead service lines also requires proper disposal of the lead material.

E. Replace all water service lines sizes less than ¾ inches in size.

F. Perform dry taps only.

G. Only MWS will perform wet taps on their schedule.

H. Prepare the site for wet taps including excavation; cleaning pipe; and backfill after completion of the tap.

PART 2: PRODUCTS

2.01 WATER SERVICE LINES AND CONNECTIONS

A. Provide Type K, annealed, copper pipe, conforming to the latest revision of ASTM B-88 for ¾-inch through 2-inch diameter service lines.

B. Provide either flared or compression water service line components such as corporation stops, couplings, and curb stops in conformance with the latest revision of AWWA Standard C800.

C. Furnish service line and connection materials in accordance with MWS published

Approved Materials List.

D. Provide water service line and connection materials in conformance with the Safe Drinking Water Act, ANSI/NSF 61 Drinking Water System Components-Health Effects.

E. For service lines larger than 2 inches, use ductile iron pipe and fittings.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install the water service line and connection a minimum of 24 inches below the finished ground surface or roadway elevation.

B. Provide a 12-inch minimum gooseneck supported by a brick for each water service line 2 inches and smaller.

C. If work is to be performed beyond the water meter box, a licensed and bonded plumber is required.

D. Disinfect all service lines.

END OF SECTION

SECTION 33 12 16.07
BLOW OFF VALVES

PART 1: GENERAL

1.01 SCOPE

A. Blow Off Valves

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed valves and components for approval.

C. Furnish five sets of notarized shop drawings and certificates of inspection, stating that the valves and components were constructed and satisfactorily tested in full compliance with these specifications.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing blow off valves and boxes or manholes at the contract unit price per each for the unit installed complete and ready for operation.

B. Include all costs in the unit price for piping, connections to main, materials, valve, equipment, labor, excavation, backfill, manhole or valve box, casting, piping, fittings, rodding, testing, service, and incidentals, necessary for a complete installation.

PART 2: PRODUCTS

2.01 BLOW OFF VALVE ASSEMBLY

A. Furnish blow off valves and components in accordance with MWS published Approved Materials List.

B. For 2-inch blow-off valve assemblies, provide red brass blow-off ball valves in conformance with the latest revision of ASTM B283, UNS Number C83800, threaded ends, lever handle, blowout proof stem and minimum working pressure of 150 psi.

C. Provide Type K copper piping in conformance with the latest revision of ASTM B88 for blow-off valve assemblies 2-inch and smaller.

D. Provide copper fittings in conformance with the latest revision of ANSI Standard B16.22 for solder joints and ANSI Standard B16.26 for flared joints.

E. Provide gate valves for blow-off valve assemblies larger than 2-inch.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install the type and size blow-off valves and components as indicated on the Drawings with the actual location subject to field verification and adjustment.

B. Operate blow-off valve assembly to ensure proper operation before placing the water main into service.

END OF SECTION

SECTION 33 12 16.09
PRESSURE REDUCING VALVES

PART 1: GENERAL

1.01 SCOPE

A. Pressure reducing valves for water

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

C. Furnish five sets of notarized shop drawings and certificates of inspection, stating the valves were constructed and satisfactorily tested in full compliance with these specifications.

D. Submit a start-up report after installation including actual set pressures, testing results, and other items concerning valve installation.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing pressure reducing valves at the contract unit price per each valve installed complete and ready for operation.

B. Include all cost in the unit price for pressure reducing valves for items and incidentals necessary for a complete and operable installation unless a component is specifically included as separate item on the Bid Schedule.

PART 2: PRODUCTS

3.01 PRESSURE REDUCING VALVES

A. Provide pressure reducing valves in conformance with the latest revision of AWWA Standard C530.

B. Provide valves in conformance with the Safe Water Drinking Act, ANSI/NSF 61 Drinking Water System Components – Health Effects.

C. Furnish pressure reducing valves from manufacturers in accordance with MWS published Approved Materials List.

D. Provide pressure reducing valves of the size, type, pressure class, and quantity as indicated on the Drawings.

E. Provide pressure reducing valves with anti-cavitation option.

F. Provide internal and external coatings per manufacturers recommendations.

PART 3: EXECUTION

3.01 INSTALLATION

A. Verify initial pressure reducing valve set pressures from MWS and adjust

pressure settings for actual field conditions at the direction of MWS.

B. Maintain constant valve outlet pressure during start up.

C. Provide the services of manufacturer's representative on-site during installation to ensure the valve is installed, tested, and started properly.

END OF SECTION

SECTION 33 12 16.11
GATE VALVES

PART 1: GENERAL

1.01 SCOPE

A. Gate valves

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittals Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

C. Furnish five sets of notarized shop drawings and certificates of inspection, stating that the valves were constructed and satisfactorily tested in full compliance with these Specifications.

D. Submit engineered foundations for valves larger than 36-inch.

E. Provide MWS with the access to observe all testing, if requested and submit certified copies of all test results prior to valve shipment.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing gate valves at the contract unit price per each for the unit installed complete and ready for operation.

B. Include all costs in the unit price for furnishing, installing, and testing valves including but not limited to: labor, materials, equipment, service, excavation, bedding, backfill, valve, valve box, valve box footing blocks, valve box casting, flush port valve, flush port box, accessories, engineered foundations if required, and all incidentals necessary for a complete and operable installation.

PART 2: PRODUCTS

2.01 SMALL VALVES – SMALLER THAN 2-INCH

A. Provide differential pressure rated 125 psi, red brass, rising stem, single-wedge, disc type with screwed ends for valves smaller than 2-inch.

B. Utilize smaller than 2-inch valves only with MWS written approval.

2.02 GENERAL VALVE REQUIREMENTS- 2-INCH THROUGH 60-INCH

A. Provide differential pressure rated 250 psi, ductile iron, resilient seated gate valves in conformance with the latest revisions of AWWA Standard C509 or AWWA Standard C515.

B. Provide valves in conformance with the Safe Water Drinking Act, ANSI/NSF 61 Drinking Water System Components – Health Effects.

C. Furnish valves from manufacturers in accordance with MWS published Approved

Materials List.

D. Provide vertical mounted valves unless otherwise specified.

E. Provide valves with non-rising stems that open clockwise with operating nut painted red to indicate gate valve opens right.

F. Provide valve ends with restrained mechanical joints in conformance with the latest revision of AWWA Standard C111 for non-exposed piping installations and for exposed piping installations, provide valves with flanged joints.

G. Provide hand wheels for valves located in vaults, pits, and/or exposed piping.

H. Where indicated on the Drawings, provide outside screw and yoke (OS&Y) flanged end valves with the Underwriters' Laboratory (UL) label for Factory Mutual (Fire Service) type meter installations.

I. Provide valve stems manufactured of a low zinc alloy.

J. Provide valve stem seals with O-rings capable of replacement under pressure when the valve is fully open.

K. Provide valves with a resilient seat that will be bonded or mechanically attached to either the gate or valve body.

L. Provide valves with a rubber material for the resilient seat bonded or vulcanized in accordance with the latest revision of ASTM D429.

M. Provide protective fusion bonded epoxy interior and exterior coating, including bolt holes, in conformance with the latest revision of AWWA Standard C550.

N. Provide locking type valve extensions on any gate valve where operating nut is 5 feet below finished grade with the extension 2 feet below finished grade.

2.03 HORTIZONAL VALVES

A. Provide vertical valves for sizes 24 inch and smaller where adequate cover is available and if adequate cover is not available; provide horizontal, resilient-seated, beveled geared actuator valves.

B. Provide horizontal, resilient-seated, beveled geared actuator valves for valves greater than 24 inch.

C. Provide flush ports, piping, fittings, and accessories, sized as recommended by the manufacturer to permit removal of foreign material from the valve internal cavity upon opening of the valve.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install valves in accordance with the latest revision of AWWA Standard C600.

B. Install valves plumb and operate to verify valve parts are functioning properly.

C. Disinfect through newly installed gate valve utilizing temporary water cap with pluggable outlet.

END OF SECTION

SECTION 33 12 16.17
TAPPING SLEEVES AND VALVES

PART 1: GENERAL

1.01 SCOPE

A. Tapping sleeves and valves

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed tapping sleeves and valves for approval.

C. Furnish notarized shop drawings and certificates of inspection, stating the tapping sleeves and valves were constructed and satisfactorily tested in full compliance with these Specifications.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing, installing, and testing tapping sleeves and valves at the contract unit price per each for the unit installed complete and ready for operation.

B. Include all costs in the unit price for labor, equipment, materials, excavation, bedding, backfill, tapping sleeve and valve, valve box, valve box footing blocks, valve box casting, incidentals, flush port if required, and all incidentals necessary for a complete and operable installation.

PART 2: PRODUCTS

2.01 GENERAL

A. Refer to Section 33 12 16.11 Gate Valves for tapping valve requirements.

B. Provide sleeves in conformance with the Safe Water Drinking Act, ANSI/NSF 61 Drinking Water System Components – Health Effects.

C. Furnish tapping sleeves in accordance with MWS Approved Material List.

D. Provide a ductile iron outlet in conformance with the latest revision of AWWA Standard C110 with outlet end compatible with a mechanical restrained joint connection.

E. Provide bolts and nuts in conformance with the latest revision of AWWA Standard C111.

F. Provide ductile iron sleeves in conformance with the latest revision of ASTM A536 with rubber gaskets held together by bolts with the valve bolted to the sleeve.

G. Provide oval flange cross sectional shaped seals.

H. Determine the outside diameter and type of material of the existing water main to be tapped prior to ordering the tapping sleeve.

I. Provide a ¾-inch nominal pipe thread test tap on the top of the tapping sleeve.

J. Furnish rubber gaskets for use between the flanges of the sleeve and valve.

K. Provide only tapping sleeves for tapping existing water mains and do not use tapping saddles.

PART 3: EXECUTION

3.01 INSTALLATION

A. Provide MWS approved excavation dimensions in order to perform the tap.

B. Perform tightening of sleeve bolts in the proper sequence to prevent undue stress on the existing water main.

C. Align valve properly and attach to the sleeve.

D. Insure the tapping sleeve and valve is plumb through the use of a bubble self-leveling type device.

E. Install tapping sleeve and valve without removing the existing water main from service.

F. Perform pressure test on tapping sleeve and valve after installation on the existing water main to insure watertightness with no leakage permitted and perform testing in the presence of MWS.

G. Contact MWS personnel to schedule tapping of existing water main by MWS.

END OF SECTION

SECTION 33 12 16.19

AIR RELEASE AND VACUUM RELIEF VALVES

PART 1: GENERAL

1.01 SCOPE

A. Air release valves, vacuum relief valves, and combination air valves for water and wastewater.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

C. Furnish five sets of notarized shop drawings and certificates of inspection, stating the valves were constructed and satisfactorily tested in full compliance with these specifications.

D. Submit valve start up report after installation.

E. Submit a detailed schedule of valves for more complex installations.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing air release, vacuum relief valves, or combination air valves, and vaults at the contract unit price per each for the unit installed complete and ready for operation.

B. Include costs in the unit price for piping, connections to main, materials, equipment, labor, excavation, backfill, manhole or valve box, casting, fittings, rodding, testing, service, and all incidentals necessary for a complete and operable installation.

PART 2: PRODUCTS

2.01 AIR RELEASE AND VACUUM RELIEF VALVES

A. Provide air release and vacuum relief valves in conformance with the latest revision of AWWA Standard C512.

B. Provide valves in conformance with the Safe Water Drinking Act, ANSI/NSF 61 Drinking Water System Components – Health Effects.

C. Furnish air release and vacuum relief valves from manufacturers in accordance with MWS published Approved Materials List.

D. Provide bodies and covers of ductile iron meeting the latest requirements of ASTM A536, Grade 65-45-12 or cast iron meeting the latest requirements of ASTM A126, Class B, or ASTM A48, Class 35.

E. Use Pressure Class 300 for ductile iron body valves and Pressure Class 250 for

cast iron bodied valves.

F. For valve sizes 2 inches and smaller, provide connections to the valve conforming to the requirements for tapered pipe threads for general use, per ASME B1.20.1.

G. For valve sizes greater than 2 inches, provide connections to the valve per ASME B16.42.

H. Furnish 316 stainless steel cover bolts, nuts, float balls, and guides.

I. Provide properly sized orifices for the service condition required.

J. Provide air release valves with a port to allow reverse direction capability.

K. Provide internal and external coatings per MWS or manufacturers recommendations.

L. For sewage force main applications, provide special long-body sewage air release valves, complete with top and bottom flushing connections and hoses.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install the type and size air release, vacuum relief, and/or combination valves as indicated on the Drawings with the actual location subject to field verification and adjustment.

B. Provide the services of the manufacturer's field representative during installation to ensure the valve is installed, tested, and brought into operation properly.

END OF SECTION

SECTION 33 12 16.21
ALTITUDE VALVES

PART 1: GENERAL

1.01 SCOPE

A. Altitude valves

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

C. Furnish five sets of notarized shop drawings and certificates of inspection, stating that the valves were constructed and satisfactorily tested in full compliance with these Specifications.

D. Submit valve start up report after installation.

E. Submit a detailed schedule and/or operational schematic of valves for more complex installations.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing altitude valves at the contract unit price per each for the unit installed complete and ready for operation.

B. Include all costs in the unit price for testing and startup of the altitude valve.

C. Include all cost in the unit price for altitude valves for items and incidentals necessary for a complete and operable installation unless a component is specifically included as separate item on the Bid Schedule.

PART 2: PRODUCTS

2.01 ALTITUDE VALVES

A. Provide altitude valves in conformance with latest revision of AWWA Standard C530.

B. Provide altitude valve materials in conformance with the Safe Water Drinking Act, NSF / ANSI 61 Drinking Water System Components – Health Effects.

C. Furnish altitude valves from manufacturers in accordance with MWS published Approved Materials List.

D. Furnish altitude valves with an approved wireless remote telemetry unit (RTU) meeting the requirements of MWS existing SCADA system and associated instrumentation for remote monitoring of the status and remote open/close control where indicated on the Drawings. MWS shall be responsible for programming the new unit into the master control station.

E. Provide a position indicator rod on the altitude valve for the purpose of continuous visual indication of the status of the valve.

PART 3: EXECUTION

3.01 INSTALLATION

A. Verify initial valve control parameters from MWS and adjust for actual field conditions at the direction of MWS.

B. Provide the services of the manufacturer's field representative during installation to ensure the valve is installed, tested, and brought into operation properly.

END OF SECTION

SECTION 33 12 16.23
CORPORATION STOPS

PART 1: GENERAL

1.01 SCOPE

A. Corporation stops

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for furnishing and installing corporation stops incidental to the Work with no separate payment allowed.

PART 2: PRODUCTS

2.01 CORPORATION STOPS

A. Provide corporation stops in conformance with the latest revision of AWWA Standard C800.

B. Provide corporation stops in conformance with the Safe Water Drinking Act, NSF / ANSI 61 Drinking Water System Components – Health Effects.

C. Furnish corporation stops from manufacturers in accordance with MWS published Approved Materials List.

D. Provide brass corporation stops of the type, size, and threads for inlet and outlet as indicated on the Drawings.

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 33 12 16.25
CHECK VALVES

PART 1: GENERAL

1.01 SCOPE

A. Check valves within the water distribution system not including privately owned and maintained backflow prevention devices.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittals Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

C. Furnish five sets of notarized shop drawings and certificates of inspection, stating that the valves were constructed and satisfactorily tested in full compliance with these Specifications.

D. Submit engineered foundations for 12-inch and larger check valves.

E. If requested, submit certified copies of all test results prior to valve shipment.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing check valves at the contract unit price per each for the unit installed complete and ready for operation.

B. Include all costs in the unit price for testing and startup of the check valve.

C. Include all cost in the unit price for check valves for items and incidentals necessary for a complete and operable installation unless a component is specifically included as separate item on the Bid Schedule.

PART 2: PRODUCTS

3.01 CHECK VALVES

A. Provide full opening, swing type check valves in conformance with the latest revision of AWWA Standard C508.

B. Provide check valve materials in conformance with the Safe Water Drinking Act, NSF / ANSI 61 Drinking Water System Components – Health Effects.

C. Furnish check valves from manufacturers in accordance with MWS published Approved Materials List.

D. Provide check valve body material of ductile iron in conformance with the latest revision of ASTM A395 or A536, Grade 65-45-12, Grade 70-50-05, or Grade 80-55-06.

