WATER DISTRIBUTION

SYSTEM DESIGN

AND

SPECIFICATIONS

SECTION 12
Revised April 2024

WATER DISTRIBUTION SYSTEM DESIGN
AND SPECIFICATIONS

12.01 **General**

Water mains, service connections and appurtenances shall be constructed in accordance with **American Water Works Association (AWWA) Standard C600** as amended herein. Subjects not governed by the above shall be governed by the pertinent provisions of the following, listed in order of precedence:

(a) Great Lakes - Upper Mississippi River Board of State Sanitary Engineers Recommended **Standards for Water Works**, latest revision.

(b) **Standard Specifications for Water and Sewer Main Construction in Illinois**, latest revision.

Construction standards and all materials not addressed herein, but used in water distribution construction shall comply with the **Rockford Water Division Specifications** available from the water utility.

Manufacturers and/or their suppliers will be required to provide a statement indicating that all components they provide are "American Made". Failure to provide certification shall be cause for rejection.

All brass fittings and valves for service lines shall be manufactured in accordance with AWWA Standard C-800, latest revision. Any brass part of the fitting or valve in contact with potable water shall be made of a “No-Lead Brass”, defined for this specification as UNS Copper Alloy No. C89520 or C89833 in accordance with the chemical and mechanical requirements of ASTM B584 and AWWA C-800. This “No-Lead Brass” alloy shall not contain more than nine one hundredths of one percent (0.09% or less) total lead content by weight.

Any Brass part of the fitting or valve not in contact with potable water shall be made of 85-5-5-5 brass as defined for this specification as UNS Copper Alloy C83600 per ASTM B62, ASTM B584 and AWWA C-800.

All brass fittings and valves shall be certified by an ANSI accredited test lab per NSF/ANSI Standard 61, Drinking Water Components – Health Effects, Section 8 or NSF/ANSI Standard 372, Drinking Water System Components – Lead Content. Proof of certification is required.

Brass fittings and valves shall comply with the United States Of America Safe Drinking Water Act, and the U.S. Environmental Protection Agency. All brass fittings and valves shall have the manufacturers name or trademark permanently stamped or cast on it. Another marking identifying the “no lead” brass alloy, e.g., ‘NL’, shall be cast or permanently stamped on the fitting or valve.

Certificates of compliance with these specifications shall be provided with all materials supplied. Failure to conform to these specifications or failure to provide the required certification shall be cause for rejection of materials.

12.02 **Water Main Materials**

All water mains shall conform to **AWWA Standard C151 & C111** and, be constructed of **Class 52** Ductile Iron pipe for all sizes through twelve (12) inch, and **Class 51** Ductile Iron pipe for all sizes larger. Other materials may be allowed upon the review and approval by the Water Superintendent or their designee. If approved for use, High Density Polyethylene (HDPE) shall conform to AWWA Standard C906. All pipe, shall be cement mortar lined inside, conforming to **AWWA Standard C104**, and bituminous coated on the outside.

The exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m2 of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be

less than 3 mils with a local minimum not less than 2 mils. The coating system shall conform in every respect to ISO 8179-1 "Ductile iron pipes - External zinc-based coating - Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01."

Pipe-to-pipe joints on straight runs of main shall be "*push-on"* type with the exception of submerged river crossings or other special applications. Approval of joints in those situations will be made by the **Rockford Water Division**. All joints on fittings, valves, and bends, shall be "*mechanical"* type with ductile iron retainer glands. To ensure electrical conductivity, brass wedges *MUST* be used with push on joints in accordance with Section 41-2.05D of the Standard Specifications for Sewer and Water in Illinois. All mechanical joints shall be tightened to the manufacturer's specification using a torque stick.

Pressure connections or wet tap connections will not be permitted if the existing main is the same size or smaller than the proposed main that is to tee into the existing (example an 8" pressure connection will not be allowed on an 8" existing water main).

All mains shall be a minimum of eight (8) inch nominal diameter. Larger sizes will be required when needed to satisfy local water demand, fire flows, and/or transmission lines.

Water mains shall be designed using standard pipe sizes of 8", 12", 16", 20", 24", 30" and 36" nominal diameter. When design calculations yield an intermediate pipe size the next larger standard size shall be used.

Water mains shall be sized so that the pressure at maximum flow conditions is at least twenty-five (25) psig in all parts of the distribution system. In addition, the velocity at maximum flow must be no more than ten (10) fps. Friction losses shall be calculated by the Hazen-Williams formula, using a friction coefficient (C) of 100.

Static head and distribution system, flow characteristics can be, acquired from the **Rockford Water Division**.

12.03 **Water Main Locations**

Water mains shall, in general, be located between the curb and sidewalk. Preferred locations are shown on detailed drawings that can be obtained from the **Rockford Water Division**. Water mains parallel to curbs shall be located at least two (2) feet from the back of the curb.

All water mains shall be looped.

a.) Water mains shall be constructed within the public Right-Of-Way whenever possible.

b.) When it is necessary to construct a water main on private property, an exclusive water main easement shall be granted to the Water Division, extending a minimum of ten (10) feet on either side of the main and shall be recorded with the final plat.

c.) No water main shall be laid under, nor within ten (10) feet of, any building or permanent structure.

d.) Water main that connects to an existing public water main at two locations or more (looped), and/or has multiple services tapped off of it, shall be public water main.

e.) In locations where it is determined by the Water Superintendent, or their designee, that it is not feasibly possible to loop a water main, a flushing device shall be installed.

12.04 **Water Main Grades**

Water mains shall be laid at a uniform grade between main junctures. Where a uniform grade is not possible, the grade shall be designed so that the number of changes in the direction of slope are the minimum possible.

a.) Where both ends of a section of main are at a lower elevation than an intermediate point, a means of releasing entrapped air (e.g. fire hydrant, air release valve) must be provided at the top of the "hill".

b.) Where both ends of a section of main are at a higher elevation than an intermediate point, a means of flushing out sediment through a fire hydrant must be provided at the bottom of the "valley."

The minimum radii of curves which may be laid by deflecting twenty (20) foot lengths of push-on joint pipe at the joints are:

8" - 230' radius
12" - 230' radius
16" - 380' radius
20" - 380' radius
24" - 380' radius
30” - 380’ radius
36” - 380’ radius

a.) Curve radii shall be measured in the plane defined by centerlines of the pipe.

b.) Curves with smaller radii than permitted above shall be made using bends and offsets.

12.05 **Protection of Water Supplies**

No water main shall pass through or come into contact with any part of a sewer manhole or storm sewer inlet structure.

