

ORDINANCE NO. 2023-08-____

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF MCKINNEY, TEXAS, AMENDING CHAPTER 110, ENTITLED “UTILITIES,” OF THE CODE OF ORDINANCES OF THE CITY OF MCKINNEY, TEXAS, THROUGH THE AMENDMENT OF EXISTING ARTICLE I, ENTITLED “IN GENERAL,” BY AMENDING SECTION 110-1, THROUGH THE AMENDMENT OF EXISTING ARTICLE II, ENTITLED “WATER AND SEWER CONNECTIONS,” BY AMENDING SECTIONS 110-21, 110-22, 110-23, AND 110-51 AS SET FORTH HEREIN BELOW; REPEALING ALL CONFLICTING ORDINANCES; RESERVING ALL EXISTING RIGHTS AND REMEDIES; PROVIDING FOR IMMUNITY; PROVIDING FOR INJUNCTIONS; PROVIDING A PENALTY; PROVIDING FOR THE PUBLICATION OF THE CAPTION OF THIS ORDINANCE; AND PROVIDING FOR AN EFFECTIVE DATE

WHEREAS, the City of McKinney, Texas (the “City”) is a Home Rule City possessing the full power of local self-government pursuant to Article 11, Section 5 of the Texas Constitution, Section 51.072 of Texas Local Government Code and its Home Rule Charter; and

WHEREAS, the City adopted the Code of Ordinances, City of McKinney, Texas (“McKinney Code”), for the protection of the public health and general welfare of the people of the City; and

WHEREAS, the City Council of the City of McKinney, Texas (the “City Council”) enacted Chapter 110 of the McKinney Code to provide an equitable charge for water and sanitary sewer connections and a proportionate distribution of the cost of potable water and sanitary sewer facilities to serve customers in the area covered by the City’s Certificate of Convenience and Necessity both within the City’s corporate limits and its extraterritorial jurisdiction (collectively the “Certificated Area”); and

WHEREAS, Section 552.001(d) of the Texas Local Government Code specifically empowers a city that owns or operates a utility system including a water and/or sewer system to prescribe the kind of water mains and sewer pipes that may be used inside or outside the city; and

WHEREAS, Section 552.001(d) of the Texas Local Government Code also allows a city to inspect those facilities, and require that they be kept in good condition at all times and prescribe the necessary rules, which may include penalties, concerning such water and sewer facilities; and

WHEREAS, the City Council recognizes that additional requirements are necessary for persons desiring to connect to the City’s water and sanitary sewer services; and

WHEREAS, the City Council finds and determines that it is in the best interest of the public health, safety and general welfare of the citizens of McKinney, Texas, to amend certain provisions of Chapter 110, entitled “Utilities,” of the McKinney Code as provided herein below.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF MCKINNEY, TEXAS, THAT:

- Section 1. All of the above premises are found to be true and correct legislative determinations and are incorporated into the body of this Ordinance as if set forth in their entirety.
- Section 2. From and after the effective date of this Ordinance, Section 110-1, “Definitions,” of the McKinney Code, is hereby amended to add the following additional definitions to be inserted in alphabetical order to existing Section 110-1, “Definitions,” to hereafter read as follows:

“Design Standards or Water and Wastewater Design Standards, means the rules, regulations, standards, and specifications governing the configuration, design, construction, and acceptance of water line and wastewater line improvements including by way of example, and not limitation, mains, cut-offs, manholes, fire hydrants, service lines, and any other appurtenances related thereto, which are enforced by the Director of Engineering.”

Section 3. From and after the effective date of this Ordinance, Section 110-21, “Purpose,” of the McKinney Code, is hereby deleted in its entirety and replaced with a new Section 110-21 entitled “Purpose; Improvements Required; Acceptance,” to hereafter read as follows:

“Sec. 110-21. - Purpose; Improvements Required; Acceptance.

- (a) The intention and purpose of this article is to provide an equitable charge for water and sanitary sewer connections and a proportionate distribution of the cost of potable water and sanitary sewer facilities to serve the city's customers within the certificated area. This article is also intended to require that all extensions of and connections to the city's water and sewer utilities comply with and conform to the minimum requirements of Texas and federal law in addition to the city's regulations to protect the city's public drinking water supply and drinking water supply system (collectively "water system") from contamination or pollution including, but not limited to, proper system construction or configuration on the customer's side of the meter.
- (b) All water and wastewater improvements necessary to provide water and wastewater services to any locations within the City's corporate limits or the City's ETJ or any certificated areas of the City shall be designed, constructed, and installed in strict accordance with the Water and Wastewater Design Standards adopted by and through this Ordinance and attached hereto and incorporated herein by reference for all purposes allowed by law as Exhibit 1.
 - (1) The Director of Engineering is authorized and directed to apply and enforce all standards found in the Water and Wastewater Design Standards in the City and in the ETJ and in the City's certificated areas.
 - (2) The Director of Engineering may amend the requirements set out in the Water and Wastewater Design Standards from time to time, provided that an amendment shall be filed with the City Secretary at least 30 days before it becomes effective. No such standards shall conflict with this Article or any other City ordinance.
- (c) All water and wastewater improvements necessary to provide water and wastewater services to any locations within the City's corporate limits or the City's ETJ or any certificated areas of the City shall be designed, constructed, and installed at the sole cost of the developer, including all required testing and studies, on the subject property being served, as deemed necessary by the Director of Engineering to protect the City's public drinking water supply and drinking water supply system (collectively "water system") from contamination or pollution including, but not limited to, proper system construction or configuration on the customer's side of the meter.
- (d) Acceptance of Water and Wastewater Improvements

Following completion and final inspection of Water and Wastewater Improvements, the developer shall provide the City with a statement or affidavit specifying the value of water, sewerage, and other related utility assets being dedicated to the City together with a “bills paid” affidavit form acceptable to the City. The Director of Engineering shall accept such improvements in writing and thereafter make such payments, if any, to the developer as specified in any agreement entered into under this Chapter, if applicable.
- (e) Maintenance Bond

The subdivider shall furnish a maintenance bond in the amount of 15 percent of the contract price of all public improvements, or in such amount as approved by the Director of Engineering, with a reputable and solvent corporate surety in favor of the City to indemnify the City against any repairs which may become necessary to any part of the construction of Water and Wastewater Improvements in connection with the subdivision, arising from defective workmanship or materials, for a period of two full years from the date of final acceptance of the Water and Wastewater Improvements. Final acceptance will be withheld until the required maintenance bond is furnished to the City.

(f) Final Acceptance

Upon satisfactory completion of the required Water and Wastewater Improvements, the Director of Engineering shall issue a release of covenants to the property owner.”

Section 3. From and after the effective date of this Ordinance, Section 110-22, “Location of Lines; City Access; and System Protection,” of the McKinney Code, is hereby amended by deleting paragraph (c) in its entirety and replacing said paragraph (c) with a new paragraph (c) to hereafter read as follows:

“(c) Customer shall install in strict compliance with the Water and Wastewater Design Standards, and at customer's own expense, any necessary water and wastewater mains, cut-offs, manholes, fire hydrants, service lines, and any other appurtenances related thereto from the City's facilities and equipment to the point of use, including any customer service isolation valves, backflow prevention devices, clean-outs, and other equipment as may be specified by the City.”

Section 4. From and after the effective date of this Ordinance, Section 110-23, “Permit; Requirements to Connect,” of the McKinney Code, is hereby amended by deleting paragraph (b) in its entirety and replacing said paragraph (b) with a new paragraph (b) to hereafter read as follows:

“(b) All persons desiring retail utility services from the City or desiring to transfer service from a service location to another service location shall file an application with the City at the City's designated location. No connection to the City's utility system shall be made before the person has met the application, fee, and design and construction and extension requirements of this chapter specifically including the Water and Wastewater Design Standards and, if applicable, the City's Subdivision Regulations.”

Section 5. From and after the effective date of this Ordinance, Section 110-23, “Permit; Requirements to Connect,” of the McKinney Code, is hereby amended by deleting paragraph (d)(2) in its entirety and replacing said paragraph (d)(2) with a new paragraph (d)(2) to hereafter read as follows:

“(2) For developers in the City limits or the ETJ or certificated areas of the City desiring retail utility service from the City, the developer has complied with the requirements of the Water and Wastewater Design Standards and, if applicable, City's subdivision regulations to obtain retail utility service from the City for the subdivision.”

Section 6. From and after the effective date of this Ordinance, Section 110-23, “Permit; Requirements to Connect,” of the McKinney Code, is hereby amended by deleting paragraph (i)(3) in its entirety and replacing said paragraph (i)(3) with a new paragraph (i)(3) to hereafter read as follows:

“(3) Describe the facilities that are required to be constructed and the materials to be used in the construction of the facilities, state the size of each meter to be installed, define who will be responsible for the construction of those projects, and require the facilities to be sized and constructed in accordance with the

Water and Wastewater Design Standards and, if applicable, City's subdivision regulations, and as determined by the City's Director of Engineering.”

Section 7. From and after the effective date of this Ordinance, Section 110-23, “Permit; Requirements to Connect,” of the McKinney Code, is hereby amended by deleting paragraph (k)(2) in its entirety and replacing said paragraph (k)(2) with a new paragraph (k)(2) to hereafter read as follows:

“(2) No retail utility service shall be provided at premises located in whole or part outside the corporate limits of the City unless the person desiring such service has filed an application with the City, the City has determined the application meets the requirements of this chapter including the Water and Wastewater Design Standards, and if applicable the City’s Subdivision Regulations, and approved such application, and the person is a Qualified Service Applicant as defined by this Section.”

Section 8. From and after the effective date of this Ordinance, Section 110-23, “Permit; Requirements to Connect,” of the McKinney Code, is hereby amended by deleting paragraph (k)(3) in its entirety and replacing said paragraph (k)(3) with a new paragraph (k)(3) to hereafter read as follows:

“(3) The application for service to property located outside the corporate limits of the City shall include the following statement:

THE APPLICANT UNDERSTANDS AND AGREES THAT ALL ORDINANCES OF THE CITY (AS NOW WRITTEN AND AS HEREINAFTER AMENDED) RELATING TO UTILITY SERVICES OR TO PLUMBING MATTERS, INCLUDING BUT NOT LIMITED TO THE DESIGN STANDARDS AND CROSS-CONNECTION AND BACK-FLOW PROTECTION REQUIREMENTS, AND INCLUDING ORDINANCES THAT IMPOSE CRIMINAL SANCTIONS, APPLY TO UTILITY SERVICES PROVIDED BY THE CITY TO PREMISES OUTSIDE OF THE CITY’S CORPORATE LIMITS. THE APPLICANT ALSO UNDERSTANDS AND AGREES THAT THE CITY MAY SUSPEND OR DISCONNECT SUCH SERVICES IN THE EVENT THAT THE APPLICANT OR ANY OTHER PERSON AT THE PREMISES TO BE SERVED FAILS TO COMPLY WITH SUCH ORDINANCES.”

Section 9. From and after the effective date of this Ordinance, Section 110-23, “Permit; Requirements to Connect,” of the McKinney Code, is hereby amended by deleting paragraph (k)(4)b in its entirety and replacing said paragraph (k)(4)b with a new paragraph (k)(4)b to hereafter read as follows:

“b. The person has complied with the City’s utility facilities extension requirements as set out in this Chapter including the Design Standards, if necessary.”

Section 10. From and after the effective date of this Ordinance, Section 110-51, “Fire Hydrant Flow Standards,” of the McKinney Code, is hereby amended by deleting paragraph (b) in its entirety and replacing said paragraph (b) with a new paragraph (b), to read as follows:

“(b) Any Utility within the City’s corporate limits and ETJ and certificated areas shall maintain a minimum sufficient water flow and pressure to fire hydrants in a residential area located in the City or the City's ETJ or the City’s certificated areas.”

Section 11. From and after the effective date of this Ordinance, Section 110-51, “Fire Hydrant Flow Standards,” of the McKinney Code, is hereby amended by deleting paragraph (d) in its entirety and replacing said paragraph (d) with a new paragraph (d), to read as follows:

“(d) The City shall have the right to adopt a fire flow standard exceeding the minimum standards set out in subparagraph (c) of this Section based on:

(1) the density of connections;

(2) service demands; and

(3) other relevant factors.

In the event of any conflict between the fire flow standard adopted in this Section and the fire flow standard adopted by the City by and through the Water and Wastewater Design Standards or the City’s Subdivision Ordinance and/or the edition of the International Fire Code currently adopted by the City, the more stringent provisions shall apply.”

Section 12. From and after the effective date of this Ordinance, Section 110-51, “Fire Hydrant Flow Standards,” of the McKinney Code, is hereby amended by deleting paragraph (e) in its entirety and replacing said paragraph (e) with a new paragraph (e), to read as follows:

“(e) Notwithstanding anything to the contrary provided herein, the City will not require another Utility located in the City’s corporate limits or ETJ or certificated areas to provide water flow and pressure in a fire hydrant greater than that provided by the City’s Water System.”

Section 13. From and after the effective date of this Ordinance, Section 110-51, “Fire Hydrant Flow Standards,” of the McKinney Code, is hereby amended by deleting paragraph (g) in its entirety and replacing said paragraph (g) with a new paragraph (g), to read as follows:

“(g) The City will attempt to enter into a written memorandum of understanding with each Utility, other than the City’s Utility, which Utility provides water service within the City’s corporate limits and/or ETJ and/or certificated areas that will provide for:

(1) the necessary testing of fire hydrants; and

(2) other relevant issues pertaining to the use of the water and maintenance of the fire hydrants to ensure compliance with this subsection.”