E. Provide a stainless steel hinge pin with bronze support bearings; stainless steel/steel bolts, nuts, and studs; and mechanical or flanged ends in

conformance with latest revision AWWA Standard C111 with ANSI B16.2.

F. Provide check valves that can be mounted horizontal or vertical positioned for repair/maintenance without removal.

G. Provide protective fusion bonded epoxy interior and exterior coating, including bolt holes, in conformance with the latest revision of AWWA Standard C550.

H. Provide check valve rated at a minimum working pressure of 250 psi.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install valves in accordance with the latest revision of AWWA Standard C508.

B. Install valves plumb and operate to verify valve parts are functioning properly.

END OF SECTION

SECTION 33 12 19
FIRE HYDRANT ASSEMBLY

PART 1: GENERAL

1.01 SCOPE

A. Fire Hydrant Assembly

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit name of fire hydrant manufacturer, type of bonnet paint, shop drawings and detailed data outlined in AWWA C502.

C. Furnish five sets of certified drawings, certificates of inspection, sworn to by the factory inspector in the presence of a Notary Public, stating that the hydrant and material used in fabrication conform to the applicable requirements of AWWA C502, and the tests specified have been performed and all tests requirements have been meet.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing fire hydrant assemblies at the contract unit price per each for the unit installed complete and ready for operation.

B. Include all cost in the unit price for fire hydrant assemblies for materials, equipment, labor, excavation, backfill, concrete or stone blocking, mechanical joints, restrained joints, and rodding (if required), riser pipe/extension, testing, ductile iron fittings, appurtenances, and removal and stockpile of existing fire hydrant (if applicable), and all incidentals necessary for a complete and operable installation.

C. Do not include in the unit price for fire hydrant assemblies the linear feet of 6-inch fire hydrant leads, tapping sleeves and valves, valves, valve boxes, pavement replacement, and/or other units of work if specifically included on the Bid Schedule.

PART 2: PRODUCTS

2.01 FIRE HYDRANTS

A. Provide fire hydrant in conformance with AWWA Standard C502, Dry Barrel Fire Hydrants, of latest edition.

B. Provide fire hydrant in conformance with the Safe Water Drinking Act, NSF / ANSI 61 Drinking Water System Components – Health Effects. Note: Section

1417 Reduction of Lead 2011 by HR3588, the Community Fire Safety Act excludes fire hydrants.

C. Furnish fire hydrants from manufacturers in accordance with MWS published Approved Materials.

D. Provide fire hydrant with compression post type opening to the left (counterclockwise) against the pressure.

E. Provide fire hydrant outlets consisting of one main valve with a 4½-inch pumper nozzle outlet and two 2½-inch hose nozzle outlets with nozzles and caps meeting National Fire Protection Association (NFPA) 1963 - Standard for Screw Threads and Gaskets for Hose Connections.

F. Provide nozzle caps that are chained or cabled to the barrel of the fire hydrant with a chain or cable constructed of material not less than ⅛-inch in diameter.

G. Provide fire hydrant with a lower hydrant barrel fabricated from ductile iron pipe as single piece connected to upper hydrant barrel by means of joint coupling that will provide three hundred sixty degree rotation of upper barrel.

H. Provide fire hydrant with a mechanical joint inlet.

I. Lubrication shall be accessible without removing stem nut.

J. Provide fire hydrant with a 1-inch square operating nut on top of stem and on nozzle caps.

K. Protect the opening between the stem nut and the top of bonnet by a weather shield cap.

L. Provide fire hydrant with an arrow 1¼-inch long and the word “open” in ½-inch high letters casted with ⅛-inch relief on or near the top of the fire hydrant bonnet to indicate the direction of operation clearly visible when viewed from the top.

M. Use O-rings or other approved seals of equal ease of operation. Do not use stuffing boxes or glands.

N. Provide fire hydrant edges and corners with sufficient radius in accordance with standard foundry practices.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install fire hydrants in conformance with AWWA Manual M17 - Installations, Field Testing, and Maintenance of Fire Hydrants.

B. Set fire hydrant plumb at locations as shown.

C. Connect fire hydrants to 6-inch water mains or larger with sufficient pressures.

D. Protect the casting containing fire hydrant outlets and the stem from damage with a method approved by MWS.

E. Use a minimum of 2 cubic feet of clean TDOT No. 57 or No. 67 stone for drainage around fire hydrant.

F. Do not cover drain ports, bolts, or fittings when placing concrete thrust blocks.

G. Locate the upper flange connection 6 inches above the finished grade to easily remove bolts and revolve the top part of hydrant.

H. Install fire hydrant at proper height where hydrant wrench can turn 360 degrees on 4½-inch pumper nozzle outlet and 2½-inch hose nozzles without ground surface obstruction.

I. Do not install fire hydrant at an excessive height with final height approved by MWS.

J. Locate fire hydrant measuring a minimum of 18 inches from the face of curb or edge of pavement if no curb exist to the 4½-inch pumper nozzle nut.

K. Use a bury depth of 3 ½ feet. Use an offset bend instead of extensions if the water main or lead has a depth greater than 3 ½ feet. Obtain MWS approval in writing prior to installation of fire hydrants that require changes in bury depth due to obstructions not shown.

L. Use concrete blocks, 12-inch x 12-inch x 4-inch minimum underneath the hydrant base and around the hydrant to undisturbed earth, or use the equivalent of poured concrete without clogging the drain hole.

M. Use concrete blocks, 20-inch x 20-inch x 4-inch minimum, between hydrant base and back of trench to undisturbed earth or use the equivalent of poured concrete without clogging the drain hole.

N. Connect fire hydrants to a new water main with a tee connection with Class 350 ductile iron mechanical restraint joints (Mega Lugs and Field-Lok gaskets or rodding) including connections from the fire hydrant tee to the fire hydrant valve and from the fire hydrant valve to the fire hydrant base.

O. Connect fire hydrants with tapping sleeve and valve with Class 350 ductile iron restraint mechanical joints for connections to existing water mains.

P. Place out of service indicators approved by MWS on fire hydrants that are not in service. Remove indicators after water line is tested and approved by MWS.

3.02 TESTING

A. MWS may, at any time prior to or during installation of hydrants, randomly select

a furnished hydrant for disassembly and laboratory inspection at MWS expense, to verify compliance with Specifications. When a hydrant is found to be non-compliant, replace with a compliant hydrant.

B. Fire hydrant assemblies shall be visually examined for leaks by MWS under pressure for a 10-minute period. Repair all visible leaks regardless of the amount of leakage.

3.03 HYDRANT COATING REQUIREMENTS

A. Obtain test data from MWS including static and residual pressure; provide material and labor to properly paint hydrants per MWS Fire Hydrant Painting Colors Policy and provide labor to attach tags provided by MWS for each fire hydrant installed.

B. Apply coatings in strict accordance with recommendations from the manufacturer.

C. Use the following table for a summary of the current fire hydrant color policy:

Table 1 - MWS FIRE HYDRANT PAINTING COLORS					
	HYDRANT RESIDUAL PRESSURE (2-1/2" NOZZLE - psi)	FLOW (gpm)	BARREL	CAPS	DOME
ALL HYDRANTS	0	0	SHROUD WITH BLACK BAG AND TURN IN FOR REPAIR - OUT OF SERVICE EXCEPTION: EMERGENCY CALL IN IF HYDRANT IS ADJACENT TO ESSENTIAL SERVICES (HOSPITAL, NURSING HOMES, ETC)		
PUBLIC HYDRANT	0.1 - 8.9	1-500	RED	BLACK	RED
PUBLIC HYDRANT	9 - 35.9	501-1000	RED	GREEN	GREEN
PUBLIC HYDRANT	>= 36	>1000	RED	ORANGE	ORANGE
END OF LINE PUBLIC HYDRANT	0.1 - 8.9	1-500	WHITE	BLACK	RED
END OF LINE PUBLIC HYDRANT	9 - 35.9	501-1000	WHITE	GREEN	GREEN
END OF LINE PUBLIC HYDRANT	>= 36	>1000	WHITE	ORANGE	ORANGE

Notes:

1. White "cap color" is the de facto indicator of the fire hydrant flow capacity; barrel color can sometimes also provide useful information. For example, fire hydrants with white barrels signify those which are last on a dead end main.
2. Typically, silver fire hydrants (caps and barrels) signify private hydrants while red hydrants (caps and barrels) signify hydrant not yet in service.
3. Cap color is determined by field tests performed by Metro Water Services or their designee and is representative of the latest residual pressure testing performed. Records of testing are available at the office of MWS.
4. Regulations of the Tennessee Department of Environment and Conservation (Rules of TDEC Public Water System Chapter 1200-5-1-.17, paragraph 18) require that fire hydrant be capable of providing at least 500 gallons per minute with a minimum residual pressure of 20 pounds per square inch (psi). There are some hydrants in MWS' system that are not capable of this requirement and are color coded accordingly (black caps). Therefore, the MFD agrees not to connect a pumper truck to any black cap hydrants.
5. In order to assure consistency, it is imperative that all water companies having jurisdiction within Davidson County identify their hydrant using this same cap color code.

END OF SECTION

SECTION 33 12 33
WATER METERS

PART 1: GENERAL

1.01 SCOPE

A. Water meters and fire service meters

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

C. Furnish five sets of notarized shop drawings and certificates of inspection, stating that the water meters were constructed and satisfactorily tested in full compliance with these specifications.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for relocating, furnishing, and/or installing water meters at the contract unit price per each for the unit installed complete and ready for operation.

B. Include all cost in the unit price for materials, equipment, labor, excavation, backfill, appurtenances, and concrete box with lid, and all incidentals necessary for a complete and operable installation.

1.04 GENERAL

A. Adjust and/or relocate existing water meters and boxes as necessary.

B. Install the meter at a depth in which the top of the meter is 18 to 24 inches below the top of the meter box.

PART 2: PRODUCTS

2.01 GENERAL

A. Furnish water meters from manufacturers in accordance with MWS published Approved Materials List.

B. Provide water meters in conformance with the Safe Water Drinking Act, NSF / ANSI 61 Drinking Water System Components – Health Effects.

C. Provide water meters in the MWS system equipped with an encoded register wired to a meter interface unit (MXU) with 6 feet of wire for residential accounts and 25 feet of wire for commercial accounts.

D. Provide an affidavit of compliance and a certificate of testing for accuracy in conformance with the latest revision of the AWWA Standard applicable for the meter type utilized.

E. Provide serial numbers, meter size, and direction of water flow on meters in raised characters. Provide the manufacturer's serial number imprinted permanently on the outer case and the register box lid.

F. Furnish metal mutilated pinions and white number wheels with black figures. The number wheels may be made of plastic, but wheel gears must be made of metal.

2.02 RESIDENTIAL COLD WATER MAGNETIC DRIVE METERS

A. Provide residential cold water oscillating–piston magnetic drive meters (size 5/8 - inch through 1 - inch) in conformance with the latest revision of AWWA Standard C700.

B. Supply registers operating by permanent drive magnets with straight reading with 6 numeral wheels measuring in cubic feet including a low flow indicator on the face dial.

C. Provide register secured to the main case by means of a tamper resistant locking screw seal pin so the register cannot be removed by nonutility personnel. Seal wiring or a frangible head screw is not acceptable.

D. Provide registers and casings with a guarantee from the manufacturer to be free from defective material and workmanship for a period of 25 years.

E. Provide all reduction gearing contained in a permanently hermetically sealed, tamper proof enclosure made from a stainless steel or copper material, covered with a heat tempered glass lens.

F. Provide registers with convertibility to AMR applications.

G. Provide registers with two permanently potted wire connections.

H. Provide outer casing of noncorrosive water corks bronze with a separate measuring chamber that can be easily removed from the case.

I. Equip meters with breakable frost proof bottoms or equivalent frost protection safeguards.

J. Equip meters with plastic liners or corrosion resistant material on bottom plates.

K. Provide external bolts and washers of corrosion resistant material easily removed from the case.

L. Cover threaded main case bolts holes.

M. Provide meter coupling washers of vulcanized hard red fiber, 1/8 - inch thick, suitable for use with standard 5/8 - inch and 1 - inch water meters.

N. Provide measuring chambers of synthetic polymer of positive displacement type and not cast as part of the main case.

O. Provide interchangeable piston assemblies in all measuring chamber assemblies of the same size that operate against a replaceable control roller allowing for repair to AWWA standards.

P. Provide meters with an unconditional guarantee for performance meeting AWWA new meter accuracy standards for a period of 5 years from the date of shipment.

Q. Provide meters with an unconditional guarantee for performance meeting AWWA repaired meter accuracy standards for a period of 15 years from the shipment date.

R. Provide meters with accuracy for normal flow of registration of not less than 98.5% and not more than 101.5%. At minimum flow, the meter should register not less than 95% and not more than 101% in accordance with the latest revision of AWWA Standard C700.

S. Provide meters capable of component repair without entire meter replacement.

2.03 COMMERCIAL COLD WATER DISPLACEMENT METERS

A. Provide commercial displacement cold water meters manufactured in conformance with the latest revision of AWWA Standard C700.

B. Supply registers operating by permanent drive magnets with straight reading with 6 numeral wheels measuring in cubic feet including a low flow indicator on the face dial.

C. Provide outer meter casings of bronze composition.

D. Provide meters with measuring chambers separate from the outer casting and constructed of bronze, stainless steel, hard rubber or an approved synthetic polymer.

E. Provide meters with discs constructed of hard rubber or approved synthetic polymer.

F. Provide meters with accuracy for normal flow of registration of not less than 98.5% and not more than 101.5%. At minimum flow, the meter should register not less than 95% and not more than 101% in accordance with the latest revision of AWWA Standard C700.

G. Provide meters capable of component repair without entire meter replacement.

2.04 COMMERCIAL TURBINE WATER METERS

A. Provide commercial Class II in-line high velocity type turbine water meters manufactured in accordance with the latest revision of AWWA Standard C701.

B. Supply registers operating by permanent drive magnets with straight reading with

6 numeral wheels measuring in cubic feet including a low flow indicator on the face dial.

C. Provide outer meter casings of bronze composition.

D. Provide meter register that is hermetically sealed.

E. Provide turbines and rotors manufactured of vulcanized hard rubber or approved synthetic polymer having sufficient rigidity and strength for the meter to operate at the maximum operating capacity.

F. Provide turbine spindles manufactured of phosphor bronze, stainless steel, Mondel, or approved suitable corrosion resistant materials.

G. Provide rotor spindles manufactured of phosphor bronze, stainless steel nickel alloy, or approved synthetic polymer.

H. Provide meters with accuracy for normal flow of registration of not less than 98.5% and not more than 101.5% in accordance with the latest revision of AWWA Standard C701.

2.05 COMMERCIAL COMPOUND WATER METERS FOR SIZES GREATER THAN 2 INCH

A. Provide Class II commercial compound meters for sizes greater than 2 inch manufactured in accordance with the latest revision of AWWA Standard C702.

B. Supply registers operating by permanent drive magnets with straight reading with 6 numeral wheels measuring in cubic feet.

C. Provide meters manufactured with stainless steel external fasteners and tapped bosses on the top of the case near the outlet for testing purposes.

D. Provide 2-inch meters with oval flanges.

E. Provide 3-inch and larger meters with ductile iron companion flanges of the same size and type as the meter flanges.

F. Provide meters with the required gaskets, bolts, and nuts.

G. Provide meters with rigid, easily removable, lead free strainers with a minimum effective straining area of double the water main case inlet.

H. Use of synthetic polymers will not be acceptable.

I. Provide meters with accuracy for normal flow of registration of not less than 98.5% and not more than 101.5%. At minimum flow, the meter should register not less than 95% and not more than 101%. If the accuracy of the meter falls below 98.5%, the accuracy of the changeover flow rates will not be less than 90% and not more than 103% of the indicated difference in the flow rate in accordance with the latest revision of AWWA Standard C702.

2.06 COMMERCIAL FIRE SERVICE WATER METERS FOR 4 -INCH AND LARGER ABOVE

A. Provide commercial Type II compound fire service meters for 4-inch and larger above manufactured in accordance with the latest revision of AWWA C703.

B. Provide register operated by permanent drive magnets with straight reading with 6 numbering wheels measuring in cubic feet.

C. Provide meters manufactured with stainless steel external fasteners

D. Provide meters with ductile iron companion flanges of the same size and type as the meter flanges.

E. Provide meters with the required gaskets, bolts, and nuts.

F. Provide a separate strainer unit with the main case and cover manufactured of bronze or cast iron coated with an approved no-corrosive material and a stainless steel strainer unit. Provide stainless steel bolts for use with the strainer unit.

