

Chapter 10 Subdivision

City of Lake Worth



Ordinance No. 1170

Date: 11/12/2019

Adopted by City of Lake Worth City Council

ORDINANCE NO. 1170

AN ORDINANCE OF THE CITY OF LAKE WORTH, TEXAS, REPEALING AND REPLACING THE CURRENT SUBDIVISION REGULATIONS AND DESIGN CRITERIA AND CONSTRUCTION STANDARDS (DCCS) AND ADOPTING A NEW SUBDIVISION REGULATIONS AND DESIGN CRITERIA AND CONSTRUCTION STANDARDS (DCCS) ORDINANCE OF THE CITY OF LAKE WORTH; PROVIDING A PENALTY; PROVIDING FOR SEVERABILITY; PROVIDING SAVINGS; PROVIDING ENGROSSMENT AND ENROLLMENT; PROVIDING FOR PUBLICATION IN THE OFFICIAL NEWSPAPER OF THE CITY AND PROVIDING AN EFFECTIVE DATE.

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ARTICLE 10.100, GENERAL PROVISIONS

Section 10.101 Authority

- A. This Ordinance is adopted under the authority of the Constitution and laws of the State of Texas, including Chapters 43 and 212, Texas Local Government Code, as amended
- B. The following rules and regulations are hereby adopted as the Subdivision Regulations of the City of Lake Worth, Texas (sometimes hereinafter referred to as "City"), and shall be applicable to the development of property, the subdivision of land and the filing of plats and plans, as defined herein and in Chapter 212 of the Texas Local Government Code. The City shall have all remedies and rights provided by said Chapter 212 with regard to the control and approval of subdivisions and plats both within the City. The regulations herein shall apply within the corporate limits of the City, as they may be from time to time adjusted by annexation or disannexation.

Section 10.102 Jurisdiction

The provisions contained in the following sections of these subdivision regulations shall apply to any of the following forms or types of land subdivision and development activity within the City limits:

- A. The division of land into two or more tracts, lots, sites or parcels.
- B. All subdivisions of land whether by metes and bounds division or by plat, which were outside the jurisdiction of the City subdivision regulations in Tarrant County, Texas and which subsequently came within the jurisdiction of the City and its subdivision regulations through annexation.
- C. The division of land previously subdivided or platted into tracts, lots, sites or parcels subject to and not in accordance with adopted City Subdivision Regulations in effect at the time of such subdividing or platting and having occurred on or after Month Day, Year. (adoption date of current ordinance)
- D. The combining of two or more contiguous tracts, lots, sites or parcels for the purpose of creating one or more legal lots except as otherwise provided herein.
- E. When a building permit is required on property for the following reasons but not limited to:
 - 1. New construction; or
 - 2. Additions, such as increasing the square footage of an existing building by more than 20 percent of its gross floor area; or
 - 3. Moving of a primary structure onto vacant property.
- F. For tracts where any public improvements are proposed.
- G. Whenever a property owner proposes to divide land lying within the City into two (2) or more tracts for purpose of development, that results in parcels or lots all greater than five (5) acres in size, or in the event that development of any such tract is intended, and where no public improvement is proposed to be dedicated, he shall first obtain approval of a concept plan and meet with the Development Review Committee (DRC). See Section 3.4.1 of this Ordinance for requirements for Concept Plans.

Section 10.103 Purpose

These Subdivision Regulations are intended to protect, promote, improve and provide for the public health, safety, and general welfare of the citizens of the City of Lake Worth through minimum standards which provide:

- A. Equitable, harmonious, and efficient development and distribution of population and land uses;
- B. Effective transportation system providing facilities for efficient circulation for all modes of transportation – pedestrian, bicycle, and vehicular modes;
- C. Adequate public facilities – communication, transportation, drainage, water, wastewater, schools, parks, public safety and recreational facilities, and other public facilities and services;
- D. Protection and preservation of places of historical, cultural, natural or architectural importance and significance to the community;
- E. Safe, orderly, and efficient development and expansion of the City, in accordance with and pursuant to its adopted regulations and ordinances; and
- F. Encouragement of the development of a stable, prospering economic environment.

Section 10.104 Application of Regulations

A. Purpose

To carry out the purposes hereinabove stated, it is determined that:

- 1. Land must not be platted until proper provision has been made for adequate public facilities for roadways, drainage, water, wastewater, public utilities, capital improvements, parks, recreation facilities, and rights-of-way for streets.
- 2. Proposed plats, or subdivisions which do not conform to the policies and regulations shall be denied, or, in lieu of denial, disapproved conditioned on conformance with conditions, and;
- 3. There shall be an essential nexus between the requirement to dedicate rights-of-way and easements and/or to construct public improvements in connection with a new subdivision and the need to offset the impacts on City public facilities systems created by such new development.
- 4. No lots within a subdivision may be sold until a plat has been considered and acted on by the Planning & Zoning Commission, and approved by the City Council, or approved by the appropriate Administrative Officers, whichever the case may be.

B. Approval Required

1. Land Development

Before any plat within the City is recorded with the County Clerk, it shall first be approved for conformity with the provisions of this Ordinance.

Article 10.100

2. Permits

Unless otherwise exempt by the terms of these Subdivision Regulations, no building permit, certificate of occupancy, plumbing permit, electrical permit, utility tap or certificate of acceptance for required public improvements shall be issued by the City for any parcel until:

- i. A plat has been approved in accordance with these regulations;
- ii. All water, wastewater, streets, drainage, electrical, public utilities and park improvements, whether they are public or private, as required by these regulations, have been constructed and accepted by the City of Lake Worth in accordance with this Ordinance, adopted Plans, or other applicable regulations; and
- iii. Bonds or security for completion of improvements have been provided in accordance with this Ordinance.

C. Violations

1. No transfer of land in the nature of a subdivision as defined herein shall be exempt from the provisions of this Ordinance unless otherwise specified, even though the instrument or document of transfer may describe land so subdivided by metes and bounds.
2. The filing of any plan or plat with the County Clerk without complying with the requirements of this Ordinance shall be deemed a violation of the provisions of this Ordinance and is hereby prohibited.
3. The transfer of any land by the delivery of or by the filing of any instrument in the nature of a conveyance without having first complied with the requirements set forth herein shall be deemed a violation of the provisions of this Ordinance and is hereby prohibited.

D. Exception

There is, however, excepted from the provisions of this Ordinance any conveyance transferring any land or interest in land to or from the State of Texas or City of Lake Worth, Texas.

E. Note

Minimum standards for development are contained in the Zoning Ordinance, the adopted Building Code and in this Ordinance. However, the Comprehensive Plan and Thoroughfare Plan contain policies designed to achieve an optimum quality of development. Subdivision design should be of a quality to carry out the purpose and spirit of the policies expressed in these plans, the regulations specified in this ordinance, and is encouraged to exceed the minimum standards required herein.

Section 10.105 Exemptions

The provisions of these subdivision regulations shall not apply to:

- A. Land legally platted and approved prior to the effective date of these subdivision regulations except as otherwise provided for herein (construction of facilities shall conform to construction standards in effect at the time of construction); or

- B. Existing cemeteries complying with all State and local laws and regulations (does not apply to new cemeteries or expansion of existing cemeteries); or
- C. Divisions of land created by order of a court of competent jurisdiction; or
- D. When a building permit is requested for unplatted or already platted parcels for the following activities:
 - 1. Replacement or reconstruction of an existing primary single-family or duplex structure but not to exceed the square footage of the original structure.
 - 2. Additions (increase in square footage of structure) to the primary structure but do not exceed more than 50 percent of the gross floor area of the original structure.
 - 3. Accessory buildings and/or structures in compliance with current adopted Building Code.
 - 4. Remodeling or repair that does not include electrical work (no expansion of square footage) and in compliance with the current adopted Building Code.
 - 5. Moving a structure off a lot or parcel or for demolition permits.

Section 10.106 Interpretation, Conflict and Separability

A. Interpretation

In their interpretation and application, the provisions of these regulations shall be held to be the minimum requirements for the promotion of the public health, safety and general welfare. These regulations shall be construed broadly to promote the purposes for which they are adopted.

B. Conflict with Other Laws

These regulations are not intended to interfere with, abrogate, or annul any other ordinance, rule or regulation, statute of other provision of law except as provided in these regulations. Where any provision of these regulations imposes restrictions different from those imposed by any other provision of these regulations, or other provision of law, the provision which is more restrictive or imposes higher standard shall control.

Section 10.107 Owner Consent

Written consent of the owner of any tract of land to be developed is required for any application relating to or for a plat, replat, pre-application conference, plat amendment, or any application to be reviewed by the Development Review Committee. A representative for the owner may provide the required written consent in place of the owner if the representative has, in a form acceptable to the City Attorney, express written authority to act on behalf of the owner. Written consent is required in accordance with this Section, regardless of whether these regulations refer to the party making application as "owner," "subdivider," "person" "developer" or "applicant".

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Section 10.108 Applicability of Pending Plat Approval

All applications for plat approval, including final plats, pending on the effective date of these regulations and which have not lapsed shall be reviewed under regulations in effect immediately preceding the date of adoption of these regulations.

Section 10.109 Superseding Regulations

Upon the adoption of these regulations according to law, all Subdivision Regulations of the City of Lake Worth previously in effect are hereby superseded, except as provided in the regulations herein, Exemptions and Applicability.

Section 10.110 Amendment

For the purpose of protecting the public health, safety and general welfare, the Planning and Zoning Commission and City Council may from time to time propose amendments to these regulations which shall then be approved or disapproved by the City Council at a public meeting.

Section 10.111 Enforcement, Violations, and Penalties

A. Violations and Penalties

Any person, firm or corporation who violates, disobeys, omits, neglects or refuses to comply with or who resists the enforcement of any of the provisions of this article shall be fined in accordance with the general penalty provision set forth in Section 1.109 of the City Municipal Code for each offense. Each day that a violation is permitted to exist shall constitute a separate offense.

B. Civil Enforcement

Appropriate civil actions and proceedings may be maintained in law or in equity to prevent unlawful construction, to recover damages, to impose additional penalties, to restrain, correct, or abate a violation of these regulations, whether such violation occurs with respect to lands within the corporate boundaries of the City. These remedies shall be in addition to the penalties described above.

Section 10.112 Payment of All Indebtedness

No person who owes delinquent taxes, delinquent assessments, delinquent fees, or any other delinquent debts or obligations to the City, and which are directly attributable to a piece of property, shall be allowed to record an approved plat until the taxes, assessments, debts or obligations directly attributable to said property and owed by the property owner or a previous owner thereof shall have been first fully discharged by payment, or until an arrangement satisfactory to the City has been made for the payment of such debts or obligations. It shall be the applicant's responsibility to provide evidence or proof that all taxes, assessments, debts or obligations have been paid before any plat is filed.

Section 10.113 Right to Deny Hearing

The City shall have the right to deny a hearing if the person or applicant proposing a subdivision of land does not:

- A. Submit all the information necessary and required for a pre-application conference and/or plat application by the required deadlines;
- B. Pay the required application fees (non-refundable);
- C. Fail to provide any other items or information as prescribed by this and other applicable ordinances.

Section 10.114 Schedule of Fees

Fees and charges for the filing of plats shall be as established by separate ordinance of the City Council from time to time.

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Article 10.200

A

Section 10.201 General

The following words, terms and phrases, when used in these Subdivision Regulations, shall have the meanings ascribed to them below, except where the context clearly indicates a different meaning.

Section 10.202 Definitions

ABANDONMENT - Relinquish the public interest, claim, or title to a public right-of-way, easement, public way, or other public property.

ACCESS - Ingress and egress between the site and a paved public street, private street, or approved access easement.

ADDITION - One or more lot, tract or parcel of land created for the purpose of development. Refer also to *Subdivision* and *Plat*.

ADEQUACY - It is the policy of the City that every development and subdivision shall be served by the applicable and appropriate public facilities (e.g. water, sanitary sewer, roads, access, drainage facilities, parks, and public safety), as determined by the City Manager or designee (City Engineer).

ADMINISTRATIVE OFFICERS - Any office referred to in these Subdivision Regulations shall be the person so retained in this position by the City, or his duly authorized representative. This definition shall also include engineering, planning and other consultants retained by the City to supplement or support existing City staff, as deemed appropriate.

1. Building Official

The officer or designated authority charged with the administration and enforcement of the building codes.

2. City Attorney

The attorney, or firm of attorney, that has been specifically employed by the City to assist in legal matters. This term shall also apply if the City retains a person to perform the functions of City attorney as an official City employee.

3. City Engineer

The registered professional engineer or firm of registered professional consulting engineers that has been specifically employed by the City to perform engineering review, design and related activities. The City Engineer is also the designated Floodplain Administrator.

4. City Manager

The person or authorized representative/designee holding the position of the chief executive officer, as appointed by the City council, under the terms of the City Charter.

5. Planning and Zoning Administrator

The professional land planner, or firm of professional land planners, that has been specifically employed by the City to assist in planning- and zoning-related matters. This term shall also apply if the City retains a person to perform the functions of City planner as an official City employee.

6. City Secretary

The person or authorized representative holding the office of City Secretary under the terms of the City Charter.

7. Director of Building Development

The person designated by the City Manager to oversee the subdivision review process, gather all staff comments and recommendations, and convey said recommendations to the Commission, Council and other departments.

8. Director of Public Works

The person designated by the City Manager to oversee compliance with the City Master Thoroughfare Plan and designate an individual to be part of the DRC; may also be City Engineer.

AGENT - Any authorized person acting on behalf of the property owner during the land development process.

AGREEMENT - Written contractual agreement between the City, the applicant or developer, and/or other public or private agencies including the following:

1. Cross Access Easement Agreement

A reciprocal contract entered into by adjacent property owners and/or the City and to be recorded in the county real property records, by which the property owners agree to shared access and maintenance of drive approaches and/or parking areas.

2. Developer Agreement

A contract entered into by the applicant and the City, by which, among other things, the applicant promises to complete the required public improvements within the subdivision or addition within a specified time period following final plat approval.

APPEAL - Review of a decision or act by a higher approving authority or court of law.

APPLICANT - A person or entity that submits a formal application for an approval required by this ordinance. Also, referred to as "developer", "subdivider", or other similar term.

APPLICATION - A written request for an approval required by this ordinance.

APPROVING AUTHORITY - The Governing Body, appointed Commissions, Committees and Boards; Administrative Officers; and/or designees granted with the power to make land development and subdivision decisions in accordance with the City Charter, City ordinances and regulations, and state law.

BLOCK - One or more lots, tracts or parcels of land bounded by streets, railroads, or subdivision boundary lines, or a combination thereof. Further, it is an area of land enclosed by streets and occupied by or intended for building.

1. Block Length. The length of a block shall be considered to be the distance from property corner to property corner measured along the property line of the block face:

- a. The block face with the greatest dimension, or
- b. The block face with the greatest number of lots.

2. Block Width. The width of a block shall be considered to be the distance from property corner to property corner measured along the property line of the block face between intersecting streets, and shall be the side with one of the following criteria:

- a. The block face with the least dimension, or
- b. The block face with the fewest number of lots.

C

CITY - The City of Lake Worth, Texas.

CITY COUNCIL - The duly elected governing and legislative body of the City of Lake Worth, Texas. See also, *Governing Body*.

CITY STANDARDS - See *Design Criteria and Construction Standards*.

CONSTRUCTION DOCUMENTS OR PLANS - Refer to *Plans, Engineered Plans or Documents*.

COMMISSION - See also, *Planning and Zoning Commission*.

COMMENCEMENT OF CONSTRUCTION - After receipt of the appropriate approvals and permits, it is the initial disturbance of soils associated with land development including but not limited to clearing, grading, excavating activities, or other construction activities.

COMPREHENSIVE PLAN - The general plan of the City, as recommended by the Planning and Zoning Commission and adopted by the City Council, including all its revisions and plan elements (including, but not limited to, the future land use plan, thoroughfare plan, parks and open space plan, etc.). This plan indicates the general locations recommended for various land uses, transportation routes, public and private buildings, streets, parks, water and wastewater facilities, and other public and private developments and improvements. The following plans or documents are associated with or incorporated into the Comprehensive Plan.

1. Future Land Use Plan

The element of the Comprehensive Plan that sets the direction of land use public policy in Lake Worth and intended to depict the future land use pattern.

2. Parks Master Plan

An element of the Comprehensive Plan which supports the stated community vision and depicts the existing parks, recreation areas, and open space within the municipality and guides the dedication and/or development of future public parks, recreational facilities and open space.

3. Master Thoroughfare Plan

An element of the Comprehensive Plan which is coordinated with the Future Land Use Plan to guide the provision of the transportation network to facilitate development and redevelopment objectives. Streets are typically classified as follows:

a. Freeways

A highway intended to move large volumes of traffic around and across the city without direct access to adjacent land.

b. Arterial

A street that interconnects and augments the principal arterial system with more land access at a lower level of traffic mobility.

c. Collector Streets

Also, known as feeder streets or secondary thoroughfares, which provide vehicular circulation within neighborhoods, and from local streets to major thoroughfares. May be continuous through several neighborhoods. Collects and distributes traffic from local access streets, as in residential neighborhoods or commercial developments, to the major arterial network.

d. Local or Residential Street

Local residential streets, also known as minor thoroughfares or streets, which primarily provide direct vehicular access to abutting residential property Inter-

nal streets within a neighborhood that provide access to residential lots and building sites and should be arranged to discourage most through traffic, except that which is directly related to the area.

DEDICATION - The deliberate appropriation of land by an owner for any general and public use. The transfer of title to, and responsibility for, public improvements to the local government from the owner of a development subject to an improvements and exactions ordinance.

DEED RESTRICTION (RESTRICTIVE COVENANT) - Written agreement which restricts or limits the use or activities that may take place on a property within a subdivision.

DESIGN CRITERIA AND CONSTRUCTION STANDARDS - The standards and specifications for the construction of subdivision improvements. A copy is maintained and available for inspection at the City Hall, and which is incorporated herein by reference.

DEVELOPMENT - Refer to *Land Development*.

DEVELOPMENT REVIEW COMMITTEE (DRC) - The review body comprised of representatives from City departments tasked with the oversight of subdivision and land development. The DRC shall be responsible for reviewing any development proposals, vacation, plans, plats, preliminary engineering design plans and any other items deemed necessary which are associated with development.

DWELLING UNIT - Also refer to the Zoning Ordinance. Any building or portion thereof, which is designed or used as living quarters for one or more families. The area of a structure set aside for single-family living; a single-family residence is one dwelling unit; a duplex is two (2) dwelling units; and each apartment is a separate dwelling unit within an apartment home complex.

ENGINEER - Refer to *Professional Engineer*.

ESCROW - A conveyance or monetary deposit to the City to be retained until the occurrence of a contingency or performance of a condition, such as construction of public improvements in accordance to the approved engineering documents.

FILING DATE - The date that the appropriate Administrative Officer determines that the application satisfies all requirements of these Subdivision Regulations and all other applicable ordinances, except for requested variances, and all applicable fees have been paid.

FLOODPLAIN MANAGEMENT - A decision-making process that aims to reduce flood losses and protection of the natural resources and function within the floodplains.

Administered by the City Engineer in accordance with Article 3.1600, *Flood Damage Prevention*, of the Lake Worth Code of Ordinances.

GUARANTEE - A pledge, guarantee, or confidence in the form of an executed document provided by a surety company or a guarantor to pay one party (the obligee) a certain amount if a second party (the principal) fails to meet the terms of the agreement and/or satisfactorily complete the project. Types of financial guarantee provided for land development are as follows:

1. Bond

A type of surety used by investors in construction projects to protect against an adverse event that causes disruptions, failure to complete the project due to insolvency of the builder(s), or the failure to meet contract specifications. Any form of a surety bond in an amount and form satisfactory to the City.

2. Escrow

A deposit of cash with the City in accordance with City policies.

3. Letter of Credit

An irrevocable letter of credit on a form acceptable to the City and approved by the City Attorney.

IMPROVEMENTS OR FACILITIES:

1. Off-site Improvements or Facilities

Existing or proposed facilities or improvements required for service to the site but not located within the boundaries of the plat.

2. On-site Improvements or Facilities

Existing or proposed facilities or improvements constructed within the property boundaries of the plat. These include streets, water lines, sewer lines, storm drainage, curb and gutter, and any other construction or reconstruction to serve the property.

3. Public Improvements or Facilities

Existing or proposed facilities constructed to City standards, dedicated for public use, and maintained by the City.

LAND DEVELOPMENT - Any new construction, including any building, structure or improvement of any nature (residential or nonresidential), or the enlargement of any external dimension of any building, structure, or improvement. Any mining, excavation, landfill or land disturbance is also considered land development.

LAND USE - The purpose or activity, for which a parcel of land, a building or structure is designed, arranged or intended, or for which it is occupied or maintained. Refer to *Zoning Regulations*.

LOT OR LOT OF RECORD - A divided or undivided tract or parcel of land having frontage on a public street and which is or in the future may be offered for sale, conveyance, transfer or improvement; which is designated as a distinct and separate tract; and which is identified by a tract/lot number or symbol in a duly approved subdivision plat which has been properly filed of record.

PERSON - any individual, association, firm, corporation, governmental agency, political subdivision, partnership, corporation, or other legal entity authorized by law, its or their successors or assigns, or the agent of any of the aforesaid.

PLAN - The following are documents often referenced when developing property within the City:

1. Concept Plan

A sketch drawing of initial development ideas superimposed on a topographic and/or aerial map to indicate the general plan of development.

2. Construction Plans or Documents— Refer to *Engineered Plans or Documents* (below).

3. Drainage Plan

A general plan for handling the storm water affecting property proposed for development. Refer to the Design Criteria and Construction Standards for requirements of the drainage plan, as applicable.

4. Engineered Plans or Documents

The maps or drawings accompanying a plat and showing the specific location and design of public improvements to be installed in the subdivision in accordance with the require-

ments of the City as a condition of approval of the plat. These drawings are signed and sealed by a professional engineer.

PLAT - A plan, map or chart of a quantity of land with actual or proposed features (as lots); the land represented; *also*, to make a plat.

The following are types of plats associated with the legal creation of a subdivision of land and/or development on property within the City limits as established and provided for in this Ordinance:

1. Amending Plat

Generally, any plat created for at least one of the purposes listed in this Ordinance and, specifically, as described in *Texas Local Government Code § 212.016*.

2. Final Plat (aka File or Record Plat).

A subdivision plat that is presented to the proper review authority for approval and intended to be recorded with the county clerk after proper certification. Note: minor plats, short form, amending plats and replats are also final plats.

1. Preliminary Plat

An initial plat of the proposed plan for subdividing, improving, and developing a tract, including supporting data such as topographic features, existing and proposed drainage features and facilities, street layout and direction of curb flow, water and wastewater utility layout, and other pertinent features with notations sufficient to substantially identify the general scope and detail of the proposed development. The plat of any lot or lots of record that is not to be recorded of record but is only a proposed division of land for review and study by the city.

4. Replat

A plat (replat) of all or part of an existing subdivision, that may be recorded and is controlling over the preceding plat without vacating that plat in accordance with this Ordinance and *Texas Local Government Code § 212.014*.

5. Recorded Plat

Any plat that has been duly recorded in the plat records of Tarrant County.

6. Subdivision Plat

A plat that divides a tract in two (2) or more parts to

- a. Lay out a subdivision of the tract, including an addition to a municipality,
- b. Lay out suburban, building, or other lots, or
- c. Lay out streets, alleys, squares, parks, or other parts of the tract intended to be dedicated to public use or for the use of purchasers or owners of lots fronting on or adjacent to the streets, alleys, squares, parks, or other parts.

A division of a tract includes a division regardless of whether it is made by using metes and bounds description in a deed of conveyance or in a contract for a deed, by using a contract of sale or other executory contract to convey, or by using any other method.

7. Vacating Plat

An instrument (approved and recorded in the same manner as the original plat) that references a plat, or any part of a plat, that once executed and recorded causes the referenced plat to have no effect.

P

PLATTING - Below are definitions pertaining to the process of platting property:

1. Minor Platting

A subdivision of land involving four (4) or fewer lots fronting on an existing street which does not require the creation of any new street(s) or the extension of municipal facilities; amending plats; and certain replats described in *Texas Local Government Code* §212.0065. The process includes final short form plat.

2. Plat Approval

Granted by the appropriate governing body or administrative officers when the plat document is prepared in accordance to City standards.

3. Plat Certification

Executed statement(s) on the face of the plat provides evidence that the document is prepared, reviewed and approved according to City standards and State law.

4. Plat Filing

The term used when an approved and certified plat is recorded with the County Clerk.

PLANNING AND ZONING COMMISSION - The Planning and Zoning Commission of the City of Lake Worth, Texas.

POWER OF ATTORNEY - A document used to appoint an agent to represent or make decisions on behalf of another person or organization.

PRE-APPLICATION CONFERENCE - The meeting with City staff required prior to filing any formal plat applications.

PROFESSIONAL ENGINEER - A person who has been duly authorized and licensed under the provisions of the Texas Engineering Practice Act and/or by the Texas Board of Professional Engineers to engage in the practice of engineering in the State of Texas. Also, known as Engineer, Registered Engineer, Registered Professional Engineer, or Licensed Engineer.

PROFESSIONAL LAND PLANNER - A person, other than a surveyor or engineer, who also possess and can demonstrate a valid proficiency in the planning of residential, commercial, industrial and other related developments; such a proficiency often having been acquired by education in the field of landscape architecture or other specialized planning curriculum and/or by actual experience and practice in the field of land planning, and may be certified by the American Institute of Certified Planners (AICP).

PROFESSIONAL LAND SURVEYOR - A registered professional land surveyor, as authorized by the State statutes to practice the profession of surveying.

PROPERTY OWNER - Also, known as "applicant" or "subdivider" or "developer." Any person or firm, association, syndicate, general or limited partnership, corporation, trust or other legal entity, or any agent thereof, that has sufficient proprietary interest in the land sought to be subdivided to commence and maintain proceedings to subdivide the same under this ordinance. In any event, the term "property owner" shall be restricted to include only the owner(s) or authorized agent(s) of such owner(s), such as a developer, of land sought to be subdivided.