Section 14. From and after the effective date of this Ordinance, Section 110-51, “Fire Hydrant Flow Standards,” of the McKinney Code, is hereby amended by deleting paragraph (g) in its entirety and replacing said paragraph (g) with a new paragraph (g), to read as follows:

Section 15. This Ordinance shall be cumulative of all other ordinances of the City and shall not repeal any of the provisions of said ordinances except in those instances where provisions of those ordinances are in direct conflict with the provisions of this Ordinance and such ordinances shall remain intact and are hereby ratified, verified and affirmed.

Section 16. If any section, article, paragraph, sentence, clause, phrase or word in this Ordinance, or application thereof to any person or circumstance, is held invalid or unconstitutional by a court of competent jurisdiction, such holding shall not affect the validity of the remaining portions of the Ordinance, and the City Council hereby declares it would have passed such remaining portions of the Ordinance despite such invalidity, which remaining portions shall remain in full force and effect.

- Section 17. All rights and remedies of the City of McKinney are expressly saved as to any and all violations of the provisions of any ordinances which have accrued at the time of the effective date of this Ordinance; and, as to such accrued violations and all pending litigation, both civil and criminal, whether pending in court or not, under such ordinances, same shall not be affected by this Ordinance but may be prosecuted until final disposition by the courts.
- Section 18. All of the regulations provided in this Ordinance are hereby declared to be governmental and for the health, safety and welfare of the general public. Any member of the City Council or any City official or employee charged with the enforcement of this Ordinance, acting for the City of McKinney in the discharge of his duties, shall not thereby render himself personally liable; and he is hereby relieved from all personal liability for any damage that might accrue to persons or property as a result of any act required or permitted in the discharge of his said duties.
- Section 19. Any violation of this Ordinance can be enjoined by a suit filed in the name of the City of McKinney in a court of competent jurisdiction, and this remedy shall be in addition to any penal provision in this Ordinance or in the Code of the City of McKinney.
- Section 20. Any person, firm or corporation violating any of the provisions of this Ordinance shall be subject to the penalty provisions set forth in Section 1-18 of the McKinney Code; and each and every day such violation shall continue shall be deemed to constitute a separate offense.
- Section 21. The caption of this Ordinance shall be published one time in a newspaper having general circulation in the City of McKinney following the City Council's adoption hereof as provided by law.
- Section 22. This Ordinance shall become effective from and after the date of its final passage and publication as provided by law, and it is accordingly so ordained.

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DULY PASSED AND APPROVED BY THE CITY COUNCIL OF THE CITY OF MCKINNEY,
TEXAS ON THE ____ DAY OF AUGUST, 2023.

CITY OF MCKINNEY, TEXAS

GEORGE C. FULLER
Mayor

CORRECTLY ENROLLED:

EMPRESS DRANE
City Secretary

DATE: _____

APPROVED AS TO FORM:

MARK S. HOUSER
City Attorney

EXHIBIT 1

Please see the attached Water and Wastewater Design Requirements.

UTILITIES

WATER AND WASTEWATER DESIGN REQUIREMENTS

1 General

1.1.A. General

1. Compliance with Master Plans – All water and wastewater plans shall comply with the current edition of the Water Distribution System Master Plan (Water Master Plan) and the current edition of the Wastewater Collection System Master Plan (Wastewater Master Plan) and be submitted to the Director of Engineering for review.
2. General Design Criteria – It is the responsibility of the engineer of record (engineer) to ensure that all water and wastewater plans are in conformance with the current edition of the City's various ordinances and master plans listed in **Section 1.3.B** and the following:
 - a. North Central Texas Council of Governments (NCTCOG) – Public Works Construction Standard Specifications and Standard Drawings
 - b. Rules and Regulations established by the Texas Commission on Environmental Quality (TCEQ)
 - c. American Water Works Association Standards (AWWA)
3. The engineer shall obtain the available record drawings (See **Section 1**), and field investigations and verifications shall be required prior to construction in accordance with the SUE Requirements in **Section 1.11**.
4. All new additions to the water system shall have two adequate points of connection to the public water system. The purpose of two connection points is to provide for continuous service for customers and fire protection when one point of connection is not in service.
5. Water and wastewater mains shall be sized and extended through the limits of a development to provide a connection for ultimate development of adjacent properties.
6. Siphons shall not be allowed for new development.
7. Construction Standards and Specifications – All work and materials shall be in accordance with the current edition of the City of McKinney Construction Standards and Specifications Manual and the North Central Texas Council of Governments (NCTCOG) Public Works Construction Standards. Should a conflict be found between the two publications, the City of McKinney Construction Standards and Specifications Manual shall take precedence. In the event that an item is not covered by the City of McKinney Construction Standards and Specifications Manual, the NCTCOG Public Works Construction Standards shall apply. Notification in writing by the contractor shall be made to the engineer, City inspector, and the Director of Engineering of the issue. The Director of Engineering shall make the final decision regarding all construction materials, methods, and procedures specified in construction plans. Reference to all documents contained in the project specifications shall refer to the current edition of each document.

1.1.B. Separation of Water Mains from Wastewater Mains

1. All water mains and wastewater mains shall be separated per TCEQ Rules and Regulations. Refer to the following:
 - a. Chapter 290 – Public Drinking Water SUBCHAPTER D: RULES AND REGULATIONS FOR PUBLIC WATER SYSTEMS §§290.38 – 290.47
 - b. Chapter 217 – Design Criteria for Domestic Wastewater Systems SUBCHAPTER C: CONVENTIONAL COLLECTION SYSTEMS §§217.51 – 217.71

1.1.C. State Highway Alignment Criteria

1. Prior to the design of facilities within TxDOT right-of-way, the engineer shall contact the appropriate regulatory agency to determine any special design, construction requirements and/or permitting requirements and shall copy the Director of Engineering on all correspondence with each regulatory agency.
2. Water and wastewater mains within or crossing a TxDOT right-of-way shall meet the requirements of the TxDOT Collin County Area Office and the TxDOT Utility Manual. Utility permits for lines within or crossing TxDOT rights-of-way shall be processed according to **Section 1.9**.
3. No new water or wastewater mains will be allowed in the TxDOT right-of-way except for perpendicular crossings.

1.1.D. Typical Utility Layouts within Right-of-Way

1. Water Mains – Water mains shall be located on the north or east parkway behind the curb. For arterial roadways, water lines shall be located outside of the ROW in a water easement.
2. Wastewater Mains – For arterial roadways, the wastewater lines shall be located outside of the ROW in a wastewater easement. For residential and collectors, wastewater mains shall be located along the roadway centerline.
3. Stormwater Mains – Stormwater mains shall be located along the centerline of the outside travel lane furthest from the water main.
4. Where Street Trees are proposed in accordance with **Section 7.4** of this manual, the utility layouts noted in that section shall be used.

1.1.E. Tunneling, Jacking, and Boring

1. All water and wastewater mains to be installed under existing roadways shall be installed by a method other than open cut. Dry bores are only allowed within City right-of-way (ROW). Percussion Method (Impact Moling/Missiles) shall not be allowed within City ROW. Steel casing shall be a minimum of 1/2 inch thick and the inside diameter shall be appropriately sized for construction and maintenance of the carrier pipe. The design of the steel casing thickness shall be verified by the engineer. No bends and/or curves are permitted with casing pipes. Casings shall be required when crossing under existing and proposed arterials, highways, and railroads. Casings may also be required where deemed necessary by the Director of Engineering.
2. The construction bore and receiving pit shall be located at a minimum distance of 4 feet behind the back of curb. The engineer shall provide a distance greater than 4 feet where there is no curb or barrier protection at the edge of pavement. Additional bore setback distances or shoring shall be required to maintain roadway integrity and the safety of construction personnel. When bore and receiving pits are located on private property, permanent water and wastewater easements for the pits will be required for the installation and future maintenance of the line.
3. The engineer shall design the pipe casing for the following loading conditions and/or applicable combinations thereof:
 - a. Cooper's E-80 Railway loading or AASHTO HS20 loading, as applicable.
 - b. Earth loading with the height of fill above the casing as shown on the plans as existing or finish grade whichever is greater.
 - c. All other applicable loading conditions, including loads applied during transportation and handling.
4. The engineer shall consider the location, size, and depth of bore and receiving pits relative to existing utilities when establishing the beginning and ending stations.
5. Full panel replacement shall be required where open cut is allowed by the Director

of Engineering.

1.1.F. Crossings

1. Storm Drain Crossings – A steel encasement pipe shall be used to encase the carrier pipe when there is less than two foot clearance between a water/sewer line and the storm drain. The encasement pipe shall be extended a minimum of 10 feet from the outside edge of a box culvert or the outside diameter edge of the storm drain for future maintenance of the carrier pipe.
2. Railroad Crossings – Refer to **Section 1.9** for requirements regarding coordination with regulatory agencies.
3. Pipeline Crossings – Refer to **Section 1.9** for requirements regarding coordination with regulatory agencies.
4. Creek Crossings
 - a. Water and wastewater mains constructed under any flowing stream or semi-permanent body of water, such as a marsh or pond, shall be installed inside a separate watertight encasement pipe. Water mains shall have isolation valves on each side of the crossing. Wastewater mains shall have manholes on each side of the crossing.
 - b. The engineer shall determine the type and limits of any special embedment, and specify the limits for specialized backfills to prevent soil erosion at the areas of trench backfill and as approved by the Director of Engineering.
 - c. Mains with less than 4 feet of cover shall be protected by a concrete encasement, a minimum of 10 feet past the top of the embankment on each side, and by additional streambank stabilization practices as required by the Director of Engineering. Refer to **Section 4** for additional floodplain development requirements.
 - d. Bank stabilization shall be provided for existing creek and ditch embankments disturbed by construction operations in accordance with the **Section 4** and **Section 8** of this manual and as approved by the Director of Engineering.
5. Aerial Creek Crossings
 - a. Aerial crossings may be used when other alternatives have been evaluated and rejected. Any development within the fully developed 100-year floodplain must meet the requirements in **Sections 4** and **8** of this manual. This may include, but is not limited to, a flood study and environmental permitting. The design of aerial creek crossings shall be performed by a structural Professional Engineer licensed in the State of Texas.
 - b. Aerial crossings shall meet the requirements in Section 4 of this manual related to Erosion Hazard Setback Easements (EHSE). EHSE limits shall be determined for the aerial crossing and shown on both plan and profile views. Aerial crossings shall be designed to the entire limits of the EHSE to compensate for the ultimate condition in the event the creek has eroded completely within the limits of the EHSE. Additional spans and/or piers may be needed beyond the location of the existing channel banks, which may be initially buried. Manholes shall be located outside the EHSE.
 - c. The engineer shall use a minimum 1/2 inch thick steel encasement pipe or ductile iron pipe around all aerial carrier pipes. The carrier pipe shall be restrained or welded all around joints or be a monolithic pipe between a span section. Minimum 1/2 inch thick by 6 inch wide stainless steel straps, bolts, and nuts or concrete collars shall be all around the steel encasement pipe at each pier/support structure. The steel encasement shall be extended to the manholes on each side of the crossing.
 - d. A span section must withstand the hydraulic forces applied by the occurrence of a fully developed 100-year flood including buoyancy. Spans must be a minimum of 50 feet. Both the aerial crossing encasement pipe and the supporting structure shall be capable of withstanding impacts from debris and

water. A scour analysis shall be performed and submitted to the Director of Engineering for review and approval.

- e. Wastewater mains shall have manholes on each side of the crossing. The encasement pipe shall extend from manhole to manhole on each side of the crossing. Pier spacing for the aerial crossing supports must maintain adequate grade and meet the requirements in **Section 4** regarding development in the floodplain.
- f. Aerial crossings that parallel an existing aerial crossing shall be provided with adequate separation (20 feet minimum) to allow for maintenance and repair operations for the crossings.
- g. Support structures/piers shall be provided within the erosion hazard setback easement for the channel. Sanitary sewer manholes shall be placed on each side of the crossing outside of the erosion hazard setback easement.

1.1.G. Easements - All proposed water or wastewater facilities that are outside of ROW or existing easements, shall be provided with permanent water or wastewater easement. The following are the minimum requirements for the easements:

1. Water and wastewater easements shall have a minimum width of 15 feet. Additional easement width shall be provided based on depth and diameter of utilities. The minimum easement width for water and wastewater mains deeper than 10 feet to the bottom of pipe, shall be equal to 2.5 times the depth of the line rounded up to the nearest 5 feet. For example, a wastewater main 13 feet deep. The wastewater easement would be $2.5 \times 13 \text{ feet} = 32.5 \text{ feet}$, rounded up to the nearest 5 feet = 35 feet. In addition, the minimum easement width shall increase for pipe sizes larger than 36 inch such that there is still 7.5 feet minimum beyond the outer edge of pipe, rounded up to the nearest 5 feet. (i.e. 36 inch pipe requires min 20 foot easement). Larger easement widths may be required by the Director of Engineering.
2. Single water or wastewater mains shall be located in the center of the easements. For 2 or more parallel water and wastewater mains in an easement, maintain the centerline of the utility a minimum of 7.5 feet from the edge of the easement for mains less than or equal to 10 feet deep. For mains greater than 10 feet deep, the easement width shall be 2.5 times the depth.
3. In residential developments, water and wastewater mains shall not cross residential lots. Water and wastewater easements shall be located completely on one side of a fence or property line.
4. Fire hydrants located outside of ROW or adjacent to water main easements shall be in a 15 feet wide easement along fire hydrant lead. Easement shall extend 10 feet beyond fire hydrant.
5. Two inch and smaller water meters serving multi-family residential and non-residential developments shall be in a minimum 5 feet x 5 feet water easement. Meters larger than 2 inches shall be in a minimum 15 feet x 20 feet water easement and shall not be within the ROW.
6. Temporary construction easements shall be provided to allow for construction operations for the installation.
7. Non-residential 3 inch and larger water meters shall be located in a water easement and clear of high traffic areas. The water easement shall be centered on the vault. The easement shall measure the outside dimensions of the vault and offset an additional 5 feet each side, and rounded to the nearest 5 foot interval. Water meter vaults shall be sized according to the size of the water meter. Refer to the City of McKinney Standard Details for minimum water meter vault sizes.
8. Permanent water or wastewater easements are required when boring and receiving pits are located on private property. The boring and receiving pit areas are necessary for future maintenance of the line.
9. Access easements shall be provided to all water and wastewater easements

including sections of water and wastewater mains that are not accessible or cutoff by tributaries, creeks or other obstructions along the permanent water or wastewater easement. Additional access points shall be provided so that the distance between access points does not exceed 1,500 feet as measured along the maintenance access path.