G. Provide hermetically sealed registers.

H. Furnish outer casing of bronze composition.

I. Provide measuring chamber constructed of bronze, stainless steel, or hard rubber not cast as a part of the outer casing.

J. Provide turbines and rotors made of vulcanized hard rubber having sufficient rigidity and strength to operate at the rated capacity of the meters.

K. Furnish turbine spindles made of phosphor bronze, stainless steel, Mondel, or other approved suitable corrosion resistant materials.

L. Furnish rotor spindles made of phosphor bronze, stainless steel, or nickel alloy.

M. Use of synthetic polymers will not be acceptable.

N. Provide all bronze bypass assembly with lockable ball valves and check valve.

O. Provide meters with accuracy for normal flow of registration of not less than 98.5% and not more than 101.5%. At minimum flow, the meter should register not less than 95% and not more than 101%. If the accuracy of the meter falls below 97%, the accuracy of the changeover flow rates will not be less than 85% of the indicated flow spread at the crossover flow in accordance with the latest revision of AWWA Standard C703.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install meters plumb and as shown or as located by MWS.

END OF SECTION

SECTION 33 13 10

DISINFECTION OF WATER MAINS

PART 1: GENERAL

1.01 SCOPE

A. Disinfecting water mains, valves, fittings, temporary water mains, and appurtenances

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit a disinfection plan in accordance with procedures specified in Tennessee Department of Environment and Conservation (TDEC) Chapter 0400-45-01-.17.(8) and the latest American Water Works Association (AWWA) C651 standards and as indicated. The disinfection plan shall be reviewed and approved by MWS a minimum of two weeks prior to construction. The disinfection plan shall include, but not be limited to: an overall explanation of the disinfection process; the method of disinfection; the number and location of sampling points depicted on a copy of the construction drawings; and a description, location, and sample procedure of all tie-ins.

C. Submit a revised disinfection plan in accordance with procedures specified in TDEC Chapter 0400-45-01-.17.(8) and the latest AWWA C651 standards as warranted or requested by MWS.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for disinfection of water mains incidental to the Work with no separate payment allowed.

1.04 GENERAL

A. Comply with TDEC Chapter 0400-45-01-.17.(8) and the latest AWWA C651 standards.

B. Install a temporary water main cap on ends of new water mains and tap sampling cap with a pluggable outlet of adequate size to be utilized as a sampling, filling and/or flushing location.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 33 14 13

ACCEPTANCE TESTING FOR WATER

PART 1: GENERAL

1.01 SCOPE

A. Pressure and leakage tests for water mains and appurtenances

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit a water test plan.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for acceptance testing for water mains incidental to the Work with no separate payment allowed.

B. Provide labor, equipment, or any other devices necessary for proper testing at no cost.

1.04 GENERAL

A. Provide pressure and leakage testing of water mains and appurtenances in conformance with the latest revision of AWWA Standard C600.

B. Test water main in lengths between line valves or plugs not more than 1,000 feet in urban areas and 2,500 feet in rural areas.

C. Provide and install temporary plugs and blocking adequate for tests.

D. Do not make connections to the existing water system until the new water main has been tested, disinfected, and accepted by MWS.

E. Be prepared to test completed and/or relatively short sections of water main at the direction of MWS to expedite areas that need to be backfill promptly.

F. Coordinate with MWS to test water mains and provide other necessary equipment other than the MWS supplied pressure recording equipment.

G. Provide a MWS approved backflow prevention device with an annual certificate of inspection.

H. Notify MWS 48 hours prior to the scheduled testing of a section of water main.

I. Remedy conditions that may cause a greater leakage and/or loss of pressure of the section and retest the section until it meets the specified requirements.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 PRESSURE TEST

A. Perform pressure tests for newly installed water main sections in the presence of MWS.

B. Supply pressure at 1.5 times the stated working pressure of the water main at the lowest elevation along the test section or 150 psi whichever is greater.

C. Maintain pressure for a minimum of 4 hours with no more than a 5 psi variance for the duration of the test.

D. Introduce water slowly to vent all air for the section of pipe being tested.

E. Install temporary corporation stops where permanent components such as fire hydrants, blow offs, and/or air release valves, are not located at high points.

F. Fill each section to be tested with water from the distribution system utilizing a ¾ inch or greater corporation stop / service tap, Type K copper tubing, and MWS approved backflow preventer.

G. Add makeup water with the amounts shown in Table 1 to the water main section as directed and measured by MWS if the specified testing pressure cannot be maintained. Add makeup water only one time during the test.

H. Do not exceed indicated maximum amount shown in Table 1 per hour per 1,000 feet for the 4 hour test.

Table 1 – Hydrostatic Testing Allowance per 1,000 Feet of Main Tested – Gallons Per Hour*

Average Test Pressure (psi)	Nominal Pipe Diameter - inches															
	3"	4”	6”	8”	10”	12”	16”	18”	20”	24”	30”	36”	42”	48”	54”	60”
450	0.43	0.57	0.86	1.15	1.43	1.72	2.29	2.58	2.87	3.44	4.30	5.16	6.02	6.88	7.74	8.60
400	0.41	0.54	0.81	1.08	1.35	1.62	2.16	2.43	2.70	3.24	4.05	4.86	5.68	6.49	7.30	8.11
350	0.38	0.51	0.76	1.01	1.26	1.52	2.02	2.28	2.53	3.03	3.79	4.55	5.31	6.07	6.83	7.58
300	0.35	0.47	0.70	0.94	1.17	1.40	1.87	2.11	2.34	2.81	3.51	4.21	4.92	5.62	6.32	7.02
275	0.34	0.45	0.67	0.90	1.12	1.37	1.79	2.02	2.24	2.69	3.36	4.03	4.71	5.38	6.05	6.72
250	0.32	0.43	0.64	0.85	1.07	1.28	1.71	1.92	2.14	2.56	3.21	3.85	4.49	5.13	5.77	6.41
225	0.30	0.41	0.61	0.81	1.01	1.22	1.62	1.82	2.03	2.43	3.04	3.65	4.26	4.86	5.47	6.08
200	0.29	0.38	0.57	0.76	0.96	1.15	1.53	1.72	1.91	2.29	2.87	3.44	4.01	4.59	5.16	5.73
175	0.27	0.36	0.54	0.72	0.89	1.07	1.43	1.61	1.79	2.15	2.68	3.22	3.75	4.29	4.83	5.36
150	0.25	0.33	0.50	0.66	0.83	0.99	1.32	1.49	1.66	1.99	2.48	2.98	3.48	3.97	4.47	4.97
125	0.23	0.30	0.45	0.60	0.76	0.91	1.21	1.36	1.51	1.81	2.27	2.72	3.17	3.63	4.08	4.53
100	0.20	0.27	0.41	0.54	0.68	0.81	1.08	1.22	1.35	1.62	2.03	2.43	2.84	3.24	3.65	4.05

***** Source: AWWA C600 Table 4A

I. Locate and repair water main sections unable to maintain specified test pressure and retest water main sections to the satisfaction of MWS.

J. Assume expense for location, repair, and retesting of defective water mains.

K. Remove and plug additional corporation stops in the water main upon completion of testing.

END OF SECTION

SECTION 33 31 00
GRAVITY SEWER MAINS

PART 1: GENERAL

1.01 SCOPE

A. Gravity sewer mains, connections, abandonments, and excavation and backfill.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed gravity sewer main pipe, joints, joint materials, specials, interior coatings, and fittings for approval.

C. Submit crushed stone bedding and envelope material sieve analysis and compaction methods.

D. Submit abandonment plan, bypass pumping requirements, proposed grouting sequence, and plugging, if any, and other information pertinent to completion of the Work.

E. Submit an installation plan for gravity sewer main taps and connections to be performed on existing gravity sewer mains.

F. Submit cut sheets for each individual sewer line segment indicating the following information: beginning and ending structures with stationing conforming to the drawings, distance, gradient between structures of the segment, size and type of pipe material, the location of service connections, the depths of cut of the segment, alignment, deflection angle, and other pertinent information. Cut sheets require MWS review and approval prior to commencing excavation.

G. Submit asphaltic binder information certifying material is in conformance with the latest revision of Metro Public Works standard specification Section 02575 if gravity sewer mains or service lines are to be installed within a Metro Public Works roadway or the latest revision of the applicable TDOT asphaltic binder specification if gravity sewer mains or service lines are to be installed within a TDOT roadway.

H. Submit flowable fill information certifying material is in conformance with the latest revision of Metro Public Works standard specification Section 02225 if gravity sewer mains or service lines are to be installed within a Metro Public Works roadway or the latest revision of the applicable TDOT flowable specification if gravity sewer mains or service lines are to be installed within a TDOT roadway.

I. Submit outside roadway backfill material source, quality information, and compaction methods.

J. Submit Proctor Density Test results in accordance with the latest revision of ASTM D698 or ASTM D1557 when required by MWS.

K. Submit compaction field testing results in accordance with the latest revision of ASTM D6938 or other approved method when required by MWS.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing gravity sewer mains or service lines at the contract unit price per linear foot for the gravity sewer main or service lines installed complete and ready for operation. Measure the gravity sewer main or service lines horizontally along the centerline of the pipe in place from centerline of structure to centerline of structure, including fittings such as tees or tee wyes, and cleanouts. MWS will compensate for furnishing and installing vertical stacks at the contract unit price per vertical foot installed complete and ready for operation.

1. Include cost in the unit price for gravity sewer mains or service lines for labor, equipment, material, cutting, laying to grade and alignment, joints, bypass pumping, standby time and delay in MWS locating and gaining access to existing gravity sewer mains or service lines, hydrostatic testing and other testing required, and all incidentals necessary for a complete and operable installation.
2. Include cost in the unit price for gravity sewer mains or service lines for fittings, such as tees, tee wyes, and/or cleanouts whether indicated on the Drawings or not.
3. Include cost in the unit price for gravity sewer mains or service lines for excavation. Excavation is unclassified with no distinction made between rock and/or dirt excavation. Rock excavation beyond anticipated or indicated in a provided geotechnical report will not be considered basis for additional payment.
4. Include cost in the unit price for gravity sewer mains or service lines for crushed stone bedding, crushed stone envelope, and additional crushed stone used as backfill material between top of the crushed stone pipe envelope and the bottom of the flowable fill.
5. Include cost in the unit price for gravity sewer mains or service lines for

outside of roadway backfill material.

6. Include cost in the unit price for gravity sewer mains or service lines for dewatering operations including but not limited to water filtration systems for groundwater, obtaining permits with appropriate agencies on dewatering activities, and appropriately filtering and properly disposing of groundwater in accordance with permits.
7. Include cost in the unit price of gravity sewer mains or service lines for grade and alignment survey staking operations performed by a Tennessee registered land surveyor.
8. Undercutting of undesirable material at the trench base and approved refill material to be paid with Unforeseen Work Elements allowance bid item.

B. MWS will compensate for furnishing and installing taps and connections at the contract unit price per each for each tap and connection complete and ready for operation.

1. Include all cost in the unit price for taps and connections for labor, equipment, excavation, material, backfilling, and all incidentals necessary for a complete and operable installation.

C. MWS will compensate for cutting and plugging in order to abandon a gravity sewer main or service line at the contract unit price per each.

1. Include all cost in the unit price for cutting and plugging for labor, equipment, materials, bypass pumping, permanent solid gravity sewer main plug, and all incidentals necessary for a complete gravity sewer main abandonment operation.
2. Include all cost in the unit price for pipe grout, labor, and all incidentals necessary for a complete abandonment.

D. MWS will compensate for furnishing and installing flowable fill at the contract unit price per theoretical cubic yard calculated utilizing the specified trench width per gravity sewer main or service line size, the length, and the specified flowable fill depth; not the actual amount of flowable fill if more material is installed.

1. Include all cost in the unit price for flowable fill for excavation, material, labor, and all incidentals necessary for a complete installation.

E. MWS will compensate for furnishing and installing asphalt binder at the contract unit price per theoretical cubic yard calculated utilizing the specified trench width per gravity sewer main or service line size, the length, and the specified binder

depth; not the actual amount of binder if more material is installed.

1. Include all cost in the unit price for asphalt binder for excavation, material, labor, and all incidentals necessary for a complete installation.

F. MWS will compensate for furnishing and installing miscellaneous concrete at the contract unit price per cubic yard for concrete installed between a proposed gravity sewer main or service line traversing perpendicular and above an existing water main.

1. Include all cost in the unit price for miscellaneous concrete for excavation, materials, labor, and all incidentals necessary for a complete installation.

1.04 GENERAL

A. Calculate Bid Schedule payment items of flowable fill and asphalt binder by the following table. If a wider than indicated trench width is utilized during construction, payment will only be compensated based on the trench width limits detailed in the following table.

Maximum Trench Width Limits in Feet for Compensation for Binder and Flowable Fill Items per Pipe Size in Inches and Depth in Feet			
Pipe Size (inches)	**Trench Depth (feet)**		
	Up to 5	Greater Than 5 to 10	Greater Than 10
4	2.5	3.0	4.0
6	3.0	3.5	4.5
8	3.0	3.5	4.5
10	3.5	4.0	5.0
12	3.5	4.0	5.0
15	4.0	4.5	5.5
16	4.0	4.5	5.5
18	4.0	4.5	5.5
20	4.5	5.0	6.0
21	4.5	5.0	6.0
24	5.0	5.5	6.5
30	-	6.0	7.0
36	-	6.5	7.5
42	-	7.5	8.5
48	-	8.0	9.0
54	-	8.5	9.5
60	-	9.5	10.5
64	-	10.0	11.0
66	-	10.0	11.0

B. Bury gravity sewer mains and service lines in roadways to the slope and alignment requirements indicated on the Drawings. Utilize crushed stone material compacted in maximum 8-inch lifts at the proper moisture content as the supplementary trench backfill material between the crushed stone envelope and the flowable fill.

C. Bury gravity sewer mains and service lines outside of roadways to the slope and alignment requirements indicated on the Drawings. Utilize suitable native backfill material compacted in 12-inch lifts.

D. Maintain existing gravity sewer services during the Work.

E. Do not plug manholes or structures on the existing system and/or new gravity sewer mains placed in service without a written bypass plan.

F. MWS will make every reasonable effort to locate and uncover all manholes and/or structures to divert wastewater when required for the Work. Circumstances may prevent timely location and access due to such items as weather conditions, lack of access to a location, high wastewater flows, and/or a lack of forces due to higher priority situations. Consider standby time due to these types of delays incidental to the Work with no separate payment allowed.

G. Perform Proctor Density Test in accordance with the latest revision of ASTM D698 or ASTM D1557 when required by MWS. Test to be performed by an independent MWS approved materials testing firm. Pay for test if Work is found to be noncompliance.

H. Perform compaction field testing results in accordance with the latest revision of ASTM D6938 or other approved method when required by MWS. Compaction tests to be performed by an independent MWS approved materials testing firm. Pay for test if Work is found to be noncompliance.

I. Abandon gravity sewer mains with a permanent concrete cap and fill with grout for a distance of approximately 20 feet into the main.

PART 2: PRODUCTS

3.01 GENERAL

A. Provide gravity sewer main products and accessories from manufacturers in accordance with MWS Approved Material List.

B. Provide pipe material for gravity sewer mains and service lines as indicated on the Drawings.

C. Provide TDOT No. 57 or No. 67 crushed stone for pipe bedding, pipe envelope, and for locations where additional pipeline depth is required within roadways prior to excavatable flowable fill and/or to avoid existing utilities.

D. Provide TDOT No.57 or No. 67 crushed stone for refill for undercutting of the pipeline trench.

E. Provide asphaltic binder in conformance with the latest revision of Metro Public Works standard specification Section 02575 when the gravity sewer main or service line is to be installed within a Metro Public Works roadway and provide asphaltic binder in conformance with the latest revisions of the applicable TDOT specification when the gravity sewer main or service line is to be installed within a TDOT roadway.

F. Provide excavatable flowable fill in conformance the latest revision of Metro Public Works standard specification Section 02225 when a gravity sewer main or service line is to be installed within a Metro Public Works roadway and provide excavatable flowable fill in conformance with the latest revisions of the applicable TDOT specification when the gravity sewer main or service line is to be installed within a TDOT roadway.

G. Provide Grade B or Grade C cement based dry pack grout for abandonment of gravity sewer mains in conformance with the latest revision of ASTM C1107.

