City of Knox, Indiana

WATER

PROJECT

CONSTRUCTION

STANDARDS

COPY

Adopted: 8/23/2022 (Date)

City of Knox, Indiana
Water System Construction standards

SECTION 1. GENERAL PROVISIONS

SECTION 2. WATER MAIN STANDARDS AND REQUIRMENTS

SECTION 3. SERVICE CONNECTION STANDARDS

SECTION 4. SURFACE RESTORATION & EROSION CONTROL

Figures:

SECTION 1 - GENERAL PROVISIONS

1.01 – Purpose and Objectives

A. These standards set forth uniform requirements for users of the City Public Water Supply (PWS) and is intended to enable the City to comply with current and applicable state and federal regulations.

B. The objectives of these standards are:

1. To assure quality of City supplied potable water to end users.
2. To prevent contamination of the City PWS.
3. To provide minimum standards for design, materials, and workmanship of construction of City PWS.
4. To clarify responsibilities of the Developer, Contractor, End user, and City.

C. These standards provide for regulation of construction of water system through the issuance of permits to connect to the City Public Water Supply system and through enforcement of the general guidelines.

1.02 Definitions and terms

Abbreviations and Definitions - Whenever the following abbreviations, or definitions are used in these standards or other documents, the intent and meaning shall be interpreted as follows:

A. **Abbreviations**

ASTM ..... American Society of Testing and Materials

AASHTO..... American Association of State Highway and Transportation Officials

AWWA ..... American Water Works Association

ANSI ..... American National Standards Institute

ASME ..... American Society of Mechanical Engineers

ACI ..... American Concrete Institute

NEMA ..... National Electrical Manufactures Association

INDOT ..... Indiana Department of Transportation

IDEM ..... Indiana Department of Environmental Management

OSHA ..... Federal Occupational Safety and Health Act

PWS..... Public Water System

SDWA..... Safe Drinking Water Act (Federal)

EPA..... United States Environmental Protection Agency

B: **Definitions**

Acceptance: The formal written acceptance by the City of an entire project which has been completed in all respects in accordance with the approved Plans, Specifications, and these Standards including any previously approved modifications thereof.

Backfill: Earth and/or other material used to replace material removed from trenches during construction which is above the pipe bedding.

Bedding: That portion of the trench backfill which encases the water pipe to a minimum depth above and below the bell/barrel of the pipe, as provided in the section of these Standards. For the purpose of properly supporting the pipe.

City: The City of Knox, Indiana along with their employees and representatives.

City Representative: The authorized agent of the City of Knox assigned to make detailed observations of any or all portions of the work.

Contractor: Any Contractor who meets the City requirements and is licensed to enter into contracts for and to perform the construction work.

Corporation Stop: a fitting inserted in the water main to be used to connect a service tap.

County: Starke County, State of Indiana.

Curb Stop or Service Valve: A fitting inserted in the service pipe near the curb or street edge for turning on or shutting off the flow of water to the customer or consumer

Customer or Consumer: The person, firm, corporation, governmental agency or association having interest, whether legal or equitable, sole or only partial, either as tenant or owner, in any property which is, or is to be, supplied with water service.

Developer: Any individual, partnership, firm, corporation, or other entity who, as property owner, is initiating the work.

Director: Director of the Planning Department or his/her authorized representative.

Easement: Easements are areas of property outside of dedicated public rights-of-way, granting the City rights of access to build, repair, and maintain water lines or other utilities.

Engineer: The Engineer in responsible charge of design on behalf of the Developer/Contractor.

Inspector: A direct employee of the City or A City representative assigned to make detailed inspection of any or all portions of the work and materials. The inspector has full authority to reject materials and/or any portion of the work not supplied and installed in accordance with these Standards. The inspector shall also have the full authority to stop the work, if necessary, to resolve issues or conflicts relative to construction.

Other Specifications and Materials: Wherever in these Standards other specifications or regulations are mentioned, it shall be understood that the materials and methods mentioned therewith shall conform to all requirements of the latest revision of the specifications so mentioned.

Permits: Clearance to perform specific work under specific conditions at specific locations. The Developer or their duly authorized representative shall furnish to the City all necessary plans, specifications, and documents required by the City to make application for permits.

Plans: Construction plans, including system maps, water main plans, and profiles, cross sections, utility plans, detailed drawings, etc., or reproductions thereof, approved or to be approved by the City and/or City's Representative, which show location, character, dimensions, and details of the work to be done.

Plumber: A qualified person or firm licensed by the state of Indiana and registered by the City to perform plumbing services including installation and repair of water distribution piping.

Premises: A dwelling, building, structure, or parcel of real estate which is normally supplied through a separate water service pipe and meter.

Private fire service or system: A privately owned arrangement of pipes, fixtures, and devices designed for stand-by service and from which is taken only for the extinguishment of fires.

Record Drawing (As-Built): Plans indicating that the Plans have been reviewed and revised, if necessary, to accurately show all as-built construction and installation details including, but not limited to, key elevations, locations and distances.

Right-of-Way: All land or interest therein which by deed, conveyance, agreement, easement, dedication, or process of law is reserved for or dedicated to the use of general public, within which the City shall have the right to install, inspect, repair, and maintain water mains and appurtenances.

Service Tap or Connection: The conduit for transporting water from the water main into the building.

Standard Drawings: The drawings of structures, pipes, components, details or devices commonly used and referred to on the Plans and in these Standards.

Standards: The Standard Specifications, design and construction of water facilities and their locations within the City of Knox as contained herein and all subsequent additions, deletions, or revisions.

Tap Fee: The fee associated with performing the connection of the Service Tap to the Water Main.

Ten State Standards: Recommended Standards for Water Works, latest edition, developed by the Committee of the Great Lakes – Upper Mississippi River Board of State Public Health and Environmental Managers.

Trench: The excavation of pavement and earthen material to build and install the water system including pipes, fittings, valves, and appurtenances.

Uniform Plumbing Code: The Uniform Plumbing Code adopted by the current International Association of Plumbing and Mechanical Officials, current edition.

Water Main: The conduit for transporting water to service taps and fire hydrants.

Water Meter: The device used to measure and record the quantity of water supplied to the customer by the Water Utility

Water Superintendent: Authorized Agent of the City of Knox.

Work: All of the construction to be done under the City's permit, in accordance with the approved Plans, Specifications, these Standards, and conditions.

1.03 GENERAL RULES AND REQUIREMENTS

A. The instructions and directives included herein cover the design and construction of water facilities. The City of Knox is responsible for these instructions and directives and issues these guidelines. The purpose of these Standards is to establish minimum criteria for design, materials, and workmanship.

B. All water lines and facilities shall be designed and constructed in full accordance with these Standards, Indiana Department of Environmental Management (IDEM), and Ten States Standards for Water Works, latest edition. All water main extensions shall conform to Indiana Rule 327 IAC 8-3.2 "Technical Standards for Water Mains".

C. The jurisdiction of the Standards includes the entire water distribution system and its appurtenances. It shall be the Developer's/Contractor's responsibility to comply with all requirements of the City or other authority having jurisdiction on work if such authority imposes greater requirements. Furthermore, the developer shall be responsible for procuring all necessary permits and licenses, pay all charges and fees for acquiring and recording all easements, and giving all notices necessary and incidental to the work.

D. Addenda and/or revisions to these Standards may be issued periodically and will be distributed and made available to the public, developers, and contractors at the City Office. Users shall be responsible to keep apprised of any changes and revisions to these Standards. Any conflicts between these Standards and any applicable State laws shall be superseded by such law. If any conflict arises between these Standards and applicable City Ordinances, the Ordinance shall prevail. These Standards are approved and adopted by the City of Knox Board of Public Works and Safety.

E. Supply From One Service-- No more than one house or building shall be supplied from one service connection except by special permission of the Board of Public Works. Whenever two or more parties are supplied from one pipe connecting with a service main, each building or part of building separately supplied shall have a separate means of lockable shut off or stop box and a separate meter.

F. Turning On Water, Tapping Mains--No person, except an authorized city employee, shall turn on any water supply at the curb stop box, or tap any distributing main or pipe of the water supply system or insert a stop cock or other appurtenance therein without a City permit.

G. Use of Fire Hydrants--No person, other than an authorized city employee or fire department personnel, shall operate a fire hydrant or interfere in any way with the City water system without first obtaining authority to do so from the Water Superintendent.

H. Private Water Supply--No water pipe of the City water supply system shall be connected with any pump, well, or tank that is connected with any other source of water supply. When any such connection is found, the Water Superintendent shall notify the owner to sever the connection and if this is not done immediately, the City shall turn off the water supply forthwith. Before any new connection to the city system is permitted, the department shall ascertain that no cross connection will exist when the new connection is made.

I. Permitting Use By Others--No person shall permit City water to be used for any purpose except upon his own premises except in an emergency and then only if written permission is first obtained from the water superintendent. Anyone wishing to obtain water from a hydrant for construction purposes shall make application to the water superintendent for such services.

J. Contractor Requirements - The developer/owner shall notify the Water department of their choice of contractors prior to the work. Selected Contractors shall be licensed and bonded and shall provide proof of insurance upon request of the City.

K. Record Drawings – The Contractor shall provide record drawings. All plans submitted as record ("as-built") drawings shall have all pertinent items shown on the plan view and properly scaled and dimensioned. All elevations, final dimensions, pipe sizes and tap locations are required to accurately and legibly display on the drawings. This includes pipes, vaults, valves, hydrants, casings, etc. All sheets shall have the phrase "as-built" or "record drawing" boldly printed on them with the date and signature of the Preparer.

1.04 RIGHT OF WAYS (R.O.W) AND EASEMENTS

A. Whenever possible water mains shall be constructed within the public right-of-way.

B. Should the construction be outside the limits of the public right-of-way, recorded easements shall be acquired, dedicated and recorded solely for the benefit of the City of Knox. The **minimum** permanent easement width to be dedicated to the City for the water main is 15 feet. All water mains shall be centered in the easement unless sewer line is present and not less than 15 feet from any building line. In that case, maintain minimum 10 feet of separation between water and sewer lines. The easements shall be exclusively under the discretion and control of the City. Ingress and egress shall be available to the City's crew at all times. No utility companies are allowed to use the easements for installation of their utility lines without the expressed written permission of the City.

C. Drawings and legal descriptions for easements shall be prepared by a Registered Land Surveyor licensed in the State of Indiana.

1.05 DRAFTING STANDARDS FOR WATER PROJECT ENGINEERING DRAWINGS

A. General - These Standards have been established for the purpose of ensuring uniformity in the design and drafting techniques of projects to be submitted for review and acceptance.
   1. All projects submitted, having more than two (2) sheets, shall have a title sheet which will include:
      a. General Overall Area Map;
      b. Vicinity Location Map;
      c. A Site Plan Detailing the Project;
      d. Name/Title of Project,
      e. Owner and Engineer's Name; and
      f. Professional Engineer's Seal and Signature.
   2. All sheets are to be certified and dated by a professional engineer licensed in the State of Indiana.
   3. All sheets are to be numbered, with total number of sheets included.
   4. Include detail sheet(s)/specification sheet(s), as applicable.
   5. Design drawings shall be 24-inch by 36-inch.

B. Scales - The following scales for drawings are required:
   1. Plan and Profile: Variable; Not to Exceed 1"=50' Horizontal and 1"=5' Vertical.
   2. Cross Sections: 1"=5' Horizontal and Vertical

C. Plan and Profile Sheets
   1. General
      a. North Arrow;
      b. The Scales Used;
      c. Project Name and Number, Sheet Number, Date Drawn, Date and Nature of Revisions;
      d. All topography in the area affected by construction;
      e. Apparent and proposed Right-of-Way lines, Property lines, and Easements;
      f. Locations of bench marks with proper descriptions and datum;
      g. Locations of all existing and proposed utilities in the proper area including service taps and proposed sewer laterals;
      h. Match lines shall be easily identifiable.

   2. Water Main Profile Drawings - All water main profile drawings shall include the following, as a minimum:
      a. Existing and finished grade lines;
      b. Depth of burial to top of pipe;
      c. Elevations to USGS datum;
      d. Types of materials used;
      e. Profile of existing and proposed utilities; and
      f. Special construction required due to unfavorable soil conditions, jacked and bored casing pipe, etc.

D. Details
   1. All pertinent information shall be included on these pages such as trench diagrams with depths and materials, thrust restraint, hydrant assemblies, pipe crossing diagrams, valve assemblies, pipe casings, etc.
   2. Any special design criteria that is part of the project.

Section 2 – Water Main Standards and Requirements

2.01 WATER MAIN GENERAL DESIGN REQUIREMENTS AND LAYOUT

A. Requirements for Construction Permits are as follows:

1. It shall be the responsibility of the Developer to file the "Notice of Intent" for the construction or modification of any facility as part of the Water Utility from the Indiana Department of Environmental Management (IDEM), or any other applicable regulatory agency.

2. The City of Knox Water Superintendent shall issue final approval for the installation of all water facilities. All facilities shall be designed and installed in accordance with these Standards as well as applicable State and Federal regulations.

3. Plans showing locations, dimensions, material, and details shall be submitted to the City for any development that includes water service.

4. The developer shall be responsible for design and construction of the water distribution system including water main extensions, valves, fittings, meters, meter pits, corporation stops, curb stops, valve boxes, service taps, etc. in accordance with the standards set forth herein.

