

**SPECIFICATION REQUIREMENTS
FOR THE CONSTRUCTION
OF WATER AND WASTEWATER FACILITIES**



CITY OF
Siloam Springs
It's a natural.



SILOAM SPRINGS WATER AND WASTEWATER DEPARTMENT

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PART G – GENERAL REQUIREMENTS

SECTION G1 – GENERAL

G1.1 Description:

This part of the specifications stipulates general requirements for the preparation of reports, plans, specifications, methods of construction, inspection, testing, and final approval of any proposed water and/or sanitary sewer lines, appurtenances, or other structures that are within the jurisdiction of the City of Siloam Springs Water and Wastewater Department. Any deviations from the requirements set forth herein in these specifications will be approved only by written authorization from the City of Siloam Springs Water and Wastewater Department or the Planning and Zoning Commission. Special conditions may arrive on any project that are not covered in these specifications or that may require special handling. In case of such special conditions, complete detail as to materials, method of construction, or other procedures shall be submitted to the City of Siloam Springs Water and Wastewater Department or the Planning and Zoning Commission for review and approval.

Standard construction details are incorporated and made a part of these specifications and shall become a part of the standard requirements for water and sewer line construction. The Standard Details are included in the appendices at the back of these specifications.

Where reference is made to a particular industry specification (ASTM. Etc.) it is hereby understood that reference is made to the latest specification revision in effect.

G1.2 Disclaimer:

These specifications are intended to set forth minimum standards of quality for the construction of water and sewer facilities, which are to be accepted, by the City of Siloam Springs Water and Wastewater Department. These specifications do not replace the Engineer's specifications and contract documents; however, construction of all water and sewer facilities must meet these standards of quality as a minimum.

The City of Siloam Springs Water and Wastewater Department shall not be responsible nor shall it bear any liability for the Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, nor, shall the City be responsible for any actions resulting from direction of the project by the Engineer.

The City of Siloam Springs Water and Wastewater Department shall not be responsible for the acts or omissions of the Contractor or any Subcontractor, any

Supplier, or of any other person or organization performing or furnishing any of the Work.

Nothing contained in these specifications shall be construed as an endorsement or warranty by the City of Siloam Springs Water and Wastewater Department of any product, material, or workmanship. The City of Siloam Springs Water and Wastewater Department shall not be responsible nor shall it bear any liability for the failure of any material or method of construction.

G1.3 Definitions:

The City of Siloam Springs Water and Wastewater Department – The department of the City of Siloam Springs under the jurisdiction of the City Administrator, hereinafter referred to as “Department”, having full and complete authority to manage the sanitary sewage treatment plant and collection system; and to manage the water treatment plant and its collection and distribution systems.

Developer – Individual, partnership, corporation, or other legal entity such as an improvement district desiring to construct water and/or sanitary sewer facilities for immediate or contemplated future inclusion in the City of Siloam Springs Water and Wastewater Department’s systems.

Engineer – Individual registered to practice engineering in the State of Arkansas who is responsible for the preparation of reports, plans, specifications and inspection of the work or the proposed improvements.

Contractor – The individual, partnership, corporation or other legal entity with whom the Developer has entered into an agreement to construct the water and/or sewer facilities.

Resident Inspector – An authorized representative of the Engineer responsible for the inspection of construction for compliance with approved plans and contract documents.

City Engineer – Employee of the City of Siloam Springs responsible for approval of new construction, reconstruction, or alterations involving the City’s water system and sanitary sewage system.

The term “as specified” shall mean as specified by the City of Siloam Springs Water and Wastewater Department in plans, proposals, other specifications, and written or oral instructions.

The term “or equal” shall mean that the proposed material or item shall perform adequately the duties imposed by the general design and is of same or equal design, substance, and junction to that specified by using the name of a product,

manufacturer, or vendor. Use of the term “or equal” shall mean any party proposing to substitute an “equal” shall obtain an approval of the Department. The City of Siloam Springs Water and Wastewater Department shall make final approval of such items or materials judged to be “equal”.

The term “these specifications” shall refer to the “Specification Requirements for the Construction of Water and Sewer Facilities”, latest revision, written by the City of Siloam Springs Water and Wastewater Department and adopted by the Siloam Springs Board of Directors.

It is the responsibility of the Contractor, Engineer, Developer, or Owner, etc. to obtain copies of and to comply with the latest revisions of these specifications.

Abbreviations used throughout these specifications have meanings as follows:

ASTM.....	American Society for Testing and Materials
AASHTO.....	American Association of State Highway and Transportation Officials
AHTD.....	Arkansas Highway and Transportation Department
ANSI.....	American National Standard Institute
AWWA.....	American Water Works Association
CI.....	Gray Cast Iron
CS or CC.....	AWWA (Mueller Corporation Stop) Thread
DI.....	Ductile Iron
FIP.....	Female Iron Pipe
IP.....	Iron Pipe
OSHA.....	Occupational Safety and Health Agency
MIP.....	Male Iron Pipe
PE.....	Polyethylene
psi.....	pounds per square inch (gauge)
SSPC.....	Steel Structures Painting Council
ADH.....	Arkansas Department of Health

SECTION G2 – JURISDICTION

G2.1 Description:

This section describes the area presently being served or proposed to be served water and/or sewer service by the Department.

G2.2 Area of Jurisdiction:

These general requirements for water and sanitary sewer lines shall be required for the area within the city limits of Siloam Springs, Arkansas, as may be changed from time to time and those areas outside the city limits served by the Department's water distribution system or whose sewage is to be treated by the Department's treatment facilities.

SECTION G3 – PLANS AND SPECIFICATIONS

G3.1 Description:

This section covers the requirements for submission of plans and specifications to the Department in order to obtain approval.

G3.2 Preliminary Report:

When requested by the Department, the Engineer shall prepare and submit a preliminary engineering report prior to approval of constructions plans. The report shall conform to accepted engineering criteria including the requirements of the Arkansas Department of Health and the Arkansas Department of Energy and Environment, Division of Environmental Quality.

The size, scope, and contemplated land use of the proposed development will determine the need for a preliminary report.

G3.3 Construction Plans and Specifications:

No water or sewer main extension may be approved for connection to the Department's system which was constructed prior to approval of constructions plans by the Department or which was not constructed in accordance with approved plans. Construction plans shall conform to the requirements herein. Specifications shall be in accordance with Parts "M" and "C" of these requirements as a minimum. The submission of construction plans for approval shall be accompanied by a letter from the Engineer stating that materials and workmanship will be in accordance with these specifications and standard details.

All plans shall be drawn to a scale suitable for adequately showing the facilities proposed except as stipulated herein. All plans and profiles of sewer lines shall be drawn to scale with the profile vertical scale at one inch equal to five feet or one inch equal to 10 feet and plan horizontal scale for water and/or sewer lines of one inch equal to 50 feet or larger. All drawings shall be on D-size sheets (24 inches by 36 inches). All coordinates and elevations shall be based on Siloam Springs GPS network (State Plane Coordinate System and NAVG 1988). An overall project map shall accompany the construction plans. The project map shall be a minimum 22 inches by 34 inches in size and shall be drawn to a scale of one inch equal to 100 feet or larger. It shall depict the entire project and show all proposed water and/or sewer lines properly labeled as to size and pipe material. All other utilities shall be shown along with the proposed road profile if applicable. A vicinity map at a scale of one inch equal to 2000 feet shall be

furnished indicating the location of the project in relation to arterial streets and major highways.

G3.4 Changes From Approved Plans:

Any changes from the approved construction plans and specifications shall be authorized upon approval by the Arkansas Department of Health and by the City Engineer or authorized representative of the Department prior to the start of their construction.

G3.5 Design Considerations:

As a minimum, design and layout shall meet the scale requirements referred to above in G3.3. In addition, the following principals shall be adhered to:

Sanitary Sewer Mains:

1. No gravity sewer main conveying raw sewage shall be less than eight inches in diameter.
2. Where the difference in invert elevation between any two pipes entering a manhole is two feet or more, a drop connection shall be utilized as shown on the standard detail sheets.
3. The minimum earth cover for sanitary sewer mains shall not be less than 30 inches. Earth cover less than 30 inches will be considered on a case by case basis, but under no circumstances will they be allowed without prior written approval from both the ADH and the City of Siloam Springs.
4. Where the earth cover over the pipe bells cannot be maintained at least 30 inches the pipe material shall be ductile iron pipe as specified in Section M12.2 of these specifications. Sewers buried to depths of 20 feet or less may be of SDR-26 PVC or ductile iron pipe. Sewers buried to depth greater than 20 feet shall be ductile iron pipe only from manhole to manhole.
5. Sewer pipe material shall be of the types listed in Section M12 of these specifications. Materials not specifically authorized in these specifications are forbidden for use in the system unless approved in writing otherwise.
6. Location of main extensions to serve parcels of property shall be planned so as to minimize the length of building sewer which must be maintained by the property owner.
7. All sewer main extensions without regard to length shall terminate in a standard manhole.

8. Sewer service laterals shall be installed to all lots. The installation of 2 laterals in the same ditch located at a common property line will be allowed on a case by case basis, contingent upon the slope of the lots and depth of the sewer service at the property line.

Water Distribution Mains:

1. No water main shall be less than six inches in diameter.
2. Fire hydrants shall be installed on six inch or larger diameter mains every 800 feet and in no event shall there be a greater distance than 400 feet to a future dwelling or business between hydrants along the main within the city limits of Siloam Springs. In no instance shall a three-way fire hydrant be set on a line less than six inches in diameter. All fire hydrant installations must be installed in accordance with the latest adopted addition of the state fire code.
3. All main extensions without regard to length shall terminate in a fire hydrant or flush valve.
4. The minimum earth cover shall not be less than 36 inches for mains and 30 inches for services.
5. The normal working pressure in the main should be approximately 60 psi and not less than 35 psi. The minimum pressure allowed under all conditions of flow shall be 20 psi. The design must be so that the system pressure will meet the requirements of the latest adopted addition of the state fire code.
6. The hydraulic analysis of the water distribution system shall be reflected on the plans. The design flows and residual pressures in the mains shall be indicated. Additional design data may be required, if in the opinion of the City Engineer, it is necessary for review and approval of the plans.
7. Sufficient valves shall be provided on water mains to minimize inconvenience and sanitary hazards during repairs. Valves should be located at nor more than 500 foot intervals in commercial districts or 2000 foot intervals in other districts.
8. All taps on existing mains shall be performed only upon approval by the Department and only with an authorized City representative inspecting the work. Notice to the City shall be provided a minimum of 48 hours (two business days) prior to any work being performed on a tap to a City main. The Contractor shall be required to provide all equipment, material and labor to excavate for the tap, prepare the main for tapping, to tap the main, and to connect the main extension to the existing main.

9. Water pipe materials shall be of types listed in Part M of these specifications. Materials not specifically authorized in these specifications are forbidden for use in the system unless approved in writing from the Director.

G3.6 Approval:

The following shall be submitted to the Department for approval of any proposed construction:

1. Four sets of complete constructions plans (two sets shall be half-size prints), or a digital copy that is compatible with the city's system shall be furnished to the Department.
2. A statement by the Engineer, Owner and Developer, that work will conform to these specifications and that professional construction inspection will be provided, must accompany the plans.
3. When requested by the Department, design data for sewer extensions shall be furnished for the Department's review. Upon approval, two sets of plans will be returned to the Engineer to be submitted to the Arkansas Department of Health for review and approval.
4. Duly executed easements.
5. Written request of any deviations in the proposed plans from these rules.
6. Name and address of the Owner, Engineer, Developer and the installation Contractor.
7. Copies of any and all bonds required by these Rules.

G3.7 Conformity:

All plans, specifications and construction procedures shall conform to the standards as established by the Department. All plans and specifications shall be prepared under the supervision of a Professional Engineer registered in the State of Arkansas. The engineer's seal shall be on all plans and specifications.

G3.8 "As-Built" Drainage (Plans of Record):

Upon completion of the project as shown on the final approved plans and specifications, two complete sets of “as-built” drawings along with a digital copy in AutoCAD compatible with the city’s current format shall be furnished the Department for record purposes by the same Engineer who prepared and submitted the construction plans and specifications. The size and scale of the drawings shall be as outlined in Paragraph G3.3. The “as-built” drawings shall show, both in plan and elevation (MSL), the exact location, dimensions, size and type of pipe supplied of all facilities constructed. In addition, the as-built drawings should reflect the location, width, and type (i.e., water, sewer, or utility) of easement.

G3.8.1 Sanitary Sewer System:

All service wyes and manhole stub outs must be shown on the “as-built” drawings. Each service line shall be referenced with the sewer main stations in lineal feet and dimensioned to at least one lot corner. The depth of the end of each service line shall be clearly marked on the “as-built” drawings.

G3.8.2. Water Distribution System:

All meter boxes with an indication of whether it is a single or split service, valves, and blow offs must be shown on the “as-built” drawings. Meter boxes shall be referenced by dimensioning to at least one lot corner. Valves, blow offs, and all other appurtenances shall be referenced by dimensioning to at least two permanent objects.

SECTION G4 – INSPECTION AND LAYOUT

G4.1 Description:

This section covers the requirements of inspection and layout for the construction of water and/or sanitary sewerage facilities.

G4.2 Responsible Engineer:

The Engineer who prepared and submitted the construction plans and specifications shall be responsible for construction layout, general direction, and resident inspection as described in more detail in the following sections. Continuous project responsibility shall be an express condition of plan approval. The Engineer's responsibility shall extend through submittal of "as-built" plans and full acceptance of the project by the Department for maintenance.

G4.3 General Direction:

All water and/or sanitary sewerage facilities proposed shall be constructed under the general direction of the Engineer. General direction shall consist of, but not be limited to, periodic visits to the construction site to observe the progress and quality of the executed work to determine if the work is proceeding in accordance with the approved plans and specifications and with the standards set forth by the Department.