Horizontal and vertical separation between water mains, water appurtenances and all storm and sanitary sewers, and appurtenances, or other sewerage structures shall be as follows:

a.) Whenever possible, water mains shall be laid no less than ten (10) feet horizontally from any existing or proposed drain, storm sewer, sanitary sewer, combined sewer or sewer service connection.

b.) When it is impossible to accomplish a ten (10) feet horizontal separation between a water main and a sewer, the bottom of the water main must be at least eighteen (18) inches above the top of the sewer and the water main and sewer must be constructed in separate trenches. Where separate trenches are not possible, the water main must be constructed on a shelf of undisturbed earth located as far as possible from the sewer.

c.) When it is impossible to accomplish the separations required above, both the water main and the sewer must be constructed of water main materials and the sewer must be pressure tested for water tightness at the maximum expected surcharge head before backfilling.

d.) Whenever a water main crosses a sewer, the bottom of the water main must be at least eighteen (18) inches above the crown of the sewer for all portions of the water main located less than ten (10) feet from the sewer.

e.) When it is impossible to accomplish the vertical separation required above, both the water main and the sewer must be constructed of water main materials and the sewer must be pressure tested for water tightness at the maximum expected surcharge head before backfilling. Wherever the water main is less than ten (10) feet from the sewer, a full twenty (20) foot length of water main pipe shall be centered at the point of sewer crossing. Rubber gasketed sewer will not be accepted as a water main quality material.

f.) In addition to the above, when it is necessary that a water main cross under a sewer the bottom of the sewer must be at least eighteen (18) inches above the crown of the water main for all portions of the water main located less than ten (10) feet from the sewer. The sewer must also be supported to prevent settling and breaking of the water main.

Water mains and services shall have a minimum cover of six (6) feet, and a maximum cover of eight (8) feet from the top of the pipe to the finished ground surface. Any variation from this policy is at the discretion of the Water Superintendent, or their designee.

g) Water mains and services with less than five-foot (5) of cover shall be insulated. A ½-inch thick closed cell foam insulation is to be wrapped around shallow services and then an Insulation board (polystyrene) is to be laid, over top of main and service. The 4'x 8' standard boards shall orientate to provide a minimum coverage of eighteen (18) inches beyond the outside edge of the pipe being, covered. The insulation board shall have a minimum R-value of R-9 and comply with ASTM C 578-92 Type 1X. One 2-inch thick sheet of insulation is equivalent of 1 foot of ground cover when determining thickness requirements. (See Standard Detail)

h) All water main, and services to the property line, shall have a plastic caution tape placed in the trench approximately 3 feet above the top of the pipe to warn excavators of the nearby pipe. The tape shall be yellow with black lettering and 4 inches in width.

12.06 **Pipe Fitting Specifications**

Pipe fittings shall be 250 PSI rated cast iron or ductile iron, fully complying with the provisions of **AWWA Standard C110 (ANSI Standard A21.10)**. Ductile iron "compact" fittings, rated at 350 PSI, are acceptable provided they fully comply with the **AWWA Standard C153 (ANSI Standard A21.53)**.

All fittings shall be cement mortar lined in accordance with the provisions of **AWWA Standard C104 (ANSI Standard A21.4)**.

Fitting joints shall be mechanical type, fully complying with the provisions of **AWWA Standard C111 (ANSI Standard A21.11)**. Fittings shall be furnished with ductile iron retainer glands and all joint accessories.

12.07 **Dead Ends**

All dead ends on newly laid mains shall be closed with cast iron or ductile iron plugs and caps. Where a dead end is not equipped with a fire hydrant, the last pipe shall be fitted with a bleeder plug and valve. The valve shall be a two (2) inch gate valve. A cast iron valve box shall be provided for the bleeder valve as well as the (2) inch 90-degree bend. The valve-operating wheel shall be readily accessible for operation through the valve box opening, which shall be set flush with the finished surface. Detailed drawings can be obtained from the **Rockford Water Division**.

In order to reduce cost and allow future main extension to be made without interruption of water service, extensions should, where possible, end one (1) pipe length beyond a control valve. The stub end must be capped or plugged but the bleeder valve may be located in the control valve vault, provided no service connections are made to the stub.

12.08 **Thrust Blocking**

The parameters involved in the design of thrust blocks shall include pipe size, maximum system pressure, angle of the bend, (or the configuration of the fitting), and the horizontal bearing strength of the soil. Bearing surface should, where possible, be placed against undisturbed soil. Where it is not possible, the fill between the bearing surface and undisturbed soil must be compacted to at least 90% Standard Proctor density.

Thrust blocks shall be used wherever there is a change in horizontal direction, and on dead ends. On vertical down and vertical up bends, restrained glands are required (see Section 12.16 **Restrained Glands**). Thrust block size shall be determined by **Rockford Water Division**.

Thrust blocks shall be P.C. concrete, a minimum twelve (12) inches thick, formed between the pipe, or fitting and the undisturbed trench wall, and shall be, anchored in such a manner that the pipe and fitting joints will be accessible for repairs.

Recommended alternative to thrust blocking in most situations would be the use of **Restrained Glands** (see Section 12.16).

12.09 **Trench Depth**

Trenches shall be excavated to a depth sufficient to provide a minimum cover of six (6) feet, and a maximum cover of eight (8) feet from the top of the pipe to the finished ground surface. Trench depth shall be increased where necessary so that the main is installed on a uniform gradient despite minor local variations in surface grade.

12.10 **Proper Backfilling**

All trenches shall be backfilled, from the bottom of the trench to the centerline of the pipe, with FA-6 or approved native material. The backfill material shall be deposited in the trench for its full width on each side of the pipe simultaneously, distributed evenly by hand, and compacted by tamping.

All trenches shall be backfilled, from the centerline of the pipe to a depth of one (1) foot above the top of the pipe, with FA-6 or approved native material compacted by tamping. The contractor shall use special care in placing this portion of the backfill so as to avoid injuring or moving the pipes.

When the type of backfill is not indicated in the plans, or elsewhere specified, the trench shall be backfilled, from one (1) foot above the pipe to the finished grade, with native material, or other materials approved by the City, in twelve (12) inch layers compacted by tamping. The material shall be unfrozen and free from clods and rocks.

Granular backfill is required under pavements, curbs, driveways, or sidewalks planned to be constructed within one (1) year after backfill. The area requiring such granular backfill shall be indicated in the plans. Where the excavation is made through or within two (2) feet of permanent pavements, curbs, driveways, or sidewalks, or where such structures are undercut by the excavation, or where such structures may reasonably be expected to be constructed over or within two (2) feet of the excavation within one (1) year after backfilling, the entire backfill to the subgrade of the structures shall be made with CA-6 material or an equal granular material approved by the City, placed in six (6) inch layers, loose measurement, and compacted to not less than ninety-five (95) percent of standard laboratory density. Recycled materials meeting the CA-6 gradation in accordance with the Illinois Department of Transportation's Standard Specifications for Road and Bridge Construction may be allowed upon review and approval by the Water Superintendent, or their designee.

12.11 **Setting Valves**

Water main valves shall be located on right-of-way lines extended, or lot lines extended, unless otherwise shown on the plans.

a.) Three (3) valves shall be installed at each cross fitting, two (2) valves at each tee fitting, and one (1) valve on each hydrant branch.

b.) Additional mainline valves shall be installed as needed so that no more than five hundred (500) feet of main will be isolated by any shut-off.

c.) Valves shall be arranged so that no more than four (4) need be closed to isolate any section of main.

d.) Access to the valve shall be through a cast iron valve box.

Unless otherwise noted on plans all distribution main line valves shall be *"gate valves"*. Use of other valves shall be approved by the Water Superintendent, or their designee.

A cast iron valve box shall be provided for every valve, complying with Section 12.16 of these specifications. The valve-operating nut shall be readily accessible for operation through the valve box opening, which shall be set flush with the finished surface.