PART 3: EXECUTION

3.01 GENERAL

A. Provide the services of a Tennessee registered land surveyor for grade and alignment survey operations.

B. Set grade stakes, lines, bench marks and elevations, and provide proper equipment to verify alignment and/or grade. Provide grade hubs no more than 100 feet apart with center line hubs no more than 50 feet apart to check laser equipment and grade between manholes. Provide offset stakes at each manhole, junction structure, or change in alignment location. Preserve survey staking, check staking, and reset missing, disturbed, or damaged staking, and/or property boundaries.

C. Deliver gravity sewer main products and accessories to job site free of damages and/or defects. If damages or defects are discovered, provide new material at no cost to MWS.

D. Store materials on site in enclosures or under protective above ground coverings.

E. Keep interiors of gravity sewer main products free of dirt and debris.

F. Install gravity sewer main, joints, gaskets and fittings in accordance with the latest revision of ASTM D2321 and manufacturer's recommendations

G. Install gravity sewer mains and service lines to the gradient and alignment indicated on the Drawings.

H. Install gravity sewer mains and service lines in crushed stone gravel bedding in the dry.

I. Install dewatering systems, if necessary, for excavation and gravity sewer main installation. Provide water filtration systems for groundwater, obtain permits with appropriate agencies for dewatering activities and appropriately filter and properly dispose of groundwater in accordance with permits.

J. Clean the inside of the bell and the outside of the spigot of the pipe, grind or smooth rough edges of the spigot of the pipe, and wipe clean as recommended by the pipe manufacturer prior to insertion of the gasket and final joints and/or fittings assembly.

K. Maintain a minimum of 10 feet horizontal separation when installing a gravity sewer main or service line is sharing a parallel alignment with a water main or water service line.

L. If the new gravity sewer main or service line is installed over an existing water main or existing water service pipe, maintain a minimum vertical separation of 24 inches from the bottom of the gravity sewer main or service line to the top of the water main. Attempt to place the crossing at a point to keep the water main joints at equal distances and as far as possible from the gravity sewer main or service line. Install concrete material between the existing water main and gravity sewer main crossing for the entire width of the distance between the utilities and for a length of at least 6 feet centered at the point of crossing.

3.02 EXCAVATION

A. No blasting will be permitted.

B. MWS may limit the method of excavation if conditions warrant such as trenching within areas of high concentration of utilities.

C. Contact Tennessee One Call Center (1-800-351-1111) the location of buried facilities pursuant to TCA 65-31-101 through TCA 65-31-133; however, take sole responsibility for the location of all affected underground utilities.

D. Locate and preserve existing utilities. The types and locations of known existing

utilities as indicated on the Drawings are approximate. Repair or replace damaged utilities, whether shown on the Drawings or not, at no cost to MWS.

E. Notify MWS immediately, stop the Work, and wait for MWS direction before resuming the Work if solvents, petroleum products, or any unknown chemical substance is discovered during excavation.

F. Consider all excavation material unclassified, whether a geotechnical report is provided or not.

G. Saw cut pavement to trench width limits when excavation is within a roadway.

H. Excavate trench width to permit a minimum of 6 inches between the edge of the trench and the outside of the gravity sewer main and/or service line.

I. Excavate to allow for a minimum of 6 inches of crushed stone bedding below the bottom of the gravity sewer main and/or service line.

J. Remove unstable soil at the trench bottom if discovered and refill area with appropriate material. Notify and receive approval from MWS prior to undercutting and removing undesirable material at the trench base and utilizing approved refill material.

K. Remove all loose material from the trench bottom. Do not lay gravity sewer mains and accessories directly on rock.

L. Excavate in accordance with Trench Safety Systems, TOSHA and OSHA regulations, and permits.

M. Dispose of surplus excavated material at a Metro approved permitted site. Do not place excavated material on private property.

3.03 BACKFILL WITHIN ROADWAY

A. Take precautions not to damage the gravity sewer main and accessories during backfill operations. Replace damaged items at no cost to MWS.

B. Install specified backfill material for the full width of the excavated trench and to specified depths.

C. Install No. 57 or No. 67 crushed stone compacted to 95% Standard Proctor Density in 8-inch lifts for pipe bedding and pipe envelope. Place crushed stone bedding 6 inches below the bottom of the gravity sewer main and/or service line. Place crushed stone envelope to a height of 8 inches above the top of the gravity sewer main and/or service line. Utilize crushed stone material compacted in maximum 8-inch lifts at the proper moisture content as the supplementary trench backfill material between the crushed stone envelope and the flowable fill.

D. Install flowable fill above crushed stone envelope at a minimum thickness of 14 inches for MPW roadways and 23 inches for TDOT roadways.

E. Install asphalt binder above flowable fill at a minimum thickness of 8 inches for MPW roadways and 11 inches for TDOT roadways compacted flush with the roadway surface elevation. Maintain smooth driving surface until final paving is complete.

F. Remove the indicated thickness of asphalt binder as part of the milling operations when preparing to pave the roadway.

G. Install the indicated thickness of asphaltic surface mix as part of the paving operations in accordance with Metro Public Works or TDOT specifications.

H. Remediate any settlement of backfill material for a period of one year after final completion and final acceptance of the Work by MWS.

3.04 BACKFILL OUTSIDE OF ROADWAY

A. Take precautions not to damage the gravity sewer main and accessories during backfill operations. Replace damaged items at no cost to MWS.

B. Install specified backfill material for the full width of the excavated trench.

C. Install No. 57 or No. 67 crushed stone compacted to 95% Standard Proctor Density in 8-inch lifts for pipe bedding and pipe envelope. Place crushed stone bedding 6 inches below the bottom of the gravity sewer main and/or service line. Place crushed stone envelope to a height of 8 inches above the top of the gravity sewer main and/or service line.

D. Install native soil compacted to 90% maximum Proctor Density in 12-inch lifts above the crushed stone envelope to finished grade. Do not utilize rock greater than 8 inches as backfill.

E. Remediate any settlement of backfill material for a period of one year after final completion and final acceptance of the Work by MWS.

F. Seed and straw disturbed area to reestablish growth. Replace trees and vegetation removed during clearing and excavation with trees and vegetation of equal size or larger.

END OF SECTION

SECTION 33 31 13.17

REINFORCED CONCRETE PIPE AND FITTINGS

PART 1: GENERAL

1.01 SCOPE

A. Reinforced Concrete Pipe and fittings for gravity sanitary sewers.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit for MWS approval descriptive information and shop drawings covering complete details of pipe, manufacture, including concrete design mix, reinforcement, lining material, joints, joint materials, fittings, and special pieces.

C. Submit a Certification of Inspection stating: the quantity of pipe, including joints, and pipe length in the shipment, the pipe fabricated in accordance with American Concrete Pipe Association QCast Quality Assurance Program requirements, including reinforcement and wall thickness, dates of inspection, dates and results of concrete cylinders and cores compressive tests (3-edge bearing test for 0.01-inch crack strength), pipe piece number, lay schedule number in line, and subjected to and is shipped in conformance with the latest revision of ASTM C76 and ASTM C443.

D. Submit a Certification of Inspection stating the coarse aggregate utilized in in conformance with the latest revision of ASTM C33, the Portland cement utilized is Type I/II, the water to cement ratio is no more than 0.43 by weight, all reinforcement is in conformance with the latest revision of ASTM A82, A185, A496, or A497, utilized a corrosion protection additive and if indicated, a lining system, and all joints are manufactured in conformance with the latest revision of ASTM C443.

E. Submit, prior to fabrication and shipment, a laying schedule of all pipes including all fittings, adapters, and specials, stationing, pipe class, class coding, stationing for all gradient changes, and the transition stations for the various pipe classes and the limits of each.

1.03 MEASUREMENT AND PAYMENT

A. Compensation for reinforced concrete pipe and fittings is not addressed in this section; refer to gravity sewer mains specification section.

B. Consider all requirements in this section incidental to the Work with no separate payment allowed.

PART 2: PRODUCTS

2.01 REINFORCED CONCRETE PIPE AND FITTINGS

A. Provide 4000 psi concrete strength, Wall B or Wall C, Class III, Class IV, or Class V pipe indicated on the Drawings in conformance with the latest revision of ASTM C76.

B. Provide pipe reinforcement with steel areas and clearances for the entire pipe length in conformance with the latest revisions of ASTM C76 and the following:

1. For plain steel wire in conformance with ASTM A82;
2. For plain steel welded wire in conformance with ASTM A185; and
3. For fabricated deformed steel mats in conformance with ASTM C496 or ASTM C497.

C. Provide two full circular steel cages of reinforcement for pipe 42-inch and larger and do not use elliptical or quadrant steel cages.

D. Provide steel end ring type joints with extruded or molded and cured rubber gaskets in conformance with ASTM C443.

E. Provide Xypex C1000 or approved equal corrosion resistant additive in an amount per manufacture's recommendation.

F. If indicated on the Drawings, provide a mechanically cast lining material system, either a minimum 0.065-inch thick PVC or a minimum 80 mils dry film thickness HDPE. Provide locking studs that penetrates the concrete when the pipe or fittings are cast, and a flap or Type P-1 joint for welding by a certified welder to each adjacent liner section into the pipe wall.

G. Provide standard pipe lengths of 12 feet.

H. Provide pipe without lifting holes in the walls.

I. Transport, handle, and store pipe and/or fittings as recommended by the manufacturer.

PART 3: EXECUTION

3.01 GENERAL

A. Install pipe and fittings in accordance with the laying schedule provided by the manufacturer.

B. Install pipe and fittings in conformance with the American Concrete Pipe Association requirements.

C. Repair the interior lining/coating of pipe and/or fittings as recommended by the lining/coating manufacturer utilizing a certified manufacturer's representative or their designate.

END OF SECTION

SECTION 33 31 51
BYPASS PUMPING

PART 1: GENERAL

1.01 SCOPE

A. Temporary bypass pumping

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 – Submittal Procedures.

B. A minimum of 7 days prior to starting the work, submit to MWS for review, a detailed Bypass Pumping Plan with descriptions outlining provisions and precautions to be taken regarding handling wastewater flows and protection of facilities and environment including, but not limited to, the following:

1. Staging areas for pumps;
2. Sewer plugging method and types of plugs;
3. Size and location of manholes or access points for suction and discharge hose or piping;
4. Size of pipeline or conveyance system to be bypassed;
5. Number, size, material, location and method of installation of suction piping;
6. Number, size, material, method of installation and location of installation of discharge piping;
7. Bypass pump sizes, manufacturer, capacity, number of each size to be on site and power requirements;
8. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted);
9. Standby power generator size, location;
10. Downstream discharge plan, including anticipated average daily and peak hydraulic data;
11. Method of protecting discharge manholes or structures from erosion and damage;
12. Thrust and restraint block sizes, calculations, and locations;
13. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill;
14. Method of noise control for each pump and/or generator;
15. Any temporary pipe supports and anchoring requirements;

16. Indicate on the Drawings locations and computations for access to bypass pumping;
17. Manpower/staffing requirements needed for bypass pumping operations;
18. Traffic and/or street closure plan if applicable;
19. Calculations for selection of bypass pumping pipe size;
20. Schedule for installation of and maintenance of bypass pumping lines;
21. Plan indicating selection of location of bypass pumping line locations and areas to be fenced;
22. All items related to testing, inspection, maintenance, and monitoring as described;
23. Bypass pumping/piping emergency plan; and
24. Bypass Pumping System Inspection Checklist.

C. MWS review of a Bypass Pumping Plan does not relieve any responsibility for adequacy or proper execution of the plan.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for bypass pumping incidental to the Work with no separate payment allowed.

1.04 GENERAL

A. Furnish all material, labor, equipment, power, maintenance, and other items necessary to implement a temporary sewer bypass pumping system for the purpose of diverting existing flow to complete the Work.

B. Do not discharge or release wastewater or debris into the environment.

C. Take sole responsibility for site cleanup consistent with MWS's Spill and Overflow Response Plan and fines or penalties enacted by the Tennessee Department of Environmental and Conservation, the United States Environmental Protection Agency, or other regulatory groups or programs if a discharge or release of wastewater or debris occurs during bypass pumping operations.

D. Ensure temporary sewer bypass pumping activities are completed in full compliance with the Metro Stormwater Management Regulations and no illicit discharges of pollutants to a location that would create contaminated stormwater runoff to a storm sewer, a stormwater conveyance, or a stream within Metro Nashville Davidson County shall occur per Metro Ordinance §15.64.205 - Non-stormwater discharges.

E. Locate all bypass pumping equipment and accessories above 100 year flood elevation where possible.

F. Provide, if required by MWS, trailer mounted or portable, bypass pumping assemblies conforming to all requirements.

G. Take sole responsibility for the design, installation, and operation of the bypass pumping system.

H. Employ the services of a vendor who can demonstrate a specialization in the design and operation of temporary bypass pumping systems. Provide at least five (5) references of projects of similar size and complexity within the past three (3) years.

I. Meet the requirements of all codes and regulatory agencies having jurisdiction.

J. Divert the flow around the work area in a manner that will not cause damage, backup, overflow, or surcharge the system; protect public and private property; and protect water resources, wetlands, and other natural resources.

K. Maintain uninterrupted sewer service.

L. Adhere to any satellite city ordinances or apply for variances as needed.

M. Schedule bypassing during low sewer flows times when possible.

N. Use of open trenches or channels to convey flow will not be permitted under any circumstances.

PART 2: PRODUCTS

2.01 EQUIPMENT

A. Provide electric or diesel powered pumps with fully automatic self-priming without the need for foot valves or vacuum pumps that can continue to operate in dry conditions.

B. Place pumps with start/stop controls in temporary berms designed to contain fluids.

C. Use coupled, flanged, or proper butt-fusion high density polyethylene (HDPE) discharge pipe free of visible cracks, discoloration, pitting, varying wall thickness, holes, or other deleterious faults with a minimum pressure rating of 2.5 times the total dynamic head of pumps and keep a HDPE fusion machine and qualified operator onsite for the duration of bypass pumping operations to perform immediate repairs.

D. Provide flexible hose and couplings that are abrasive resistant and suitable for the intended services and internal and external loadings including traffic loading where applicable.

E. Use short sections of discharge hose only with the written approval from MWS.

F. If multiple pumps are used with a header system, supply check valves so pumps can be removed, serviced, and/or replaced while the system remains operational.

G. Keep an adequate supply of spare parts, accessories, and hoisting equipment for pumps and piping onsite for immediate repairs.

H. Use adequate insulation / protection at the suction and discharge locations to reduce sewer gases and odors to the surrounding area during bypass pumping operations.

I. Provide noise attenuators for pumps and/or generators to muffle sound to conform to noise ordinances.

2.02 DESIGN REQUIREMENTS

A. Obtain hydraulic data from MWS, if available.

B. Design bypass pumping systems to operate 24 hours per day and have sufficient capacity to safely divert 2 times the peak flow around the work area.

C. Provide 100% redundant standby pumps of each size isolated with valves from the primary bypass pumping system that automatically switch from the initial system upon failure.

D. Determine discharge and suction piping sizing according to flow calculations and system operating calculations.

E. Provide redundant piping for relatively long bypass lengths or large diameter bypass lines, if required by MWS.

F. Design the bypass pumping system to overcome any existing force main pressure on discharge.

G. Make special design considerations for pump suction lifts greater than 23 feet.

PART 3: EXECUTION

3.01 QUALITY CONTROL AND MAINTENANCE

A. Perform hydrostatic leakage and pressure tests of the bypass pumping discharge piping using clean water and 2.5 times the dynamic head of the pumps prior to actual operation of the system for each setup.

B. Notify MWS 24 hours prior to testing.

C. Physically inspect the bypass pumping system on a continuous basis of at least every two hours and document inspections with an approved Bypass Pumping System Inspection Checklist containing all components of the bypass system.

D. Ensure the temporary bypass system is properly maintained and a responsible, adequately trained operator is available at all times when pumps are operating.

E. Provide telemetry with an auto dialer feature or designated personnel to continuously monitor the bypass pumping system during all hours of operations.

F. Immediately alert MWS of malfunctions or high levels of bypass pumping operations.

G. Provide inline stream monitoring systems if bypass pumping activities are to be conducted near streams, water conveyance areas, or any case where a potential exists for wastewater to discharge into a waterway. Mount monitoring systems in the receiving streams and in the immediate downstream areas of where the bypass piping goes back to gravity. Monitoring systems to have the minimum following characteristics:

1. Measures real time conductivity and dissolved oxygen in at least 30 minute intervals;
2. Web-portal capabilities with alarm functions for dissolved oxygen and conductivity;
3. Capabilities of sending email and text message alarms to at least five devices;
4. Solar battery charging capabilities.

