

APPENDIX – WATER AND SEWERS.

MINIMUM STANDARDS FOR WATER DISTRIBUTION AND SANITARY SEWER CONSTRUCTION.

Editor's note: Section 27-47 of this Code established by Ordinance 841, Section 16, which states the Council shall establish minimum standards for the protection and welfare of the general public, to facilitate water and sewer maintenance, repair, and to standardize types of construction and installations by resolution. Resolution 844 establishes Minimum Standards for Water and Sewer.

This appendix is a reprint of that resolution except for a few changes in capitalization, the correction of typographical errors and the addition of an index for the convenience of the user.

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GENERAL.

SEC. 1-1. SCOPE.

These regulations shall apply to the design and construction of all public water distribution and sanitary sewerage facilities installed within the corporate limits of the City of Buffalo, Wyoming. This resolution is enacted for the purpose of safe guarding the best interests of the public, the landowner, the subdivider, and the investor by the establishment of adequate standards for the installation and maintenance of water and sewer piping.

SEC. 1-2. DEFINITIONS.

For the purpose of this resolution, the following terms, phrases, words, and their definitions shall have the meaning given in this Section. When inconsistent with the context, words in the present tense shall include the future tense, words in the singular number shall include the plural and words in the plural shall include the singular.

1) Abbreviations: Whenever the following abbreviations are used in this resolution, they are to be construed the same as the respective expression represented:

- AASHO: American Association of State Highway Officials
- ASTM: American Society for Testing Materials
- ASA: American Standards Association
- AWWA: American Water Works Association
- GPM: Gallons Per Minute
- FSSC: Federal Standard Stock Catalog
- NBFU: National Board Fire Underwriters
- PSI: Pounds per Square Inch

2) Alley: A public right-of-way which affords a secondary means of access to adjoining property.

3) Building: To include all structures erected within the City of Buffalo.

4) Building Inspector: The person authorized and empowered by the City Council to issue building permits and inspect construction.

5) City: City of Buffalo, Wyoming.

6) Easement: A specific use authorized by a property owner appurtenant to the land.

7) Existing Facilities: Existing utilities.

8) Installation Permit: Authorization for the installation of sewer or water lines, or both, issued by the Building Inspector.

9) Licensed Engineer: A person licensed as a professional engineer by the State of Wyoming.

10) Lot: A parcel, piece, or portion of land designated by either metes and bounds, registered land survey, auditor's plat, or other means and separated from other parcels or portions by said description for purpose of sale, lease or separation thereof.

11) Lot Line: The property line bounding a lot except that where any portion of a lot extends into the right-of-way of a proposed public right-of-way, the line of such right-of-way shall be the lot line.

12) Planning Commission: The City of Buffalo Planning and Zoning Commission.

13) Service Connection: The location at which the individual service lines intersect with the main distribution or collection lines.

14) Service Line: The service line is that portion of the installation which leads from the lot to the main distribution or collection lines.

15) Surveyor: A person duly registered as a land surveyor by the State of Wyoming.

16) Utility: Those services provided to the general public for a fee characterized by telephone, electrical, natural gas, television, water and sewer services.

SEC. 2. INSTALLATION ACCORDING TO STANDARDS, WARRANTY AND MAINTENANCE.

All water distribution and sanitary sewer facilities shall be installed according to these regulations and when

completed and approved by the City, shall become the property of the City of Buffalo to maintain after a one (1) year warranty period.

EXCEPTION: The water service from the corporation cock to the property and the sewer line from the main to the property shall be the property owner's responsibility for maintenance.

SEC. 3. INSTALLATION AT COST OF DEVELOPER.

The subdivider or developer shall install at their cost according to these regulations, all water distribution mains, sanitary sewer mains and appurtenances to, in and through his subdivision except as otherwise provided in these regulations. The sewer and water mains shall always be designed so that the system may be readily extended.

SEC. 4. CITY MAY PARTICIPATE.

The City may participate in bearing the cost of larger mains for future development. The extent of the City participation shall be the difference in the cost of materials between the minimum size (water lines six (6) inch, sewer lines eight (8) inch) and the larger size required.

If the district, subdivision or development under one ownership is of such size that mains larger than the minimum are required by this resolution. The entire cost of such oversized mains shall be borne by the subdivider, developer or district.

SEC. 5. PERMITS FOR CONSTRUCTION.

Water distribution and sanitary sewerage facilities coming within the scope of these regulations shall be constructed only **after** a permit for construction has been issued by the City. The permit for construction will not be issued until plans and specifications covering the proposed construction have been submitted to the City and reviewed by the City Engineer, Building Inspector, and Planning Commission.

SEC. 6. PLANS AND SPECIFICATIONS.

Three complete copies of plans and specifications covering the proposed construction consisting of a detailed layout of the area to be served by the proposed construction, including any contiguous or adjacent areas which might be affect, together with sufficient details, and supplemental drawings, as may be requested for complete review of the proposed construction,

Before a permit for construction shall be issued by the City, the final plans and specifications shall be approved by the State of Wyoming Department of Environmental Quality.

Separate plans shall be submitted for the water distribution facilities and for the sanitary sewerage facilities. Plans for water distribution shall show the exact location of all water mains with respect to property lines and the proposed location of valves and fire hydrants. Plans for sanitary sewers must include profiles of each individual sewer line, and both the invert and top elevation of each manhole. All plans must show the location and elevation of existing facilities to which the proposed construction will connect; together with the location of other existing utilities. Specifications covering the materials to be used and construction requirements shall accompany the plans when presented for approval.