PUBLIC IMPROVEMENTS - Facilities, infrastructure and other appurtenances built to City standards, and ultimately owned and maintained by the City. Public improvements provide a public service (such as wastewater collection and treatment and water storage and distribution), and which protect the general health, safety, welfare and convenience of the citizens of Lake Worth, including efficiency in traffic circulation and access for emergency services.

PUBLIC FACILITIES SYSTEM - The operation and maintenance of water, wastewater, roadway, drainage or park facilities owned or operated by or in behalf of the City for the purposes of providing services to the public, including existing and new developments.

PUBLIC INFRASTRUCTURE IMPROVEMENT - A water, wastewater, roadway, drainage or park facility that is a part of one or more of the City public facilities systems.

PUBLIC OPEN SPACE EASEMENT (POSE) - An easement located at street intersections to promote visibility at the intersection.

PUBLIC PARK - Land dedicated to the City specifically for development and use as a public open space and/or recreational area.

PHASED DEVELOPMENT - Development that will occur in phases over time.

REVIEW - A review of an application for a development permit based on documents, materials, and reports.

RIGHT-OF-WAY (ROW) - A use of land dedicated by plat or metes and bounds to and for use by the public and which right-of-way is separate and distinct from the lots, parcel abutting it, and not included within the dimensions or areas of such lots or parcels.

The following are types of rights-of-way and/or design standards that may be established/associated with the creation of a subdivision:

1. Alley

A minor public right-of-way not intended to provide the primary means of access to abutting lots, which is used primarily for vehicular service access to the back or sides of properties otherwise abutting on a street.

2. Parkway

The area between the curb or edge of pavement and the property line of the abutting lot which is used for street improvements. See also *Street Improvements*.

3. Public Street

A public right-of-way, however designated, designed to City standards and maintained by the City, which provides vehicular access to adjacent land and in accordance with the Thoroughfare Plan.

4. Street Improvements

This means any street or thoroughfare, together with all appurtenances required by City regulations to be provided with such street or thoroughfare, and including but not limited to curbs and gutters, walkways (sidewalks), drainage facilities to be situated in the right-of-way for such street or thoroughfare, traffic control devices, street lights and street signs, for which facilities the City will ultimately assume the responsibility for maintenance and operation. Also, referred to as *Parkway*.

5. Street Right-of-Way

The width of the right-of-way for any roadway is the shortest perpendicular distance between the lines which delineate the rights-of-way of the street.

ROUGH PROPORTIONALITY - A term used to describe the nature and extent of required public improvements or facilities corresponding to the scale and type of proposed development; the portion of costs of a public improvement.

S

SHALL, MAY - The word "shall," wherever used in this ordinance, will be interpreted in its mandatory sense; the word "may" shall be interpreted as permissive.

STREET(S) - A way for vehicular traffic, whether designated as a street, highway, road, avenue, boulevard, lane, place or other name. "Street" does not include a path or an alley. The design of streets within a development or improved with redevelopment shall comply with the approved Master Thoroughfare Plan. See also, *Plan, Master Thoroughfare Plan*.

1. **Access or Frontage Road**

A street or road that provides access to adjacent properties along a freeway or expressway.

2. **Approach Street**

A new or existing street not adjacent to a subdivision being developed but which provided access or improved access to such subdivision.

3. **Cul-de-sac**

A street having but one outlet to another street and terminated on the opposite end by a vehicular turnaround.

4. **Dead End Street**

A street, other than a cul-de-sac, with only one outlet.

5. **Street Width**

The portion of the right-of-way constructed and designated for vehicular traffic. The shortest distance between the opposite edges of a paved surface or where curbs exist, the distance measured from face of curb to face of curb.

6. **Standard Street**

A standard street is a street or road that meets or exceeds the minimum Street Improvements. This means any street or thoroughfare, together with all appurtenances required by City regulations to be provided with such street or thoroughfare, and including but not limited to curbs and gutters, walkways (sidewalks), drainage facilities to be situated in the right-of-way for such street or thoroughfare, traffic control devices, street lights and street signs, for which facilities the City will ultimately assume the responsibility for maintenance and operation.

SUBDIVIDER - Any person or any agent thereof, dividing or proposing to divide land so as to constitute a subdivision as that term is defined herein. In any event, the term "subdivider" shall be restricted to include only the owner, equitable owner, or authorized agent of such owner or equitable owner, such as a developer, or land sought to be subdivided.

SUBDIVISION - Refer to *Addition*. A division or redivision of any tract of land situated within the corporate limits for the purpose of transfer of ownership, layout of any subdivision of any tract of land or any addition, or for the layout out of building lots, or streets, alleys or parts of other portions for public use or the use of purchasers or owners of lots fronting thereon or adjacent thereto.

TRACT - An unplatted parcel of land described by metes and bounds and typically recorded in the county deed records.

U.S. ARMY CORPS OF ENGINEERS - The branch of the U.S. Army that plans, engineers, and manages national water resource projects and facilities.

UTILITY - Water, sanitary sewer, electric, gas, telephone, cable TV or any other such item of service either for public or private use.

UTILITY (PUBLIC) - An entity that provides an essential commodity or service, such as electric, gas distribution, and local telephone, and that is generally under government regulation. A service provided to the public by either a private or a public agency.

U

WAIVER - As a part of the discretionary review process, the developer or applicant requests certain regulations not apply to the subdivision.

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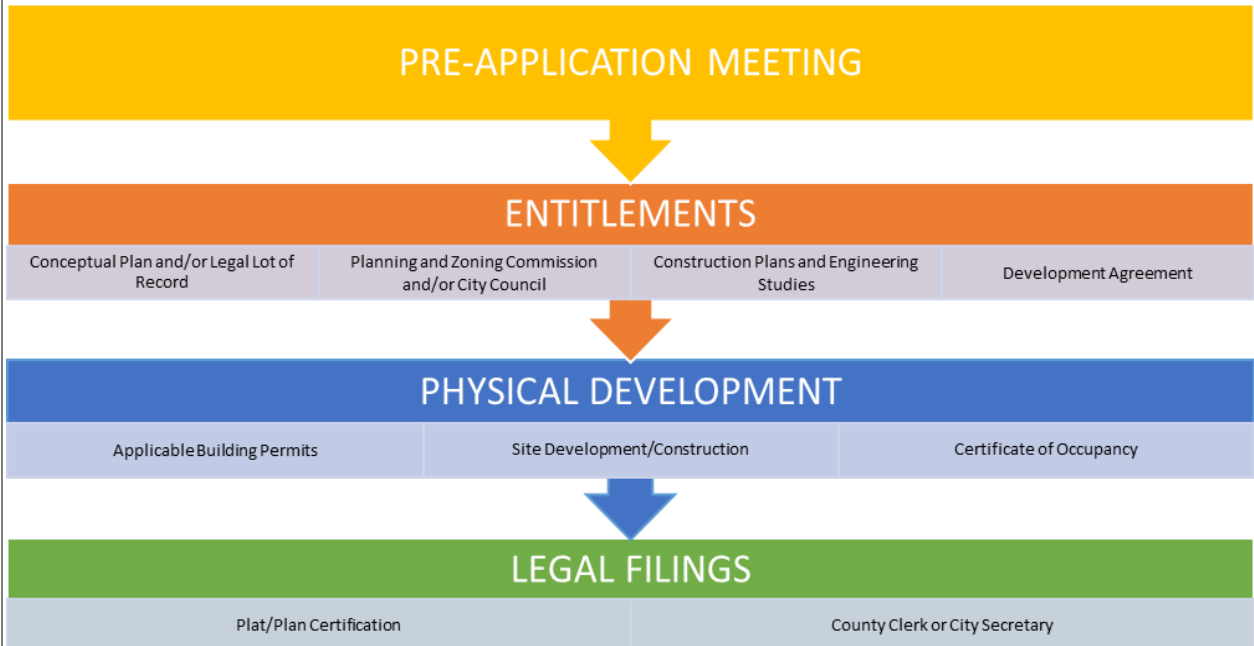
ARTICLE 10.300, SITE DEVELOPMENT PROCEDURES - PLAT

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Article 10.300

Section 10.301 Overview of Site Development Process

No final plat shall be approved by the City Council, and no completed improvements shall be accepted by the City or its representatives, unless and until such plat and improvements conform to all applicable regulations and standards as prescribed by the City of Lake Worth. All improvements, including, but not limited to streets, alleys, sidewalks, parking lots, drainage ways, water and sewer lines and improvements shall be designed, placed and constructed according to the procedures and policies herein and with the criteria and details in Appendix B, Design Criteria and Construction Standards.



A. Pre-application Meeting

The conceptual phase of the development process includes informal review of any development proposal with staff and/or with the Development Review Committee (DRC) during a Pre-application Meeting. Required forms, if applicable, are available from the Planning and Zoning Department, and appointments should be made with Building and Development Services. The plan or plat required for this phase is not an official plat and does not constitute and shall not be construed as the submission of or filing of a plat within the meaning of this Ordinance or within the meaning of the laws of the State of Texas or of the United States, including, without limitation, Texas Local Government Code Chapter 212, as amended.

B. Entitlements

The review and approval process by the City varies by the type of subdivision or land development proposal and may also include zoning actions.

1. Plats

The applicable Administrative Officers and/or Approving Authority reviews the plat and plans for compliance with City regulations and approves, approves with conditions, or disapproves the plat and plans. Refer to Section 10.303, Specific Plats and Procedures.

2. Engineered Construction Plans and Engineering Studies

Engineered studies and construction documents bearing the seal and signature of a professional engineer licensed in the State of Texas, and cost estimates with the applicable development agreement are typically submitted to the Planning and Zoning Department for distribution to the DRC with an approved preliminary plat and prior to application for a final plat or replat. All plans shall be in accordance with the regulations herein and with Appendix B, Design Criteria and Construction Standards.

3. Guarantee of Public Improvements

All required public improvements and facilities will be constructed prior to the legal filing of the plat or shall be guaranteed with an approved agreement and the provision of surety in accordance with these Subdivision Regulations, and with Appendix B, Design Criteria and Construction Standards.

C. Physical Development

The technical review process varies by the type of subdivision or land development proposal. Applicable approvals including, but not limited to, zoning and plat are required prior to proceeding to the physical development. The applicable Administrative Officers review the construction documents and engineering studies for compliance with City regulations.

1. Building Permit

An original complete application is required to be submitted to the Planning and Zoning Department. The following approvals are required prior to permit approval:

- a. Preliminary plat;
- b. Final plat;
- c. Engineered construction plans;
- d. Engineering studies; and
- e. Off-site easements and dedications.

2. Certificate of Occupancy

Upon final inspection and completion of the project constructed in conformity with approved plans, the City Manager and/or designee may issue a certificate of occupancy.

D. Legal Filings

1. Plat Certification

The certification on the face of the approved plat or plan shall be executed by the applicable Approving Authorities prior to filing with the City Secretary or the Tarrant County Clerk in accordance with the regulations herein and all applicable state law requirements.

2. Filing of Approved Plat

Submit the required number of blackline copies, fees, tax certificate and other copies, as may be required by City staff and the Tarrant County Clerk.

Article 10.300

Section 10.302 General Plat Review Procedures

A. Intent of Required Procedures and Required Improvements

The requirements of these Subdivision and Development Regulations are designed and intended to assure that:

1. All purchasers of property within the subdivision shall have a usable, buildable parcel of land;
2. The impacts of new development are mitigated through contributions of rights-of-way, easements and construction of capital improvements;
3. The City can provide for the orderly and economical extension of public facilities and services which are:
 - a. Provided at the earliest stage of the development process;
 - b. Constructed and installed properly;
 - c. Required only according to the proportionate share of the costs; and
 - d. The new development and the required public facilities and services conform to the adopted Comprehensive Plan, other adopted City plans, and applicable capital improvements plans.

B. Role of Development Review Committee (DRC)

The Development Review Committee (DRC) is responsible for reviewing all development proposals for compliance with these regulations and to:

1. Fairly and efficiently enforce the provisions of these regulations, including information not evidenced on the plat or plan, and
2. Facilitate cooperation between the City and the applicant so that the application is complete and in proper form.

C. Pre-Application Meeting

1. The Development Review Committee (DRC) will review sketches, plans, and or plats with the applicant to determine what may be required for the proposed development. No formal application is required, but sketches and plans should be submitted to the Planning and Zoning Department in advance of the meeting.
2. Prior to submitting a formal application all DRC review comments from the Pre-Application Meeting must be addressed.

D. Plat Determination

1. Based on the information provided at the pre-application conference and/or DRC meeting, determination will be made regarding the type of plat or plan which is best suited for the type of development proposed.
2. The name of the proposed subdivision and the street names shall be unique and not duplicate the name of an existing plat or subdivision. The City will review and prohibits duplication of an existing plat or subdivision. In such case, another name will be required. Refer to Article 10.400, Minimum Design Standards.

E. Formal Plat Application

City staff is authorized to create and require the use of subdivision and platting application forms, which are available on the City website or may be received in hard copy form from the Planning and Zoning Department. The application forms specify all the elements required for submittal.

F. Complete Application Required

1. A complete application must be submitted to the City to be considered.
2. No required application shall be accepted by the City for processing unless it is accompanied by all documents required by and prepared in accordance with the requirements of these Subdivision Regulations, all applicable City regulations, and the application form.
3. A determination of completeness shall not constitute a determination of compliance with the substantive requirements of these Subdivision Regulations and any applicable City regulations.
4. Within ten (10) business days after the submittal of the formal application, the applicant will be notified of the application status, which may be one of the following:

a. Incomplete Application

- i. An application which is lacking required information and/or fee and will not be reviewed by the appropriate Administrative Officers, departments and/or agencies. The determination shall specify the documents or other information needed to complete the application and shall state the date the application will expire if the documents or other information is not provided.
- ii. If the Planning Administrator issues two (2) incomplete determinations, the applicant shall pay a re-submittal fee before any additional application is approved by the City Council. The fee shall be in the amount of the professional fees, including engineering; and legal fees, if required, for the review of the application and supporting documents and issuance of comments plus an administrative fee of 20 percent of the total professional fees.
- iii. The applicant shall be deemed to have been notified if the City has sent the applicant and/or the designated representative a written explanation sent by USPS mail and/or email as specified on the application.

b. Complete Application

- i. An application that includes all the required information, documents, and fees will be deemed complete, and distributed for review by the appropriate administrative officers, departments, and/or agencies.
- ii. The applicant will be provided a fee receipt by the City.

Article 10.300

G. Application Expiration

1. An application shall expire on the forty-fifth (45th) day after submittal if:
 - a. The applicant fails to provide documents or other information necessary to comply with the City's requirements relating to the required application;
 - b. The City has provided to the applicant, not later than the tenth (10th) business day after the date the application is submitted, unless otherwise specified, written notice that specifies the necessary documents or other information, and the date the application will expire if the documents or other information is not provided; and
 - c. The applicant fails to provide the specified documents or other information within the time provided in the notification. If the required application is not completed by the forty-fifth (45th) day after the application is submitted to the appropriate Administrative Officers, the required application will be deemed to have expired and it will be returned to the applicant together with any accompanying information.
2. No vested rights accrue solely from the filing of an application that has expired pursuant to this section, or from the filing of a complete application that is subsequently denied.

H. Filing Date

1. For the purpose of these Subdivision Regulations, the filing date of an application for approval of a plat or plan shall be the date that the appropriate Administrative Officers determine that the application satisfies all requirements of these Subdivision Regulations and all other applicable ordinances, except for requested variances, and all applicable fees have been paid.
2. The statutory period requiring formal approval or disapproval of the plat or plan shall commence on the filing date.
3. Action shall be taken by the Planning and Zoning Commission within 30 days of the filing date unless a waiver is requested by the applicant.
4. A plat or plan shall be submitted to the City Council within 30 days after the date the plat is approved or disapproved by the Planning and Zoning Commission unless a waiver is requested by the applicant.

I. Certification Required

1. In accordance with the regulations herein and Texas Local Government Code § 212.009, as amended, when approved, all plans and plats shall include a certificate of approval of endorsed (signature and date) by the Chair of the Planning and Zoning Commission and the Mayor or Mayor Pro Tem and attested by the City Secretary.
2. The certificate shall be on the face of the plan or plat document (Refer to Appendix A, Plat and Plan Requirements).

J. Documentation of Approved Plat

1. City Clerk

As specified herein by plat type, submit one (1) hard copy and one (1) electronic version of the approved plat.

2. Tarrant County Clerk

Submit the required number of blackline copies, electronic version, fees, tax certificate and other copies, as may be required for by City staff and the Tarrant County Clerk for official filing of the approved subdivision.

K. Miscellaneous Reviews Procedures

1. Phased Development

a. If the subdivider intends to develop the subdivision in phases or sections, the plat shall include only those sections or phases of the subdivision that the subdivider intends for immediate development.

b. The subdivider shall provide an illustration (hard copy and/or electronic version) showing all phases of the development shall be provided to City staff to review for substantial conformity.

2. Simultaneous Submission of Plats

An applicant may simultaneously submit both preliminary and final plat applications for review and approval.

Article 10.300

Section 10.303 Specific Plats and Procedures

A. Preliminary Plat

1. Purpose and Authority
 - a. The preliminary plat serves as a guide in the preparation of a final plat, and in the engineering plans to serve the final plat. The plat is not to be recorded and is only a proposed division of land for review and study by the City.
 - b. The preliminary plat is not contemplated by the Texas Local Government Code but is regulated herein.
2. Process and Applicability

The preliminary plat will be reviewed by the Planning and Zoning Commission and considered by the City Council.
3. Complete Application Submittal Required

An applicant must submit the completed application form, fee, additional documents, if required, and plat prepared in accordance with the Appendix A, Plat and Plan Requirements.

 - a. Additional copies of the preliminary plat may be required if revisions or corrections are necessary.
 - b. Waivers may be requested in accordance with Section 10. 302, General Plat Review Procedures.
 - c. Engineering studies may be required by the City Engineer in accordance with these Subdivision Regulations and the Design Criteria and Construction Standards.
4. Notice. Written notification is not required. Notice of scheduled public meetings will be made as required by state law, as amended
5. Criteria for Approval

No preliminary plat shall be reviewed by the Planning and Zoning Commission and considered by the City Council, unless the following standards have been met:

 - a. Acceptance of preliminary engineering studies and analysis by the City Engineer as provided by the applicant to:
 - i. Confirm the adequacy of the existing utility and/or roadway system to serve the proposed development; and
 - ii. Show the comprehensive drainage area and plan.
 - b. The plat conforms to the Comprehensive Plan, including, but not limited to, all adopted water, sewer, future land uses, and thoroughfare plans.
 - c. The plat conforms to applicable zoning and other regulations.
 - d. The plat meets all other requirements of these Subdivision Regulations.

6. Determination

a. Recommendation of Commission

The Planning and Zoning Commission shall review the preliminary plat and recommend approval, approval with conditions, or disapproval of the plat within 30 days of the filing date of the preliminary plat application.

b. City Council Action

i. Commission Recommendation

Following the recommendation of the Commission, the City Council shall make a decision to approve, approve with conditions or disapprove the preliminary plat application within 30 days of the recommendation by the Commission.

ii. Conditional Approval or Denial

If the City Council conditionally approves or disapproves the preliminary plat application, the Administrative Officers shall provide the applicant a written statement of the conditions for the conditional approval or reasons for disapproval that clearly articulates each specific condition for the conditional approval or reason for disapproval, including a citation to the law that is the basis for the conditional approval or disapproval, if applicable.

ii. Approval

Approval of the preliminary plat application by the City Council shall also constitute approval of plans and any other documents or information submitted with the preliminary plat application.

c. Applicant Response

i. If the City Council conditionally approves or disapproves a preliminary plat, the applicant may submit to the Administrative Officers a written response that satisfies each condition for the conditional approval or remedies each reason for disapproval provided to the applicant.

ii. There is no deadline for when the applicant may submit the response.

iii. If the applicant submits a response under this section, the response shall be reviewed by the Administrative Officers and forwarded to the City Council for action within 15 days of the date the response is submitted.

iv. The City Council shall take action to approve or disapprove of the applicant's previously conditionally approved or disapproved preliminary plat.

- v. The City Council shall approve the preliminary plat if the applicant's response adequately addresses each condition of the conditional approval or each reason for disapproval.
- vi. The City Council shall disapprove the preliminary plat if the applicant's response fails to adequately address each condition of the conditional approval or each reason for the disapproval.
- vii. The City Council may only disapprove the preliminary plat for a specific condition or reason previously provided to the applicant. If the City Council disapproves the preliminary plat, the Administrative Officers shall provide the applicant a written statement of the reasons for disapproval that clearly articulates each specific reason for disapproval, including a citation to the law that is the basis for the disapproval, if applicable. If the preliminary plat is disapproved after the applicant files a response under this section, the disapproval is final.

d. Approval

Approval of the preliminary plat application by the City Council shall also constitute approval of plans and any other documents or information submitted with the preliminary plat application.

7. Certification

Refer to Section 10.302, General Plat Review Procedures.

8. Documentation of Approved Plat

An approved and certified preliminary plat will be filed with the City Secretary.

9. Exception

For subdivisions less than five (5) acres which contain four (4) lots or less, the requirement for a preliminary plat may be waived in writing by the City Manager or the designated administrative official if no public improvements are being proposed and if the development has access to a public street.

10. Commencement of Development

No construction activities or development activity shall commence, nor shall any building permit, utility connection permit, electrical connection permit or similar permit be issued, for any development or land division subject to this Section, until a final plat has been approved by the applicable Approval Authority.

11. Extension and Reinstatement Procedure

An approved preliminary plat shall be valid for 12 months after the date of City Council approval. If no action is taken within 12 months, the subdivider will be required to file a new pre-application meeting for DRC review and pay all applicable fees.

Actions include submission of the following:

- a. Submittal of engineered construction documents and/or engineering studies or a complete application for final plat approval.
- b. Extension Request

A one-time, six (6) month extension may be granted by the DRC, provided that a written request for an extension is signed and submitted to the Planning and Zoning Department 60 days prior to the expiration date.
- c. Reinstatement Request

An approved preliminary plat may be reinstated by the DRC, provided that a written request is signed and submitted to the Planning and Zoning Department 60 days prior to the expiration date.
- d. Determination

The decision of the DRC shall be in writing and may grant a six-month extension or reinstate the plat or deny the request. If the request is denied, the applicant or property owner must submit a new application for approval and pay all applicable fees. In determining whether to grant a request for extension or reinstatement, the DRC shall take into account the following:

 - i. Reasons for lapse,
 - ii. The ability of the property owner to comply with any conditions attached to the original approval, and
 - iii. The extent to which newly adopted subdivision regulations shall apply to the plat or study.

B. Final Plat

1. Complete Application Submittal Required

An applicant must submit the completed application form, fee, additional documents, if required, and plat prepared in accordance with the Appendix A, Plat and Plan Requirements.

- a. An application for final plat shall not be accepted by the City if a preliminary plat has expired and become void.
- b. A certificate from the County Clerk shall be submitted with the application which shows the payment all taxes with no delinquent taxes against the subject property.

2. Notice

Written notification is not required. Notice of scheduled public meetings will be made as required by state law, as amended.

3. Criteria for Approval

No final plat shall be approved unless the following standards have been met:

- a. The final plat shall conform with the preliminary plat, as approved, incorporating all conditions, changes, directions and additions.
- b. Approval of the preliminary plat is required prior to submittal and review of the final plat, unless waived in accordance to Section 10.303.B.10, Exception.
- c. An executed Public Improvements Agreement, as applicable, and provision of security is provided to the Administrative Officers for consideration by the City Council.

4. Determination

a. Recommendation of Commission

The Planning and Zoning Commission shall review the preliminary plat and recommend approval, approval with conditions, or disapproval of the plat within 30 days of the filing date of the preliminary plat application.

b. City Council Action

- i. Following the recommendation of the Commission, the City Council shall make a decision to approve, approve with conditions or disapprove the preliminary plat application within 30 days of the recommendation by the Commission.
- ii. If the City Council conditionally approves or disapproves the preliminary plat application, the Administrative Officers shall provide the applicant a written statement of the conditions for the conditional approval or reasons for disapproval that clearly articulates each specific condition for the conditional approval or reason for disapproval, including a citation to the

law that is the basis for the conditional approval or disapproval, if applicable.

c. Applicant Response

- i. If the City Council conditionally approves or disapproves a preliminary plat, the applicant may submit to the Administrative Officers a written response that satisfies each condition for the conditional approval or remedies each reason for disapproval provided to the applicant.
- ii. There is no deadline for when the applicant may submit the response.
- iii. If the applicant submits a response under this section, the response shall be reviewed by the Administrative Officers and forwarded to the City Council for action within 15 days of the date the response is submitted.
- iv. The City Council shall take action to approve or disapprove of the applicant's previously conditionally approved or disapproved preliminary plat.
- v. The City Council shall approve the preliminary plat if the applicant's response adequately addresses each condition of the conditional approval or each reason for disapproval.
- vi. The City Council shall disapprove the preliminary plat if the applicant's response fails to adequately address each condition of the conditional approval or each reason for the disapproval.
- vii. The City Council may only disapprove the preliminary plat for a specific condition or reason previously provided to the applicant. If the City Council disapproves the preliminary plat, the Administrative Officers shall provide the applicant a written statement of the reasons for disapproval that clearly articulates each specific reason for disapproval, including a citation to the law that is the basis for the disapproval, if applicable. If the preliminary plat is disapproved after the applicant files a response under this section, the disapproval is final.

d. Approval

Approval of the preliminary plat application by the City Council shall also constitute approval of plans and any other documents or information submitted with the preliminary plat application.

5. Certification

Refer to Section 10.302, General Plat Review Procedures.

6. Documentation of Approved Plat

An approved and certified final plat will be filed with the Tarrant County Clerk.

C. Minor Plat

1. Complete Application Submittal Required

An applicant must submit the completed application form, fee, additional documents, if required, and plat prepared in accordance with the Appendix A, Plat and Plan Requirements.

a. Applicability

An application for approval of a minor plat may be filed only when all of the following circumstances apply:

- i. The proposed division results in four (4) or fewer lots;
- ii. All lots in the proposed subdivision front onto an existing public street and the construction or extension of a street or alley is not required; and
- iii. The plat does not require the extension of any municipal facilities or public improvements to serve any lot within the subdivision.