3.02 INSTALLATION AND REMOVAL

A. Locate, protect, and minimize disturbance of existing utilities in the area selected for bypass pipelines.

B. Incorporate a primary and secondary plugging device when plugging or blocking flows and remove plugging device in a manner that permits the sewage flow to return to normal without surge or causing other major disturbances downstream.

C. Do not install bypass pipelines in wetland areas.

D. Locate bypass pipelines, if possible, off streets and sidewalks.

E. When bypass pipelines cross local streets and/or private driveways cover with temporary pavement.

F. Restore property to preconstruction conditions upon completion of bypass pumping operations.

G. Obtain written approval from the property owner for placement of bypass equipment and/or piping on private property.

END OF SECTION

SECTION 33 31 61

ACCEPTANCE TESTING FOR SANITARY SEWERS

PART 1: GENERAL

1.01 SCOPE

A. Acceptance testing for gravity sewer mains, sanitary sewer force mains, low pressure sanitary sewer mains, and sewer manholes.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit a test plan in accordance with these specifications.

C. Submit signed test reports for all sanitary sewer testing required.

1.03 MEASUREMENT AND PAYMENT

A. Consider expenses for acceptance testing of sanitary sewers incidental to the Work with no separate payment allowed.

B. Provide labor, equipment, or any other devices necessary for proper testing at no cost.

1.04 PERFORMANCE REQUIREMENTS

A. Supply pipe materials, manholes, and other sanitary sewer appurtenances that will meet performance requirements.

B. Ensure sewer service connections and service lines meet performance requirements.

C. Install gravity flow sanitary sewers with straight alignments and uniform grades between manholes.

D. Install sewer pipe with no more than 5 percent barrel deflection.

E. Provide installed sewer pipes with no visual seal, longitudinal, and/or transverse cracks.

F. Provide installed sewer pipes with no measureable leakage and/or infiltration.

1.05 TESTING REQUIREMENTS

A. Perform Mandrel Test, Low Pressure Air Test, and internal video observations for newly installed gravity sanitary sewers.

B. Perform Hydrostatic Pressure Test for newly installed sanitary force mains.

C. Perform Vacuum Test for newly installed sanitary sewer manholes.

D. Perform Infiltration Test, Exfiltration Test, and/or Smoke Test at the direction of MWS.

1.06 OBSERVATION

A. Perform testing in the presence of MWS.

B. Observable leakage, infiltration, grade defects, and/or cracks will not be accepted.

1.07 REMEDIATION

A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.

B. Repair deficiencies in sanitary sewer pipe by re-bedding pipe, re-laying pipe, and/or removing and replacing pipe that does not conform to the Drawings and Specifications at no additional cost.

PART 2: PRODUCTS

2.01 NOT USED

PART 3: EXECUTION

3.01 MANDREL TEST

A. Perform testing no sooner than 30 days after backfilling of line segment.

B. Construct or furnish mandrel with a minimum diameter of 95 percent of the inside diameter of the pipe being tested.

C. Construct or furnish mandrel with metal or rigid plastic material that can withstand 200 psi without being deformed.

D. Construct or furnish mandrel to have nine or more nonadjustable or noncollapsible runners or legs.

E. Construct or furnish the barrel section of the mandrel with a diameter of 75 percent of the inside diameter of the pipe being tested.

F. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel.

G. Retest repaired or replaced sewer sections.

3.02 LOW PRESSURE AIR TEST

A. Perform low pressure air test on gravity sanitary sewer mains less than a 36-inch inside diameter in accordance with the latest version of ASTM C 828, ASTM C 924, as ASTM F1417 as applicable.

B. Use testing pneumatic plugs that can remain in place when pressurized to 25 psig without external aids.

C. For pipes 36 inches inside diameter and larger test pipe at each joint. 10 seconds is the minimum time allowable for pressure to drop from 3.5 psig to 2.5 psig.

D. For pipe less than 36 inch inside diameter test in accordance with the following:

1. Determine ground water level.
2. Plug both ends of pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug concrete pipe.
3. After manhole-to-manhole section of sanitary sewer main has been sliplined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.
4. Pressurize pipe to 4.0 psig. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in system. Allow pressure to stabilize for 2 to 4 minutes. Adjust pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 1 below:
5. To determine air loss, measure time interval for pressure to drop to 2.5 psig. Time must exceed that listed in the table below for pipe diameter and length. For sliplining, use diameter of carrier pipe.

TABLE 1 - LOW PRESSURE AIR TEST (TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG)

Pipe Diam. (in)	**Min. Time (min /sec)**	Length for min. time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) shown (min:sec)										
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft	550 ft	600 ft
6	**5:40**	398	0.854	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:25	7:07	7:50	8:33
8	**7:33**	298	1.519	7:33	7:33	7:33	7:33	7:36	8:52	10:08	11:24	12:40	13:56	15:12
10	**9:27**	239	2.374	9:27	9:27	9:27	9:54	11:52	13:51	15:50	17:48	19:47	21:46	23:45
12	**11:20**	199	3.419	11:20	11:20	11:20	14:15	17:06	19:57	22:48	25:39	28:30	31:20	34:11
15	**14:10**	159	5.342	14:10	14:10	17:48	22:16	26:43	31:10	35:37	40:04	44:31	48:58	53:25
18	**17:00**	133	7.692	17:00	19:14	25:39	32:03	38:28	44:52	51:17	57:42	64:06	70:31	76:56
21	**19:50**	114	10.47	19:50	26:11	34:54	43:38	52:21	61:05	69:48	78:32	87:15	95:59	104:42
24	**22:40**	99	13.67	22:48	34:11	45:35	56:59	68:23	79:47	91:10	102:34	113:58	125:22	136:46
27	**25:30**	88	17.30	28:51	43:16	57:42	72:07	86:33	100:58	115.24	129.49	144.14	158.40	173.05
30	**28:20**	80	21.36	35:37	53:25	71:14	89:02	106:51	124:39	142:28	160:16	178:05	195:53	213:41
33	**31:10**	72	25.85	43:06	64:38	86:11	107:44	129:17	150:50	172:23	193:55	215:28	237:01	258:34

3.03 HYDROSTATIC PRESSURE TESTING FOR SANITARY SEWER FORCE MAINS AND LOW PRESSURE SANITARY SEWER MAINS

A. Perform Hydrostatic pressure testing in accordance with the latest version of applicable AWWA standard.

B. Pressurize line to 1.5 times the stated working pressure of the pipeline at the lowest elevation or 150 psi whichever is greater.

C. Maintain pressure for a minimum of 4 hours with no more than a 5 psi variance

for the duration of the test.

D. Introduce water slowly to vent all air for the section of pipe being tested.

E. If permanent air vents such as air release valves, are not located at all high points on the section, install corporation cocks at points to expel air as the line is filled with water. Remove corporation cock and plug the line after pressure test has passed.

F. If the specified testing pressure cannot be maintained, makeup water may be added into the pipeline to main the pressure as directed by the on-site project representative. No more than the amount shown Table 2 - Pressure Testing Make Up Allowance Table below shall be allowed as make up water. The quantity shown is the maximum amount allowed per hour per 1,000 feet for the 4 hour test. The addition of makeup water shall be done only one time and in the presence of MWS allowing visual measurement of the amount added.

Table 2 - Pressure Testing Make Up (Allowance) Water to Maintain Testing Pressure*
Gallons allowed per hour per 1,000 feet of main tested

	Average Test Pressure (psi)									
Pipe Diameter	**100**	**125**	**150**	**175**	**200**	**225**	**250**	**275**	**300**	**350**
1”	0.07	0.08	0.08	0.09	0.10	0.10	0.11	0.11	0.12	0.13
1.25”	0.08	0.09	0.10	0.11	0.12	0.13	0.13	0.14	0.15	0.16
1.5”	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19
2”	0.14	0.15	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.25
2.5”	0.17	0.19	0.21	0.22	0.24	0.25	0.27	0.28	0.29	0.32
3”	0.20	0.23	0.25	0.27	0.29	0.30	0.32	0.34	0.35	0.38
4”	0.27	0.30	0.33	0.36	0.38	0.41	0.43	0.45	0.47	0.51
6”	0.41	0.45	0.50	0.54	0.57	0.61	0.64	0.67	0.70	0.76
8”	0.54	0.60	0.66	0.72	0.76	0.81	0.85	0.90	0.94	1.01
10”	0.68	0.76	0.83	0.89	0.96	1.01	1.07	1.12	1.17	1.26
12”	0.81	0.91	0.99	1.07	1.15	1.22	1.28	1.37	1.40	1.52
16”	1.08	1.21	1.32	1.43	1.53	1.62	1.71	1.79	1.87	2.02
18”	1.22	1.36	1.49	1.61	1.72	1.82	1.92	2.02	2.11	2.28
20”	1.35	1.51	1.66	1.79	1.91	2.03	2.14	2.24	2.34	2.53
24”	1.62	1.81	1.99	2.15	2.29	2.43	2.56	2.69	2.81	3.03
30”	2.03	2.27	2.48	2.68	2.87	3.04	3.21	3.36	3.51	3.79
36”	2.43	2.72	2.98	3.22	3.44	3.65	3.85	4.03	4.21	4.55
42”	2.84	3.17	3.48	3.75	4.01	4.26	4.49	4.71	4.92	5.31
48”	3.24	3.63	3.97	4.29	4.59	4.86	5.13	5.38	5.62	6.07
54”	3.65	4.08	4.47	4.83	5.16	5.47	5.77	6.05	6.32	6.83
60”	4.05	4.53	4.97	5.36	5.73	6.08	6.41	6.72	7.02	7.58

***** Source: ANSI/AWWA C600-11 Table 5A

3.04 INTERNAL VIDEO OBSERVATIONS

A. Deliver a color video media compatible with MWS current operating software and devices.

B. Identify each media with labels showing Project Name, Contractor’s name, and

each manhole-to-manhole pipe segment of sewer line.

C. Audio commentary in video media to be sufficiently free from electrical interference and background noise to provide complete intelligibility of oral report.

D. Visually display and provide commentary in video media which contain the following: narrative of location, direction of view, manhole numbers/stations, length of segment, pipe diameter and material, date, time of observation, and location of laterals and other key features.

E. Utilize video observation equipment with current technology and standards including rotating head, capable of 90-degree rotation from horizontal and 360-degree rotation about its centerline.

F. Utilize video observation equipment capable of measuring distance traveled the in sewer, accurate to plus or minus 2 feet in 1,000 feet.

G. Provide 360-degree sweep of pipe interior and provide commentary on points of interest and document with MWS standard notations.

H. Points of interest may include, but are not limited to the following: defects, encrustations, mineral deposits, debris, sediment, and any location determined not to be installed to specifications and drawings.

I. Maximum recording rate of travel shall be 30 feet per minute.

J. Do not exceed depth of flow shown in Table 3 below for respective pipe sizes as measured in manhole.

K. When depth of flow at upstream manhole of sewer line section being worked is above maximum allowable, reduce flow to level shown in Table 3 below, by plugging or blocking of flow, or by pumping and bypassing of flow as specified.

Table 3 - Maximum Depth of Flow for internal video observation	
Nominal Pipe Diameter	Maximum Depth of Flow
6” - 10”	20 percent of pipe diameter
12” - 24”	25 percent of pipe diameter

3.05 VACUUM TESTING FOR MANHOLES

A. Install vacuum test head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.

B. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified in Vacuum Test Time Table 4 below:

C. If drop in vacuum exceeds 1 inch Hg over specified time period tabulated in Table 4 below, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

TABLE 4 - MINIMUM TESTING TIMES FOR SANITARY MANHOLES – VACUUM TEST			
DEPTH (FT)	TIME IN SECONDS BY DIAMETER		
	48”	60”	72”
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
*	5.0	6.5	8.0
*Add T times for each additional 2-foot depth. (The values listed above have been extrapolated from ASTM C924-85)			

3.06 EXFILTRATION TEST

A. Determine ground water elevation.

B. Plug sewer in downstream manhole and plug incoming pipes in upstream manhole

C. Install riser pipe in outgoing pipe of upstream manhole when highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.

D. Fill sewer pipe and manhole of pipe riser with environmentally acceptable biodegradable dyed water to point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest

E. Allow water to stabilize for one to two hours. Take water level reading to determine drop of water surface, in inches, over one-hour period, and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to the Table 5 - Water Test Allowable Leakage below.

3.07 INFILTRATION TEST

A. Determine ground water elevation. Ground water elevation must be not less than

2 feet above highest point of sewer pipe or service lead (house service)

B. Plug incoming pipes in upstream manhole.

C. Insert calibrated 90 degree V-notch weir in pipe on downstream manhole.

D. Allow water to rise and flow over weir until it stabilizes.

E. Take five readings of accumulated volume over period of 2 hours and use average for infiltration. Average must not exceed that calculated for 2 hours from allowable leakage according to Table 5 - Water Test Allowable Leakage below.

TABLE 5 - WATER TEST ALLOWABLE LEAKAGE				
DIAMETER OF RISER OR STACK IN INCHES	VOLUME PER INCH OF DEPTH		ALLOWANCE LEAKAGE*	
	INCH	GALLONS	PIPE SIZE IN INCHES	GALLONS/MINUTE PER 100FT.
1	0.7854	.0034	6	0.0039
2	3.1416	.0136	8	0.0053
2.5	4.9087	.0212	13	0.0066
3	7.0686	.0306	12	0.0079
4	12.5664	.0306	15	0.0099
5	19.6350	.0544	18	0.0118
6	28.2743	.1224	21	0.0138
8	50.2655	.2176	24	0.0158
			27	0.0177
			30	0.0197
			36	0.0237
			42	0.0276
For other diameters, multiply square of diameters by value of 1” diameter			Equivalent to 50 gallons per inch of inside diameter per mile per 24 hours	
* Allowable leakage rate shall be reduced to 10 gallons per inch of inside diameter per mile per 24 hours, when sewer is identified as located within 25-year flood plain				

3.08 SMOKE TEST PROCEDURE FOR POINT REPAIRS

A. Perform smoke test under the direction of MWS.

B. Utilize Smoke generator that produces a minimum of 2500 standard cubic feet per minute

C. Give written notices to area residents no fewer than 2 days prior to proposed testing. Also give notice to local police and fire departments 24 hours prior to actual smoke testing.

D. Operate equipment according to manufacturer's recommendation

E. Conduct test by forcing smoke from smoke generators through sanitary sewer

main and service connections. Operate smoke generators for minimum of 5 minutes.

F. Introduce smoke into upstream and downstream manhole as appropriate. Monitor tap/connection for smoke leaks. Note sources of leaks.

G. Repair and replace taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at time. When repair or replacement, testing or retesting, and backfilling of excavation is not completed within one work day, properly barricade and cover each excavation.

H. For houses where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to newly installed liner pipe, perform dye test to confirm reconnection. Introduce dye into service line through plumbing fixture inside structure or sewer cleanout immediately outside structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms reconnection.