5. Street/curb cut permit must be completed with the Knox Street department.

6. A copy of these permits/notifications shall be filed with the City Water Department.

B. Water Main Separation distances:

1. Horizontal and Vertical Separation: Water mains shall be separated from existing or proposed sanitary and storm sewers (sewers) and building services (laterals). The distance shall be measured from the exterior edge of pipe to exterior edge of pipe. **Crossings** shall be made at an angle **greater than or equal to 45°** as measured from centerline of sewer pipe to centerline of water pipe.

Horizontally: 10 feet

Vertically (When crossing): 18 inches

All sewer pipe joints within 10' horizontal distance shall be compression type joints. All sewer pipes crossing water mains shall be marked to identify it as a sewer pipe. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be constructed of water main grade pipe as specified in the materials Section with compression type joints. Laterals shall be constructed of PVC SDR 26 with compression type joints. The water main and crossing pipes shall not be in contact.

4. Water mains shall be buried to a minimum depth of 5'-0" from proposed surface of ground to top of pipe.

5. Water mains shall not be constructed within 8 feet horizontal distance of a sanitary sewer manholes, storm sewer manholes, or drainage grate structures.

6. Water mains shall not be constructed within 10 feet horizontal distance from any above ground or underground storage tanks containing sewage or septic system treatment equipment, absorption fields, liftstations, or grave sites.

7. Water mains shall be separated from any aboveground or underground storage tanks and their distribution services containing hazardous materials, petroleum products, or waste materials by a distance of 25 feet horizontal distance from the exterior edge of the water main to the exterior edge of the tank or distribution device and shall not cross such tanks or distribution device.

8. Water Mains shall be separated by 50 feet from landfills.

9. Water mains near Surface Water Bodies shall be separated from existing or proposed bodies of water by 10 feet horizontal distance. Where mains cross water bodies:
   a. Water mains located under surface water bodies less than 15' in width at the crossing point shall be coved with a minimum of 2 feet of material.
   b. Water mains located under surface water bodies greater than 15' in width at the crossing point shall be constructed with watertight flexible joints and valves at each end of the crossing that are accessible from the ground surface and not subject to flooding. The upstream valve shall be installed in a manhole structure or meter pit with permanent taps made on each side of the valve to allow insertion of a leakage meter and for sampling purposes.
   c. Water mains located above surface water bodies shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement. Mains above surface water bodies shall be designed for ease of repair or replacement.

C. Valve locations:
   1. Sufficient valves shall be provided on water mains so that mains can be shut down for repairs without inconvenience to water users or creating a sanitary hazard. Valves and tee fittings shall be provided at all locations where future mains will be installed to serve future development.

   2. Valves shall be installed at every intersecting right of way such that the flow of water can be shut off in each direction of flow, at locations so that the maximum distance between valves is less than 600', and at the end of each dead end.

   3. Where customers are widely scattered, the maximum distance between valves can be increased to 2,500 feet.

D. Fire Hydrants:
   1. Fire hydrants shall be installed at points near intersection of streets and at intervals of approximately 500'. The maximum distance between hydrants shall be less than 600'.

   2. Hydrants shall be connected to a water main of at least 6 inches in diameter, and have an auxiliary valve. The auxiliary valve shall be located greater than 18" from the hydrant to allow for T-handle operation.

3. All fire hydrants shall be arranged for operation with operating nut of size and shape which is the same as that of the existing fire hydrants, or as specified by the local Fire Department.

4. Pumper nozzle shall have a normal setting of between eighteen (18) and twenty-four (24) inches above the curb or centerline of road and if necessary, the Developer/Contractor shall furnish extensions.

5. Fire hydrants shall have a means of drainage that will not erode surrounding areas or damage property. The means of drainage shall not consist of being discharged to the sanitary sewer.

E. Dead Ends:

1. Water mains shall be looped wherever practical to provide two directions of flow and avoid dead ends where flow can become stagnant.

2. As a rule of thumb, dead ends will not be allowed if the length of the looping extension does not exceed 25% of the total length of the water main extension. The City Board of Public Works shall be the sole authority for requiring a looping extension of a water main for proposed developments.

3. Where dead ends occur, they shall consist of a valve followed by one section of pipe (20' or less), and be provided with a fire hydrant if the flow pressure is sufficient or with an approved flushing hydrant or blow-off for flushing purposes as approved by the City and Water Superintendent.

4. Flushing devices should be sized to provide flows with a minimum velocity of 2.5 feet per second in the water mains being flushed.

5. No flushing device shall be directly connected to any sanitary sewer.

2.02 WATER MAIN SIZING:

A. Fire flow: If the water main includes fire flow with fire hydrants, the **minimum size** of the pipe shall be **6 inches** in diameter. The system shall be designed to provide fire protection and sized by hydraulic analysis based on flow demands and pressure requirements. The system shall be designed to maintain a **minimum pressure of 20 psi** at ground level at all points in the distribution system under ALL conditions of flow. System design shall be such that fire flows and facilities are in accordance with the requirements of the State Insurance Services Office.

B. Domestic flow: For water mains that do not include fire flow, **Domestic usage** design shall assume a peak hourly flow of no less than 1.0 gpm per residential customer. Considerations shall be made for commercial and industrial use according to table 2-1 in Rule 327 IAC 8-3.3-2 with a peaking factor as a minimum. The normal working pressure in the distribution system shall be approximately 60 psi and not less than 35 psi during peak conditions. The **minimum size** of water mains not shall not be less than **4 inches** in diameter.

C. Hydraulic calculations: Hydraulic calculations shall be prepared by the Developer/Contractor's Engineer and submitted to the City and City Engineering Representative for review and approval. Any departure from minimum requirements shall be justified by hydraulic analysis and future water use,

and will only be considered in special circumstances. Hydraulic calculations shall be based on Pressure/flow testing of the nearest fire hydrants to determine friction losses of the existing water main. If necessary, booster pump systems shall be supplied to maintain minimum pressures at the Developer/Contractor's expense.

D. Depth: The minimum depth for all water mains shall be 5.0 feet (60 inches) from top of the pipe to finished grade. The maximum depth shall be 6 feet (72 inches) from top of pipe to finished grade at all valves and hydrants.

2.03 MATERIALS:

A. All piping, accessories, and other materials in a water main shall conform to all applicable Indiana 327 IAC 8-3.2-8 state codes.

B. Water Main Pipe: Water main Pipe shall be constructed of the following materials:

1. Ductile iron pipe shall be Pressure Class 350 (12" dia. or smaller) or Pressure Class 250 (14" dia. or greater). Ductile iron pipe shall conform to the following applicable standards:

    a. ANSI/AWWA C104/A21.4 American National Standard for Cement-Mortar Lining for ductile-iron pipe and fittings for water.

    b. ANSI/AWWA C105/A21.5 American National Standard for Polyethylene Encasement for Ductile Iron Systems. In some cases, due to corrosive soil conditions or as required by the City, polyethylene encasement may be necessary.

    c. ANSI/AWWA C111/A21.11 American National Standard for Rubber Gasket Joints for Ductile-Iron Pipe and Fittings.

    d. ANSI/AWWA C150/A21.50, Thickness Design of Ductile Iron Pipe.

    e. ANSI/AWWA C151/A21.51, Ductile Iron Centrifugally Cast, for Water.

2. Plastic pipe (For 12 inches in diameter or less):

    a. PVC meeting AWWA C 900 specifications for pipes 12" in diameter or less. Pipe shall conform to minimum pressure class 235 psi (DR-18).

    b. Polyethylene (PE) pressure pipe meeting AWWA C 906 specifications for pipes 12" in diameter or less. Pipe shall be designated PE 4710 with a minimum pressure rating of 255 psi (DR9). Joints shall be electro-fusion welded according to ASTM F-2620. PE pipe shall be NSF/ANSI standard 14 certified for potable water contact. PE pipe shall be ductile iron pipe size to allow for use of ductile iron fittings.

C. Fittings: All fittings shall be ductile iron mechanical joint conforming to ANSI/AWWA C110/A21.5 or ANSI/AWWA C153/A21.53 for compact fittings. Restrained joints shall use Mega-lug restraints or equivalent, and be installed per equipment manufacturer's specifications.

D. Valves and Appurtenances: Valves shall be of resilient wedge type with mechanical joint ends. Valves shall be rated for at least 250 psi and meet or exceed all applicable requirements of

ANSI/AWWA C515*** Standard, UL 262 Listed, FM 1120/1130 Approved, and certified to ANSI/NSF 61 & 372. Valves shall have a 2" square nut stem on which to fit a T-handle wrench for valve operation. Valve boxes shall be 2-piece, screw type, asphaltic coated, and conform to ASTM 48 class 35B gray iron specifications. The valve box cover shall have the word "Water" clearly marked on top.

E. Fire Hydrants: Fire Hydrants shall be rated for 350 psi, minimum. Hydrants shall be able to provide 2.5 cubic feet per second of water velocity at the point immediately preceding the exit point. Fire hydrants shall have a bottom valve size at least 5 inches in diameter, a 5" Storz style pumper nozzle (4.5"NST x 5" Storz Adapter acceptable), and two 2.5 inch nozzles. Hydrants shall Meet or exceed the requirements of ANSI/AWWA C502 standards. Hydrants shall have an attached fiberglass rod to warn snow plows. The fiberglass marker shall be a model 17707 as manufactured by Mutual Industries, or equivalent.

F. Tracing Wire: A continuous solid wire shall be buried in the pipeline trench directly above the main to facilitate main location. The wire shall be solid #12 standard copper wire with thermoplastic insulation and capable of carrying 600 volts.

G. Lubricants: Lubricant shall be non-toxic and shall not support the growth of bacteria and shall have no deteriorating effects on the gasket or the pipe. It shall not impact a taste or odor to the water in a pipe that has been flushed in accordance with AWWA/ standard D 601. The lubricant containers shall be labeled with manufacturer's name.

H. Harware: All fasteners used in connecting joints and fittings shall be made of 304 or 316 stainless steel.

I. Joint Restraining devices: shall be Mega Lug or equivalent.

J. Buried Water Line Caution tape – Tape shall be 5 mil thick polyethylene, 3 inches wide, blue in color with Black lettering, and Words such as "'Caution – Buried Water line below".

2.04 CONSTRUCTION AND INSTALLATION

A. GENERAL: These standards shall apply to all areas of the construction. Where the construction passes through previously developed areas, special attention shall be given to the applicable portions of this section. The contractor shall provide knowledgeable personnel that will perform in a workman like manner supplying a professional installation.

1. Clearing: Preparatory to excavation, the site of all open cut excavations, embankments, and fills shall be first cleared of obstructions and existing facilities (except those which must remain temporarily or permanently in service).

2. Top Soil Stockpile: On all public or private property where grants or easements have been obtained, and on the property of the City, the Developer / Contractor shall remove and keep separate the top soil, and shall carefully replace it after the backfilling is completed.

3. Pavement Cutting: Prior to excavating paved areas, all excavation edges falling within the pavement shall be saw cut in a neat, straight manner. Cutting shall be performed with a saw

designed specifically for this purpose. The cut shall penetrate the entire pavement thickness where possible. If the existing pavement is more than 6 inches thick, then a cut of not less than 6-inch depth shall be made. If pavement cuts are made in streets which are opened to traffic prior to excavation, then the cuts shall be thoroughly filled with sand and maintained full until the excavation is performed.

4. Protection of Existing Improvements: Before any excavation is started, adequate protection shall be provided for all existing utilities and City owned structures.