10. Permanent water and wastewater easements shall have a 12 feet wide maintenance access path provided with a maximum running slope of 8H:1V and a cross slope of 10H:1V for maintenance equipment and vehicular travel. This maintenance access path shall be adjacent to any at grade utility features or appurtenances.
11. A 16 feet wide gate (locks provided by City) shall be provided at all fence locations that cross access easements and permanent easement ingress and egress locations.
12. Additional water and/or wastewater easements widths shall be provided as needed in landscape buffers or other landscape areas in accordance with the Unified Development Code to provide sufficient clearance between utilities and trees.

1.1.H. Water and Wastewater Studies

1. Water studies, when deemed necessary by the Director of Engineering, will be required based on flow rates, water line distance to site, water quality issues, pressure issues, etc. for the protection of public health, safety, and welfare.
2. A sanitary sewer basin map, when deemed necessary by the Director of Engineering, will be required to ensure sufficient system capacity downstream of a proposed development.

1.2. Water System Design Criteria

1.2.A. General

1. The intent of the water system design requirements is to list minimum requirements for public water distribution and transmission system facilities and appurtenances.
2. Design criteria for all water systems shall comply with Texas Commission on Environmental Quality (TCEQ) current edition of Chapter 290, Subchapter D (Rules and Regulations for Public Water Systems), which is included in Part I of Title 30 of the Texas Administrative Code.
3. Water mains shall be sized and extended through the limits of a development to serve adjacent properties.
4. If a water loop serves only one property, the system shall be private and metered at each connection point to the public water system.
5. Connections to substandard mains shall not be allowed. Substandard mains shall be determined by the Director of Engineering based on criteria including, but not limited to: size, material, condition, pressure, flow rate, etc. Offsite improvements may be necessary to provide adequate water service to the site.
6. Twelve inch water lines are required along proposed or future collector roadways in accordance with the Water Master Plan.
7. Only 12 inch or larger connections are permitted on 24 inch diameter and larger transmission mains. Smaller diameter connections less than 12 inch diameter shall be made on internal or parallel development lines.
8. If allowed by the Director of Engineering to connect to the water system outside of the property's respective pressure plane, the minimum static pressure shall be 50 psi. A temporary booster system or pressure reducing valve may be required.

1.2.B. Water Services

1. All water services from the main to the meter shall be a 1 inch minimum size. All water services from the meter to the structure shall be size on size including the meter size. All water services shall be located along the lot lines or adjacent property lines. Water services and meters shall be sized in accordance with Appendix E of the International Plumbing Code.
2. A domestic service connection shall not be allowed on fire hydrant leads.
3. Service saddle shall be double bronze flattened straps (no banded straps shall be allowed) with brass body or stainless steel double bolt wide straps with stainless steel body. Minimum size tap shall be 1 inch diameter using a stainless steel single strap with a minimum 2 inch band width. Tap locations, for taps 2 inches or greater, need to be a minimum of 5 feet from end of pipe section or other pipe connection.
4. Detector pads embedded in sand shall be installed above all service connections.
5. Each meter box shall be located adjacent to the curb and installed after street pavement has been completed and curbs backfilled. Bullhead meter boxes shall be spaced 2 feet apart centered. A 2 inch minimum meter locator plate shall be placed in the recess of the meter boxes. In residential developments, bullhead water services (two meter boxes with single water service line tap) are required in single family residential developments.
6. All meters supplied by the City will be at contractor's expense. Concrete meter vaults are required for meter sizes 3 inches and larger and shall be provided by the contractor.
7. In single family residential developments, the nearest edge of the water meter box shall be a minimum of 6 inches behind the back of curb, and the water service shall be no more than 12 inches deep, covered with a meter box in place at grade. If no curb is present, the water service shall be located at the property line, no more than 12 inches deep, covered with a meter box in place at grade. Along roadways without a curb, the water service line shall be constructed at a minimum of 18 inches below the ditch flowline.
8. Commercial water meters will be located in a water easement and clear of high traffic areas. Water meter vaults shall be sized according to the size of the water meter and to allow for a minimum of a 12 inch clear working area for maintenance and operation. Minimum water meter vault sizes are shown in the City of McKinney Standard Details.
9. Installation of commercial meters will include two mainline valves, one bypass valve with chain and lock, a strainer, and bypass line, all located inside the vault. Clearances between fasteners on valves, strainers, and meters to interior surfaces shall provide adequate room for maintenance.
10. Water meter boxes shall be provided for each service per City Specifications. Requests for meters larger than those indicated above should be submitted with an installation detail specifying dimensions, materials and location of the water meter vault for review and approval by the Director of Engineering.

1.2.C. Water Demand and Supply

1. Residential development submittals shall include the total number of units and the total acres of the proposed development. Non-residential development submittals shall include estimated water use records showing the minimum hourly demand, maximum hourly demand, maximum daily demand, total building square footage, and the total acres for the proposed development. The projected maximum daily demand and maximum hourly demand shall be calculated and shown in MGD in accordance with the current edition of the Water Master Plan. A water basin map and sizing analysis shall be provided for water mains that serve more than 300 single family units, 400 multi-family units, or an equivalent combination of those uses or other uses.
2. The North Texas Municipal Water District (NTMWD) supplies treated water at the

Gerrish Pump Station, McKinney Ranch Pump Station, University Pump Station, and Redbud Pump Station as shown in the Water Master Plan.

1.2.D. Pressure Planes

1. The City currently operates three pressure planes, the 794 Service Area, the 850 Service Area, and the 920 Service Area. A proposed fourth pressure plane, the 840 Service Area, was established. It is envisioned that the proposed 840 Service Area will be supplied by the 794 Service Area and pressurized with a booster pump station and pneumatic tank. The 794 Service Area has a pressure range from 40 psi to 120 psi, the 850 Service Area has a pressure range from 55 psi to 125 psi, the 920 Service Area has a pressure range from 50 psi to 140 psi, and the 840 Service Area has a pressure range from 65 psi to 90 psi. Higher pressures are experienced in the lower ground elevations in each service area in locations in close proximity to Wilson Creek or the East Fork of the Trinity River and their tributaries. The locations of the existing and proposed pressure planes are shown in the Water Master Plan.
2. The service area elevation designation is related to the high water level of elevated storage tanks.
3. Prior to the design of a water system, the engineer shall investigate and determine if the proposed water main crosses the boundary between any of the pressure planes. For those pressure planes separated by a street, a main shall be provided for each pressure plane on their respective side of the street. Proposed mains that approach pressure zone boundaries shall be designed to loop within their designated pressure planes as shown in the Water Master Plan.

1.2.E. Sizing Water Distribution Mains

1. General
 - a. Water mains shall be sized to have maximum velocities of 8 feet per second for Maximum Daily Demands and maximum velocities of 10 feet per second for Combined Maximum Daily Demand and Fire Flow Demands.
 - b. **Table 5-1** provides the water demand for residential land uses and shall apply for any residential development where the lot layout has not been finalized.
 - c. **Table 5-2** provides the water demand for non-residential land uses.

• Table 5-1 – Residential Water Demand by Land Use

District	Land Use	Estimated Units Per Acre	Population Per Unit	Maximum Daily Demand (gpad)	Maximum Hourly Demand (gpad)
R43	Estate	1.0	3.2	1,120	2,240
R12	Single Family	2.7	3.2	3,024	6,048
R8	Single Family	4.1	3.2	4,592	9,184
R6	Single Family	5.4	3.2	6,048	12,096
R5	Single Family	6.5	3.2	7,280	14,560
TR1.8	Townhome	18.1	2.0	12,670	25,340
FR	Flex Residential	9.0	2.5	7,875	15,750
MR	Mixed Residential	18.0	2.0	12,600	25,200
MF30	Multi-Family	22.5	2.0	15,750	31,500
MHR	Mobile Home Park	8.0	2.0	5,600	11,200

Table 5-2 – Non-Residential Water Demand by Land Use

Land Use	Max. Daily Demand	Max. Hourly Demand
Town Center Redevelopment	3,500 gpad	4,000 gpad
Town Center Downtown	3,000 gpad	3,000 gpad
Ex. Retail/Office, Fut. Town Center Mix, Neighborhood Comm, Prof. Campus / Employ. Mix, Entertain Ctr & Mixed Use Center, Restaurant	1,500 gpad	2,700 gpad
Institutional – Schools, Hospitals, Nursing, Government, etc.	1,500 gpad	2,000 gpad
Future Manufacturing & Warehousing / Employ Mix Comm. Center, Comm Center,	2,000 gpad	3,000 gpad
Exist. Industrial & Future Manufacturing & Warehousing	2,500 gpad	3,000 gpad

Entertainment Center	3,000 gpad	3,900 gpad
Professional Campus	3,000 gpad	4,500 gpad
Professional Campus / Comm. Center	6,000 gpad	6,000 gpad
Exist. Open, Amenity Zone & Parks	1,500 gpad	1,500 gpad
Town Center Mix	1,500 gpad	2,700 gpad
Urban Living	1,500 gpad	2,700 gpad
Utilities & Airport	1,000 gpad	1,000 gpad

gpad –gallons per acre per day
Source: 2019 Water Distribution System Master Plan Update

- d. Land uses not listed shall be classified by the land use they most nearly resemble in **Table 5-2** or calculated by the engineer in accordance with the anticipated use. The engineer shall submit the Maximum Daily Demand and the Maximum Hourly Demand to the Director of Engineering for review and approval.
- e. The engineer shall contact the Director of Engineering to obtain the map of existing pressure ranges for the project area during maximum daily demands and/or determine the size of water main required from the current edition of the Water Master Plan. For all developments, re-developments, and any type of facility tying into the City's water distribution system, the following guidelines shall be used:
 - i. The engineer shall obtain the available record drawings (See **Section 1**). When record drawings are not available, field investigations and verifications shall be required prior to construction.
 - ii. The standard water main sizes that shall be used are noted in the **Table 5-3**.
 - iii. Fire flows for all districts shall be calculated with a minimum residual pressure of 20 psi under combined fire and domestic (Maximum Daily Demand) water flow conditions and/or the latest requirement by the TCEQ. Fire flows shall be as determined by Appendix B of the International Fire Code as amended by the City of McKinney. For single-family residential areas, a minimum fire flow of 1,500 gpm shall be provided. For multi-family, commercial, and industrial areas, a minimum fire flow of 3,500 gpm shall be provided. Buildings larger than 75,000 square feet may require greater fire flows per the Fire Department.
 - iv. Mains are to be sized to ensure less than 1 foot of head loss per 1000 feet of water main using a Hazen Williams coefficient of C = 110 for the Maximum Hourly Demand flow rates within the subdivision internal distribution system.
 - v. Mains shall be sized to provide service to adjacent properties.

• **Table 5-3 – Standard Water Main Sizes**

8 inch	12 inch	16 inch	18 inch
20 inch	24 inch	30 inch	36 inch
42 inch	48 inch	54 inch	60 inch
66 inch	72 inch	----	----

- 2. Single Family Residential – 12 inch mains shall be required along all collector streets and other areas as determined by the Director of Engineering. Eight inch mains are required along smaller residential streets.

- 3. Multi-Family Residential – Minimum size main in any multi-family project shall be 8 inches. Mains over 600 feet in length between intersecting mains or mains supplying more than one fire hydrant/fire service line shall be 12 inch diameter unless an 8 inch diameter size has been verified by the City’s modeling consultant. The City’s consultant will provide the results of the modeling efforts within a brief letter report. The scope for the modeling efforts will be reviewed by the developer and the Director of Engineering for approval prior to performing the modeling efforts. The expense of the modeling efforts and letter report is the responsibility of the developer.
- 4. Non-Residential – Mains over 1,000 feet in length between intersecting mains or mains supplying more than two fire hydrants/fire service lines shall be 12 inch diameter unless an 8 inch diameter size has been verified by the City’s modeling consultant. The City’s consultant will provide the results of the modeling efforts within a brief letter report. The scope for the modeling efforts will be reviewed by the developer and the Director of Engineering for approval prior to performing the modeling efforts. The expense of the modeling efforts and letter report is the responsibility of the developer.