END OF SECTION

Mandrel Test Data Sheet
Metro Water Service

Date: _____ Project: _____

Material: _____ Sheet #: _____ Max Allowed Deflection: _____

Upstream MH Sta. #	Downstream MH Sta. #	Pipe Dia. (inches)	Length (feet	Pass or Fail

MWS Representative: _____ Date: _____

(Signature)

Contractor: _____ Date: _____

(Signature)

PIPE VS. MANDREL DIAMETER

Material and Wall Construction	Nominal Size(Inches)	Average I.D. (Inches)	Minimum Mandrel Diameter (Inches)
PVC-Solid (SDR 26)	6	5.764	5.476
	8	7.715	7.329
	10	9.646	9.162
PVC-Solid (SDR 35)	12	11.737	11.150
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.120
	27	26.351	25.033
PVC-Truss	8	7.750	7.363
	10	9.750	9.263
	12	11.790	11.201
	15	14.770	14.032
PVC-Profile (ASTM F 794)	12	11.740	11.153
	15	14.370	13.652
	18	17.650	16.768
	21	20.750	19.713
	24	23.500	22.325
	27	26.500	25.175
	30	29.500	28.025
	36	35.500	33.725
	42	41.500	39.425
	48	47.500	45.125
HDPE-Profile	18	18.000	17.100
	21	21.000	19.950
	24	24.000	22.800
	27	27.000	25.650
	30	30.000	28.500
	36	36.000	34.200
	42	42.000	39.900
	48	48.000	45.600
	54	54.000	51.300
	60	60.000	57.000
Fiberglass-Centrifugally Cast (Class SN	12	12.85	11.822
	18	18.66	17.727
	20	20.68	19.646
	24	24.72	23.484
	30	30.68	29.146
	36	36.74	34.903
	42	42.70	40.565
	48	48.76	46.322
	54	54.82	52.079
	60	60.38	57.361

Leakage Testing for Sanitary Sewer Lines
Metro Water Service

Project: _____ Sheet #: _____ Location: _____

Inspector: _____ Date: _____ Contractor: _____

Line Test Log

Test #	Manhole UP	Manhole Down	Line Length	Line Diameter	Avg. Depth of Line	Avg. Depth of Ground-water	Start Air Pressure	End Air Pressure	Time Elapsed	Time Allowed (per table*)	Pass or Fail	Inspector	Contractor
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													

TABLE 1 - LOW PRESSURE AIR TEST (TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG)

Pipe Diam. (in)	**Min. Time (min /sec)**	Length for min. time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) shown (min:sec)										
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft	550 ft	600 ft
6	**5:40**	398	0.854	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:25	7:07	7:50	8:33
8	**7:33**	298	1.519	7:33	7:33	7:33	7:33	7:36	8:52	10:08	11:24	12:40	13:56	15:12
10	**9:27**	239	2.374	9:27	9:27	9:27	9:54	11:52	13:51	15:50	17:48	19:47	21:46	23:45
12	**11:20**	199	3.419	11:20	11:20	11:20	14:15	17:06	19:57	22:48	25:39	28:30	31:20	34:11
15	**14:10**	159	5.342	14:10	14:10	17:48	22:16	26:43	31:10	35:37	40:04	44:31	48:58	53:25
18	**17:00**	133	7.692	17:00	19:14	25:39	32:03	38:28	44:52	51:17	57:42	64:06	70:31	76:56
21	**19:50**	114	10.47	19:50	26:11	34:54	43:38	52:21	61:05	69:48	78:32	87:15	95:59	104:42
24	**22:40**	99	13.67	22:48	34:11	45:35	56:59	68:23	79:47	91:10	102:34	113:58	125:22	136:46
27	**25:30**	88	17.30	28:51	43:16	57:42	72:07	86:33	100:58	115.24	129.49	144.14	158.40	173.05
30	**28:20**	80	21.36	35:37	53:25	71:14	89:02	106:51	124:39	142:28	160:16	178:05	195:53	213:41
33	**31:10**	72	25.85	43:06	64:38	86:11	107:44	129:17	150:50	172:23	193:55	215:28	237:01	258:34

SECTION 33 33 00

LOW PRESSURE SANITARY SEWERS

PART 1: GENERAL

1.01 SCOPE

A. Low pressure sanitary sewer mains for sizes smaller than 3 inches for grinder pump systems, taps and connections, abandonments, and excavation and backfill.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed low pressure sanitary sewer pipe, joints, joint materials, specials, and fittings for approval.

C. Submit crushed stone bedding and envelope material sieve analysis and compaction methods

D. Submit abandonment plan, bypass pumping requirements, and plugging, if any, and other information pertinent to completion of the Work.

E. Submit asphaltic binder information certifying material is in conformance with the latest revision of Metro Public Works standard specification Section 02575 if the low pressure sanitary sewer is to be installed within a Metro Public Works roadway or the latest revision of the applicable TDOT asphaltic binder specification if the low pressure sanitary sewer is to be installed within a TDOT roadway.

F. Submit flowable fill information certifying material is in conformance with the latest revision of Metro Public Works standard specification Section 02225 if the low pressure sanitary sewer is to be installed within a Metro Public Works roadway or the latest revision of the applicable TDOT flowable specification if the low pressure sanitary sewer is to be installed within a TDOT roadway.

G. Submit outside roadway backfill material source, quality information, and compaction methods.

H. Submit Proctor Density Test results in accordance with the latest revision of ASTM D698 or ASTM D1557 when required by MWS.

I. Submit compaction field testing results in accordance with the latest revision of ASTM D6938 or other approved method when required by MWS.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing low pressure sanitary sewers

at the contract unit price per linear foot for the low pressure sanitary sewer installed complete and ready for operation. Measure the low pressure sanitary sewer horizontally along the centerline of the pipe in place including valves, bends, reducers, and offsets.

1. Include cost in the unit price for low pressure sanitary sewer for labor, equipment, material, cutting, laying, joints, lowering, raising, other offsets necessary to avoid obstructions, field adjustments of alignment, rodding, temporary filling/flushing caps, standby time and delay in MWS access of existing wastewater system assets, hydrostatic testing and other testing required, and all incidentals necessary for a complete and operable installation.
2. Include cost in the unit price for low pressure sanitary sewers for fittings whether fittings and/or offsets are indicated on the Drawings or not.
3. Include cost in the unit price for low pressure sanitary sewers for excavation. Excavation is unclassified with no distinction made between rock and/or dirt excavation. Rock excavation beyond anticipated or indicated in a provided geotechnical report will not be considered basis for additional payment.
4. Include cost in the unit price for low pressure sanitary sewers for crushed stone bedding, crushed stone envelope, and additional crushed stone used as backfill material when water main exceeds minimum depths.
5. Include cost in the unit price for low pressure sanitary sewers for outside of roadway backfill material.
6. Include cost in the unit price for low pressure sanitary sewers for dewatering operations including but not limited to water filtration systems for groundwater, obtaining permits with appropriate agencies on dewatering activities, and appropriately filtering and properly disposing of groundwater in accordance with permits.
7. Undercutting of undesirable material at the trench base and crushed stone refill material to be paid with Unforeseen Work Elements allowance bid item.

B. MWS will compensate for furnishing and installing taps and connections at the contract unit price per each for each taps and connection complete and ready for operation.

1. Include all cost in the unit price for taps and connections for labor, equipment, excavation, material, rodding, backfilling, and all incidentals necessary for a

complete and operable installation.

C. MWS will compensate for cutting and plugging in order to abandon an existing low pressure sanitary sewer at the contract unit price of each for each cutting and plugging operation.

1. Include all cost in the unit price for cutting and plugging for labor, equipment, materials, permanent solid low pressure sanitary sewer plug, removing valve boxes over valves on abandoned low pressure sanitary sewers, and all incidentals necessary for a complete low pressure sanitary sewer abandonment operation.

D. MWS will compensate for furnishing and installing flowable fill at the contract unit price per theoretical cubic yard calculated utilizing the specified trench width per low pressure sanitary sewer size, the length of low pressure sanitary sewer installed, and the specified flowable fill depth; not the actual amount of flowable fill if more material is installed.

1. Include all cost in the unit price for flowable fill for excavation, material, labor, and all incidentals necessary for a complete installation.

E. MWS will compensate for furnishing and installing asphalt binder at the contract unit price per theoretical cubic yard calculated utilizing the specified trench width per low pressure sanitary sewer main size, the length of low pressure sanitary sewer main installed, and the specified asphalt binder depth; not the actual amount of asphalt binder if more material is installed.

1. Include all cost in the unit price for asphalt binder for excavation, material, labor, and all incidentals necessary for a complete installation.

F. MWS will compensate for furnishing and installing miscellaneous concrete at the contract unit price per cubic yard for concrete installed between a proposed low pressure sanitary sewer traversing perpendicular and above an existing water main.

1. Include all cost in the unit price for miscellaneous concrete for excavation, materials, labor, and all incidentals necessary for a complete installation.

G. MWS will compensate for furnishing and installing temporary low pressure sanitary sewer at the contract unit price per linear foot for the temporary low pressure sanitary sewer installed complete and ready for operation if indicated on the Bid Schedule. MWS will not compensate for furnishing and installing temporary low pressure sanitary sewers if being installed for contractor's ease of

construction and convenience, or being installed due to contractor's negligence. Measure the temporary low pressure sanitary sewer horizontally along the centerline of the pipe in place including valves, bends, reducers, and offsets.

1. Include all cost in the unit price for temporary low pressure sanitary sewers for labor, equipment, excavation, material, cutting, laying, temporary fittings, temporary valves, backfill, testing, temporary connections to the existing wastewater system, temporary service connections, and all incidentals necessary for a complete and operable installation.

1.02 GENERAL

A. Calculate Bid Schedule payment items of flowable fill and asphalt binder based on a trench width of 2.5 feet. If a wider trench width is utilized during construction, payment will only be compensated based on the trench width of 2.5 feet.

B. Bury low pressure sewers and backfill trench in roadways in accordance with the following table. Bury pipe at minimum depths unless additional depth is required to avoid an obstruction. Utilize crushed stone material compacted in maximum 8-inch lifts at the proper moisture content as the supplementary trench backfill material when low pressure sewers must be installed below the minimum depths.

	MPW Roadway	TDOT Roadway
Asphalt Binder above Flowable Fill to Grade	8"	11"
Flowable Fill above Crushed Stone Envelope	14"	23"
Crushed Stone Envelope above Top of Pipe	8"	8"
Total Cover (Min Depths)	30"	42"
Crushed Stone Bedding Below Bottom of Pipe	6"	6"

C. Bury low pressure sanitary sewer and backfill trench outside of roadways in accordance with the following table. Bury pipe at minimum depths unless additional depth is required to avoid an obstruction. Utilized native backfill material compacted in 8-inch lifts as the supplementary trench backfill material when the low pressure sanitary sewer must be installed below the minimum depths.

Total Cover (Minimum Depth)	Crushed Stone Bedding below Bottom of Pipe	Crushed Stone Envelope above Top of Pipe	Native Soil above Crushed Stone Envelope to Finished Grade

30”	6”	8”	22”

D. Maintain existing wastewater services throughout construction.

E. Request shut down isolation times and durations in writing to MWS 7 days in advance for approval.

F. Provide sewer customers at least 24 hour notice prior to an interruption of sewer service.

G. Do not operate valves on the existing system and/or new low pressure sanitary sewers placed in service.

H. MWS will make every reasonable effort to isolate and shut off the flow of waste water of existing low pressure sewer systems when required for the Work. Circumstances may prevent timely waste water shut offs such as but not limited to faulty valves, excess wastewater flows, access to locations, weather conditions, and lack of forces due to higher priority situations. Consider standby time due to these types of delays incidental to the Work will no separate payment allowed.

I. Do not make connections to the existing wastewater system until applicable tests including; hydrostatic testing have been performed and reported to MWS and found to be in compliance.

J. Install temporary caps on new low pressure sanitary sewer and tap caps with a pluggable outlet of adequate size to be utilized as a filling and/or flushing location.

K. Install a solid permanent low pressure sanitary sewer plug on the end of an existing low pressure sanitary sewer when performing a cutting and plugging operation for abandonment of a low pressure sanitary sewer.

L. Properly abandon valve boxes over valves on abandoned low pressure sanitary sewers.

M. Perform Proctor Density Test in accordance with the latest revision of ASTM D698 or ASTM D1557 when required by MWS. Test to be performed by an independent MWS approved materials testing firm. Pay for test if Work is found to be noncompliance.

N. Perform compaction field testing results in accordance with the latest revision of ASTM D6938 or other approved method when required by MWS. Compaction tests to be performed by an independent MWS approved materials testing firm. Pay for test if Work is found to be noncompliance.

PART 2: PRODUCTS

2.01 GENERAL

A. Provide low pressure sanitary sewer products and accessories from manufacturers in accordance with MWS Approved Materials List.

B. Provide SDR 21 PVC pipe for low pressure sanitary sewer mains unless otherwise indicated on the Drawings.

C. Provide No. 57 or No. 67 crushed stone for pipe bedding, pipe envelope, and additional backfill material when low pressure sanitary sewer exceeds minimum buried depths.

D. Provide asphaltic binder in conformance with the latest revision of Metro Public Works standard specification Section 02575 when the low pressure sanitary sewer is to be installed within a Metro Public Works roadway and provide asphaltic binder in conformance with the latest revisions of the applicable TDOT specification when the low pressure sanitary sewer is to be installed within a TDOT roadway.

E. Provide excavatable flowable fill in conformance the latest revision of Metro Public Works standard specification Section 02225 when a low pressure sanitary sewer is to be installed within a Metro Public Works roadway and provide excavatable flowable fill in conformance with the latest revisions of the applicable TDOT specification when the low pressure sanitary sewer is to be installed within a TDOT roadway.

F. Provide Certa-Lok Yelomine restraint joint pipe and fittings or approved equal for temporary low pressure sanitary sewers. Provide a temporary low pressure sanitary sewer and fittings with a pressure rating equal to 1.5 times the working pressure and adequately sized to maintain the existing level of wastewater service.

G. Provide full ported PVC bodied valve with the following: water pressure rating of 200psi at 72.4° F; C37700 brass ball; ASTM B16 brass stem; ASTM D 2241 steel handle; O-ring backing cushioned valve seats; NPT threaded for ½" to 2" or IPS socket for ½" to 4" connections; and the stem to have double O-ring seals and a safety shear point above the O-rings.

H. Provide check valves with a water pressure rating of 200 psi at 72.4° F.

PART 3: EXECUTION

3.01 GENERAL

A. Deliver low pressure sanitary sewer products and accessories to job site free of damages and/or defects. If damages or defects are discovered, provide new material at no cost to MWS.

B. Store materials on site in enclosures or under protective above ground coverings.

C. Support pipe at least every 10 feet of its length during handling, take special care to avoid placing undue stress on the pipe during handling, and avoid any actions that may damage the bell or spigot ends of the pipe.

D. Keep interiors of low pressure sanitary sewer products free of dirt and debris.

E. Install low pressure sanitary sewer, joints, and fittings per manufacturer's recommendations.

F. Install low pressure sanitary sewers to maintain minimum cover as specified.

G. Install low pressure sanitary sewer pipe in crushed stone gravel bedding in the dry.

H. Install dewatering systems, if necessary, for excavation and low pressure sanitary sewer installation. Provide water filtration systems for groundwater, obtain permits with appropriate agencies for dewatering activities and appropriately filter and properly dispose of groundwater in accordance with permits.

I. Do not deflect low pressure sanitary sewers in excess of the manufacturer's recommendations.

J. Clean the inside of the bell and the outside of the plain end of the pipe with a wire brush wipe clean prior to joint assembly.

K. Clean all gaskets prior to joints and/or fittings assembly.

L. Grind all rough edges of the plain end of a field cut pipe.

M. Maintain a minimum of 10 feet horizontal separation when installing a low pressure sanitary sewer sharing a parallel alignment with a water main or water service line.

N. If sufficient cover is available, install the low pressure sanitary sewer under existing water mains or water service lines when sharing perpendicular alignments. Maintain a minimum vertical separation of 18 inches from the bottom of the existing water main or the existing water service line to the top of the new low pressure sanitary sewer.

O. If the low pressure sanitary sewer is installed over the existing water main or

existing water service pipe, maintain a minimum vertical separation of 24 inches from the bottom of the low pressure sanitary sewer to the top of the existing water main. Center the low pressure sanitary sewer at the point of the crossing to keep the water main joints at equal distances and as far as possible from the low pressure sanitary sewer. Install concrete material between the existing water main and the low pressure sanitary sewer crossing for the entire width of the distance between the utilities and for a length of at least 6 feet centered at the point of crossing.

3.02 EXCAVATION

A. No blasting will be permitted.

B. MWS may limit the method of excavation if conditions warrant such as trenching within areas of high concentration of utilities.

C. Contact Tennessee One Call Center (1-800-351-1111) the location of buried facilities pursuant to TCA 65-31-101 through TCA 65-31-133; however, take sole responsibility for the location of all affected underground utilities.

D. Notify MWS immediately, stop the Work, and wait for MWS direction before resuming the Work if solvents, petroleum products, or any unknown chemical substance is discovered during excavation.

E. Locate and preserve existing utilities. The types and locations of known existing utilities as indicated on the Drawings are approximate. Repair or replace damaged utilities at no cost to MWS.

F. Consider all excavation material unclassified, whether a geotechnical report is provided or not.

G. Saw cut pavement to trench width limits when excavation is within a roadway.

H. Excavate trench width to permit a minimum of 6 inches between the edge of the trench and the outside of the low pressure sanitary sewer.

I. Excavate to allow for a minimum of 6 inches of crushed stone bedding below the bottom of the low pressure sanitary sewer.

J. Remove unstable soil at the trench bottom if discovered and refill area with appropriate material.

K. Excavate to allow minimum low pressure sanitary sewer pipe cover per low pressure sanitary sewer size and roadway conditions as indicated.