- b. A certificate from the County Clerk shall be submitted with the application which shows the payment all taxes with no delinquent taxes against the subject property.

2. Notice - Written notification is not required.

3. Criteria for Decision

The City Manager or designee shall approve a minor plat application when it meets the following criteria:

- a. The minor plat application is consistent with all zoning requirements for the property and all other requirements of this Ordinance;
- b. All lots to be created by the plat are already adequately served by all required utilities and services; and
- c. The plat does not require the extension of any municipal facilities or public improvements to serve any lot within the subdivision; and
- d. The applicant has submitted a completed application form, associated documents, fee, and the minor plat containing the required information specified in the Appendix A, Plat and Plan Requirements.
- e. The Administrative Officers may, for any reason, elect to present a minor plat for approval to the Planning and Zoning Commission and then to the City Council.
 - i. The Administrative Officers shall not disapprove a minor plat and shall refer any minor plat which the Administrative Officers refuses to approve to the Planning and Zoning Commission and then to the City Council within the time periods specified in Section 212.009, Texas Local Government Code.

- ii. If a minor plat is referred to the Planning and Zoning Commission and then to the City Council, the approval process shall comply with the processes provided for a final plat, as applicable.
- 4. Certification - Refer to Section 10.302, General Plat Review Procedures.
- 5. Documentation of Approved Plat

An approved and certified minor plat will be filed with the Tarrant County Clerk.

D. Amending Plat

1. Complete Application/Submittal Required

An applicant is required to submit the completed application form; associated documents; fee, as applicable; and the plat containing the required information specified in the Appendix A, Plat and Plan Requirements.

2. Notice

Written notification is not required. Notice of scheduled public meetings will be made as required by state law, as amended

3. Criteria for Approval

The City Manager or designee may approve an amending plat, which may be recorded and is controlling over the preceding plat without vacation of the preceding plat, if the amending plat is signed by the applicants only and is solely for one or more of the following purposes:

- a. To correct an error in a course or distance shown on the preceding plat;
- b. To add a course or distance that was omitted on the preceding plat;
- c. To correct an error in a real property description shown on the preceding plat;
- d. To indicate monuments set after the death, disability, or retirement from practice of the engineer or surveyor responsible for setting monuments;
- e. To show the location or character of a monument that has been changed in location or character or that is shown incorrectly as to location or character on the preceding plat;
- f. To correct any other type of scrivener or clerical error or omission previously approved, including lot numbers, acreage, street names, and identification of adjacent recorded plats;
- g. To correct an error in courses and distances of lot lines between two adjacent lots if:
 - i. Both lot owners join in the application for amending the plat;
 - ii. Neither lot is abolished;
 - iii. The amendment does not attempt to remove recorded covenants or restrictions; and
 - iv. The amendment does not have a material adverse effect on the property rights of the other owners in the plat;
- h. To relocate a lot line to eliminate an inadvertent encroachment of a building or other improvement on a lot line or easement;
- i. To relocate one (1) or more lot lines between one (1) or more adjacent lots if:

- i. The owners of all those lots join in the application for amending the plat;
 - ii. The amendment does not attempt to remove recorded covenants or restrictions; and
 - iii. The amendment does not increase the number of lots;
 - j. To make necessary changes to the preceding plat to create six (6) or fewer lots in the subdivision or a part of the subdivision covered by the preceding plat if:
 - i. The changes do not affect applicable zoning and other regulations of the City;
 - ii. The changes do not attempt to amend or remove any covenants or restrictions; and
 - iii. The area covered by the changes is located in an area that the Planning and Zoning Commission and City Council has approved, after a public hearing, as a residential improvement area; or
 - k. To replat one (1) or more lots fronting on an existing street if:
 - i. The owners of all those lots join in the application for amending the plat;
 - ii. The amendment does not attempt to remove recorded covenants or restrictions;
 - iii. The amendment does not increase the number of lots; and
 - iv. The amendment does not create or require the creation of a new street or make necessary the extension of municipal facilities.
- 4. Determination

The City Manager and/or designee may approve an amending plat that complies with these regulations and does not require a waiver; provided, however, the City Manager may, for any reason, elect to present an amending plat for approval to the Planning and Zoning Commission and then to the City Council.

 - a. The City Manager shall not disapprove an amending plat and shall refer any amending plat which the City Manager refuses to approve to the Planning and Zoning Commission and then to the City Council within the time periods specified in Section 212.009, Texas Local Government Code.
 - b. If an amending plat is referred to the Planning and Zoning Commission and then to the City Council, the approval process shall comply with the processes provided for a final plat, as applicable.
- 5. Certification

Refer to Section 10.302, General Plat Review Procedures.
- 6. Documentation of Approved Plat

An approved amending plat will be filed with the Tarrant County Clerk.

E. Replat

1. Complete Application Submittal Required

An applicant must submit the completed application form, fee, additional documents, if required, and plat prepared in accordance with the Appendix A, Plat and Plan Requirements.

a. Requirements

A replat of a subdivision is controlling over the preceding plat without vacation of the plat if the plat:

- i. Is signed and acknowledged by only the owners of the property being replatted;
- ii. Is approved by the City Council;
- iii. Does not attempt to amend or remove any covenants or restrictions; and
- iv. When applicable, in compliance with subsection E.2. below.

b. A certificate from the County Clerk shall be submitted with the application which shows the payment all taxes with no delinquent taxes against the subject property.

2. Notice

a. Written notification is not required, unless the following applies.

b. Replat for Residential Lots. Notice shall be provided if the replat meets the following:

- i. If any of the proposed property to be replatted, within the immediate preceding five (5) years, was limited by any interim or permanent zoning classification to residential use for not more than two (2) residential units per lot, or
- ii. If any lot in the approved subdivision was limited by deed restriction to residential use for not more than two (2) residential units per lot.
- iii. Notice of the public hearing shall be given by publication in an official newspaper or a newspaper of general circulation and by written notice forwarded to the owners of lots that are in the original subdivision and that are within 200 feet of the lots to be replatted, as indicated on the most recently approved county tax roll of the property upon which the replat is requested.

3. Process

The application process, approval process, criteria for approval, and recordation of a replat shall comply with the processes as provided for a final plat, as applicable.

4. Certification
 - a. Refer to Section 10.302, General Plat Review Procedures.
 - b. Note on Plat

A replat shall contain a note describing the purpose of the change or modification framed in a bold line so as to be distinctly visible on the face of the plat.
5. Documentation of Approved Plat

An approved replat will be filed with the Tarrant County Clerk.

F. Residential Replat

1. Complete Application Submittal Required

An applicant must submit the completed application form, fee, additional documents, if required, and plat prepared in accordance with the Appendix A, Plat and Plan Requirements.

2. Applicability

a. A replat without vacation of the preceding plat must conform to the requirements of this section if:

- i. During the preceding five (5) years, any of the area to be replatted was limited by an interim or permanent zoning classification to residential use for not more than two residential units per lot; or
- ii. Any lot in the preceding plat was limited by deed restrictions to residential use for not more than two (2) residential units per lot.

b. If a proposed replat described above requires a variance or exception, a public hearing must be held by the City Council.

3. Notice

Notice of the public hearing required by Section F.2. shall:

- a. Be given no less than 15 days prior to the date of the public hearing in an official newspaper and
- b. By written notice, with a copy of any special conditions, sent to the owners, as indicated on the most recently approved ad valorem tax roll of the City, of lots that are in the original subdivision within 200 feet of the lots to be replatted. The written notice may be delivered by depositing the notice, properly addressed with postage prepaid, in a post office or postal depository within the boundaries of the City.

4. Determination

a. Variance

If the proposed replat requires a variance and is protested in accordance with this subsection:

- i. The proposed replat must receive, in order to be approved, the affirmative vote of at least three-fourths ($\frac{3}{4}$) of the members present of the Planning and Zoning Commission and City Council.
- ii. For a legal protest, written instruments signed by the owners of at least 20 percent of the area of the lots or land immediately adjoining the area covered by the proposed replat and extending 200 feet from that area, but within the original subdivision, must be filed with the Planning and Zoning Commission and City Council prior to the close of the public hearing.

- b. If a proposed replat described by Section G.1. does not require a variance or exception:
 - i. The City shall, not later than the 15th day after the date the replat is approved, provide written notice by mail of the approval of the replat to each owner of a lot in the original subdivision that is within 200 feet of the lots to be replatted according to the most recent City or County tax roll.
 - ii. This Section does not apply to a proposed replat if the Planning and Zoning Commission or the City Council holds a public hearing and gives notice of the hearing in the manner provided herein.
- 5. Process

Except for public hearing, notice, and protest procedures as described above, the application process, approval process, criteria for approval, and recordation of a replat described by this Section shall comply with the processes as provided for a final plat, as applicable.
- 6. Certification - Refer to Section 10.302, General Plat Review Procedures.
- 7. Documentation of Approved Plat

An approved replat will be filed with the Tarrant County Clerk.

G. Vacating Plat

1. Complete Application Submittal Required

Submit the completed application form, associated documents, and the vacating plat containing the required information specified in Appendix A, Plat and Plan Requirements.

2. Process and Applicability

a. The Vacating Plat will be considered by City Council with a recommendation from the Planning and Zoning Commission.

b. By property owner. The property owner of the tract covered by a plat may vacate, upon review by the Planning and Zoning Commission and approval by the City Council, the plat at any time before any lot in the plat is sold. The plat is vacated when a signed, acknowledged instrument declaring the plat vacated is approved and recorded in the manner prescribed for the original plat (instrument language is available from the city, upon request).

c. By all lot owners. If some or all of the lots covered by the plat have been sold, the plat, or any part of the plat, may be vacated on the application of all the owners of lots in the plat with approval obtained in the manner prescribed for the original plat.

3. Criteria for Approval

a. The Planning and Zoning Commission shall review, and the City Council may approve, the petition for vacation on such terms and conditions as are in accordance with Texas Local Government Code § 212.013, as amended, and as are reasonable to protect the public health, safety and welfare.

b. As a condition of vacation of the plat, the City Council may direct the petitioners to prepare and seek approval of a revised final plat in accordance with this ordinance such that the property does not become "unplatted."

4. Determination

The Planning and Zoning Commission shall recommend approval, and the City Council shall approve, the plat vacation only if the criteria and conditions cited above are satisfied.

5. Certification

Refer to Section 10.302, General Plat Review Procedures.

6. Documentation of Approved Plat

a. If the City Council approves vacating a plat, the City Secretary shall record a copy of the plat vacation instrument in the office of the County Clerk of Tarrant County along with an exhibit showing a drawing of the area or plat vacated.

- b. The County Clerk shall write legibly on the vacated plat the word "vacated" and shall enter on the plat a reference to the volume and page at which the vacating instrument is recorded.
- c. If the City Council vacates only a portion of a plat, it shall cause a revised final plat drawing to also be recorded that shows that portion of the original plat that has been vacated and that portion that has not been vacated.
- d. On the execution and recording of the vacating instrument the vacated plat (or the vacated portion of the plat) has no effect.

Section 10.304 Additional Requirements for Plat Approval

A. Waivers

1. Purpose and Authority

- a. The City Council may approve waivers to these subdivision regulations so that substantial justice may be done, and the public interest secured when it finds that unreasonable hardships or difficulties may result from strict compliance with these regulations, and/or the purposes of these regulations may be served to a greater extent by an alternative proposal. Any waiver granted shall not have the effect of nullifying the intent and purpose of these regulations.
- b. Waivers are regulated herein and in accordance with Section 10.101, Authority.

2. Process and Applicability

- a. Waivers may be granted only when in harmony with the general purpose and intent of the adopted Comprehensive Land Use Plan and these regulations so that the public health, safety and welfare may be secured, and substantial justice done.
- b. Alternative standards. Waivers to the regulations herein and contained in Appendix B, Design Criteria and Construction Standards may only be granted based on evidence provided by the design engineer and acknowledged by the City Manager and/or designee, that the alternative standards provide the same degree of protection that the original standards would provide.
- c. Waivers should be submitted with the application for preliminary plat. If a waiver is submitted after approval of the preliminary plat, a separate application and fee and review process will be required.

3. Criteria for Approval

In granting a waiver, the City Council shall prescribe only conditions that it deems necessary or desirable to protect the public interest. In making the findings hereinbelow required, the City Council shall consider:

- a. The nature of the proposed land use(s),
- b. Existing adjacent land uses of land,
- c. The number of persons who will reside or work in the proposed subdivision, and
- d. The probable effect of such waiver upon traffic conditions and upon the public health, safety, convenience, and welfare in the vicinity.
- e. Pecuniary hardship standing alone shall not be deemed to constitute undue hardship.

4. Determination

No waiver shall be granted unless the City Council finds:

- a. That there are special circumstances or conditions affecting the land

involved such that the strict application of the provisions of these regulations would deprive the applicant of the reasonable use of the land;

- b. That the waiver is necessary for the preservation and enjoyment of a substantial property right of the applicant;
- c. That the granting of the waiver will not be detrimental to the public health, safety, or welfare, or injurious to other property in the area; and
- d. That the granting of the waiver will not have the effect of preventing the orderly subdivision of other land in the area in accordance with the adopted Comprehensive Land Use Plan and the provisions of these regulations; or
- e. That the waiver is necessary as a result of the determination regarding the rough proportionality of an exaction requirement.

5. Official Record

Such findings, together with the specific facts, shall be incorporated into the official minutes of the City Council meeting at which such waiver is granted.

B. Traffic Study

- 1. Traffic Impact Analysis (TIA) are required for developments which include and/or generate:
 - a. 50 or more dwelling units; or
 - b. 500 or more one-way trips per day; or
 - c. Collector or Arterial Streets not included in the Master Thoroughfare Plan (MTP).

At any time during the pre-application proposal or plat application process, the City Manager or designee (City Engineer) may require a sight-distance study and/or a traffic impact analysis for any portion of the tract to be subdivided.

- 2. The plat or any related development application which requires a traffic impact analysis or study shall be held as 'incomplete' by the City and not scheduled for consideration until the results of the completed study or traffic impact analysis have been reviewed by the City Engineer and any affected public agency [such as the State of Texas, if required].
- 3. Based on the study or analysis, the City Manager and/or designee may impose stricter standards on the proposed plat in order to accommodate increased traffic because of the proposed development.

C. Development Agreement

- 1. Agreement Required

As a condition to plat approval, the subdivider shall execute a contract with the City providing for the installation of public improvements required by the development regulations of the City.

- a. This agreement shall be considered by the City Council at a regularly scheduled meeting.
 - b. This agreement, entitled "Development Agreement," shall constitute a covenant which will run with the land and will be binding upon any assignee or owner in the chain of title. The Development Agreement shall be in the form provided in, Appendix B, Design Criteria and Construction Standards.
 2. Revisions

After execution of the Development Agreement by the subdivider and the City, any changes in the contract or the plans or specifications that alter the scope of the project must be recommended by the City Engineer, approved by the City Attorney, and considered by the City Council at a regularly scheduled meeting. Upon approval, an addendum to the Development Agreement shall be executed by the subdivider and the City.
- D. Adequacy of Specific Facilities
 1. Purpose and Authority

All lots to be platted shall be connected to the City public facility systems, as follows:

 - a. A public water system which has capacity to provide water for domestic use and emergency purposes, including adequate fire protection.
 - b. An approved means of wastewater collection and treatment. The City Manager and/or designee shall be responsible for determining the approved means of wastewater collection and treatment.
 - c. Proposed roads shall provide a safe, convenient and functional system for vehicular, bicycle and pedestrian circulation and shall be properly related to the approved Master Thoroughfare Plan. New subdivisions shall be supported by a thoroughfare network having adequate capacity, and safe and efficient traffic circulation. Each development shall have adequate access to the thoroughfare network.
 - d. Drainage improvements serving new development shall be designed to prevent overloading the capacity of the downstream drainage system. The City may require the use of control methods such as retention or detention, the construction of off-site drainage improvements, or drainage impact fees in order to mitigate the impacts of the proposed subdivision.
 2. Process and Applicability
 - a. Minimum Design Standards

Article 10.400 of these regulations provides for the minimum requirements for development plans within the City. Additional technical standards are provided in the Appendix B, Design Guidelines and Construction Standards.

b. Adequacy

The City Manager and/or designee shall review the development for adequacy of the proposed and existing public improvements necessary to support the subdivision or development.

E. Rough Proportionality

1. Authority

Rough Proportionality is adopted pursuant to Texas Local Government Code, § 212.904, as amended.

2. Process and Applicability

a. Plat application

The City Manager and/or designee shall review the plat application and prepare a written statement affirming that each exaction requirement to be imposed as a condition of approval is roughly proportionate to the demand created by the subdivision or development on the applicable City public facility systems, taking into consideration the following:

- i. Current categorical findings and recommendations made by the North Central Texas Council of Government (NCTCOG) in developing standard specifications for public infrastructure improvements and storm water management;
- ii. Proposed and potential use of the land;
- iii. Timing and sequence of development in relation to availability of adequate levels of public facilities systems;
- iv. Engineering studies specific to the development including, but not limited to, impact fee studies, traffic impact studies, drainage studies, fire protection consumption and irrigation water needs, and solid or liquid waste collection or disposal;
- v. Level of service and functionality of both on-site and off-site public infrastructure improvements in serving the proposed subdivision or development;
- vi. Degree to which public infrastructure improvements necessary to serve the proposed subdivision are supplied by other developments;
- vii. Anticipated participation by the City in the costs of necessary public infrastructure improvements;
- viii. Degree to which acceptable private infrastructure improvements to be constructed and maintained by the applicant will offset the need for public infrastructure improvements;
- ix. Any reimbursements for the costs of public infrastructure improvements for which the proposed subdivision is eligible; and/or

- x. Any other information relating to the impacts created by the proposed subdivision or development on the City public facility systems.
 - b. The City Manager and/or designee may require that the applicant, at its expense, submit any information or studies that may assist in making the proportionality determination.
 - c. Rough proportionality will be considered in conjunction with the development application by City Council with a recommendation from the Planning and Zoning Commission.
- 3. Determination
 - a. The Planning and Zoning Commission and City Council shall consider the report concerning the proportionality of the exaction requirements in making a decision on a plat application and may grant a waiver to the requirements herein or make a decision to participate in the costs of improvements.
 - b. The Administrative Official responsible for issuing a permit for which an exaction requirement is imposed as a condition of approval shall consider the report concerning the proportionality of the exaction requirements in making its decision as to whether to grant the permit or to modify or waive an exaction requirement.
- 4. Rough Proportionality Appeal
 - a. An applicant may file an appeal to contest any exaction requirement, other than impact fees, imposed as a condition of approval or in which the failure to comply is grounds for denying the application pursuant to the regulations herein.
 - b. The purpose of a proportionality appeal is to assure that an exaction requirement imposed as a condition of approval does not result in a disproportionate cost burden on the applicant, taking into consideration the nature and extent of the demands created by the proposed subdivision or development on the City public facility systems.
- 5. Appeals Procedure
 - a. An applicant shall file a written appeal with the City Secretary within 10 days of the date the Planning and Zoning Commission or the City Administrative Officer responsible for issuing the permit takes action applying the exaction requirement. This may include denial of the permit or plat. The applicant shall submit 15 copies of the appeal.
 - b. A separate appeal form shall be submitted for each exaction requirement for which relief is sought. The City Secretary shall forward the appeal to the City Council for consideration.
 - c. The applicant may request postponement of consideration of the plat application by the City Council pending preparation of the study and/or appeal, in which case the applicant shall also waive any the statu-

tory period for acting upon the application for the time necessary for the City Council to decide the appeal.

- d. No Development Agreement may be executed by the City:
 - i. Until the time for appeal has expired unless the applicant agrees in writing that the rough proportionality determination of the is reasonable and accurate and that no appeal will be filed; or,
 - ii. If an appeal is filed, until the City Council has made a determination with respect to the appeal.
- e. The appeal shall state the reasons that application of the exaction requirement is not roughly proportional to the nature and extent of the impact created by the proposed subdivision or development on the City public facility systems and does not reasonably benefit the proposed subdivision or development.
- f. The appellant shall submit 15 copies of a study in support of the appeal that includes, with respect to each specific exaction requirement appealed, the following information within 30 days of the date of appeal, unless a longer time is requested:
 - i. Total capacity of the City water, wastewater, roadway, drainage, or park system, as applicable, to be utilized by the proposed subdivision or development, employing standard measures of capacity and equivalency tables relating the type of development proposed to the quantity of system capacity to be consumed by the subdivision. If the proposed subdivision is to be developed in phases, such information also shall be provided for the entire development, including any phases already developed.
 - ii. Total capacity to be supplied to the city's public facilities systems for water, wastewater, roadway, drainage or parks, as applicable, by the exaction requirement. This information shall include any capacity supplied by prior exaction requirements imposed on the development.
 - iii. Comparison of the capacity of the applicable City public facility systems to be consumed by the proposed subdivision or development with the capacity to be supplied to such systems by the proposed exaction requirement. In making this comparison, the impacts on the city's public facilities systems from the entire subdivision or development shall be considered.
 - iv. The amount of any City participation in the costs of oversizing the public infrastructure improvements to be constructed by the applicant in accordance with City requirements.
 - v. Comparison of the minimum size and capacity required by City standards for the applicable public facility systems to be utilized by the proposed subdivision or development with the size

and capacity to be supplied by the proposed exaction requirement.

- vi. Any other information that shows the alleged disproportionality between the impacts created by the proposed development and the exaction requirement imposed by the City.
 - g. The City Manager and/or designee shall evaluate the appeal and supporting study and shall make a recommendation to the City Council based upon analysis of the information contained in the study and utilizing the same factors considered by the engineer in making the original proportionality determination.
6. City Council Decision of Appeal
- a. The City Council shall decide the appeal within 30 days of the date of final submission of any evidence by the applicant.
 - b. Upon receipt of the final submission of evidence from the applicant, the City Secretary shall schedule a time and date for the City Council to consider the appeal and shall cause the applicant to be notified at the address specified in the appeal form of the time, date and location at which the City Council shall consider the appeal.
 - c. The applicant shall be allotted time, not to exceed 30 minutes, to present testimony at the City Council meeting.
 - d. The Council shall base its decision on the criteria listed herein and may:
 - i. Deny the appeal and impose the exaction requirement in accordance with the report and recommendation of the City Manager and/or designee or the decision of the Planning and Zoning Commission; or
 - ii. Grant the appeal, and waive in whole or in part an exaction requirement to the extent necessary to achieve proportionality; or
 - iii. Grant the appeal, and direct that the City participate in the costs of acquiring land for or constructing the public infrastructure improvement.
 - e. In deciding an appeal, the City Council shall determine whether application of the exaction requirement is roughly proportional to the nature and extent of the impact created by the proposed subdivision on the City public facility systems for water, wastewater, roadway, drainage, or park facilities, as applicable, and reasonably benefits the subdivision. In making such determination, the Council shall consider:
 - i. The evidence submitted by the applicant;
 - ii. The City Manager and/or designee report and recommendation; and

- iii. If the property is adjacent to a state or county road, any recommendations from the county or State.
 - f. The City Council may require the applicant or the City Administrative Officers to submit additional information that it deems relevant in making its decision.
 - g. The applicant shall not be deemed to have prevailed in the event that the City Council modifies the exaction requirement.
- 7. Action Following Decision of City Council
 - a. If the City Council finds in favor of the applicant and waives the exaction requirement as a condition of plat approval, or modifies the exaction requirement to the extent necessary to achieve rough proportionality, the applicant shall resubmit the plat application to the Planning and Zoning Commission or City Administrative Officer responsible for issuing the permit within 30 days of the date the City Council takes action, with any modifications necessary to conform with the City Council decision. Failure to do so will result in the expiration of any relief granted by the City Council.
 - b. If the City Council finds in favor of an applicant for any other permit and waives the exaction requirement as a condition of permit approval, or modifies the exaction requirement to the extent necessary to achieve rough proportionality, the applicant shall resubmit the permit application to the responsible official within 30 days of the date the City Council takes action, with any modifications necessary to conform the application with the City Council decision. Failure to do so will result in the expiration of any relief granted by the City Council.
 - c. If the City Council denies the appeal and the applicant has executed a waiver of the statutory period for acting upon a plat, the City shall place the plat application on the agenda of the Planning and Zoning Commission within 30 days of the City Council decision.
 - d. If the plat application is modified to increase the number of residential dwelling units or the intensity of non-residential uses, the City Manager and/or designee may require a new study to validate the relief granted by the City Council.
 - e. If the plat application for which relief was granted is denied on other grounds, a new appeal shall be required on any subsequent application.
- 8. Appeal of City Council Decision
 - a. An applicant may appeal the decision of the City Council to the county or district court of the county in which the development is located within 30 days of the date that the Council issues its final decision.
 - b. In the event that the applicant prevails in such action, the applicant will be entitled to attorneys' fees and costs, including expert witness fees.

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ARTICLE 10.400

SITE DEVELOPMENT PROCEDURES - PUBLIC IMPROVEMENTS

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Section 10.401 General Procedures

A. Engineering Requirements

1. **Approved Preliminary Plat Required.** An approved preliminary plat is required prior to submitting an application for site development which is available from the Department of Building and Development. Engineering Plans and Construction Documents will be considered concurrently with the final plat process.
2. **Engineering Plans and Documents**
 - a. **Complete Application Required**

An applicant must submit the completed application form, fee, engineering/ construction documents prepared in accordance with applicable City regulations and Appendix B, Design Criteria and Construction Standards, and additional documents, if required, by the City Manager and/or designee.
 - b. **Engineering Plans/Construction Documents**

Requirements for complete submittal are available on the appropriate application available online at www.lakeworthtx.org or at City Hall.
 - c. **Cost Estimates**

Itemized cost estimates for public infrastructure facilities required.
 - d. **Development Agreement**

An applicant must submit an executed copy of the applicable agreement required and as approved by City Council.
 - e. **Rough Proportionality determination, if applicable, made by City Manager and/or designee.**
 - f. **Off-site Easements and Dedications**
 - i. The City will advise a subdivider of any potential on-site of off-site requirement for oversized improvements. The City may participate in the cost of any improvements required to serve land areas and improvements outside the subdivision, including oversized utility lines.
 - ii. All necessary off-site easements and dedications required for city-maintained facilities and not shown on the plat must be conveyed solely to the City prior to submitting an application for a site development, such as by filing of a separate instrument, with the proper signatures affixed. The original of the documents and the appropriate fees for filing the documents at the county (per Tarrant County requirements and the City submission guidelines, as may be amended from time to time) shall be returned to the City Secretary prior to approval and release of the engineering plans.