1.2.F. Horizontal Alignment and Vertical Alignment

- 1. The following guidelines shall be used for the placement of water mains:
 - a. Sixteen inch and larger water mains shall be designed in straight alignments if possible. Avoid excessive number of high points and low points between cross street connections.
 - b. Minimum radius of curve and maximum deflection angle of pipe joints will be restricted to 75 percent of manufacturer’s recommendation, after which the use of horizontal or vertical bends will be required.
 - c. Restrained joints and concrete thrust blocks shall be provided for each dead end, valve, bend, tee-connection, fire hydrant, reducer, and where changes in pipe diameters or directions occur. The size and shape of concrete thrust blocks shall be specified by the Engineer. The length of restrained-joint piping and details of joint-restraint glands, clamps, friction slabs, or other anchors shall be specified by the Engineer. Restraining mechanisms for PVC pipe and fittings shall be tested and shall meet the requirements of ASTM F1674.
 - d. All bends shall be 45 degrees or less where practical. Two 45 degree bends in a series shall be separated by a distance of five pipe diameters instead of a 90 degree bend.

1.2.G. Depth of Cover

- 1. The minimum depth of cover for water mains are indicated in **Table 5-4**.

Table 5-4 – Depth of Cover to Top of Pipe

Pipe Size	Minimum Depth of Cover
6 inch through 8 inch	4.0 feet
12 inch through 18 inch	5.0 feet
20 inch and larger	6.0 feet

- 2. The engineer shall consider the ultimate roadway elevations in determining the depth of cover. Additional depth of cover shall be required for future development and as directed by the Director of Engineering. Depths of cover greater than 8 feet shall be approved by the Director of Engineering.

1.2.H. Pipe Material

- 1. The selected pipe material used in construction shall be noted on all plan and profile sheets in the Record Drawings.

2. The specification of pipe material is the responsibility of the engineer based on the analysis of specific site, soil conditions, loading conditions, and pressure requirements. The guidelines in Table 5-5 are based on pipe size only and in no way relieve the engineer of the responsibility of pipe material specifications applicable to the particular project and restrictions due to special construction methods.
3. Additional specifications for the pipes referenced in **Table 5-5** are as follows:
 - a. Corrosion Protection System
 - i. All Bar Wrapped Concrete Cylinder, Ductile Iron, and Steel Pipe will require a Corrosion Protection System (CPS). The CPS must be designed by a NACE certified Professional Engineer with considerable experience in corrosion engineering.
 - ii. A detailed corrosion survey shall be conducted along the alignment to identify potential corrosion problems and recommend a corrosion protection system.
 - iii. Based on the corrosion survey, a CPS shall be designed to include a Galvanic Protection System. The CPS shall be submitted for review and approval by the Director of Engineering. The final anode bed and test station locations need to be shown on the plans and record drawings.
 - iv. Dissimilar metals shall be isolated using insulating kits or other means to prevent galvanic corrosion.
 - b. Steel Pipe
 - i. Design fittings, special, associated joints and all field and shop welds shall have load capacities equal to or greater than those of connecting pipe segments.
 - ii. Design bulkhead, closure, or test plug, as needed for closure of sections and for field hydrostatic testing.
 - iii. Design and locate weld lead outlets as needed.
 - iv. Design and locate flush and sampling ports, as needed, for hydrostatic testing and disinfection.
 - c. PVC Pipe
 - i. PVC pipes shall be marked on the spigot ends with dual insert marks. The first mark, if visible, means the pipe needs to be inserted more. The second mark always needs to be visible .
 - ii. If the second mark is not visible, then the pipe was over-inserted and the joint needs to be disassembled and correctly installed
 - d. HDPE Pipe
 - i. Formulated with carbon black and/or ultraviolet stabilizer.
 - ii. HDPE pipe size selection needs to account for the pipe wall thicknesses to meet the internal diameters listed within **Table 5-5**, internal pressures, and depth of bury.

• **Table 5-5 – Pipe Materials for Mains**

Internal Diameter Pipe Size	Pipe Material
4 inch through 12 inch	<ul style="list-style-type: none"> • PVC, AWWA C900, minimum DR 18 (DR 14 for fire service lines). • Ductile Iron, AWWA C151, working pressure of 150 psi with 100 psi surge pressure, cement mortar lined, polyethylene encased. • HDPE, AWWA C901/C906, DIPS minimum DR 11, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and ANSI/NSF 14/61 listed. • PVC, AWWA Fusible C900, minimum DR 18 (DR 14 for fire service lines).
16 inch through 20 inch	<ul style="list-style-type: none"> • Ductile Iron, AWWA C151, working pressure of 150 psi with 100 psi surge pressure, cement mortar lined, polyethylene encased. • Bar Wrapped Concrete Steel Cylinder, AWWA C303, working pressure of 150 psi with 100 psi surge pressure. • HDPE, AWWA C901/C906, DIPS minimum DR 9, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and ANSI/NSF 14/61 listed, working pressure of 150 psi with 100 psi surge pressure. • PVC, AWWA C900, minimum DR 18. • PVC, AWWA Fusible C900, minimum DR 18 (DR 14 for fire service lines).
24 inch	<ul style="list-style-type: none"> • Ductile Iron, AWWA C151, working pressure of 150 psi with 100 psi surge pressure, cement mortar lined, polyethylene encased. • Bar Wrapped Concrete Steel Cylinder, AWWA C303, working pressure of 150 psi with 100 psi surge pressure, reinforced concrete cylinder pipe. • Steel, AWWA C200 and C205, working pressure of 150 psi with 100 psi surge pressure, cement mortar lined, polyurethane coating applied to the exterior, polyurethane coating shall utilize plural component polyurethane products. • PVC, AWWA C900, minimum DR 18. HDPE, AWWA C901/C906, DIPS minimum DR 9, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and ANSI/NSF 14/61 listed, working pressure of 150 psi with 100 psi surge pressure. • PVC, AWWA Fusible C900, minimum DR 18.
30 inch and larger	<ul style="list-style-type: none"> • Ductile Iron, AWWA C151, working pressure of 150 psi with 100 psi surge pressure, cement mortar lined, polyethylene encased. • Bar Wrapped Concrete Steel Cylinder, AWWA C303, working pressure of 150 psi with 100 psi surge pressure, reinforced concrete cylinder pipe. • Steel, AWWA C200 and C205, working pressure of 150 psi with 100 psi surge pressure, cement mortar lined, polyurethane coating applied to the exterior, polyurethane coating shall utilize plural component polyurethane products.

5.2.I. Fittings

1. All valves and fittings shall be restrained per the Utilities Approved Materials List in the Construction Standards and Specifications Manual.
2. Fittings shall be ductile iron in accordance with AWWA C110 or AWWA C153. All buried metal shall be wrapped in polyethylene tube wrap.

5.2.J. Pipe Embedment

1. The type of embedment for water mains less than 16 inch diameter shall be NCTCOG Class "H" embedment extended to 12 inches minimum over the top of pipe.
2. For pipe sizes 16 inches and greater, the embedment class shall be a function of the pipe material selected including dead and live load considerations provided by the engineer. The engineer shall submit calculations on the embedment selected for the particular pipe type.
3. Trench dams may be required by the Director of Engineering depending on the ground water potential, pipe slope and length of sloped line segments.

5.2.K. Dead-End Mains

1. Dead-end mains are not allowed unless approved by the Director of Engineering. The design of all water distribution systems should include the opportunity for future looping or interconnect of any approved or proposed dead-end line.
2. All dead-end lines shall only be installed upon approval from the Director of Engineering and at a maximum length of 150 feet.
3. Residential cul-de-sac dead end lines shall be reduced down to 4 inch diameter from the beginning of the cul-de-sac bulb to the last household water service connection. The fire hydrant lead shall be installed prior to the reduction of the main line size.
4. Where dead-end mains are approved, the engineer shall provide an automatic flush valve at the end of the dead-end main. The discharge from the automatic flush valve shall be routed underground to connect to the storm sewer system. Water quality concerns shall be the primary consideration when evaluating whether dead-end mains will be approved.

5.2.L. Fire Hydrants

1. Fire Department Connections and Fire Sprinkler Systems
 - a. At least one fire hydrant shall be within 50 feet of any Fire Department Connection (FDC). The FDC shall face and front a fire lane. FDC's shall be located in accordance with the International Fire Code as amended by the City of McKinney. Stand-alone FDCs located adjacent to parking lots shall be properly protected.
 - b. Fire lines exceeding 100 feet in length from the riser room to the circulating water main shall install a backflow preventer in a vault adjacent to the public water easement. The Fire Marshal shall approve the construction plans for the vault, fittings, valves, and double detector check and shall issue a separate permit for fire sprinkler systems.
2. Fire Hydrant Spacing
 - a. Single Family Residential – Fire hydrants shall be located at all intersecting streets and at intermediate locations between intersections as necessary to provide a maximum spacing of 500 feet between fire hydrants as measured along the route. The route shall be clear of permanent barriers and adjacent private property.

b. Multi-Family Residential

- i. Fire hydrants shall be located at all intersecting streets and at intermediate locations between intersections as necessary to provide a maximum spacing of 300 feet as measured along the length of the centerline of the fire lane or roadway. Any structure at grade shall be no further than 500 feet from at least two fire hydrants as measured along the route. The route shall be clear of permanent barriers and adjacent private property.
- ii. At least one fire hydrant shall be within 50 feet of any Fire Department Connection as described in **Section 5.2.L**.
- iii. Fire hydrants shall be at least 35 feet from all buildings.

c. Non-Residential

- i. Non-Residential Property – As the property is developed, fire hydrants shall be located at all intersecting streets and at intermediate locations between intersections as necessary to provide a maximum spacing of 300 feet as measured along the length of the centerline of the fire lane or roadway. The front of any building at grade shall be no further than 300 feet from a minimum of two fire hydrants as measured along the route. The route shall be clear of permanent barriers and adjacent private property.
 - ii. Fire Sprinkler System Stub-out – The Fire Marshal shall approve the vault, fittings, valves, and double detector check and will issue a separate permit for fire suppression systems.
 - iii. Fire hydrant spacing shall be in accordance with Appendix C of the current edition of the International Fire Code.
 - iv. At least one fire hydrant shall be within 50 feet of any Fire Department Connection as described in **Section 5.2.L**.
 - v. Location of fire hydrants shall be installed outside of the PCs and PTs of curve radii of fire lanes (no fire hydrants shall be located within the radius delta angle between the PC and PT of the curve). Fire hydrants shall be at least 35 feet from all buildings.
 - vi. Where access could be blocked due to a barrier between the fire hydrant and the building which it is intended to serve, additional fire hydrants shall be provided to improve the fire protection.
- d. Spacing along Arterials – Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards. For divided roadways, fire hydrants shall be provided at a spacing not to exceed 1,000 feet for each side of the roadway with a 500 feet spacing on an alternating basis between the fire hydrants.

3. Fire Hydrant Installation

- a. Fire hydrants shall be located a minimum of 3 feet and a maximum of 6 feet from the fire lane or roadway as measured from the centerline of the fire hydrant to back of curb, edge of pavement, or fire lane.
- b. A 3 feet clear radius shall be maintained for access and operation of the fire hydrant.
- c. Fire hydrants placed on private property shall be located in water easements and adequately protected behind a curb or curb stop, pipe bollards, or other methods as approved by the Director of Engineering and the Fire Department. Curb or curb stop, pipe bollards, or other methods shall be the responsibility of the owner.
- d. Fire hydrants located on public or private property shall be accessible to the Fire Department at all times.

- e. Fire Hydrants are not permitted in the bulb of a cul-de-sac due to limited parking area and reduced water main size if a dead-end line.
 - f. Standard fire hydrant barrel shoe depth where ever practical shall be 5 feet. The fire hydrant lead line shall be adjusted to meet the standard fire hydrant depth.
4. Fire Hydrant Leads
- a. Fire hydrant leads shall be a minimum of 6 inches and have a bury depth of 4 feet.
 - b. Valves shall be placed on all fire hydrant leads. The connection to the main line shall include a flanged tee connected to a flange by mechanical joint gate valve. The mechanical joint shall be restrained so that the valve is anchored to the main.
 - c. Eight inch mains shall be connected so as to serve not more than two fire hydrants located between intersecting mains. Every development shall provide adequate water capacity for fire protection purposes. The procedure for determining fire flow requirements for building or portions of buildings shall be in accordance with the current City adopted International Fire Code. The minimum required fire flow shall be 1,500 gpm at 20 psi.
 - d. Fire hydrant leads shall not exceed 50 feet unless approved by the Director of Engineering. If a variance is granted to exceed 50 feet, fire hydrant leads exceeding 100 feet in length from the circulating water main shall install a backflow preventer in a vault adjacent to the public water easement.
 - e. Existing 4 inch mains used for hydrant supply shall be replaced and dead-ends eliminated where practical. Existing 6 inch lines shall be connected so that not more than one fire hydrant shall be between intersecting lines. New fire hydrants shall not be connected to substandard mains.
 - f. For main replacement projects in established neighborhoods, fire hydrants should be designed as close as possible to the old fire hydrant location, provided coverage is adequate. Fire hydrants shall not be installed closer than 9 feet to any wastewater main or any wastewater appurtenance.
5. Specifications – Fire hydrants shall be three-way breakaway type no less than 5-1/4 inch size. Mechanical joint connection is required.
6. Public and Private Fire Mains – Public and private fire protection water mains shall be installed according to the NCTCOG, National Fire Protection Association (NFPA) 24 and the current City adopted International Fire Code.