L. Excavate in accordance with Trench Safety Systems, TOSHA and OSHA regulations, and permits.

M. Dispose of surplus excavated material at a Metro approved permitted site. Do not place excavated material on private property.

3.02 BACKFILL WITHIN ROADWAY

A. Take precautions not to damage the low pressure sanitary sewer and accessories during backfill operations. Replace damaged items at no cost to MWS.

B. Install specified backfill material for the full width of the excavated trench and to specified depths.

C. Install No. 57 or No. 67 crushed stone compacted to 95% Standard Proctor Density in 8-inch lifts for pipe bedding and pipe envelope. Place crushed stone bedding 6 inches below the bottom of the low pressure sanitary sewers. Place crushed stone envelope to a height of 8 inches above the top of the low pressure sanitary sewers. Utilize crushed stone material compacted in maximum 8-inch lifts at the proper moisture content as the supplementary trench backfill material when low pressure sanitary sewer must be installed below the minimum depths.

D. Install flowable fill above crushed stone envelope at indicated depths.

E. Install asphalt binder above flowable fill at the indicated depths compacted flush with the roadway surface elevation. Maintain smooth driving surface until final paving is complete.

F. Remove the indicated thickness of asphalt binder as part of the milling operations when preparing to pave the roadway.

G. Install the indicated thickness of asphaltic surface mix as part of the paving operations in accordance with Metro Public Works or TDOT specifications.

H. Remediate any settlement of backfill material for a period of one year after final completion and final acceptance of the Work by MWS.

3.03 BACKFILL OUTSIDE OF ROADWAY

A. Take precautions not to damage the low pressure sanitary sewers and accessories during backfill operations. Replace damaged items at no cost to MWS.

B. Install specified backfill material for the full width of the excavated trench.

C. Install No. 57 or No. 67 crushed stone compacted to 95% Standard Proctor Density in 8-inch lifts for pipe bedding and pipe envelope. Place crushed stone bedding 6 inches below the bottom of the low pressure sanitary sewer. Place crushed stone envelope to a height of 8 inches above the top of the low pressure

sanitary sewer. Utilize crushed stone material compacted in maximum 8-inch lifts at the proper moisture content as the supplementary trench backfill material when low pressure sanitary sewers must be installed below the minimum depths.

D. Install native soil compacted to 90% maximum Proctor Density in 12-inch lifts above the crushed stone envelope to finished grade. Utilize native soil material as the supplementary trench backfill material when low pressure sanitary sewers must be installed below the minimum depths. Do not utilize rock greater than 8 inches as backfill.

E. Remediate any settlement of backfill material for a period of one year after final completion and final acceptance of the Work by MWS.

F. Seed and straw disturbed area to reestablish growth. Replace trees and vegetation removed during clearing and excavation with trees and vegetation of equal size or larger.

END OF SECTION

SECTION 33 33 13
GRINDER PUMPS

PART 1: GENERAL

1.01 SCOPE

A. Grinder Pumps including controls and electrical components

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed grinder pumps and components for approval.

C. Furnish five sets of notarized shop drawings of the grinder pump components complete with the manufacturer's product data, including the tank, pump(s), piping, redundant check valve, alarm panel, and electrical components, and certification of testing and inspection stating the grinder pump components were constructed and satisfactorily tested in full compliance with these specifications and sworn to by the factory inspector in the presence of a Notary Public.

D. Provide certification that the installer has the proper manufacturer's certification and training to perform the Work.

E. Submit a start-up report after installation including pump information, test results, and other items concerning the installation.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing grinder pumps at the contract unit price per each complete and ready for operation.

B. Include all cost in the unit price for grinder pumps for grinder pump unit, which includes pump(s), tank, piping, connections to existing septic tank field piping, connection to the proposed or existing low pressure sewer main, alarm panel, and electrical work, excavation, concrete pad, bedding, concrete anchors, backfill, testing, service, site grading and landscaping, and all incidentals necessary for a complete and operable installation.

C. No payment will be made for connection of electrical work required by an existing customer in order to connect the grinder pumping unit.

PART 2: PRODUCTS

2.01 GRINDER PUMP UNITS

A. Provide grinder pump units, including alarm panel and redundant check valve, from the manufacturer in accordance with MWS published Approved Materials List.

B. Provide the required electrical disconnect box, conduit, and conductors for connection of grinder unit to alarm panel and electrical disconnect box.

C. Provide the gravity sewer piping, connections for the grinder pump unit, and the pump discharge low pressure sewer connection.

D. Provide a manufacturer's recommended redundant check valve for installation on the discharge low pressure sewer at a MWS determined location.

PART 3: EXECUTION

3.01 INSTALLATION

A. Excavate hole to a depth that the unit's removable cover extends approximately one inch to four inches above the finished grade and excavate to a sufficient diameter for the installation of poured concrete ballast. Locate excavation where no permanent obstructions will be within six feet of the unit or the discharge lines.

B. Slope the finished grade surrounding the unit away from the enclosure.

C. Install a minimum of 12 inches of TDOT Type A, Grade D crushed stone in bottom of the excavation for unit placement.

D. Install the grinder pump unit as recommended by the manufacturer's written instructions.

E. Install the unit level and fill the wet well with water to the manufacturer's recommended level to prevent the unit moving while pouring concrete ballast and backfilling around the unit.

F. Pour concrete for ballast per the manufacturer's recommendations.

G. Connect the existing septic tank piping and the proposed low pressure sewer discharge to the grinder pumping unit as recommended by the manufacturer.

H. Install a cleanout at the location directed by MWS.

I. Verify the grinder pump unit is properly vented to ensure correct operation.

J. Install the redundant check valve at the location directed by MWS.

K. Install the required electrical conduit and conductors to the alarm panel and electrical disconnect location and perform electrical connections as recommended by the manufacturer.

L. Backfill and compact the area surrounding the grinder unit with TDOT Type A, Grade D crushed stone to the depth 12 inches below finished grade.

M. Backfill, grade, and landscape disturbed area to preconstruction condition or better.

N. Properly seal around the alarm panel as recommended by the manufacturer.

O. Connect the alarm control and electrical disconnect at the location acceptable with property owner and MWS.

P. Provide the services of manufacturer's representative on-site during installation to ensure the grinder pump unit is installed, tested, and started properly.

END OF SECTION

SECTION 33 34 00
SEWER FORCE MAINS

PART 1: GENERAL

1.01 SCOPE

A. Sewer force mains, connections, abandonments, and excavation and backfill. Does not include small diameter grinder systems.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed force main pipe, joints, joint materials, specials, and fittings for approval.

C. Submit crushed stone bedding and envelope material sieve analysis and compaction methods.

D. Submit abandonment plan, bypass pumping requirements, and plugging, if any, and other information pertinent to completion of the Work.

E. Submit asphaltic binder information certifying material is in conformance with the latest revision of Metro Public Works standard specification Section 02575 if the force main is to be installed within a Metro Public Works roadway or the latest revision of the applicable TDOT asphaltic binder specification if force main is to be installed within a TDOT roadway

F. Submit flowable fill information certifying material is in conformance with the latest revision of Metro Public Works standard specification Section 02225 if the force main is to be installed within a Metro Public Works roadway or the latest revision of the applicable TDOT flowable specification if force main is to be installed within a TDOT roadway.

G. Submit outside roadway backfill material source, quality information, and compaction methods.

H. Submit Proctor Density Test results in accordance with the latest revision of ASTM D698 or ASTM D1557 when required by MWS.

I. Submit compaction field testing results in accordance with the latest revision of ASTM D6938 or other approved method when required by MWS.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing force mains at the contract unit price per linear foot for the force main installed complete and ready for operation. Measure the force main horizontally along the centerline of the pipe in place

including valves, bends, reducers, and offsets.

1. Include cost in the unit price for force mains for labor, equipment, material, cutting, laying, joints, lowering, raising, other offsets necessary to avoid obstructions, field adjustments of alignment, bypass pumping, standby time and delay in MWS isolation of existing sewer system, hydrostatic testing and other testing required, and all incidentals necessary for a complete and operable installation.
2. Include cost in the unit price for force mains for fittings whether fittings and/or offsets are indicated on the Drawings or not.
3. Include cost in the unit price for force mains for excavation. Excavation is unclassified with no distinction made between rock and/or dirt excavation. Rock excavation beyond anticipated or indicated in a provided geotechnical report will not be considered basis for additional payment.
4. Include cost in the unit price for force mains for crushed stone bedding, crushed stone envelope, and additional crushed stone used as backfill material when force main exceeds minimum depths.
5. Include cost in the unit price for force mains for outside of roadway backfill material.
6. Include cost in the unit price for force mains for dewatering operations including but not limited to water filtration systems for groundwater, obtaining permits with appropriate agencies on dewatering activities, and appropriately filtering and properly disposing of groundwater in accordance with permits.
7. Undercutting of undesirable material at the trench base and approved refill material to be paid with Unforeseen Work Elements Allowance bid item.

B. MWS will compensate for furnishing and installing connections at the contract unit price per each for each connection complete and ready for operation.

1. Include all cost in the unit price for connections for labor, equipment, excavation, material, backfilling, bypass pumping, and all incidentals necessary for a complete and operable installation.

C. MWS will compensate for cutting and plugging in order to abandon a force main at the contract unit price of each for each cutting and plugging operation.

1. Include all cost in the unit price for cutting and plugging for labor, equipment, materials, permanent solid force main plug, removing valve boxes over valves on abandoned force mains, bypass pumping, and all incidentals necessary

for a complete force main abandonment operation.

D. MWS will compensate for furnishing and installing flowable fill at the contract unit price per theoretical cubic yard calculated utilizing the specified trench width per force main size, the length of force main installed, and the specified flowable fill depth; not the actual amount of flowable fill if more material is installed.

1. Include all cost in the unit price for flowable fill for excavation, material, labor, and all incidentals necessary for a complete installation.

E. MWS will compensate for furnishing and installing asphalt binder at the contract unit price per theoretical cubic yard calculated utilizing the specified trench width per force main size and the length of force main install, not the actual amount of asphalt binder if more material is installed.

1. Include all cost in the unit price for asphalt binder for excavation, material, labor, and all incidentals necessary for a complete installation.

F. MWS will compensate for furnishing and installing miscellaneous concrete at the contract unit price per cubic yard for concrete installed between a proposed force main traversing perpendicular and above an existing water main.

1. Include all cost in the unit price for miscellaneous concrete for excavation, materials, labor, and all incidentals necessary for a complete installation.

1.04 GENERAL

A. Calculate Bid Schedule payment items of flowable fill and asphalt binder by the following table. If a wider than indicated trench width is utilized during construction, payment will only be compensated based on the trench width limits detailed in the following table.

Nominal Pipe Diameter (inches)	Trench Width (feet)
12 and smaller	2.5
14	3.0
16	3.0
18	3.0
20	3.5
24	4.0
30	4.5
36	5.0
42	6.0

48	6.5
54	7.0
60	8.0
64	8.5

B. Bury force main and backfill trench in roadways in accordance with the following table. Bury pipe at minimum depths unless additional depth is required to avoid an obstruction. Utilize crushed stone material compacted in maximum 8-inch lifts at the proper moisture content as the supplementary trench backfill material when force main must be installed below the minimum depths.

	MPW Roadway		TDOT Roadway
Nominal Pipe Size	Smaller than 12”	12” and Larger	All Pipe Sizes
Asphalt Binder above Flowable Fill to Grade	8”	8”	11”
Flowable Fill above Crushed Stone Envelope	14”	20”	23”
Crushed Stone Envelope above Top of Pipe	8”	8”	8”
Total Cover (Min Depths)	30”	36”	42”
Crushed Stone Bedding Below Bottom of Pipe	6”	6”	6”

C. Bury force main and backfill trench outside of roadways in accordance with the following table. Bury pipe at minimum depths unless additional depth is required to avoid an obstruction. Utilized suitable native backfill material compacted in 12 inch lifts as the supplementary trench backfill material when force main must be installed below the minimum depths.

Nominal Force Main Size	Total Cover (Minimum Depth)	Crushed Stone Bedding below Bottom of Pipe	Crushed Stone Envelope above Top of Pipe	Native Soil above Crushed Stone Envelope to Finished Grade
Smaller than 12”	30”	6”	8”	22”
12” and Larger	36”	6”	8”	28”

D. Request shut down isolation times and durations in writing to MWS 7 days in advance for approval.

E. Do not make connections to the existing sewer system until applicable tests including hydrostatic testing have been performed and reported to MWS and found to be in compliance.

F. Install a solid permanent force main plug on the end of an existing force main when performing a cutting and plugging operation for abandonment of an existing force main.

G. Properly abandon valve boxes and/or manholes over valves on abandoned force mains.

H. Perform Proctor Density Test in accordance with the latest revision of ASTM D698 or ASTM D1557 when required by MWS. Test to be performed by an independent MWS approved materials testing firm. Pay for test if Work is found to be noncompliance.

I. Perform compaction field testing results in accordance with the latest revision of ASTM D6938 or other approved method when required by MWS. Compaction tests to be performed by an independent MWS approved materials testing firm. Pay for test if Work is found to be noncompliance.

PART 2: PRODUCTS

2.01 GENERAL

A. Provide force main products and accessories from manufacturers in accordance with MWS Approved Material List.

B. Provide ductile iron restrained joint pipe for force mains unless otherwise indicated on the Drawings.

C. Provide No. 57 or No. 67 crushed stone for pipe bedding, pipe envelope, and additional backfill material when force main exceeds minimum buried depths.

D. Provide asphaltic binder in conformance with the latest revision of Metro Public Works standard specification Section 02575 when the force main is to be installed within a Metro Public Works roadway and provide asphaltic binder in conformance with the latest revisions of the applicable TDOT specification when the force main is to be installed within a TDOT roadway.

E. Provide excavatable flowable fill in conformance the latest revision of Metro Public Works standard specification Section 02225 when a force main is to be installed within a Metro Public Works roadway and provide excavatable flowable fill in conformance with the latest revisions of the applicable TDOT specification when the force main is to be installed within a TDOT roadway.

PART 3: EXECUTION

3.01 GENERAL

A. Deliver force main products and accessories to job site free of damages and/or

defects. If damages or defects are discovered, provide new material at no cost to MWS.

B. Store materials on site in enclosures or under protective above ground coverings.

C. Keep interiors of force main products free of dirt and debris.

D. Install force main, joints, and fittings per manufacturer's recommendations.

E. Install force main with spigot ends toward the direction of flow. Form a concentric joint with each section of adjoining pipe.

F. Install force main to maintain minimum cover as specified.

G. Install force main pipe in crushed stone gravel bedding in the dry.

H. Install dewatering systems, if necessary, for excavation and force main installation. Provide water filtration systems for groundwater, obtain permits with appropriate agencies for dewatering activities and appropriately filter and properly dispose of groundwater in accordance with permits.

I. Do not deflect force mains in excess of the manufacturer's recommendations.

J. Clean the inside of the bell and the outside of the plain end of the pipe with a wire brush wipe clean prior to joint assembly.

K. Clean all gaskets prior to joints and/or fittings assembly.

L. Grind all rough edges of the plain end of a field cut pipe.

M. Maintain a minimum of 10 feet horizontal separation when installing a force main sharing a parallel alignment with a water main or water service line.

N. Install the force main under existing water mains or water service lines when sharing perpendicular alignments. Maintain a minimum vertical separation of 18 inches from the bottom of the water main or water service line to the top of the force mains.

3.02 EXCAVATION

A. No blasting will be permitted.

B. MWS may limit the method of excavation if conditions warrant such as trenching within areas of high concentration of utilities.

C. Contact Tennessee One Call Center (1-800-351-1111) the location of buried facilities pursuant to TCA 65-31-101 through TCA 65-31-133; however, take sole responsibility for the location of all affected underground utilities.

D. Locate and preserve existing utilities. The types and locations of known existing utilities as indicated on the Drawings are approximate. Repair or replace damaged utilities, whether shown on the Drawings or not, at no cost to MWS.

E. Notify MWS immediately, stop the Work, and wait for MWS direction before resuming the Work if solvents, petroleum products, or any unknown chemical substance is discovered during excavation.

F. Do not remove any structures unless the structure is indicated to be removed on the Drawings or written approval is received by MWS.

G. Consider all excavation material unclassified, whether a geotechnical report is provided or not.

H. Saw cut pavement to trench width limits when excavation is within a roadway.

I. Excavate trench width to permit a minimum of 6 inches between the edge of the trench and the outside of the force main.