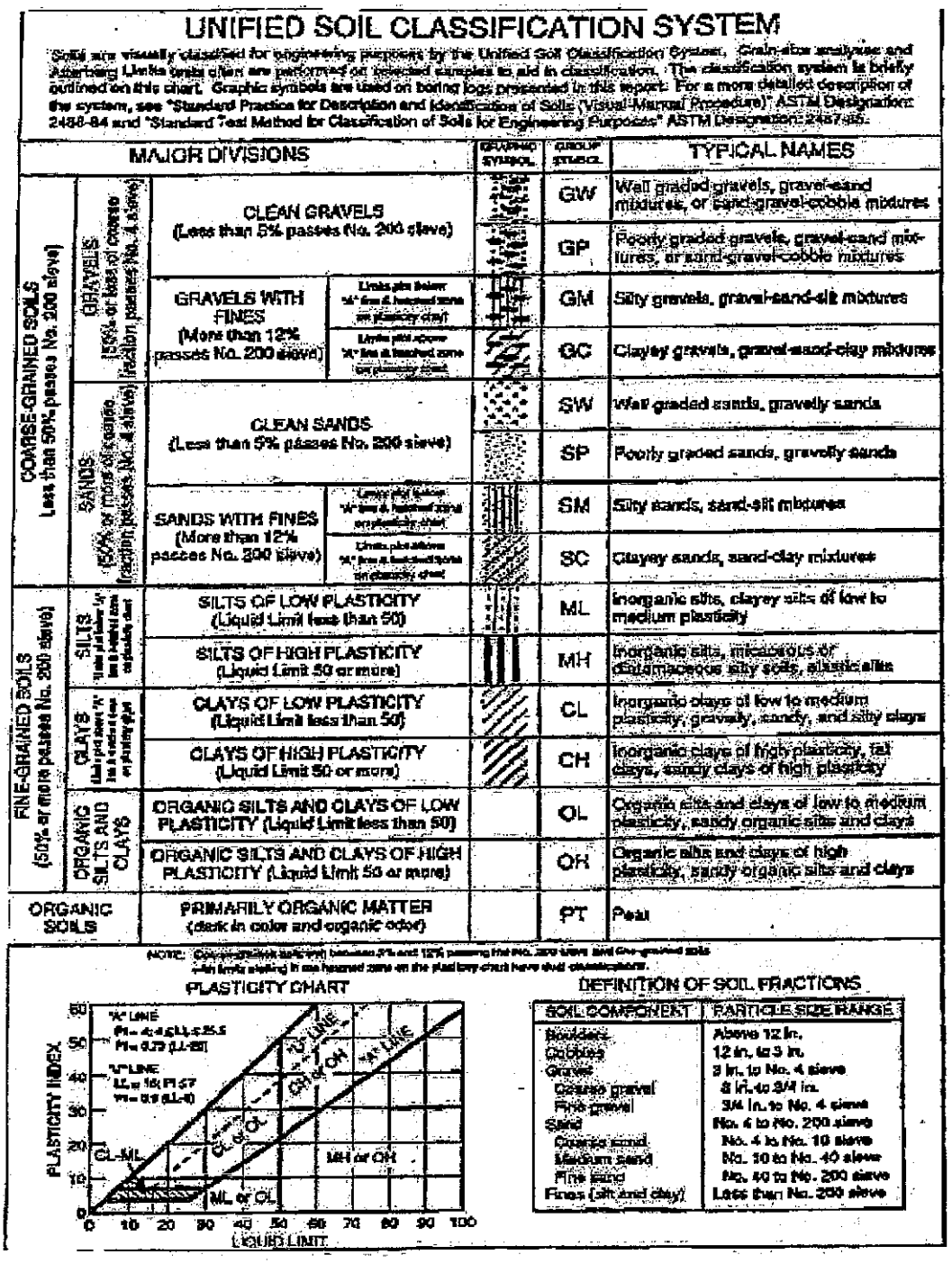
5. Protection of Trees and Shrubs: No existing trees or shrubs in street right-of-ways and easements shall be damaged or destroyed unless otherwise authorized. Where branches of trees or shrubs interfere with the Contractor's operations, they shall be protected by tying back wherever possible. No limbs or branches shall be cut. If his operation will not permit saving certain trees, the Contractor shall be wholly responsible for satisfying all claims for restoration or restitution resulting from their damage or removal. If small trees and shrubs are moved or pruned to permit more working space, pruning shall be done in accordance with Home and Garden Bulletin No. 83, U.S. Department of Agriculture, "Pruning Shades Trees and Repairing Their Injuries". However, the Contractor shall obtain, in writing, the City's permission to move or prune trees or shrubs.

6. Maintenance of Public Travel: Works shall be carried out in a manner which will cause a minimum of interruption to traffic, and may close to through travel not more than two (2) consecutive blocks, including the cross street intersected. Where traffic must cross open trenches, the Contractor shall provide suitable bridges to street intersections and driveways. The Contractor shall post suitable signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. Prior to closing of any streets the Contractor shall notify responsible municipal authorities. All traffic control shall be in accordance with the latest edition of the Indiana Manual on Uniform Traffic Control Devices and Sections 104.04, 107 and 801 of the Indiana Department of Highways Standard Specifications.

7. Utility Interruption: The Contractor shall proceed with caution in the excavation and preparation of the trench or pit that the exact location of underground structures may be determined. Prior to proceeding with trench excavation the Contractor shall contact all utility companies in the area to aid in locating their underground services. The Contractor shall take all reasonable precautions against damage to existing utilities. However, in the event of a break in an existing water main, gas main, sewer or underground cable, they shall immediately notify the responsible official of the organization operating the utility interrupted. The Contractor shall lend all possible assistance in restoring services and shall assume all costs, charges, or claims connected with the interruption and repair of such services.

B. BEDDING AND BACKFILL: All trenches or excavations shall be backfilled to the original surface of the ground or such other grades as required or directed. In general the backfilling shall be carried along as speedily as possible in order to avoid open excavations.

1. Backfill Materials: The following materials shall be used for backfill in accordance with and in the manner indicated by the requirements specified herein. Refer to Figure 1: Soil Classification Chart for more information regarding soil types.



UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified for engineering purposes by the Unified Soil Classification System. Grain-size analyses and Atterberg Limits tests often are performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. Graphic symbols are used on boring logs presented in this report. For a more detailed description of the system, see "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" ASTM Designation: 2488-84 and "Standard Test Method for Classification of Soils for Engineering Purposes" ASTM Designation: 2487-85.

MAJOR DIVISIONS				GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
					GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)			SW	Well graded sands, gravelly sands
					SP	Poorly graded sands, gravelly sands
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)	SILTS OF LOW PLASTICITY (Liquid Limit less than 50)			ML	Inorganic silts, clayey silts of low to medium plasticity
		SILTS OF HIGH PLASTICITY (Liquid Limit 50 or more)			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts
		CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)			CL	Inorganic clays of low to medium plasticity, gravelly, sandy, and silty clays
		CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)			CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity
	ORGANIC SILTS AND CLAYS	ORGANIC SILTS AND CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)			OL	Organic silts and clays of low to medium plasticity, sandy organic silts and clays
		ORGANIC SILTS AND CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)			OH	Organic silts and clays of high plasticity, sandy organic silts and clays
ORGANIC SOILS		PRIMARILY ORGANIC MATTER (dark in color and organic odor)			PT	Peat

NOTE: Coarse-grained soils with between 5% and 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone on the plasticity chart have dual classifications.

PLASTICITY CHART

DEFINITION OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Boulders	Above 12 in.
Cobbles	12 in. to 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 sieve
Sand	No. 4 to No. 200 sieve
Coarse sand	No. 4 to No. 10 sieve
Medium sand	No. 10 to No. 40 sieve
Fine sand	No. 40 to No. 200 sieve
Fines (silt and clay)	Less than No. 200 sieve

Figure 1: Soil Classification Chart

Class I - Angular, 6 to 40 mm (1/4 to 1 ½ inch), graded stone such as crushed stone.

Class II - Coarse sands and gravel with maximum particle size of 40 mm (1 ½ inch), including various grades of sands and gravel containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW, and SP according to the Unified Soil Classification System are included in this class.

Class III - Fine sand and clayey gravel including fine sands, sand-clay mixtures and gravel-clay mixtures. Soil types GM, GC, SM and SC according to the Unified Soil Classification System are included in this class.

Class IV - Silt, silty clays and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil types MH, ML, CH and CL according to the Unified Classification System are included in this class. These materials are not recommended for bedding. This class shall also include any excavated material free from rock (3 inches or larger), concrete, roots, stumps, rubbish, frozen material and other similar articles whose presence in the backfill would cause excessive settlement.

2. Backfill of Trench Excavations for Pipes and Structures Bedding and Backfill materials samples shall be made available to the City or Water Superintendent for inspection and approval prior to start of construction.

3. Rigid Pipe Bedding: For purposes of this specification, rigid pipe shall include those made of ductile iron and other materials as determined by the City, City Representative, and/or Water Superintendent. All rigid pipes shall be laid to the lines and grades on plans unless otherwise directed by the City. All rigid conduit and pipe shall be bedded in compacted Class I, II, or III materials, placed on a flat trench bottom. The bedding shall have a minimum thickness of 4" or one-fourth (1/4) the outside pipe diameter below the pipe and shall extend halfway up the pipe barrel at the sides. All material shall be placed in the trench in approximately six (6) inch layers. Each layer shall be leveled and evenly distributed on both sides of the pipe so as not to disturb, displace or damage the pipe and shall be thoroughly compacted. When Class I or II materials are used, compaction may be accomplished by hand or mechanical tamping or by "walking" the material in. Bedding from the halfway point on the pipe to a point twelve (12) inches above the top of the pipe shall be a Class I, II, III, or IV material placed in six (6) inch layers and thoroughly compacted to prevent settlement. Class III and IV material shall not be used when the trench is located in an area subject to vehicular traffic.

4. Backfill Above Pipe: For purposes of this specification, trenches shall be considered subject to vehicular traffic if all or any portion of the excavation is located within five (5) feet of a roadway or alley which is routinely traveled by powered vehicles. In the event of any question regarding the susceptibility of an area to traffic, the City and the Utilities Superintendent decision shall govern. "Caution-Buried Water line below" tape shall be placed 1' above top of pipe.

    a. Method A – Backfill in Areas Not Subject to Vehicular Traffic: The trench between a level twelve (12) inches above the top of the pipe and the ground surface shall be backfilled

with Class I, II, III or IV materials, as described above, deposited with mechanical equipment in such a manner that it will "flow" onto the bedding and not free fall. The Contractor shall consolidate the backfill by the back and forth travel of a suitable roller, wheeled device or other similar heavy equipment until no further settlement is obtained. Heavy equipment shall not be used until there is a cover of not less than three (3) feet over the pipes. To assist in promoting maximum settlement, the surface of the trench shall be left in a slightly rounded condition. Periodical dressing of the backfill in the trench to promote the drainage and safety conditions shall be made during the course of the work.

b. Method B – Backfill in Areas Subject to Vehicular Traffic (Mechanical Compaction): The trench between a level of twelve (12) inches above the top of the pipe and the surface, which are located in areas subject to or possibly subject to vehicular traffic, shall be backfilled with Class I or II materials, deposited in uniform horizontal layers of two (2) feet +/- six (6) inches. Each layer shall be thoroughly compacted by mechanical tamping utilizing vibratory compactors. Each layer shall be thoroughly compacted before the next succeeding layer is placed. This procedure shall be followed where trench walls remain stable during compaction. If in the opinion of the Utilities Superintendent and City, and/or their representative (inspector), the trench walls become unstable during compaction, then the Utilities Superintendent, City and/or their representative (inspector) may authorize the Contractor to push from the back of the trench the Class I or II material into the trench the full depth, not to exceed twenty (20) lineal feet horizontally along the trench bottom and compact using the vibratory compactor in two (2) foot diagonal lifts. When Class I or II materials do not contain sufficient moisture to obtain proper compaction, in the opinion of the Utilities Superintendent, City and/or their representative, it shall be moistened or wetted as directed by the Water Superintendent, City, and/or their representative.

5. Temporary Surfaces Subject to Traffic: All streets shall be open to traffic immediately after completing the backfill operation. This shall be accomplished by installing the compacted aggregate base immediately after granular backfill. The use of class II backfill as a temporary surface is specifically prohibited.

6. Maintaining Trench Surfaces: All surface settlement of the backfill along trenches located beneath streets, roads, alleys, driveways and parking lots which are subject to traffic shall be kept filled level with or slightly above the original paved surface at all times with compacted aggregate base material until the permanent pavement is satisfactorily restored. When temporary asphalt pavement is used, depressions and "pot holes" shall be promptly filled with the temporary asphalt material. Special attention shall be given to the timely and proper maintenance, leveling and grading of the surface of all backfilled trenches, especially those subject to traffic and especially following rains. The surface of street, roads and alleys shall be maintained smooth and free of ruts and water trapping depressions by periodic power blading, scarifying; and/or filling settled areas, ruts, pockets, or holes with compacted aggregate base material or temporary asphalt where used.

As a dust preventive, calcium chloride shall be applied over the surface of the compacted aggregate base in such amounts and at such times as are necessary to avoid or eliminate dust complaints from nearby residents. In event of any question regarding the existence or nonexistence of a dust nuisance, the Utilities Superintendent and the City's decision on the matter will govern. The material used shall be Regular Flake Calcium Chloride having a minimum chemical content of Calcium Chloride of seventy-seven percent (77%). Unless otherwise specified or ordered by the Water Superintendent, City, and/ or their representative; the rate of application shall be one and one half (1½) pounds per square yard of surface covered.

Wherever surface settlement is not important, unless otherwise specified or directed, the backfill shall be neatly rounded over the trench to a sufficient height to allow for settlement to grade after consolidation. Just prior to the completion of all work under the contract, any surface settlement below original ground surface shall be refilled in a satisfactory manner, and reseeded as specified if required.

C. BORING AND JACKING: Construction of the pipeline by boring and jacking methods under highways, railroads, and streams will be permitted unless otherwise specified on the plans. Plans and details describing the materials and methods of construction proposed for use shall be submitted to the City, City Representative, and/or the Water Superintendent for approval.

1. Backstop: The backstop shall be of sufficient strength and positioned to support the thrust of the boring equipment without incurring any vertical or horizontal displacement during such boring operations.

2. Guide Rails: The guide rails for the boring equipment may be of either timber or steel. They shall be laid accurately to line, grade and maintained in this position until completion of the boring operations.

3. Casing Pipe: The casing pipe and joints shall be steel construction capable of withstanding the traffic load and constructed to prevent leakage from the casing or conduit throughout its entire length excepting the open ends.

   a. The casing pipe shall be welded steel pipe, new and unused. The pipe shall have a minimum yield of 35,000 psi and meet the requirements for Class B pipe under ASTM specification A-139 "Electric Fusion (Arc) – Welded Steel Pipe".

   b. The minimum wall thickness for the casing pipe shall be as follows:

Diameter	Minimum Wall of Casing Thickness (inches)
18" and under	0.375
20" and over	0.500

4. Where lengths of casing pipe are joined during the boring operations, care shall be taken so that the proper line and grade is maintained. After welding of each joint, the casing pipe exterior wall shall be coated with coal tar, or bitumastic material.