5.2.M. Valves

1. General – The following guidelines should aid the engineer in placement of valves on proposed water mains.
- a. Valves are to be located at street intersections at or near side property lines, unless a specific construction issue requires the placement of the valve at a nonstandard point of connection. Valves shall be installed on each branch and mainline segment at tees and crosses for 12 inch or larger water mains. Site specific approval may be given to use a fire hydrant isolation valve within 100 linear feet of the connection point.
 - b. Valves 20 inches and under shall be Resilient Wedge Gate Valves (RWGV). Valves shall be spaced 600 feet or less in a single family residential district and 500 feet or less in all other districts. Valves shall be placed in such a manner as to require two, but not more than three valves, to shut down each main segment without shutting off more than one fire hydrant.
 - c. Twenty four inch and larger valves may be butterfly type and shall be spaced at a maximum of 1,000 foot intervals. All valves shall have horizontal mounted actuators with a manhole for access to the actuators.

- d. Valves shall be placed at or near the ends of mains in such a manner that a shut down can be made for a future main extension without causing loss of service on the existing main. A minimum of 20 feet of main shall be installed past the valve and mechanical pipe thrust restraints shall be used to anchor it.
 - e. Main line water valves shall be provided on each side of the domestic service line connection serving Care Facilities, Emergency Rooms, Hospitals, Clinics, Schools, Montessori Schools, and Day Cares.
 - f. Where fire lines are connected to the water main, valves shall be installed on one side of the connection to provide the ability to isolate the main line and continue to provide water to the fire line. The fire line shall be provided with a valve at the connection with the main line.
 - g. Valve boxes shall be provided for buried valves. They shall be three-piece screw-type cast iron boxes of the extension type. The three pieces shall consist of the top section, bottom section, and cover.
 - h. Two inch square nuts that would be over 5 feet deep shall have valve stem extensions. In these cases, the 2 inch square valve operating nut shall be no greater than 2 feet from the finish grade. Valve box extensions may be cast iron or C-900 PVC.
 - i. Mechanical joint restraints are required for all valves.
 - j. The location of isolation valves shall be placed to anticipate system flushing and disinfection.
 - k. All valves shall be located outside of barrier free ramps.
 - l. All valves shall be stationed along water mains including profiles and reference roadway centerline stationing.
2. Air Release, Air/Vacuum, and Combination Air Valves
- a. Air release valves, air/vacuum, and combination air valves shall be required on 16 inch and larger water mains and as necessary for proper system operation. There are three primary functions of the valves that the engineer shall consider as follows:
 - i. To vent large volumes of air during filling of the line;
 - ii. To allow air into the pipe during emptying for maintenance and/or repairs; and,
 - iii. To vent small volumes of air that come out of solution during service.
 - b. Typically these are installed at high points where the pipeline has a vertical change in gradient. Additional installation locations may be requested by the Director of Engineering.
 - c. A fire hydrant shall be required at high points on 12 inch water mains for air relief and flushing maintenance operations. When a fire hydrant cannot be used, an air release valve may be approved by the Director of Engineering.
3. Flush Valves

A corporation stop shall be a 2 inch minimum ball type with compression inlet fitting with tee head shut off and a compression outlet fitting, designed for a minimum working pressure of 300 psi. The 2 inch curb stop shall be ball type with compression inlet fitting. Pipe shall be 2 inch diameter, DR-9 (250 psi) HDPE poly pipe with PE4710 as specified in ASTM F714.

5.2.N. Connections to Existing Water Mains

- 1. Tapping Sleeves and Valves
 - a. Size on size tapping sleeves are not allowed. The largest allowable tapping sleeve shall be the main line size less one standard pipe size (Example: 16 inch x 12 inch, 8 inch x 6 inch, etc.). If a size on size connection is required,

then a cut-in connection shall be used.

- b. Connections to an existing line shall be made with full body stainless steel tapping sleeve and valve. A resilient wedge gate valve shall be flanged to the tapping sleeve.
 - c. The tap location needs to be a minimum of 5 feet from an existing bell and spigot connection or other type of pipe connection.
2. Cut-In Connection – When connecting to an existing main, it may be required to provide a cut-in connection with a tee and valve being installed into the existing main in lieu of a tapping sleeve and valve where there is not an existing main line valve between proposed water connection locations as directed by the Director of Engineering. A test shut down of the existing water main(s) shall be conducted by the Public Works Department. The requirement for a test shut-down may be waived with approvals of the Director of Engineering and the Water Superintendent.
3. Four-Way Connections – The installation of a cross fitting shall not be allowed. Four-way connections shall be made via offset tees or a ring connection. Valves shall be provided on all legs of offset tees and ring connections except that a single valve may be placed between the offset tees or within the ring segment. Through legs of tees shall be equal to the largest pipe size. The ring segment shall be equal to or greater than the smaller pipe size. Where pipe size changes occur at a four-way connection, the largest size on each leg shall govern.
4. Blow-off valves shall be required at low points on mains 16 inches or greater in accordance with the City of McKinney Standard Details.
5. Requirements for Abandoning Water Mains
 - a. The engineer is to note the limits and appropriate conditions for abandoning existing water mains that are being replaced.
 - b. The engineer shall make allowances to permit the existing and proposed mains to remain in service simultaneously thereby providing a means for transferring customer's services from the old main to the new main with minimum interruption. If the construction of a proposed main necessitates the abandoning of the existing main prior to the new main's placement into service, then provisions for a temporary water main with services must be addressed with the design.
 - c. Abandoned lines to remain in place shall have the interior completely filled with grout. Valves to be abandoned in place shall have any extensions and the valve box removed and shall be capped in concrete.
 - d. Existing fire hydrants and valves located on mains being abandoned are to be removed and delivered to the Public Works Department.
6. Replacement Lines – To replace an existing line, the new line should be designed parallel to the line being replaced. The engineer shall perform a field investigation to determine pavement condition over the existing main. Based on this field investigation, the engineer shall include additional quantities for pavement replacement, if needed. Also, locate the proposed main at least 5 feet away from the existing curb to avoid damaging the curb or undercutting the pavement during installation of the proposed line. On lines being abandoned, the engineer should note and locate points of cut and plug at the junction with the line that remains in service.

5.2.O. Flushing and Disinfection

1. The following information pertains to the current Engineering Department Pre-Construction Agenda.
2. General
 - a. All flushing and disinfection shall comply with AWWA C-651.
 - b. All work shall be coordinated in advance (minimum 72 hours) with the

designated construction inspector.

- c. The contractor is responsible for the cost of all water used in the filling, flushing, and disinfection of the new potable water system.
 - d. The contractor shall submit a Flushing and Disinfection Plan for review prior to beginning any water main installation. This plan shall show all the information needed to commission the public water mains and appurtenances in accordance with all applicable requirements. The Flushing and Disinfection Plan shall indicate how the contractor will ensure appropriate minimum velocities and flows to ensure proper flushing. Special attention should be paid to the larger diameter, long water mains. Alternative methods as identified in AWWA 651 may be more appropriate.
 - e. Sample points shall be provided on each 1,000 feet intervals of new water main, at the end of line, and at each branch on the main line.
3. Initial Fill – The contractor shall utilize a jumper connection with backflow preventer and temporary meter assembly connected to an existing fire hydrant to fill the new system.
4. Debris Flush (Segment Flush)
 - a. Segmented Debris Flush – The new water distribution system shall be flushed one segment at a time, using the in-line isolation valves and fire hydrants to ensure a full flow through each hydrant. The contractor shall provide all assistance necessary to operate valves and hydrants under the direction of the construction inspector.
 - b. The contractor may utilize the jumper or the main isolation valve to perform the debris flush. When the jumper is used, the contractor may perform all necessary activities as described below without requesting the assistance of the Public Works Department.
 - c. When the main isolation valve is used, the construction inspector must be given 72 hour notice to coordinate with the Public Works Department valve crew. The Public Works Department valve operator is the only one on-site authorized to operate the isolation valve on the “live” City system.
 - d. When using the jumper system to complete the debris flush, the contractor shall ensure there is an adequate supply to maintain appropriate flush velocities and flows.
 - e. When the main isolation valve is used to complete the debris flush, the Public Works Department valve operator will utilize the main in-line valve as long as the new valves and fire hydrants are open to prevent backflow into the water system.
 - f. When using this method, the City valve operator will use a flow rate meter to estimate the amount of water used. The Public Works Department will report these readings to the billing office. The contractor is responsible for the cost of the water used.
5. Disinfection
 - a. The contractor shall provide the equipment and material needed for the disinfection process. Chlorine shall be loaded into all portions of the new water distribution system. The water source for the loading and pushing of chlorine shall be from a hose with a double check valve assembly (jumper connection) connected to a fire hydrant. Main line water valves shall not be used for loading and pushing of chlorine. Chlorination to include the main lines, fire hydrant leads, and all water services.
 - b. The construction inspector will verify the chlorine residual at the beginning of the process (minimum 100 mg/L).

6. Disinfection Flush

- a. After a minimum of 24 hours, the construction inspector will verify a minimum chlorine residual of 10 mg/L.
 - b. The contractor shall flush the new distribution system and appurtenances to reduce the residual to a maximum of 4 mg/L. This includes all fire hydrants and water services. The contract may utilize the jumper system or the main isolation valve to perform this flush. Any operation of the main isolation valve will require coordination with the Public Works Department valve operator. The contractor is responsible for the cost of all water used. Once the residual has been dissipated and the water has remained in the pipe for a minimum of 16 hours with no use or flushing during the minimum of 16 hours, then the system is ready for the bacteriological testing. Refer to the City of McKinney Standard Details for temporary water test station information.
 - c. All flush water (potable water and super chlorinated water) shall be diverted to the nearest wastewater manhole by hose including all fittings and appurtenances. A strainer shall be used on the hose discharge into the wastewater manhole. Maintain a minimum 1 foot vertical air gap between end of discharge hose and manhole frame. If a sanitary sewer manhole is not available then the contractor shall provide a dechlorination diffuser at the flush outlet point(s) including all fittings and appurtenances. Detention may be allowed on-site dependent on weather conditions and approval from the Director of Engineering. The detained water cannot be released until the chlorine residual is less than 0.01 ppm (mg/L).
7. Operation – The process delineated above will be reiterated until passing water sample test results are received. Upon receipt of the passing water sample tests, the City construction inspector will work with the Public Works Department to place the new system into operation.

1.3. Wastewater Design Criteria

1.3.A. General

1. Design criteria for all wastewater systems shall comply with the current edition of the TCEQ Chapter 217 (Design Criteria for Domestic Wastewater Systems).
2. Wastewater main sizes shall comply with the Wastewater Master Plan.
3. Wastewater mains shall be sized and extended through the limits of a development to serve adjacent properties.
4. Larger lines shall not flow into smaller lines
5. Wastewater systems shall be designed so that all wastewater mains will be gravity flowlines. If the use of a wastewater lift station is approved by the Director of Engineering, it shall be designed in accordance with **Section 5.4**.
6. All wastewater flows shall remain in their respective drainage basins unless expressly approved by the Director of Engineering.
7. Connections to substandard mains and manholes shall not be allowed. Substandard mains shall be determined by the Director of Engineering based on criteria including, but not limited to: size, material, condition, flow rate, capacity, etc. Offsite improvements may be necessary to provide adequate wastewater service to the site.

1.3.B. Sewer Services

1. General – The sizes and locations of service laterals shall be designated as follows:
 - a. All sewer services shall be extended to a point 10 feet beyond the property line at a maximum depth of 5 feet.
 - b. Cleanouts shall be placed at the ROW/property line for all services.

2. Single Family Residential

- a. Service lateral size shall be 4 inch minimum at a 2 percent minimum grade for each lot or unit from the cleanout near ROW/property line to main.
- b. One service lateral per lot or each unit. Duplexes and/or townhomes shall have two 4 inch service laterals that shall be independently attached to the main.
- c. Service laterals shall be installed at the center of the lot or duplex unit and shall have a minimum horizontal separation of 10 feet from the water service.
- d. The engineer shall review the finish pad elevations, depth of service lateral lines, slopes from pad to street to verify the sanitary sewer system can serve all properties within the sanitary sewer basin.

3. Multi-Family Residential

- a. Service lateral size shall be 6 inch minimum at a 2 percent minimum grade.
- b. A minimum of 1 service lateral per building shall be required.
- c. Service laterals shall have a minimum horizontal separation of 10 feet from the water service.

4. Non-Residential

- a. A minimum of 1 service lateral per building shall be required.
- b. Service laterals shall have a minimum horizontal separation of 10 feet from the water service.
- c. Local Retail and Commercial – Service lateral size shall be 6 inch minimum at a 2 percent minimum grade.
- d. Manufacturing and Industrial – Service lateral size shall be 8 inch minimum at a 0.76 percent minimum grade.

1.3.C. Design Flow

1. All wastewater collection systems shall be designed in accordance with the current Wastewater Master Plan.
2. Where possible, all collection systems will be laid out so that all lines will be gravity flow unless approved by the Director of Engineering.
3. Residential development submittals shall include the total number of units and the total acres for the proposed development. Non-residential development submittals shall include total building square footage, the planned use for the building, and total acres for the proposed development. The projected wastewater flows shall be calculated and shown in MGD in accordance with the Wastewater Master Plan and per TCEQ Chapter 217 (Design Criteria for Domestic Wastewater Systems). A sanitary sewer basin map and sizing analysis shall be provided for sewer mains that serve more than 300 single family units, 400 multi-family units, or an equivalent combination of those uses or other uses.

All wastewater collection systems must be designed to convey the peak wet weather flow from the entire service area including offsite areas throughout the system. Basin delineation shall be provided using NCTCOG, LIDAR, or surveyed contours. Contours shall be provided on 2 foot or less intervals. USGS topo is not permissible.