Plans shall be drawn at a scale of not less than 1" equals 100'. Plans shall preferably be prepared on 20" x 30" Plan and Profile sheets. Detail or supplemental drawings to accompany plans shall be drawn on 8 ½" x 14", 11" x 17" or 17" x 22" size sheets.

Datum: All elevations shown on plans or drawings shall be referred to the elevation above mean sea level as established by the City Engineer as the City Datum Plan. An assumed elevation, or arbitrary designation of an elevation not corresponding to correct City Datum Plan, will not be acceptable.

Engineer: All designs, plans and specifications submitted for approval shall be prepared by a registered professional engineer licensed to practice in the State of Wyoming.

"As Constructed" Drawings: Within 30 days after completion of construction, one reproducible copy and two sets of prints of "as constructed" drawings shall be submitted for the permanent records of the City.

Engineering Surveys: All engineering surveys required for the planning, design and construction of the proposed facilities, including detailed layout and staking for installation, shall be the responsibility of the person, firm, or corporation requesting or receiving the permit for construction. Such surveys shall be made by a professional engineer or land surveyor licensed to practice in the State of Wyoming..

SEC. 7. INSPECTION OF CONSTRUCTION; NOTIFICATION OF COMMENCEMENT – SUSPENSION OF WORK; CERTIFICATION OF MATERIALS.

a) All construction coming within the scope of these regulations shall be inspected for compliance and conformance with the approved plans and specifications. The inspection shall be performed continually throughout the construction under the direction of an engineer licensed to practice in the State of Wyoming and acceptable to the City. The costs of inspection and other related work shall be borne by the subdivider or developer.

b) The City shall be notified a reasonable time in advance before actual construction is started in order that inspection may be arranged. The engineer selected for the inspection shall have authority to order the suspension of construction or any work not complying with the requirement of the resolution, or the approved plans and specifications.

c) Materials installed, or work performed not in compliance with this resolution or the approved plans and specifications, shall be removed, replaced, or placed in compliance with the resolution and all approved plans and specifications before the construction will be accepted by the City and before the connection to the existing facilities will be permitted. No installed materials shall be covered or backfilled until the work has been inspected and approved. At the completion of the work the City shall be provided with a mylar copy of the "as constructed" plans showing the location of all installed materials including service lines and a copy of the specifications for the project. The engineer for the project shall be responsible to certify to the State DEQ that the work was completed according to the approved plans and specifications.

d) A manufacturer's certificate of compliance with requirements set forth in the plans and specifications shall accompany each shipment of materials and a copy shall be submitted to the inspecting engineer. (Ord. 1161, § 1, 6/97)

SEC. 8. INSTALLATION TO CONFORM WITH STATE STANDARDS.

All water and sewer installations shall be in conformity with this resolution as well as state regulations.

SEC. 9. WARRANTY.

The person, firm, or corporation in whose name the Permit for Construction has been issued shall warrant or guarantee the work covered by the permit for construction for a period of one (1) year from the date of final completion of the work against defects in workmanship and materials, including settlement of backfill, and shall make all needed repairs arising out of such defective workmanship or materials or both.

WATER DISTRIBUTION.

A. DESIGN.

SEC. 10A-1. GENERAL.

The water distribution system for any subdivision or addition to be served by the existing municipal water supply system shall be designed such that it can deliver the required design flow to the subdivision or addition, or to any portion thereof served by an individual street main, with the resulting residual pressure at any point to be not less than 40 psi.

Conformity to Long-Range Plan: The design of the water distribution system serving any subdivision or addition

shall conform to the long-range water distribution system plan adopted by the City and shall incorporate in the layout the principal transmission and feeder mains provided for in the long-range plan, or those portions thereof that are within the boundaries of the area being developed.

SEC. 10A-2. DESIGN FLOW.

The design flow to be used for the sizing of the feeder and street mains shall be the calculated maximum domestic daily water demand based on the anticipated number of service connections (allowing for future areas to be served in the case of feeder mains) plus the required fire flow.

a) **Maximum Daily Demand:** The maximum domestic daily water demand shall be based on an allowance of 375 gallons per day. In computing maximum daily demand it should be computed as four persons per connection, the maximum daily demand per service connection will be 1,500 gallons per day or 1.04 gallons per minute.

This maximum daily demand per service connection is based on an area having 500 service connections, or more. For a lesser number of service connections, the above maximum daily demand shall be multiplied by the following diversity factors:

<u>No. of Services</u>	<u>Diversity Factor</u>
50 or less	1.50
100	1.30
250	1.20
500	1.00

Straight-line interpolation shall be used for a number falling between those listed.

b) **Fire Flow:** The required fire flow to be added to the maximum domestic daily water demand to obtain the design flow for sizing of water mains shall be as follows:

<u>Type of Construction</u>	<u>Fire Flow</u>
Residential	1,000 gpm
School (residential area)	1,250 gpm
Institutional (hospital, nursing home, etc.)	1,500 gpm
Commercial	1,750 gpm

c) **Peak Hourly Demand:** For use in determining the variation in operating water pressures, as subsequently specified, the anticipated peak hourly demand shall be the computed maximum domestic daily water demand multiplied by a factor of 2.0.

SEC. 10A-3. WATER PRESSURE.