J. Excavate to allow for a minimum of 6 inches of crushed stone bedding below the bottom of the force main.

K. Remove unstable soil at the trench bottom if discovered and refill area with appropriate material. Notify and receive approval from MWS prior to undercutting and removing undesirable material at the trench base and utilizing approved refill material.

L. Remove all loose material from the trench bottom. Do not lay force mains and accessories directly on rock.

M. Excavate to allow minimum force main cover per force main size and roadway conditions as indicated.

N. Excavate in accordance with Trench Safety Systems, TOSHA and OSHA regulations, and permits.

O. Dispose of surplus excavated material at a Metro approved permitted site. Do not place excavated material on private property.

3.03 BACKFILL WITHIN ROADWAY

A. Take precautions not to damage the force main and accessories during backfill operations. Replace damaged items at no cost to MWS.

B. Install specified backfill material for the full width of the excavated trench and to specified depths.

C. Install No. 57 or No. 67 crushed stone compacted to 95% Standard Proctor Density in 8-inch lifts for pipe bedding and pipe envelope. Place crushed stone bedding 6 inches below the bottom of the force main. Place crushed stone envelope to a height of 8 inches above the top of the force main. Utilize crushed stone material compacted in maximum 8-inch lifts at the proper moisture content

as the supplementary trench backfill material when force main must be installed below the minimum depths.

D. Install flowable fill above crushed stone envelope at indicated depths.

E. Install asphalt binder above flowable fill at the indicated depths compacted flush with the roadway surface elevation. Maintain smooth driving surface until final paving is complete.

F. Remove the indicated thickness of asphalt binder as part of the milling operations when preparing to pave the roadway.

G. Install the indicated thickness of asphaltic surface mix as part of the paving operations in accordance with Metro Public Works or TDOT specifications.

H. Remediate any settlement of backfill material for a period of one year after final completion and final acceptance of the Work by MWS.

3.04 BACKFILL OUTSIDE OF ROADWAY

A. Take precautions not to damage the force main and accessories during backfill operations. Replace damaged items at no cost to MWS.

B. Install specified backfill material for the full width of the excavated trench.

C. Install No. 57 or No. 67 crushed stone compacted to 95% Standard Proctor Density in 8-inch lifts for pipe bedding and pipe envelope. Place crushed stone bedding 6 inches below the bottom of the force main. Place crushed stone envelope to a height of 8 inches above the top of the force main.

D. Install native soil compacted to 90% maximum Proctor Density in 12-inch lifts above the crushed stone envelope to finished grade. Utilize native soil material as the supplementary trench backfill material when force main must be installed below the minimum depths. Do not utilize rock greater than 8 inches as backfill.

E. Remediate any settlement of backfill material for a period of one year after final completion and final acceptance of the Work by MWS.

F. Seed and straw disturbed area to reestablish growth. Replace trees and vegetation removed during clearing and excavation with trees and vegetation of equal size or larger.

END OF SECTION

SECTION 33 39 13
MANHOLES

PART 1: GENERAL

1.01 SCOPE

A. Precast concrete manholes and accessories.

1.02 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 Submittal Procedures.

B. Submit manufacturer's product data for proposed manhole and accessories for approval.

C. Submit crushed stone bedding, backfill material sieve analysis, and compaction methods.

1.03 MEASUREMENT AND PAYMENT

A. MWS will compensate for furnishing and installing manholes up to 6 feet in depth and accessories at the contract unit price per each for the manhole and accessories installed complete and ready for operation.

1. Include all cost in the unit price for labor, excavation, bedding, backfill, restoration, manhole including any reinforcement, waterproofing admixture, manhole base, fillet (invert), manhole steps, pipe resilient connectors, stub-outs, plugs, sealants, testing, and any incidentals needed for a complete installation.

2. Undercutting of undesirable material at the trench base and crushed stone refill material to be paid with Unforeseen Work Elements allowance bid item.

B. MWS will compensate for furnishing and installing frames and covers and accessories at the contract unit price per each installed complete and ready for operation of the type indicated.

1. Include all cost in the unit price for labor, materials, equipment, sealants, testing, and any incidentals needed for a complete installation.

C. MWS will compensate for furnishing and installing additional manhole sidewall at the contract unit price per vertical foot that exceeds the 6-foot manhole depth, complete in place. Measurement of additional manhole sidewall will be made vertically in place from the invert of the outlet sewer pipe to the bottom side of the frame and cover, excluding the initial 6 feet.

1. Include all cost in the unit price for additional manhole sidewall for labor, equipment, excavation, material, backfilling, and all incidentals necessary for a complete and operable installation.

D. MWS will compensate for furnishing and installing manhole connections to existing sewers at the contract unit price per each for the manhole connection made complete and ready for operation.

1. Include all cost in the unit price for manhole connections to the existing system for labor, equipment, excavation, material, precast or cored hole, resilient connector, stainless steel external banc, insulator ring, backfilling, and all incidentals necessary for a complete and operable installation.
2. Compensation for sewer connections to proposed manholes will not be permitted.
3. Compensation for manhole connections is permitted only for existing sanitary sewers. Payment for connections in conjunction with water main installation will not be permitted.

E. MWS will compensate for furnishing and installing manhole vent pipe assemblies at the contract unit price per each for each manhole vent pipe assembly installed complete and ready for operation.

1. Include all cost in the unit price for manhole vent pipe assemblies for labor, pipe, fittings, interior and exterior coatings, connection the manhole, concrete foundation, excavation, bedding, insect screen, and all incidentals necessary for a complete and operable installation.

F. MWS will compensate for furnishing and installing manhole stub outs for future sewer connections at the contract unit price per each installed complete and ready for operation.

1. Include all cost in the unit price for labor, excavation, bedding, backfill, pipe material, connection to manhole, stub out plug, and all incidentals necessary for a complete and operable installation.

G. MWS will compensate for furnishing and installing drop pipe assemblies at the contract unit price per each assembly installed complete and ready for operation.

1. Include all cost in the unit price for labor, excavation, bedding, backfill, pipe material, pipe bends, hand formed mortar stop, manhole

connections, and all incidentals necessary for a complete and operable installation.

1.04 GENERAL

A. Use various lengths of manhole sections in combination to provide correct height with fewest joints.

B. For stub outs provide a 24-inch long stub out with resilient connector to the size, line, and gradient indicated on the Drawings for future sewer mains. Provide a bell end of a joint of pipe and plug and seal the bell with a plug. Consider the stub out as a part of the manhole when performing vacuum testing.

C. Construct drop pipe assemblies when the upstream proposed sewer invert is 2 feet or greater above the downstream discharging sewer invert where indicated on the Drawings. Drop pipe assemblies must be approved by MWS for each proposed location. Inside manhole drop pipe assemblies are not permitted.

D. Backfill drop assembly with 3000 psi concrete to form solid encasement for all drop connections. Extend concrete encasement minimum of 4-inches outside bells as indicated on the Drawings.

E. Locate vent pipes outside of roadway as indicated on the Drawings and provide vent outlet assemblies as indicated on the Standard Details with the opening of the vent pipe no less than 9 feet above the existing ground and a minimum of 1 foot above the 100-year flood plain elevation.

F. For manholes in conjunction with water main use, cutouts or holes should be 6-inches or greater from the floor base.

G. Provide water additive, pre-packaged, inorganic, flowable, non-gas liberating, non-metallic, cement-based non-shrink grout having a minimum 28-day compressive strength of 7,000 psi meeting the latest revision of ASTM Designation C 1107 when connecting to existing structures.

PART 2: PRODUCTS

2.01 MANHOLES

A. Provide concentric manholes with steps.

B. Provide a minimum 4,000 psi, 28-day compressive strength precast concrete manholes to support an AASHTO H-20 vehicle loading.

C. Brick masonry materials for manholes or manhole adjustments are not permitted.

D. Provide manhole waterproofing admixture of XYPEX C1000 or approved equal at 3% during the batching operation. Add dye to verify XYPEX C1000 admixture

was added during batching operation.

E. Provide manholes and accessories conforming to the latest requirements of ASTM C478 and ASTM C913.

F. Provide precast base riser section with integral floors.

G. Provide adjustment rings set to the cone section by low strength waterproof and water tight epoxy.

H. Provide a double seal of flexible bitumastic joint sealant joints between the sections of precast manhole sidewalls and provide a single seal of flexible bitumastic joint sealant between the precast concrete sidewall and manhole cover frame conforming to the latest revisions of ASTM C990.

I. Mark the date of manufacture and name or trademark of manufacturer on inside of the manhole barrel.

J. Provide manhole sections without penetrations for lifting.

K. Provide a flexible connector assembly with a 2-foot section of piping immediately outside of the manhole.

L. For manholes larger than 48-inch diameter, provide precast base sections with flat slab top precast sections when transitioning to 48-inch diameter manhole access riser sections. Provide concentric transitions located to provide minimum of 7-foot head clearance from base to underside of transition section.

2.02 DOG HOUSE MANHOLES

A. Provide dog house manholes only at locations where indicated on the Drawing and only with MWS approval.

B. Spray or trowel apply coating to the dog house manhole interior base section the greater of 4 feet or 2 feet above the largest diameter pipe. Provide epoxy resin, similar to Warren Environmental Systems S-301, polyurea similar to SpectraShield, or a urethane similar to Sprayroq SprayWall system formulated for application within a sanitary sewer environment or approved equals.

C. The cured epoxy or urethane resin system shall conform to the following minimum structural standards:

Minimum Requirements			
Cured Product	Test Method	Urethane Results	Epoxy Results
Compressive Strength	ASTM D695	10,500 psi	12.000 psi
Tensile Strength	ASTM D638	7,000	7,000
Flexural Strength	ASTM D790	12,000 psi	11,000 psi
Flexural Modulus	ASTM D790	550,000 psi	500,000 psi
Shore D Hardness	ASTM D2240	90	83 - 85
Adhesion to Concrete	ASTM D4541	Substrate failure	Substrate failure

2.03 FRAMES AND COVERS

A. Provide cast iron frames, grates, rings, and covers in conformance with the MWS Approved Materials List and as indicated on the Standard Details and conforming to the latest requirements of ASTM A48, Class 30 and AASHTO H-20 vehicle loading.

B. Provide castings that conform to the shapes and dimensions with the logos and wording indicated on the Standard Details. Provide castings that are smooth, clean, complete, free from blisters, defects, and any other surface imperfections. Defective castings will not be permitted.

C. Provide frames and covers where the cover securely rests on the frame without rocking and the cover is in complete contact with the frame for the entire perimeter of the contact surface.

D. When inside roadways, secure the frame and cover to the manhole cone section with high strength waterproof epoxy.

E. When outside roadways, provide flexible bitumastic joint sealant between manhole frame and top cone section.

F. When outside roadways, secure the frame and cover to the manhole cone section with a minimum of two concrete anchors 7/8 inch in diameter spaced 180 degrees apart imbedded a minimum of 3 inches.

G. Use concrete adjustment rings when vertical adjustments are 2 inches or greater with a maximum total adjustment of 18 inches.

H. Provide two non-penetrating pick holes in manhole covers as indicated on the Standard Details.

I. Provide watertight manhole frames and covers where indicated on the Drawings or when subjected to ponding. Provide watertight frames and covers with exterior cover having non-penetrating concealed pick holes and the interior cover being a solid, gasket locking T-bar design as indicated on the Standard Details. Watertight manhole frames and covers shall be provided with minimum of four bolts and gasket designed to seal frame to cone.

2.04 PIPE CONNECTIONS TO MANHOLE

A. Provide connectors from the MWS Approved Materials List.

B. Provide Kor-N-Seal resilient connector, A-Lok resilient connector, or an approved equal conforming to the latest revisions of ASTM Designation C 923 for pipe to manhole connections.

C. Provide a stainless steel external band around the resilient connector and external band around the pipe.

D. Provide the manhole manufacturer's insulator ring.

E. Fill the void between the pipe and the connector with an approved flexible gasket material.

F. Where rigid joints between pipe and cast-in-place manhole base are specified, provide polyethylene-isoprene water-stops in conformance with the latest revisions of ASTM C923.

G. For water main to manhole connections, seal the space between the pipe and the manhole sidewall with an assembly consisting of a rubber gasket and a stainless steel clamp with a minimum width of 9/16 inches.

H. Provide a distance of at least 16 inches measured from the top of the pipe opening to the top of the base or sidewall section.

2.05 STEPS

A. Insert and securely embed steps in the manhole sidewall as indicated on the Standard Details.

B. Provide non-skid design steps manufactured of either plastic coated steel constructed of ½-inch steel reinforcing rods encapsulated in polypropylene plastic or aluminum magnesium silicide alloy in conformance with Federal Specifications QQ-A-200/8.

C. Provide steps that will support a 1,000 pound load.

2.06 VENT PIPES

A. Provide 4" diameter class 350 ductile iron pipe.

B. Apply two coats of aluminum epoxy at a thickness of 5.0 millimeters and a top coat of dark green asphaltic polyurethane at 3.0 to 5.0 millimeters to the exposed vent pipe.

PART 3: EXECUTION

3.01 GENERAL

A. Install and verify that lines and grades are constructed in accordance with the Drawings.

B. Provide an adequate foundation for all manhole structures by removing and replacing unsuitable material with well-graded granular material, by tightening with coarse rock, or by such other means as provided for foundation preparation of the connected sewers, or as directed by MWS.

C. Set manhole frame for the cover on the manhole sidewall in a double seal bed of flexible bitumastic joint sealant such as Ram-Nek at the required elevation and red head anchor the frame to the manhole sidewall as indicated on the Drawings.

D. Tilt the surface of the frame and cover to conform to the slope, crown, or grade of the existing or proposed surface where manholes are constructed in paved areas or fill slopes.

E. Perform vertical adjustments to proposed and existing frame and covers with concrete adjustment rings in the available heights or with flexible bitumastic joint sealant as required.

F. Dewater sufficiently to maintain the ground water level at or below the bottom of the manhole foundation prior to and during the placement of the foundation.

G. Place precast base on minimum 6-inch foundation of crushed stone or concrete foundation slab for a 48-inch diameter manhole and an 8-inch foundation for manholes larger than 48-inches in diameter.

H. If excavation for pipe installation requires undercutting adjacent to the manhole, undercut to competent material for the manhole.

I. Notify MWS immediately when unsatisfactory material is encountered in the manhole foundation subgrade. Undercut, with MWS approval, up to 12-inches of additional material to achieve suitable foundation.

J. Protect manholes from damage until Work has been accepted. Repair damage to manholes at no additional cost to MWS.

K. Provide a minimum of 72 hour notice to customers whose sanitary sewer service is to be interrupted for any reason.

3.02 PRECAST MANHOLE SECTIONS

A. Install sections, joints, and flexible bitumastic joint sealant material in accordance with manufacturer's recommendations and as indicated on the Drawings.

B. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frames.

C. Wrap the outside of the manhole at each riser joint with bitumastic waterproofing material per manufacturer’s recommendations. No grout is permitted on the interior of manhole riser joints prior to testing.

D. When installing a manhole 14 feet or greater depth, properly cure concrete foundation pad for 72 hours prior to manhole installation.

3.03 PIPE CONNECTIONS AT MANHOLES

A. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions and as indicated on the Drawings.

1. For connecting steel, ductile iron, PVC, or other smooth exterior pipes to the manhole, seal the space between the pipe and manhole wall with an assembly consisting of rubber gaskets or links mechanically compressed to form watertight barrier.

2. For connecting concrete, cement mortar coated, or smooth exterior pipes to the manhole, seal the space between the pipe and manhole wall with an assembly consisting of stainless steel power sleeve, stainless steel take-up clamp with a minimum width of 9/16 inch and a rubber gasket.

B. Fill the space between manhole wall and pipe connection with non-shrinking flexible gasket material.

C. Utilize a manhole supplier specified torque wrench to seat the resilient connector with an approved flexible gasket material.

3.04 INVERT CHANNELS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

1. Slope of invert bench: 1-inch per foot minimum; 1-$^{1}/_{2}$-inches per foot maximum

2. Depth of bench invert to equal the crown of the largest pipe diameter.

B. Construct a 0.2 foot invert cross slope through manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings. Form invert channels with concrete if not integral with manhole base section. For direction

changes of mains, construct channels with curves tangent to direction of mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.05 BACKFILL

A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with the requirements of gravity sewer mains.

B. Provide positive drainage away from all manhole frames to natural grade in unpaved areas.

END OF SECTION