B. Pre-Construction Procedures

1. Building and Construction Permit(s)

Approved engineering plans, associated documents, and the applicable permit application(s) are required prior to the start of any construction on site and/or any development that requires floodplain management, erosion control, storm drainage, grading, and/or vegetation or tree removal.

2. Final Plans. The developer shall submit the final-approved engineering plans prior to construction, as follows:

- a. Three (3) full-size set of plans;
- b. Half-size set(s), as requested, and
- c. One (1) electronic version.

3. Inspection Fees

Payment of the inspection fees as specified and approved by the City Council are required prior to scheduling the required pre-construction conference.

4. Pre-construction Conference

All contractors participating in the construction shall be presented with a set of approved plans bearing the stamp of release of the City Manager and/or designee, as appropriate. At least one (1) set of these plans shall remain on the job site at all times.

C. Expiration After City Approval

Approved construction plans shall be valid for a period of 12 months after approval by the applicable Approving Authority - Director of Building and Development Services and the City Engineer. A one-time, 6-month extension may be granted by the above prior to the date of expiration. Submit the request for extension 60 days prior to expiration.

D. Guarantee of Public Improvements

1. Development Agreement

- a. The subdivider/developer shall guarantee the public improvements will be constructed by executing the applicable Development Agreement, as specified by the City Manager and/or designee.
- b. The City Manager and/or designee may approve the applicable Development Agreement when the total project cost is less than \$25,000.

2. Guarantee

- a. The developer shall guarantee 125 percent of the estimated developer's share of the cost of the required public improvements by one of the methods discussed herein.
- b. The developer shall provide a guarantee for maintenance for a period of two (2) years in the amount of 125 percent of the actual cost of the required public improvements by one (1) of the methods discussed

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herein and as specified in the Appendix B, Design Criteria and Construction Standards.

- c. Where City participation is necessary or agreed upon, the developer shall guarantee 100 percent (100%) of the estimated City's share of the cost of the required public improvements by one (1) of the methods discussed herein.

3. Developer shall furnish a financial guarantee in one (1) of the following ways:

a. Payment and Performance Bond.

- i. Furnish the City with a performance and payment bond executed by a surety company authorized to do business in the State of Texas.
- ii. The bonds shall be subject to the approval of the City Attorney and must be executed by a corporate surety in conformance with Texas law; or

b. Escrow or Interest-bearing Account

- i. Assign an interest-bearing account, with a financial institution which is insured by the Federal Deposit Insurance Corporation or Federal Savings and Loan Insurance Corporation, in an amount equal to the percentage discussed below.
- ii. If an interest-bearing account is utilized, the developer shall execute three (3) copies of a letter, approved by the City Attorney, assigning the account to the City and authorizing the City to withdraw funds and requiring authorization by the City before the developer may withdraw funds.
- iii. Any arrangement involving an interest-bearing account shall be accepted in writing by the financial institution.

c. Letter of Credit

Deposit a certified check, Irrevocable Letter of Credit or cash with the City in an amount equal to the percentage as discussed herein.

E. Inspection during Construction of Improvements

- 1. Periodic construction inspections, as required, shall be conducted by the City Manager or designee. Said inspections shall ensure that construction is in accordance with the approved engineering plans.
- 2. Upon completion of each inspection, a written report shall be forwarded to the City Manager that fully documents the inspection conducted, the tests completed, specific items that are in compliance or noncompliance, actions that must be taken to bring the construction into compliance, and any other information required by the City Engineer. The City of Lake Worth may either require reinspection or conduct its own independent inspection as required by the City Manager or designee.
- 3. The City will not deem required public improvements satisfactorily completed until the applicant's engineer or surveyor provides certification to the City Man-

ager or designee by submittal of detailed sealed as-built drawings which indicate all public improvements and their locations, dimensions, materials and other information required by the City Engineer, and until all required public improvements have been completed in accordance with approved plans.

F. Improvements Required Prior to Acceptance

1. Provision of the following improvements, as applicable, designed and constructed in accordance with the regulations herein and with Appendix B, Design Criteria and Construction Standards, are required prior to acceptance by the City into its public infrastructure system:

- a. Streets,
- b. Street lights,
- c. Street signs,
- d. Alleys,
- e. Easements,
- f. Required landscaping,
- g. Monuments and markers,
- h. Traffic control signs, and
- i. Utility, water and wastewater, and storm drainage facilities.

2. Provision of Maintenance Guarantee

The subdivider/developer shall guarantee the required improvements will be maintained for a 2-year period by providing the following as specified in the regulations herein and/or by the City Manager and/or designee:

- a. Applicable Development Agreement with the City designated as the beneficiary, and
- b. Acceptable form of financial guarantee as outlined in the regulations herein and in Appendix B, Design Criteria and Construction Standards.

G. Acceptance of Improvements

1. The City shall inspect the installation of all required improvements to insure compliance with City requirements and the approved engineering plans and/or construction documents.
2. When all required improvements have been satisfactorily completed, the City shall either accept, in writing, the improvements as having been satisfactorily completed, or shall issue a punch list to the developer denoting items remaining to be completed.
3. The City shall not accept dedications of required improvements nor release a performance bond or other guarantee, until:
 - a. All improvements have been satisfactorily completed in compliance with the approved plans;
 - b. Approved "as built" plans have been submitted to and accepted by the City;

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- c. The required maintenance guarantee surety as specified in the Design Criteria and Construction Details has been provided;
 - d. Receipt of affidavit of payment, as required by City Manager and/or designee; and
 - e. Any and all other requirements identified in this ordinance or other City codes and ordinances have been satisfied.
- 4. Acceptance of the development shall mean that the developer transfers all rights to all the public improvements to the City for use and maintenance.
- 5. Upon acceptance of the required public improvements, the City Manager and/or designee shall submit a certificate to the developer stating that all required public improvements have been satisfactorily completed.
- H. Withholding Services and/or Improvements

Until the subdivision construction is accepted, the City will withhold ALL CITY SERVICES AND/OR IMPROVEMENTS of whatsoever nature, including the maintenance of streets, the furnishing of water, wastewater service and electric service.
- I. Building Permit
 - 1. Building Permit Required

No building permit may be issued for any building or structure on a newly subdivided parcel of land until all the requirements of these subdivision regulations have been met and public improvements have been installed and accepted, including filing of final plat and all water, wastewater, storm drainage, sidewalks and street improvements.
 - 2. Exception
 - a. With the approval of the Development Review Committee, the Building Official may release building permits for up to 10 percent of the lots within the subdivision and/or development, provided that all public improvements and utilities relating to said land are complete.
 - b. Final inspections or certificates of occupancy will not be issued until final acceptance of the subdivision and the public improvements, and the filing of the final plat.
- J. Final Acceptance – New Subdivisions
 - 1. When installation of the street, alley, storm drainage, water and wastewater improvements provided by the developer have been completely performed on the part of the contractor, the contractor shall notify the City that the improvements are ready for final inspection.
 - 2. If the work is satisfactory and in accordance with the approved final construction plans, then the City will issue a letter of acceptance to the developer with a copy to the contractor.
 - 3. No Certificate of Occupancy shall be issued by the City nor shall any permanent utility services be granted to the site unless all final inspections have been completed, the “Letter of Acceptance” has been written, and any required maintenance bond has been filed with the City.
 - 4. The City of Lake Worth may, at its sole discretion, disconnect any utility services until the requirements of this ordinance have been met.

Section 10.402 Design Standards

City policy regarding the minimum design and construction requirements for public infrastructure installed with development is specified herein. Both the regulations herein and Appendix B, Design Criteria and Construction Standards are intended to be used for design of the subdivision and public improvements.

A. Basis for Standards

1. Minimum Design Standards

The design standards established herein for development are in support of the Comprehensive Plan and Master Thoroughfare Plan.

2. Appendix B, Design Criteria and Construction Standards

Design standards and technical standard details are specified in the appendix, as adopted by City Council.

Amendments to the Appendix A, Concept Plan and Plat Requirements, and Appendix B, Design Criteria and Construction Standards may be considered at a regular meeting of the City Council.

B. Minimum Standards

It is the intent of these regulations that no development occurs until and unless these minimum levels of service and/or standards are met. Therefore, each subdivision in the City shall be required to dedicate, construct and/or upgrade required facilities and infrastructure to a capacity that meets these minimum levels.

1. Conform with Adopted Plans

The minimum standards herein support the vision of the adopted Comprehensive Plan, Master Thoroughfare Plan, and/or other adopted City plans, as provided by the City Manager and/or designee.

2. Minimum Level of Service

Certain minimum requirements and sizes for utilities, roadways, and other facilities are specified that have been determined by the City Council to be necessary in order to protect or promote the public health, safety.

3. Minimum Standards for Public Infrastructure.

These minimum standards take into consideration the soil conditions and topographic configuration of the City, the use and impact analyses of the North Central Texas Council of Governments in developing standard specifications for public works installation, and other historical use and performance metrics associated with public infrastructure within the City.

C. Dedication Required

The City may require the dedication of easements and rights-of-way for or construction of on-site or off-site public improvements and facilities to serve a proposed subdivision.

D. Adequacy of Public Facilities

1. Every subdivision of land shall be adequately served by improved streets, water and wastewater facilities.

2. If adequate levels of public facilities and services cannot be provided concurrent with the schedule of development proposed, the City may deny the subdivision until the public facilities and services can be provided or may require that the development be phased so that the availability and delivery of facilities and services coincides with the demands for the facilities created by the development.

E. Additional Requirements

Whenever the City Council determines that levels of service in excess of these minimum standards are necessary in order to promote the orderly development of the City, the owner shall qualify for reimbursement for any costs in excess of the minimum levels of service through City participation, to the extent funds are available through the determination of proportionality outlined in Chapter 10.300 or other means adopted by the City.

Section 10.403 Site Development

A. General

The minimum criteria for the physical improvement of each site is established to provide safe, orderly and sustainable growth.

B. Site Grading

The building pad and foundation elevation shall be graded to the most recent City adopted Building Code Standards and conform with applicable restrictions in the floodplain.

C. Restrictions in the Floodplain

Site design shall conform to the regulations in Article 3.1600 of the Lake Worth Code of Ordinances and in Appendix B, Design Criteria and Construction Standards.

D. Monument and Markers

Permanent Survey Markers. All boundary corners, block corners, etc., as established in the process of creating a subdivision plat shall comply with the Texas Board of Professional Land Surveying Practices Act and General Rules of Procedures and Practices, (663.17 Monumentation).

E. Easements

1. Easements shall be provided on final plat and coordinated with the construction plans (refer to Appendix B, Design Criteria and Construction Standards), and may include, but are not limited to the following types of easements:

- a. Utility,
- b. Floodplain,
- c. Fire Lane,
- d. Drainage,
- e. Detention and/or
- f. Public Open Space.

2. Unless by agreement approved by the City Council, no building or structure shall be constructed over or into an easement. If any building, structure of physical improvement is within an easement, it shall be the sole responsibility of the property owner to remove or abate the obstruction immediately at their sole cost.

Article 10.400

Section 10.404 Subdivision Layout

A. General

The minimum criteria for the design of each new subdivision is established to promote access and connectivity and sustain community character.

B. Lots

The size shape and orientation of lots shall be appropriate to the type and location of the proposed development.

C. Building Lines

Building lines for each lot shall be shown on the final plat and shall be consistent with the development standards specified in Chapter 14, Zoning in the Lake Worth Code of Ordinances and in Appendix B, Design Criteria and Construction Standards.

D. Blocks

Generally, the length, width, and shapes of blocks shall:

1. Conform to the zoning requirements for lot size, setbacks and lot dimensions;
2. Provide an adequate building site suitable for the type of use;
3. Address site specific topographic conditions, and
4. Provide access, circulation, and control and safety of street traffic.

E. Access

Provide vehicular and pedestrian access in accordance with the Appendix B, Design Criteria and Construction Standards.

F. Access Management

Joint and cross access easements/agreements promote connections between existing and new development and manages traffic flow between businesses along a corridor. The intent of the joint-access and cross-access provisions is to limit access connections to arterials and collectors and to help meet the spacing guidelines between driveways in accordance with the adopted Appendix B, Design Criteria and Construction Standards.

G. Driveways

Driveway design shall conform to the Appendix B, Design Criteria and Construction Standards.

H. Parking

1. Required to be On-site. All parking shall be off-street, meaning that all vehicle maneuvering is done on the subject parcel and not in the street right-of-way. Refer to Appendix B, Design Criteria and Construction Standards.
2. Conformance with Zoning Ordinance Required. Location and number of required parking spaces must conform to the Chapter 14, Zoning of the Lake Worth Code of Ordinances.

I. Planned Development

All proposed planned developments shall comply with the provisions relating thereto and contained within Chapter 14, Zoning of the Lake Worth Code of Ordinances. All streets not dedicated to the public shall be constructed in accordance with Appendix B, Appendix B, Design Criteria and Construction Standards and shall be maintained by means of the property owner(s) or other means as approved by the Planning and Zoning Commission.

Article 10.400

Section 10.405 Infrastructure in the Right-of-Way

A. General

All public facilities shall be designed and constructed in accordance with the most current adopted City regulations, technical specifications and standard details. Public facilities typically located within the public right-of-way include sidewalks, driveways, street lights, street signs, streets and alleys.

B. Sidewalks

1. Purpose

Proposed sidewalks shall provide safe and convenient pedestrian circulation and shall be properly related to the Comprehensive Plan and the Master Thoroughfare Plan.

2. General

- a. Sidewalks shall be constructed for all lots adjoining dedicated streets, along major thoroughfares where lots do not adjoin the street, across power line easements, and in other areas where pedestrian walkways are necessary.
- b. Every new subdivision, or re-subdivision, shall be required to install sidewalks, with appropriate barrier free ramps, within the public street right-of-way.
 - i. All sidewalks shall conform to the latest ADA and Texas Accessibility Standards (TAS) requirements.
 - ii. Barrier free ramps shall be provided for access across streets per Appendix B, Design Criteria and Construction Standards.
- c. Sidewalk construction may be delayed until development of lots but must be constructed for each lot prior to completion of any primary structure. In locations not adjacent to lots and across bridges and culverts, the sidewalk shall be constructed with the other improvements to the subdivision.

3. Required for Certificate of Occupancy

The City may withhold a Certificate of Occupancy for a commercial use and final inspection approval for a residential structure if sidewalks are not properly installed, inspected and accepted by the City Manager and/or designee.

C. Street Lights

A Street Lighting Plan shall be required by the City as a part of the plat application process. Street light design shall conform to Appendix B, Design Criteria and Construction Standards.

D. Street Names and Signs

1. Street Names

- a. New street names shall not duplicate or cause confusion with the names of existing streets.

- b. New streets which are an extension of existing streets shall bear the names of existing streets.
 - 2. Street name signs shall be City approved and furnished and installed by the Subdivider/Developer for all intersections within or abutting the subdivision and shall be designed and constructed in accordance with City requirements and Appendix B, Design Criteria and Construction Standards.
- E. Traffic Control Signs

Install the appropriate type and number of traffic control signs, as specified in Appendix B, Design Criteria and Construction Standards, to promote vehicular and pedestrian safety.
- F. Streets
 - 1. Purpose

Proposed streets shall provide a safe, convenient and functional system for vehicular, bicycle, and pedestrian circulation and shall be properly related to the Master Thoroughfare Plan and/or Comprehensive Plan, and shall be appropriate for the particular traffic characteristics of each proposed subdivision or development
 - 2. Conform to Master Thoroughfare Plan

Proposed streets shall provide a safe, convenient and functional system for traffic circulation; shall be properly related to the adopted Master Thoroughfare Plan, road classification system, Comprehensive Plan and any amendments thereto; and shall be appropriate for the particular traffic characteristics of each development.

 - a. The arrangement, character, extent and location of all streets shall be considered in their relation to:
 - i. Existing and planned streets or driveways,
 - ii. Topographical conditions,
 - iii. Drainage constraints,
 - iv. Public safety, and
 - v. Existing and planned land use(s).
 - b. Amendment Required

Any land study or subdivision plat involving a change to a proposed alignment shown on the Master Thoroughfare Plan must be approved through the amendment process.
 - c. When a street is not shown on the Master Thoroughfare Plan, the arrangement of streets in a subdivision shall:
 - i. Provide for continuation or appropriate projection of existing streets in surrounding areas,

- ii. Conform to a plan for the neighborhood approved or adopted by the City to meet a particular situation where topographical or other conditions make continuance or conformity to existing streets impracticable,
- iii. Provide for future access to adjacent vacant areas which will likely develop under a similar zoning classification.
- iv. Not conflict in any way with existing or proposed driveway openings.
- v. Allow for the appropriate dedication and/or improvement on each plat application to meet the minimum street construction and right-of-way standards.

3. Responsibility

The property owner shall assure that the subdivision is adequately served by improved streets and thoroughfares and shall be responsible for the costs of rights-of-way and street improvements, in accordance with the following policies and standards, and may be required to participate in the cost of provision of oversized facilities.

G. Pavement Types and Markings

- 1. Pavement construction standards shall comply with Appendix B, Design Criteria and Construction Standards.
- 2. Pavement Markings: Pavement markings shall conform to the Texas Manual on Uniform Traffic Control Devices (TMUTCD) and Appendix B, Design Criteria and Construction Standards.

Section 10.406 Utilities in the Right-of-Way

A. General

1. All subdivision plats and engineering plans shall provide location and design of public utilities prepared in accordance to franchise requirements and Appendix B, Design Criteria and Construction Standards.
2. All distribution lines, cables, etc. for utilities other than those specified below shall be installed below ground within the subdivision.
3. Transmission lines or major cables to provide utilities such as electric, telephone, and cable television to the area as a whole may be located above ground on the perimeter of the subdivision being served. The installation of these utilities shall conform to commonly accepted construction standards and be subject to review by the City Manager and/or designee.

B. Utility Services

1. Design and Location. Utility services, such as electrical, gas, telephone, and cable TV utility lines shall be shown on the final plat and the engineering plans.
2. Review. All easements shown on the final plat will be reviewed by both the utility companies and the City prior to granting final approval for all residential subdivisions affected by this section
3. Approval. Acceptance of easement locations and widths shall be provided prior to final plat approval.
4. Nothing in this section shall be construed to require any existing facilities in place prior to the effective date of this section to be placed underground.

C. Electric, Telephone and Cable Services

1. Utility lines for electric service, telephone service and cable television service shall be installed underground in any new subdivision platted after approval of this Ordinance.
2. Service to all street light poles shall be underground.

D. Water and Wastewater Facilities.

1. Design. Water and wastewater facilities shall be shown on the engineering plans.
2. Review. Easements for water and wastewater facilities shown on the final plat will be reviewed by prior to granting approval of the final plat and/or engineering plans.
3. Approval.
 - a. Acceptance of easement locations and widths shall be provided prior to final plat approval.
 - b. Acceptance of installed facilities shall be provided prior to filing of the final plat.

4. Extension of all utilities shall be as follows:

- a. When adjacent to an existing subdivision, the utilities shall extend along the entire frontage of the subdivision adjacent to the street or thoroughfare.
- b. If the subdivision is not adjacent to a thoroughfare, the extension of utilities shall be accomplished in a manner to allow future connection to new subdivisions. If new subdivisions will never be constructed beyond a developing subdivision due to physical constraints, the City Manager and/or designee may waive the requirement for adjacent utility line construction.

E. Storm Drainage Facilities

1. Design and Location

Storm drainage improvements shall be designed in accordance with the Chapter 14, Zoning of the Lake Worth Code of Ordinances, the Comprehensive Plan and Appendix B, Design Criteria and Construction Standards, and for the ultimate development of the area within the watershed, whether inside or outside the subdivision or addition, since the runoff tends to increase in direct proportion to the amount of impervious area such as sidewalks, pavements, buildings, etc.

2. Review

Easements for storm drainage facilities shown on the final plat will be reviewed by prior to granting approval of the final plat and/or engineering plans.

3. Approval

- a. Acceptance of easement locations and widths shall be provided prior to final plat approval.
- b. Acceptance of installed facilities shall be provided prior to filing of the final plat.

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APPENDIX A

To Chapter 10,
Subdivision Regulations

PLAN AND PLAT REQUIREMENTS

APPENDIX A PLAT AND PLAN REQUIREMENTS

APPENDIX A PLAT AND PLAN REQUIREMENTS

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APPENDIX A PLAT AND PLAN REQUIREMENTS

CHAPTER 1 REQUIREMENTS FOR CONSTRUCTION DOCUMENTS and ENGINEERING PLANS

A. Plan Set Order

A civil construction plan submittal shall meet the following general sheet requirements and order.

1. Cover Sheet with Vicinity Map
2. General Notes
3. Final Plat
4. Site Layout
5. Dimensional Control Plan
6. Paving Plan and Profile
7. Grading Plan
8. Drainage Area Map
9. Storm Sewer Layout
10. Storm Sewer Plan and Profile
11. Channel and/or Culvert Plan and Profile
12. Retaining Wall
13. Water Layout
14. Water Plan and Profile
15. Sanitary Sewer Layout
16. Sanitary Sewer Plan and Profile
17. Storm Water Pollution Prevention Plan (Erosion Control Plan)
18. Traffic Control Plan and Details including pavement markings and signage
19. Standard Construction Details

B. Sheet Size

1. The Construction Plans shall be submitted on standard 22"x34" sheets or on a size as specified by City Manager or designee.
2. Half-size plans may be required for inspection(s) or as specified by City Manager or designee.

APPENDIX A PLAT AND PLAN REQUIREMENTS

C. Sheet Layout

Each sheet of the Construction Plans shall include the following:

1. Date
2. North arrow
3. Scale
(Scale shall be 1 inch equal 20, 40 or 50 feet horizontally and 1 inch equal 2, 4, or 5, feet vertically.)
4. Date
5. Benchmark description to sea level datum
6. Seal and signature of the Licensed Professional Engineer in the State of Texas who prepared the plans
7. Title block, including space for the notation of revisions
(This space is to be completed with each revision to the plan sheet and shall clearly note the nature of the revision and the date that the revision was made.)

APPENDIX A PLAT AND PLAN REQUIREMENTS

CHAPTER 2 REQUIREMENTS FOR PLAT DOCUMENTS

(Information and items required to be shown on the face of the document.)

A. PRELIMINARY PLAT

All preliminary plats shall be submitted in a legible format and drawn to a minimum scale of one-inch equals one-hundred feet or larger (1" = 100'). The required copies or prints, as specified on the application shall, at a minimum, show the following information:

1. Names and contact information for the applicant, property owner, land planner, engineer and/or surveyor.
2. Location of subdivision on vicinity map.
3. Scale, north arrow, date and other pertinent data oriented to the bottom or right side of the sheet.
4. Proposed name of the subdivision.
5. Title Block including:
 - a. Total number of units per acre,
 - b. Total number of lots per phase or for the entire development, and
 - c. Number of dwelling units, the acreage, and the gross residential density by housing type.
6. Boundaries and property lines of proposed subdivision, including abstract lines, survey lines and corporate boundaries with bearings and distances sufficient to locate the exact area proposed for the subdivision.
7. Layout of the subdivision within the entire tract of land, including remainder tracts, in accordance with the approved Concept Plan.
8. Proposed phases of development.
9. Location and dimension of any existing structures, fences, paved areas, cemeteries, or other existing features within the proposed subdivision.
10. Location of all existing or abandoned oil or gas wells, oil or gas pipelines and other appurtenances associated with the extraction, storage, production and distribution of natural gas or petroleum products, and all related easements on the site or on immediately adjacent property.
11. Name, zoning, and location of all adjacent properties and property owners, including existing adjoining developments and tracts of land.
12. Existing lot and block numbers and date recorded.
13. Proposed arrangement of individual lots, including dimensioned property lines, lot area, lot and block number, and building lines.
14. Minimum finished floor elevations of building foundations shall be shown for lots.

APPENDIX A PLAT AND PLAN REQUIREMENTS

15. Proposed location, dimensions, area and arrangement of all parcels to be set aside for public or private parks, playgrounds or other common use of property, including area set aside for common use by the home owners association.
16. Existing sewer or water mains, gas mains or other underground structures, easements of record or other existing features within the area proposed for subdivision.
17. A declaration confirmed by engineering analysis (if required by the City Engineer) and prepared by an engineer professionally licensed in the State of Texas, stating that the existing utility main(s) serving a proposed subdivision is adequate.
18. The applicant shall also provide copies of letters from applicable local utility companies stating that the utility company has reviewed the plat and stated any requirements.
19. Location and width of all proposed and existing streets, alleys, rights-of-ways, sidewalks and easements providing access to and within the proposed subdivision.
20. Proposed and existing street names and block numbers.
21. Proposed on-site and off-site dedications of land or rights-of-way for public improvements for each proposed phase of the subdivision.
22. Any proposed supplemental transportation systems, showing the layout and dimensions of walkways, sidewalks, bike trails, and other related improvements.
23. Typical cross-section of proposed street improvements and rights-of-way.
24. Contours at five-foot intervals and except on terrain with less than a two percent grade, in which event, contours at two-foot intervals are required. The source of contour information will be placed on the plat. Contours are to be based on the Texas North Central Zone (4202) State Plane Coordinates (SPC). All easements or rights-of-way necessary for drainage within or without the boundaries of the subdivision shall be reflected upon the preliminary drainage plan.
25. Location and size of all physical features pertinent to drainage:
 - a. Natural topographical and drainage features, such as water courses and water-bodies;
 - b. Floodplains according to Federal Emergency Management Agency (FEMA) information, floodways, and flood hazard areas;
 - c. Army Corps of Engineers flowage easement(s) requirements;
 - d. Drainage area in acres or area draining into the proposed subdivision; and
 - e. Outline of major wooded areas, stands of trees, or the location of significant individual trees.
26. Locations proposed for drainage discharge from the site shall be shown by directional arrows.
27. Notes on the Face of the Plat:
 - a. Special Notice (Required): Selling a portion of this addition by metes and bounds is a violation of city ordinance and state law and is subject to fines and withholding of utilities and building permits.