When valve vaults are required, they shall be constructed of concrete block, concrete brick laid up in alternate courses of headers and stretchers, or precast concrete, placed upon a concrete foundations ring (4) four inches thick with a minimum outside diameter of five (5) feet. Precast concrete base or foundation ring shall be placed on a well-graded granular bedding material not less than six (6) inches thick, extending to the limits of the excavation. The bedding course shall be firmly tamped and made smooth and level. Concrete block or brick shall be set in mortar with the vertical joints broken to provide drainage. The cone of the vault shall be no more than thirty-six (36) inches in height and at grade shall accept the manhole rim and cover specified below.

Manhole rims and covers shall be of *"heavy"* construction when located in paved surfaces and outside of paved surface; and of *"extra heavy"* construction when located in paved surfaces designated by the City as major arterial streets.

12.12 **Valve Specifications**

a) **Gate Valves**
Gate valves shall be iron body, bronze-mounted, non-rising stem, *"double disc"* gate valves with parallel seat or *"resilient seat wedge"* type, opening left (counter clockwise), and shall fully comply with the provisions of **AWWA Standard C500** for double disc type and **AWWA Standard C509** for resilient seat type.

Gate valves shall be furnished with "O" ring stem seals.

All joints shall be *"mechanical joint"* type and shall fully comply with the **AWWA Standard C111 (ANSI Standard A21.11)**.

The following manufacturers are listed as offering valves in essential compliance with these specifications. Responsibility rests with the supplier for demonstrating that a particular valve model complies fully with these specifications. **Manufacturers other than those listed may be acceptable provided the supplier can satisfy the City's specifications indicating that all components they provide, are "*American made*".**

1. Mueller Company, Decatur, Illinois
2. Waterous/American Flow Control, Birmingham, AL

3. Kennedy Valve, Elmira, New York

b) **Butterfly Valves**
Butterfly valves shall be of the rubber, seated type that are, in full compliance with the provisions of **AWWA Standard C504**. In addition the following special requirements shall prevail over the general provisions of the above referenced standards.

Butterfly valves shall be class 150B as designated in **AWWA Standard C504**.

Valve bodies shall be of *"cast iron"* conforming to **ASTM A-126 class B** or of *"ductile iron"* conforming to **ASTM A-536 grade 65-45-12**. Valve ends shall be of *"mechanical joint"* type and shall be integral with the bodies.

Valve discs shall be of the offset shaft type so as to provide a full-uninterrupted three hundred sixty (360) degree sealing surface. Discs shall be streamline and present the smallest profile consistent with the structural requirements of the valve class. Valve discs shall be constructed of ductile iron conforming to **ASTM A-536 grade 65-45-12**.

Valve seats shall be of "Buna-N" rubber. Seats mounted on the disc shall be clamped thereon. Seats mounted in valve bodies shall be cemented and clamped or bonded to the valve body. Seat clamps shall be of stainless steel with stainless steel fasteners. Seats shall mate with a continuous three hundred sixty (360) degree sealing surface of **18-8** stainless steel.

Valve shafts shall be of **18-8 Type 304** stainless steel. A stub shaft comprises two (2) separate shafts inserted into the valve-disc hubs. Each stub shaft shall be inserted into the valve-disc hubs a distance of at least one and one half (1-1/2) shaft diameters.

Valve actuators shall meet the requirements of **AWWA Standard C504** for nut input, and shall require a minimum of two (2) turns per inch of valve size from fully open to fully closed position. Valves shall be designed for buried service and shall turn left (counter-clockwise) to open.

Butterfly valves shall be installed and supported by a butterfly valve adaptor.

The following manufacturers are listed as offering valves essential for compliance with these specifications. Responsibility rests with the supplier for demonstrating that a particular valve model complies fully with these specifications. **Manufacturers other than those listed may be acceptable provided the supplier can satisfy the City's specifications indicating that all components they provide, are "*American made*".**

1. Kennedy Valve, Elmira, New York
2. Val-matic/American-Darling Valve, Birmingham, Alabama
3. Mueller Company, Decatur, Illinois

c) **Tapping Valves**
Tapping gate valves shall be iron-bodied, bronze mounted, non-rising stem, *"double disc"* gate valves with parallel seats or *"resilient seat wedge"* type, opening left (counter clockwise), and shall fully comply with the latest provisions of **AWWA Standard C500** for double disc type and **C509** for resilient type. Auxiliary type will **not** be accepted.

Valves shall be furnished with "O" ring stem seals.

Seat openings shall be larger than the nominal size of the valve by an amount sufficient to pass a full diameter tapping machine cutter through the valve.

Tapping valves shall be furnished with standard AWWA mechanical joint outlet end and flanged inlet end. Flanged end will have a raised face to match the groove in the

tapping sleeve outlet flange. Both the flange and mechanical accessories along with the ductile iron retainer glands **(RWDS-21-1994)** will be furnished.

The following manufacturers are listed as offering valves in essential compliance with these specifications. Responsibility rests with the supplier for demonstrating that a particular valve model complies fully with these specifications. **Manufacturers other than those listed may be acceptable provided the supplier can satisfy the City's specifications indicating that all components they provide, are "*American made*".**

1. Mueller Company, Decatur, Illinois
2. Kennedy Valve, Elmira, New York

A hydrostatic test of the tapping sleeve and valve assembly shall be completed in accordance with Section 12 after installation of the tapping sleeve and valve, but prior to making the tap. The test shall be made with the valve open using a tapped mechanical joint cap. No leakage is acceptable. The test pressure shall be maintained for a minimum of 15 minutes.

12.13 Setting Fire Hydrants

Fire hydrants shall be located as shown on the plans or as otherwise directed so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians. One (1) hydrant shall be set at each street intersection and at the end of every cul-de-sac. Intermediate hydrants shall be set so that they are no more than three hundred (300) feet apart in commercial and industrial developments, or five hundred (500) feet apart in residential developments. Distances between fire hydrants shall be measured along roadway centerlines.

a.) Fire hydrants shall be located as shown on the **Rockford Water Divisions** detailed drawings, and shall be installed with the pumper nozzle directly toward the closest roadway.

b.) Wherever possible, fire hydrants shall be installed in the unpaved area between the curb and sidewalk, with no part of the hydrant located closer than two (2) feet from the sidewalk.

c.) Where the sidewalk extends to the curb, fire hydrants shall be installed so that no less than three (3) feet of unobstructed sidewalk exists between the hydrant and the R.O.W. line.

d.) Access to the hydrant auxiliary valve shall be through a cast iron valve box. The valve-operating nut shall be readily accessible for operation through the valve box opening, which shall be set flush with the finished surface.

All hydrants shall stand plumb and have their nozzles parallel or at right angles to the curb, with the pumper nozzle facing the curb. No portion of the pumper hose nozzle cap shall be less than twenty-four (24) inches from the gutter face of the curb, driveway or other vehicular traffic surface. Hydrants shall be set with indicated bury line to finished grade, and with centerline of all nozzles at least eighteen (18) inches, but not more than twenty-four (24) inches above finish grade. Break-a-way flange shall be installed not less than two (2) inches, nor more than six (6) inches above finished grade. Precautions must be taken to provide adequate drainage of hydrants. Hydrant drains shall not be connected to or located within 10 feet of sanitary sewers or storm drains.

Each hydrant shall be connected to the main by a six (6) inch diameter branch line controlled by an independent six (6) inch gate valve placed eighteen (18) inches in front of the hydrant.