5. Stream crossings shall be a minimum of 3 feet from the stream bottom (as defined by the regulating agency) and the top of the casing pipe.

6. Casing Spacers: The carrier pipe (Water Main shall be centered within the casing by use of stainless steel or polyethylene casing spacers. Casing spacers shall be bolt on style with a two-piece shell and use stainless steel hardware for connections. Casing spacers shall be installed per the recommendations of the manufacturer.

7. Casing Ends: After the water main is fully installed within the entire length of the casing, the casing ends shall be suitably protected against the entrance of foreign material which would interfere with the conduit removal. Brick and mortar bulkhead walls or rubber couplings shall be used to seal the casing ends. Provisions for venting the space between the casing and carrier pipe shall be made by the contractor.

D. DIRECTIONAL BORING:

1. General: The pipe shall be HDPE DR 9 (250psi) and in accordance with AWWA C906. Other pipe materials and methods may be considered as specific situations require at the direction and approval of the Water Superintendent, City, and/or City Representative. Proper implements, tools and facilities shall be provided and used for the safe and convenient performance of the work. The Contractor shall provide any necessary data, reports, information, details, and construction schedules as requested by the City Representative, including, but not limited to the Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards, certified copies of reports of factory tests, and details of equipment to be used and drilling fluid to be used. All work shall be done in a careful, workmanlike manner to the satisfaction of the City Representative and Owner.

2. Pipe Handling and Inspection: Pipe handling and installation shall be in accordance with manufacturers' recommendations and appropriate AWWA standards. All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor. All pipe, fittings, valves, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. Pipe shall be handled in such a way that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at their expense in a manner satisfactory to the City Representative. Proper implements, tools, and facilities satisfactory to the City Representative shall be provided and used by the Contractor for the safe and convenient performance of the work. If damage occurs to any pipe, fitting, valve, or water main accessories in handling or in installation, the damage shall be immediately brought to the attention of the Water Superintendent. The Superintendent may reject any of the damaged items.

3. Pipe Installation: At times when pipe installation is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the City Representative. The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or coatings and so as to leave a smooth end at right angles to the axis of the pipe. Flame cutting of pipe by means of an oxyacetylene torch shall not be allowed. Whenever it is necessary to join pipes of dissimilar

material, special adapter fittings manufactured for this particular use shall be used. Pipe lengths shall be joined by the use of electrofusion welded joints. Where HDPE or other plastic pipe is installed in the open cut condition it shall be installed in compacted select fill material. All HDPE plastic pipe installations shall have two continuous different colored #8 copper tracer wires pulled with the pipe. The continuity of these wires shall be field verified prior to project final acceptance.

4. Surface and Subsurface Conditions: The contractor shall verify the location of all known utilities and structures by test pitting prior to any boring. These utilities and structures include underground utilities such as, but not limited to, storm drains, electric cables, water mains, sewer lines, septic systems, gas lines, telephone lines, fiber optic lines, cable television lines, wells, and field drain tiles. These utilities and structures also include above ground utilities such as, but not limited to, electric and telephone poles, electric transformers, buildings, trees, and existing road signs.

5. Experience: The Contractor shall demonstrate experience and expertise in trenchless excavation methods by providing a list of three utility references for whom similar work has been performed prior to commencing any work. These references shall include a name and telephone number for contact so the City Representative may verify claims. The Contractor shall also provide documentation showing successful completion of at least 5,000 lineal feet of directional boring of the size and type being installed for the project. All supervisory personnel shall be adequately trained and shall have at least four years of verifiable experience in directional boring. The Contractor shall also submit the names and resumes of all supervisory field personnel for review by the City Representative prior to commencing any work.

6. Directional Boring System Requirements: The system shall be remotely steerable and permit electronic monitoring of tunnel depth and location. The system shall be able to control the depth and direction of the pipe and must be accurate to a window of ±2 inches. The system will utilize a fluid-cutting process, using a drilling fluid such as bentonite and/or a polymer. This fluid shall be totally inert and contain no risk to the environment. The drilling fluid shall remain in the tunnel to increase the stability of the tunnel and to provide a lubricant to reduce frictional drag when the pipe is installed. The spoils shall be discharged in a manner that does not adversely affect the existing surface of the ground or cause a public nuisance. The Water Superintendent shall reserve the right to restrict spoil discharge to the existing ground surface for any reason to which the Contractor shall recover the spoils by use of a vacuum system mounted on a vehicle for removal of the spoils. Spoils are not to be discharged into sewers or storm drains. The Contractor is responsible for disposal of all spoil material in accordance with all federal, state and local requirements. Upon completion of boring and pipe installation, the Contractor shall remove all spoils from all starting and termination pits. The pits shall to be restored to their original condition.

E. PIPE LAYING

1. General: In general, installation of buried water mains shall conform to the requirements of the manufacturer, the AWWA Standard for the type of pipe being installed, as specifically indicated on the plans, or specified herein.

   Extreme care shall be taken in handling pipe to prevent damage. Pipe, fittings and valves shall not be dropped to ground or into trench; they shall be carefully lowered, piece by piece, using crane, backhoe, or other approved lifting device.

   Where water is encountered in trench, Contractor shall furnish and operate suitable pumping equipment of capacity adequate to dewater trench, dispose of such water, and maintain drainage conditions, as approved by the City and Water Superintendent. It is essential that discharge of trench dewatering pumps be conducted to natural drainage channels, drains or storm sewers (with City approval). No pipe shall be laid in any water without the City's and Water Superintendent's approval. During cold weather, valves and hydrants shall not be stored where trapped moisture can freeze and damage fittings.

   Mains shall be laid and maintained to the indicated lines with fittings, valves and hydrants at required locations. All valve and hydrant stems shall be set plumb.

   Wherever obstructions not shown on the plans are encountered during the process of the work and interfere to such an extent that an alteration in the plan is required, the City or the Utilities Superintendent shall have the authority to change the location from the shown line and grade.

   The excavations for construction of pipe lines shall be of sufficient width, and only of sufficient width to permit the work to be constructed in a workmanlike manner. Working space shall be provided in all pipe trenches to allow room all around for the proper installation of joints and the drainage of water, if necessary. Sheeting shall be used where necessary to protect curb, walk, trees, and other utility lines. Except as otherwise specified, the excavation work for the pipes, valves and hydrants shall be performed in accordance with these Standards.

   The trench shall be excavated to the depth required so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at every point between pipe joints, except that it will be permissible to disturb and otherwise damage the finished surface over a maximum length of eighteen (18) inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle. Any part of the bottom of the trench excavated below the specified grade shall be corrected by filling with approved material, thoroughly compacted in three (3) inch layers. The finished sub grade shall be prepared accurately by means of hand tools. No blocking under pipes will be permitted except as approved by the Utilities Superintendent under special conditions.

   Where the bottom of the trench at sub grade is found to be unstable or to include ashes, cinders, all types of refuse, vegetable or other organic material, or large pieces or fragments of inorganic material which in the judgment of the Water Superintendent should be removed, the Contractor shall excavate, remove and satisfactorily dispose of such unsuitable material to the width and depth ordered by the Water Superintendent. Before the pipe is laid, the sub grade shall then be made by backfilling with approved Class I or Class II material as defined in these Standards. The fill

material shall then to be thoroughly compacted by means of hand or mechanical tamping to a minimum 85% Standard Proctor Density.

In event of rock excavation or where ledge rock, boulders and large stones, or hard pan, shale or cemented gravel, are encountered in the bottom of the trench, then said materials shall be removed to provide a clearance of at least six (6) inches below and on each side of all pipe, valves and fittings. The space between the rock or other hard trench bottom and the pipe shall be filled with Class I or II material and hand or mechanically tamped as explained above.

Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient protection of the work. All pipe, fittings, valves and hydrants shall be carefully lowered into the trench piece by piece by derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to pipe or pipe coating. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. Before lowering and while suspended, the pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective, damaged or unsound pipe shall be rejected. All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench, and shall be kept clean by approved means during and after laying.

Care should be taken to prevent dirt from entering the joint space. At times when pipe laying is not in process, the open ends of pipe shall be closed by approved means, and no trench water shall be permitted to enter the pipe.

Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise directed, pipe shall be laid with bell ends facing in the direction of laying and for lines on an appreciable slope, bells shall face upgrade.

Wherever necessary to deflect pipe from a straight line, either in the vertical or horizontal plane to avoid obstructions, to plumb stems, or for other reasons, the degree of deflection shall be within permissible limitations as defined by the manufacturer.

All plugs, caps, tees and bends shall be provided with restrained joints and grip rings. The restrained joints shall be of adequate strength to prevent movement, as approved by the City Representative.

All bedding and backfill material shall be placed and compacted in accordance with the applicable portions of these Standards.

2. Depth of Cover for Water Mains: All water mains shall be constructed with a normal minimum earth cover of sixty (60) inches over the top of the pipe and a maximum of seventy-two (72) inches except as follows:

   a. For purpose of avoiding direct interference with existing structures or utilities, the City or Water Superintendent may authorize increase or decrease depth of cover.

   b. For the purpose of making grade changes within tolerable limits, the depth may be increased to an approved depth.

c. Unless otherwise shown on the plans or permitted by the City or Water Superintendent, the new mains shall cross beneath the existing mains, except in cases where the specified cover can be maintained by crossing above the existing mains.

d. Where connections to existing mains dictates changes in the required depth of cover.

3. Connections to Existing Mains: All connections to City mains shall be made by the Water Department or by an approved Contractor. The type of connection to be made shall be at the discretion of the Water Department. The cost for the connection to the City mains shall be based upon costs for materials and labor as determined by the Board of Public Works and shall be billable to the developer.

F. GATE VALVE AND VALVE BOX INSTALLATION

1. Installation of Gate valves and valve boxes: Gate valves and valve boxes shall be installed per the manufacturer's recommendations. Valve box alignment discs and dense foam debris inserts (mud Plugs) shall be required on each valve box.

G. HYDRANT INSTALLATION

1. Hydrant barrels shall be constructed in such a manner that it is not necessary to cut off the water or to excavate to make repairs. The barrel of the hydrants shall be constructed in sections which are to be jointed in such a manner that the upper section of the barrel extending above the ground may be separated from the lower section by impact without injury to the stem or the barrel.

2. Hydrants shall be located in such a manner as to provide complete accessibility, and in such a manner that the possibility of damage from vehicles or injury to pedestrians will be minimized. When set in the space between the curb or sidewalk or between the sidewalk and property line, no portion of the hydrant or nozzle cap shall be within six (6) inches of the sidewalk. All hydrants shall stand plumb and shall have their nozzles parallel or at right angles to the curb. They shall conform to the established grade, with nozzle at least twelve (18) inches above the ground.

3. Hydrants shall be thoroughly cleaned of dirt and other foreign matter before setting, and the hydrant shall be suitably anchored with a hydrant adapter. Said adapter shall be at least twenty-four (24) inches in length. All hydrants are to be properly supported and braced and surrounded with approximately five (5) cubic feet of washed gravel.

4. The 4½" "pumper nozzle or storz connection" shall be positioned to face the street. An "OUT OF SERVICE" bag or ring shall be placed on all new hydrants until approved for use.

H. FITTINGS: All fittings shall be installed with proper support so as not to hang from the pipe. All crosses, tees, caps, plugs, wyes, and bends shall have concrete thrust blocks and appropriate mechanical joint restraining system such as Mega-Lug, or equivalent. Concrete thrust blocks shall be placed in the proper position and extend to undisturbed ground to resist movement. Joint restraining devices such as Mega-Lug, or equivalent shall be installed according to manufacturer's standards and recommendations.

2.05 INSPECTION, TESTING, AND DISINFECTION

A. INSPECTION: This section describes the minimum requirement and general procedures for the inspection, testing, disinfection of water main systems dedicated to the City of Knox. Connection permits for utility service will not be issued until all the requirements of this section are fulfilled. Inspection of the construction shall occur for the duration of the project, including the installation of service connections.

1. Contractor and / or Owner shall provide notice to the City and their representative of the planned commencement of construction thirty (30) days prior to such commencement.

2. Once the construction starts, the Contractor shall be responsible for informing and / or notifying the inspection representative assigned of the following (NOTE: The City may require as much as five (5) working days notice to provide inspection services during construction.):

   a. Daily work schedule, including any changes in schedule;
   b. Prior notification if work is to be performed on weekends and / or holidays;
   c. Date tests are to be performed; and
   d. Date as-built verification is to be performed.

3. The City, upon request of the Contractor and / or Owner, will schedule the Final Inspection. All testing required shall be paid for by the Contractor and performed under the observation of the City or City's representative. It shall be the Contractor's responsibility to schedule the testing with the City representative and / or City. Test results obtained in the absence of the presence of the City will not be accepted.

B. TESTING:

1. HYDROSTATIC TEST: After the pipe has been laid and backfilled, all newly laid pipe or any valve sections of it shall, unless otherwise expressed specified, be subjected to a hydrostatic pressure tests. The duration of each pressure test shall be for a period of not less than two hours and not more than six hours.