APPENDIX A PLAT AND PLAN REQUIREMENTS

b. Access easements (to be used if applicable):

The undersigned does covenant and agree that the access easement may be utilized by any person or the general public for ingress and egress to other real property, and for the purpose of general public vehicular and pedestrian use and access, and for fire department and emergency use in, along, upon and across said premises, with the right and privilege at all times of the City of Lake Worth, its agents, employees, workmen and representatives having ingress, egress, and regress in, along, upon and across said premises.

c. Drainage Easement Restriction (to be used if applicable):

No construction or filling, without the written approval of the City of Lake Worth shall be allowed within a drainage easement. Then only after detailed engineering plans and studies show that no flooding will result; that no obstruction to the natural flow of water will result; and subject to all property owners of the property affected by such construction becoming a part of the request may any construction take place. Where construction is permitted, all finished floor elevations shall be a minimum of two (2) feet above the ultimate 100-year flood elevations based on land use.

d. Drainage and Detention Easement (Above Ground Detention)

This plat is hereby adopted by the Owners and approved by the City of Lake Worth (Called "City") subject to the following conditions which shall be binding upon the Owners, their heirs, grantees, successors and assigns: The area or areas shown on the plat as "Drainage and Detention Easement" shall remain accessible at all times and shall be maintained by Owners of the lot or lots that are traversed by, or adjacent to the Drainage and Detention Easement. The City will not be responsible for the maintenance and operation of the drainage facilities within the Drainage and Detentions Easement or for any damage to private property or person that results from conditions within the Drainage and Detention Easement. No obstruction to the natural flow of storm water run-off shall be permitted by construction of any within the Drainage and Detention Easement, unless approved by the City Manager and/or designee. Each property owner shall keep the portion Drainage and Detention Easement traversing or adjacent to their property clean and free of debris, silt, and any materials which would result in unsanitary conditions or obstruct the flow of water. The City shall have the right of ingress and egress for the purpose of inspection and supervision of maintenance work by the property owner. The City shall not be held liable for any damages of any nature resulting from failure of facilities within the Drainage and Detention Easement. The City shall have the right to enter upon the Drainage and Detention Easement at any point, or points, to investigate, survey, construct and maintain any drainage facility deemed necessary for drainage purposes. The minimum finished floor elevation for each lot shall be as shown on the plat.

e. Drainage and Detention Easement (Underground Detention)

This plat is hereby adopted by the Owners and approved by the City of Lake Worth (Called "City") subject to the following conditions which shall be binding upon the Owners, their heirs, grantees, successors and assigns:

APPENDIX A PLAT AND PLAN REQUIREMENTS

the area or areas shown on the plat is called "Drainage and Detention Easement shall remain accessible at all times and shall be maintained by the Owners of the lot or lots that are traversed by, or adjacent to the Drainage and Detention Easement. The City will not be responsible for the maintenance and operation of the drainage facilities within the Drainage and Detention Easement or for any damage to private property or person that results from conditions within the Drainage and Detention Easement. No obstruction to the natural flow of storm water run-off shall be permitted by construction of any type within the Drainage and Detention Easement, unless approved by the City Manager and/or designee. Each property owner shall keep the Drainage and Detention Easement traversing or adjacent to their property clean and free of debris, silt, and any materials that would result in unsanitary conditions or obstruct the flow of water, The City shall have the right of ingress and egress for the purpose of inspection and supervision of maintenance work by the property owner. The City shall not be held liable for any damages of any nature resulting from the failure of facilities within the Drainage and Detention Easement. The City shall have the right to enter upon the Drainage and Detention Easement at any point, or points, to investigate, survey or construct and maintain any drainage facility deemed necessary for drainage purposes.

f. Fire lanes (to be used if applicable):

That the undersigned does hereby covenant and agree that he (they) shall construct upon the fire lane easements, as dedicated and shown hereon, a hard surface in accordance with the City of Lake Worth paving standards for fire lanes, and that he (they) shall maintain the same in a state of good repair at all times and keep the same free and clear of any structures, fences, trees, shrubs, or other improvements or obstruction, including but not limited to the parking of motor vehicles, trailers, boats or other impediments to the accessibility of fire apparatus. The maintenance of paving on the fire lane easements is the responsibility of the owner, and the owner shall post and maintain appropriate signs in conspicuous places along such fire lanes, stating "Fire Lane, No Parking." The local law enforcement agency(s) is hereby authorized to enforce parking regulations within the fire lanes, and to cause such fire lanes and utility easements to be maintained free and unobstructed at all times for the Fire Department and emergency use.

g. Floodway Easement (to be used if applicable):

No construction or filling, without the written approval of the City of Lake Worth shall be allowed within a floodway easement. Then only after detailed engineering plans and studies show that no flooding will result; that no obstruction to the natural flow of water will result; and subject to all property owners of the property affected by such construction becoming a part of the request may any construction take place. Where construction is permitted, all finished floor elevations shall be a minimum of two (2) feet above the ultimate 100-year flood elevations based on land use.

h. Public Open Space Easement (POSE)/Visibility Triangle:

No structure, object, or plant of any type may obstruct vision from a height of 30 inches to a height of ten (10) feet above the top of curb, including, but not limited to buildings, fences, walks, signs, trees, shrubs, cars, trucks, etc., in the public open space easement as shown on the plat.

APPENDIX A PLAT AND PLAN REQUIREMENTS

i. Utility easements (to be used if applicable):

Any public utility, including the City of Lake Worth, shall have the right to move and keep moved all or part of any building, fences, trees, shrubs, other growths or improvements which in any way endanger or interfere with the construction, maintenance, or efficiency of its respective systems on any of the easements shown on the plat; and any public utility, including the City of Lake Worth, shall have the right at all times of ingress and egress to and from and upon said easements for the purpose of construction, reconstruction, inspection, patrolling, maintaining and adding to or removing all or part of its respective systems without the necessity at any time of procuring the permission of anyone.

28. The following shall be included on the plat. Examples are provided herein:

- a. Owner's Dedication. An executed and notarized statement that the applicant legally owns the area as described in the legal description.
- b. Legal Description. An accurate legal description, such as by metes and bounds, by bearings and distances (including necessary curve and line data), accurate to the nearest one-hundredth of a foot, for all boundary, block and lot lines, with descriptions correlated to a permanent survey monument.
- c. Surveyor's Certificate: A statement, signed and sealed, certifying the plat was prepared by a Registered Professional Land Surveyor (RPLS) in the State of Texas.

29. Plat approval:

Approval date and signatures of the Chair of the Commission and the Mayor of the City of Lake Worth, attested by the City Secretary signifying approval of the plat.

APPENDIX A PLAT AND PLAN REQUIREMENTS

B. FINAL PLAT

The final plat shall include only that portion of the approved preliminary plat which the subdivider proposes to record and then develop, provided, however, that such portion conforms to all the requirements of these criteria and specifications.

All final plats shall be submitted in a legible format and drawn to a minimum scale of one inch equals one hundred feet or larger (1" =100'). The required copies or prints, as specified on the application shall, at a minimum, show the following information:

1. All information that is required for a preliminary plat shall be shown on the final plat, except physical features, such as topography, buildings, utility structures, water bodies and tree cover.
2. The final plat shall contain a title block in the lower right corner of the page. The words "Final Plat", the name of the addition or subdivision, the name of the owners, their address and telephone number, and the address and legal description of the project shall be shown in the title block.
3. Provide a place for the County Clerk of Tarrant County to stamp the date and location where the plat will be filed in the lower right-hand corner of all sheets of the plat drawing near the title block:
4. Instrument No. _____, Date _____ in the lower right-hand corner of all sheets of the plat drawing near the title block.
5. The final plat shall provide the name of the engineer/surveyor, date of preparation and date of revisions. The plat shall be signed and sealed.
6. All aspects of the final plat shall conform to the standards of Tarrant County for plats with respect to clarity, sheet size, lettering size and reproducibility, and the county's formatting requirements for same shall control if different from this ordinance. It is the applicant's responsibility to be familiar with the county's standards for filing plats and to comply with same.
7. The exterior boundary of the subdivision shall be indicated by a distinct bold solid line and corner markers by individual symbols.
8. Special Notes regarding Flood Plain Restrictions:
 - a. If a flood plain easement is required or proposed, the following full statement of restriction shall be placed in the dedication instrument on the subdivision plat.

FLOOD PLAIN RESTRICTION

No construction shall be allowed within the flood plain easement, without the prior written approval of the City. In order to secure approval, detailed engineering plans and/or studies for the improvements, satisfactory to the City, shall be prepared and submitted by the party or parties wishing to construct within the flood plain. Where construction is permitted, all finished floor elevations shall be a minimum of two (2) feet above the 100-year ultimate flood plain. Any construction approved within the flood plain shall not increase the 100-year design frequency storm elevation.

APPENDIX A PLAT AND PLAN REQUIREMENTS

- b. The following statement shall be required when an unlined improved drainage channel, in a drainage easement, or when a floodplain easement is proposed.

FLOODPLAIN/DRAINAGEWAY MAINTENANCE

The existing creeks, streams, or ponds (drainage ways) traversing along or across portions of this addition, will remain unobstructed at all times and will be maintained by the individual lot owners, homeowner's association or approved maintenance entity whose lots are traversed by or adjacent to the drainage ways. The City of Lake Worth will not be responsible for the maintenance, erosion control, and/or operation of said drainage ways. Property owners shall keep the adjacent drainage ways traversing their property clean and free of debris, silt or other substances which would result in unsanitary conditions, and the City shall have the right of entry for the purpose of inspecting the maintenance work performed by the property owners. The drainage ways are occasionally subject to storm water overflow and/or bank erosion that cannot be defined. The City of Lake Worth shall not be liable for any damages resulting from the occurrence of these phenomena, nor the failure of any structure(s) within the drainage ways. The drainage way crossing each lot is contained within the flood plain easement lines as shown on the plat.

- c. If a floodway easement is required or proposed, the following full statement of restriction shall be placed in the dedication instrument of the subdivision plat.

FLOODWAY RESTRICTION

No encroachment, including fill, new construction or improvements shall be allowed within the floodway easement.

- 9. The following shall be included on the plat. Examples are provided herein:
 - a. Owner's Dedication. An executed and notarized statement that the applicant legally owns the area as described in the legal description.
 - b. Legal Description - An accurate legal description, such as by metes and bounds, by bearings and distances (including necessary curve and line data), accurate to the nearest one-hundredth of a foot, for all boundary, block and lot lines, with descriptions correlated to a permanent survey monument.
 - c. Surveyor's Certificate: A statement, signed and sealed, certifying the plat was prepared by a Registered Professional Land Surveyor (RPLS) licensed in the State of Texas.
- 10. Plat approval: Date of approval and signatures of the Chair of the Commission and the Mayor of the City of Lake Worth, attested by the City Secretary signifying approval of the plat.

APPENDIX A PLAT AND PLAN REQUIREMENTS

C. MINOR PLAT

All minor plats shall be submitted on sheets no larger than eighteen inches by twenty-four inches (18" x 24") and to a scale of not less than one hundred feet to the inch (1" = 100') or larger. Where more than one sheet is required to encompass the subdivision, eighteen inches by twenty-four inches (18" x 24") shall be filed showing the entire subdivision together with the complete dedication, attests, dates, titles and seals, on one (1) sheet.

The face of the minor plat shall include all the requirements for a final plat.

D. REPLAT

All replats shall be submitted on sheets no larger than eighteen inches by twenty-four inches (18" x 24") and to a scale of not less than one hundred feet to the inch (1" = 100') or larger. Where more than one sheet is required to encompass the subdivision, eighteen inches by twenty-four inches (18"x24") shall be filed showing the entire subdivision together with the complete dedication, attests, dates, titles and seals, on one (1) sheet.

The face of the replat shall include all the requirements for a final plat, and the items below:

Any replat which adds or deletes lots must include the original subdivision boundaries.

The title on the face of the plat shall identify the document as

Lot No(s). _____, being a replat of Lots _____ of Block _____
of the _____ Subdivision.

E. AMENDING PLAT

All amending plats shall be submitted on sheets no larger than eighteen inches by twenty-four inches (18" x 24") and to a scale of not less than one hundred feet to the inch (1" = 100') or larger. Where more than one sheet is required to encompass the subdivision, eighteen inches by twenty-four inches (18" x 24") shall be filed showing the entire subdivision together with the complete dedication, attests, dates, titles and seals, on one (1) sheet.

The face of the amending shall include all the requirements for a final plat.

F. VACATION PLAT

All vacating plats shall be submitted on sheets no larger than eighteen inches by twenty-four inches (18" x 24") and to a scale of not less than one hundred feet to the inch (1" = 100') or larger. Where more than one sheet is required to encompass the subdivision, eighteen inches by twenty-four inches (18" x 24") shall be filed showing the entire subdivision together with the complete dedication, attests, dates, titles and seals, on one (1) sheet.

The face of the vacating plat shall include all the requirements for a final plat.

APPENDIX B

To Chapter 10,
Subdivision Regulations

**DESIGN CRITERIA
AND
CONSTRUCTION STANDARDS
(DCCS)**

APPENDIX B

DESIGN CRITERIA AND CONSTRUCTION STANDARDS

APPENDIX B DESIGN CRITERIA AND CONSTRUCTION STANDARDS

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APPENDIX B DCCS

CHAPTER 1 GENERAL TERMS AND CONDITIONS

A. Purpose

The following Design Criteria and Construction Standards are intended to provide the minimum specifications for design of development with the City and will primarily be used by the design engineer. There may be special circumstances which dictate requirements in excess of those outlined. In most cases, these exceptions will be requested by City staff during the review process and will also be apparent to the design engineer while preparing the Construction Plans and Specifications for the subdivision.

B. Compliance Required

No final plat shall be approved by the City Council, and no completed improvements shall be accepted by the City or its representatives, unless and until such improvements conform to the Lake Worth Design Criteria and Construction Standards, and all other applicable standards, as prescribed by the City of Lake Worth. All improvements, including, but not limited to streets, alleys, sidewalks, parking lots, drainage ways, water and sewer lines and improvements shall be designed, placed and constructed in accordance with the Design Criteria and Construction Standards herein.

Design and construction of all public improvements shall conform to the following:

1. City of Lake Worth Subdivision Regulations as specified in Chapter 10, Subdivision of the Lake Wroth Code of Ordinances,
2. City of Lake Worth Zoning Regulations as specified in Chapter 14, Zoning of the Lake Worth Code of Ordinances, and
3. North Central Texas Council of Government Standard Specification for Public Works Construction.

The latest version of "Standard Specifications for Public Works Construction, North Central Texas" of the North Central Texas Council of Governments (NCTCOG), with all amendments thereto, shall govern and shall constitute the technical specifications for all improvements to be dedicated to the City of Lake Worth except as amended by the Lake Worth Design Criteria and Construction Standards and is made a part thereof, but is not physically bound within this document.

4. Any and all applicable, as may be amended, Federal law and US Federal regulatory agencies, including, but not limited to Federal Emergency Management Agency (FEMA) and United States Army Core of Engineers (USACE).

C. Construction by Developer

1. The improvements, whether on-site or off-site, including streets, water lines, sanitary sewer lines, drainage, sidewalks, traffic signals (if warranted by a developer funded traffic engineering study), street lighting (by arrangement by the developer with the electric company), street signs (by payment to the City for installation cost), and all other required improvements for the subdivision, shall be installed by the developer at no cost to the City, unless otherwise provided herein, and
2. Shall be in accordance with the subdivision regulations and all specifications and regulations of the City, and the engineering plans as approved by the City Manager or designee or his agent.
3. The developer shall submit three (3) sets of final-approved engineering plans prior to construction.

D. Construction Contractor

1. The developer shall employ a construction contractor that meets the following:
 - a. City and statutory requirements for being bonded and insured;
 - b. Acceptable prior work experience approved by the City Manager or designee,
 - c. Has financial resources which would enable the contractor to be capable of performing the work; and
 - d. Is qualified in all respects to bid on public projects and do work on public streets.
2. The developer shall notify the City Manager or designee of the contractor selected and provide a copy of the signed contract bid, along with all supporting documents.
3. The improvements shall be installed within all applicable time frames agreed to by the City.

E. Civil Engineer

The developer shall employ a civil engineer licensed to practice in the State of Texas for the design and preparation of the plans and specifications (hereinafter referred to as the "engineering plans") for the construction of the improvements. The engineering plans shall include any engineering studies, plan/profile sheets, and other construction documents for the improvements.

F. Preconstruction Conference

Construction of the improvements shall not be initiated until a pre-construction conference has been conducted regarding the proposed construction. Further, the developer will give a minimum of 48 hours written notice to the City Manager or designee, indicating the time and date that construction will commence.

G. Inspection by the City

1. The developer shall not backfill or cover any sanitary sewer, storm drain, or water pipes unless a City inspector is present and gives his consent to proceed.
2. Further, no service lines of water or sewer mains shall be connected to any building until the water and sewer mains have been completed, inspected, and accepted by the City.
3. The developer will reimburse the City for overtime worked by City personnel in performing project inspection.

H. Review by City Manager or designee

Construction of all public improvements shall be subject to routine review by the City Manager or designee to evaluate conformance with the engineering plans, project specifications, and City standards. However, such review and evaluation shall not relieve the developer, its engineer, and/or agent of responsibility for the design, construction, and maintenance of the improvements. Refer to definition of City Engineer in Article 10.200, Definitions.

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I. Final Walk Through

A final walk through is required. A punch list will be prepared by the City and all items shall be addressed prior to final acceptance. A final walk through will not be scheduled until the City performs an initial review of the site/development/improvements to ensure that the majority of the items are complete.

J. As-Built Plans or Record Drawings

Upon completion of construction of the improvements that are required by this contract and the subdivision regulations, the developer shall deliver to the City the following items of as-built construction plans for the improvements constructed or engineered by the developer.

1. One (1) set of as-built plans;
2. One (1) electronic version of all sheets in plans, and
3. One (1) set of as-built reproducible plans.

K. Construction Bonds

Prior to initiating any construction of the improvements, the developer's contractors shall provide the City with one (1) original and one (1) quality copy of a construction and maintenance guarantees in accordance with Article 10.400 of Chapter 10, Subdivision Regulations and shall name the City (or developer as noted) as beneficiary.

L. Where specific topographic or other conditions make variance from these standards necessary in order to achieve the best overall design, these standards may be modified by the City Manager, upon recommendation from the Director of Public Works and/or City Manager or designee.

M. Where the appropriate use of the neighboring property will not be substantially injured, the City Manager, after consultation with the City Manager or designee, may in specific cases, and subject to appropriate conditions and safeguards, authorize waivers to the specifications herein in order to permit reasonable development and improvement of property where literal enforcement of these values would result in an unnecessary hardship. Waivers require approval by the City Council. More information is provided in Chapter 3 of the Subdivision Regulations.

N. Interruption of Services.

1. The developer and/or a representative of the developer shall provide a minimum of 72-hour notice to the City with required plans and/or documentation prior to interruption of service, such as utilities and road closure. The City may, at its discretion, require a meeting prior to disruption of services.
2. In the event that existing utility service is to be interrupted during construction, official notice as well as meeting with the City and all other applicable parties shall be held 72 hours prior to interruption.

CHAPTER 2 REQUIREMENTS FOR PLAN DOCUMENTS

A. Plan Set Order

A civil construction plan submittal shall meet the following general sheet requirements and order.

1. Cover Sheet with Vicinity Map
2. General Notes
3. Final Plat
4. Site Layout
5. Dimensional Control Plan
6. Paving Plan and Profile
7. Grading Plan
8. Drainage Area Map
9. Storm Sewer Layout
10. Storm Sewer Plan and Profile
11. Channel and/or Culvert Plan and Profile
12. Retaining Wall
13. Water Layout
14. Water Plan and Profile
15. Sanitary Sewer Layout
16. Sanitary Sewer Plan and Profile
17. Storm Water Pollution Prevention Plan (Erosion Control Plan)
18. Traffic Control Plan and Details (including pavement markings and signage)
19. Standard Construction Details (Appendix B-6)

B. Sheet Size

1. The Construction Plans shall be submitted on standard 22" x 34" sheets or on a size as specified by City Manager or designee.
2. Half-size plans may be required for inspection(s) or as specified by City Manager or designee.

C. Sheet Layout

Each sheet of the Construction Plans shall include the following:

1. Date
2. North arrow
3. Scale (Scale shall be 1 inch equal 20, 40 or 50 feet horizontally and 1 inch equal 2, 4, or 5, feet vertically.)
4. Benchmark description to sea level datum
5. Seal and signature of the Licensed Professional Engineer in the State of Texas who prepared the plans
6. Title block, including space for the notation of revisions
(This space is to be completed with each revision to the plan sheet and shall clearly note the nature of the revision and the date that the revision was made.)

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CHAPTER 3 DESIGN STANDARDS – SITE DEVELOPMENT

City policy regarding the minimum design for subdivisions and the construction requirements for public infrastructure installed with development is specified herein, Article 10.400, Site Development Procedures – Public Improvements, of Chapter 14, Subdivision Regulations, of the City Code of Ordinances, and North Central Texas Council of Government Standard Specification for Public Works Construction, as amended.

SECTION 3.1 SITE GRADING

The building pad and foundation elevation shall be graded to the most recent City adopted Building Code Standards and conform with applicable restrictions in the floodplain.

SECTION 3.2 MONUMENT MARKERS

A. Permanent Survey Markers

All boundary corners, block corners, etc., as established in the process of creating a subdivision plat shall comply with the Texas Board of Professional Land Surveying Practices Act and General Rules of Procedures and Practices, (663.17 Monumentation).

B. SPC Coordinates

A minimum of two (2) monuments at prominent locations (block corners, boundary corners, etc.) within a subdivision shall have Texas North Central Zone (4202) State Plane Coordinates (SPC) in U.S. Survey Feet noted on the subdivision plat. The Texas North Central Zone (4202) State Plane Coordinate (SPC) shown on the subdivision plat shall have the appropriate metadata listed.

C. Elevation Data

A minimum of two (2) monuments at prominent locations (block corners, boundary corners, etc.) within a subdivision of which require minimum finished floor elevations on all or part of the lots shall have the mean sea level elevations noted on the subdivision plat. The mean sea level elevations shown on the subdivision plat shall have the appropriate metadata listed.

D. Lot Markers

1. Lot markers shall be iron pins not less than one-half inch (1/2") in diameter and no less than 18 inches long and shall be set flush with the ground at each lot corner.
2. All lot corners shall be set prior to the acceptance of public improvements and shall be marked in a way that is traceable to the responsible registrant or associated employer.

SECTION 3.3 EASEMENTS

A. Utility Easements

1. Where not adjacent to a public right-of-way, easements at least 15 feet wide for utility construction, service, and maintenance shall be provided where necessary in locations approved by the City Council.
2. Easements at least 15 feet wide for utility construction, service, and maintenance shall be provided for lots, which have frontage along state highways.
3. Easements of at least ten (10) feet in width shall be provided on each side and rear lot lines, where necessary, for utilities such as electric, telephone, and gas.
4. Easements having greater width dimensions may also be required along or across lots where engineering design or special conditions make it necessary for the installation of utilities outside public rights-of-way.
5. The following statement of restrictions shall be placed in the dedication instrument:

Utility Easement Restriction

Any public utility, including the City of Lake Worth, shall have the right to move and keep moved all or part of any building, fence, tree, shrub, or growths or improvements which in any way endanger or interfere with the construction, maintenance, or efficiency of its respective systems on any of the easements shown on the plat; and any public utility, including the City of Lake Worth, shall have the right at all times of ingress and egress to and from and upon said easements for the purpose of construction, reconstruction, inspection, patrolling, maintaining, and adding to or removing all or part of its respective systems without the necessity at any time of procuring the permission of anyone.

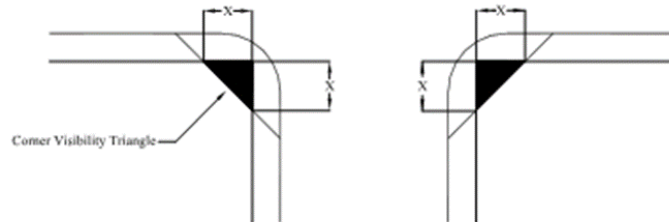
B. Fire Lane Easement

1. Emergency access and fire lane easements shall be provided in locations required by the Chief of the Lake Worth Fire Department.
2. These easements shall have a minimum width of 24 feet and a minimum height clearance of 15 feet.
3. Any emergency access and fire lane easement more than 100 feet in length shall either connect at each end to a dedicated public street or be provided with a cul-de-sac having a minimum diameter of 80 feet with an additional distance of ten (10) feet on all sides clear of permanent structures.
4. These easements shall be constructed in accordance with the criteria and standards herein for concrete street sections as shown in the Construction Details (Appendix B-6) and approved by the City Manager and/or designee.
5. These easements shall be maintained by means of a Homeowner's Association, the property owner granting the easement or other means, as approved by the City.

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C. Public Open Space Easement (POSE)/Sight Visibility

1. The POSE shall be shown on the plat and/or plan as follows:



2. A triangular POSE is required on corner lots at the intersection of two (2) streets in accordance with the following table (in feet):
3. Visibility triangles shall meet American Association of State Highway and Transportation Officials (AASHTO) requirements.
4. The City will review each site layout to review sight distances, clearances, stopping sight distances, and obstructions.

	Alley	Local	Collector	Arterial	Freeway
Alley	25 ft x 25 ft	15 ft x 15 ft	--	--	--
Local	20 ft x 20 ft	20 ft x 20 ft	25 ft x 25 ft	25 ft x 25 ft	--
Collector	--	20 ft x 20 ft	25 ft x 25 ft	25 ft x 25 ft	--
Arterial	--	25 ft x 25 ft	25 ft x 25ft	45 ft x 45 ft	--
Freeway	--	--	--	*	*

-- = Not permitted

* As required by TXDOT

Note: The above table is provided by guidance only.