Any defects, deficiencies or irregularities in the work found by the Engineer or reported by the resident inspector shall be reported to the Department. Such action, as deemed appropriate, and as approved by the City Engineer, shall be taken to correct such deficiencies.

All work performed subject to these requirements shall at all times be subject to the general inspection of the City of Siloam Springs Engineer or his representative. The frequency of visits and the number of hours required for Department personnel shall be governed by the quality of inspection being performed by the Engineer and resident inspector.

G4.4 Resident Inspection:

If deemed necessary by the City Engineer or other department head to insure conformance with the approved plans and specifications, full time resident inspection may be required and shall be performed by qualified personnel under

the direct supervision of the Engineer. The name of the resident inspector shall be furnished to the Department prior to start of construction. It shall be the responsibility of the resident inspector to safeguard the Department's interests by checking the construction work for compliance with the approved plans, specifications, and other standards. Any defects, deficiencies, or irregularities shall be reported to the Engineer. A job diary shall be kept outlining all aspects of the construction project and shall be made available to the Department upon request.

G4.5 Construction Layout:

The layout and staking of the construction work shall be completed by trained and qualified survey personnel under the supervision of the Engineer. Such layout and staking shall consist of alignment and grad stakes necessary to establish batter boards or grade lines necessary for use in attaining proper alignment and grade of the facilities. The use of laser beam type grade lights is encouraged for gravity sewer construction.

Where mains and service lines are adjacent to or under proposed streets, or which are located in areas where the final grade of the site has not been established before installation, the water main or service line shall be staked for grade to insure a minimum cover of 36 inches for water mains and 30 inches for sewer mains after completion of all dirt work.

Proposed grade cut sheets for water and/or sewer lines shall be submitted to the Department before any construction of water or sewer lines is started. The Department shall review the said cut sheets to insure accuracy.

SECTION G5 – RULES AND REGULATIONS

G5.1 Description:

This section covers such rules and regulations as required by law for the completion of plans, specifications, and construction work on any and all proposed water and/or sanitary sewerage facilities.

G5.2 Laws, Regulations and Ordinances:

All Federal, State, County, and City Laws, Regulations, or Ordinances shall be complied with on all projects. This shall include, but not be limited to the obtaining of approval from the Arkansas Department of Health and the Arkansas Department of Energy and Environment, Division of Environmental Quality. Responsibility for submission to, and approval by, the Arkansas Department of Health and the Arkansas Department of Energy and Environment, Division of Environmental quality shall be the Owner, Developer or Engineer's including payment of any applicable fees.

G5.3 Permits and Licenses:

All permits and licenses required by any Federal, State, County, or Local Governing Body shall be obtained in strict accordance with the requirements of the governing agency. When required by the licensing agency, the Department will assist in application for permits and licenses, but the costs of any permit, fee, or bond required will be borne by the Developer.

G5.4 Performance and Payment Bond:

Any corporations, partnerships, firms, individuals or other legal entity laying or installing water and/or sewer lines, except when being laid by Department employees, shall have a contractor's license and shall post performance and payment bond, in a form acceptable to the Department, for the amount of the contract to guarantee performance of the proposed installation in accordance with the plans and specifications within the time prescribed for such completion and for a period of two years after acceptance and becoming a part of the municipal system.

SECTION G6 – EXISTING UTILITIES

G6.1 Description:

This section covers the requirements with respect to existing public or private utilities.

G6.2 Proximity:

All plans shall be drawn in such manner that all known utilities are shown using the best available information including utility maps, field surveys, or other sources of information. Water and sewer lines shall be kept, where possible, a minimum horizontal distance of five feet from all underground utilities with the following exception: a minimum horizontal distance of 10 feet shall be maintained between water lines and all sanitary sewer lines and structures, measured edge to edge. Exceptions shall be only as authorized by the Arkansas Department of Health, Engineering Section and the Department.

G6.3 Crossings of Water and Sewer Lines:

At water and sewer crossings, the water line shall be placed so that the bottom of the water line will be at least 18 inches above the top of the sewer line at its highest point and must be partially protected by being entirely surrounded by at least 18 inches of carefully compacted clay backfill or similar barriers. In cases where water and sewer crossings do not meet these minimum requirements the Arkansas Department of Health, Engineering Section, may allow deviation on a case by case basis, if supported by data and pertinent facts from the Engineer and agreed to by the Siloam Springs Water and Wastewater Department. Said deviations will only be allowed upon written approval from both the Arkansas Department of Health, Engineering Section and the Siloam Springs Water and Wastewater Department.

Where 18 inches of clearance cannot be maintained as described above, the proposed line shall be encased a minimum of 10 feet in each direction. Water lines crossing beneath sewer lines will be approved on a case by case basis, and must maintain both of the following:

1. 18 inches of separation from the top of the water line to the bottom of the sewer line.

2. Proposed line shall be encased a minimum of 10 feet in each direction.

SECTION G7 – EASEMENTS

G7.1 Description:

This section covers the requirements of easements for the purpose of maintaining water and/or sanitary sewer lines where the proposed lines will be on private property or where the lines would not be within public rights-of-way.

G7.2 Width of Easement:

Where water and/or sanitary sewer lines are not placed in public rights-of-way, a permanent easement shall be acquired for the Department and dedicated by the Owner for the purpose of maintaining the lines. The easement shall have a minimum width of 15 feet or a width equal to the maximum depth to sewer flow line whichever is greater. Common utility easements will be accepted provided that the easement is wide enough to accommodate the above requirements. Where practicable, easements of maximum width possible will be provided to allow access to all manholes, fire hydrants, valves, and other appurtenances.

G7.3 Filing of Easements:

Easements shall be duly executed and presented to the Department along with the necessary filing fee to allow them to be recorded and filed by the Department. The form of the easement shall meet with the requirements of standard easements and shall be acceptable to the City Engineer or his representative (see appendix for sample form). All easements shall be in favor of the City of Siloam Springs. Easements as show on a recorded plat shall be considered as public easements and adequate for this purpose.

G7.4 Plans:

Construction plans should reflect the type, location, and dimensions of all proposed easements. As-built should reflect the type, location, and dimensions of all dedicated easements.

SECTION G8 – FINAL INSPECTION AND ACCEPTANCE

G8.1 Description:

This section covers the requirements for final inspection and acceptance of the water and/or sanitary sewerage facilities upon completion of the project.

G8.2 Acceptance Testing:

Methods of acceptance testing are outlined in Part T – Testing, of these standard specifications. All tests shall be conducted in the presence of the Engineer or designated representative of the Engineer, the Contractor, and a representative of the Department. The Contractor shall give the Department at least 48 hours' notice prior to commencing any tests. All water and/or sewer services, main line, and appurtenances shall be in place before the main line is tested.

G8.3 Final Inspection:

Before water and/or sanitary sewer extensions are accepted for maintenance and service connections to these extensions approved, a final inspection will be made by Department personnel in the presence of the Engineer. The final inspection will not be conducted until "as-built" plans are submitted.

Final inspection will be made at the request of the Engineer. A list of material and workmanship defects, if any, will be forwarded to the Engineer. Defects noted must be corrected before acceptance. Improvements found not as depicted on the submitted "as-built" plans shall be rejected.

G8.4 Maintenance Bond:

Upon completion of the project and after all defects have been corrected in accordance with the final inspection, a maintenance bond in a form acceptable to the City Engineer or his representative for an amount equal to 50% of the construction cost shall be submitted to the Department (see appendix for sample form). The bond shall be for a period of two years and shall cover all defects in materials and workmanship. The bond shall be binding on the Owner, Developer, and the Contractor who installed the improvements.

G8.5 Acceptance:

No connection of customer facilities or other utilization of main extensions will be permitted by the Department until a letter of acceptance is issued. The acceptance letter will not be issued until the following requirements are met:

1. Receipt of two copies of approved “as-built” plans and profiles of main extensions.
2. Satisfactory correction of all defects noted in final inspection.
3. Receipt of maintenance bond if applicable.
4. Receipt of all required easements.
5. Receipt of Engineer’s certification that all improvements have been constructed in accordance with the approved plans and specifications.
6. Receipt of an affidavit from the Owner or Developer that all materials, supplies and labor bills have been paid.
7. Receipt of Engineer’s report outlining the total capital cost for water and/or sewer facilities, including all engineering fees.
8. Testing requirements, including bacteriological samples, have been certified as acceptable.
9. A digital copy in AutoCAD compatible with the city’s current format shall be furnished the Department for record purposes by the same Engineer who prepared and submitted the construction plans and specifications.

G8.6 Plat Approval:

Final plats shall not be approved by the City until all of the above listed requirements have been met and the Department has accepted the water and/or sewerage facilities.

G8.7 Inspection Before Expiration of Maintenance Bond:

An inspection will be made by the Department before the expiration of the maintenance bond. A list of any defects in material or workmanship found during this inspection will be forwarded to the Developer’s Engineer. If corrections are not made within a reasonable period of time, a claim will be filed with the bonding

company. As soon as defects found during this inspection are corrected, the Department will issue full acceptance of the project for maintenance.

G8.8 Use of Completed Portions:

Portions of the project completed will not be allowed to be put into service without written approval from the Department. Approval of the use of completed portions of the project will be granted only in the best interest of the Department. Use of completed portions of an incomplete project does not constitute acceptance of the project by the Department.

SECTION G9 – SERVICE CONNECTIONS

G9.1 Description:

This section describes certain requirements with respect to service line locations.

G9.2 Minimum Size and Location of Services:

G9.2.1 Sewer Services:

All services stubs shall be installed on the sewer main to facilitate connection of anticipated services to the sewer. All service stubs shall terminate in suitable manner for insertion of a watertight plug or watertight cap. Unless anticipated service requires a larger line, all service stubs shall be four inches in nominal diameter.

Service stubs shall terminate at least two feet inside the property line but in no case shall the service stub terminate at a distance less than eight feet from the sanitary sewer main.

The exact location of all sanitary sewer stubs shall be accurately identified in the field at the property line in order that the exact location can be easily found by a metal detector when the connection is made. This shall be done by burying a tee post painted green at the end of the service stub with continuous 10 gauge tracer wire to the top of the post.

The location shall be shown on the “as-built” drawings both in distance from manholes and in distance from property corners along the street right-of-way line or lot line. Service stubs should be terminated a minimum of two feet inside the property line. Service stubs shall be installed to provide sufficient vertical clearance from other utilities, but in no case shall it be less than two feet deep.

G9.2.2 Water Services:

All water services shall be installed on the water main to facilitate connection of anticipated services. All water service meter boxes shall be set two feet inside the property line. Unless anticipated service requires a larger line, all service lines shall be one inch nominal diameter. The meter box shall be field adjusted to final grade.

The location of meter boxes shall be shown on the “as-built” drawings by referencing to at least one lot corner.

PART M – MATERIALS

SECTION M1 – DESCRIPTION

M1.1 General:

These specifications are intended to set a standard of quality and design for all material used in the construction of water and/or sewer mains and appurtenances. Projects that would necessarily involve materials other than those included in this specification shall be subject to the approval of the City of Siloam Springs Water and Wastewater Department.

M1.2 References:

Any reference to specifications published by other agencies shall refer to the latest edition or revision of such specifications.

SECTION M2 – POTABLE WATER PIPE

M2.1 General:

All pipe furnished shall be designed for the distribution of potable water. Lubricant furnished for lubricant joints shall be nontoxic, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe material and shall not impart taste or odor to water. The lubricant containers shall be labeled with the manufacturer's name.

M2.2 Flanged Cast Iron and Ductile Iron Pipe:

The pipe shall have a cement mortar lining and seal coat in accordance with ANSI A21.4 / AWWA C104. The pipe and flanges shall conform to ANSI A21.15 / AWWA C115, Class 250 psi. Drilling shall conform to ANSI B16.1, Class 125 flange. An 8-mil thick polyethylene sheeting or tubing around the pipe that meets Appendix A of ANSI/AWWA C105/A21.5, loose polyethylene encasement must be used.

M2.3 Ductile Iron Pipe, 6" – 36":

Pipe shall conform to ANSI A21.51 / AWWA C151 and shall have cement mortar lining and seal coat conforming to ANSE A21.4 / AWWA C104/. Joints shall conform to ANSI A21.11 / AWWA C111 and may be mechanical joint or push-on joint unless otherwise specified. The minimum thickness class shall be Class 50 unless otherwise specified. An 8-mil thick polyethylene sheeting or tubing around the pipe that meets Appendix A of ANSI/AWWA C105/A21.5, loose polyethylene encasement must be used.

M2.4 Polyvinyl Chloride Pipe, 6" – 18":

Pipe shall conform to AWWA C-900 and shall have cast/ductile iron pipe outside dimensions. Pipe shall be made from Class 12454-A or 12454-B material as defined by ASTM D1784. Joints shall have a rubber gasket and an integral bell. Pipe shall be Class 235 (DR 18) designed for a 200 psi working pressure and a 35 psi surge allowance.

M2.5 Copper Pipe:

Copper pipe shall be Type “k”, soft tempered, seamless, for underground installation, in accordance with ASTM B88 and Federal Specifications WW-T-799.

M2.6 Polyethylene Service Pipe, 1” & 2”:

M2.6.1 Material:

Polyethylene pipe shall be manufactured from high density polyethylene conforming to ASTM D2737, SDR-9, and PE 3408.

M2.6.2 Pressure:

The pipe shall be capable of withstanding a maximum working pressure of 200 psi at 73.4 degrees F.