The minimum static water pressure to be provided at the street main shall be 40 psi. The maximum static water pressure shall not exceed 100 psi.

The normal maximum variation in water pressure at any point between the static pressure and the operating pressure during peak hourly demands (not including fire flow) shall not exceed 35 psi.

SEC. 10A-4. LAYOUT.

The layout of the water distribution system for any subdivision or addition shall consist of a closed-loop grid system, with no dead ends or stub mains. Water mains serving cul-de-sacs or dead end streets must loop back to the closest street main.

Where a subdivision is being developed, it shall be planned such that each stage of development will be served by a closed-loop section to be installed prior to any lot being served by the municipal water system.

Feeder or other water mains shall be provided with the required tees, crosses, and valves, as designated by the City Water Distribution Plan, to facilitate connections to the main in the future.

a) Location: All water mains, valves, hydrants, and other water supply appurtenances shall be installed within the public dedicated streets and alleys or, if approved by the City, in dedicated public easements having unrestricted access at all times, with the easement of being a covenant running with the land prohibiting the construction of fences, structures, that would restrict, interfere, or hinder access for maintenance, repair, or replacement of the utilities.

All water mains shall be installed within the streets, alleys or easements, at the exact location, with respect to the street or property lines as designated by the City Engineer. On curved streets, the water mains shall be laid on a curve, at a designated distance from the respective property lines. No water mains, or water main appurtenances except service lines shall be installed under curbs, gutters, or sidewalks; or on private property.

SEC. 10A-5. MINIMUM PIPE SIZE.

The minimum size for any public water main shall be 6 inches, including lines to fire hydrants.

SEC. 10A-6. VALVES.

Valves shall be provided at the end of each street main, and at intermediate points along the main so that not over one block will be placed out of service in the event repairs are required. Maximum distance between valves in a residential area, on both street mains and feeder mains shall be 800 feet. Maximum spacing of valves on street mains and feeder mains in a commercial area, or a commercial area with an adjacent residential area, shall be 500 feet.

At points where water mains intersect, at least two valves will be installed at each tee intersection, and at least three valves at each cross intersection.

All valves shall be uniformly installed on property lines extended, unless otherwise designated by the City.

SEC. 10A-7. FIRE HYDRANTS.

All fire hydrants shall be installed in locations so that each hydrant will serve an area of not greater than 130,000 square feet; the distance between hydrants shall be not greater than 400 feet. A fire hydrant shall be located at each street intersection with the intermediate hydrants evenly spaced along each street. Additional hydrants may be required by the City where access to a hydrant may be blocked, or excessive lengths of hose lines required.

Hydrants shall be installed back of the street curb at the location designated by the City. Intermediate hydrants along a street shall be located on the extensions of lot lines.

SEC 10A-8. SERVICE CONNECTIONS.

Individual water service lines will be required for each lot or residential to be served. Dual service to more than one residence, or more than one lot, from a single service line connected to the street main will not be permitted.

In all subdivisions, water service lines shall be extended to the curb stop at each lot, prior to the installation of curbs, gutters, or street paving.

B. MATERIALS.

SEC. 10B-1. GENERAL.

All water mains shall be constructed of either cast iron pipe, ductile-iron pipe or PVC Pipe, with the pipe, fittings, valves, and other underground appurtenances to be protected against exterior corrosion by a polyethylene protective wrap, or where previously approved by the City Building Inspector, by the use of a sand envelope backfill.

SEC. 10B-2. CAST-IRON PIPE.

Cast-iron pipe shall be designed for 150 psi working pressure, with half-thickness cement lining, meeting the requirements of AWWA Standard C106 for Cast-Iron Pipe Centrifugally Cast in Metal Molds, or AWWA Standard C108 for Cast-Iron Pipe Centrifugally Cast in Sand-lined Molds. Pipe shall be furnished with the single gasket push-on joint.

SEC. 10B-3. DUCTIBLE-IRON PIPE.

Ductible-iron pipe shall be designed for 150 psi working pressure, with half-thickness cement lining, meeting the requirements of AWWA Standard C151 for Ductible-Iron Pipe, Centrifugally Cast in Metal Molds, or Sand-lined Molds. Pipe shall be furnished with the single gasket push-on joint.

SEC. 10B-4. PVC PIPE.

PVC pipe shall conform to ASTM D2241-SDR21, 200 P.S.I. and shall be made from clean virgin, NSF approved class 12454-A.P.V.C. compound conforming to ASTM resin specifications D 1784. Pipe shall be supplied with push type joints using a rubber ring conforming to ASTM D 1869 joints to be assembled with a nontoxic lubricant.

SEC. 10B-5. PIPE FITTINGS.

Pipe fittings for either cast-iron, ductible-iron pipe or PVC shall meet the requirements of AWWA Standard C111 for Cast-Iron Pressure Fittings. Except where otherwise specified by the City, fittings shall be equipped with mechanical-joint couplings conforming to ASA Standards for a Mechanical Joint for Cast-Iron Pressure Pipe and Fittings on PVC.

SEC. 10B-6. VALVES AND BOXES.

Gate valves shall be iron-body, bronze-mounted, double-disc, parallel-seat, valves meeting the requirements of AWWA Standard C500 for Gate Valves for Ordinary Water Works Service.

SEC. 10B-7. BUTTERFLY VALVES.

Butterfly valves shall conform to AWWA C504 for rubber seated butterfly valves for ordinary water works service.