Restrained joints shall be used on the tee branch, both sides of the auxiliary control valve, and the hydrant shoe.

Each hydrant shall be placed upon a two (2) foot square concrete base set upon undisturbed soil. The hydrant shall be braced until the backfill is made.

A cast iron valve box shall be provided for every valve, complying with Section 12.16 of these specifications. The valve-operating nut shall be readily accessible for operation through the valve box opening, which shall be set flush with the finished surface.

When hydrant valve vaults are required they shall be constructed of precast concrete, or constructed in the manner previously specified under gate valve vaults. The neck of the vault shall be drawn toward the main where a manhole rim and cover shall be installed. The cone slot on a precast concrete vault shall be blocked, bricked, and mortared around the hydrant barrel to prevent both barrel movement and soil penetration.

12.14 **Fire Hydrant Specifications**

Fire hydrants shall fully comply with all of the general provisions of the latest revision of **AWWA Standard C502** and with the special requirements hereinafter provided.

The inlet connection shall be six (6) inch oversized mechanical joint type, which is designed to be installed on **Class D Pit Cast** or **Class 250 Cast Iron** pipe and **Class 52 Ductile Iron** pipe by using two (2) types of available gaskets furnished with the hydrant. Gaskets for oversized cast iron and ductile iron are to be color coded to identify which gasket is to be used on which pipe. The interior shoe and lower valve plate shall be coated with an epoxy at a minimum of four (4) mils thickness. Ductile iron restrained retainer glands, bolts (COR-Blue), nuts, and gaskets, shall conform to **AWWA Standard C111**.

The main valve shall be five and one-quarter (5-1/4) inches in size, closing with water pressure. The upper valve plate and seat ring shall both be of solid, one-piece bronze construction, and the seat ring shall be attached to the hydrant shoe by threading into a bronze fitting. The zinc content in the bronze shall not exceed sixteen (16) percent. The main valve assembly shall include provisions to restrain movement of the main valve and stem in any direction other than parallel to the axis of the stem.

Lower barrel length shall be based on a nominal six (6) foot bury (trench) depth. Barrel and stem extensions shall be available in six (6) inch lengths and longer lengths in increments of six (6) inches. The manufacture's name, size of main valve opening, and year of manufacture shall be cast in the upper barrel of the hydrant.

NOTE:
Installation of large diameter water mains may require ordering a longer lower barrel section to meet the water main bury requirements. Likewise, replacing obsolete hydrants in existing subdivisions, which might be less then six (6) foot trench cover, may require a shorter lower barrel section (see Section 12.09 on **Trench Depth** & Section 12.13 on **Setting Hydrants**).

The outlet connections shall be:

(a) One (1) four (4) inch pumper nozzle, 5.0109 inch **ODM, 4 TPI (NHT)**.

(b) Two (2) two and one-half (2-1/2) inch hose nozzles, 3.0686 inch **ODM, 7-1/2 TPI (NHT)**.

Nozzles shall be fastened mechanically into the upper barrel and have the nozzle caps chained to the upper barrel. Leaded in nozzles shall not be allowed. The centerline of all nozzles shall be no less than eighteen (18) inches, but not more than twenty-four (24) inches above the groundline bury mark on the lower barrel of the hydrant.

Both hydrant operating nut and nozzle cap nuts shall be one (1) inch square at the base tapering to seven-eighths (7/8) inch at the top and not less than one (1) inch in height. The hydrant-operating nut shall turn right (clockwise) to open.

Hydrants shall be of the "break-away" flange and stem coupling design. The breakaway design shall allow for three hundred sixty (360) degree facing nozzles by infinite degrees. Safety stem coupling shall be of frangible design, which provides for a clean break or tear into halves upon impact. Stem coupling shall be secured to the stem with stainless steel pins and fasteners.

All fire hydrants, public and private, shall have a Harrington Integral Hydrant Storz nozzle installed on hydrants during assembly and shall meet or exceed the requirements of AWWA C502 regarding material and pressure testing. The Storz nozzle shall have a brass metal face seal and hard anodized aluminum Storz ramps and lugs. The aluminum's finish shall be hardcoat anodized to Mil-A-8625f, Type 3, and dark gray. The adapter shall be made of forged or extruded 6061-T6 aluminum. The blind cap shall have hard anodized aluminum Storz ramps and lugs, made of forged or extruded 6061-T6 aluminum. The center cap shall be equipped with a suction seal. The cap shall be connected to the adapter of the hydrant with a 0.15" vinyl coated aircraft cable.

Fire hydrants installed in public R.O.W. and in easements maintained by the City, shall have the upper barrel, above the groundline, painted a minimum of one (1) coat of "Yellow" **Rustoleum** Industrial grade Iron Oxide Primer and two (2) finish coats of "Traffic Yellow" Rustoleum Industrial grade oil base Alkyd Enamel. Hydrants installed on private property, in conjunction with the owner's fire protection system, shall be painted "Red". Painting and coatings shall be in accordance with **AWWA Standard C502**. Please note that all private hydrant leads or water main, when reviewed and approved by the Water Superintendent, or their designee, shall have a hot box, meter, and backflow installed at the property line to distinguish ownership in accordance with all applicable requirements and ordinances.

Hydrant Lubrication
Each threaded nozzle and cap, shall be coated with a premium, synthetic, food grade, non-drying thread sealant and anti-seize compound, approved by the specific hydrant manufacturer, immediately before or after installation.

Approved Hydrants
Only the following manufacturers and models are accepted by the City of Rockford.

1. Kennedy Guardian K-81A
2. Mueller Super Centurion A-423

12.15 **Manhole Castings**

Castings shall be manufactured of cast iron conforming to **ASTM A-48-74 class 30** or ductile iron conforming to **ASTM A-536-72 grade 60-40-18.**

Both the rim and cover shall be machined both vertically and horizontally so that there will be no variation from circular, straight edge.

Castings shall be supplied in two (2) weight patterns as follows:

(a) **Heavy** - Frame and cover weighing approximately 285 pounds complete.

(b) **Extra-Heavy** - Frame and cover weighing approximately 540 pounds complete.

The design of each casting is the Water Division's own, and is shown on detailed drawings that can be obtained from the **City of Rockford Water Division**. All casting must conform to

the dimensions thereon in order to ensure interchangeability with existing castings. Castings shall be supplied as bare metal, without any coating or paint whatsoever.

Covers shall be supplied with a checkered pattern top lettered, "WATER" except where the water vault houses a water system boundary valve. Boundary valves shall be supplied with a cover that has a checkered pattern top and is lettered “WATER HI LO VALVE.”
(See Standard Detail)

12.16 **Valve Boxes**

Valve boxes shall be Tyler/Union cast iron 6850 series or East Jordan (EJ) 8550 series, with “WATER” imprinted on top cover with a debris cap and with an Adapter II by Adaptor Inc. installed.

Boundary valves shall be supplied with a valve box that has a checkered pattern top and is lettered “WATER HI LO VALVE.”

12.17 **Restrained Glands**

Restrained glands shall be cast from ductile iron and machined to dimensions and/or tolerances hereinafter specified either directly or by reference. All bolts shall be COR-Blue.