4. Flow calculations must include the specifics of the average dry weather flow and the dry weather flow peaking factor.

1.3.D. Sizing Wastewater Collection Mains

1. General

- a. The engineer shall contact the Director of Engineering to obtain contact information for the City consultant maintaining the City's wastewater collection system model and/or determine the size of wastewater main required from the Wastewater Master Plan.
- b. The standard wastewater main sizes that shall be used are noted in the **Table 5-6**.

• **Table 5-6 – Standard Wastewater Main Sizes**

8 inch	10 inch	12 inch
15 inch	18 inch	21 inch
24 inch	27 inch	30 inch
33 inch	36 inch	39 inch
42 inch	48 inch	54 inch
60 inch	----	----

2. Average Daily Flow

- a. **Table 5-7** shall be used to calculate the average daily wastewater flow. The collection system shall be designed based on the peak flow calculations.
- b. For replacement of existing sewer and construction of parallel sewers for additional capacity, wastewater flow data will be provided by the Director of Engineering from data generated by the Wastewater Master Plan computer model developed by the Director of Engineering.
- c. Wastewaters with direct connections to service lines shall be designed to be no more than 70% full and interceptors shall be designed for 100% full.
- d. Proposed parallel wastewater mains adjacent to existing wastewater mains shall be sized to eliminate surcharge in the existing lines.
- e. **Table 5-8** summarizes the non-residential land use demand rates. Land uses not listed shall be classified by the land use they most nearly resemble in **Table 5-8** or calculated by the engineer in accordance with the anticipated use. The engineer shall submit the average daily demand and peak flow calculations including off-site flows within the drainage basin to the Director of Engineering for review and approval.

• Table 5-7 – Residential Wastewater Flows by Land Use

District	Land Use	Estimated Units Per Acre	Population Per Unit	Average Daily Flow at 100 gpcd (gpad)
R43	Estate	1.0	3.2	320
R12	Single Family	2.7	3.2	864
R8	Single Family	4.1	3.2	1,312
R6	Single Family	5.4	3.2	1,728
R5	Single Family	6.5	3.2	2,080
TR1.8	General – Townhome	18.1	2.0	3,620
FR	General	9.0	2.5	2,250
MR	General	18.0	2.0	3,600
MF30	Multi-Family Low Density	22.5	2.0	4,500
MHR	Mobile Home Park	8.0	2.0	1,600

Table 5-8 – Non-Residential Wastewater Flows by Land Use

Land Use	Average Daily Flow
Town Center Redevelopment	3,500 gpad
Town Center Downtown	1,500 gpad

Ex. Retail/Office, Fut. Town Center Mix, Neighborhood Comm, Prof. Campus / Employ. Mix, Entertain Ctr & Mixed Use Center, Restaurant	1,500 gpad
Institutional – Schools, Hospitals, Nursing, Government, etc.	1,500 gpad
Future Manufacturing & Warehousing / Employ Mix Comm. Center, Comm Center,	1,400 gpad
Exist. Industrial & Future Manufacturing & Warehousing	1,000 gpad
Entertainment Center	1,500 gpad
Professional Campus	1,700 gpad
Professional Campus / Comm. Center	1,300 gpad
Exist. Open, Amenity Zone & Parks	150 gpad
Town Center Mix	1,800 gpad
Urban Living	300 gpad
Utilities & Airport	300 gpad

gpad – gallons per acre per day
 Source: 2019 Wastewater Collection System Master Plan Update

3. Peak Flow Factor – Peak flow factors are as follows:
 - a. For average daily flow less than 0.05 MGD – Peak Flow Factor = 5.
 - b. For average daily flow between 0.05 MGD and 1.0 MGD – Peak Flow Factor = 4.
 - c. For average daily flow between 1.0 MGD and 2.0 MGD – Peak Flow Factor = 3.5.
 - d. For average daily flow greater than 2.0 MGD – Peak Flow Factor = 3.

1.3.E. Inflow and Infiltration

1. After determining the peak flow amount, the engineer shall add an average daily inflow and infiltration rate of 650 gpad.

1.3.F. Horizontal Alignment and Vertical Alignment

1. The following guidelines shall be used for the placement of wastewater mains:
2. Horizontal curves will be allowed along centerlines of curved residential streets. Minimum radius of curve and maximum deflection angle of pipe joints will be restricted to 75 percent of manufacturer’s recommendation, after which the use of a manhole will be required for a change in alignment.
3. Vertical curves are not allowed.
4. For new construction in open space areas, sewer mains shall be laid straight between manholes.
5. When the locations are known, services for future lots shall be installed.
6. Alignment should follow the centerline of ROW and/or easements.
7. No wastewater main shall be placed under pavement on divided arterial roadways.
8. For main replacement projects, when flow permits, 8 and 10 inch mains should be replaced in the same alignment.
9. Public wastewater mains shall not be located nearer than 8 feet from any tree.

Reference **Section 7** for additional landscape requirements within the ROW.

- 10. No wastewater mains shall be located in alleys.
- 11. Wastewater mains deeper than 12 feet with service connections will require a second shallower parallel main to convey wastewater to the nearest downstream manhole
- 12. The minimum acceptable Manning’s “n” value for use in wastewater design shall be 0.013. Pipes shall be placed on such a grade that the velocity complies with current City’s desired minimum and maximum criteria summarized in **Table 5-9**.

• **Table 5-9 – Grades for Wastewater Mains**

Pipe Diameter (inches)	Minimum Slope (percent)	Maximum Slope (percent)
8	0.76	8.40
10	0.56	6.23
12	0.44	4.88
15	0.33	3.62
18	0.26	2.83
21	0.21	2.30
24	0.17	1.93
27	0.15	1.65
30	0.13	1.43
33	0.11	1.26
36	0.10	1.12
39	0.09	1.01
>39	**	**

** For pipes larger than 39 inch diameter, the slope can be determined by Manning's formula to maintain a flow velocity greater than 2.0 feet per second and less than 10.0 feet per second when the pipe is flowing full. Manning’s formula is as follows:

$$V = \frac{1.486}{n} (R)^{2/3} (S)^{1/2}$$

Where:

- V = flow velocity (feet per second)
- n = Manning’s roughness coefficient (dimensionless)
- R = hydraulic radius, which is the area of the flow divided by the wetted perimeter (R = A/P) (feet)
- A = flow area (square feet)
- P = wetted perimeter (feet)
- S = pipe slope (feet per foot)

1.3.G. Depth of Cover

1. The depth for the design of sewer mains shall be determined by providing a 2 percent grade for the service lateral from the center of the house or building to the center of the proposed main and including an additional 2 foot drop from the finish floor elevation.
2. When establishing depth for proposed wastewater mains, engineer shall evaluate proposed street grades and anticipate the size of proposed storm sewers in unimproved areas. Future storm sewers should be at least 3 feet below the top of pavement. The proposed wastewater main shall be at least 2 feet below the bottom of the future storm sewer. Minimum cover shall be 4 feet. Any main with less than minimum cover shall be encased in Class "G" embedment and is subject to approval by the Director of Engineering. Refer to **Section 5.1.F.4** for additional requirements for shallow cover at creek crossings.
3. The service lateral within the ROW must have at least 3 feet of cover at its shallowest point. The engineer is responsible for insuring that sufficient depth and grade is maintained to serve all proposed and future building sites in the sewer shed.
4. The engineer shall consider the ultimate roadway elevations in determining the depth of cover. Additional depth of cover shall be required for future development and as directed by the Director of Engineering.
5. Depth of cover greater than 20 feet must be approved by the Director of Engineering.

1.3.H. Manhole Locations and Manhole Sizes

1. Manholes shall be designed based on the following requirements and in the following locations:
 - a. A manhole shall not be located in the flow path of a watercourse, or in an area where ponding of surface water is probable. Additional manholes may be required as determined by the Director of Engineering.
 - b. At each end of lines that are installed for aerial crossings and siphons.
 - c. At the location of service lateral connections that are 6 inch diameter or greater.
 - d. Spacing shall be limited to 500 feet. TCEQ mains with horizontal curvature shall have a maximum spacing of 300 feet per TAC Title 30, Part 1, Chapter 217, Subchapter C, Rule 217.53.
 - e. At all locations where diameter of the pipe changes.
 - f. At all locations where pipe material changes.
 - g. At all locations where the horizontal or vertical alignment of the sewer main changes.
 - h. At the beginning and end of horizontal curves.
 - i. At the end of wastewater collection system pipes. Provide pipe stub outs with plugs for future connections that may be extended in the future.
 - j. Spacing between a manhole and an upstream cleanout shall be limited to 300 feet.
 - k. Manhole testing shall be in accordance with ASTM 1244.
 - l. Existing brick manholes shall be replaced.

2. Floodplains

Bolt down sanitary sewer manhole lids with gaskets shall be used to prevent the entrance of stormwater when manholes are placed within the limits of the fully developed 100-year floodplain.

Where more than three manholes in sequence are to be bolt down sanitary sewer manhole lids with gaskets, every third manhole shall be vented 2 feet above the fully developed 100-year floodplain elevation or 6 feet above the adjacent ground line, whichever is higher. The engineer shall obtain and provide the elevation of the fully developed 100-year floodplain. Sealed manholes shall also be used in all areas subject to carrying drainage flow or in drainage ways. Refer to **Section 4** of this manual for methodologies to determine the limits of the fully development 100-year floodplain.

3. Manhole Lids and Rims

Reference the City of McKinney Standard Details for additional requirements for standard lids and, bolt down sanitary sewer manhole lids with gaskets.

4. Manhole Sizes

- a. Manholes to be constructed on existing or proposed sewer lines shall be sized as shown in **Table 5-10**.
- b. Manholes deeper than 15 feet shall be a minimum of 5 feet diameter and require structural design. Manholes deeper than 20 feet require approval from the Director of Engineering. Manhole diameter may increase due to pipe geometry, excessive depths, and multiple pipes connected to the manhole. Special manholes shall be designed for mains larger than 36 inch diameter pipe and for mains greater than 15 feet deep. 18 inch minimum measured outside diameter to outside diameter of pipe along the outside surface of the wastewater manhole shall be maintained between pipes to manhole connections. If the 18 inch separation cannot be achieved a larger diameter manhole shall be selected to meet these requirements.
- c. Where pipes enter a manhole there shall be a minimum of 0.10 foot of drop between flowlines. Where unequal size pipes enter a manhole, crown of pipes shall match elevations.
- d. The manhole invert channels and benches shall be manufactured in the precast plant with the manhole bottom section. The invert channels shall be sloped to maintain a smooth transition through the manhole connecting all inlets and outlets without the need of further field modifications.

• **Table 5-10 – Manhole Diameter Requirements**

Pipe Diameter	Manhole Minimum Diameter
8 inch through 12 inch	4.0 feet
15 inch through 27 inch	5.0 feet
30 inch through 36 inch	6.0 feet

- 5. Drop Manholes – Drop manholes shall be required when the inflow elevation is more than 24 inches above the outflow elevation. New drop manholes shall be constructed with inside drops with a 6 foot minimum diameter. Depending on the depth of the drop manhole and inside clearances between drop bowl apparatus and the manhole, the Director of Engineering may increase the minimum diameter above 6 feet. Drop manholes shall increase in diameter as necessary to accommodate the pipe for an internal drop connection as necessary to provide 48 inches of clear space for construction and maintenance operations. Within the manhole the inverts shall be sloped to maintain a smooth transition through the manhole connecting all inlets and outlets. Outside drop connections will not be allowed.
- 6. Corrosion Protection for Manholes
 - a. Apply non-structural polyurethane coating material to all exposed new interior surfaces in sanitary sewer manholes and wet wells. Apply a structural polyurethane coating material to all exposed interior surfaces in

existing/rehabbed sanitary sewer manholes and wet wells. Surface preparation and protective coating material (PCM) shall follow manufacturer's recommendations.

- b. Approved corrosion protection shall be provided for:
 - i. All wastewater manholes for 15 inch and greater line sizes.
 - ii. First wastewater manhole on line connecting to 15 inch or greater line.
 - iii. Force main transition manholes.
 - iv. All drop manholes.

1.3.I. Pipe Material

1. The specification of pipe material is the responsibility of the engineer based on the analysis of specific site, soil conditions, loading conditions, and pressure requirements. The following guidelines are based on pipe size only and in no way relieve the engineer of the responsibility of pipe material specifications applicable to the particular project and restrictions due to special construction methods.
2. Allowable pipe materials for gravity mains are shown in **Table 5-11**.
3. Additional specifications for the pipes referenced in **Table 5-11** are as follows:

- a. For water and wastewater separation deficiencies, wastewater pipe shall be:

- i. (8 inch-15 inch) PVC Pressure Pipe Class 160 SDR 35 (ASTM D2241) or Ductile Iron AWWA C151 Pressure Class 350, internal ceramic liner and green polyethylene encased. Ceramic liner to be manufactured by Protecto 401 or HDPE, AWWA C901/C906, DIPS minimum DR13.5 (160 psi), ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and

ANSI/NSF 14/61 listed.

- ii. (18 inches and larger) – Green PVC Pressure Pipe Class 160 SDR 35 (ASTM D2241) or Ductile Iron AWWA C151 Pressure Class 350 (internal ceramic liner and green polyethylene encased). Ceramic liner to be manufactured by Protecto 401 or HDPE, AWWA C901/C906, DIPS minimum DR13.5 (160 psi), ASTM D2239, ASTM D2737, ASTM D3035,

ASTM F714 and ANSI/NSF 14/61 listed.