SEC. 10B-8. ALL VALVES.

Either gate or butterfly shall have nonrising stems, and furnished with "O-ring" packing. Valves shall be provided with a standard two inch square operating nut, and shall open counterclockwise. All valves shall be equipped with mechanical-joint ends. Flange-ends for hydrant auxiliary valves shall meet the requirements for ASA Class 125 Cast-Iron Pipe Flanges, with bolt holes straddling centerlines.

SEC. 10B-9. VALVE BOXES.

For both main line and hydrant auxiliary valves shall be a standard cast-iron, two-piece, screw-type adjustable valve box, or correct size for the valve, designed for a five foot backfill of the pipe.

SEC. 10B-10. FIRE HYDRANTS.

All fire hydrants shall be the Mueller A-24015 AWWA improved type with six inch flanged inlet, two 2 ½" hose nozzles, national standard hose threads, one 4" pumper nozzle with national standard hose threads, 5 ¼" main valve and standard pentagon operating nut, or an approved equal.

Hydrants shall be designed for a top of the pipe depth of five feet. Each hydrant shall be installed with a 6 inch flange X mechanical-joint auxiliary gate valve, meeting the standards herein specified.

SEC. 10B-11. POLYETHYLENE WRAP.

Polyethylene wrap for corrosion-protection of water mains shall be at least eight mil thickness polyethylene film in flat tubes manufactured of virgin polyethylene as produced from DuPont Alathon Resin, or approved equal. Flat tube widths shall be such as furnished for pipe with mechanical-joint bells. In addition to the wrap required for the pipe, sufficient material shall be provided for corrosion-protection of fittings, valves and hydrants.

SEC. 10B-12. ADHESIVE TAPE.

Adhesive tape for the holding in place of the polyethylene wrap shall be a 2-inch Polyken No. 900, Scotchrap No. 50, or approved equal. Tape shall bond securely to both metal and polyethylene film surfaces.

SEC. 10B-13. COPPER SERVICE PIPE FITTINGS.

Copper service pipe shall meet the requirements of ASTM Standard Specifications B88 for seamless Copper Water Tube, Type K. Fittings shall be equal to Mueller H-15430 (Copper tube nuts) and H-154000 (three part union). Corporation cocks shall be in all-bronze cock with Mueller thread inlet and copper service pipe outlet, equal to Mueller H-15000. Curb valves shall be Ford ball or Mueller Oviseal or approved equal.

C. MINIMUM CONSTRUCTION REQUIREMENTS.

SEC. 10C-1. EXCAVATION AND BACKFILL.

a) **General:** Trenches and excavations shall be kept free from water during excavation, fine grading, pipe laying and jointing. Where the trench bottom is unstable because of the presence of water, and in all cases where the static ground water level is above the bottom of the trench, the ground water shall be lowered by means of pumps or sand points to keep the trench free from water and the bottom stable.

The bottom of the trench, at pipe grade, shall be free from rock, boulders, or hard lumps, and graded to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed soil at all points between bell holes.

b) **Trench depths:** Trenches for water mains shall be excavated to provide a minimum depth of 5 feet to the top of the pipe, unless otherwise directed by the City Building Inspector. Greater depths may be required beneath existing utilities, and in making connections to existing mains.

c) **Compaction Requirements:** Any trench or excavation opened on or in any street, avenue, alley or thoroughfare within the City of Buffalo, must be backfilled and the backfill material placed over and around the pipe to a depth of twelve inches above the pipe shall be compacted to not less than 90% of the maximum dry density as determined by the AASHO (T99) Method. The remainder of the backfill material shall be placed in such a manner that uniform compaction of not less than 90% of the maximum dry density as determined by AASHO T99 or AASHO T147 methods. When the trench or excavation is in an oiled or surfaced street, alley, avenue or thoroughfare, the top (1') one foot shall be compacted to a density of not less than 95% of the maximum dry density as determined by AASHO T99 method.

SEC. 10C-2. INSTALLATION OF WATER MAINS.

a) **Grade and Alignment:** Grade of water mains shall be as established in the field to provide a minimum depth of five feet. Alignment of water mains shall be as shown on the plans.

b) **Handling Pipe and Fittings:** Handling, unloading from trucks, and installation of all pipe, fittings, valves, hydrants, and other materials shall be by such methods as will insure their final installation in a sound and undamaged condition.

c) **Installing Pipe and Fittings:** Cutting of cast-iron, ductile-iron or PVC pipe shall be done in such manner as to avoid damage to the pipe and leave a smooth cut at right angles to the axis of the pipe. Where using a push-on joint, the cut end shall be tapered about 1/8 inch back from the end at an angle of 30 degrees. The interior of all pipe shall be cleaned of all foreign material before being installed and shall be kept clean until the work has been inspected and accepted. When pipe laying is stopped at the end of a day's work, or for any other reason, the open end of the line shall be kept sealed with a watertight plug.

During installation, each pipe length and fitting shall be carefully inspected for defects. Defective pipe and fittings shall be either rejected, or salvaged by cutting off the damaged portion.

1) **Making-Up Push-On Joints:** In making up the single rubber gasket push-on joint, the gasket and gasket seat shall be wiped clean and the gasket placed in the bell with the large round side of the gasket first, so it will spring into place in the bell head. The gasket shall be lubricated with a thin film of vegetable lubricant. The joint shall be pulled together by the use of Choker slings or by the use of a bar used as a lever against the bell end of the pipe.