Restrained glands shall be designed for use in place of standard glands for **AWWA Standard C111 (ANSI Standard A21.11)** mechanical joints. The approved restrained gland type shall be:

(a) Individually activated wedge type gland *(e.g. Megalug style (COR-Blue bolts); Uniflange style)* shall be used for restraint due to its increased resistance to joint separation as pressure or external forces increase and its ability to provide joint resiliency and deflection. The wedge type gland shall have a working pressure up to three hundred fifty (350) psi. in main sizes through sixteen (16) inches, and two hundred fifty (250) psi. in larger sizes along with a minimum safety factor of 2:1. The wedges shall be ductile iron heat treated to a minimum hardness of 370 BHN. It shall also have individual activated wedge screws with specially engineered heads designed to break off when desired torque is reached, leaving a hex head in case future removal is required.

Restrained glands shall be used on all water mains, hydrant and large service branches, which have vertical down and vertical up bends and any intermediate joints between those bends. Joint restraint will also be required on at least two (2) full pipe lengths of the horizontal run either side of the bend.

On horizontal bends; pipe size, angle of bend, maximum system pressure, soil classification and moisture content, depth of bury, type of trench bedding and compaction and whether or not the pipe is polyethylene wrapped, will all be used in calculating the pipe length to soil friction needed for proper joint restraint on either side of the bends. On bridges or other special situations requiring joint restraint, the method of restraint shall be determined by the **Rockford Water Division**.

Hydrant installations including the branch end of the tee, as well as the pressure side of distribution valves used at main dead ends, will also require the use of restrained glands.

Restrained glands shall be furnished factory coated with bituminous material meeting the requirements for outside coatings of **AWWA Standard C151 (ANSI Standard A21.51)**.

12.18 **Service Connections**

Every property with frontage along a water main and having an inhabitable dwelling shall be, provided a water service to the property line when the main is constructed, unless the property

has an existing service connection to another main along which the property fronts. Every property shall have a separate service connection to the water main, and no more than one property shall be served by any one connection to a main.

Service connection sizes shall be approved by the City based on design criteria in the **AWWA Manual M-22**. Services shall be sized so flow velocity at maximum anticipated demand is no more than 10.0 fps and friction loses between the main and the water meter at maximum demand is no more than 25.0 psig.

(a) All new residential subdivisions zoned R-1 shall be provided with a minimum one (1) inch service connection.

(b) On existing single family residences with less then two (2) full bath rooms or when replacing existing services, three quarter (3/4) inch service connections will generally be adequate. However, all new connections shall be one (1) inch service connections.

(c) Duplexes and larger single-family residences with two (2) or more full bathrooms generally can be served with one (1) inch service connections. A detailed analysis using **AWWA Manual M-22** should be conducted on those large single family homes or two family duplexes where large demand fixtures (e.g., sprinkler systems, etc.) need to be factored in.

(d) Service connections for multifamily residences, commercial and industrial properties will require detailed analysis to determine size and shall be approved by the Building Department.

(e) Service taps shall reviewed be approved by the Water Superintendent, or their designee. Water Superintendent to determine if Water Division or Developer's Contractor will make the service connection tap. All appropriate service connection fees are to be paid for prior to making any connections to City water main. All service taps made by a contractor shall be inspected by the Water Superintendent, or their designee.

(f) A crimping tool shall not, be used to temporarily stop a water service, except in an emergency. If a crimping tool is used to stop a service line, the final repair shall be as directed by the Engineer, but in no case shall un-crimping the line be allowed. The temporary freezing of a service is the approved method of use for the City of Rockford.

Service branch pipes two (2) inches in diameter and smaller shall be seamless *"Type K soft"* copper tubing for underground service, conforming to **ASTM B-88-47,** complying with Section 12.20 of these specifications. Service branch pipes larger than two (2) inches shall be **Class 52** ductile iron. HDPE services may be allowed based on existing condition and upon the review and approval by the Water Superintendent, or their designee.

Each service shall be provided with a valve at the point of connection with the main. For copper services, the valve at the main shall be a corporation stop; for ductile iron services, connection to the main shall be made by means of either a tapping valve and sleeve or installation of a tee and standard gate valve at the R.O.W. line. Corporation stops shall be, buried. Gate valves shall be, provided with a valve box.

The table below lists the largest service sizes that may be tapped directly into the main for each size of main. For other main or service sizes, a service saddle or tapping sleeve is required.

MAIN SIZE		LARGEST DIRECT TAP
4 inch	=	3/4 inch
6 inch thru 20 inch	=	1 inch
24 inch	=	1-1/2 inch

30 inch	=	2	inch

Combination services (Fire and Domestic) will be allowed with a single valve at the property line (a valve at the main may be allowed if a tapping valve is utilized), with access to the valve through a pre-cast manhole, and shall be split inside the building. All applicable cross-connection devices, valves, and meters shall be installed immediately after the split or as approved by the City of Rockford Water Division and Building Department. All meters shall be placed within the structure within two (2) feet of the building penetration. All installations shall be in accordance with the Illinois Plumbing Code and IDPH.

Standard service connection sizes are 1", 1-1/2", 2", 4", 6" and 8" in addition to the standard water main sizes. When design calculations yield an intermediate service connection size the next larger standard size shall be used.

No service connection shall be larger than the main to which it is connected. On dead end mains no service connection shall be larger than 1/2 the main size.

Copper service connections shall be connected to the main by a corporation stop and shall be controlled by a curb stop accessible through a curb box. The curb stop and box shall be, installed on the R.O.W. line and shall not be located in or under any service walk or driveway. If any curb stop box is located in a walk or driveway, an A.Y. McDonald, cast iron box receptacle (part 5639) must be, used. *Where the entire area between the curb and R.O.W. line is paved, the top of the curb box must be fitted with a pavement sleeve.*

Service connections shall be installed perpendicular to the water main at the point of connection and extend in a straight line to the boundary of the R.O.W. or easement in which the main is located. Where a service perpendicular to the main will not reach the property to be served, the service shall be laid in a straight line between the main and the property line.

The separation between the service connection and sanitary sewers, storm sewers, sewer appurtenances, or other sewer structures shall be the same as required for water mains in Section 12.05 **Protection of Water Supplies**.

Ductile iron service connections shall be connected to the main by a tapping sleeve and valve or by a tee and standard valve. Access to the valve shall be, provided with a valve box. Valve vaults may be required in special circumstances as directed by the Water Superintendent, or their designee. All water services are required to be installed/tapped by a licensed plumber and inspected by the City of Rockford (Building Department) prior to backfilling.

Any service that is no longer going to be utilized by a property shall be abandoned at the water main. Abandonment requirements shall be size dependent and will either be abandoned by using a solid sleeve, corporation sleeve, or removing and replacing a section of water main. All abandonment requirements shall be reviewed and approved by the Water Superintendent, or their designee.

12.19 Tracer Wire for PVC and HDPE Services Installed, on Private Property

A tracer wire shall be laid with all PVC & HDPE water services and shall be of insulated, #8 solid copper core and rated for underground service. The start of the tracer wire shall be connected to the City's copper water service by means of a brass ground clamp. The wire shall be ran along the length of the PVC or HDPE pipe, with plastic adhesive tape applied at intervals of approximately ten (10) feet along the pipe length. The wire shall terminate at the meter connection by means of a brass ground clamp with at least two (2) inches of bare copper wire exposed. PVC or HDPE may only be allowed upon review and approval by the Water Superintendent, or their designee.