   The basic provisions of AWWA C-600, Section 4 shall be followed for all pressure testing. The test pressure shall not exceed pipe and/or thrust restraint design pressures. The test pressure shall not vary by more than plus or minus 5 psi for the duration of the test. **All newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing or 150 psi (gauge) whichever is greater.**

   Each valve section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the City / Water Superintendent. The pump pipe connection and all necessary apparatus, including gauges and meters shall be furnished by the Contractor.

   Before applying the specified test pressure, air shall be expelled completely from the test section. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at all points so that the air can be expelled as the section is filled with water. After all the air has been expelled, the corporation cocks shall all be closed and the test pressure applied. At the

conclusion of the pressure test the corporation cocks shall be removed and plugged or left in place at the direction of the City / Water Superintendent.

Any exposed pipe, fittings, valves, hydrants and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, hydrants or joints that are discovered following the pressure test shall be repaired or replaced by the contractor with sound material approved by the City / Water Superintendent and the test shall be repeated until it is satisfactory to the City / Water Superintendent.

2. LEAKAGE TEST: After the completion of the pressure test, a leakage test shall be conducted to determine the quantity of water lost by leaking under the specified test pressure. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled.

   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 that determined by the following formula:

   $L = SD\sqrt{P}/133{,}200$ Where:

   L = allowable leakage, in gallons per hour
   S = length of pipe tested, in feet
   D = normal diameter of the pipe, in inches
   P = average test pressure during the leakage test, in psi (gauge)

3. ACCEPTANCE: Acceptance shall be determined on the basis of allowable leakage. If any test of laid pipe discloses leakage greater than that specified, the Developer/Contractor shall at his own expense, locate and make approved repairs as necessary until the leakage is within the specified allowance.

   All visible leaks are to be repaired regardless of the amount of leakage. All flanged pipe shall be "bottle-tight".

   If the section under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

C. DISINFECTION - CHLORINATION OF WATER MAINS:

1. Chlorination of New Water Mains: Before being placed in service, all new water distribution systems, or extensions to existing systems, or any valved section of such shall be chlorinated. Chlorination shall follow the basic procedures as outlined in the latest edition of ANSI/AWWA C651 "Disinfecting Water Mains" Standards.

2. Care shall be taken during and after construction to remove all dirt remaining in the pipe. Potable water shall be used for disinfection, hydrostatic pressure testing, and flushing. Drainage should take place away from the work area. Adequate drainage must be provided during flushing. The means of drainage selected by the Contractor shall be approved by the City prior to

flushing. When dechlorination is required, it is recommended that any high-velocity flushing be completed prior to disinfection.

3. If applicable, the valve(s) isolating the main from existing system should be locked out and tagged out to prevent unintentional release of the elevated chlorine residual water used for disinfection.

4. A 50 part per million chlorine solution shall be induced into the upstream side of the newly laid water main. In the process of chlorinating newly laid water pipe involving more than one (1) valved section, all valves or other appurtenances shall be operated while the pipe line is filled with the chlorinating agent. Back pressure, causing a reversal of flow in the pipe being treated shall be prevented. The chlorine solution shall remain in the pipe for at least twenty-four (24) hours. At the end of this 24-hr period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L of free chlorine. Following chlorination, all treated water shall be thoroughly flushed from the newly laid water pipe line until the replacement water throughout the length shall, upon test, be proved comparable in quality to the water served the public from the existing water supply system.

5. Samples of the water for tests shall be taken by the contractor under the direction of the City and in accordance with methods of sampling as recommended by the State Board of Health. The bacteriological test shall be performed by the State Board of Health Laboratory or by a testing laboratory which is approved for bacteriological testing by the State Board of Health. The City's representative will send the samples to the State Laboratory, unless otherwise directed by the City. At least two (2) sets of successive satisfactory bacteriological samples taken at twenty-four (24) hour intervals shall be obtained from the newly laid pipe lines and equipment before water is discharged through them to the existing system. The new piping shall be lightly flushed a second time prior to taking the second sample. Should the test of the second or last taken sample prove ineffective, the chlorination procedure shall be repeated until confirmed tests show that water sampled from the newly laid pipe conforms to the requirement stated above. When the bacteriological tests of the samples of water taken from the new mains prove to be satisfactory and before the new mains are placed in service, the City shall increase the chlorine dosage of the water being delivered to the entire distribution system as specified herein under the heading of "City's Responsibility for Temporary Step-up of System Chlorination".

6. Reconnection of Services: The reconnection of existing building services from existing water mains to new mains shall not be made until the water in the newly constructed mains has been disinfected and satisfactorily tested as specified herein.
7. Chlorination Procedure When Cutting into Existing Mains: Under ideal trench and installation conditions with full time inspection by the City, the Developer / Contractor may be permitted to make cuts into existing pipe lines for the insertion of valves, fittings, repairs or for other purposes by the following procedure of disinfection:
    a. Sprinkle the inside surfaces of the appurtenances to be installed with a dry hypochlorite (or apply a hypochlorite slurry) and place a small quantity of the hypochlorite powder into the ends of the existing pipe on either side of the opening before the new pipe and fittings are installed. At the discretion of the Water Superintendent or the City and / or when the trench and installation conditions are not ideal for making the cuts into existing mains, the Developer / Contractor shall introduce the solution of chlorine or the suspension of hypochlorite into the isolated

or valved-off sections of mains through a tap in the main to be made for this special purpose or through a fire hydrant when one is available in a suitable location. In either of the two (2) above procedures, the chlorine introduced should be in sufficiently high concentration amounts, forty to fifty parts per million (40 – 50 ppm), reaching every part of the isolated section of mains.

b. The maximum permissible contact period shall be used after which the water bearing strong chlorine solution shall be flushed out of the isolated section of mains before they are returned to service. The Developer / Contractor shall schedule the making of all the project cut-in connections to existing mains as close together, time-wise, as is feasible. The Contractor shall notify the City Water Superintendent at least seventy-two (72) hours in advance, so arrangements can be made for inspection of the work and so the City can step up the system chlorination and notify the affected water customers.

c. All water customers who will be affected by the isolated section of mains for the purpose of making the cut-in connections and disinfection should be given advanced notification by the City Water Department, if possible. through the local newspaper or by personal notice to each customer.

8. City's Responsibility for Temporary Step-Up of System Chlorination: At least eight (8) hours prior to the making of cuts into existing pipe lines for the insertion of valves, fittings, repairs and the connection of new mains to existing mains and prior to the placing of newly constructed water mains into service, the City will increase the chlorine dosage of the water supply to the system to effect a free chlorine residual of at least 0.5 ppm, or a combined available chlorine residual of at least 1.0 ppm. The said chlorine residual shall be maintained by the City for a sufficient period of time to establish a record of satisfactory bacteriological quality of the water throughout the distribution system. After at least two (2) successive sets of satisfactory bacteriological samples of water have been taken from the system at approximate twenty-four (24) hour intervals, the stepped-up chlorination may be cut back to the normal dosage.

9. Sampling: The City Water department shall determine the number and location of sampling points to be used. The Water Department shall be responsible for collection and testing of bacteria samples required. In no instance shall a fire hydrant be used for sampling. Any additional work or materials needed to achieve satisfactory test results shall be provided by the contractor.

END OF SECTION

Section 3 – Water Service Connections

3.01 General Service Connection Requirements

A. Conformance: Water services shall conform to the latest edition of the Uniform Plumbing Code and to these Standards.

B. Tapping of Water Main: The water service for Service lines are connected to water mains by either: 1. Direct Tapping 2. Saddle Tapping 3. Tapping Sleeve & Valve. Direct tapping to PVC C900 pipe sizes 6" through 12" with pressure classes of DR 18 or DR 14 is restricted to ¾" or 1 inch. Saddle tapping shall be used on Corp stops sizes 1-1/4 inch to 2 inch and on all HDPE 4710 water mains. Saddle taps used on HDPE 4710 water mains shall be specifically approved for this use by manufacturer. Tapping sleeves and valves are to be used when service connections larger than 2 inches are required.

C. Sizing: All NEW water services shall be sized for the anticipated water usage at the service using a customer supplied inventory of fixtures and devices or estimated flow requirements that could be connected to the City's main line, but in no case shall be less than one (1) inch in diameter. The City Water department or City Representative shall designate the size service line according to data and proposed usage provided by the customer.

D. Service Tap location: Each service shall be perpendicular to the main, and made in straight section of pipe, and not at any joint or into fittings. All service piping shall be provided with a continuous tracing wire buried in the trench directly above the service and terminated in the curb stop box, meter pit/vault, and at the foundation of the building.

E. Service Connections and meter locations: All connections to the mains shall be made by the Water Department or a Department approved contractor. Customers shall pay all installation costs, including connections from the main to the curb stop as dictated by the latest Water Ordinance. Customers shall furnish a frost proof location with clean and easy access (no crawl spaces) for the meter. Approved meter locations shall be:

1. Meter pit or vault
2. Frost Free Basement
3. Heated first floor location

F. Materials: All service pipes between the water main and curb box, and from curb box to meter pit shall be ductile iron pipe or type "K" copper, as approved by the Water Department. The use of lead pipe shall not be permitted for providing service to new buildings. Existing Lead pipes shall be replaced all the way back to the water main at the customer's expense. Polyethylene tubing is acceptable downstream of the water meter.

G. Maintenance: The customer shall install and maintain at their own expense, the service line from the curb stop into their own premises. The Water Department shall be notified in advance of any such connection or repair and shall reserve the right to inspect before the trench is backfilled, each service installed. The Water Department shall maintain meter, and service line between the water main and curb stop. The owner shall be responsible for design and construction of the service tap line from the meter pit to the premises. Any customer, developer, contractor, or person responsible for disturbing or damaging water service or valve boxes, once the service has been properly installed, shall be liable for the cost of the repairs. If the customer fails to provide proper maintenance to the service equipment, the Water Department, at its option, may either: 1) provide necessary maintenance and

bill the customer for labor and materials; or 2) discontinue water service to the customer as provided for in the General Rules, until such time as necessary repairs are made.

H. Special Protective Devices: Service lines for all new industrial customers, multi-stored buildings (excluding single family residences), and commercial customers as required by the Water Department, shall be equipped with an approved reduced pressure principle backflow preventer. The Water Department reserves the right, at its discretion, to require any customer to install on his service line a tank, check valve, detector check valve, reduced pressure principle backflow preventer, gate valve, or other appliances, apparatus or equipment of such a type and design as is approved by the Utility, in writing, and thereafter, to require any change, alteration, substitution, or addition to any such device as aforesaid. Failure upon the part of the customer to comply with such requirements of the Water Department within thirty (30) days after written notice to the customer or within some agreed extension beyond such thirty (30) day period, shall authorize the Water Department at its option, and without further notice, to discontinue service.

I. Inside Piping and Shut-Off Valves: Each applicant for service shall, at his own expense, equip their service line with a suitable shut-off valve or valves just inside the foundation wall and shall provide all piping and attachments, all of which shall be assembled, installed and maintained by the customer, subject to approval of any authorized inspectors and in accordance with the Water Department's General Rules in force at that time, or as may be amended from time to time.

J. Depth of Bury: Service taps shall be buried to a distance of 4'-6" minimum to 5' maximum from said surface of ground to top of pipe.

K. Demolition of Buildings and Retiring Water Service:
Contractor shall contact the City Water Department and make arrangements for removal of all water meters by the City Water Department prior to demolition. Contractor shall excavate and expose the water service pipe, both domestic and fire protection, to the buildings at the locations of the curb stops. Contractor shall neatly cut the water service line at a point 1 foot away on the building side of the shut-off valve (curb stop), cap and seal, and block the line. Contractor shall contact the City Water Department, giving not less than 48 hours notice of when the City Water Department should be on site to inspect the exposed water service and the sealing procedure utilized prior to backfilling. Failure to have City inspection is grounds for re-excavating at the contractor's expense.

3.02 Meters and Meter Pits

A. Service Meter Enclosure Installation (PITS):

1. All meter pits/vaults shall be constructed at the customer's expense according to the City of Knox Water Department Standards.

2. Enclosure shall be set vertically on a base of clean, washed gravel a minimum of one (1) foot deep and twelve (12) inches beyond outside of enclosure. Backfill shall be tamped in six (6) inch layers all around enclosures in excavated area to maintain stability and prevent settlement.

3. Meter enclosure locations shall be as determined by the Developer / Contractor and approved by the City, City Representative, or Water Superintendent. Generally, meter pits shall be placed in lawns as near as possible to dedicated right-of-way lines.

4. Individual meter enclosures for meter yokes shall be a minimum of twenty (20) inches in inner diameter. Enclosures shall be manufactured from PVC or PE and shall be of a ribbed type construction. Nominal wall thickness shall be not less than 2.0 inches. Enclosures shall include two (2) 2½"wide slots at the bottom to accommodate service tubing.

5. Covers for Enclosures (Casting): Covers shall be cast iron, four (4) inches deep with an 11½" diameter lid opening. Lid is required to have lifter worm lock with standard pentagon bolt. The words "WATER METER" shall be cast in top of the lid. Covers shall be Ford Meter Box Company, Model No. W3-D, or equivalent. The lids shall also be pre-drilled to accept either one or two transmitters (to be determined by the Water Department).