M2.6.3 Dimensions:

Pipe dimensions and tolerances shall conform to ASTM D2737 copper tube size with the following dimensions:

Table 1: Copper Pipe Dimensions

NOMINAL SIZE (inches)	OD (inches)	MINIMUM WALL THICKNESS (inches)
1	1.125	0.125
2	2.125	0.236

M2.6.4 Pipe Markings:

As a minimum the pipe shall have the following markings applied at intervals specified in ASTM Standards:

1. Nominal Size
2. ASTM Designation Code
3. Manufacturer or Trade Name
4. Class of Pipe
5. S.D.R.

M2.6.5 Manufacturers:

Pipe conforming to or equal to these specifications will be accepted from the following manufacturer:

1. Phillips Driscopipe, Inc.
2. Eagle Pipe, Inc.

M2.6.6 Connections:

A stainless steel insert shall be used at all connections of polyethylene pipe meeting these specifications.

SECTION M3 – WATER PIPE FITTINGS

M3.1 Iron Fittings:

Iron fittings shall be designed for working pressure of at least 250 psi, may be ductile iron or gray iron and shall conform to ANSE A21.10 / AWWA C110. Joints shall be mechanical joints which conform to ANSE A21.11 / AWWA C111, latest revision. All fittings shall be furnished with gaskets and mechanical joint fittings shall be furnished with bolts, nuts and iron glands. All fittings are to be fusion bonded epoxy lined and coated. The FBE coating/lining meets the applicable requirements of AWWA C116/ ANSI/NSF Standard 61 certified for contact with potable water.

M3.1.1 Mechanical Joint Retainer Glands:

Shall be made from ductile iron and shall be designed for a working pressure of at least 200 psi. The set screws shall be extended through the outer part of the glands. Glands shall be designed to standard mechanical joint fittings (AWWA C110). The minimum number and minimum size set screws shall be as follows:

Table 2: Set Screw Requirements

SIZE GLAND (inches)	SIZE SET SCREW (inches)	NUMBER SET SCREWS
6	5/8	6
8	5/8	9
10	5/8	16
12	5/8	16
16	5/8	24
20	5/8	28
24	5/8	32

M3.1.2 Swivel Hydrant Adapters and Tees:

Shall be designed for a working pressure of at least 250 psi and to fit standard mechanical joint fittings (AWWA C110). One end of the swivel adapter and the branch of the tee shall be provided with a gland that may be rotated 360 degrees on the fitting. Lengths of swivel adapter shall be as specified.

M3.1.3 Tapping Sleeves:

Sleeves shall be designed for a working pressure of at least 200 psi. A test plug shall be furnished through the body for hydrostatic pressure testing on sleeves 6-inch and larger. The outlets shall conform to ANSE

B16.1, Class 125 flanges designed to accept tapping valves. Sleeves shall be designed to properly fit the type and class of pipe specified. Sleeves must be stainless steel. All bolts shall be corrosion resistant alloy. Sleeves which are designed in such manner that the watertight seal around the outlet is achieved by a gasket placed between the sleeve body and the pipe barrel shall be provided with a recess in the sleeve body to accommodate the gasket.

M3.1.4 Steel Couplings:

Couplings shall be mechanical type with follower rings and gaskets designed for a working pressure of at least 225 psi and to properly fit the type and class pipe specified. The bolts and coatings shall conform to paragraph 3.1 above.

M3.2 Ductile Iron Compact Fittings:

Compact or lightweight fittings shall be ductile iron fittings and shall conform to the requirements of ANSI A21.53 / AWWA C 153, latest revision, for "Ductile Iron Compact Fittings, 3 inch through 12 inch, for Water and Other Liquids". All fittings shall have a minimum pressure rating of 350 psi. All fittings are to be fusion bonded epoxy lined and coated. The FBE coating/lining meets the applicable requirements of AWWA C116/ ANSI/NSF Standard 61 certified for contact with potable water.

Joints shall be mechanical joints which conform to ANSI A21.11 / AWWA C111, latest revision. All fittings shall be furnished with gaskets and mechanical joint fittings shall be furnished with bolts, nuts and iron glands.

SECTION M4 – WATER SERVICE FITTINGS

M4.1 Tapping Saddles:

All one inch service saddles shall be made from ductile or malleable iron provided with a shop coat and designed for a working pressure of 200 psi. A rubber gasket shall be provided between the casting and pipe surface. Saddle straps and bolts shall be high strength corrosive resistant alloy steel. The tapping saddles must be double band. The outlet threads shall be compatible with AWWA CC type one inch corporation stops for one inch service and 2"npt for two inch service.

M4.2 Corporation Stops:

Corporation stops shall conform to AWWA C800 without a positive stop. The inlet shall be AWWA CC tapered threads and the outlet with a compression coupling. The compression outlet shall utilize a Buna-N beveled gasket to provide a watertight connection and with a split clamp locking device. The split clamp shall be grooved and provided with a stainless steel screw to draw down the clamp for the prevention of mechanical pullout. The corporations shall be AWWA red brass with precision machined castings and compatible with conventional aping machines.

M4.3 Service Tubing:

See Section 2.4 (Copper Tubing) and 2.5 (Polyethylene Tubing).

M4.4 Meter Setting:

Meter setters shall be brass meter mountings for pit installations, shall have integral pack joints and shall be 70 Series Coppersetter, Catalog NO. V72-7W-44-33-NL, by the Ford Meter Box Company, Inc or approved equal.

M4.5 Red Brass Pipe and Fittings:

All red brass pipe and fittings shall be of the best quality and conform to ANSI / AWWA C 800 or latest revision.

M4.6 Service Fittings:

All service fittings shall be manufactured by the following companies or approved equal:

Table 3: Pre-Approved Fitting Manufacturers

Description	Catalog No.	Manufacturer
Service Tap Saddle	F202	Ford Meter Box
	202	Romac
	313	Rockwell
	402	JCM
One Inch Corporation Stop	F1000-4-NL	Ford Meter Box
One Inch Service Tubing (Polyethylene)	SDR-9	Phillips Driscopipe
Meter Setter	V72-7W-44-33-NL	Ford Meter Box

SECTION M5 – WATER VALVES

M5.1 Gate Valves, 2”and Larger, Double Disc:

Double disc gate valves are not permitted.

M5.2 Gate Valves, 3” through 36” with Resilient Seat:

Resilient seat gate valves three inches through 36 inches shall be designed for a working pressure of 200 psi. Valves shall conform to AWWA C509 with non-rising stem, O-ring stem seals, two inch square operating nut. Valves shall open when the operating nut is turned to the left (counter clockwise). Valve ends shall be as specified. The resilient seat may be bonded or mechanically attached to the gate. All interior metal surfaces shall be coated with a two-part thermosetting epoxy. Valves conforming to these specifications shall be Mueller or approved equal.

M5.3 Butterfly Valves:

Butterfly valves furnished and installed, when approved by the city, shall be Class 150 B in conformance with the requirements of AWWA C504, latest revision, for “Rubber Seated Butterfly Valves”. All butterfly valves shall be furnished by Henry Pratt Company, groundhog type, or approved equal.

M5.3.1 Body:

The valve body shall be constructed of case iron ASTM – 126, Class B, and shall have integrally cast mechanical joint ends unless otherwise specified. If flange ends are specified, they shall conform to Class 125, ANSI B16.1. Body thickness shall be in strict accordance with AWWA C504, latest revision, Class 150B.

M5.3.2. Valve Seats:

All butterfly valves shall be of the tight closing, synthetic rubber seat type, as follows:

1. Valves 20 inches (nominal diameter) and smaller shall have bonded seats, which are simultaneously molded in, vulcanized and bonded to the body. Seat bond must withstand 75 pounds pull under test procedure ASTM D429, Method B.

2. On valves 24 inches and larger, all seats shall be of a synthetic rubber compound. Seats shall be retained in the valve body by mechanical means without retaining rings, segments, screws, or hardware of any kind in the flow stream.
3. Seats shall be a full 360 degrees without interruption and have a plurality of grooves mating with a spherical disc edge seating surface. Valve seats shall be field adjustable around the full 360 degrees circumference and replaceable without dismantling operator, disc, or shaft and without removing the valve from the line. Manufacturer shall certify that rubber seat is field replaceable.

M5.3.3 Valve Discs:

Valve discs shall be as follows:

1. Valves 12 inches through 20 inches nominal diameter shall have valve discs constructed of alloy cast iron ASTM A-436, Type 1.
2. Valves 24 inches nominal diameter shall have valve discs constructed of cast iron with a stainless steel seating edge.
3. Valves 30 inches through 48 inches nominal diameter shall have valve discs constructed of ductile iron with a stainless steel seating edge.

M5.3.4 Valve Shaft and Bearings:

The valve shaft shall be constructed of stainless steel and the bearings shall be corrosion resistant and self-lubricating.

M5.3.5 Operator:

The valves shall be equipped with a totally enclosed type operator, fully gasketed and grease packed, suitable for direct burial. The operator shall be designed for operation with a nominal two inch by two inch operating nut for use with a standard T wrench. Operators shall be designed to open with a counterclockwise rotation of the operator nut.

M5.3.6 Painting:

All valves shall be painted in accordance with AWWA G504, latest revision.

M5.3.7 Testing:

The valve shall be hydrostatically tested at 150 psi for leakage in accordance with AWWA C504, latest revision.

M5.3.8 Affidavit of Compliance:

The manufacturer shall furnish to the Engineer prior to delivery an affidavit stating that the valve and all materials used in its construction conform to the requirements of AWWA C504 and that all tests specified therein have been performed and that all test requirements have been met.

M5.3.9 Outside Coating:

All valves shall have an exterior epoxy coating 10 mils thickness.

M5.3.10 Inside Coating:

All valves furnished and installed shall have the interior ports and discs coated with a minimum of 10 mils thickness of Keysite No. 750 epoxy enamel or approved equal, which has passed FDA extraction tests required for use in contact with potable water.

M5.3.11 Butterfly Valve Boxes:

All buried valves shall be furnished with a suitable valve box. The manufacturer shall submit three sets of drawings prior to delivery for review by the Engineer and the Department, showing the principal dimensions, construction details, and materials used in the construction of the valve box.

M5.4 Air Release Valves:

All air release valves shall be APCO No. 200-A. or approved equal. The open end of the air relief pipe shall be extended to at least one foot above grade and provided with a screened, downward-facing elbow. Relief piping shall be covered by a 24 mesh corrosion resistant screen. Discharge piping from air relief valves shall not connect directly to any storm drain, storm sewer, or sanitary sewer.

SECTION M6 – VALVE BOXES

M6.1 Valve Boxes (standard depth):

Shall be two piece, screw-type, 5 ¼ shaft, 27 to 37 inch extension, with drop cover marked “WATER”, and shall have a combined weight of at least 80 pounds, No. 565-S manufactured by Tyler Pipe, or approved equal.

M6.2 Valve Boxes (extra depth):

Shall be two-piece, screw type, 5 ¼ inch shaft, with extension length appropriate for depth of bury, drop cover marked “WATER”, and shall be 6850 Series, manufactured by Tyler Pipe, or approved equal. If the depth of bury exceeds four feet, an operator extension shall be provided with the box to enable the operation of the valve with a standard four foot T wrench.

M6.3 Valve Box Collar:

All valve boxes in earthen surfaces shall have a two foot diameter by six inch deep precast concrete collar installed around the top of the valve box.

SECTION M7 – METER BOXES

M7.1 Meter Boxes in Paved Surfaces:

Meter boxes shall not be within driveways, alleys, or in any other concrete or paved surface unless no other alternative is available, and with written approval from the city. Meter Boxes shall be constructed of concrete with a minimum thickness of 1 ½ inch and a depth of 24 inches. Meter boxes shall be of the proper and necessary dimensions to accommodate the particular size meter to be housed. The meter box shall be such that it can be easily removed by one man for purpose of providing easy access to the complete meter assembly and yoke cut off. All concrete meter boxes shall have a two-piece cast iron lid.

M7.2 Meter Boxes in Non-Paved Surfaces:

Meter Boxes shall be PVC plastic, Meter boxes for single and dual service must be equal to Carson Industries 1220-3. Meter boxes for two inch meters shall be equal to Carson Industries 1730-6B.

SECTION M8 – FIRE HYDRANTS

M8.1 Fire Hydrants

All fire hydrants shall be Mueller Centurion Catalog Number A-423; traffic model or approved equal, and conforming to AWWA C 502 or latest revision, and equipped as follows:

Working Pressure	Minimum 200 psi
Size of Valve Opening	Minimum 5 ¼ inch
Diameter of Inlet connection	Six inches
Type of Inlet Connection	Mechanical Joint
Number & Size of Hose Connection	2 – 2-½” / 1 – 4-½”
Nozzle Arrangement	All in same plane
Nozzle Thread.....	National Standard
Nozzle Cap Chains	Each cap
Nozzle Cap Washers	Rubber
Operating Threads.....	Grease or Oil W/O-Ring Seals
Seat Rings	Bronze to Bronze
Direction to Turn to Open.....	Left (counterclockwise)
Shape & Size of Operating & Nozzle Cap Nut.....	5-sided, 1 ½” from flat to point
Operating Nut	Bronze
Color above ground:	
Barrel and Top	Chrome Yellow
Nozzle Caps	Chrome Yellow

M8.2 Design Specifications:

M8.2.1 Hydrant Design:

The hydrant shall be of the dry top design. Stem threads shall be sealed from the waterway in both the open and closed position. The thrust collar of the operating nut and the thrust collar bearing surfaces of the bonnet shall be automatically lubricated each time the hydrant is operated or thrust collar bearing surfaces of the bonnet shall be bronze bushed to reduce corrosion. A weather cap shall be provided.

M8.2.2 Hydrant Selection:

The hydrant shall be of the breakable or traffic type. The union between the upper and lower barrel shall consist of breakable bolts and/or nuts or two part breakable flanges. The union between the upper and lower stem shall consist of a torque diverting breakable coupling made of coated steel, cast iron, or bronze.