2) **Making-Up Mechanical Joints:** In making up mechanical joints, it is important that the entering spigot is centered in, and that the gland or follower ring is parallel to the face of the connecting bell. Deflections in the pipe joint shall be made after the bolts have been slightly and uniformly tightened. Final tightening shall be done using a

ratchet wrench, or impact wrench, with a torque of between 60 and 90 ft. lbs. bringing the following gland towards the bell face evenly by alternate tightening of the bolts. The face of the pipe that will be in contact with the gasket, shall be clean before assembling the joint.

d) **Installing Valves and Valve Boxes:** Valves and boxes shall be set plumb, with each valve box placed directly over the valve, and with the top of the box adjusted to be flush with the finished grade. After the valve box has been placed and thoroughly compacted around the valve and box to the full trench depth. After installation is completed, each valve shall be checked with a valve key to determine if the key can be readily set on the operating nut.

e) **Installing Fire Hydrants:** Before installing each hydrant shall be checked to see that the hydrant valve is clean, and the hydrant is in operating condition. Prior to setting, a pit at least 2 feet square and 2 feet in depth shall be dug below the centerline of the hydrant and filled with coarse gravel or crushed rock. The hydrant, auxiliary gate valve and box, shall be set plumb and braced into position until backfilled, with the elevation of the hydrant being set as directed. After bracing and after application of polyethylene corrosion-protection wrap, a concrete thrust block shall be installed back of the hydrant, with additional gravel placed to a depth of about 1 foot over the top of the pipe, completely surrounding the hydrant and auxiliary gate valve. The remaining backfill shall be placed and thoroughly compacted around the hydrant barrel to the full trench depth.

f) **Polyethylene Wrap:** Polyethylene corrosion-protection wrap shall be installed on all water mains, fittings, valves and hydrants; with the wrap being installed in accordance with the pipe manufacturer's recommendation. The wrap installation shall be substantially as follows:

1) After picking up a length of pipe with pipe tongs or sling, a length of polyethylene tube, cut approximately 2 feet longer than the pipe, shall be slipped on the spigot end, bunching up the tube accordion-fashion between the tongs and the spigot end.

2) After lowering the pipe into the trench and making up the joint, the tongs, or sling, shall be removed and hooked into the bell end, raising the pipe sufficiently to permit the tube to be slipped along the full length of the pipe. Enough of the tube shall be left bunched up at each end to provide an overlap at the joint of about 1 foot.

3) To make the overlap joint, the tube is pulled over the bell, folded over the adjacent spigot, and wrapped with 3 turns of the 2 inch adhesive tape, sealing the tube to the pipe. The tube on the adjacent pipe shall then be pulled over the first wrap and taped in place behind the bell.

4) The resulting wrap on the barrel of the pipe will be loose. Excess material shall be then pulled snugly around the bottom of the pipe and folded over at the top, with the folds held in place by strips of adhesive tape applied at 3 to 4 foot intervals along the pipe.

5) Valves shall be wrapped by bringing the tube on the adjacent pipe over the bells and sealing them with tape. The valve body is then wrapped with a flat sheet of the film (cut from the tube material), passed under the valve bottom and brought up around the body to the stem and fastened with tape.

6) Hydrants shall be protected by slipping a section of the tube over the hydrant, encasing it from the inlet valve to ground level. The bottom of the hydrant need not be wrapped.

All fittings that require concrete thrust blocks shall be wrapped before placement of the thrust block.

1) **Alternate Corrosion Protection:** As an alternate to the polyethylene wrap corrosion protection, and for use in locations specifically approved by the City, a sand envelope backfill may be used for corrosion protection. For this type of installation, the trench shall be excavated not less than 6 inches below the specified pipe subgrade, and the trench backfilled to the pipe subgrade elevation with sand, in which the pipe is bedded. After installation, sand backfill shall be placed to not less than 12 inches over the top of the pipe. The remainder of the trench shall be backfilled with excavated materials, as previously specified. At valve and hydrant locations, the sand backfill shall be placed to within 1 foot of the surface of the ground, completely surrounding the valve box or hydrant. Sand backfill material shall be a non-cohesive-pit-run sand or sand-gravel, with not over 10 percent clay or silt.

g) **Concrete Thrust Blocks:** Concrete thrust blocks shall be cast in place back of each hydrant, back of each tee, back of each bend of 11 ¼ degrees or greater, and at such other locations as shown on the approved drawings.

Each block shall have a minimum bearing area of not less than four square feet against the undisturbed side or end of the trench or excavation. Forming of thrust blocks shall be subject to approval of the City before actual placement of concrete.

h) **Service Connections:** All service connections from the street main to the water meter (regardless of the location of the meter) shall be constructed of copper water tube or service pipe, using copper water tube flared fittings. Minimum size of any service shall be ¾ inch. All service lines shall be installed to provide a minimum depth of no less than 5 feet.

The City will furnish the corporation cock and make the main tap; and will furnish, for installation by the installer, the copper water tube and fittings from the street main to the curb stop adjacent to the property line, meter, remote reader and wire for meter hook-up.

SEC. 10C-3. PRESSURE AND LEAKAGE TESTS.