5. The following full statement of restrictions shall be placed in the dedication instrument or on the face of the plat:

Public Open Space Easement

No structure, object, or plant of any type may obstruct vision from a height of 30 inches to a height of ten (10) feet above the top of the curb, including, but not limited to buildings, fences, walks, signs, trees, shrubs, cars, trucks, etc., in the public open space easement shown on the plat.

D. Drainage and Detention Easements

1. Floodway easements shall be provided along natural drainageways and lakes or reservoirs. Floodway easements shall encompass all areas beneath the water surface elevation of the base flood, plus such additional width as may be required to provide ingress and egress to allow maintenance of the banks and for the protection of adjacent property, as determined and required by the City Manager or designee.
2. The following applicable statement(s) of restriction(s) shall be placed in the dedication instrument of the subdivision plat:

Drainage and Detention Easement (Above Ground Detention)

This plat is hereby adopted by the Owners and approved by the City of Lake Worth (Called "City") subject to the following conditions which shall be binding upon the Owners, their heirs, grantees, successors and assigns: The area or areas shown on the plat as "Drainage and Detention Easement" shall remain accessible at all times and shall be maintained by Owners of the lot or lots that are traversed by, or adjacent to the Drainage and Detention Easement. The City will not be responsible for the maintenance and operation of the drainage facilities within the Drainage and Detentions Easement or for any damage to private property or person that results from conditions within the Drainage and Detention Easement. No obstruction to the natural flow of storm water run-off shall be permitted by construction of any within the Drainage and Detention Easement, unless approved by the City Manager and/or designee. Each property owner shall keep the portion Drainage and Detention Easement traversing or adjacent to their property clean and free of debris, silt, and any materials which would result in unsanitary conditions or obstruct the flow of water. The City shall have the right of ingress and egress for the purpose of inspection and supervision of maintenance work by the property owner. The City shall not be held liable for any damages of any nature resulting from failure of facilities within the Drainage and Detention Easement. The City shall have the right to enter upon the Drainage and Detention Easement at any point, or points, to investigate, survey, construct and maintain any drainage facility deemed necessary for drainage purposes. The minimum finished floor elevation for each lot shall be as shown on the plat.

Drainage and Detention Easement (Underground Detention)

This plat is hereby adopted by the Owners and approved by the City of Lake Worth (Called "City") subject to the following conditions which shall be binding upon the Owners, their heirs, grantees, successors and assigns:

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The area or areas shown on the plat is called "Drainage and Detention Easement shall remain accessible at all times and shall be maintained by the Owners of the lot or lots that are traversed by, or adjacent to the Drainage and Detention Easement. The City will not be responsible for the maintenance and operation of the drainage facilities within the Drainage and Detention Easement or for any damage to private property or person that results from conditions within the Drainage and Detention Easement. No obstruction to the natural flow of storm water run-off shall be permitted by construction of any type within the Drainage and Detention Easement, unless approved by the City Manager and/or designee. Each property owner shall keep the Drainage and Detention Easement traversing or adjacent to their property clean and free of debris, silt, and any materials that would result in unsanitary conditions or obstruct the flow of water, The City shall have the right of ingress and egress for the purpose of inspection and supervision of maintenance work by the property owner. The City shall not be held liable for any damages of any nature resulting from the failure of facilities within the Drainage and Detention Easement. The City shall have the right to enter upon the Drainage and Detention Easement at any point, or points, to investigate, survey or construct and maintain any drainage facility deemed necessary for drainage purposes.

3. Maintenance Required
 - a. Existing creeks, lakes, reservoirs, or drainage channels traversing along or across portions of this addition, will remain as an open channel at all times and will be maintained by the individual owners of the lot or lots that are traversed by or adjacent to the drainage courses along or across said lots.
 - b. The City of Lake Worth will not be responsible for the maintenance and operation of said drainageways or for the control of erosion.
 - c. Each property owner shall keep the natural drainage channels traversing or adjacent to his property clean and free of debris, silt, or any substance which would result in unsanitary conditions and the City shall have the right of ingress and egress for the purpose of inspection and supervision of maintenance work by the property owner to alleviate any undesirable conditions which may occur.
4. The natural drainage channel, as in the case of all-natural drainage channels, are subject to storm water overflow and natural bank erosion to an extent that cannot be definitely defined. The City of Lake Worth shall not be liable for damages of any nature resulting from the occurrence of these natural phenomena, nor resulting from a failure of any structure(s) within the natural drainage channels.

SECTION 3.4 LOTS

The size, shape and orientation of lots shall be appropriate to the type and location of the proposed development.

A. Lot Design

1. Lot design shall provide adequate width, depth, and shape to provide open area, and to be appropriate for the location of the subdivision for the type of development and use contemplated, and in accordance with the Zoning Ordinance.
2. No lot shall have less width at the building line than is required by the Zoning Ordinance.
3. All side lines of lots shall be at approximately right angles to straight street lines and radial to curved street lines except where a variation to this rule will provide a better street and lot layout.

B. Street Frontage Required

1. Every lot shall have frontage on, and access to, a public street in compliance with the Zoning Ordinance. Regulations for access and driveways from lots onto streets is provided herein.
2. Double frontage and reverse frontage lots should be avoided except where essential to provide separation of residential development from traffic arteries or to overcome specific disadvantages of topography and orientation.
3. Where single family or duplex uses abut an existing or proposed Arterial or Collector roadway, the plat or dedication instrument shall provide:
 - a. Lots with property lines along the roadway shall include a statement restricting access to the Arterial or Collector; or
 - b. Lots with frontage on two (2) streets (aka reverse frontage) providing screening along the Arterial or Collector, and including a statement restricting access to the Arterial or Collector), or
 - c. Lots with screened rear alleys, or
 - d. Other treatment as may be necessary or required for adequate protection of adjoining properties, and as approved by the City Council after taking into consideration the proposed method of off-street parking and maneuvering which will restrict access to the Arterial or Collector.

C. Large Lots

1. Where the area is divided into larger lots than for required by the applicable zoning district and, in the opinion of the City, any or all of the tracts may be re-subdivided, the original subdivision shall be laid out such that the alignment of future street dedications may conform to the general street layout in the surrounding area and the Master Thoroughfare Plan map.
2. Larger lots shall be configured such that future subdivision conforms with the requirements of this ordinance and the minimum standards specified by the Zoning Ordinance.

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SECTION 3.5 BUILDING LINES

- A. The shorter dimension across a residential lot, adjacent to a street, shall designate the front yard orientation of the lot, unless otherwise specified on the face of the plat.
- B. Building lines for each lot shall be shown on the final plat and shall be consistent with the Zoning Ordinance.
- C. If a variance was granted, the date and case number of the variance shall also be listed on the face of the plat.

SECTION 3.6 BLOCKS

A. Block Width

The width of a block shall be considered to be the distance from property corner to property corner measured along the property line of the block face between intersecting streets, and shall be the side with one of the following criteria:

- 1. The block face with the least dimension, or
- 2. The block face with the fewest number of lots.

B. Block Length

- 1. The length of a block shall be considered to be the distance from property corner to property corner measured along the property line of the block face:
 - a. The block face with the greatest dimension, or
 - b. The block face with the greatest number of lots.
- 2. Where an existing plat or connection to existing streets controls, the block lengths shall not exceed 1,600 feet in length.
- 3. Where no existing plat or subdivision layout controls, the blocks shall a minimum of 500 feet and a maximum of 1,600 feet in length.
- 4. In cases where physical barriers or property ownership creates conditions where it is appropriate that these standards be varied, the length may be increased or decreased to meet the existing conditions having due regard for connecting streets, circulation of traffic and public safety as determined by the City Manager and/or designee(s).

C. Block Configuration

The length, width and shapes of blocks shall be determined with due regard to:

- 1. Provision of adequate building sites suitable to the type of use;
- 2. Zoning requirements for minimum lot size and dimensions;
- 3. Provision of adequate access and circulation;
- 4. Control and safety of street traffic; and
- 5. Limitations and/or opportunities of topography.

SECTION 3.7 ACCESS

Provide vehicular and pedestrian access as follows:

A. Pedestrian Access.

1. When new development or redevelopment occurs on a platted lot within $\frac{1}{4}$ mile of a school, park or shopping center, the City Council may require a public walkway to be constructed to provide pedestrian access to the development.
2. Location. The access may be provided:
 - a. In the middle of the proposed subdivision block, or
 - b. Opposite a street that terminates between the streets at the ends of the block.
3. If required, the concrete walkway shall not be less than five (5) feet nor more than ten (10) feet in width, through the block from sidewalk to sidewalk, or curb to curb, or if no street, to the property line adjacent to school, park, or shopping center and shall meet barrier free requirements in accordance with ADA and Texas Accessibility Standards.

B. Vehicular Access to Subdivisions

1. Vehicular access to subdivisions shall be by means of a public street constructed to standards and specifications herein.
2. One- and Two-Family Subdivisions:
 - a. Subdivisions containing more than 30 one- or two-family dwelling units shall have a platted and constructed secondary ingress and egress to a public street.
 - b. Subdivisions with more than 30 but less than 40 one- or two-family dwelling units may be permitted with one (1) access point if a platted and constructed secondary entrance will connect to future development.
3. Multi-family developments of 100 dwelling units or more shall have a platted and constructed secondary ingress and egress to a public street.
4. Phased construction of any type of subdivision, including residential units, shall provide all residential units with a platted and constructed secondary entrance when more than 30 residential units are proposed in a single phase.

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SECTION 3.8 ACCESS MANAGEMENT

Joint- and cross-access easements/agreements promote connections between existing and new development and manage traffic flow between businesses along a corridor. The intent of the joint- and cross-access provisions is to limit access connections to arterials and collectors and to help meet the spacing guidelines between driveways in accordance with the TXDOT standards and the specifications herein.

- A. Joint and cross access shall be determined during the platting and/or permit process. The design of the joint access facilities must be agreed to by all the interested parties and all property owners involved and approved by the City Manager or designee.
- B. Types of Development
 - 1. Shared access does not apply to single-family residential development.
 - 2. Adjoining commercial or office properties and major traffic generators, e.g. shopping plazas, must provide a cross-access drive and accessible pedestrian connection (not necessarily in the same place) to allow circulation between adjoining properties. These connections must be accompanied by supporting public access easements.
 - 3. Public access easements and associated connections must be in place prior to issuance of a building permit for planned development and/or mixed-use development.
- C. Requirements
 - 1. Adjoining parcels with driveways that can reasonably be shared (as determined by the City Manager or designee) must share access points.
 - 2. The easement shall extend to the edges of the property lines of the development site under consideration.
 - 3. If the easement is required, the physical connection must be built to said property lines. It must be visually obvious that abutting properties may tie in to the easement and connection in the future. Abutting properties must be required to continue the public access easement and connection as they develop or redevelop in accordance with the requirements of this policy.
 - 4. The easement and connection may be provided to the front, side, or rear of the site or across the site where it connects to a public roadway.
 - 5. If the public access easement is intended to function as a City street and not a driveway, it must be constructed to adopted street standards.
- D. Filing Required
 - 1. Property owners must record all necessary easements and agreements, including:
 - 2. Any easement allowing joint-access serving more than one (1) property,
 - 3. Any easement allowing cross-access to and from the adjacent properties,

4. Any agreement to close driveways provided for access in the interim after construction of the joint access driveway(s) or public access easements system, and
5. Any joint maintenance agreement defining maintenance responsibilities of property owners that share the joint-access driveway and cross-access system. The property owner must also agree to close any pre-existing curb cuts after the construction of both sides of a joint-access driveway.

E. Waiver of Requirement

Joint- and cross-access requirements may be waived when, in the judgement City Manager or designee, such a waiver is warranted based on the following:

1. Incompatible land uses,
2. Significant physical constraints, such as topography, and
3. Other unique site condition and/or determinant, as specified by City Manager.

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SECTION 3.9 DRIVEWAYS

A. Process and Applicability

1. Driveways shall be determined during the platting, site plan, and/or permit process.
2. Any driveway proposed to connect to TxDOT facilities must be permitted through TxDOT and a copy of the signed permit will be required prior to approval of construction plans and issuance of a building permit.

B. Number and Location

The number of driveways allowed per lot is limited according to functional street classification and the traffic volume generated by the development proposal. The number and location of driveways shall be located in accordance to the type of development and the street classification as specified on the Master Thoroughfare Plan map:

1. Residential Development

a. Local Street

One driveway is permitted per residential use/lot from local streets. Two driveways may be permitted if the lot width is greater than the minimum as specified for the zoning district and with approval by City Manager and/or designee.

b. Collector Street

Residential driveway access to Collector Streets will only be allowed when design conditions do not permit any other possibility as determined by the City Manager or designee.

c. Arterial and TXDOT Facilities

No new residential driveways may access Arterials or Freeways as identified on the Master Thoroughfare Plan map.

2. Non-residential Development

a. TXDOT Facilities

- i. All driveways and access proposed to connect to a TXDOT facility shall conform to the current TXDOT Access Management Manual, TXDOT Roadway Design Manual and the adopted City Design Criteria and Construction Standards.

- ii. Any driveway proposed to connect to TxDOT facilities must be permitted through TxDOT and a copy of the signed permit will be required prior to issuance of a building permit.

b. Arterials

Driveways off of arterial streets shall be located at an existing or proposed median opening. Median openings shall be planned such that driveways on opposite sides of an arterial street are served by the same median opening.

c. Collectors and Local Streets

If medians are proposed on collector, local or private streets, the separation between the driveway at the median opening and the next driveway shall be located to discourage drivers from attempting a wrong- direction entry or exit.

3. Additional driveways shall only be permitted in accordance to the following:

- a. An approved traffic impact analysis (TIA), and/or
- b. As a recommendation of a trip generation report.

4. Where a site is served by two (2) streets (corner lot), access shall be from the lesser of the two (2) streets, with the following permissible exceptions:

a. Infill development/redevelopment

A lot may be permitted to access the higher classified roadway if the lesser classified street serves exclusively as an entry point into an existing single-family subdivision. This provision is made to acknowledge existing travel patterns.

b. New development

Where connectivity to neighborhood services is important, consideration shall be given to design such that neighborhood uses access the lesser classified street.

C. Design of Driveways and Approaches

1. General Design

- a. The driveway shall begin at the street curb and extend to the right-of-way line or to a point ten (10) feet from the face of curb, whichever is greater.
- b. The angle of the driveway approach with the curb line shall be 90 degrees.
- c. Driveways shall be kept at a minimum of five (5) feet away from obstructions such as street light poles, fire hydrants, traffic signal poles, etc.

2. Width

- a. Residential driveway approaches shall not be less than 11 feet in width, nor more than 18 feet wide measured at the property line.
- b. Commercial and industrial driveway approaches shall not be less than 24 feet in width, nor more than 35 feet wide measured at the property line.

3. Parking

- a. Residential driveways shall provide a minimum of 18 feet between the property line and any garage door, gate, or other obstruction to provide for safe parking or stack space out of the public right-of-way and completely on the property.

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- b. Nonresidential driveway approaches shall not be constructed or designed for parking of vehicles or for use as angle parking and shall be located entirely within the frontage of the premises they serve except for driveways serving joint and/or cross access.
 - 4. Construction Standards
 - a. The driveway shall be 6-inch thick, Class A (per NCTCOG) concrete, reinforced with #3 steel bars on 18-inch centers each way.
 - b. The drive approach at the right-of-way line, with a normal ten (10) foot parkway, shall be 0.2 feet higher than the top of curb as per the City Standard Details. The elevation at this location may be lower provided that barrier free ramps are provided to bring the sidewalk down to the driveway grade.
 - c. Driveways shall be graded at a 2% maximum longitudinal slope in areas where sidewalks cross, so that the sidewalk crossing is at a 2% maximum cross slope.
 - d. Radius
 - i. Residential driveways shall be constructed with return curbs having a rolled face disappearing at the sidewalk and joining the street curb with a minimum 5-foot radius and a maximum 10-foot radius.
 - ii. Commercial and industrial driveways shall have a minimum 25-foot radius and a maximum 30-foot radius.
- D. Connection Spacing
 - 1. Measurement
 - a. Driveway connection spacing shall be defined as the distance between connections or between driveways and roadways.
 - b. Spacing is measured from the closest edge of pavement of the first connection to the closest edge of pavement of the second connection along the edge of the traveled roadway.
 - 2. Spacing shall conform to the most current TXDOT Manual Access Management Manual.
 - 3. Deviation from these guidelines will be considered only for cases where not granting the deviation would deny reasonable access to the property.
 - 4. The following table details the minimum connection spacing criteria along Collector and Arterial roadways.

POSTED SPEED (mph)	MINIMUM SPACING (between driveways)
≤ 30	200 feet
35	250 feet
40	305 feet
45	360 feet
≥ 50	425 feet

SECTION 3.10 OFF-STREET PARKING

The following outlines the minimum construction standards for off-street parking:

- A. Parking lots shall be constructed of a minimum of 3,600 pounds per square inch (psi) reinforced concrete with a minimum thickness of six (6) inches or four (4) inches of Type "B" and 2 inches of type "D" HMAAC.
- B. The subgrade thickness and content shall be determined from a geotechnical report sealed by a Licensed Professional Engineer in the State of Texas provided by the Developer.
- C. Standard curb and gutter as shown in Construction Standards shall be placed around all landscaping areas and the external boundary of the parking lot.
- D. All off-street parking areas shall be stripped in accordance with the latest version of the Manual for a Traffic Control Devices (MUTCD) published by the Texas Department of Transportation.
- E. The following minimum dimensions apply for off-street parking:

Parking Angle	Stall Width	Stall Length	Maneuvering Space
90 degrees	9 feet	18 feet	24 feet
60 degrees	9 feet	18 feet	20 feet
45 degrees	9 feet	18 feet	18 feet

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CHAPTER 4 DESIGN STANDARDS – PUBLIC INFRASTRUCTURE

SECTION 4.1. GENERAL REQUIREMENTS FOR PUBLIC INFRASTRUCTURE AND UTILITIES

- A. All public utilities and infrastructure shall be designed and constructed in accordance with the most current adopted City regulations, technical specifications and standard details.
 - 1. Public facilities typically located within the public right-of-way include sidewalks, driveways, street lights, street signs, streets and alleys.
 - 2. Public utilities typically located within the public right-of-way include electric, water, sanitary sewer, storm sewer, telephone and cable services.
- B. All subdivision plats and engineering plans shall provide location and design of public utilities prepared in accordance to franchise requirements and the adopted standards herein.
- C. All distribution lines, cables, etc. for utilities other than those specified below shall be installed below ground within the subdivision.
- D. Additional utility easements may be required beyond the right-of-way based on the design of the subdivision.
- E. Transmission lines or major cables to provide utilities such as electric, telephone, and cable television to the area as a whole may be located above ground on the perimeter of the subdivision being served. The installation of these utilities shall conform to commonly accepted construction standards and be subject to review by the City Manager and/or designee.

SECTION 4.2. SIDEWALKS

A. Purpose

Proposed sidewalks shall provide safe and convenient pedestrian circulation and shall be properly related to the Comprehensive Plan and the Master Thoroughfare Plan.

B. General

1. Sidewalks shall be constructed for all lots adjoining dedicated streets, along major thoroughfares where lots do not adjoin the street, across power line easements, and in other areas where pedestrian walkways are necessary.
2. Every new subdivision, or re-subdivision, shall be required to install sidewalks, with appropriate barrier free ramps, within the public street right-of-way.
 - a. All sidewalks shall conform to the latest ADA and Texas Accessibility Standards (TAS) requirements.
 - b. Barrier free ramps shall be provided for access across streets per the Design Criteria and Construction Standards.
3. Sidewalk construction may be delayed until development of lots but must be constructed for each lot prior to completion of any primary structure. In locations not adjacent to lots and across bridges and culverts, the sidewalk shall be constructed with the other improvements to the subdivision.
4. Required for Certificate of Occupancy

The City may withhold a Certificate of Occupancy for a commercial use and final inspection approval for a residential structure if sidewalks are not properly installed, inspected and accepted by the City Manager and/or designee.
5. Sidewalks shall be constructed in accordance to detail included herein.

At a minimum, sidewalks shall be constructed of Class A (per Item 303 of NCTCOG) concrete reinforced with #3 reinforcing steel at 18-inch centers each way and shall have a width of not less than five (5) feet and a minimum thickness of four (4) inches.

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SECTION 4.3 STREET LIGHTS

A Street Lighting Plan shall be required by the City as a part of the plat application process. Street lights are a combination of poles, fixtures, and systems owned and maintained by the TXDOT, ONCOR Electric and the City.

A. Poles

1. Street light poles shall be installed within the parkway between the back of curb and the sidewalk at the property line.
2. Poles must be approved by the City or by a public electric utility holding a City franchise and by the City Manager and/or designee.
3. Poles shall be contracted and paid for by the developer during the construction phase of the development and before building permits are issued.
4. Poles not purchased through a public electric utility holding a City franchise, shall be certified by a Licensed Professional Engineer in the State of Texas as meeting the specifications as required by a public utility company holding a City franchise, and shall be approved by the City Manager and/or designee prior to purchase.

B. Location

The location of street lights shall be as follows:

1. At all intersections;
2. Where a new street intersects an existing street;
3. In proximity to fire hydrants, whenever possible;
4. Every 300 feet or mid-block, whichever is the shortest distance;
5. If more than one (1) mid-block street light is required, spacing of installed street lights shall create an equal balance of light throughout the entire block length; and/or
6. At the end of the cul-de-sac block if the street is 400 feet or longer.

C. Illumination

Street light illumination levels shall conform to the agreement with ONCOR, and the AASHTO Roadway Lighting Design Guide, as amended. LED lighting is preferred.

SECTION 4.4 STREET NAMES AND SIGNS

A. Street Names

1. New street names shall not duplicate or cause confusion with the names of existing streets.
2. New streets which are an extension of existing streets shall bear the names of existing streets.

- #### B.
- Street name signs shall be City approved. The developer shall furnish and install signs at all intersections within or abutting the subdivision in accordance with the regulations herein.

SECTION 4.5 TRAFFIC CONTROL SIGNS

The following signs are the minimum required to be shown on the Signage Plan and installed within a subdivision, as applicable:

- A. Stop signs,
- B. Street name signs,
- C. Speed limit signs,
- D. Slow children at play signs,
- E. Weight limit 6 tons signs, and
- F. Other as determined by the layout of the development.

SECTION 4.6 GENERAL STREET DESIGN

A. Purpose

Proposed streets shall provide a safe, convenient and functional system for vehicular, bicycle, and pedestrian circulation and shall be properly related to the Master Thoroughfare Plan and Comprehensive Plan and shall be appropriate for the particular traffic characteristics of each proposed subdivision or development.

B. Conform to Master Thoroughfare Plan

Proposed streets shall provide a safe, convenient and functional system for traffic circulation and shall be properly related to the adopted Street Classification design criteria included in the Master Thoroughfare Plan.

1. The arrangement, character, extent and location of all streets shall be considered in their relation to:
 - a. Existing and planned streets or driveways,
 - b. Topographical conditions,
 - c. Drainage constraints,
 - d. Public safety, and
 - e. Existing and planned land use(s).
2. When a street is not shown on the Master Thoroughfare Plan, the arrangement of streets in a subdivision shall:
 - a. Provide for continuation or appropriate projection of existing streets in surrounding areas;
 - b. Conform to a plan for the neighborhood approved or adopted by the City to meet a particular situation where topographical or other conditions make continuance or conformity to existing streets impracticable;
 - c. Provide for future access to adjacent vacant areas which will likely develop under a similar zoning classification;

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- d. Not conflict in any way with existing or proposed driveways and/or access; and
 - e. Allow for the appropriate dedication and/or improvement to meet the minimum street construction and right-of-way standards.
 - 3. Amendment Required

Any land study or subdivision plat involving a change to a proposed alignment shown in the Master Thoroughfare Plan and/or map must be approved through the amendment process outlined in the Plan.
- C. Design Criteria
 - 1. All dedicated public streets shall conform to the design criteria and cross-sections provided in the Master Thoroughfare Plan and in the Standards and specifications herein, as well as to the following items.
 - 2. All proposed streets shall be planned, designed and constructed based on their anticipated function, traffic volumes, adjacent land use and system continuity.
 - 3. Any and all new streets which an extension of existing streets are shall be dedicated at equal or greater widths than the existing streets.
 - 4. All streets shall be designed to coordinate with existing streets in adjoining subdivisions.
 - 5. Streets shall be platted to avoid double frontage lots.
 - 6. Any roadway design criteria not addressed in City regulations or Master Thoroughfare Plan shall conform to the latest edition of the American Association of State Highway and Transportation Officials. (AASHTO) Geometric Design of Highways and Streets and the Texas Manual on Uniform Traffic Control Devices (TMUTCD).
 - 7. Right-of Way Dedication and/or Improvement Required

In the case of existing roads adjacent or abutting the proposed development or subdivision, the City may require that the entire right-of-way be dedicated and/or improved to the adopted standards and specifications herein, based upon factors including:

 - a. The impact of the proposed subdivision on the road;
 - b. Safety to the traveling public;
 - c. Conditions and life expectancy of the road;
 - d. The impact of the proposed subdivision on other roads;
 - e. Timing of this development in relation to need for improving road; and
 - f. The impact of the traffic on the specific road segment (s) as well as the City transportation system.

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D. General Standards by Street Classification

Refer to Master Thoroughfare Plan map, the tables and the standards and specifications herein.

Street Classification	Designation on MTP	Min. Right-of-Way (feet)	Min. Roadway Width (feet)	Travel Lanes		Parking Lanes		Median Width (feet)	Parkway Width (feet)	Sidewalks Required (Yes/No)
				Number of Lanes	Width of Lane (feet)	Number	Width (feet)			
Major Thoroughfare (Arterial)	P6D	120	(2) 36	6	12	None	28	28	10	Yes
	P6U	92	72	6	12	None	None	None	10	Yes
	P7U	104	84	7	12	None	None	None	10	Yes
Major Collector	M4D	100	(2) 26	2	12	None	28	28	10	Yes
				2	14	None	28	28	10	Yes
	M4U	68	48	4	12	None	None	None	10	Yes
	M5U	80	60	5	12	None	None	None	10	Yes
Minor Collector	C	60	40	2	12	2	8	None	10	Yes
				2	8	2	8	None	10	Yes
Local	L	50	30	1	14	2	8	None	10	Yes
				2	8					

To be updated with update to Master Thoroughfare Plan

E. General Standards by Street Classification

Refer to Master Thoroughfare Plan map, the tables on the next pages and the standards and specifications herein.