M8.2.3 Hydrant Main Valve:

The main valve seat ring shall be made of bronze and threaded into a bronze retainer ring or it may be threaded into a heavy bronze bushing in the shoe.

M8.2.4 Hydrant Seat:

Seat must be removable, using a short, lightweight wrench, which will fit all depths of bury.

M8.2.5 Hydrant Shoe:

The shoe of the hydrant shall be internally coated with one coat of two part thermoset epoxy coating (four mil.).

SECTION M9 – POLYETHYLENE MATERIAL FOR PIPE ENCASEMENT

M9.1 Material:

Polyethylene material for the encasement of cast iron pipe (gray or ductile) shall conform to ANSI A21.5 / AWWA C105.

M9.2 Tape:

Tape for field application shall be Polyken #900 or Scotchrap #50, or equal, at least three inches wide.

SECTION M10 – PVC WATER PIPE EMBEDMENT MATERIALS

M10.1 Description:

This section covers materials used for embedment of water mains. Unless otherwise specified herein or shown on the plans, embedment materials shall be restricted to ASTM D448, size #67 (maximum particle size of $\frac{3}{4}$ inch per AWWA C605), or ASTM D2774 (maximum particle size of $\frac{1}{2}$ inch).

Class I or Class II materials are unacceptable for PVC water pipe embedment and shall not be used.

Quarry screenings minus $\frac{1}{2}$ inch shall be approved as equal to ASTM D2774.

*(Class I or Class II materials shall include, but not be limited to, Arkansas Highway and Transportation Department (AHTD) Class 7 Aggregate Base (old designation SB 2.)

SECTION M11 – PIPE DETECTION

M11.1 Trace Wire:

Trace wire shall be 10 gauge, insulated solid copper wire. Insulation shall be rated for direct burial of the wire. Stranded copper wire is not approved. All water and force main piping will have tracer wire laid approximately six inches above the top of the pipe.

Gravity sewer pipe shall have tracer wire laid approximately six inches above the top of the sewer in instances where line of sight to the adjacent manhole is not available for identifying the location of the line.

M11.2 Detection Tape:

All pipes shall have foil detection tape laid approximately 18 inches above the pipe. All foil detection tape shall be color coded and include language identifying what is conveyed within the pipe: water line shall be identified by blue tape with the word "WATER", sanitary sewer shall be identified by green tape with the word "SEWER", and re-claimed water shall be identified by purple tape with the word "RECYCLED" or "RE-CLAIMED". The foil detection tape will not replace the use of tracer wire; it will be used in conjunction with it.

SECTION M12 – SANITARY SEWER PIPE

M12.1 Description:

All gravity sewer pipe shall be Ductile Iron or Polyvinyl Chloride (PVC) Type PSM. The minimum acceptable size of all gravity sewer mains is eight inch diameter. All pipe installed shall be of the type, size, class, and thickness as indicated in these specifications and on the design plans. The strength of pipe used shall be based on standard engineering design principles and manufacturer or trade association recommendations. Only pipe materials listed in this section shall be used for sanitary sewer mains and service lines unless specifically authorized by the City Engineer of the Siloam Springs Water and Wastewater Department.

M12.2 Ductile Iron Gravity Sewer Pipe, 8” – 36”:

Ductile iron pipe shall conform to ASTM Standard A 746 (Ductile Iron Gravity Sewer Pipe) or ANSW/AWWA C 151/A 21.51-81 or latest revision. It shall be lined with a cement mortar lining and seal coat in accordance with the latest revision of ANSI / AWWA C104/A21.4. Pipe shall be manufactured with the type joints specified. Joints shall conform to ANSW / AWWA C111/A21.11 and may be mechanical joint or push-on joint unless otherwise specified. The minimum thickness class shall be Class 50 unless specified.

M12.3 Polyvinyl Chloride (PVC) Gravity Sewer Pipe, 8” – 15”:

PVC pipe for gravity sewers shall conform to the latest revision of ASTM Designation D3034 (Type PSM) and shall have a minimum Standard Dimension Ratio (SDR) of 26. The pipe shall have a minimum pipe stiffness (F/dY) of 115 psi at 5% deflection as defined in ASTM D 2412.

The pipe shall be made of a plastic having a cell classification of 12454-B as defined in ASTM D1784. All pipe and fittings shall be tested in accordance with ASTM Designations D2412, D2162, and D2444.

All pipe sections shall be straight and true in alignment and shall be furnished in thirteen foot lengths. Provision shall be made for expansion and contraction at each joint by use of a gasket type joint and integral bell.

Users of PVC pipe are to take particular notice of the bedding and backfilling requirements for PVC gravity sewer pipe listed in Section C3.5 and the testing requirements listed in Section T6. All gravity sewer pipe is required to pass a mandrel test for deflection of no more than 5% during the final inspection.

M12.4 Sanitary Sewer Service Lines:

M12.4.1 General:

Service lines are defined as that portion of the sanitary drainage system which extends from the city sewer main to the stub out at the property line or wherever City maintenance terminates.

All service lines shall meet with the requirements of this section of the specifications for pipe and joint material except as outlined below. Service lines shall be bedded as required for mains.

The minimum size of any service line shall be four inches in diameter. Sizes of service lines for multifamily or commercial applications shall be as a minimum as required by the Arkansas State Plumbing Code unless otherwise directed by the Siloam Springs Water and Wastewater Department.

Service lines may be constructed of polyvinyl chloride (PVC) pipe (SCH 40 or SDR 26) or ductile iron pipe.

M12.4.2 Ductile Iron Pipe, 4" – 36":

Ductile iron pipe shall meet the requirements of Section M12.2.

M12.4.3 Polyvinyl Chloride (PVC) Pipe, 4" – 15":

PVC pipe shall be Schedule 40 or SDR 26.

M12.5 Pipe Joints:

All joints shall be as shown on the plans and as specified herein.

M12.5.1 Ductile Iron Pipe:

All joints shall be push-on or mechanical, unless otherwise specified, and shall conform to the requirements of ANSI / AWWA C111/A21.1180.

M12.5.2 Polyvinyl Chloride (PVC) Pipe:

The use of solvent or chemically welded joints is prohibited.

Joints shall be push-on, elastomeric gasket type conforming to ASTM D3212 and ASTM F-477.

M12.6 Sewer Pipe Fittings:

M12.6.1 Standard Fittings:

All bends, tees, plugs, adapters, wyes, or other fittings shall meet with the requirements of the type of pipe used and all joints shall meet with the requirements for the joints listed above.

PVC sewer wyes, tee-wyes, bends, or other fittings shall be one piece molded construction with:

1. Elastomeric Gaskets conforming to ASTM 3212
2. Self-cleansing sanitary flow
3. Design meeting ASTM 3034 standards

M12.6.2 Special Fitting:

All special fittings shall be in accordance with the pipe manufacturer's recommendations and as approved. Connections between different kinds of pipe shall be detailed on the plans and shall be as such to provide self-cleansing sanitary flow and watertight joints and connections.

SECTION M13 – MANHOLES

M13.1 Description:

This section covers materials to be used in the construction of standard manholes, drop manholes, and watertight manholes.

M13.2 Concrete:

Concrete used in the construction of manholes shall conform to the requirements of Section M14 Concrete and Reinforcing Steel.

M13.3 Mortar:

Mortar shall be composed if one part Portland cement to two parts fine aggregate, by volume. Cement and fine aggregate shall conform to the requirements of Section M14 Concrete and Reinforcing Steel. Masonry cement shall be strictly prohibited for use in any part of manhole construction.

M13.4 Brick Manholes:

Brick type manholes are explicitly prohibited for use in the municipal sanitary sewage collection system.

M13.5 Pre-cast Manholes:

Pre-Cast manholes are prohibited for use in the municipal sanitary sewerage collection system. Exceptions will be made on a case-by-case basis with written permission from this department.

M13.6 Cast-in Place Manholes:

Cast-in-place manholes shall be made of Class A concrete conforming to the requirements of Section M14 – Concrete and Reinforcing Steel.

M13.7 Drop Type Manholes:

Materials used in the construction of drop manholes shall conform to the requirements of Sections 13.6 above and/or applicable parts of this specification.

M13.8 Fiberglass Manholes:

Fiberglass manholes are explicitly prohibited for use in the municipal sanitary sewerage collection system.

M13.9 Manhole Rings and Covers:

All castings for manhole rings and covers must be of the best quality gray cast iron, free from cracks, holes, scale, shrinkage, distortion, and other defects which might make them unfit for their intended use. They shall be of workmanlike finish, shall be non-rocking, shall have all bearing surfaces machined smooth and shall be of such quality that a blow from a hammer will produce an indentation on a rectangular edge of the casting without flaking the metal.

Manhole rings and lids shall have a combined weight of not less than 250 pounds and shall have a minimum access diameter of 24 inches. The manhole lids shall be of solid construction without any openings of any type except two concealed pick holes, which shall be located on direct opposite sides of the manhole lid. The concealed pick holes shall be of such design as not to allow infiltration into the manhole. Manhole lids shall have "SANITARY SEWER" or "CITY OF SILOAM SPRINGS SANITARY SEWER" cast on the lids.

Standard manhole rings and covers shall be Vulcan Foundry, Pattern VM – 48 A, or approved equal.

M13.10 Watertight Manhole Rings and Covers:

Watertight manhole rings and covers where required on the plans shall be Vulcan Foundry, Pattern VM – 50 Special, or approved equal.

M13.11 Manhole Steps:

Manhole steps are not required in sanitary sewer manholes except under extenuating circumstances and only as approved by the Department.

M13.12 Water Stops:

Water stops for pipe connections to manholes shall be Fernco Concrete Manhole Adapters, or equal, furnished in the appropriate size for the type and class of

pipe used. Water stops are required for all gravity sewer pipes entering manhole walls or bases.

SECTION M14 – CONCRETE AND REINFORCING STEEL

M14.1 Description:

This section covers materials for concrete and reinforcing steel used in the construction of potable water lines, sanitary sewer lines, and sanitary sewer manholes.

M14.2 Cement:

Cement shall be Portland Cement conforming to the requirements of ASTM C 150, "Standard Specification for Portland Cement", Type I or IA. Type III or IIIA Portland cement, high early strength, may be used if approved in advance by the City Engineer.

M14.3. Water:

Water used in mixing concrete and mortar shall be free from injurious amounts of acids, alkalis, oils, sewage, and organic matter. It shall be fit for drinking.

M14.4. Reinforcing Steel:

Reinforcing steel where required on the plans shall conform to the latest edition of ASTM A615 and/or ASTM 185 (Specifications for steel bars for concrete reinforcement).

M14.5 Composition and Strength:

Concrete shall be composed of Portland cement, fine and coarse aggregate and water proportioned in keeping with the following:

Table 4: Portland Cement Mix Requirements

	CLASS "A" CONCRETE	CLASS "B" CONCRETE
Minimum Sacks of Cement (Per Cubic Yard)	6	5
Consistency range in Slump (Inches)	2-4 (with vibration) 4-6 (without)	2-4 4-6
Air Entrainment (if applicable)	6%	6%

Air-entraining agents, if used, shall conform to ASTM C260. The total air content (entrained and entrapped air) shall be six percent plus or minus one percent.

Proportioning of concrete shall be by weight except that water may be measured by volume.

A one cubic foot sack of Portland Cement will be considered as weighting 94 pounds.

One gallon of water weighs 8.34 pounds.

Coarse aggregates shall be no larger than $\frac{3}{4}$ inches. The designated range of coarse aggregate shall be $\frac{3}{4}$ inch to No. 4. Fine aggregates shall consist of clean, sound, properly graded sand conforming to ASTM C-33.

Class A concrete made with ordinary Portland cement shall have a minimum compressive strength at 28 days of 3000 psi. Class B concrete made with ordinary Portland cement shall have a minimum compressive strength at 28 days of 2000 psi. If made with high early strength cement, those strengths shall be attained at the end of 7 days.

M14.6 Use:

Class A concrete shall be used for all structures and manholes unless otherwise specified. Class B concrete shall be used for pipe bedding or encasement, when required, and for thrust blocking. Class of concrete shall be shown on the plans in all locations where concrete is required.

M14.7 Testing:

The Siloam Springs Water and Wastewater Department reserves the right to require the Contractor to provide test specimens in accordance with Section T8 CONCRETE TESTING of these specifications.

SECTION M15 – SANITARY SEWER PIPE EMBEDMENT MATERIALS

M15.1 Description:

This section covers materials used for embedment of water mains. Unless otherwise specified herein or shown on the plans, embedment materials shall be restricted to ASTM D448, size #67 (maximum particle size of $\frac{3}{4}$ inch per AWWA C605), or ASTM D2774 (maximum particle size of $\frac{1}{2}$ inch).

M15.2 Class I Embedment Material:

Class I material consists of manufactured angular, granular material, $\frac{1}{4}$ to $1\frac{1}{2}$ inches (six to 40 mm) in size.

M15.3 Class II Embedment Material:

Class II material consists of coarse sands and gravel with maximum particle size of $1\frac{1}{2}$ inches (40 mm), including variously graded sands and gravel containing small percentage of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW, and SP are included in this class.

GW – Well graded gravel and gravel/sand mixtures, little or no fines. 50% or more retained on a No. 4 sieve. More than 95% retained on a No. 200 sieve. Clean.

GP – Poorly graded gravel and gravel/sand mixtures, little or no fines. 50% or more retained on a No. 4 sieve. More than 95% retained on a No. 200 sieve. Clean.

SW – Well graded sands and gravelly sands, little or no fines. More than 50% passes a No. 4 sieve. More than 95% retained on a No. 200 sieve. Clean.

SP – Poorly graded sands and gravelly sands, little or no fines. More than 50% passes a No. 4 sieve. More than 95% retained on a No. 200 sieve. Clean.