Before final acceptance of the work by the City, the water mains, between valved sections, shall be filled and tested for leakage at a pressure of 200 psi for a period of not less than 4 hours. Leakage must not exceed 25 gallons per inch of diameter per mile of length per 24 hours. Where the leakage is in excess of this amount, the installer shall locate and repair any leaks until the pipe line or main line meets the leakage limitations. Test pump, pipe connections, pipe taps, and similar facilities shall be furnished by the installer. Test gauges will be provided by the City.

SEC. 10C-4. STERILIZATION OF PIPE.

All water lines shall be thoroughly flushed to remove all foreign material prior to chlorination of the lines. The flushing and sterilization of the pipe lines shall be done in accordance with the requirements of the Wyoming State Department of Environmental Quality.

The chlorine dosage shall be at least 50 PPM and the chlorinated water shall be retained in the pipe lines not less than 24 hours or as directed by the City after which time the chlorine residual in the pipe line shall be not less than 10 PPM. In the event that the residual is less than 10 PPM, the entire disinfection procedure shall be repeated until the 10 PPM residual is obtained.

After a pipe line has been properly chlorinated it shall be flushed to remove the highly chlorinated water. All blow-offs, pressurizing pump, corporation stops and chlorine shall be provided by the permittee.

SANITARY SEWERS.

A. DESIGN.

SEC. 11A-1. DESIGN.

All sanitary sewers and appurtenances shall be designed to carry the design flows established in each situation by the City after evaluation of the area served and anticipated future expansion.

SEC. 11A-2. DESIGN FLOWS.

Where actual flow measurements are not available, or where data from existing water usage or sewage flows are not applicable, trunk or main sewers shall be designed on the basis of an average per capita flow of not less than 250 gallons per day, and lateral and sub-main sewers shall be designed for an average per capita flow of not less than 400 gallons per day. If design flows are based on sewer gauging of flow measurements, or on an analysis based on water usage records or similar data, an outline of the design procedure used shall be presented with the plans and specifications submitted for approval.

SEC. 11A-3. MINIMUM SIZE.

No public sanitary sewer shall be less than 8 inches in diameter. Minimum size for a house connection shall be 4 inches. Minimum size of connection for commercial or institutional service shall be in accordance with the International Plumbing Code standards. (R.O. 1261 §6 6/06)

SEC. 11A-4. VELOCITY OF FLOW.

All sewers shall be designed and constructed with hydraulic slopes sufficient to give mean velocities, when flowing full, of not less than 2.0 feet per second, based on Manning’s formula using a value for “n” of 0.013. The following shall be the minimum slopes to be provided:

Sewer	Slope in Feet per Foote
8”	0.0040
10”	0.0028
12”	0.0022
14”	0.0018
15”	0.0016
16”	0.0014
18”	0.0012

Upon approval by the City, slopes slightly less than those required for the 2.0 feet per second velocity when full may be permitted. Such decreased slopes will only be considered where the depth of flow will be not less than 0.4 of the diameter for the design average flows, and where computations of the depth of flow in such pipes at minimum average and peak rates of flow are submitted showing the basis of design.

Maximum slopes for vitrified clay or PVC pipe shall be 0.20 for 8 inch, 10 inch, and 12 inch sizes, and 0.12 for larger sizes. Cast-iron pipe shall be used where steeper grades are required; or drop manholes provided to reduce the slopes to the maximum specified.

House connections shall be installed on a minimum slope of 0.020.

SEC. 11A-5. DEPTH.

Sanitary sewers shall be designated to permit floor drains from basements to be connected, unless in subdivisions or areas in which non-basement houses are constructed. In no case shall sanitary sewers be designed for a depth of cover of less than 36 inches over the top of the pipe. Where shallower depths are approved by the City concrete-encased pipe with or without insulation, as the City may direct, shall be used. Allowance for loads on the sewer pipe shall be made because of width and depth of trench, concrete cradles or concrete encasements shall be installed where required to increase the supporting strength of the pipe.

SEC. 11A-6. ALIGNMENT AND LOCATION.

Sewers shall be designed for uniform slope and alignment between manholes. When sewers are installed in alleys they shall be installed along the centerline of the alley. Where installation is within the dedicated public streets, the manholes shall be located so that the required horizontal clearance from water mains can be maintained, and no portion of the sewer main will be under curb, gutter or private property. The centerline of manholes shall not be closer than 6 feet from the flow line for any gutter. On any individual street, the sanitary sewer shall be located on one side or the other of the street water main, with unavoidable crossings of the water main to be made at approximately 90 degrees to the water main.

SEC. 11A-7. CLEARANCES.

Sanitary sewers shall be located to maintain a horizontal clearance of not less than 10 feet from any water main, with a minimum vertical clearance of 1 foot (between outside of the pipes), with the sewer to be installed below the water main. Where the required vertical clearance cannot be obtained, or where the sewer must cross above the water main (regardless of clearance), the sewer pipe shall be constructed of pressure rated water pipe with mechanical joints or slip on joints as set forth in this resolution for a distance of 10 feet on each side of the water main. Sanitary sewers shall have a minimum clearance of 6 inches (between outside walls of the pipe) from gas mains, storm drains, and other utilities.

SEC. 11A-8. MANHOLES.

Manholes shall be installed at the end of each line; at all changes in grade, size or alignment; at all intersections and at distances not greater than 400 feet apart. Lampholes will not be accepted as substitutes for manholes. Drop

manholes shall be provided for a lateral sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where sewers change in size at a manhole, the tops of the sewers shall be placed at the same elevation.