- iii. For water and wastewater TCEQ separation deficiencies (larger than 18 inches) – FRP with recommended Structural Number (SN) and Pressure Class Number (PN) (150 psi minimum) or HDPE, AWWA C901/C906, DIPS minimum DR13.5 (160 psi), ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and ANSI/NSF 14/61 listed.

- b. HDPE Pipe

- i. HDPE pipe size selection needs to account for the pipe wall thicknesses to meet the internal diameters listed within **Table 5-11**, internal pressures, and depth of bury.

• **Table 5-11 – Pipe Materials for Gravity Mains**

Internal Diameter Pipe Size	Pipe Material
4 inch through 15 inch	<ul style="list-style-type: none">• Green PVC, SDR 26 (Pipe Class 160 psi) or 35 (ASTM D3034). Fittings shall be equivalent to pipe class.• 4 inch and 6 inch pipe for sanitary sewer laterals shall be green, PVC, SDR (Pipe Class 160 psi).• HDPE, AWWA C901/C906, DIPS minimum DR 32.5, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and ANSI/NSF 14/61 listed.• Ductile Iron, AWWA C151 Pressure Class 350, internal ceramic liner and green polyethylene encased. Ceramic liner to be manufactured by Protecto 401 or approved equal.
18 inch and larger	<ul style="list-style-type: none">• Solid Wall Green PVC, ASTM F679.• Fiberglass Reinforced Pipe (FRP) is acceptable for 24 inch diameter and larger lines. FRP with recommended Structural Number (SN) and Pressure Class Number (PN). Documentation shall be provided by the manufacturer indicating a minimum of 2 years of successful production of FRP in the U.S.• HDPE, AWWA C901/C906, DIPS minimum DR 32.5, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and ANSI/NSF 14/61 listed.
30 inch and larger	<ul style="list-style-type: none">• Solid Wall Green PVC, ASTM F679.• FRP with recommended Structural Number (SN) and Pressure Class Number (PN). Documentation shall be provided by the manufacturer indicating a minimum of 2 years of successful production of FRP in the U.S.• HDPE, AWWA C901/C906, DIPS minimum DR 32.5, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and ANSI/NSF 14/61 listed.

Notes: For piping that does not have the green material for wastewater applications, the pipe shall be spiral wrapped with appropriate detectable or non-detectable caution tape. The spiral wrapping shall be on 2 feet centers measured along the pipe.

The selected pipe material used in construction shall be noted on all plan and profile sheets in the Record Drawings.

4. For trench depths greater than 10 feet or other dead and/or live loading considerations, the engineer shall provide a pipe with the appropriate SDR rating which shall meet or exceed SDR 26 pipe specifications. The Director of Engineering may issue written approval for use of Ductile Iron AWWA C151 Pressure Class 350 (internal ceramic liner and polyethylene encased). Ceramic liner to be manufactured by Protecto 401 or approved equal.
5. Additional specifications for the above referenced pipes are as follows:
 - a. Ductile Iron Pipe – All buried metal shall be wrapped per AWWA C105/A21.5 ASTM 674 polyethylene tube wrap.
 - b. Different pipe materials are not allowed between manholes.
 - c. The material used for the wastewater shall be designed for a minimum structural life cycle of 50 years. If the pipe material will deteriorate when subjected to corrosive conditions, the engineer shall provide for an acceptable corrosion resistant liner or provide calculation and data that demonstrates that the design and operational characteristics will provide for the minimum life cycle.
 - d. All gravity sewer pipes shall be green in color. PVC fittings may be either green or white in color.
 - e. All pipes with encasings shall be restrained joint pipes for all applications.

1.3.J. Pipe Embedment

1. The type of embedment and backfill for sewer mains shall in accordance with the City of McKinney Standard Details.
2. Trench Dams may be required by the Director of Engineering depending on the ground water potential, pipe slope and length of sloped line segments.

1.3.K. Cleanouts

1. Residential cleanouts located on service laterals shall be 4 inch diameter and located on the property line/ROW line.
2. Cleanouts on residential sewer services are to be located and installed as per approved drawings, building code requirements, and City of McKinney Standard Details.
3. A clean-out with watertight plugs may be installed in lieu of a manhole at the end of a wastewater collection system pipe if no extensions are anticipated, if the cleanout is 300 feet or less from the downstream manhole. Cleanout installations must pass all applicable testing requirements outlined for gravity collection pipes in TCEQ Chapter 217.57 (Testing Requirements for Installation of Gravity Collection System Pipes).
4. Cleanouts shall not be used on City maintained collection systems for multifamily, commercial and industrial development.
5. Cleanouts shall be provided on service laterals with locator pad and tape to surface at the property line.

1.3.L. Connections to Existing Wastewater Mains

1. When connecting a 6 inch or larger new line to an existing wastewater main the engineer shall provide a new manhole at the point of connection. Prior to breaking into the existing line the new manhole and upstream pipe segment shall pass inspection by the Director of Engineering.

1.3.M. Abandonment of Wastewater Mains

1. The engineer shall specify on the plans the limits and appropriate conditions for abandoning existing wastewater mains that are to be replaced by the construction of proposed wastewater mains.
2. The engineer shall ensure that the service laterals tying into the existing sewer line to be abandoned are transferred to the new main so a live sewer main is not abandoned. If a manhole on the sewer main being abandoned is to remain in service because other sewer mains are entering this manhole, then the sewer main to be abandoned shall be plugged inside the manhole. A note on the plans showing which sewer main is to be plugged inside the manhole is required.
3. Abandonment of wastewater mains shall be in accordance with the City of McKinney Standard Details. All abandoned wastewater and force main lines shall be cut and plugged and all void spaces within the abandoned line shall be filled with grout, flowable fill or an expandable permanent foam product in accordance with the Utilities Approved Materials List in the Construction Standards and Specifications Manual.
4. Abandonment of all utilities within TxDOT ROW shall comply with TxDOT standards.

1.4. Wastewater Lift Station Design Criteria

1.4.A. General

1. The use of a wastewater lift station shall be approved by the Director of Engineering. Lift stations shall be designed as permanent installations. Lift stations shall be designed to exceed the minimum requirement established in TCEQ Chapter 217.59 (Lift Station Site Requirements) and the requirements of this section. Lift stations will only be allowed after all other alternatives for transporting wastewater flows have been investigated and the lift station is found to be the best alternative for the service area. The Director of Engineering reserves the right to review each proposal and determine whether there is enough merit to justify a lift station.
2. A preliminary design submittal will be required for each proposed lift station. The submittal shall include a typed report, plans, and a basin map prepared by a registered professional engineer in accordance with the Plan Review Development Checklist in **Appendix B**.

1.4.B. Site Selection and Requirements

1. Site Selection – The following are the minimum criteria that shall be met for a lift station site.
 - a. The station should be located as remotely as possible from populated areas. The lift station site shall not be located within 150 feet of an existing or proposed residential dwelling and 100 feet from a residential lot.
 - b. The station site and its access shall be dedicated to the City as a wastewater easement. The fencing set back shall be 20 feet from the easement line to allow for a landscape and drainage buffer.
 - c. The station site shall be located so it may serve as much of the entire sewer drainage basin as possible. This may require that the station be located off- site of the development. When a station serves a larger area than the proposed development, the developer may enter into a pro-rata agreement with the City to be reimbursed the cost of excess capacity as other developments connect to the system.
2. Site Access
 - a. Access will be provided by a concrete surface from a public street and/or dedicated access easement. Concrete shall be a minimum 6 inches thick, 4,000 psi reinforced concrete pavement with a minimum of 15 feet in width and 20 feet in length to allow maintenance vehicles to park fully outside of the City ROW designed in accordance with **Section 2**.
 - b. Access drives shall be “T” shaped with applicable turning radii when located on existing and future thoroughfares and all other locations when pulling out becomes a safety hazard. The alignment of the drive shall allow maintenance vehicles the ability to back up straight to the wet well.
 - c. The station shall be accessible during the fully developed 100-year flood and FEMA 100-year flood. The elevation of the site shall be a minimum of 2 feet above both the fully developed 100-year floodplain and the FEMA 100-year floodplain in accordance with **Section 4**.
3. Site Security
 - a. At a minimum, security of the lift station site shall be provided by an intruder- resistant fence (IRF) to restrict access by an unauthorized person(s). The IRF shall be placed around the perimeter of the site

encompassing all interior structures and apparatuses and shall maintain a 3 foot clearance from all lift station components.

- b. The IRF shall consist of a minimum 8 foot high solid screening device that complies with the Unified Development Code. If landscaping is provided in accordance with the tubular steel or wrought iron screening device option, the landscaping and irrigation system shall be owned and maintained by the property owner. A minimum 16 foot wide slide gate consisting of tubular steel or wrought iron shall be provided for access.

4. Site Interior

- a. Interior shall be a minimum 6 inches thick reinforced concrete pavement designed in accordance with **Section 2**. Site shall be graded to drain away from the station to prevent storm water inflow or infiltration into the wet well. The wet well top elevation shall be a minimum of 6 inches higher than interior concrete to provide wheel stop for maintenance vehicles.
- b. Control panel shall have a 3 foot minimum clear working area away from face of cabinet. Electrical and Instrumentation Panels shall be located where they do not obstruct vehicle access to the wet well or the dry well. They shall be placed at an elevation so that they are easily accessible.
- c. A 15 foot high halogen area light with photometric cell on an aluminum pole shall be placed within 10 feet of wet well and control panel without obstructing daily operations.
- d. Hoisting equipment shall be provided when the ultimate sized pump weight exceeds 2,500 lbs. Hoisting equipment shall be electric and capable of lifting selected pumps onto a 54 inch high truck bed or trailer with minimal manual assistance.
- e. Provide a 1 inch potable freeze-proof water service with a 1 inch angle stop and double check valve shall be installed in an appropriately sized meter box.

1.4.C. Wet Well and Valve Vault Design

- 1. Wet Well Design – Wet well shall be cast in place or pre-cast watertight and gas tight walls with watertight joint meeting ASTM C478-90. Steel, HDPE and RCP are not acceptable materials. The tops may be pre-cast with the hatches built in. All wall penetrations through the wet well wall shall be gas tight. The wet well shall be hydrostatically tested to the top of the wet well for 48 hours prior to putting the lift station into service. Only losses due to evaporation will be tolerated. Additional design requirements are as follows:
 - a. Orientation
 - i. Orientation shall consider the routing of incoming sewer and force main for ease of maintenance and to minimize effluent turbulence.
 - ii. Orientation shall allow a 5 ton vehicle to pull in forwards or backwards directly to the wet well or the dry well.
 - iii. All influent gravity mains discharging into the wet well shall be located so that the invert/flowline is above the “on” setting liquid level of the pumps.
 - b. Level Sensors
 - i. Liquid level sensors shall be ENM-10 level regulators switch or approved equal. Sensors shall be provided for “All Pumps Off,” “Lead Pump On,” “Lag Pump On,” and “High Level Alarm” levels as well as additional “Lag- Lag Pump On” for lift stations

with more than two pumps.

- ii. Level Sensors shall be placed in a stilling well.
- c. Wet Well and Valve Vault Separation – Wet wells and valve vaults shall be a common slab separated by expansion joint. The wet well and valve vaults shall have separate entrances.
- d. Liner and Coatings
 - i. Wet wells shall have a minimum of 10 percent sloped bottoms to the pump intakes and shall have a smooth finish to avoid excess sludge deposits.
 - ii. Apply polyurethane coating material to all exposed concrete and grouted surfaces. Surface preparation and PCM application shall follow manufacturer’s recommendations.
- e. Hatches – The wet well shall have a lockable odor suppressing aluminum door with an aluminum frame and safety grate. The minimum opening size shall be 4 feet x 6 feet with 2 doors large enough to adequately maintain the wet well. Door and frame shall be in accordance with the Utilities Approved Materials List in the Construction Standards and Specifications Manual.
- f. Ventilation
 - i. The design of a wet well must reduce odor potential in a populated area or as directed by the Director of Engineering.
 - ii. Passive ventilation structures shall be provided and must include screening to prevent the entry of birds and insects to the wet well. An air vent pipe shall have a minimum diameter of 4 inches with outlet located 1 foot above wet well top.
 - iii. Continuous mechanical ventilation structures shall be provided with ventilation equipment providing a minimum capacity of 12 air exchanges per hour and be constructed of corrosion resistant material.
- g. Cable Strain Relief – A stainless steel cable holder shall be provided for all cables in the wet well for cable strain relief purposes.

2. Wet Well Volume

- a. Wet well volume for a submersible pump station is the volume contained above the top of the motor, or as specified by the pump manufacturer.
- b. High level alarm elevation shall be a minimum of 60 inches below the top of the wet well or 48 inches below the flowline elevation of the lowest service tap, whichever elevation is lower.
 - i. Alarm shall be sent when both pumps are running on a duplex station or when the level is 6 inches to 12 inches over all pumps running. The Director of Engineering shall approve all situations and levels that need to trigger an alarm.
 - ii. Wet well volume shall be calculated by the following method:

$$TQ \frac{V}{4} = 7.48$$

Where:

- V = active volume (cubic feet)
- Q = pump capacity (gallons per minute)
- T = cycle times (minutes)
- 7.48 = conversion factor (gallons per cubic foot)

- c. Pump cycle time, based on Peak Flow, must equal or exceed the criteria shown in **Table 5-12**.