*(Class I or Class II materials shall include, but not be limited to, Arkansas Highway and Transportation Department (AHTD) Class 7 (old designation SB 2.))

SECTION M16 – SANITARY SEWAGE FORCE MAINS

M16.1 Description:

All sanitary sewage force mains shall be of equal design, material, and construction as potable water pipe. All air release valves shall be Val-Matic VMC-801A or approved equal. The open end of the air relief pipe shall be extended to at least one foot above grade and provided with a screened, downward-facing elbow. Relief piping shall be covered by a 24 mesh corrosion resistant screen. Discharge piping from air relief valves shall not connect directly to any storm drain, storm sewer, or sanitary sewer.

M16.2 Design:

Sanitary sewer force mains shall be designed to avoid the need for air or vacuum release assemblies unless approved by the City Engineer and the Public Works Director. If possible, force mains shall be designed without significant high points and with the top of the force main below the hydraulic grade line (HGL) at the minimum pumping rate so that relief valves will not be needed. A high point shall be considered significant if it is two feet or more above the minimum HGL, or, when pumping is intermittent, above the static head line.

M16.3 Air/Vacuum Relief Valves:

If high points in the force main cannot be eliminated, a stainless steel A.R.I. Flow Control Accessories sewage air release valve or approved equal shall be installed at each significant high point where air could become trapped. The air release valve shall be installed in a manhole structure in accordance with the requirements of Section M13 – Manholes, and provisions shall be required for draining the structure.

PART C CONSTRUCTION PROCEDURES

SECTION C1 – DESCRIPTION

C1.1 General:

This part of the specifications shall set forth minimum acceptable construction procedures for the installation of water and sanitary sewerage facilities under the jurisdiction of the Siloam Springs Water and Wastewater Department.

Construction procedures other than those outlined in this specification shall meet with the approval of the Department. Complete specifications covering any unusual or special construction procedure not listed in this specification shall be submitted to the Department for approval prior to the beginning of construction.

SECTION C2 – EXCAVATION

C2.1 Trench Excavation General:

The trench shall be excavated so that the pipe can be laid to the alignment and depth required, and it shall be excavated only so far in advance of the pipe laying as set out elsewhere in these specifications.

The trench shall be so braced and drained that the workmen may work therein safely and efficiently. Any and all applicable safety standards shall apply. It is essential that the discharge of any trench dewatering pumps be conducted to natural drainage channels, drains, or storm sewers.

The contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his part.

All excavation shall be dewatered before any construction is begun. Concrete shall be placed only upon dry firm foundation material and pipe shall be laid only in dry trenches.

C2.1.1 Trench Depth:

The trench for all sanitary sewers and water shall be excavated to at least six inches below the grade required to provide proper pipe embedment and a minimum earth cover of 30 inches for sanitary sewers and 36 inches for water mains.

All over-excavation below the established pipe grade shall be backfilled to the proper grade with pipe bedding material. All pipe bedding material shall be installed so as to provide a uniform and continuous bearing support for the pipe at every point along the pipe barrel.

The subgrade beneath the centerline of the pipe shall be finished to within 0.03 feet of a straight line between pipe joints or batter boards, and all tolerances shall be above the specified grade. The finished subgrade shall be prepared accurately by means of hand tools.

C2.1.2 Bell Holes:

The bottom of the trench under each bell shall be excavated sufficiently to allow the pipe bell to maintain six inches of bedding.

C2.1.3 Trench Width:

The width of the trench shall be ample to permit the pipe to be laid and jointed properly, and the backfill to be placed and compacted as specified. The trench width shall not exceed the maximum width as shown on the Standard Detail Sheet of the plans at any point from the trench bottom to a point 12 inches above the barrel of the pipe.

If the contractor over-excavates the trench, he shall provide additional pipe bedding gravel or concrete as necessary to prevent crushing of the pipe due to excessive earth loads.

C2.1.4 Trench Length:

The Engineer shall have the right to limit the amount of trench excavated in advance of the pipe laying. In general, such excavation shall not exceed 300 feet, and trench excavated to grade shall not exceed 100 feet.

C2.1.5 Pipe Clearance in Rock:

Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least six inches below and on each side of all pipe, valves, and fittings for pipes 21 inches in diameter or less, and nine inches for pipes larger than 24 inches in diameter. Every trench in rock shall be fully opened at least 50 feet in advance of the place where pipe is being laid or concrete or masonry work is in progress.

C2.1.6 Excavation in Poor Soil and Refilling to Grade:

Where the bottom of the trench is found to unstable Class IV or V soils or to include ashes, cinders, all types of refuse, vegetable or other organic materials, or large pieces of fragments of inorganic material which in the judgment of the City Engineer should be removed, the Contractor shall excavate and remove such unsuitable material to the width and depth ordered by the City Engineer.

Before the pipe is laid, the subgrade shall be made by backfilling ASTM D448, size #67 (maximum particle size of $\frac{3}{4}$ inch per AWWA C605), or ASTM D2774 (maximum particle size of $\frac{1}{2}$ inch with clean crushed rock or gravel (ASTM D 2487, Class I material). or crushed stone (AHTD SB-2) in six to eight inch uncompact layers. The layers shall be thoroughly tamped by hand or machine to the density of adjacent undisturbed soil so as to provide a uniform and continuous bearing and support for the pipe bedding.

C2.1.7 Wet Excavation:

When water or unstable soil is encountered in the bottom of the trench, the Contractor will be required to excavate below grade a minimum of 12 inches, and the trench will be brought back to grade and the pipe shall be completely embedded with clean crushed rock or gravel (ASTM D2774 with ½ inch max particle size, AASHTO #67 with a maximum particle size of ¾ inch per AWWA C605, or AHTD Class 8 (SB-3)). The bedding shall be placed in layers that shall be thoroughly tamped and formed to provide a uniform and continuous bearing and support for the pipe bedding.

C2.1.8 Removal of Water and Muck:

The Contractor shall provide sufficient pumps and other necessary equipment to keep the trench free of water, which may accumulate. If the bottom of the trench becomes soft and muddy, the Contractor shall remove all such soft material and replace it with bedding material as described above in C2.1.7.

C2.1.9 Deviations Occasioned by Other Structures:

Whenever obstructions not shown on the plans are encountered during the progress of the work and interfere to such an extent that an alteration in the plan is required, the Engineer shall have the authority to change the plans and order a deviation from the line and grade only after approval of the change by the Siloam Springs Water and Wastewater Department, or the Engineer may arrange with the owners of the structures in conflict for the removal, relocation or reconstruction or the obstruction.

C2.1.10 Bracing and Shoring:

The sides of any excavation, when deemed necessary, shall be properly supported with shielding, bracing, shoring, or sheeting in accordance with the latest State Law and OSHA Regulations. Such bracing, shoring, or sheeting shall be withdrawn as the work progresses in such a manner as not to endanger life and property and to allow for backfilling of the trench in accordance with these specifications.

In case the excavation is close enough to buildings or other foundations as to endanger their stability by removing such bracings, then they shall be made secure and left in place, and the line trench shall be backfilled and thoroughly tamped with the bracing in place.

Where the trench walls are sloped away from the trench to prevent slides or cave-ins, it will be permissible to cut the trench banks on a slope above an elevation two feet above the crown of the pipe.

It is the responsibility of the contractor to maintain the excavation free from slides or cave-ins and safe for workman and to comply with federal labor requirements for trench safety. No observation of any project by the Engineer or representative of the Siloam Springs Water and Wastewater Department will reduce the Contractor's responsibility.

C2.1.11 Use of Explosives:

In the event the use of explosives is necessary for the efficient prosecution of the work, the Contractor shall notify the Engineer in advance of their use and shall exercise every precaution to protect completed work, neighboring property, water lines, or other underground structures. Any damage to private property resulting from the use of explosives shall be the liability of the Contractor.

The Contractor shall notify all owners of neighboring property or public utility property of intention to use explosives at least eight hours before blasting is done close to such property. Any observation of this project by a representative of the Siloam Springs Water and Wastewater Department does not in any way reduce the responsibility of the Contractor for damage resulting in the use of explosives. In all cases, where explosives are necessary, the Contractor shall obtain appropriate permits from governmental agencies prior to their use.

C2.1.12 Excavation for Manholes:

Excavation for manholes shall be as specified in Section C7 Manholes.

C2.1.13 Disposal of Excavated Materials:

Excavated material shall be piled adjacent to the work to be used for backfilling, if suitable. All excavated material, which is unsuitable for backfilling, and any excess material shall be disposed of in a manner approved by the Engineer.

SECTION C3 – EMBEDMENT (BEDDING) AND BACKFILLING

C3.1 General:

This section covers the minimum requirements for the embedment and backfilling of potable waterlines, sanitary sewer lines, and sanitary sewage force mains.

Gravity sanitary sewer, force sewer, ductile iron pipelines shall be installed using embedment materials as defined in Section M15 of these specifications. PVC potable water lines and sanitary sewage force mains shall be installed using embedment materials meeting Section M10 of these specifications.

Backfilling of pipelines shall include the refilling and consolidation (compaction) of the fill in the excavation up to the surrounding ground surface or road grade at crossings. All pipeline trench backfill shall be placed in layers of appropriate thickness and compacted by hand or approved mechanical methods. All trench backfill (except that under paved areas) shall be compacted to a minimum density of 85% of that of the adjacent undisturbed soil as determined in accordance with ASTM D2922.

Where trenches are under existing or proposed paved area, the entire trench above the herein required embedment up to a point two feet below existing or proposed subgrade shall be backfilled with AHTD SB-2 and compacted to 90 percent Modified Proctor Density as determined by AASHTO T-180. The remaining two feet shall be backfilled with AHTD SBB-2 placed in 6 in lifts and compacted to 95% Modified Proctor Density as determined by AASHTO T-180.

Where trenches are under existing or proposed public streets of the City of Siloam Springs, the entire trench above the herein required embedment shall be backfilled up to the subgrade with AHTD Sb-2 placed in 4-6 in lifts and compacted by approved mechanical methods to 95% Modified Proctor Density as determined by AASHTO T-180.

C3.1.1 Select Materials:

Select materials are defined as good earth, sand, or gravel and shall be free from rocks larger than ½ inches in diameter or hard lumpy materials. Soil Classes I, or II, are included in this designation. Select materials require hand placement and consolidation.

C3.1.2 Pipe Protection Cover:

Pipe protection cover shall be defined as backfill from the top of the pipe bedding to a point 18 inches above the top of the pipe and shall consist of select material as defined above in Section C3.1.1. Pipe Protection Cover

requires hand placement; however, should the material excavated from the trench be completely free of rock larger than ½ inch the trench may be machine backfilled.

Should the excavated material not be suitable for machine backfill, or hand placement, the contractor may, at his option, use crushed limestone (maximum particle size of ¾ inch per AWWA C605) to a depth of 18 inches above the top of the pipe. The trench may then be backfilled in accordance with Section C3.9 of these specifications.

C3.2 Ductile Iron Water Pipe Embedment:

Ductile iron water pipe may be bedded as specified for “Type 2” Standard Laying Conditions as described in ANSW / AWWA C150/A 21.50, “Thickness Design of Ductile Iron Pipe”, unless structural or foundation requirements indicate more stringent bedding conditions are necessary.

The trench bottom shall be shaped and graded so as to provide a continuous bearing support for the pipe at every point along the pipe barrel. Bell holes shall be excavated to accommodate the pipe bells so that no weight of the pipe is supported by any bell.

Select materials shall be hand placed and consolidated (hand tamped) to the centerline of the pipe. The intent is to cradle the pipe so that the full length of each joint is uniformly supported on firm bedding and the weight of the pipe and fill is borne uniformly by the pipe barrel.

C3.3 Polyvinyl Chloride (PVC) Water Pipe Embedment

Polyvinyl Chloride (PVC) water pipe may be bedded as specified for “Type 2” Typical Embedment Types as described in AWWA C605, “Underground Installation of PVC and PVCO Pressure Pipe and Fittings”, unless structural or foundation requirements indicate more stringent bedding conditions are necessary.

The trench bottom shall be shaped and graded so as to provide a continuous bearing support for the pipe at every point along the pipe barrel. Bell holes shall be excavated to accommodate the pipe bells so that no weight of the pipe is supported by any bell.

Select materials shall be hand placed and consolidated (hand tamped) to the centerline of the pipe. The intent is to cradle the pipe so that the full length of

each joint is uniformly supported on firm bedding and the weight of the pipe and fill is borne uniformly by the pipe barrel.

C3.4 Ductile Iron Sewer Pipe Embedment:

Ductile iron sewer pipe shall be bedded in pipe embedment materials as specified for "Type 4" Standard Laying Condition as described in ASTM A 746, "Standard Specification for Ductile Iron Gravity Sewer Pipe."

The pipe shall be bedded in Class I or Class II embedment materials as defined in Section M15 of these specifications to a depth of 1/8 pipe diameter, six inches minimum under pipe for the full width of the excavated trench. All pipe bedding material shall be tamped by hand or approved mechanical methods so as to provide a uniform and continuous bearing support for the pipe at every point along the pipe barrel.

Class I embedment material shall then be hand placed and consolidated (by hand or approved mechanical methods) to the top of the pipe.

C3.5 Polyvinyl Chloride (PVC) Sewer Pipe Embedment:

Polyvinyl Chloride (PVC) sewer pipe shall be bedded in accordance with ASTM D 2321, "Standard Recommended Practice for Underground Installation of Thermoplastic Sewer Pipe."

The pipe shall be bedded in Class I or Class II embedment materials as described in M15 of these specifications for the full width of the excavated trench from a point four to six inches below the bottom of the pipe barrel up to a point a minimum of six inches above the top of the pipe. All pipe embedment materials shall be tamped by hand or approved mechanical methods so as to provide a uniform and continuous bearing support for the pipe at every point along the pipe barrel.