1. Freeway. Facilities regulated and maintained by TXDOT.
2. Arterials
 - a. Connectivity. Arterials typically connect with streets designated as Freeway or Collector.
 - b. Driveway connection spacing criteria are specified in the Standards and specifications herein.

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3. Collectors

- a. Connectivity. Collectors typically intersect with Arterials and may connect with Freeways.
- b. Street layout shall provide for continuation of Collector roadways in areas between Arterials.
- c. Where single family or duplex uses abut an existing or proposed Collector street, the plat or dedication instrument shall provide information as specified in the above paragraph:

4. Residential/Local Streets

- a. Local streets generally shall not intersect with Arterials. Connection shall only be permitted where design conditions do not permit any other possibility.
- b. Residential streets shall be so laid out that their use by through traffic will be discouraged, but access is provided to adjacent subdivisions.
- c. Those local streets designated by the Planning and Zoning Commission shall be extended through the tract to the tract boundary to provide future connection with adjoining unplatted lands. In general, these extensions should be at such intervals as necessary to facilitate internal vehicular circulation with adjoining unplatted lands.

Street Classification	Minimum Design Speed (MPH)	Maximum Percent Grade	Minimum Percent Grade	Minimum Centerline Radius (without superlevation)
Local	20	10	0.6	200 ft
Collectors	30	8	0.6	450 ft
Arterials	45	6	0.6	1,100 ft

5. Intersections

- a. Street intersections should be laid out so as to intersect at right angles and shall not vary by more than 5 degrees.
- b. Horizontal curves are required for deflection angles of 1 degree or more.
- c. At an intersection, the vertical profile of the higher classification roadway (or roadway that will carry more traffic) shall be smooth and continuous through the intersection. The cross slope of the intersecting street shall

transition from its normal crown section to match the longitudinal vertical profile of the street which it intersects. The length of this cross-slope transition shall be designed per AASHTO criteria based on design speed, cross slope grade differential, width of rotated section, and number of lanes rotated.

- d. Corner radii at the intersection of two Local roadways shall be twenty-five (25) feet radius minimum. Larger radii may be required for intersections of higher classification roadways per AASHTO design criteria.
 - e. A 5-foot x 5-foot minimum triangular right-of-way corner clip dedication is required at roadway intersections to be able to accommodate sidewalk barrier free ramps (see Standard Details). This corner clip may need to be increased for larger intersection corner radii and at skewed intersections.
 - f. Roadway profiles shall be designed so that they are graded at 2% maximum where crosswalks are (or will be) located.
 - g. The intersection sight distance for all street intersections shall be analyzed by the design engineer per the latest edition of the AASHTO Geometric Design of Highways and Streets. The approach and departure sight triangles shall be plotted on the construction plans in order to ensure that no obstructions are constructed within these areas.
 - h. Public Open Space Easement. All street intersections shall comply with the POSE easement standards established herein.
6. Additional Engineering Studies
- a. Process. At any time during the pre-application proposal or preliminary plat application process, the City Manager or designee may require a sight-distance study and/or a traffic impact analysis for any portion of the tract to be subdivided with regard to level of service and/or adequacy.
 - b. The preliminary plat or any related development application which requires a traffic impact analysis or study shall be held as 'incomplete' by the City and not scheduled for a public hearing until the results of the completed study or traffic impact analysis have been reviewed by the City Manager and/or designee and any affected public agency, such as the State of Texas, is required.
 - c. Based on the study or analysis, the City Manager and/or designee may impose stricter standards on the proposed plat which will be provided to the applicant in writing.
 - d. The City Manager or designee shall forward a report on the traffic impact analysis or study to the Planning & Zoning Commission and/or Council at the next available public hearing to assist in their determination of the impact of the development to the existing and proposed roadway infrastructure, as well as assess any safety concerns.

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- e. Traffic Impact Analysis (TIA) will be required for developments which include and/or generate:
 - i. 50 or more dwelling units; or
 - ii. 500 or more one-way trips per day; or
 - iii. Collector or Arterial Streets not included in the City adopted Comprehensive Plan.
- 7. Additional Right-of-Way
 - a. Additional right-of-way may be required at high-volume drive-ways and intersections for turning lanes.
 - b. Additional right-of-way will be determined by the City during the design phase of the street system and before submittal of the final plat.
 - c. Additional right-of-way dedication (other than that required along roadways designated on the Master Thoroughfare Plan) shall not be required from a previously platted property where:
 - i. The plat of such property is being modified by an amending plat.
 - ii. The plat of such property is being modified by a replat.
 - a) The property is occupied by a building or buildings; and
 - b) The sole purpose of the replat is to remove previously platted fire lanes, easements, mutual access easements, or delineate the legal boundaries of ownership of the property; and
 - c) No additional development rights will be conveyed to the property as a result of the replat.

SECTION 4.7 DESIGN CRITERIA BY STREET TYPE

A. Public Streets

The property owner shall assure that the subdivision is adequately served by improved streets and thoroughfares and shall be responsible for the costs of rights-of-way and street improvements, in accordance with the following policies and standards, and may be required to participate in the cost of provision of oversized facilities.

B. Private Streets

1. All streets not dedicated to the public shall be constructed in accordance with the standards herein and shall be maintained by means of the property owner (s) or other means as approved by the Commission.
2. Any request to dedicate a private street as a public street shall be approved only if arrangements are made to bring the street into conformity with all City standards and regulations in effect at the time of dedication at the cost of affected property owners.
3. All private streets that intersect with public streets shall be constructed with standard drive approaches. In cases where an unusual condition exists, the City Manager or designee may approve standard intersection approaches when requested prior to the preparation of the plans.
 - a. Private streets will be named and shown on the plat.
 - b. Street signs for said private streets shall be erected and maintained by the property owner(s).

C. Alleys

Alleys are not encouraged by the City and will only be approved on a case by case basis by the City Manager.

Alleys, where provided, shall be dedicated on the plat for public ingress and egress.

1. The minimum distance between an alley/street intersection and a street/street intersection shall be the width of at least one (1) lot.
2. Alleys should intersect streets at right angles or radially to curved streets.
3. Maximum alley length between access points to a street shall be 600 feet. A length of between 600 feet and 1,600 feet without access to a public street may be approved by the City Council if it finds unusual conditions or limiting factors. In no case shall an alley length exceed 1,600 feet between street access points.
4. Private and dead-end alleys are prohibited.
5. Alleys shall not intersect streets that are designated as Collectors or Arterials as designated on the Master Thoroughfare Plan.
6. In cases where two (2) alleys intersect or turn a sharp angle, lot corners shall be platted so that a triangular area of 25 feet x 25 feet or greater, is dedicated as part of the alley for the purpose of providing a minimum radius of 30 feet to the inside edge of the alley paving.

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7. Grading. Alley paving should have a minimum grade of 0.5% and a maximum grade of 10.0%.
 8. Design by Type of Development
 - a. Commercial and Industrial
 - i. Alleys, or loading courts, may be provided in lieu of off-street loading space.
 - ii. Alleys must have a minimum paved width of 20 feet.
 - b. Residential

Alleys are not required in residential areas except as extended from an existing development with alleys.
 - c. Single-Family and Duplex
 - i. Alleys serving single family residential and duplex areas shall have a minimum right-of-way width of 20 feet.
 - ii. Alleys shall have a minimum width of 12 feet exclusive of any curbs.
 - iii. Alley turnouts shall be paved to the right-of-way of the street in which the alley intersects and shall be 12 feet wide at that point.
 - iv. A uniform transition in alley pavement widths shall be made for a minimum distance of 20 feet.
- D. Half Streets
1. Half streets shall be prohibited, except divided Arterial streets where essential to the reasonable development of the subdivision in conformity with the other requirements of these regulations, and where the Planning and Zoning Commission finds it will be reasonable to require the dedication of the other half when the adjoining land is subdivided. The other half of the street shall be platted within the adjacent tract at the time it is platted.
 2. Construction of half streets shall be prohibited, except:
 - a. When essential to the reasonable development of the subdivision in conforming with the requirements of this ordinance and the Master Thoroughfare Plan, and
 - b. Where the City finds it will be practical to require the dedication of the other one-half when the adjoining property is subdivided.
 3. If the owner or subdivider is responsible for one-half (1/2) of the street, the owner or subdivider shall escrow the amount of the construction cost of the facility, unless the City participates in the construction of the facility.
 4. Whenever a partial street has been previously platted along a common property line, the other portion of the street shall be dedicated.
 5. Improvements shall be made to all on-site facilities as defined herein

E. Cul-de-Sac

1. The cul-de-sac shall be measured from the centerline of the intersecting street to the centerline of cul-de-sac turnaround.
2. Streets designated to be dead-ended permanently shall be platted and constructed with a paved cul-de-sac.
3. A street ending permanently in a cul-de-sac shall not be longer than 600 feet unless a turnaround with a minimum outside roadway diameter of 80 feet is provided and a street property line diameter of at least 100 feet.
4. If necessary, the City may draw from the surety in order to construct the permanent cul-de-sac prior to the term of the filed surety expiring.
5. Temporary Cul-de Sac
 - a. A street ending in a temporary cul-de-sac to allow for subsequent phasing of the development or continuation of a road at a later date may be used.
 - b. The dead end shall have a temporary turnaround outside roadway diameter of at least 80 feet with the roadway base, materials and design thickness to be approved by the City Manager or designee.
 - c. Proper easements and/or dedications shall be in place to allow for the public usage of the temporary cul-de-sac.
 - d. The developer shall provide surety in the amount to cover a standard cul-de-sac design meeting the standard specifications of the City for a permanent cul-de-sac.

F. Dead End Streets

1. Prohibited. Dead end streets are not allowed except:
 - a. To provide access to adjacent land areas, and
 - b. Shall be more than 250 feet in length or equal to one lot depth, whichever is greater.
2. Turnaround Required
 - a. Any permanent or temporary dead-end street longer than 250 feet, shall have a hard-surfaced turning area 80 feet in diameter for a cul-de-sac.
 - b. Where adjacent property contains an existing dead-end street over 250 feet in length without a cul-de-sac which abuts the proposed subdivision, the City Manager and/or designee shall require the developer to construct a cul-de-sac as provided above.
3. Other Dead-End Streets
 - a. Streets which dead end at power lines or similar rights-of-way, and which are intended for future extension across these rights-of-way, shall be constructed in the right-of-way for half the distance across the rights-of-way.
 - b. Streets which dead end at railroad rights-of-way shall not be required to be constructed over the railroad right-of-way by the subdivider but an agreement must be reached regarding the timing and construction of the crossing by the railroad owner.

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SECTION 4.8 PAVEMENT TYPES BY STREET CLASSIFICATION

- A. The Developer shall provide the minimum thicknesses as specified below:
 - 1. Alleys and Driveways
Six (6) inches of reinforced concrete on eight (8) inches of lime or cement stabilized subgrade.
 - 2. Private Streets
Six (6) inches reinforced concrete on a minimum of eight (8) inches of lime or cement stabilized subgrade.
 - 3. Local Streets
 - a. Six (6) inches reinforced concrete on a minimum of eight (8) inches of lime or cement stabilized subgrade is preferred.
 - b. Asphalt pavement may be used upon the approval of the City Manager.
 - 4. Collector Streets
Seven (7) inches of reinforced concrete on eight (8) inches of lime or cement stabilized subgrade.
 - 5. Arterial Streets
Eight (8) inches of reinforced concrete on ten (10) inches lime or cement stabilized subgrade
 - 6. TXDOT Streets, including Freeways
As per approved by TXDOT according to TXDOT standards.
- B. A geotechnical report sealed by a Licensed Professional Engineer in the State of Texas shall provide recommendations for pavement and subgrade thickness and lime or cement content.
- C. All concrete streets shall be constructed with a minimum compressive strength of 3,600 pounds per square inch (psi) at 28 days.
- D. Spacing and construction joints shall conform to the parabolic street pavement.
- E. Pavement Markings
Pavement markings shall be thermoplastic and shall conform to the *Texas Manual on Uniform Traffic Control Devices* (TMUTCD) and the adopted criteria and specifications herein, unless otherwise directed by City Manager or designee.

SECTION 4.9 GENERAL CRITERIA FOR PUBLIC FACILITIES

- A. All public utilities and infrastructure shall be designed and constructed in accordance with the most current adopted City regulations, technical specifications and standard details. Public utilities typically located within the public right-of-way include electric, water, sanitary sewer, storm sewer, telephone and cable services.
- B. All subdivision plats and engineering plans shall provide location and design of public utilities prepared in accordance to franchise requirements and the adopted standards herein.
- C. All distribution lines, cables, etc. for utilities other than those specified below shall be installed below ground within the subdivision.
- D. Additional utility easements may be required beyond the right-of-way based on the design of the subdivision.
- E. Transmission lines or major cables to provide utilities such as electric, telephone, and cable television to the area as a whole may be located above ground on the perimeter of the subdivision being served. The installation of these utilities shall conform to commonly accepted construction standards and be subject to review by the City Manager and/or designee.

SECTION 4.10. ELECTRIC, TELEPHONE AND CABLE SERVICES

Refer to Article 10.400 of the Subdivision Regulations and the standards and specifications herein.

SECTION 4.11. WATER FACILITIES

- A. General
 - 1. This section pertains to general design requirements for water distribution system construction in the City of Lake Worth.
 - 2. All water lines shall be sized and designed in accordance with the City of Lake Worth Water Distribution System Master Plan or as determined by the City Manager or designee. In the absence of specific standards, all water supply, distribution, pumping, and storage improvements shall be designed in accordance with the most current standards of the American Water Works Association, the Standard Specifications for Public Works Construction of the North Central Texas Council of Governments, and criteria adopted by the Texas Administrative Code, Chapter 290, "Water Hygiene".
 - 3. Water lines for multi-family, commercial and industrial fire protection lines shall be private and isolated from the public system by a double detector check placed at the property line. All water lines shall be 6 inches minimum diameter and looped when possible. Dead end lines shall not exceed 50 feet on multi-family, commercial, or industrial sites. All public water lines located on private property shall be centered in a 15-foot minimum easement. Larger easements may be required by the City Manager or designee to provide adequate space

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for maintenance. Water lines shall not be located under paved surfaces where possible.

Multi-family developments may be supplied fire protection and domestic service by the same water line provided that a fire-rated master meter is used along with a double detector check at the looped end of the water line.

If residential developments require fire suppression systems, the developer is responsible for the design and specification of said fire suppression system.

4. The developer shall furnish, install, construct, or extend, at his own expense, water distribution facilities necessary for the proper development of the subdivision. The water system shall provide individual service to every lot in the subdivision. All water mains constructed within a proposed subdivision shall be extended to the perimeter of the proposed subdivision to allow for future extension of the water system into adjacent properties. The water system shall be designed and constructed in accordance with the specifications contained in these Standards.

5. All components of the water system must comply with ANSI/NSF Standard 61.

B. Water Line Sizing

1. Standard water line diameters are as follows:

- a. Six (6) inch (minimum),
- b. Eight (8) inch,
- c. Twelve (12) inch, and
- d. Sixteen (16) inch diameter.

Other sizes must be approved by the City Manager or designee.

2. All water lines shall be looped except in cul-de-sacs.
3. Dead end lines shall not exceed 50 feet on multi-family, commercial, or industrial sites.

C. Water Line Location

1. Water lines shall be located in the parkway.
2. Along State Highways, water lines are required to be constructed on both sides of roadway.
3. New water lines crossing existing streets shall be placed by boring.
4. A casing shall be required under major and minor collector roadways.
5. Open cut excavation will not be allowed to cross existing streets, unless approved by the City Manager or designee.
6. All public water lines located on private property shall be centered in an easement.
7. Water lines shall not be located under paved surfaces where possible.
8. Easements for water line construction shall meet the following requirements:

- a. The easement width shall be a minimum of 15 feet.
 - b. If the water line is less than 12 feet deep, the outside diameter of the water line shall be located a minimum distance of 6 feet from the edge of the easement, and if other utilities are located in the same easement, the outside diameter of the water line shall be located a minimum distance of 3 feet from the outside diameter of the other utilities.
 - c. If the water line is greater than 12 feet deep, the outside diameter of the water line shall be located a minimum distance of 9 feet from the edge of the easement, and if other utilities are located in the same easement, the outside diameter of the water line shall be located a minimum distance of 6 feet from the outside diameter of the other utilities.
9. All piping with mechanical couplings, push-on, or similar joints subject to internal pressure shall be designed with blocking, anchors, and restraining harnesses to preclude separation of joints.
- D. Polyvinyl Chloride (PVC) Pipe
 1. PVC pipe shall be designed, manufactured, and tested in accordance with the applicable requirements of AWWA C-900 (6 inch through 12 inch water pipe), AWWA C-905 (16 inches and larger water pipe), and AWWA M-23.
 2. All PVC water pipe shall be blue in color.
 3. 6 inch through 12 inches water pipe shall be pressure class 150, DR 18. Pressure class 200, DR 14 pipe may be required by the City Manager or designee in areas of high distribution system pressure.
 4. Fittings
 - a. Fittings shall be ductile iron in accordance with AWWA C110 or AWWA C153.
 - b. Fittings: ANSI/AWWA C111/A21.11, except gaskets shall be neoprene or other synthetic rubber and factory installed. Natural rubber will not be acceptable.
 - c. All buried metal shall be wrapped in polyethylene Tube Wrap: ANSI/AWWA C105/A21.5
- E. Installation
 1. General
 - a. All installations shall conform to the latest NCTCOG Specifications, as amended by these standards.
 - b. Separations – Water line installations shall conform with the separation criteria outlined in the Texas Administrative Code, Chapter 290.44, “Water Distribution.”
 - c. Cover
 - i. All 6-inch and 8-inch water pipe shall be installed with a minimum of 42 inches of cover over top of pipe.

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- ii. All 12-inch water pipe shall be installed with a minimum of 48 inches cover.
 - iii. All pipe 16 inches and larger water pipe shall be installed with a minimum of 60 inches of cover over top of pipe.
 - d. The amount of trench excavation shall not exceed 200 feet from the end of the pipe laying operations, and no more than 300 feet of total open trench will be allowed.
 - e. At the end of each work day, all trench excavation shall be backfilled to the end of the pipe laying operation.
 - f. Backfill must contain no large rocks or clumps larger than three (3) inches in diameter.
 - g. Barricades and lights will be required around any open trench left overnight.
 - h. All connections to existing water mains shall be made under pressure unless dry connections will not cause any loss of service.
 - i. Under special conditions connections that cause an interruption of service may be performed with approval of the City Manager or designee.
 - j. Coated tracer wire shall be installed in the embedment material above the PVC pipe with the tracer wire terminating outside valve boxes accessible by City Staff. Install a test station. Blue underground water line tape of a minimum 4-inch width shall be installed above the embedment material.
 - k. Density tests shall be taken every 150 feet. The density reports shall be submitted daily to the City's inspector.
 - l. All density reports shall be completed and delivered to the City's inspector before paving is allowed to begin.
- 2. PVC Water Pipe

PVC water pipe and appurtenances shall be installed as specified in AWWA Manual M-23 and in accordance with the pipe manufacturer's recommendations.
- 3. Fittings
 - a. Fittings shall be installed in accordance with AWWA C-600.
 - b. All mechanical joint bends, tees, and reducers which require blocking shall be additionally restrained with EBAA megalug retainer gland or approved equal.
 - c. All fittings that are concrete blocked must be polyethylene wrapped.

F. Fire Hydrants

1. Location by Type of Development

a. Commercial and Industrial

Locate fire hydrants at street intersections and/ not more than 300 feet apart.

b. Residential

Locate fire hydrants at street intersections and not more than 400 feet apart.

c. Multifamily

Locate fire hydrants at street intersections and/ not more than 300 feet apart.

HOSE NOZZLE	PUMPER NOZZLE
Nominal Size of Coupling Waterway	2 ½", 4"
Number of Threads Per Inch	7 ½", 4"
Thread Designation (NH = Fire	2.5-7.5 NH 4 – 4 NH
Approximate Outside Diameter of External Thread	3 1/16", 5"
Length of Nipple	1', 1 ¼"
Length of Pilot to Start of Second Thread	¼", 7/16"
Depth of Coupling	15/16", 1 3/16"
Diameter of Gasket Seat in Coupling	3 3/16", 5 1/8"
Length of Coupling Internal Thread	11/16", 7/8"
From Face of Coupling to Start of Second Thread	3/16", 3/8"

2. Materials

a. Fire hydrants shall be manufactured in accordance with AWWA C-502, Dry-Barrel Fire Hydrants.

b. Hydrants shall be manufactured such that all maintenance and adjustments can be performed without excavation and such that hydrants may be faced in any direction in relation to base.

c. The hydrant nozzle arrangement shall be three-way, consisting of two 2½ inch hose nozzles and one 4 inch pumper nozzle. The two hose nozzles are 180 degrees apart with the pumper nozzle in between and

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on the same horizontal plane. Centerline of outlet nozzle shall be a minimum of 18 inches above the ground/hydrant bury line.

- d. Outlet nozzles shall be fastened into the nozzle section by threads or mechanical means and secured in place by a pin, a set screw or other acceptable method to prevent the nozzle from turning or backing out. Connecting the nozzle to hydrant by leading is not acceptable.
- e. Nozzle cap harnessing and gaskets shall be furnished.
- f. Threads on hose and pumper nozzles shall meet the requirements of National Fire Protection Association, NFPA 1963, "Standard for Screw Threads and Gaskets for Fire Hose Couplings" as follows:

3. Shut off:

- a. The hydrants shall be of the compression type, with the main valve opening against the pressure and closing with the pressure.
- b. The valve action shall provide positive shut-off at minimum closing torque.
- c. Wedge action closing gates shall not be used.
- d. All hydrants shall open by turning the operating-stem nut to the RIGHT (CLOCKWISE). A clearly visible CURVED ARROW and the word "OPEN" shall be cast in relief on the top of the hydrant to indicate the direction of opening.
- e. The fire hydrant operating nut shall be square in shape. The square nut shall measure 1 inch at the base, and 7/8 inch at the top with all faces tapered uniformly. The nut shall be so designed as to protect the working mechanism from the moisture and dirt.

4. Bury Length

The standard fire hydrant bury length from ground to bottom of the connecting pipe shall be 3 feet 6 inches. The hydrant shall be of a design that will permit extensions without disturbing the bottom section of the hydrant.

5. Hub Type

Inlet connection shall be mechanical joint unless otherwise specified and shall be for 6-inch ductile iron pipe. The nominal diameter of the fire hydrant main valve opening is to be 5¼ inches.

6. Hydrant Body

The body of the hydrant between the elbow and the top cap must be made in two parts connected by a swivel flange, or breakable flange which will permit facing of the nozzles in any desired direction in increments of 45 degrees or less. The complete hydrant shall be of such design that when the hydrant barrel is broken through traffic collision or otherwise, it may be replaced without disturbing the bottom section of the hydrant. Extension sections, where required, shall include barrel extension section, extension rod with connectors provided for lengthening the complete unit. These units shall be available in increments of six (6) inches in length.

7. The fire hydrant body shall be painted a high gloss alkyd fire hydrant red.
8. Ballards shall be placed around fire hydrants in high traffic areas. The ballards shall be placed at 45-degree angles to the fire hydrant with a minimum spacing of 30 inches.
9. Location Markers
A location marker shall be placed in the center of the roadway opposite the fire hydrant. If the fire hydrant is located near the intersection of at least two streets a marker shall be placed on all streets. The installation of this reflector shall be in accordance with the manufacturer's recommendation. Location markers shall be Stemsonite 1-88-55A or approved equal.
10. Manufacturers
Approved fire hydrants manufacturers are as follows:
 - a. Mueller (Super Centerion 200)
 - b. M&H (Model 129)

G. Valves

1. Resilient seated gate valves shall be used for 6 inch through 16 inch water lines. Butterfly valves shall be allowed for 16 inches and larger water lines when approved by the City Manager or designee.
2. Valves of approved design shall be installed at the intersections of all water mains so as to provide for proper maintenance and operation of the system and to provide a means of shutting off the supply to portions of the system for repairs. Valves shall be spaced such that only one fire hydrant is out of service at any one time. Three (3) valves shall be used on a four-way water line intersection and a minimum of two (2) valves shall be used on a three-way intersection.
3. Materials
 - a. Resilient Seated Gate Valves
 - i. Resilient seated gate valves 3 inches through 16 inches shall meet or exceed the latest revisions of AWWA C509 and shall meet or exceed the requirements of these standards.
 - ii. Resilient seated gate valves for buried service shall be furnished with a square 2 inch operating nut. The valve box shall be Tyler Pipe 6850 series or approved equal. The valve box lid shall be painted safety blue. The paint shall be Glidden or approved equal.
 - b. Butterfly Valves
Butterfly valves shall meet or exceed the latest revision of AWWA Standard C504 for Class 150B butterfly valves and shall meet or exceed the requirements of this specification. All valve components shall conform to Underwriters Laboratories classification in accordance with ANSI/NSF Standard 61.

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4. Installation
 - a. Valves shall be furnished with extensions, such that the working nut is a maximum of 48 inches below grade.
 - b. Adjustable valve boxes shall be furnished and set on each valve in accordance with these standards. Valves that are deeper than 48 inches, AWWA C900 PVC pipe shall be used for stacks, as long as the adjustable valve box is used at the top.
 - c. After the final clean-up and alignment has been complete, the contractor shall cast in place a concrete block, 24 inches by 24 inches around all valve box tops at the finish grade. See Construction Details in Appendix B-6.
 - d. Valves located within a right-of-way shall be indicated on the face of the curb, or where curbs do not exist, on a conspicuous location adjacent to the valve location. Markings are to be the stamping of a four (4) inch high letter "V" with the point of the "V" pointing towards the valve location. Once stamped, the "V" shall be painted blue.
 - e. Valve markers shall be provided in rural areas.
5. Manufacturers
 - a. Approved manufacturers of 3 inch through 12-inch resilient seated gate valves are as follows:
 - i. Mueller
 - ii. M & H
 - iii. U.S. Pipe
 - iv. CLOW
 - v. American Flow Control
 - b. Approved manufacturers of 16 inches resilient seated gate valves are as follows:
 - i. Mueller
 - ii. M & H
 - iii. American Flow Control
 - c. Approved manufacturers of 16" and larger butterfly valves are as follows:
 - i. Dezurik
 - ii. Clow
 - iii. Keystone
6. Air Release and Flushing Valves
 - a. Adequate air relief, and flushing valves shall be provided for flushing, disinfection, daily operation requirements, and repairs when required by the City Manager or designee. Air release valves shall be required on 12 inches and larger water lines. Water lines shall be designed so that each section of the water line can be flushed at its lowest and highest points.