A 0.1 foot drop shall be provided through manholes to allow for transition losses, except where approved by the City.

SEC. 11A-9. SEWER CONNECTIONS.

House connections to any public sanitary sewer shall be made only by the use of a Y-branch or approved type of cut in saddle. Saddles, if used, shall be of a type that will not project into the sewer or otherwise interfere with flow in the pipe or the use of sewer cleaning equipment. Connections to the sanitary sewer system shall be made only after the necessary permit to do so has been obtained from the office of the Building Inspector. House connections shall be installed in accordance with applicable sections of this resolution. All cut in taps to existing sewers will be made by the City.

In all subdivisions, house sewer connections shall be extended to the property line of each lot from the lateral or street sewer prior to the installation of curbs, gutters and street paving.

SEC. 11A-10. ROOF OR FOUNDATION DRAINS.

No roof drains, foundation drains or sub-drains shall be connected to the sanitary sewer system.

B. MATERIALS.

SEC. 11B-1. PIPE.

All sanitary sewers, including house or service connections, within the public streets, alleys or easements, shall be constructed of vitrified clay, cast-iron or PVC pipe or other materials approved by the City.

a) **Vitrified Clay Pipe:** Vitrified clay pipe, and fittings, shall meet the requirements of ASTM Tentative Specifications for Extra Strength Clay Pipe. Designation C200.

b) **Vitrified Clay Pipe Joints:** All vitrified clay pipe and fittings shall be furnished with a factory-fabricated joint meeting the requirements for ASTM Specifications for Vitrified Clay Pipe Joints having Resilient Properties, Designation C425, for either Types 1, 2 or 3 material combinations.

c) **Cast-Iron Pipe:** Cast-iron sewer pipe shall be Class 150 pipe meeting the requirements previously specified for cast-iron pipe for water mains.

d) **PVC Pipe:** PVC pipe shall conform to ASTM D3034-73, SDR-35; fittings and accessories shall have bell and spigot identical to that of the pipe, with rubber ring joints.

SEC. 11B-2. MANHOLES.

All manholes shall be constructed of precast reinforced concrete with an eccentric cone top section, 48 inch inside diameter. The precast manhole sections shall meet the requirements of ASTM Standard Specification for Reinforced Concrete Manhole Sections, Precast, Designation C478, with concrete for the sections being made using Type V Portland cement. The precast sections shall be installed on a concrete base slab. In fabricating the precast sections, allowance shall be made for thickness of the vitrified clay pipe, as the base slab on which the bottom precast section shall be formed to the elevation of the outside bottom of the pipe. The bottom precast section shall be fabricated with a flat base. Blocked out openings shall be provided in the sections for the incoming and outgoing sewer pipe, or, as an alternate, such openings may be cut in the field.

a) **Manhole Steps:** Manhole steps shall be cast-iron steps equal to the Clow F-3650 step. Wrought iron or steel steps will not be accepted. The steps shall be placed 90 degrees from the direction of Flow of the sewer in a vertical line.

b) **Manhole Rings and Covers:** Manhole rings and covers shall be the "Comco" No. 250C Rings and covers, or

approved equal, with the total weight of ring and cover to be not less than 275 pounds. The ring shall be provided with an interior retaining lip, and shall have a net height of 5 ½ inches.

c) **Manhole Base Slab:** Slab may be pre-cast or poured in place and must be at least 6" in thickness and 6' in diameter.

d) **Concrete:** Concrete for manhole base slabs and interior concrete fill shall be mixed in the following proportions, based on a 1 yard batch.

Cement type V	470 to 564 lb. (5-6) sack
Water	239 to 284 lb.
Fine Aggregate	1192 to 1310 lb.
Coarse Aggregate	1463 to 1755 lb.
Air Entraining Agent	As required to entrain 7% plus or minus 2% air

Water amount above is based on an allowance of 2 percent moisture in the aggregates.

Water content shall be adjusted in the field to obtain a maximum slump of 3 inches.

e) **Mortar and Grout:** Grout for filling of the joints in the precast concrete manhole sections, and for grouting in of pipe through the walls of a manhole, shall consist of 1 part by volume of Type V Portland cement to 2 ½ parts by volume of fine aggregate, with sufficient water to make a workable mix that can be packed into the openings to be grouted. Mortar for grouting of the manhole ring and cover shall consist of the same mix with the addition of ¼ parts by volume of hydrated lime.

C. MINIMUM CONSTRUCTION REQUIREMENTS.

SEC. 11C-1. EXCAVATION AND BACKFILL.

a) **General:** Trenches and excavations shall be kept free from water during excavation, fine grading, pipe laying and jointing. Where the trench bottom is unstable because of the presence of water, and in all cases where the static ground water level is above the bottom of the trench, the ground water shall be lowered by means of pumps or sand points to the extent necessary to keep the trench free from water and the bottom stable.

b) **Trench Bottom:** The bottom of the trench, at pipe grade, shall be clean and free from rock, boulders, or hard lumps, and graded to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed soil at every point between bell holes. Bell holes of sufficient size to permit proper making up of joints, shall be provided at each joint.