Class I or Class II bedding materials shall be compacted to a standard proctor density of 90% or better as defined in AASHTO T 99. The intent of the specification is to cradle and protect the pipe so that the full length of each joint is uniformly supported on firm bedding and the weight of pipe and fill is borne uniformly by the pipe barrel.

Select material shall then be placed and consolidated (by hand or approved mechanical methods) to two feet above the top of the pipe.

C3.6 Ductile Iron Force Main Embedment:

Embedment procedures for ductile iron force mains shall be identical to those for ductile iron water mains as defined above in Section C3.2.

C3.7 Service Lines:

The bedding of service lines in the street right-of-way and/or easement shall meet the requirements set forth above.

C3.8 Manholes:

Backfilling of manholes is detailed in Section C7 – Manhole Construction.

C3.9 Backfilling:

This section specifies the procedures for backfilling areas excavated during the construction of sewer lines, manholes, force mains, water lines, valves, fittings, fire hydrants and other appurtenances.

C3.9.1 Backfill Material:

All backfill material shall be free from cinders, ashes, refuse, vegetable, or organic material, boulders, rocks, or stones, frozen soil, or other material that in the opinion of the Engineer or the Siloam Springs Water and Wastewater Department is unsuitable.

C3.9.2 Pipe Protection Cover:

After embedment materials have been placed to the required depth and compaction as required above, the Pipe Protection Cover (as defined in C3.1.2) shall be placed to a depth of 18 inches above the pipe. All pipelines, regardless of material, shall have at least 12 inches of pipe protection cover.

C3.9.3 Backfilling of Ductile Iron Pipe:

After the pipe protection cover has been placed, the trench, excavated areas around manholes, valves, fittings, fire hydrants, and other appurtenances shall be backfilled with excavated material free from rock larger than eight inches.

C3.9.4 Backfilling of Polyvinyl Chloride (PVC) Pipe:

After the pipe protection cover has been placed, the trench, excavated areas around manholes, fittings, and other appurtenances shall be backfilled with excavated material free from rock larger than eight inches; however, place no rock or stones having a dimension larger than six inches within three feet of the top of the pipe.

C3.9.5 Backfilling of Sanitary Sewer Service Lines:

The backfilling of sewer lines in the street right of way and/or easement shall meet the requirements set forth above for the pipe material.

C3.9.6 Backfilling of Potable Water Service Lines:

Initial backfill of Polyethylene Tubing shall consist of a minimum of six inches of select materials, as defined in Section C3.1.1, over the top of the pipeline. The remainder of the trench shall be backfilled with materials as defined in Section C3.9.1, Backfill Material.

Where the water service line trench is under existing or proposed paved areas or public streets of the City of Siloam Springs, the trench shall be backfilled according to Section C3.1.

SECTION C4 – PIPE LAYING

C4.1 Description:

This section covers the laying of pipe for potable water lines, sanitary sewer lines, and sanitary sewage force mains. All material shall be in accordance with PART M - MATERIALS of these specifications.

C4.2 General:

C4.2.1 Alignment and Grade:

All water mains shall be laid and maintained to the required lines and grades as shown on the plans with fittings, valves and hydrants, and other appurtenances at the required locations, spigots centered in bells and all valve and hydrant stems plumb.

C4.2.2 Installing Ductile Iron Pipe:

Ductile iron pipe and ductile iron pipe fittings shall be installed in accordance with AWWA C 600, or latest revision, (Installation of Ductile Iron Water Mains and Their Appurtenances.)

C4.3 Water Pipe and Force Main Laying:

All pipe and fittings shall be installed to the line and grade as detailed on the plans. Subject to the approval of The Department, other fittings may be added to or substituted for those shown on the plans, should the need therefore arise during construction with approval from the Department and the Engineer. This permissive stipulation in no way shall relieve the Contractor of the responsibility for furnishing and installing all fittings required for a complete and proper installation of pipeline as detailed on the plans.

All dirt and other foreign matter shall be removed from the inside of pipe and fittings before they are lowered into the trench. They shall be kept clean during and after laying, care shall be taken to keep dirt out of the jointing space. At the end of each day's work, and when pipe laying is disconnected for an appreciable period, open ends of pipe shall be closed with a watertight plug or cap firmly secured in place.

All pipe and fittings shall be lowered carefully into the trench in such a manner as to prevent damage to pipe, fittings or linings. Neither pipe nor fittings shall be dropped or dumped into the trench.

Cutting of pipe, where needed, shall be done in a neat and workmanlike manner without damage to pipe or pipe lining.

Unless otherwise directed by the Engineer, pipe shall be laid with bell ends facing in the direction of laying. For lines on an appreciable slope, bells shall, at the direction of the Engineer, face upgrade. Whenever necessary to deflect pipe from a straight line in either the horizontal or vertical plane, to avoid obstructions, or for other allowable reasons, the degree of deflection at any joint shall be not greater than that which will provide adequate gasket space entirely around the spigot end of pipe. The joint opening shall be approximately 1/8 inch.

Joint Deflections shall not exceed the maximum recommended by the pipe manufacturer or 5 degrees, whichever is less.

All water main construction that is performed shall have a tracer wire (See Section M-10) installed from the valve where the main installation begins to all fittings, tracer wire will be placed six inches above water line. Where the tracer wire is tied to valves, fittings, corporation stops and the branch piece on the meter setting, the tracer wire shall not be stripped of its insulation. All tracer wires shall be connected to any and all adjoining tracer wires with the use of a water proof fitting.

C4.4 Gravity Sewer Lines:

Each joint of pipe shall be inspected carefully before being placed in the trench. Any joint found to be cracked or otherwise damaged as to impair its usefulness shall be plainly marked in such a manner that the marking will not rub or wash off. Damaged joints shall be removed from the site as soon as feasible.

All sewer pipe shall be laid with the bell upstream. Each pipe shall be laid to plan line and grade, or to line and grade directed by the Engineer, using batter boards and top line, or laser beam grade light. Where batter boards and top line is used, each pipe shall be plumbed for line with a plumb bob, and graded for elevation with a grade stick. Care shall be taken that each spigot is centered properly in the bell or the proceeding pipe and properly sated, and that each pipe is solidly bedded. As the work progresses, the pipes shall be cleared of all dirt and other foreign matter. They shall be maintained clean until accepted or put in service.

At the end of each day's work, and when for any reason the laying of pipe will be discontinued for an appreciable period, the open ends of pipe line shall be closed temporarily with a watertight plug or cap.

The cutting of pipe for any reason shall be done in a neat and workmanlike manner without damage to pipe or pipe lining.

Pipe shall be lowered carefully into the trench in such manner that spigot and bell will not become contaminated. Spigot and bell shall be checked for cleanliness immediately before insertion of spigot into bell.

Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Full responsibility for the diversion of drainage and for de-watering of trenches during construction shall be borne by the Contractor.

Spigot and bells shall be cleaned thoroughly before the application of lubricant and attachment of the pre-formed gasket. Application of lubricant and attachment of the gasket shall be in strict accordance with the manufacturer's recommendations.

Pipe shall not be placed in the trench without excavating for bells so that the entire barrel of the pipe is uniformly supported on the pipe bedding.

Pipe shall be supported to proper line and grade, and secured against upheaval or floating during the placement of concrete bedding, when required.

C4.5 Steep Grades:

Ductile iron pipe shall be used on all sewer or force main pipe when the grade is 15 percent or greater.

Sewers or force mains on 20 percent slopes or greater shall be anchored securely with concrete anchors or equal, spaced as follows:

1. Not over 36 feet center to center on grades 20 percent and up to thirty-five percent;
2. Not over 24 feet center to center on grades 35 percent and up to 50 percent;
3. Not over 16 feet center to center on grades 50 percent and over.

C4.6 Connections to Existing Lines:

Connections to existing water or sewer lines are made only upon prior approval of the Siloam Springs Water and Wastewater Department and only in the presence of an authorized representative of the Siloam Springs Water and Wastewater Department. No connection to existing sewer lines will be made until

the newly constructed facilities meet with all required standards on construction, pass all required tests, and are approved by the Department for connection.

C4.7 Potable Water Service Lines:

Polyethylene Tubing shall be installed with a minimum earth cover of 30 inches over the top of the pipeline. Consideration for thermal contraction shall be given by “snaking” the pipeline in the trench. Steel inserts shall be used at all connections of all service lines. Tracer wire (See Section M10) shall be installed on all polyethylene tubing from the corporation stop on the main to the branch piece on the meter setting. The tracer wire shall be laid six inches above the water line. Where the tracer wire is tied to the corporation stop and to the branch piece on the meter setting, the tracer wire shall not be stripped of its insulation.

SECTION C5 – PIPE JOINTS

C5.1 Description:

This section covers the installation of pipe joints. Joint materials shall be as specified in Section M – MATERIALS.

C5.2 Pipe Joint Installation:

All pipe joints other than those specified herein shall be made in strict accordance with the manufacturer's recommendation and as approved. All joints shall be made watertight in accordance with the latest ASTM Standards. Excavation for bells or other joint protrusions shall be made to insure that the bottom of the pipe firmly rests against the bedding for entire length of the pipe.

C5.3 Installation of Slip-Type or Push-On Joints:

Prior to joining, the bell and spigot end of the pipes shall be cleaned thoroughly by whatever means as are necessary to remove all foreign matter and attain the required cleanliness. A wire brush shall be used as necessary. Particular care shall be exercised to clean the gasket seat.

Joints shall be made in strict accord with the recommendations of the pipe manufacturer. The rubber gasket shall be cleaned and inserted in the gasket seat within the bell. Apply lubricant in accordance with the manufacturer's recommendations. The spigot end of the pipe shall be inserted per the manufacturer's recommendation in the bell of the pipe to which connection is being made. The alignment of the added pipe shall deviate from true alignment not more than 5 degrees for 4-inch pipe, not more than 3 degrees for 12-inch pipe; deviations for intermediate size pipes shall be in conformance with the stated maximum deviations.

C5.4 Installation of Mechanical Joints:

The spigot end of pipe and the bell of fitting and the rubber gasket shall be cleaned thoroughly as specified for pipe joints in paragraph C5.3 above. The gland shall also be cleaned in a like manner.

The taper portion of the spigot end will be removed and then the gland and gasket are placed on the spigot end of the pipe, a sufficient distance from the end to avoid fouling the bell, the spigot end shall be inserted in the fitting bell to firm contact with the bell shoulder. The rubber gasket than shall be advanced into

the bell and seated in the gasket seat. Care shall be exercised to center the spigot end within the bell.

The gland shall be brought into contact with the gasket, all bolts entered, and all nuts made hand tight. Continued care shall be exercised to keep the spigot centered in the bell.

The joints shall be made tight by turning the nuts with a wrench first partially tightening a nut, then partially tightening the nut 180 degrees therefrom and working thus around the pipe with uniformly applied tension until the required torque is applied to all nuts. Joint deflections shall not exceed the maximum recommended by the pipe manufacturer.

Required torque ranges and indicated wrench lengths for standard cast iron bolts are as follows:

Table 5: Torque Requirements for Mechanical Joints

PIPE SIZE (Inches)	BOLT SIZE (Inches)	RANGE OF TORQUE (Foot Pounds)	LENGTH OF WRENCH* (Inches)
3	5/8	45-60	8
4-24	3/4	75-90	10
30-36	1	100-120	14

* The torque loads may be applied with torque measuring or torque indicating wrenches, which may also be used to check the application of approximate torque loads applied by a man trained to give an average pull on a definite length of regular socket wrench.

SECTION C6 – PIPE FITTINGS

C6.1 Description:

This section covers the installation of pipe fittings, valves, plugs, caps, etc. for water lines and the installation of pipe fittings for sanitary sewer lines.

C6.2 Pipe Fittings Installation:

All pipe fittings shall be installed in strict accordance with the manufacturer's recommendations. Joints caused by the installation of fittings shall meet with the requirements of SECTION C5 – PIPE JOINTS. All pipe fittings shall meet with requirements of SECTION M – MATERIALS.

C6.3 Fire Hydrant Installation:

All fire hydrants shall be installed at the location shown on the plans or at the direction of the Engineer and shall be installed in accordance with the Standard Detail sheet of these specifications.

C6.3.1 Examination of Material:

Prior to installation, all hydrants shall be inspected for direction of opening, cleanliness of inlet elbow, handling damage, and cracks.

C6.3.2 Placement:

All hydrants shall stand plumb and shall have their nozzles parallel with, or at right angles to, the street with the pumper nozzle facing the curb. Hydrants shall be set to established grade with the pumper nozzle centerline at least 18 inches above the final grade, unless otherwise directed by the City Engineer.

C6.3.3 Location:

Unless otherwise shown on the plans, hydrants shall be placed as follows: When placed beyond the curb, valves and hydrants shall be located out of paved or sidewalk areas and so that no portion of the hydrant or nozzle cap is within 10 feet of the gutter face of the curb. When set in the lawn space between the curb and the sidewalk, or between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within 12 inches of the sidewalk. The location of all hydrants and appurtenances shall be within the street right of way or dedicated utility easement.

C6.3.4 Connection to Mains:

Each hydrant shall be connected to the main with a six inch ductile iron pipe branch and independent six inch gate valve as shown on the Standard Detail Sheet of these specifications.

C6.3.5 Hydrant Drainage:

Whenever a hydrant is set in any soil, previous or impervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with sand over the reaction backing to at least 6 inches above the waste opening in the hydrant, and to a distance one foot around the elbow. No drainage system shall be connected to a sewer.

C6.4 Thrust Blocking for Fittings:

All plugs, caps, tees, and bends deflecting 11-1/4 degrees or more shall be provided with reaction backing or shall be restrained joint pipe. The fitting must be braced against unexcavated earth at the end of the trench with Class B concrete as shown on the Standard Detail Sheet.