B. Meters :

1. Unless specified in the contract between the Water Department and customer or by the rate on file, the water supplied shall be measured by a meter of standard manufacture as specified by the Water Department. The meter shall be furnished (1" included in the connection fee) and installed by the Water Department according to its requirements. All meters 1-1/4" or greater in size, the customer shall bear the cost of the meter plus installation fee. After installation by the customer's licensed plumber and approved by the City Water Department the meter shall become the property of the City Water Department and the Water Department shall be responsible for the maintenance and calibration of the meter according to AWWA standards. Valving is required before and after the meter and is the responsibility of the owner for adequate maintenance and or replacement.

2. Meters in Pits shall utilize yokes of correct size for corresponding meters per city specifications.

3. Meters in basement and first floors shall utilize copper horns of correct size per city specifications.

4. Size: The Water Department will designate the size, type, and brand of meter to be used by any customer.

3. By-Passes: By-passes are not permitted. In special cases (ex. backflow preventers) where service should not be interrupted; a by-pass may be permitted with permission granted by the Water Department Superintendent. Approved by-passes shall not exceed two (2) inches in diameter. All by-passes shall be equipped with valves that may be secured with a padlock.

4. Meter Installation: Before the Water Department installs a meter, the customer shall provide a location in the plumbing to accept the meter. The customer shall furnish and install approved ball valves on the inlet and outlet of the meter. After the meter has been properly installed it shall become the property of the Water Department, and it shall be provided to subsequent users of the same service without further charge. The customer shall be responsible for protecting the meter from freezing, fire, mechanical damage, and vandalism.

5. Future Provisions shall be made for metering of water usage to each service connection either by use of a meter pit or by a meter at the water service entrance to the building. If a service is metered at the building, a key curb stop shall be installed at the edge of the right-

of-way or easement line. Water services installed for future connections shall be terminated at the right-of-way or easement line and valved and capped to insure 100 percent water tightness.

6. Individual booster pumps shall not be allowed for any individual service connection from the water main. Clear space of (3) three feet around the meter is required and the meter shall not be enclosed with cabinetry or other objects which prohibits maintenance or replacement.

7. All meters shall be Neptune 360, or City Water Department approved equivalent.

3.03 Private Fire Protection Service

A. Inspection and Testing: The private fire protection service on a customer's premises shall be subject to inspection and testing by the Water Department or any other authority having jurisdiction at such times as it is deemed necessary.

B. Design Submittal: Before any services connections or modifications are made to any existing or new private fire protection service system, final plans of a fire protection system shall be filed with the City Water Department. The City is not responsible for the proper design or performance of an existing or new Private Fire Protection Service System. The following shall be shown on the final plans:

1. The sizes and locations of the systems piping.
2. The sizes and locations of all connections to the Water Department's service line and or mains.
3. The sizes, locations, and types of all valves.
4. The sizes and locations of all hose connections, reels, and cabinets.
5. The sizes and locations of any storage tanks connected to the system.
6. The outlet sizes and locations of all fire hydrants.

C. Accessibility and Frost Protection: All fire protection lines within buildings must be installed in such a manner that all pipes shall be protected from frost and be easily accessible for inspection at any time. Underground pipes placed outside buildings must be placed and maintained at a minimum depth of five feet (5') of cover over the pipe.

D. General Purpose Tap and Fire Protection System: No connection with a fire protection system will be permitted to supply water for general purposes unless the connection has been approved by the customer's fire underwriter and unless the General Purpose Tap is metered. If such a connection is approved; it shall be made outside the building to be served. Both the fire protection line and the general purpose line shall be valved (valve maintenance is the responsibility of the owner) separately in accordance to the Water Department's specifications to permit either to be turned on or off without affecting the other.

E. Check valves, Detector Check Valves, And Reduced Pressure Backflow Preventers:

1. Double Check Valve – Shall be installed in every fire protection system. All check valves installed by the customer shall be of design and manufacture approved by the Water Department. In every case where double check valve system is approved by the Water Department, gate valves and gauges shall be installed in accordance with ISDH and AWWA recommendations and specifications.

2. Double Detector Check Valves – The double detector check valves shall be installed by the customer at the customer's expense. The valves shall be installed with all necessary plumbing and valving to accept a meter. All required metering shall be furnished by the Water Department at the customer's expense.

3. Backflow Preventers – Shall meet all the requirements set forth by the Water Department, ISDH, and the AWWA. Reduced pressure backflow preventers may not be installed in pits and or vaults or other confined areas below grade. The construction of by-pass lines around backflow preventers is absolutely forbidden.

4. Backflow Device Inspection – All backflow devices in service shall be inspected by a certified inspector according to ISDH requirements for frequency of that type of device at the Owner's expense. A report of the inspection shall be sent to the Water Department for their record.

5. Number of Services Allowed Per Tap – One service only will be allowed to any one building or premises, unless in the opinion of the Water Department, more than one is absolutely necessary for the proper protection of the premises. All fire protection equipment connected to the Water Department's service shall be confined within the building or on the premises named in the application, and where two (2) or more connections are made for one building or premises, they shall remain separate, unless special written permission is obtained from the Water Department to connect the same in a manner approved by it.

6. Cross Connections – A private fire protection system or any other service supplied with water from the City Water Department shall be supplied exclusively with no connection allowed with any other source that could contaminate the supply. No auxiliary or secondary suction pipe to another pump taking water from wells, streams, tanks of any kind, or other source will be permitted. Any private fire protection system, irrigation distribution system, or other water system using water originating from a source other than the City Water Department shall be kept absolutely separate from the City Water Department.

END OF SECTION

Section 4 – Surface Restoration & Erosion Control

4.01 General

A. Restoration of surfaces within the public right-of-way and easements shall include the removal of the existing surface, the disposal of the surplus material in an approved method, and the construction of new surfaces and adjusting all new and existing structures for proper grade prior to paving as indicated on the plans and/or as specified in these Standards.

4.02 Restoration of Paved Surfaces

A. Paved Surfaces: After all excavations within the limits of paved surfaces have been properly backfilled and compacted, the paved surfaces shall be restored to a condition as good as or better than existed prior to the beginning of the work, in accordance with the following specifications. Streets, alleys, sidewalks, driveways, curbs and gutters, not constructed or maintained by the State Highway Department, but paved with asphalt, concrete, cinders, crushed stone, waterbound macadam, oil-bound macadam, or heterogeneous paving materials, which are wholly or partially removed, damaged, or disturbed by the Contractor's operations, shall be restored with like or better materials, acceptable to the City, to a condition as good as or better than existed prior to the beginning of the work, so that movement of traffic, both vehicular and pedestrian, through the restored way shall be as free, safe and unimpeded as before.

B. Temporary Surfaces: Temporary Surfaces shall be installed and maintained by the Contractor until the permanent pavement is placed. Before placing permanent pavement, all or parts of the temporary surface shall be removed, as necessary, and hauled from the site of the work. Temporary Pavement Replacement Trench surfaces of highly traveled streets and roads may be, at the direction of the City, required to receive a temporary pavement replacement of cold mixed bituminous pavement. This temporary pavement shall be surface mixture Class A or B prepared and placed in accordance with Section 406 Cold Mixed Bituminous Pavement of the latest edition of the Indiana Department of Transportation Standard Specifications. Prime and tack coats shall not be required. All temporary pavements shall be maintained by the Contractor to proper grade so as not to impede the safe flow of traffic until the permanent pavement replacement is made.

C. Permanent Paving: Permanent paved surfaces shall be restored in accordance with the following requirements, unless otherwise set forth by the City Street Department Superintendent, in all cases, the methods and materials of restoration shall meet the requirements of the Indiana Department of Transportation, as applicable.

1. Concrete Pavement: Existing local streets, roads, alleys, driveways and parking areas consisting of concrete pavement shall be restored according to the following requirements. Areas subjected to excavation or damage by the Contractor is to be replaced as a whole. Sidewalks shall be replaced in complete sections, from control joint to control joint. Streets and driveways shall be replaced in sections that coincide with the original pattern, and to the City's satisfaction. Prior to placing concrete, the existing edges are to be saw-cut in a neat straight manner, sub-base compacted, wetted down and edges swept clean. The use of flexible joint material is required as needed. All chunks of existing material larger than three by three (3" x 3") inches are to be removed. Class "A" concrete pavement shall consist of a cast in place, layer of INDOT Class A concrete with one (1) layer of woven wire fabric (6 x 6 _

W1.4 x W1.4) meeting ASTM Designation 497. The concrete layer shall be six (6) inches thick. All rigid concrete pavement work and materials shall meet the latest specifications of the Indiana Department of Transportation.

2. Asphalt Pavement: Existing local streets and roads consisting of asphalt paving shall be restored with binder and surface of the thickness specified and as follows: Areas subject to asphalt pavement replacement shall have the existing edges (those created by cutting prior to excavation) re-cut in a neat straight manner as to remove irregularities and damaged areas. Manholes, service line trenches and existing valve areas are to be boxed out in a neat manner. All cuts shall be parallel or perpendicular to the trench. Curved or diagonal cuts shall not be allowed. All chunks of existing material larger than three by three (3 x 3) inches are to be removed. The aggregate base course, including the previously placed temporary surface or pavement, shall have the upper portions removed to allow placement of the binder and surface. After the base is cutback, it shall be re-compacted with suitable equipment approved by the City. Care shall be taken to assure that not less than six (6) inches of compacted aggregate base remains below the permanent pavement. A tack coat shall be applied to the cleaned and patched surface at a rate of 0.05 to 0.10 gallons per square yard immediately prior to placing of bituminous mixtures. The binder course(s) shall consist of compacted Hot Asphaltic Concrete, Type A, Size No. 9LV or 11LV as defined by the latest edition of the Indiana Department of Transportation Standard Specifications. Compaction shall be accomplished with suitable smooth wheel rollers. Generally, conventional self-propelled rollers of not less than 10 tons gross weight shall be used. The City may allow other specialized rollers for narrow trenches or lighter rollers with vibratory action. The City shall consider alternate equipment only if Contractor requests same in writing and includes technical data on the specific equipment to be considered. The quantity and thickness of binder courses required shall match the existing pavement, but not less than one (1) course, three (3) inches in thickness. When the existing pavement surface is granular material, or a new granular base is placed, the surface shall be fine graded and compacted by rolling to produce a smooth uniform surface free of voids and depressions. A prime coat, if specified, shall be applied to the graded and compacted granular surface at the rate of 0.30 to 0.50 gallons per square yard prior to the placing of bituminous mixtures or surface seal coats. The surface course shall consist of compacted Hot Asphaltic Concrete Surface Type A (Size No. 11LV or 12LV), as defined by the latest edition of the Indiana Department of Transportation Specifications and placed in the same manner as described above for binder. The surface thickness shall match the existing pavement, but not less than one (1) inch.

3. Adjustments of Shoulders: The shoulders of the road shall be adjusted to the elevation of the resurfacing with all materials (i.e., earth, sod, gravel, crushed stone, asphalt, etc.) necessary. The transition may be made within a distance of one (1) foot to one and one-half (1 ½) feet from the edge of paving except in unusual cases where a greater distance is required. Existing driveways shall be primed and wedged from a feather edge to the final height of the resurfaced street paving.

4.03 Restoration of Lawn and Landscaping areas:

A. All ground surfaces in public Rights of Way and easements that have been damaged or destroyed by the Contractor's operations shall be restored to as good conditions prior to the work or better.

B. All surplus material, rock, trees, shrubs, concrete pipe, asphalt, crushed stone, etc., not to be used in the Contractor's restoration operations shall be removed from the site and disposed of in an acceptable manner.

C. Restoration of Grassed Areas with Sod: Where shown on the plans or required by the City, established grassed areas shall be restored with sod containing grasses of comparable quality. Sod shall be placed and rolled so that the final elevations of the area being restored are the same as existed prior to the beginning of construction. Sod shall be pegged where necessary, and shall be watered and cared for to assure its survival.

D. Restoration of Grassed Areas with Seed and Mulch: The Contractor shall seed and mulch in the following manner:

1. The top 3 inches of areas to be seeded or landscaped shall be backfilled with native topsoil from the site. If no topsoil exists, the contractor will be responsible for providing needed quantities.

2. The ground shall be loosened approximately three (3) inches deep with a disc or a harrow, and fertilized with twenty-five (25) pounds of 10-10-10, or equivalent, and one hundred (100) pounds of agricultural lime per one thousand (1,000) square feet. The mixture of seed applied shall be as specified in project documents or as follows:

    35% Kentucky Bluegrass
    30% Perennial Rye Grass (Lolium Perenne)
    30% Kentucky 31 Fescue
    5% Inert Matter

    The seed shall be applied at a rate of four (4) pounds per one thousand (1,000) square feet and shall be well raked or boarded into the soil and mulched with straw of sufficient thickness to hold the seed until it has germinated.

3. Mulching Material: Materials for mulching shall be wheat, oats, barley or rye straw only. All materials shall be reasonably free from weed seeds, foreign material, and other grasses and chaff, and shall contain no Johnson Grass. The straw shall be reasonably bright in color and shall not be musty, moldy, caked, or of otherwise low quality. The straw shall be dry on delivery, and spread evenly. Erosion control blankets shall be used in place of straw mulching in areas of steep slopes or high drainage flows as determined by the City's Representative or as shown on project documents. The erosion control blankets shall have two layers of

netting, comparable to North American Green S-150BN. Erosion control blankets shall be installed per manufacturer's instructions.

E. Any fence, retaining wall, or part thereof that is damaged or removed during the course of the work shall be replaced or repaired and shall be left in as good of condition as before the starting of the work. The manner in which the fence is repaired or replaced and the materials used in such work shall be subject to the approval of the City Representative.