(See Standard Detail)

12.20 Copper Tubing Specifications

Tubing shall be seamless **Type K** copper tubing, suitable for underground service, and conforming to **ASTM B-88-47** Type K, soft. Copper is to be of one continuous piece. No joints, couplings, etc. allowed from main to curb stop, *unless* authorized by the Water Superintendent, or their designee.

Tubing shall be supplied in the following standard water tube sizes:

(a) 1 inch
(b) 1-1/2 inch
(c) 2 inch

12.21 Copper Compression Joint Specifications

Compression joint is hereby defined to be a joint whereby plain end copper tubing is connected to a fitting and locked into place by compressive forces created when a nut threaded onto the body of the fitting is tightened. A compression joint shall require no preparation of the end of the tubing other than simple cleaning.

A compression joint shall consist of:

(a) a receptacle in the fitting body for the end of the copper tubing, the outside of which receptacle shall be threaded to accept the coupling nut; and

(b) a gasket which shall provide the hydraulic seal for the joint and transmit the compressive forces to the gripper band; and

(c) a gripper band which shall produce circumferential indentations in the tubing, thereby restraining the tubing and preventing joint separation; and

(d) a coupling nut which shall thread onto the body of the fitting and, upon tightening, compress the gasket and gripper band; and

(e) a device or means of providing positive electrical continuity through the joint.

The gasket shall be made of a synthetic rubber material capable of providing a watertight seal when installed at temperatures ranging from minus twenty (-20) degrees Fahrenheit to one hundred (100) degrees Fahrenheit. It shall be capable of maintaining a watertight seal through repeated temperature cycles between thirty-two (32) degrees Fahrenheit and eighty (80) degrees Fahrenheit, and shall be undamaged by water temperatures up to one hundred sixty (160) degrees Fahrenheit. The gasket shall be, totally confined by the fitting body/coupling nut assembly.

The gripper band shall be made from corrosive resistant steel. It shall be concave in shape so as to produce two parallel circumferential indentations in the tubing, and shall overlap itself upon compression.

The coupling nut shall be made of waterworks bronze **(ASTM B-62)**.

The fitting body receptacle and coupling nut eye shall be manufactured to a close tolerance to **Type K** copper water tube, so that the tubing cannot be inserted into the coupling assembly unless the tubing is truly round in cross section and axially straight.

Compression couplings shall include provision for positive electrical connection between the tubing and the fitting body. The electrical connection shall be adequate to conduct 200 amps without damage to the gasket or any other part of the joint.

Compression coupling joints shall not pull apart at loads less than 2000 pounds.

12.22 Corporation Stop Valve Specifications

Corporation stop valves shall be manufactured of waterworks bronze **(ASTM B62)**, with full diameter stop orifice, and thread patterns conforming to **AWWA Standard C800** figure 1 for **Type K** copper service tube.

Design and dimension of corporation stops must conform, with **Mueller H-15000** stops to allow use in the City's tapping machines.

Corporation stop valves shall be, furnished in one (1) inch, one and one-half (1-1/2) inch and two (2) inch sizes for use with **Type K** copper tubing in the same standard water tube sizes.

Corporation stop valves shall be furnished with compression joints complying with Section 12.19 **Copper Compression Joint Specifications**.

12.23 Curb Stop Valve Specifications

Curb stop valves shall be manufactured of waterworks no—lead brass (**ASTM Standard B62**), with full round top orifices, and ninety (**90**) degree stop rotation. Tee heads must be designed for connection to curb box shut-off rods similar to **Mueller #82865** or **AY McDonald #451-414**.

Curb stop valves shall be "O" ring seal plug or ball types. Inverted or tapered plug valves, as well as stop and waste designs, are not accepted.

Curb stop valves shall be, furnished in one (1) inch, one and one-half (1-1/2) inch, and two (2) inch sizes for use with **Type K** copper tubing.

Copper joints on curb stop valves shall be compression type, complying fully with the specifications in Section 12.19 **Copper Compression Joint Specifications**.

The following manufacturers are listed as offering curb stop valves in essential compliance with these specifications. Responsibility rests with the supplier to demonstrate that a particular curb stop model complies fully with these specifications. **Manufacturers other than those listed may be acceptable, and will be given full consideration, provided the supplier can satisfy the City that these specifications are met.**

1. Mueller Company, Decatur, Illinois
2. A.Y. McDonald Manufacturing Company, Dubuque, Iowa (1” ONLY)

12.24 Curb Stop Box Specifications

Curb stop boxes shall be extension type, with arch pattern bases, for a nominal six (6) foot trench depth. Upper sections shall be of steel and shall telescope a minimum of twelve (12) inches. Provisions shall be made to prevent the upper sections from turning or from pulling out of the base sections.

Upper sections for three-quarter (3/4) inch and one (1) inch curb stop boxes shall be one (1) inch size. Upper sections for larger curb stop boxes shall be one and one-quarter (1-1/4) inch in size. The base sections shall be adequately sized to accommodate Mueller Oriseal pattern curb stops.

Stationary rods thirty-six (36) inches long shall be furnished with curb stop boxes. Rod design shall center the upper end of the rod in the upper box section.

Lids shall be furnished with curb stop boxes. Lids shall have brass bushings iron pipe threaded, and shall be cast with lettering to indicate a water service valve.

Curb stop boxes shall be coated, inside and outside, with coal tar enamel.

The following manufacturers are listed as offering curb stop boxes in essential compliance with these specifications. **Manufacturers other than those listed may be acceptable, and will be given full consideration, provided the supplier can satisfy the City that these specifications are met.**

Stop size	Manufacturer	Box Number	Lid Number
1	A.Y. McDonald	5601ALR	5601L
1-1/2 & 2	A.Y. McDonald	5603ALR	5601L
1	Mueller	H-10314	89982
1-1/2 & 2	Mueller	H-10386	89981

12.25 **Service Saddle Specifications**

Service saddles shall be of the double strap type in pipe sizes up to sixteen (16) inch, and triple strap in larger pipe diameters. Saddles shall be designed for a working pressure of three hundred (300) PSI.

Outlet opening shall be furnished with **AWWA "CC"** type tapered threads in one and one-half (1-1/2) inch, and two (2) inch sizes.

The saddle body shall be made of ductile iron with an enamel coating, and complying with **ASTM Standard A536**. Straps and nuts shall be made of forged low alloy steel, electro-galvanized with di-chromate seal and conforming to **ASTM Standards A108** and **B633**. The inlet gasket shall be of "Buna-N" rubber, cemented in place.

In soils considered corrosive, service saddle material of construction shall be: Saddle body made of waterworks no-lead brass, with straps and nuts made of silicon bronze, all in compliance with **AWWA Standard C800**.

The following manufacturers are listed as offering service saddles in essential compliance with these specifications. Responsibility rests with the supplier to demonstrate that a particular saddle fully complies with these specifications. **Manufacturers other than those listed may be acceptable, and will be given full consideration, provided the supplier can satisfy the City that these specifications are met.**

1. Smith-Blair 317
2. Power Seal 3417DI

12.26 **Service Fitting Specifications**

Service fittings shall be manufactured of waterworks bronze **(ASTM B-62)**.

Services fittings shall be, furnished in one (1) inch, one and one-half (1-1/2) inch, and two (2) inch sizes for use with **Type K** copper tubing in the same standard water tube sizes.