C6.5 Retainer Glands:

Retainer glands or other necessary means of thrust restraint shall be installed at designed locations where in the opinion of the City of Siloam Springs Water and Wastewater Department they are needed.

C6.6 Location of Valves:

Valves in water mains shall be located as shown on the plans and valve boxes shall be set to finished grade.

C6.7 Valve Boxes and Valve Pits:

A valve box shall be provided for every valve. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve with the box cover finish with the surface of the finished pavement or other level as may be directed.

C6.8 Valve Box Collar:

All valve box lids outside of paved areas shall have a two foot diameter collar placed around them. After the valve box lid has been adjusted to final grade, the collar shall be centered on the valve box lid and shall be six inches thick. The top of the pad shall be flush with the top of the box and the surrounding ground. Valve box collars shall not be constructed until every item of cleanup has been completed and the soil has compacted.

C6.9 Dead Ends:

All dead ends on water mains shall have ductile iron plugs or caps and be suitably restrained and/or blocked as shown on the plans or directed by the Engineer. Blow off valves are not allowed as a means of flushing at the end of dead end lines. Fire hydrants meeting the requirements of Section M8 will be required in all cases unless otherwise approved by the Director.

C6.10 Sewer Wye Connections:

Wye connections placed in sanitary sewer lines for services shall be installed in accordance with the manufacturer's recommendations and as approved by the Department. Installation of wye branches shall be as indicated on the Standard Detail sheet.

SECTION C7 – MANHOLES

C7.1 Description:

This section covers the construction methods for manholes, drop manholes, and watertight manholes.

C7.2 Excavation and Backfill:

C7.2.1 Excavation:

Excavation for manholes shall be of such dimension and depth as to allow the construction of the manhole as shown on the Standard Detail Sheet. The area of excavation for the base shall be only that necessary to provide an adequate base with its sides and bottom poured against undisturbed earth. All other excavation below the required grade shall be filled with concrete poured monolithically with the base.

C7.2.2 Base:

The concrete base shall have a minimum thickness of eight inches below the invert and shall be poured on undisturbed earth. The base shall be poured monolithically with the barrels as shown on the Standard Detail Sheet. The base shall have a minimum diameter of two feet greater than the outside of the finished manhole barrel.

C7.2.3 Backfill:

Backfilling of pipelines entering manhole connections shall be done in accordance with the requirements of the pipe material and backfilling manholes up to 12 inches above the base will be done with pipe protection cover. Backfill of manholes shall be compacted to a density of not less than 90% Modified Proctor as defined in AASHTO Designation T-180 (90%) density shall be obtained the entire depth of excavation except that in public streets or roadways where a density of 95% shall be obtained.

Backfill around manholes shall not be completed until adequate strength has been obtained to support the backfill without damage to the manhole. In no case will backfill be allowed on manholes until the concrete is at least 48 hours old except as approved by the Department. Manholes must be leak tested prior to backfilling.

C7.3 Inverts:

The invert of the manhole shall be hand placed and shaped from the concrete poured for the base prior to the initial set of the concrete base. The invert shall be shaped and smoothed so that the manhole will be self-cleaning and free of areas where solids may be deposited as sewage flows through the manhole and from service lines. The sidewall depth of the invert shall be approximately $\frac{1}{2}$ the diameter of the abutting pipe and the shape shall approximate the bottom half of the pipe. The bottom flow line of the invert shall connect the flow line of all main sewer pipes entering the manhole bottom. Inverts shall be shaped, formed and brushed smooth from the concrete poured for the base prior to the initial set of the base. Inverts shall be smooth.

No pipeline will be laid entirely through the manhole barrel and broken out. In all cases, the pipe or pipes shall extend entirely through the manhole wall so that a joint occurs at least three feet outside the manhole wall. The pipe may extend through the barrel into the manhole no more than four inches and the invert must be shaped throughout from all inlet pipes to the outlet pipe.

Additional smoothing of manhole inverts may be necessary. Mortar for smoothing inverts shall be mixed in the proportions by volume of one part cement to two parts sand. If carefully done, mortar may be mixed in a mortar box. Mortar shall have a workable consistency, but shall be as dry as feasible.

C7.4 Connections to Manholes:

Pipe connections to manholes are a constant source of potential trouble. In order to insure that pipe will not break immediately adjacent to the manhole, excavation for the manhole bottom shall be limited to the area to be filled with concrete. Each pipe entering the manhole shall have a joint approximately three feet outside the manhole wall. The contractor shall support the pipe stub entering the manhole all the way to undisturbed earth by backfilling under the pipe and up to mid spring line with concrete. A water stop sleeve or collar shall be used on all pipes entering manhole walls.

C7.5 Manhole Barrels:

The minimum thickness of manhole barrels shall be six inches. The barrel shall be poured monolithically with the base. The manhole barrel shall be of such construction so that the finished manhole will have an inside diameter of four feet plus or minus $\frac{1}{2}$ inch. Other than shallow manholes, (i.e., manholes less than four feet in depth), the top section or cone shall be concentric.

C7.6 Forms:

Prior to setting the forms in place, any water that may have accumulated in the excavated area shall be pumped out. All concrete shall be poured in the dry.

The forms shall be removed after the initial set of the concrete so that holes may be cut in the manhole barrel for the installation of pipes which are to enter the manhole at points other than adjacent to the manhole base. After these pipes have been put in place, the barrel shall be repaired using a grout mixture.

If honeycombing of the barrel is found to be present after removal of the forms they shall be repaired as directed by the Engineer. Manholes with excessive honeycombing will not be accepted by the City of Siloam Springs After and Wastewater Department.

C7.7 Manhole Heights:

Manholes are to be built to the established final grade unless otherwise noted on the plans or directed by the Engineer. The manhole rings and covers shall be attached preferably by being cast into the top of the manhole or by being grouted to the completed manhole. If manhole rings are grouted to completed manholes, a keyway shall be formed in the top of the manhole outside of where the manhole ring will rest.

Mortar for grouting manhole rings to manholes shall be mixed in the proportions by volume of one part Portland cement to two parts sand. Masonry cement is prohibited for use. Tops of the manhole rings and covers shall be level except in public rights of way where the top shall be set flush with pavement, sidewalks, or other surface area.

C7.8 Drop Manholes:

Drop manholes shall be constructed at all manholes where the difference in invert elevation between incoming and outgoing sewers is two feet or more. Drop manholes shall be constructed of the same material and dimensions as are standard manholes, the only difference being in the inlet arrangements as shown on the Standard Detail Sheet.

C7.9 Watertight Manholes:

Construction of watertight manholes shall be of the same materials and dimensions as are standard manholes, the only difference being in the manhole ring and cover as shown on the Standard Detail Sheet.

C7.10 Manhole Details:

All manholes shall be constructed in accordance with the standard manhole details on the Standard Detail Sheet or as approved by the Department.

C7.11 Connection to Existing Manholes:

Connection to existing manholes shall not be made until all other manholes and sewer lines have been completed, cleaned, tested, inspected, and approved for connection by the Department, unless approved by the City Engineer.

Where gravity outfall lines discharge into an existing manhole, the flow of sewage must be diverted around this construction. The Contractor shall intercept the sewage flow at the existing manhole, or at the first upstream manhole from the construction, and shall provide suitable pumping equipment and rerouting conduit to pump the sewage around the involved construction in a safe and sanitary manner. Discharge shall be into an appropriate manhole downstream from the construction.

Connection to the existing manhole shall be done in a careful manner. It is preferable to cut into the manhole wall using a circular diamond tip cutter. If the area is to be broken out, breakout shall be in small increments and with sharp tools to minimize damage to the manhole. The area to be broken out shall first be marked off with a sharp chisel. Subject to these requirements, the details of making this connection, including securing the end of pipe in place, shall be as proposed by the Contractor and approved by the Department.

C7.12 Manhole Stub Outs:

Where it is anticipated that a sewer line is to be extended in future construction work or where required by the Department, one short joint of pipe (three feet or less) shall be stubbed out from the manhole for future connection. The size of the stub out shall be of the size pipe required for the future construction or as required by the Department. The stub out shall terminate in a standard bell and be sealed with a watertight plug. The stub out shall be backfilled under the pipe and up to mid-springline with concrete.

C7.13 Watertightness:

All manholes constructed shall be watertight and show no visible evidence of infiltration or leakage. Manholes shall be tested in accordance with Part T of this

specification and any manhole that is not watertight will not be accepted by the Department. Manholes with visible signs of honeycombs are subject to vacuum testing to prove watertightness.

SECTION C8 – CONCRETE AND REINFORCING STEEL

C8.1 Description:

This section covers the construction methods for concrete and reinforcing steel. All material shall conform to the requirements of Section M13 – Concrete and Reinforcing Steel.

C8.2 Ready-Mix Concrete:

All concrete for poured in place manholes and other structural applications shall be ready mixed concrete. Ready mixed concrete shall conform to ASTM Standard D-94 and to applicable portions of these specifications for on-site mixing. The concrete shall be delivered and placed within one hour after all materials, including mixing water, shall have been placed in the mixing drum. Each batch shall be accompanied by a load ticket with a copy for the inspector showing the concrete type, mixing proportions, and time mixing began.

C8.3 Reinforcing Steel:

Steel reinforcing shall be free from rust, scale, and from mortar, dirt or other objectionable coatings. It shall be placed accurately in accordance with details shown on the plans and properly secured in position.

C8.4 Vibration:

All structural concrete must be vibrated as it is placed. The use of form vibrators is not acceptable. Internal vibrators shall be capable of transmitting vibration to the concrete at frequencies not less than 4,500 impulses per minute. Duration of vibration shall be limited to the time necessary to provide satisfactory consolidation without causing segregation. The vibrator shall not be inserted into the lower courses previously vibrated. Vibrators shall be applied in a substantially vertical position and at uniformly spaced points not further apart than the visible effectiveness of the vibrator. Vibration shall be supplemented by such spading as the Engineer may require. All concrete in manholes and pipe foundations need not be vibrated if other methods produce satisfactory results. The slump of the concrete shall be the minimum that is practical. When vibration is used to consolidate the concrete, the slump shall not exceed four inches, otherwise the slump shall not exceed six inches.

C8.5 Application of Structural Concrete Other Than Manholes:

Utilization of reinforced or unreinforced concrete for structural uses other than poured in place manholes shall be subject to individual design and specification of the responsible Engineer to meet the specific needs of the project. Design and specification shall be in keeping with current engineering practice, applicable codes of practice, and subject to the review and approval of the Siloam Springs Water and Wastewater Department.

SECTION C9 – PAVEMENT REPAIRS

C9.1 Description:

This section covers the construction methods to be used in the repair of roads, streets, or other public rights-of-way.

C9.2 Permanent Repairs:

All permanent repairs of streets, roads, alleys, sidewalks or other public rights-of-way shall meet with the construction requirements of the governing agency or private owner and shall meet with the requirements of all local Ordinances, Regulations, Permits, or Codes governing the repairs to roads, streets, or other public rights-of-way.

C9.3 Temporary Surfacing:

Methods of temporary surfacing shall meet with the requirements of Paragraph C9.2 or as otherwise approved to adequately maintain traffic and proper drainage.

SECTION C10 – WATER AND SEWER LINE SEPARATION

C10.1 Protection of Water Supplies:

There shall be no physical connections between the potable water supply system and a sewer, or appurtenance there to which permit the passage of any sewage or polluted water into the potable supply. No water pipe shall pass through or come in contact with any part of a sewer manhole.

C10.2 Horizontal Separation:

Sewer lines and structures shall be laid at least 10 feet horizontally from any existing or proposed water main and vice versa. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten foot separation, the Arkansas Department of Health, Engineering Section, may allow deviation on a case by case basis, if supported by data and pertinent facts from the Engineer and agreed to by the Siloam Springs Water and Wastewater Department. Said deviations will only be allowed upon written approval from the Arkansas Department of Health, Engineering Section and the Siloam Springs Water and Wastewater Department.

C10.3 Crossings:

At water and sewer crossings, the water line shall be placed so that the bottom of the water line will be at least 18 inches above the top of the sewer line at its highest point and must be partially protected by being entirely surrounded by at least 18 inches of carefully compacted clay backfill or similar barriers. In cases where water and sewer crossings do not meet these minimum requirements the Arkansas Department of Health, Engineering Section, may allow deviation on a case by case basis, if supported by data and pertinent facts from the Engineer and agreed to by the Siloam Springs Water and Wastewater Department. Said deviations will only be allowed upon written approval from both the Arkansas Department of Health, Engineering Section and the Siloam Springs Water and Wastewater Department.

Where 18 inches of clearance cannot be maintained as described above, the proposed line shall be encased a minimum of 10 feet in each direction. Encasement shall extend until 10 feet of horizontal separation is achieved and may be significantly longer than 10 feet when the crossing is not at a 90-degree angle. Water lines crossing beneath sewer lines will be approved on a case by case basis, and must maintain both of the following:

1. 18 inches of separation from the top of the water line to the bottom of the sewer line.
2. Proposed line shall be encased a minimum of 10 feet in each direction. Encasement shall extend until 10 feet of horizontal separation is achieved and may be significantly longer than 10 feet when the crossing is not at a 90-degree angle.

PART T – TESTING

SECTION T1 - DESCRIPTION

T1.1 General:

This part of the specifications outlines test requirements for materials, construction methods, and leakage tests for newly constructed water and/or sewer mains and their appurtenances. Testing for materials and construction methods (compaction) shall be at the Developer's option except as stipulated herein. The Siloam Springs Water and Wastewater Department has the authority to require any test outlined in these specifications if in the opinion of the Department they are needed to demonstrate that the quality of materials and construction procedures meet the requirements of these specifications.