c) **Trench Depths:** All trenches for sewers shall be excavated to not less than 4 inches above the specified grade elevation, with the remainder of the excavation to be done by hand at the time the pipe subgrade is prepared, and immediately prior to installing the pipe. The bottom of the trench, at pipe subgrade, shall be shaped to fit the outside surface of the bottom quadrant of the pipe, and to the grade required, in such manner that the pipe shall have a continuous bearing on undisturbed soil for the full length of the pipe, except for such distance as required for bell holes. The subgrade shall be so shaped and graded that the spigot end of the pipe will be accurately centered in the adjacent pipe socket when laid without raising or lowering of the pipe after installation in the trench.

d) **Special Bedding:** Where the subgrade is unstable so as to prevent proper placing and bedding of the pipe, the installer shall excavate the trench not less than eight (8") inches below the specified pipe grade, the full width of the trench and fill with gravel, or other approved non-cohesive material, not less than eight inches (8") above the pipe in which the pipe shall be bedded.

e) **Trench Width:** The minimum trench width for sewers at the center of the pipe shall not be less than 12 inches greater than the nominal diameter of the pipe, to permit the proper making-up of joints. In order that the backfill weight will not exceed the allowable loading on the pipe the maximum trench width at a point 1 foot above the top of the pipe shall not exceed 3 foot for sewer up to 10 feet in depth.

f) **Excavation for Manholes:** Excavation for manholes shall be of such dimensions as to allow for the forming of the concrete base, the installation of the pre-cast concrete manhole sections, and the grouting-in and making of

connections to the manhole barrel. Finish excavation for the base slabs shall not extend below the exact grade of the bottom of the concrete base.

g) **Backfill:** Trenches shall be backfilled immediately after the pipe installation has been approved for backfilling. All backfill material shall be carefully placed to avoid displacement or damages to the pipe or adjacent structures. Backfill from the bottom of the trench to approximately 1 foot over the top of the pipe shall be placed by hand, taking particular care to completely fill under the pipe haunches. This portion of the backfill, for the full width of the trench, shall be thoroughly compacted by either pneumatic or mechanical compaction equipment.

SEC. 11C-2. INSTALLATION OF SEWERS.

A) **General:** The laying of pipe shall be commenced at the lowest point, so that the spigot ends point in the direction of flow. Pipe shall be laid with ends abutting, and true to line and grade. They shall be fitted and matched so that when laid they will form a sewer with a smooth and uniform invert.

B) **Handling:** Trenches shall be kept free from water during jointing. The interior of the pipe, and the outside of the spigot, shall be kept clean during laying operations. Pipe shall be lowered into the trench by such methods as will avoid damage and unnecessary handling in the trench.

C) **Pipe Laying:** Sewer shall be laid continuously through manhole locations and the manhole constructed later. Pipe sections within the manholes shall not be broken out until after the manhole has been set and the interior concrete fill has hardened. Where, due to change in alignment, a portion of the manhole invert may be made of concrete formed to match the semicircular section of the sewer pipe.

D) **Grade and Alignment:** The grade and alignment of sewers shall be determined and maintained by the use of a line parallel to the grade and line of the sewer, this line to be supported above the ground surface on batter boards. Not less than three batter boards shall be kept in position at all times as a check on the accuracy of the grade line. Equivalent methods of maintaining grade and alignment may be used, if approved by the City.

E) **Jointing Vitrified Clay Pipe:** The factory-fabricated joint shall be installed in strict accordance with the manufacturer's instructions.

F) **Jointing of Cast-Iron Pipe:** Cutting of cast-iron pipe shall be done in such manner as to avoid damage to the pipe and leave a smooth cut at right angles to the axis of the pipe. The cut end shall be tapered 1/8 inch back at an angle of 30 degrees. The gasket and gasket seat shall be wiped clean and the gasket placed in the bell, the large round side of the gasket first, so it will spring into place in the bell.

The surface shall be lubricated with a thick film of vegetable lubricant. The joint shall be pulled together by the use of choker slings, or by the use of a bar used as a lever against the bell end of the pipe.

PVC: The PVC pipe shall be cut square and the edge beveled back, a minimum of 1/8" back at an angle of 30 degrees. In making up the push-on type of joint, the gasket and gasket seat shall be wiped clean and the gasket placed in the bell, the large round side of the gasket first, so it will spring into place and lubricated with a thick film of vegetable lubricant furnished with the pipe. The joint shall be pulled together by the use of choke slings, or by the use of a bar used as a lever against the bell end of the pipe.

H) **Installation of Manholes:** Manholes shall be constructed in accordance with City Standard Manhole drawings. The concrete manhole base shall be formed and placed prior to the setting of the manhole barrel sections, unless otherwise approved by the City. In forming the concrete base at manholes having an invert drop, the base shall be formed to the elevation of the bottom of the downstream pipe, with the upstream pipe being blocked up to the invert drop elevation specified. After the manhole sections have been installed, all joints shall be grouted in and pointed up, and the interior concrete fill placed and floated to a smooth surface. After the concrete has hardened, the pipe within the manhole shall be broken out flush with the concrete fill and the walls of the manhole, and pointed up to form a smooth continuous invert channel through the manhole. If the manhole is installed in ground water the manhole shall be externally coated with a bituminous material approved by the City.

SEC. 11C-3. INFILTRATION AND EXFILTRATION.

All sanitary sewers shall be constructed such that infiltration of ground water into any section of the sewer, including house or sewer service connections, or exfiltration of sewage from the sewer, shall not exceed 250 gallons per inch of diameter per mile of sewer in 24 hours. The completed sewers, after compaction, or any section thereof, shall be subject to infiltration or exfiltration tests at the cost of the installer.