Copper joints on service fittings shall be furnished with compression joints complying with Section 12.19 of these specifications.

12.27 **Horizontal Directional Boring**

Directional boring/drilling installation shall be accomplished where required on the Plans or in the Special Conditions to minimize disturbance of existing surface improvements. The Contractor shall be compensated for the restoration work only within the areas at the connection points, or other locations as may be approved by the Engineer. The Contractor shall be responsible for repairs, without compensation, for any other repair areas, including pit/boring points and areas above the drilled pipe where underground pressure may cause heaving or damage to pavement and ground surfaces.

The Contractor must submit boring/drilling pit locations to the Water Superintendent, or their designee for approval before beginning construction. Boring pits may be located within roadway right-of-way and easements as authorized by the City of Rockford. Any other locations that may be desired by the contractor for boring pits or other uses shall be the responsibility of the Contractor to attain authorization, including private property as may be required.

The drilling equipment shall be capable of placing the pipe as shown on the plans. The installation shall be by a steerable drilling tool capable of installing continuous runs of pipe without intermediate pits, at a minimum distance and radius requirements per the manufacture's specification and recommendations. The guidance system shall be capable of installing pipe within 6-inches of the plan vertical dimensions required to remove and reinstall pipe, which vary in depth and alignment from these tolerances.

Pull back forces shall not exceed the allowable pulling forces for the pipe being installed. The minimum radius of the pipe shall be per the manufacture's specification and recommendations. Drilling fluid shall be a mixture of water and benonite clay and shall be designed for existing soil conditions. Disposal of excess fluid and spoils shall be the responsibility of the Contractor.

12.28 **Hydrostatic Testing**

After the pipe has been laid and partly backfilled as specified, all newly laid pipe or any valved sections of it shall, unless otherwise expressly specified, be subjected to a hydrostatic pressure equal to fifty (50) percent more than the operating pressure at the lowest elevation of the pipe section, but not to exceed the pressure rating of the type of pipe specified. The duration of each pressure test shall be for a period of not less than one hour and not more than six hours. The basic provisions of AWWA C-600 and C-603 shall be applicable.

Each valved section of pipe shall be, slowly filled with water and the specified test pressure applied. Before applying the specified test pressure, all air shall be expelled completely from the pipe, valves and hydrants. If permanent air vents are not specified, the contractor shall install corporation stops at all points located at a higher elevation than the immediately adjacent sections of main so that air can be expelled as the line is filled with water. After air has been expelled, corporation stops shall be closed and test pressure applied.

After test pressure has been reached and the system allowed to stabilize, not more than plus or minus five pounds per square inch gauge (+or- 5 PSIG) deviation will be allowed for the duration of the test.

All exposed pipe, fittings, valves, hydrants and joints shall be carefully examined. All joints showing visible leaks shall be repaired by the contractor. Any cracked or defective pipe, fittings, valves, or hydrants discovered in consequence of the pressure test shall be removed and replaced by the contractor. The test shall be repeated until satisfactory to the City.

A leakage test shall be conducted if the pressure test can not be satisfactorily completed. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved sections thereof, to maintain pressure within five pounds per square inch (5 PSI). Leakage **shall not** be measured by a drop in pressure in a test section over a period of time.

No pipe installation will be, accepted if the leakage is greater than specified in **AWWA Standard C600-87**, which is, determined by the following formula:

JOB NO. _____

ROCKFORD WATER DIVISION
LEAKAGE TEST RESULTS

Date _____ Subdivision _____

Inspector _____ Contractor _____

$$\text{Formula:} \quad L = \frac{SD\sqrt{P}}{132{,}200}$$

L = Allowable leakage, in gallons per hour *
S = Length of pipeline, in feet
D = Pipe diameter, in inches
P = Test pressure, in PSI (100 PSI minimum) (150 PSI Standard)

ALLOWABLE LEAKAGE: L = _____ gals. / Hr.*

TEST RESULTS: L = _____ gals. / Hr.

* NOTE: When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gph/inch of nominal valve size shall be allowed.

PROCEDURE

1. Slowly fill the water main expelling air at the highest point.

2. Corporation stop used for test procedure should be at the highest elevation, otherwise 0.433 PSI/ft. differential must be added to the 100 PSI minimum test pressure.

3. After test pressure has been reached, start one (1) hour timing period.

4. During one (1) hour test, periodically pressurize system to maintain no more than five (5) PSI loss from original test pressure.

5. Note the original water mark and amount of draw-down on final pressurization at the end of the one (1) hour test.

6. Measure and record the amount of water lost compared to the allowable leakage determined in the formula above. No pipe installed will be accepted if the leakage is greater than determined by the formula.

ALLOWABLE LEAKAGE:

$$L = \frac{SD\sqrt{P}}{132{,}200}$$

L = Leakage (gals. /hr.)
S = Pipeline length (ft.)
D = Pipe diameter (in.)
P = Test pressure (100 PSI minimum = 10)
(150 PSI Standard = 12.25)

EXAMPLE:

1500 ft. – 30 - inch water main
1720 ft. - 8 - inch water main
115 ft. - 6 - inch hydrant branches off 8 - inch main

NOTE: **Only services larger than two (2) inches, where branch control valves might be found at property lines, are to be included in the leakage formula.**

$$L = \frac{(1500)\,(30)\,(\sqrt[12.25]{150})}{132{,}200} = \frac{551{,}250}{132{,}200} = 4.16 \text{ gal./hr. (30 inch)*}$$

$$L = \frac{(1720)\,(8)\,(\sqrt[12.25]{150})}{132{,}200} = \frac{168{,}560}{132{,}200} = 1.27 \text{ gal./hr. (8 inch)}$$

$$L = \frac{(115)\,(6)\,(\sqrt[12.25]{110})}{132{,}200} = \frac{8{,}452}{132{,}200} = 0.06 \text{ gal./hr. (6 inch)}$$

* Leakage test on the thirty (30) inch main conducted independently of the eight (8) inch main test. Allowable leakage on the eight (8) inch main and hydrant branches were combined.

ALLOWABLE LEAKAGE: = 4.16 gals. /hr. (30 inch)
= 1.33 gals. /hr. (6 & 8 inch)

12.29 **Disinfection**

After the backfill has been completely made, the contractor shall disinfect the pipeline in compliance with the provisions of **AWWA Standard C651** and the provisions herein specified.

Prior to disinfection, the pipeline or valved section thereof, shall be flushed at a minimum flow velocity of two and one-half (2-1/2) feet per second. Following full development of flow, flushing shall continue until the discharge runs clear or until the City direct flushing operations to cease. In no event shall the duration of flushing be less than ten (10) minutes. Water used in flushing shall be introduced into the pipeline at a point of connection with the existing distribution system designated by the City.

After flushing, the water main shall be disinfected in accordance with AWWA Standard C651. In accordance with the requirements of AWWA C651-99, at least one set of samples shall be collected from every 1,200 feet of new water main, plus one set from the end of the line and at least one set from each branch. Water used in disinfecting the pipeline shall be introduced into the pipeline through the pressure test connection made under the provisions of Section 12.28.