In all cases, pressure lines shall be tested hydrostatically, gravity sewer lines shall be air tested, manholes shall be leak tested, and PVC gravity sewer lines shall be mandrel tested. All tests shall be made in the presence of the Engineer and a representative of the Siloam Springs Water and Wastewater Department. All required tests must be successfully passed before new utilities are accepted by the Department.

SECTION T2 – BACKFILL DENSITY TESTS

T2.1 Description:

This section covers the testing of backfill around newly constructed manholes, water and sewer lines, service lines, and other structures to insure proper fill and compaction.

T2.2 Requirements:

Backfill density requirements are specified in PART C CONSTRUCTION PROCEDURES of these specifications.

T2.3 Methods of Testing:

T2.3.1 Moisture Density Relation:

The moisture density relations of material shall be determined in the laboratory in accordance with AASHTO Designation T-99 or Designation T-180, as specified.

T2.3.2 Field Density:

Field density of backfill shall be determined in accordance with ASTM Designation D 2922.

SECTION T3 – WATER MAIN AND FORCE MAIN TESTING

T3.1 Description:

This section outlines the testing of pipe materials, joints, and/or other materials incorporated into the construction of water mains and force mains to determine leakage and watertightness. All pressure pipeline shall be tested in accordance with AWWA C600 and AWWA C605 for ductile iron and PVC pipe respectively, and as specified herein.

T3.2 Hydrostatic Testing:

T3.2.1 Pressure Test:

After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 2.0 times the working pressure at the point of testing and not less than 1.5 times the working pressure at the highest point along the test section.

T3.2.2 Leakage Test:

The leakage test shall be conducted concurrently with the pressure test. Leakage is defined as the quantity of water that must be supplied into the newly laid pipeline, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipeline has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time. A meter shall be supplied by the contractor to measure allowable leakage. The meter shall be installed on the pressure side of the hydrostatic tester.

No pipeline installation will be accepted if the leakage is greater than that determined by the following formulae:

$$L_{\text{Ductile}} = \frac{S D (P)^{1/2}}{148,000}$$

L = testing allowance (makeup water) (gph)

S = length of pipe tested (ft)

D = nominal diameter of pipe (in)

P = average test pressure during test (psig)

$$Q_{\text{PVC}} = \frac{L D (P)^{1/2}}{148,000}$$

Q = quantity of makeup water (gph)

N = length of pipe tested (ft)

D = nominal diameter of pipe (in)

P = average test pressure during test (psig)

T3.2.3 Test Equipment:

All necessary equipment to perform the leak test and pressure test shall be provided by the contractor. The test meter shall have incremental divisions of 1/10 of a gallon.

T3.3 Visible Leakage:

All visible leaks are to be repaired regardless of the amount of leakage.

T3.4 Acceptance of Installation:

If any test of pipe laid discloses leakage greater than that specified in T3.2, the Contractor shall, at his own expense, locate and make repairs as necessary until the leakage is within the specified allowance.

T4 – DISINFECTION OF POTABLE WATER LINES

T4.1 General:

All newly installed water mains shall be disinfected in accordance with ANSI/AWWA C651, Section 5.2 (Continuous Feed Method), and as specified herein.

T4.2 Chlorination:

All pipes are to be disinfected after laying is completed by holding a chlorine solution of at least 50 ppm strength in the pipe for 24 hours. At the end of the 24 hour period, the treated water shall contain no less than 25 ppm of chlorine throughout the length of the main.

As the heavily chlorinated water flows past fittings and valves, related valves and hydrants shall be operated so as to disinfect new appurtenances and pipe branches. Extreme care should be taken by the Contractor to prevent heavily chlorinated water from flowing back into water mains in active service.

T4.3 Flushing:

After the lines have been disinfected, they shall be thoroughly flushed until chlorine residual measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use, or less than 1 ppm.

T4.4 Samples:

Bacteriological samples shall then be collected from each respective section of the new main by the City of Siloam Springs Water and Wastewater Department on two consecutive days and shall be submitted to the Arkansas Department of Health for analysis. All cost incurred by the city for shipping or delivery of bacteriological samples will be the responsibility of the contractor.

The lines shall not be placed in service until the results of two consecutive daily samples showing negative reports for coliform bacteria (safe) are received by the Siloam Springs Water and Wastewater Department.

SECTION T5 – AIR TESTING OF GRAVITY SEWERS

T5.1 General:

All sanitary sewer main extensions shall be air tested as required by the City of Siloam Springs Water and Wastewater Department for watertightness by low pressure air loss as described herein.

T5.2 Procedure:

1. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
2. Pipe air supply to the pipeline to be tested in such a manner that the air supply may be shut off, pressure observed, and air pressure released from the pipe without entering the manhole.
3. Add air slowly to portion of pipe under test until the internal pressure of the line is raised to approximately 4 psig, but less than 5 psig.
4. Shut the air supply off and allow at least two minutes for the air pressure to stabilize.
5. When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi, start the test.
6. Determine the time in seconds with a stopwatch for the pressure to fall 0.5 psig so that the pressure at the end of the time is at least 3.0 psig.
7. Compare the observed time with the minimum allowable times in the charge for pass/fail determination.

Table 6: Testing Time Required for Gravity Sewer Pipe

1 PIPE DIAMETER	2 MINIMUM TIME (MIN)	3 LENGTH FOR MINIMUM TIME	4 TIME FOR LONGER LENGTH								
(in)	(sec)	(ft)	(sec)	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	0.19	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.43	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.76	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.19	4:43	4:43	4:43	4:57	4:56	6:55	7:54	5:54
12	5:40	199	1.71	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.67	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.85	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.24	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.84	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.65	14:25	21:38	28:51	36:04	43:16	50:30	57:42	66:54
30	14:10	80	10.68	17:48	26:43	35:37	44:31	53:25	62:19	71:3	80:07
33	15:35	72	12.30	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.38	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

Specification time (min:sec) for Length (lf) of pipe

T5.3 Safety Precautions:

The low pressure air test may be dangerous to personnel if, through lack of understanding or carelessness, a line is over pressurized or plugs are installed improperly. It is extremely important that the various plugs be installed so as to prevent the sudden expulsion of a poorly inflated plug. As an example of the hazard, a force of 250 pounds is exerted on an eight inch plug by an internal pressure of 5 psi. Observe the following safety precautions:

1. No one shall be allowed in the manholes during the test or when a plugged pipe is under pressure.
2. Gauges, air piping manifolds, and valves, shall be located at the top of the ground.
3. Install and brace all plugs securely.
4. Do not over pressurize the lines.

T5.4 Observation:

All gravity sewer lines must pass air test before being accepted by the Siloam Springs Water and Wastewater Department. No air test results will be accepted unless a representative of the Department is present during the test.

T5.5 Test Equipment:

All necessary equipment to perform the air test in accordance with this specification shall be provided by the Contractor. The test gauge shall preferably have incremental divisions of 0.10 psi and have an accuracy of at least plus or minus 0.04 psi. In no case shall a test gauge be used which has incremental divisions of greater than 0.25 psi.

T5.6 Ground Water Elevation:

If the pipeline to be tested is below the ground water level, the starting test pressure shall be increased by 0.433 psi for each foot the ground water level is above the invert of the sewer pipe. In no case shall the starting test pressure exceed 9.0 psig.

SECTION T6 –SEWER LINE DEFLECTION TESTING

T6.1 General:

All sewer lines shall be mandrel tested in accordance with these specifications prior to acceptance by the Siloam Springs Water and Wastewater Department.

T6.2 Allowable Deflection:

The maximum allowable pipe deflection shall not exceed five percent of the inside diameter.

T6.3 Mandrel:

The mandrel (go/no go) device shall be cylindrical in shape and constructed with either 9 or 16 evenly spaced arms or prongs. Mandrels with less arms will be rejected as not sufficiently accurate. The contact length of the mandrel's arms shall equal or exceed the nominal diameter of the sewer to be inspected. Critical mandrel dimensions shall carry a tolerance of plus or minus 0.01 inch. The mandrel and all necessary equipment for the mandrel test shall be provided by the Contractor.

T6.4 Procedure:

The mandrel shall be hand pulled by the contractor through all PVC sewer lines no earlier than 30 days after the trench has been completely backfilled. Any sections of the sewer not passing the mandrel shall be uncovered and the Contractor shall re-bed, re-round, or replace the sewer to the satisfaction of the Engineer and/or the Siloam Springs Water and Wastewater Department. Repaired section shall be re-tested.

T6.5 Mandrel O.D. (Outside Diameter):

The outside diameter of the mandrel shall be set according to the following table:

Table 7: Mandrel Dimensions for Deflection Testing of SDR 26 PVC Pipe

NOMINAL DIAMETER (inches)	MANDREL O.D. (inches)
8	7.12
10	8.87
12	10.55
15	12.89

T6.6 Contractor's Warranty:

The Siloam Springs Water and Wastewater Department reserves the right to mandrel test any PVC sewer pipe before acceptance, and also prior to expiration of the first year of operation. If a previously accepted line fails a mandrel test performed during the first year of operation, the defects must be corrected at the Contractor's expense.

SECTION T7 – MANHOLE TESTING

T7.1 General:

All sanitary sewer manholes shall be tested in accordance with these specifications prior to acceptance by the Siloam Springs Water and Wastewater Department. If a manhole fails the test, the Contractor shall locate the leak and make proper repairs.

T7.2 Manhole Vacuum Testing:

A vacuum test shall be performed by the Contractor in the presence of Department personnel in order to demonstrate the watertightness of the manhole. The manhole vacuum test shall be performed with suitable apparatus made for such purpose and shall draw a vacuum of 10 inches of Mercury (Hg). The test shall pass if the vacuum remains at 10 inches Hg or drops to nine inches Hg in a time greater than one minute.

SECTION T8 – CONCRETE TESTING

T8.1 Description:

This section covers the testing of concrete used in the construction of sanitary sewer manholes and other concrete structures.

T8.2 General:

If in the opinion of the Department, the concrete furnished in the field warrants concrete testing to demonstrate its quality and strength, the cost of all testing to demonstrate such shall be borne by the Contractor. The testing laboratory shall be one recommended by the Contractor and approved by the Engineer. Testing shall be performed generally as outlined below in Section T8.3.

T8.3 Testing:

Composite samples shall be served in accordance with ASTM C172, "Standard Method of Sampling Fresh Concrete".

1. Mold and laboratory cure three specimens from each test required in accordance with ANSI/ASTM C31, "Standard Method of Making and Curing Concrete Test Specimens in the Field".
2. Test the specimens in accordance with ANSI/ASTM C39, "Standard Test Method for Compressive Strength of Concrete Specimens". Two specimens shall be tested at 28 days for acceptance and one specimen shall be tested at 7 days for information.
3. The slump of the normal weight concrete sample for each strength test shall be determined in accordance with ANSI/ASTM C143, "Standard Test Method for Slump of Portland Cement Concrete".

T8.4 Acceptance:

Should the test cylinders fail, the Contractor shall reconstruct the concrete structure at no additional cost to the Owner. The Contractor shall then be responsible for the expenses involved in re-testing the concrete.

T8.5 Routine Testing:

Testing will be required on all jobsites where 50 cubic yards of cement are placed or as directed by the Engineer. The cost of all testing made at the request of the Department will be borne by the Contractor. The Engineer shall furnish the Department copies of any and all concrete testing performed by the Engineer or his representative during the course of the work.

PART A APPENDICES

APPENDIX ONE

General: The following appendices are attached hereto: A2 Water and Sewer Maintenance Bond, A3 Easement Form, A1 Certificate of Affidavit, and A5 Standard Detail Sheets. If there are any questions on how these forms should be filled out or any questions regarding the Standard Details, please call the Siloam Springs Water and Wastewater Department.

Copies of the forms can be obtained at no cost by calling the Department at 524-5136.

and repairing said lines, manholes and appurtenances of Grantee above described, and the removal, renewal and enlargement of such at will, in whole or in part.

The said Grantors are to fully use and enjoy the said premises except for the purposes hereinbefore granted to the said Grantee, which hereby agrees to bury all pipes, where feasible, to a sufficient depth so as not to interfere with cultivation of soil, and that manholes will be constructed flush with the surface of the ground except in bottom lands, where they shall be at a height above high water, and to pay any damages which may arise to growing crops or fences from the construction, maintenance and operation as determined by three disinterested persons, one thereof to be appointed by the said Grantor; one by the said Grantee; and the third by the two so appointed as foresaid, and the written award of such three persons shall be final and conclusive.

The Grantors agree not to erect any buildings or structures in said right of way other than fences and said fences shall not exceed six (6) feet in height.

The wife of Grantor, if any, by her signature hereon, hereby releases and relinquishes unto the City of Siloam Springs, Arkansas, all her rights of dower and homestead in and to the above described easement.

The Grantee shall have the right to construct additional pipe lines upon the above describe permanent easement at any time in the future.

The consideration first above recited as being paid to Grantors is in full satisfaction of every right hereby granted. All covenants and agreements herein contained shall extend to and be binding upon the respective heirs, legal representatives, successors and assigns of the parties hereto.

It is hereby understood and agreed that the party securing this grant in behalf of the Grantee is without authority to make any covenant or agreement not herein expressed.

WITNESS the execution hereof this the _____ day of _____,
_____.

ACKNOWLEDGEMENT

STATE OF ARKANSAS)
)
COUNTY OF BENTON)

BE IT REMEMBERED, that on this date, before me, a Notary Public within and for said County and State, duly commissioned and acting, personally appeared _____
to me well known as the persons who executed the foregoing Right of Way Grant, and that they had executed the same for the consideration and purpose therein mentioned and set forth.

WITNESS my hand and seal on this _____ day of _____, _____.

Notary Public

My Commission Expires:

STANDARD DETAIL SHEETS