4.04 Erosion Control

A. Construction Projects that disturb more than 1 acre of land including material and equipment staging, storage, and material stockpiles shall require the Contractor to comply with 327 IAC 15-5 and submit a Storm Water Pollution Prevention Plan in accordance with said rule.

B. If the project disturbs less than 1 acre; Erosion Control Best Management Practices (BMP's) still must be instituted to prevent erosion and sedimentation from leaving the construction site.

C. The Contractor shall address any and all erosion problems identified by any City Representative with a suitable BMP. If a BMP should fail to address the problem either by incorrect installation or being overcome by significant natural forces or man-made forces, the BMP shall be substituted with a more suitable BMP or re-installed at the discretion of the City Representative.

D. Costs for all Erosion Control Practices, installation, maintenance, and monitoring is at the expense of the contractor and/or owner.

END OF SECTION

APPENDIX

City of Knox, IN

HYDROSTATIC WATER PIPELINE TEST REPORT

Date _____ Tester _____

Weather _____ Temperature _____

Project Name _____

Location _____

Pipe Diameter _____ Pipe Length _____ Pipe Material _____

Meter Number & Size _____ Meter Reading _____

Allowable Leakage (for 2-hour test period) _____

Test Start Time _____ Test Ending Time _____

Test Pressure Used _____ Leakage Recorded _____

Test Analysis (U-unsatisfactory S-satisfactory) _____

Sketch of pipe layout being tested (include fittings, caps, and plugs, etc. in the sketch) to be noted below or to be attached.

Figure 2

NOTES:

1. PLACE CURB BOX 3' FROM PL LINE IF NO ROOM WITHIN PUBLIC R.O.W.

2. KEEP METER PIT AS CLOSE TO CURB BOX AS POSSIBLE TO WITHIN 24". METER BOXES LOCATED WITHIN PUBLIC R.O.W. SHALL BE MAINTAINED BY THE UTILITY. OWNER SHALL MAINTAIN METER BOXES ON PRIVATE PROPERTY.

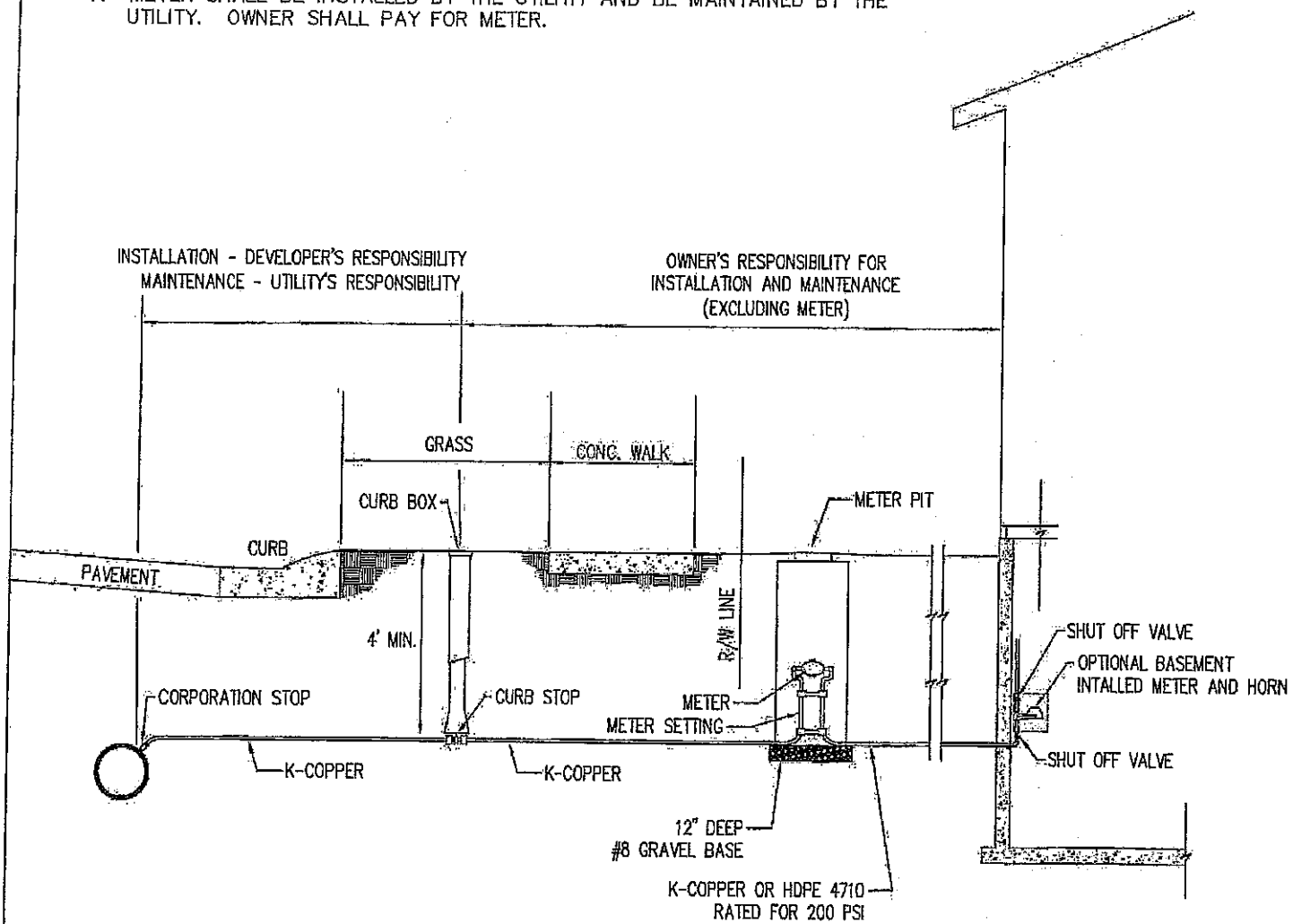
3. CURB BOX AND METER PIT MUST BE ACCESSIBLE AT ALL TIMES. DO NOT PLACE FENCE, RETAINING WALL OR OTHER CONSTRUCTION WITHIN 5' OF CURB BOX OR METER PIT.

4. SERVICE PIPING BETWEEN WATER MAIN AND BUILDING SHALL BE RUN IN AS STRAIGHT A LINE AS POSSIBLE. NO BENDS, FITTINGS, CONNECTIONS OR CHANGES IN PIPE SIZE ARE PERMITTED BETWEEN CORP STOP AND CURB STOP, OR BETWEEN CURB STOP AND METER PIT.

5. METERS PLACED IN BASEMENT OR FIRST FLOOR OF PREMISE SHALL BE PROTECTED FROM FREEZING AND DAMAGE. METERS NOT ALLOWED IN CRAWL SPACES. METERS IN PREMISE REQUIRE ELECTRONIC READIBLE TRANSMITTER (ERT).

6. NEW SERVICE LINES SHALL BE 1" DIAMETER MIN.

7. METER SHALL BE INSTALLED BY THE UTILITIY AND BE MAINTAINED BY THE UTILITY. OWNER SHALL PAY FOR METER.



RESIDENTIAL WATER SERVICE CONNECTION - TYPICAL LAYOUT

CITY OF KNOX
INDIANA

DATE	JOB #	FIGURE	SHEET #
5/22/2021	21-122	FIGURE 3	1 of 1

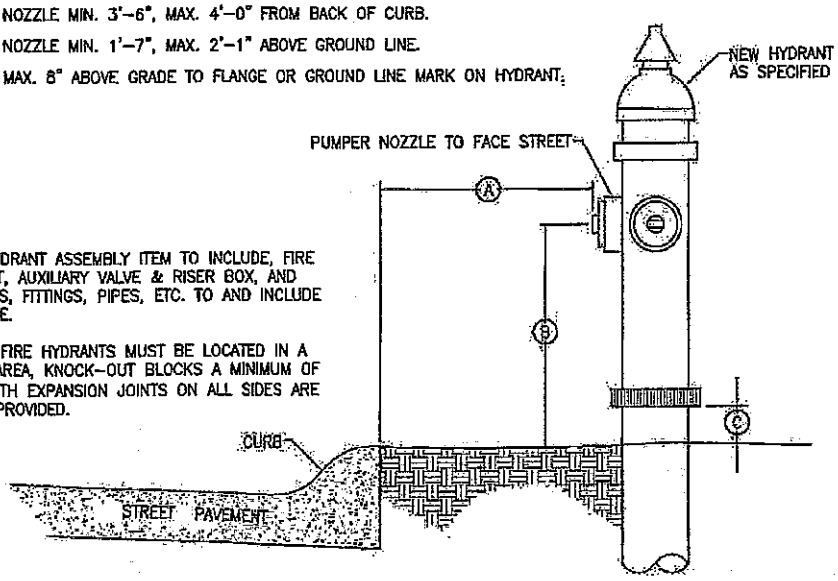
(A) PUMPER NOZZLE MIN. 3'-6", MAX. 4'-0" FROM BACK OF CURB.

(B) PUMPER NOZZLE MIN. 1'-7", MAX. 2'-1" ABOVE GROUND LINE.

(C) MIN. 2", MAX. 8" ABOVE GRADE TO FLANGE OR GROUND LINE MARK ON HYDRANT.

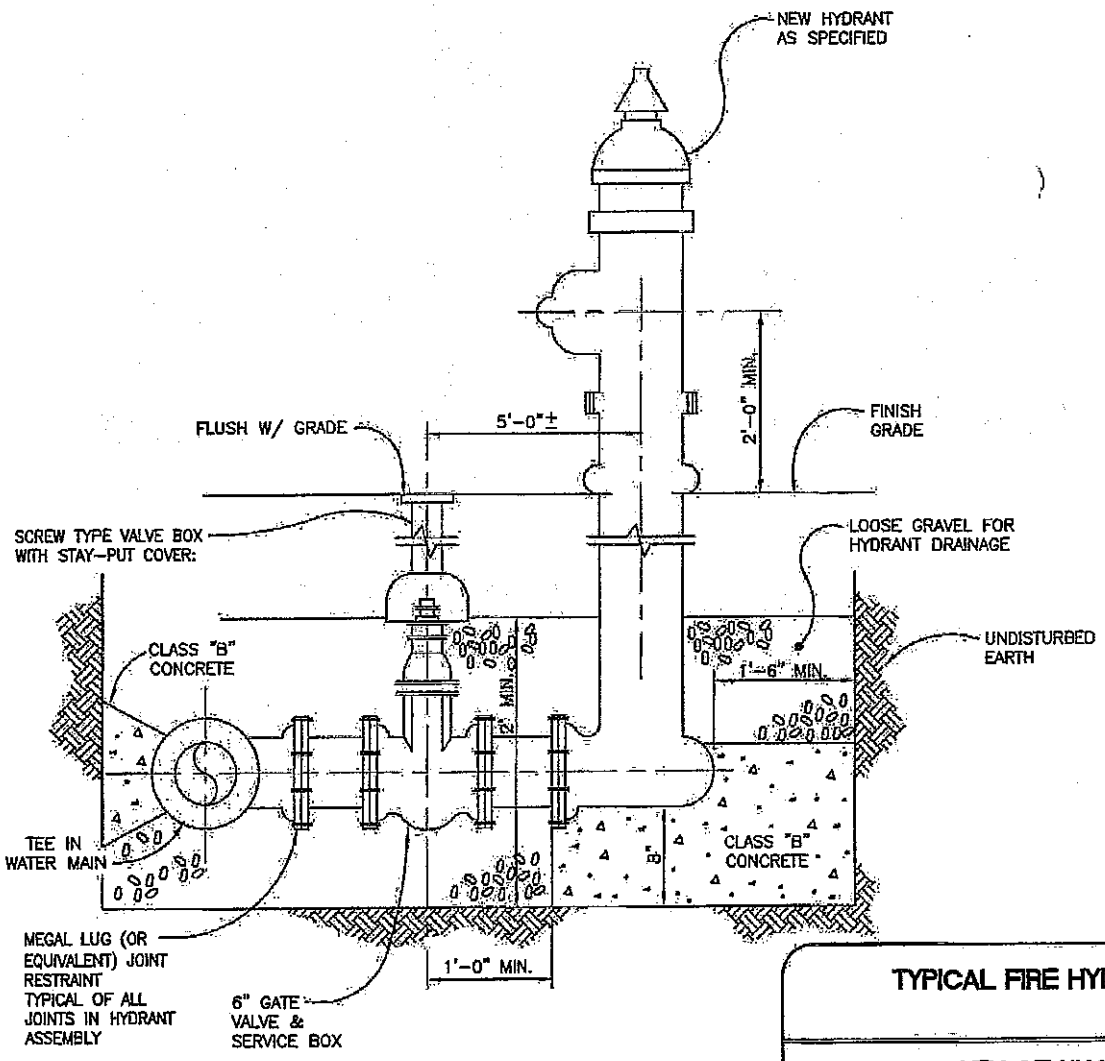
NOTES:

1. FIRE HYDRANT ASSEMBLY ITEM TO INCLUDE, FIRE HYDRANT, AUXILIARY VALVE & RISER BOX, AND ALL TEES, FITTINGS, PIPES, ETC. TO AND INCLUDE MAIN TEE.
2. WHERE FIRE HYDRANTS MUST BE LOCATED IN A PAVED AREA, KNOCK-OUT BLOCKS A MINIMUM OF 5'x5' WITH EXPANSION JOINTS ON ALL SIDES ARE TO BE PROVIDED.