• **Table 5-12 – Minimum Pump Cycle Time**

Pump Horsepower	Minimum Cycle Times
< 50	6 minutes
50-100	10 minutes
> 100	15 minutes

- d. The operation cycle “T” shall not be less than 10 minutes for Average flow and not more than 60 minutes for minimum flow conditions. The operation cycle time must exceed the manufacturer’s requirements.

3. Valve Vault

- a. Valve vaults shall have sloped bottoms towards a floor drain to remove liquid build up. The floor drain line from the valve vault connecting to the wet well must prevent gas and liquids from entering valve vault.
- b. The valve vault shall have a lockable aluminum door with an aluminum frame. The minimum opening size shall be 2 feet x 3 feet or large enough to adequately maintain the valve vault. Door and frame shall be in accordance with the Utilities Approved Materials List in the Construction Standards and Specifications Manual.

1.4.D. Pumps, Lift Station Piping, and Valves

1. Pumps

- a. Stations shall contain a minimum of two pumps and shall be capable of handling peak flows with one pump out of service.
- b. All pumps shall be explosion proof, non-clog, submersible type capable of passing a 2-1/2 inch diameter sphere or greater. Vortex impellers shall be used to prevent clogging.
- c. Pumps shall be sized to operate at optimum efficiency. Minimum acceptable efficiency at the operating point will be 60 percent. The minimum required horsepower for the motor must be capable of handling the entire range as shown in the pump curve. Where necessary, a higher horsepower pump will be required to prevent any damage to the motor as a result of loss of hydraulic head situation.
- d. All submersible pumps shall be equipped with an automatic flush valve attached to the pump volute using the hydraulic energy created by the pump operation to temporary suspend settled materials.
- e. The pump rail system shall be MTM Sch 40 stainless steel with supports on 8 feet maximum spacing.

2. Pump Capacity

- a. The firm pumping capacity shall be greater than the peak flow for the entire drainage basin. If the drainage basin is significantly larger than the proposed development and it is not feasible to design for this flow, the firm capacity may be designed to handle a portion of the basin with the ability to expand for the ultimate basin capacity with approval from the Director of Engineering.
- b. The pump curves shall be selected so that during normal operating conditions the pumps will run near the best efficiency point. The curves shall not approach shut off head when the pumps are running together.
- c. System head curves, pump curves, and head calculations shall be submitted. Calculations and pump curves at both minimum (all pumps off) and maximum (last normal operating pump on) static heads, and for a C value of both 100 and 140 must be provided for each pump and for the combination of pumps with modified pump curves. Head calculations shall be the sum of static head, friction head in force main and lift station piping, and a fittings head.
- d. Flow calculations, system curves, and head calculations shall be shown in the construction drawings as well as in a final design

report. Final design report shall include all of the preliminary design submittal requirements with the exception of the replacement of final design information.

3. Lift Station Piping

- a. Piping inside the lift station shall be ductile iron meeting AWWA C151. All fittings shall be ductile iron meeting AWWA C110 or C151. Interior of the pipe and fittings shall be lined with American Polybond Plus, which consists of a primer layer of 5 mils thick fusion bonded epoxy and 55 mils thick of modified DuPont Fusabond Polyethylene, or approved equal.
- b. All nut and bolt assemblies inside the wet well shall be ASTM 316 stainless steel unless otherwise specified.
- c. Lift station piping shall be designed with an additional emergency by-pass pump connection, allowing the station to be operated with the primary pump(s) out of service for an extended period of time.

4. Valves – Isolation valves, check valves, and air release/vacuum valves shall be located in the valve vault.

- a. Isolation Valves – Each pump shall have one isolation valve downstream of the pump and check valve, including a discharge pressure gauge between the pump and isolation valve. Isolation valves shall be plug valves meeting the City Standard Specifications. The discharge pressure gauge shall be a minimum of 4 inch diameter within the appropriate pressure ranges for the design.

b. Check Valves

- i. Check valves shall be a controlled closing swing check valve with a lever arm or a ball check. There must be at least 15 feet of vertical head downstream in order to use a ball check valve.
- ii. Check valves shall be located upstream of the isolation valve.
- iii. All external nuts and bolts shall be ASTM 316 stainless steel.

c. Air Release/Vacuum Valves

- i. Air release valves of a type suitable for wastewater service shall be installed along the force main where the force main would be prone to trapped air.
- ii. The type of valve shall be air release or a combination of air release and vacuum breaker. Valves shall be fitted with blow off valves, quick disconnect coupling and hose to permit back flushing after installation without dismantling the valve.
- iii. The engineer shall determine the valve type and location. The calculations for valve type and valve sizing shall be provided to the Director of Engineering.
- iv. Isolation valves for 3 inch and smaller air release valves shall be all bronze or brass. Isolation valves 4 inch and larger shall meet McKinney standard specification for resilient wedge gate valve.
- v. Locations of the air release/vacuum valves shall be shown on the plan and profile sheets for the force main.

1.4.E. Force
Main

1. General

- a. Force main capacity shall be sized to meet the pump capacity. The force main may be designed to handle a portion of the basin with the

ability to expand for the ultimate basin capacity with the approval from the Director of Engineering. The minimum force main size shall be 4 inch diameter except for grinder pump lift stations. The minimum recommended velocity is 3 feet per second, and the velocity shall not be less than 2.5 feet per second when only the smallest pump is in operation.

- b. Force main sewer pipe shall be designed to meet the working pressure requirements of the particular application. Design calculations and pipe selection shall be submitted to the Director of Engineering.
- c. The force main must terminate below a manhole invert with the top of the pipe matching the water level in the manhole at design flow.
- d. A force main must be designed to abate any anticipated odor.
- e. Allowable pipe materials for force mains are shown in

Table 5-13. Table 5-13 – Materials for Force Mains

Internal Diameter Pipe Size	Pipe Material*
4 inch through 12 inch	<ul style="list-style-type: none">• Ductile Iron, AWWA C151 Pressure Class 350 (Lining shall be American Polybond Plus, which consists of a primer layer of 5 mils thick fusion bonded epoxy and 55 mils thick of modified DuPont Fusabond Polyethylene, or approved equal and the exterior shall be green polyethylene encased).• HDPE, AWWA C901/C906, DIPS minimum DR 11, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and ANSI/NSF 14/61 listed. HDPE pipe size selection needs to account for the pipe wall thicknesses to meet the internal diameters listed to the left, internal pressures, and depth of bury.
12 inch and larger	<ul style="list-style-type: none">• Ductile Iron, AWWA C151 Pressure Class 350 (Lining shall be American Polybond Plus, which consists of a primer layer of 5 mils thick fusion bonded epoxy and 55 mils thick of modified DuPont Fusabond Polyethylene or approved equal, and the exterior shall be green polyethylene encased).• HDPE, AWWA C901/C906, DIPS minimum DR 11, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and ANSI/NSF 14/61 listed. HDPE pipe size selection needs to account for the pipe wall thicknesses to meet the internal diameters listed to the left, internal pressures, and depth of bury.

*Note: For piping that does not have the green material for wastewater applications, the pipe shall be spiral wrapped with appropriate detectable or non-detectable caution tape. The spiral wrapping shall be on 2 feet centers measured along the pipe.

Note: The selected pipe material used in construction shall be noted on all plan and profile sheets in the Record Drawings.

- f. For trench depths greater than 12 feet or other dead and/or live loading considerations, the engineer shall provide a pipe with the appropriate DR rating which shall exceed the minimum requirements.
- g. All fittings shall be wrapped ductile iron in accordance with AWWA C110 or AWWA C153.

- h. All valves and fittings shall be restrained with Mega-lug or approved equal.
- i. Plans shall include plan and profile for the force main.
- j. Force main shall have a minimum of 4 feet of cover and be laid to standard specifications for potable waterline.
- k. Force main separation and design criteria from water mains and all other utility lines shall meet the minimum requirements from TCEQ Chapter 217 (Design Criteria for Sewerage Systems) and Chapter 290 (Rules and Regulations for Public Water Systems).
- l. All force main contractors shall furnish and install non-metallic pipe detector tape. The detector tape must be located above and parallel to the force main and bear the label "PRESSURIZED WASTEWATER" continuously repeated in at least 1-1/2 inch letters.

2. Embedment

- a. The type of embedment for force mains less than 24 inches shall in accordance with the City of McKinney Standard Details.
- b. Pipe sizes 24 inches and greater the embedment class shall be a function of the pipe material selected including dead and live load considerations provided by the engineer. The engineer shall submit calculations on the embedment selected for the pipe type.

1.4.F. Electrical Requirements for New Lift Stations

1. Code Information

- a. The engineer shall consult with the Building Inspections Department for the latest NEC code requirements.
- b. Allow a minimum of 3 feet in front of all enclosures to wet well openings for workmen standing space. Observe NEC Article 110 rules for working clearances around the electrical panels.

2. Electrical Supply

- a. Electrical services to be 240 volt 3 phase or 480 volt 3 phase.
- b. Where a single-phase power transformer is required, install a minimum 3 KVA transformer, fused on both the primary and secondary side.
- c. Install a power phase monitor capable of protecting against phase loss, phase reversal, low voltage, and high voltage.
- d. Power phase monitor shall have 2 sets of control or alarm contacts. One set used to disable the pump control circuit. The second set used to alarm the RTU of a power failure.
- e. Install current transformer between the service disconnect and the rest of the electrical equipment to provide a means to monitor the complete station load. Terminate secondary leads on a terminal strip for connection to a future power usage monitor.
- f. Install potential transformer to provide a 120 volt secondary voltage on all 3 phases. Terminate the secondary leads on a terminal strip for connection to a future power usage monitor.
- g. All electrical power circuits to be protected by circuit breakers (versus fuses) where applicable. As a guide for single-phase circuits use: RTU 15 amp, flow meter/record 15 amp, pump control circuit 15 amp, convenience outlet/flood light 20 amp.

3. Pumps

- a. Thermal protection and moisture sending devices in submersible pumps are to be wired to disable pumps and/or control circuits.
 - b. Hand position on H-O-A switch shall be provided and will be capable of operating pump in the event of a complete failure of the level controller.
 - c. The required remote start/stop capability is to be provided by using RTU control module. Install interface relay between RTU contacts pump control circuit. RTU contact operating may be momentary action only.
 - d. Motor starters shall have a normally open auxiliary contact to be used for a pump run contact connected to the RTU.
 - e. Where submersible pump cords are to be installed in conduits, separate dedicated conduits for each pump shall be sized and installed to facilitate removal and re-installation of the pump(s) and pump cord(s).
4. Level
- a. Liquid level sensors shall be ENM-10 level regulators switch or approved equal. Sensors shall be provided for "All Pumps Off," "Lead Pump On," "Lag Pump On," and "High Level Alarm" levels as well as additional "Lag-Lag Pump On" for lift stations with more than 2 pumps.
 - b. Mercury float switch is to be installed and wired as a low level emergency shut off in the event of a continuous pump run due to a level controller failure, pump control switch left in hand position, etc.
 - c. Provide a separate dedicated conduit, sized for the float control cables.
5. Site
- a. Install a weatherproof 20 amp rated 120 volt convenience receptacle outside of the electrical control panel wired to a 20 amp circuit breaker.
 - b. A switch-operated floodlight shall be installed to illuminate control panel area at night.
6. Generator – Install a manual transfer switch between electrical service and electrical equipment along with an emergency generator receptacle (Appleton# ADJA 1033-150).
7. Controls
- a. All control relays are to be octal 8 pin or 11 pin plug-in type where feasible.
 - b. Three laminated control drawings are to be provided.
 - c. All conduit between wet well and control panel shall be sealed airtight to prevent wet well gases from entering control panel.
 - d. Enclosures shall be mounted on an appropriately sized mounting structure. Mounting structure shall be constructed of 6 inches x 2 inches x 0.25 inches hot dip galvanized steel channel stock. Intersections shall be bolted, not welded with stainless steel fasteners. Aluminum or epoxy coated steel unistrut may be attached to the mounting structure to facilitate placement of enclosures. The legs of the mounting structure shall be set at 24 inch minimum below grade and be encased in concrete.
8. Monitoring – A spare conduit shall be installed between the pump control panel and the RTU enclosure for power usage monitor wiring (1 inch minimum).
9. Supervisory Control and Data Acquisition (SCADA) – Modifications to

the City’s existing SCADA system will be required with the addition of any new lift station. Contractor shall supply SCADA equipment per City standards.

1.4.G. Emergency Provisions for Lift Stations

- 1. Minimum emergency provisions shall comply with TCEQ Chapter 217.63 (Emergency Provisions for Lift Stations).

1.5. Water and Wastewater Treatment Plant Design Criteria

- 1.5.A. Water and wastewater treatment for the City and its CCN is provided by the North Texas Municipal Water District. Water and wastewater treatment facilities other than those constructed and maintained by North Texas Municipal Water District are not authorized within the Certificate of Convenience and Necessity (CCN) boundaries of the City of McKinney other than an on-site septic system that serves one residential unit meeting all city, county and state regulations.
- 1.5.B. If a water and/or wastewater treatment facility (not constructed and operated by North Texas Municipal Water District) is authorized, then the design, materials, coatings, and equipment used in the construction and operation shall meet the highest quality of standards for the industry. All design, construction, operation, maintenance, and reporting shall meet or exceed, but not limited to, the standards set forth by Texas Commission on Environmental Quality (TCEQ) rules: Chapter 217 – Design Criteria for Domestic Wastewater Systems and Chapter 290 - Public Drinking Water, American Society for Testing and Material (ASTM) Standards, American Concrete Institute (ACI) Standards, National Science Foundation Standards, and American Water Works Association (AWWA) Standards.