Bacteriological sampling shall be collected from the pipeline following disinfection and final flushing. Samples shall be delivered to the City of Rockford Environmental Laboratory (1111 Cedar Street) for analysis. Two passing consecutive presence and absence samples must be submitted in City of Rockford Laboratory approved bottles that must be obtained from the laboratory. A Coliform Analysis Report shall be submitted with each sample (also available at this address) and shall indicate the chlorine residual (either free or total) at the time the sample was collected. Failure to record the residual shall result in the rejection of the sample. If the sample shows the presence of coliform organisms, the contractor shall be notified

(contact information MUST appear on the bacteriological form) and repeat the disinfection procedure. On resampling, two (2) consecutively passing samples collected on successive days (a minimum of 24 hours between sampling) shall be required.

If valved sections of the pipeline are disinfected separately, each section will be considered a separate pipeline for disinfection, flushing and sampling.

The City of Rockford will retain a copy of all bacteriological laboratory reports and submit results to the Illinois EPA as required. A copy of the bacteriological report shall also be sent to the City Water Engineering Supervisor and the Contractor. This work will be incidental to the contract and will not be considered for further payment.

12.30 Miscellaneous Fittings & Connections

All fittings, i.e.; ells, reducers, tees, crosses, sleeves, offsets and bends will not be paid for separately. These items shall be included in the various bid items found in the non-participating items schedule.

12.31 Polyethylene Encasement of Water Main

Ductile Iron Pipe watermain is required by all Plans, Specifications, or Special Provisions, the watermain, services (ductile iron only), including valves, fittings, hydrant barrels, and appurtenances, shall be fully encased in polyethylene film meeting the requirements of these Specifications, *unless noted otherwise*. The film shall be furnished in tube form for installation on pipe and all pipe-shaped appurtenances such as bends, reducers, offsets, etc. Sheet film shall be provided and used for encasing all odd-shaped appurtenances such as valves, tees, crosses, etc.

The polyethylene tubing shall be installed on the pipe prior to being lowered into the trench. Tubing length shall be sufficient to provide a minimum overlap at all joints of one foot or more. Overlap may be accomplished with a separate sleeve tube placed over one end of the pipe prior to connecting another section of pipe, or by bunching extra overlap material at the pipe ends in accordion fashion, After completing the pipe jointing and positioning the overlap material, the overlap shall be secured in place with plastic adhesive tape wrapped circumferentially around the pipe not less then three (3) turns.

After encasement, the circumferential slack in the tubing film shall be folded over at the top of the pipe to provide a snug fit along the barrel of the pipe. The fold shall be held in place with plastic adhesive tape applied at intervals of approximately three (3) feet along the pipe length. In addition, any rips, punctures, or other damage to the tubing shall be, repaired as they are, detected. These repairs shall be made with adhesive tape and over lapping patches cut from sheet or tubing material.

At odd-shaped appurtenances such as gate valves, the tubing shall overlap the joint and be secured with plastic adhesive tape. After which the appurtenant piece shall be wrapped with a flat film sheet or split length of tubing by passing the sheet under the appurtenance and bringing it up around the body. Seams shall be made by bringing the edges together, folding over twice, and taping down. Whenever encasement is terminated, it shall extend for at least two (2) feet beyond the joint area.

Openings in the tubing for branches, service taps, air release valves and similar appurtenances shall be made by cutting an X-shaped slit and temporarily, folding back the film. After installing the appurtenance, the cut tabs shall be secured with tape and the encasement shall be completed as necessary for an odd-shaped appurtenance.

Polyethylene encasement material shall conform to the requirements of **AWWA Standard C-105 (ANSI Standard A21.5)** for tube installation and 8-mil nominal film thickness.

In addition, polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than eight mils.

The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of anti-microbial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.

Polyethylene encasement shall be V-Bio or approved equal.

12.32 **High Density Polyethylene (HDPE) Pipe for use in Environmentally Sensitive Areas**

HDPE Minimum design requirements for use in creek, river crossings and, as shown in design plans.
Joints: The pipe is to be, joined by heat fusion, flanges or other mechanical joint systems proven for HDPE pipes. All joints shall, be welded except for transitions to other materials. Mechanical joints shall have a stainless steel internal stiffener and joint restraint. Flanges shall be follower type, of ductile iron or stainless steel, *150-psi* pressure rated. Fittings shall be molded, or fabricated. Both pipe and fittings must be NSF listed by the manufacturer with the pipe bearing the NSF 61 logo or mark and, pressure rating.

Pipe: Pipe shall be high molecular weight, high density polyethylene (HDPE)
The material shall be appropriate for potable water and shall be, listed by Plastic Pipe Institute (PPI) with a designation of PE 3408 and have a minimum cell classification of 345434, or D as described in ASTM D3350.
The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material pipe.
Pipe and fittings shall be the same material and class, made in conformance with ASTM F714, and joined in accordance with ASTM D3261.
The pipe shall be homogeneous throughout and free of cracks, holes, foreign inclusions or other injurious defects. Pipe shall be uniform in density and other physical properties.
The HDPE pipe for Horizontal Directional Drilling (HDD) installation shall be Thermal Butt-Fusion Welded Joints. Friction or pressure couplings are, not allowed. Flanged joints with SS backup flanges shall be, used as transitions to different pipe materials. Butt Fusion technique shall meet all requirements of ASTM D2657, D3261 and in accordance with pipe manufacturer requirements and recommendations.

HDPE Fittings: All fittings shall be, provided as indicated on the plans. HDPE fittings shall be of the same material and class as the pipe and shall be, manufactured by the manufacturer of the pipe. HDPE elbows, tees and wyes shall be, manufactured by mitered fabrication. The manufacturer shall have a written specification for all standard mitered fittings, which establishes Quality Control criteria and tolerances.

Mechanical Joint anchor fittings (MJ Adapter) shall be used to transition from Ductile Iron Pipe to HDPE pipe. The fittings shall be stronger than the pipe when it is, subjected to tensile stress where the pipe will pull apart before the fitting will pull out and, the pipe will rupture before the fittings will burst under pressure. Compression type connections are, strictly not allowed.

Alignment of Horizontal Directional Drilling:
No subsurface investigations shall be, allowed within the shown wetland area
Bore profile shall be, designed to avoid blowout and leakage of slurry or grout in the wetland area.
No slurry leak or spoil shall be, allowed to enter into the wetland during construction activities.
No damage, settlement or heave shall be, allowed to occur to surrounding utilities, pavements or other structures

Certification and Testing:
The contractor shall certify the pipe meets all design requirements.
The Contractor shall pressure test the fabricated pipe prior to pullback and after installation is, completed in accordance with AWWA C906 and manufacturer recommendations. The testing pressure shall be 125% of maximum design pressure for the duration of 2 hours.
Pass a pig through the entire reach of HDPE pipe. The OD of the pig shall be 95% of the nominal ID of pipe.

The Contractor shall be responsible for the design of installation using H D D or other methods. The Contractor shall furnish all of the technical expertise and effort required to perform any necessary additional subsurface investigations and to prepare design drawings.

Required design criteria:
The Contractor's design shall include, but not be limited to, the following:

Support system for launching and receiving pits
HDPE pipe plan and profile and detail drawings
Geotechnical instrumentation and monitoring of adjacent facilities
Contact grouting
All pipe connections
Entry and exit angles
Depth and radius of bore
Adequate vertical and horizontal clearance from creek, river and other facilities and utilities
Details and other design criteria.