FIRE HYDRANT LOCATION

NOT TO SCALE

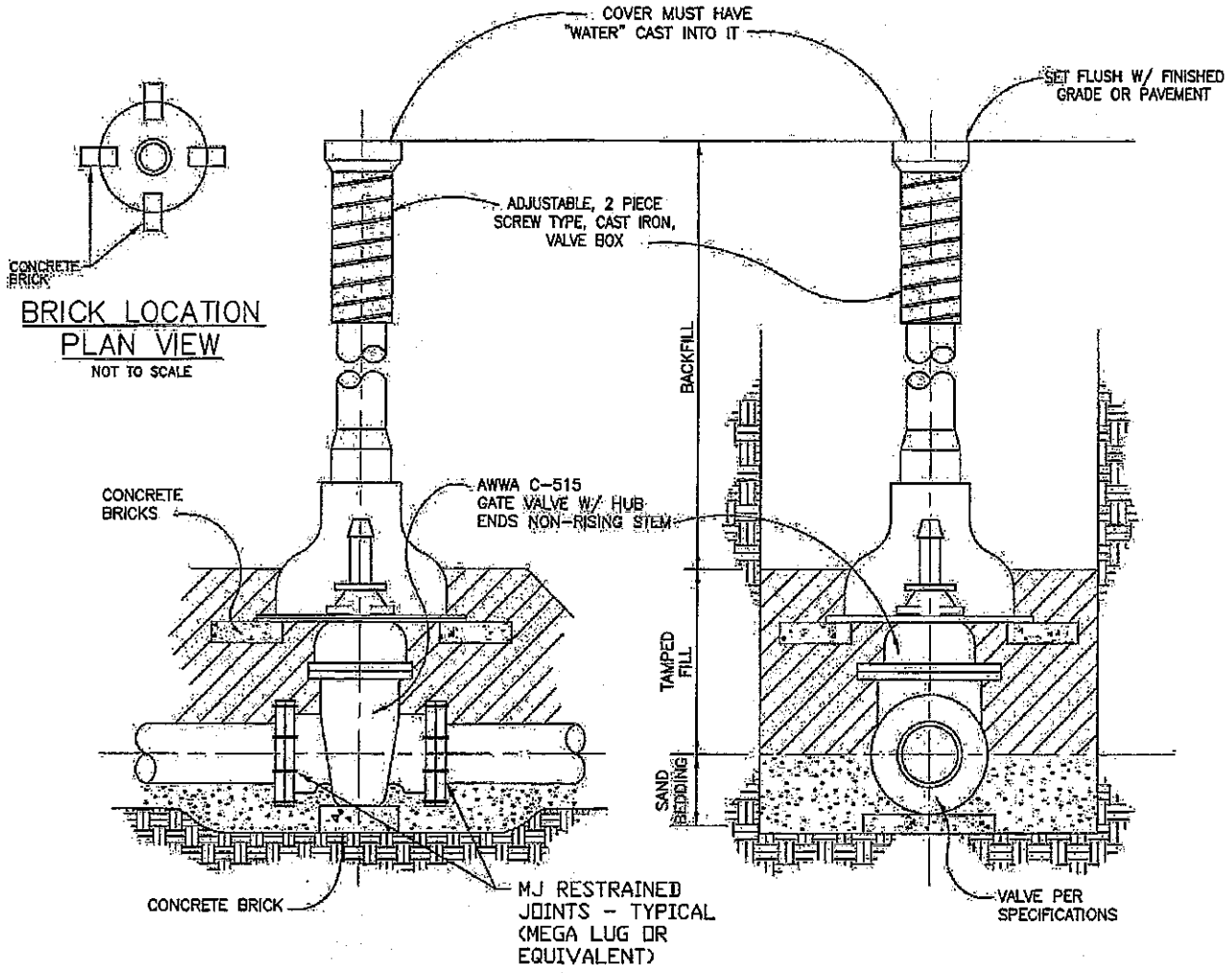


FIRE HYDRANT ASSEMBLY

TYPICAL FIRE HYDRANT

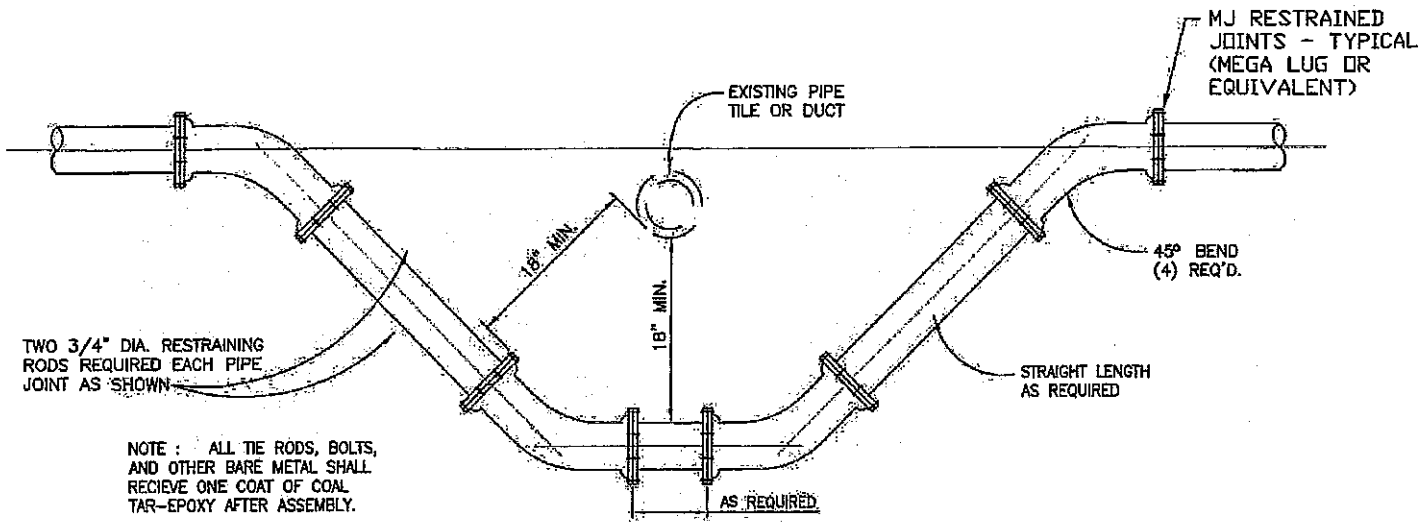
CITY OF KNOX
INDIANA

DATE	JOB #	FIGURE	SHEET
8/05/2022	21-122	FIGURE 4	1 of 1



TYPICAL DETAIL OF WATER MAIN VALVE

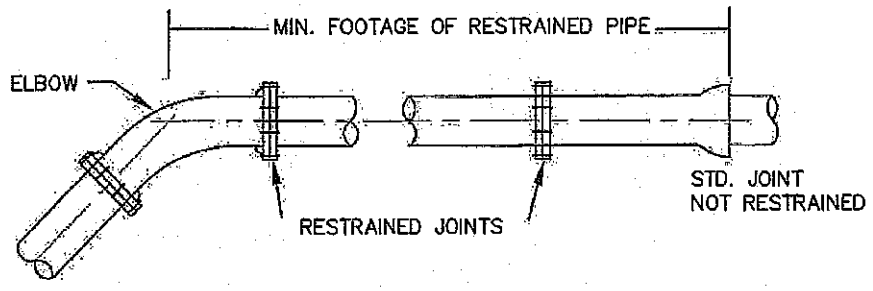
WATER MAIN VALVE TYPICAL DETAIL			
CITY OF KNOX INDIANA			
DATE: 8/05/2022	JOB #: 21-122	FIGURE 5	SHEET: 1 of 1



WATER MAIN CROSSING UNDER CONFLICTING UTILITY

MINIMUM FOOTAGE OF RESTRAINED PIPE FOR VARIOUS DEGREES OF CAST & DUCTILE IRON ELBOWS

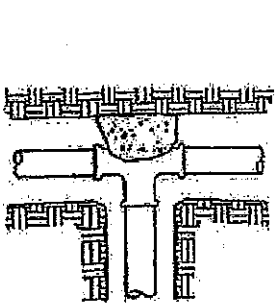
	DEGREE OF ELBOW											
	11-1/4°			22-1/2°			45°			90°-TEE-PLUG		
COVER	4'	5'	8'	4'	5'	8'	4'	5'	8'	4'	5'	8'
4" MAIN	—	—	—	—	—	—	3	3	2	10	8	5
6" MAIN	—	—	—	2	—	—	5	4	2	14	12	7
8" MAIN	—	—	—	2	2	—	6	5	3	20	16	10
10" MAIN	—	—	—	3	2	1	8	7	4	28	22	14
12" MAIN	—	—	—	3	3	2	12	9	6	39	30	19



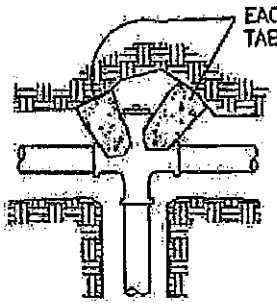
UTILITY CROSSING AND JOINT RESTRAINT

CITY OF KNOX INDIANA

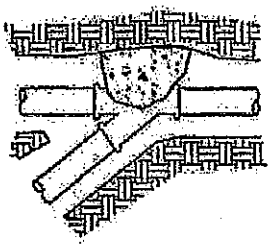
DATE	JOB #		SHEET
8/05/2022	21-122	FIGURE 6	1 of 1



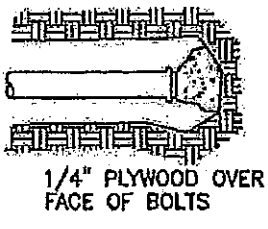
TEE



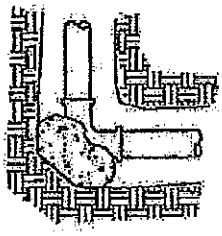
PLUGGED CROSS



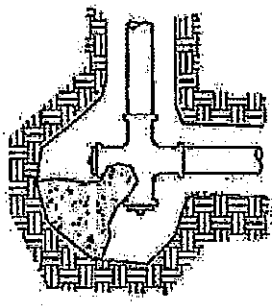
WYE



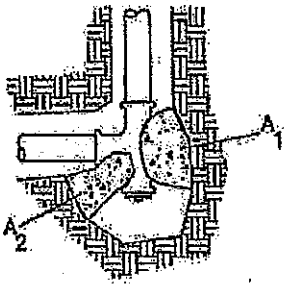
PLUG OR CAP



BEND



PLUGGED CROSS



PLUGGED TEE

1. CONCRETE THRUST BLOCKING TO BE POURED AGAINST UNDISTURBED SOIL.
2. KEEP CONCRETE CLEAR OF JOINTS AND ACCESSORIES.
3. IF NOT SHOWN ON PLANS, REQUIRED BEARING AREAS AT FITTING SHALL BE AS INDICATED BELOW, ADJUSTED IF NECESSARY, TO CONFORM TO THE TEST PRESSURES AND ALLOWABLE SOIL BEARING STRESSES STATED IN THE SPECIAL SPECIFICATIONS.
4. BEARING AREAS AND SPECIAL BLOCKING DETAILS SHOWN ON PLANS TAKE PRECEDENCE OVER BEARING AREAS AND BLOCKING DETAILS SHOWN ON THIS STANDARD DETAIL.
5. ALL CONCRETE SHALL BE 3000 PSI AT 14 DAYS.

BEARING AREA OF THRUST BLOCKS IN SQUARE FEET

FITTING SIZE	TEE, WYE, PLUG OR CAP	90° BEND PLUGGED CROSS	TEE PLUGGED ON RUN A_1	TEE PLUGGED ON RUN A_2	45° BEND	22-1/2° BEND	11-1/4° BEND
4	1.0	1.4	1.9	1.4	1.0	1.0	1.0
6	2.1	3.0	4.3	3.0	1.6	1.0	1.0
8	3.8	5.3	7.6	5.4	2.9	1.5	1.0
10	5.9	8.4	11.8	8.4	4.6	2.4	1.2
12	8.5	12.0	17.0	12.0	6.6	3.4	1.7
14	11.5	16.3	23.0	16.3	8.9	4.6	2.3
16	15.0	21.3	30.0	21.3	11.6	6.0	3.0
18	19.0	27.0	38.0	27.0	14.6	7.6	3.8
20	23.5	33.3	47.0	33.3	18.1	9.4	4.7
24	34.0	48.0	68.0	48.0	26.2	13.6	6.8

ABOVE BEARING AREAS BASED ON TEST PRESSURE OF 150 p.s.i. AND AN ALLOWABLE SOIL BEARING STRESS OF 2000 POUNDS PER SQUARE FOOT. TO COMPUTE BEARING AREAS FOR DIFFERENT TEST PRESSURES AND SOIL BEARING STRESSES, USE THE FOLLOWING EQUATION: BEARING AREA = (TEST PRESSURE/150) X (2000/SOIL BEARING STRESS) X (TABLE VALUE)

THRUST BLOCKING DETAILS

CITY OF KNOX
INDIANA

DATE	JOB #		SHEET
8/05/2022	21-122	FIGURE 7	1 of 1