- b. All dead-end lines shall have a fire hydrant installed for flushing purposes and a sampling station. Sampling station shall be an Eclipse No. 88 or approved equal.
- c. A fire hydrant shall be required at high points on water lines smaller than 12 inches for air relief and flushing.
- d. Air release valves and air/vacuum valves shall meet or exceed the latest revision of AWWA C512.

H. Tapping Sleeve

A tapping sleeve and valve shall be used when connecting a new water line to an existing line. A resilient seated gate valve shall be flanged to the tapping sleeve. The tapping sleeve shall be a Smith-Blair type 664-665 stainless steel tapping sleeve or approved equal.

I. Water Service

1. The water meter box and water service shall be in accordance with Detail W-5. 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 flow line. All water services crossing beneath streets must be encased in four (4) inches diameter PVC casing.
 - a. Casing needs to be installed at least to the meter box or 12 inches behind curb.
 - b. Casing needs to be sealed to prevent debris to enter piping.
 - c. One (1) water service per casing.
2. Meter and service sizes will be determined by the developer prior to requesting service from the City. The minimum water service size between the water main and the meter shall be one (1) inch and the minimum meter size shall be one (1) inch.
3. Water services on undeveloped lots shall be located at the property line. Each service shall be one (1) inch minimum. Each lot shall have its own service and meter.
4. Backflow

All installations shall conform with the backflow regulations outlined in the Texas Administrative Code, Chapter 290.44(h), "Backflow, Siphonage" as well as City of Lake Worth ordinances.
5. Materials
 - a. Service saddle shall be double strap bronze with brass body or stainless-steel double bolt wide straps with stainless steel body. Minimum size tap shall be one (1) inch diameter.
 - b. Service lines shall be one (1) inch minimum diameter, Type K copper as specified in ASTM B88.
 - c. Corporation and Curb Stops

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- i. Corporation stop shall be a ball type, size to be determined based upon service type, with compression outlet fitting, designed for a minimum working pressure of 200 pounds per square inch (psi).
 - ii. Curb stop shall be set with compression inlet fitting and lock ring.
 - d. See Standard Construction Details (Appendix B-6) for meter box for meters two (2) inches and smaller.
 - 6. Installation
 - a. General
 - i. All water service shall be installed in accordance with these standards.
 - ii. Each individual service location shall be saw cut into the face of the curb with a four (4) inch high blue "W" painted by the Contractor.
 - iii. If no curb exist a similar mark should be placed in the pavement near the edge of the roadway.
 - b. Residential Meters

All residential meters shall be manufactured by Badger Meters with latest technology.
 - c. Commercial Meters (3 inches and larger)
 - i. See Standard Construction Detail.
 - ii. The developer shall purchase from the manufacturer a Badger Meter (model to be specified by the City).
 - iii. The meter shall be installed by a utility contractor or plumber.
 - iv. All meters in this size class are required to have a strainer prior to the meter.
 - 7. Acceptable Manufacturers for Corporation Stops, Curb Stops, and Service Saddles:
 - a. Ford
 - b. Mueller
 - c. Smith-Blair
 - J. Flushing Valves
 - 1. Corporation stop shall be 2-inch ball type with compression outlet fitting, designed for a minimum working pressure of 200 pounds per square inch (psi).
 - 2. Two (2) inch curb stop shall be ball type with compression inlet fitting with tee head shut off.
 - 3. Pipe shall be two (2) inches diameter, Type K copper as specified in ASTM B88.

K. Water Line Bore

1. Casing

- a. Minimum casing thickness shall be one-quarter (1/4) inch.
- b. Casings shall be required under collectors and major thoroughfares, highway crossings, and railroad crossings.
- c. Casings may also be required were deemed necessary by the City Manager or designee.
- d. The construction bore pit shall be located at a minimum distance of four (4) feet behind the back of curb or edge of pavement where no curb is present.
- e. Bores need to be marked to identify locations, either in curb line marking or fiber glass stakes.
- f. Trace wire to be installed on bores.

2. The design engineer shall design the water line pipe casing for the following loading conditions and 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
- c. Loads applied during jacking, including axial load from jacking
- d. All other applicable loading conditions, including loads applied during transportation and handling.

3. Materials

- a. Steel Casing Pipe - Steel casing pipe shall be new (or used if approved by the City Manager or designee) and suitable for the purpose intended and shall have a minimum yield strength of 35,000 pounds per square inch (psi). Casing shall meet ASTM A-36, ASTM A-570, ASTM A-135, ASTM A-139, or approved equal. Pipe shall be coated with coal tar epoxy (15 mils min.) in accordance with AWWA C-210. Pipe joints shall be welded in accordance with AWWA C-206. After pipe is welded, coating shall be repaired.
- b. Cement Mortar - Cement mortar shall consist of one (1) part cement to two (2) parts clean sand with sufficient water to make a thick, workable mix.
- c. Pressure Grout Mix - Grout shall be comprised of 1 cubic foot of cement and 3.5 cubic feet of clean fine sand with sufficient water added to provide a free-flowing thick slurry. If desired to maintain solids in the mixture in suspension, one cubic foot of commercial grade bentonite may be added to each twelve to fifteen cubic feet of the slurry.
- d. Casing Insulators (Spacers) - Use casing insulators for any type of carrier pipe. Insulators shall be high density polyethylene. Insulators

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shall fit snug over the carrier pipe and position the carrier pipe approximately in the center of the casing pipe to provide adequate clearance between the carrier pipe bell and the casing pipe. Insulators shall be manufactured by "Recon" and be Racci Type or approved equal.

4. Installation

a. Excavation and Backfill of Access Pits

- i. Do not allow excavation over the limits of the bore or tunnel as specified. Trench walls of access pits adjacent to the bore or tunnel face shall be truly vertical. Shore the trench walls as necessary to protect workmen, the public, structures, roadways, and other improvements.
- ii. Excavations within the right-of-way and not under surfacing shall be backfilled and consolidated by mechanical methods as specified in these standards for compaction of trenches under roadways. Surplus material shall be removed from the right-of-way and the excavation finished to original grades. Backfill pits immediately after the installation of the carrier pipe is completed. If carrier pipe is not installed immediately after casing pipe installation, the City may require the access pits be temporarily backfilled until installation of carrier pipe.
- iii. Where seeding or sodding is disturbed by excavation or backfilling operations, such areas shall be replaced by seeding or sodding as specified.

SECTION 4.12 WASTEWATER FACILITIES**A. General**

1. This section pertains to general design requirements for wastewater collection system construction in the City of Lake Worth. All sewer lines shall be sized and designed in accordance with the City of Lake Worth Wastewater System Master Plan or as determined by the City Manager or designee. In the absence of specific standards, all collection, treatment, and disposal systems shall be designed in accordance with the most current criteria adopted by the Texas Administrative Code, Chapter 317, "Design Criteria for Sewerage Systems".
2. All sewers shall be designed with consideration for serving the full drainage area subject to collection by the sewer in question; the drainage area may be modified with the concurrence of the City Manager or designee because of the projected rate of development or the financial feasibility of the proposed extension.
3. Sewers should be designed with straight alignment whenever possible. When horizontal curvatures must be used, the maximum joint deflection should be in accordance with the pipe manufacturer's recommendations.
4. The developer shall furnish, install, construct, or extend, at his own expense, wastewater collection facilities necessary for the proper development of the subdivision. The wastewater collection system shall provide individual service to every lot in the subdivision. All sewer mains constructed within a proposed subdivision shall be extended to the perimeter of the proposed subdivision to allow for future extension of the wastewater collection system into adjacent properties. The wastewater collection system shall be designed and constructed in accordance with the specifications contained in these Standards.
5. All sewers shall be designed with hydraulic slopes sufficient to give mean velocities, when flowing full or half full, of no less than two (2) feet per second on Kutter's or Manning's formulas using an "n" value of 0.013. Slopes shall also conform to TAC Chapter 317, Sewage Collection System.
6. When a 150 pounds per square inch (psi) rated sewer line is required due to its proximity to a water line, the 150 pounds per square inch (psi) rated pipe shall terminate at a manhole on each end. The pipe shall be extended to the interior wall of the manhole. No external boot connection will be allowed.

B. Sanitary Sewer Line Sizing

1. Standard sewer line sizes are:
 - a. Six (6) inches,
 - b. Eight (8) inches,
 - c. Twelve (12) inches,
 - d. Fifteen (15) inches, and
 - e. Eighteen (18) inches in diameter;
 - f. Other sizes must be approved by the City Manager or designee.
2. Sewer lines shall be a minimum of six (6) inches in diameter.

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C. Sanitary Sewer Line Location

1. Sewer lines shall be constructed at a minimum depth of 4 feet. They shall be located in the parkway and are required to be constructed on both sides of a State Highway. No sewer lines will be allowed to cross a State highway.
2. Easements for sewer line construction shall meet the following requirements:
 - a. The easement width shall be a minimum of 15 feet.
 - b. If the sewer line is less than 12 feet deep, the outside diameter of the sewer line shall be located a minimum distance of six (6) feet from the edge of the easement, and if other utilities are located in the same easement, the outside diameter of the sewer line shall be located a minimum distance of three (3) feet from the outside diameter of the other utilities.
 - c. If the sewer line is greater than 12 feet deep, the outside diameter of the sewer line shall be located a minimum distance of nine (9) feet from the edge of the easement, and if other utilities are located in the same easement, the outside diameter of the sewer line shall be located a minimum distance of six (6) feet from the outside diameter of the other utilities.

D. Sanitary Sewer Line Materials

1. All sanitary sewer pipes shall be PVC pipe type SDR-26.
2. PVC pipe will not be allowed for depths greater than 24 feet unless approved by City Manager or designee.
3. If service connections are needed on sewer pipe constructed below 15 feet in depth, a parallel line shall be constructed at a shallower depth, specifically for service connections.
4. All PVC sanitary sewer pipe shall be green in color.
5. PVC sewer pipe and fittings shall conform to the current ASTM Designation D 3034 for four (4) inches through 15 inches and ASTM Designation F 679 for greater than 15 inches.

E. Installation

1. General
 - a. All installations shall conform to ASTM Designation D2321, and the latest NCTCOG Specifications as amended by these standards.
 - b. Sewer lines shall not be installed within nine (9) feet horizontally of any water main or fire hydrant.
 - c. Construction shall begin at the downstream end of project and continue upstream with the bell facing upstream.
 - d. No upstream piping shall be installed before downstream piping unless approved by the City Manager or designee.

- e. All concrete and clay lines will be brought up to current design standards which are located inside the developer's scope of work.

2. Excavation and Backfill

- a. When PVC pipe is used, green marker tape with the wording "Buried Sanitary Sewer" shall be installed in the backfill material no more than 12 inches above the top of the pipe.
- b. The amount of trench excavation shall not exceed 200 feet from the end of the pipe laying operations, and no more than 300 feet of total open trench will be allowed.
- c. At the end of each workday, all trench excavation shall be backfilled to the end of the pipe laying operation. Backfill must contain no large rocks or clumps larger than three (3) inches in diameter.
- d. Barricades and lights will be required around any open trench left overnight.
- e. Density tests shall be taken every 150 feet. The density reports shall be submitted daily to the City's inspector.
- f. All density reports shall be completed and delivered to the City's inspector before paving is allowed to begin.

F. Inspection

- 1. All air tests and flow tests will follow NCTCOG Standards.
- 2. All sanitary sewer lines shall be inspected using television inspection methods prior to acceptance by the City.
 - a. The Contractor is responsible for cleaning the sewer pipe. If the inspection shows debris or evidence that the line has not been properly cleaned, the review will cease, and the tape will be returned to the Contractor.
 - b. A City representative shall be present during the television inspection, unless otherwise authorized in writing.
 - c. The televised inspection shall commence only after the line has passed both air and mandrel test.
- 3. Televised Inspection Criteria
 - a. All sanitary sewer mains must be flushed with water just prior to televised inspection. Water is to be provided at the Contractor's expense. A City representative shall be present during the flushing of the main.
 - b. All television equipment used shall have a minimum of 220 lines of horizontal resolution. The picture shall be in color.
 - c. All video shall be digitally recorded and placed on a DVD or detachable storage drive.

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- d. As a title heading on the tape and during the televising, the operator must:
 - i. Note the project name and Contractor name.
 - ii. Note the name of the company and the operator performing the video inspection.
 - iii. Note line size and material, joint type and length.
 - iv. Line segment to be televised including beginning and ending station numbers.
 - v. Note page of plans used and year plans were stamped.
 - vi. Note date and time of inspection.
 - vii. A footage counter must be displayed on the tape during the filming.
 - viii. Show the above title block before and after each line segment. Show the title block at 100-foot intervals while filming the line segment.
 - ix. All defects should be shown on film for a minimum of 10 seconds before proceeding with the televising.
- e. The Contractor shall supply a log sheet used in conjunction with the DVD or digital storage device. All written information gathered must be legible and clearly understandable.
 - i. Note the project name, Contractor name and contract number.
 - ii. Note the name of the company and the operator performing the video inspection.
 - iii. Note pipe size and material, joint type and length between joints.
 - iv. Note the video footage counter, start to end.
 - v. Note line segment to be televised, station numbers from and station numbers to length of line segment as indicated on plans.
 - vi. Note page of plans used and year plans were stamped.
 - vii. Note date and time of inspection.
 - viii. Indicate by sketch the line segment to be videoed in relation to surrounding road intersections and street addresses. Identify manhole station numbers. Show direction of flow with arrows and direction the camera is going. Indicate direction of north on the sketch.
 - ix. Note the water depth at the beginning, every 50-foot station, every change in grade, and at the end of the line segment.

- x. Identify the clock location, direction, size and type of laterals entering main. Indicate laterals as saddles, punched, or glued fittings.
 - xi. Indicate final footage videoed at end of the log sheet.
 - f. One (1) video per visual televised inspection project shall be furnished to the City Manager or designee.
 - g. All videos and run sheets shall be submitted to the City. All videos and log sheets shall become the property of the City.
 - 4. Criteria for Repair
 - a. The Contractor shall make repairs if the inspection reveals any deficiency in the sewer line. If repairs are required, another television inspection shall be made after the repairs are complete on a new tape from manhole to manhole at the Contractor's expense.
 - b. Repairs shall be made to the satisfaction of the City Manager or designee and City Manager or designee.
- G. Manholes
- 1. Manholes shall be located at all intersections of sewer lines and at intermediate spacing along the line. Generally, the maximum spacing should not exceed 500 feet.
 - 2. Manholes should be located at all changes in grade and at the ends of all sewer lines that will be extended.
 - 3. A manhole is required at the junction of sewer lines with different inside pipe diameters.
 - 4. A drop of at least 0.1 feet is required through the manhole when a change in flow direction occurs.
 - 5. The flow line into a manhole should not be greater than six (6) inches above the flow line out of the manhole. Where the flow line in is greater than two (2) feet above the flow line out, a drop manhole is required.
 - 6. Minimum manhole inside diameter is four (4) feet.
 - 7. Drop-connection manholes shall have a minimum inside diameter of five (5) feet, with an interior drop connection if line size is greater than eight (8) inches.
 - 8. Minimum cast in place manhole wall thickness is eight (8) inches. For depths greater than 12 feet add an extra four (4) inches of thickness for each additional six (6) feet of depth.
 - 9. Minimum pre-cast wall thickness is five (5) inches.
 - 10. A manhole is required where a sanitary sewer line enters and exits private property.
 - 11. All manholes shall be constructed of concrete.

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12. No new connection to brick manholes will be allowed. Brick manholes must be brought to current standards.
13. All brick manholes will be replaced to new standards that are inside the developer's scope of work.
14. Installation

Use the following table to determine sanitary sewer manhole sizes:

Pipe Sizes	Depth of Cover (feet)	Minimum Diameter of Manhole (feet)	Number of Pipe Connections Allowed in Man- hole
Under 12 inches	<12	4	3
	>12-20	5	3
12 in to 18 in	<12	5	3
	>12-20 (See Note #1)	6	4

Note: 1. If the proposed design requires the sewer line to be placed at depths greater than shown above, the design will require approval by the City Manager or designee.

15. Cast-in-place
 - a. Cast-in-place manholes shall accommodate the City's specified manhole cover.
 - b. The manhole foundation shall be poured on undisturbed soil and shall have a minimum thickness of eight (8) inches.
 - c. The inlet and outlet pipes shall be poured into the foundation of the manhole. The pipe shall extend one and one-half (1½) inches into the manhole. When straight through flow occurs, the pipe shall not be laid continuously through the manhole.
 - d. The invert shall be shaped and smoothed so that no projections will exist, and the invert shall be self-cleaning. The invert floor shall have a minimum slope of one (1) inch per foot.
 - e. Concrete work shall conform to all requirements of ACI 301, Standard Specification for Structural Concrete, published by the American Concrete Institute, except as modified herein.
 - f. Detailing of concrete reinforcement and accessories shall be in accordance with ACI Publication 315.
 - g. Portland Cement shall be Type II, low-alkali and conform to ASTM Designation C-150.

- h. The manhole shall not be backfilled within 12 hours after the concrete placement.
 - i. The face of curb shall be sawed with an "MH" to mark the location of all manholes. The "MH" shall be painted green. The location of the stamp shall be a line that intersects the center of the manhole cover and the curb perpendicular to the centerline of the street. For manholes located in intersections, the curb shall be stamped at the closest location to the manhole. If no curb exist a similar mark should be placed in the pavement near the edge of the roadway.
- 16. Precast Manhole
 - a. All precast manholes shall accommodate the City's specified manhole covers.
 - b. Manhole base shall have a spread footing and be placed on a minimum of twelve (12) inches of crushed rock.
 - c. The face of curb shall be sawed with an "MH" to mark the location of all manholes. The "MH" shall be painted green. The location of the stamp shall be a line that intersects the center of the manhole cover and the curb perpendicular to the centerline of the street. For manholes located in intersections, the curb shall be stamped at the closest location to the manhole. If no curb exist a similar mark should be placed in the pavement near the edge of the roadway.
- 17. Manufacturers. Approved precast manhole manufacturers are as follows:
 - a. Hydro-conduit
 - b. Gifford Hill American
- 18. Manhole Frame and Cover
 - a. Cover-shall be per the City's specified manhole cover in the Standard Construction Details in Appendix B-6.
 - b. Materials. All manhole covers shall conform to the Standard Specifications for Grey Iron Castings, ASTM A-48, Class 30 B.
 - c. Installation
 - i. All manhole covers shall be 30 inches in diameter.
 - ii. All manhole covers shall have two (2) integrally cast pick bars.
- 19. Manufacturers-see Standard Construction Details in Appendix B-6.
- 20. Frames-see Standard Construction Detail in Appendix B-6.
 - a. Materials. All manhole frames shall conform to the Standard Specifications for Grey Iron Castings, ASTM A-48, Class 30 B.
 - b. Installation. All manhole frames shall accommodate the City's manhole cover.
 - c. Manufacturers-see Standard Construction Detail

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21. Extension Ring-see Standard Construction Detail
 - a. Materials. All precast reinforced concrete extension rings shall conform to ASTM C-478.
 - b. Installation
 - i. The number of extension ring sections shall be kept to a minimum (i.e. use 1-12-inch extension ring instead of 2-6 inch extension rings).
 - ii. A 1-inch by 3 1/2-inch bitumastic gasket shall be used to seal the extension ring at both joints.
 - iii. No more than a twelve (12) inch rise can be installed.
22. Rain Pan
 - a. Materials. Rain pans shall be high density polyethylene plastic.
 - b. Manufacturers. Knutson or approved equal.
- H. Sewer Service
 1. No sewer service line (lateral) shall be less than four (4) inches in nominal diameter.
 2. Commercial sewer laterals shall be 6 inches minimum diameter. Where the 6 - inch line connects to the system, a manhole shall be provided.
 3. Sewer laterals shall be located at the center of the lot and extended to the property line and be a minimum of 10 feet downstream of the water service.
 4. Sewer service laterals shall have no more than six (6) feet of cover at the property line.
 5. A cleanout shall be located on the service lateral at the right-of-way line.
 6. Materials
 - a. All lateral sewer service lines shall be PVC pipe type SDR-26.
 - b. All PVC sanitary sewer pipe used for lateral services shall be green in color.
 7. All service laterals shall be installed in accordance with the sanitary sewer embedment and backfill standards.
 8. Sanitary sewer service locations shall be indicated by a stamped "S", painted green.
- I. Cleanouts
 1. All cleanouts are to be constructed of PVC pipe type SDR-26.
 2. All PVC sanitary sewer pipe shall be green in color.
 3. PVC sewer pipe and fittings shall conform to the current ASTM Designation D 3034 for four (4) inches through 15 inches and ASTM Designation F 679 for greater than 15 inches.

J. Main Line Cleanouts

Main line cleanouts shall be located on dead end sewer mains at a distance no greater than 250' from the preceding manhole. If the distance is greater than 250', a manhole shall be installed at the end of the line.

K. Aerial Sewer

1. The piers for the aerial crossing shall be designed in accordance with the guide lines of the Ductile Iron Pipe Research Association.
2. Aerial sewer crossing shall be located in areas where the sewer line cannot be constructed with the appropriate minimum cover. The design engineer shall design the aerial crossing in accordance with these standards and as approved by the City Manager or designee.
3. Pier placement and spacing shall be determined according to soils analysis performed by a geotechnical engineer. Piers shall be placed at a maximum span distance as indicated by the design engineer's calculations.
4. Pier placement and spacing along with a soils report shall be submitted to the City Manager or designee.
5. All above ground sewer installations shall be ductile iron, minimum Class 150, utilizing restrained joints and shall have a wall thickness required for the size and span as designed. The pipe shall have an internal polyurethane coating.
6. The aerial pipe shall be connected to the sanitary sewer pipe by means of a manhole on each side of the aerial crossing.
7. Piers to be constructed with a minimum of Class A (per Item 303 NCTCOG) reinforced concrete.
8. The design engineer shall submit a pipe design for approval by the City Manager or designee.
9. The design engineer shall submit a pier design for approval by the City Manager or designee.

L. Sewer Line Boring

1. The design engineer shall design the sewer line pipe casing for the following loading conditions and 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.
 - c. Loads applied during jacking, including axial load from jacking.
 - d. All other applicable loading conditions, including loads applied during transportation and handling.
 - e. Bore will be marked to show location of bore.

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2. Materials

- a. Steel Casing Pipe - Steel casing pipe shall be new (or used if approved by the City Manager or designee) and suitable for the purpose intended and shall have a minimum yield strength of 35,000 pounds per square inch (psi). Casing shall meet ASTM A-36, ASTM A-570, ASTM A-135, ASTM A-139, or approved equal. Pipe shall be coated with coal tar epoxy (15 mils min.) in accordance with AWWA C-210. Pipe joints shall be welded in accordance with AWWA C-206. After pipe is welded, coating shall be repaired.
- b. Cement Mortar - Cement mortar shall consist of one (1) part cement to two (2) parts clean sand with sufficient water to make a thick, workable mix.
- c. Pressure Grout Mix - Grout shall be comprised of 1 cubic foot of cement and 3.5 cubic feet of clean fine sand with sufficient water added to provide a free-flowing thick slurry. If desired to maintain solids in the mixture in suspension, one cubic foot of commercial grade bentonite may be added to each twelve to fifteen cubic feet of the slurry.
- d. Casing Insulators (Spacers) - Use casing insulators for any type of carrier pipe. Insulators shall be high density polyethylene. Insulators shall fit snug over the carrier pipe and position the carrier pipe approximately in the center of the casing pipe to provide adequate clearance between the carrier pipe bell and the casing pipe. Insulators shall be manufactured by "Recon" and be Racci Type or approved equal.

3. Installation

- a. Tolerances
 - i. All bores shall be installed at a grade no less than the minimum indicated by TAC, Chapter 317 for the desired pipe size.
 - ii. All bores shall maintain grade enough to ensure desired clearance distances between existing utilities and bore.
- b. Excavation and Backfill of Access Pits
 - i. Bore pits must be a minimum of four (4) feet from the back of curb when located for boring under roadways.
 - ii. Do not allow excavation over the limits of the bore or tunnel as specified.
 - iii. Trench walls of access pits adjacent to the bore or tunnel face shall be truly vertical. Shore the trench walls as necessary to protect workmen, the public, structures, roadways, and other improvements.
 - iv. Excavations within the right-of-way and not under surfacing shall be backfilled and consolidated by mechanical methods as specified in these standards for compaction of trenches under roadways.
 - v. Surplus material shall be removed from the right-of-way and the excavation finished to original grades.

- vi. Backfill pits immediately after the installation of the carrier pipe is completed. If carrier pipe is not installed immediately after casing pipe installation, the right-of-way Owner may require the access pits be temporarily backfilled until installation of carrier pipe.
- vii. Where seeding or sodding is disturbed by excavation or backfilling operations, such areas shall be replaced by seeding or sodding, as specified.

M. Lift Stations

1. Minimum requirements, plans and specs submitted for approval by City Manager or designee. Lift Stations must be designed in accordance with 30 TAC, 317.3.
2. Instrumentation and Control
 - a. The voltage supplied for pump operation shall be 3 phase, 480 volts. Converting single phase power to three phase power using additional mechanical equipment shall not be allowed.
 - b. Wet-well level control shall be achieved through the use of an ultrasonic level indicating transmitter.
 - c. A main disconnect shall be installed on power supply between the meter and control panel.
 - d. All lift stations dedicated to the City of Lake Worth shall have SCADA telemetry equipment installed, at the expense of the Developer, that interfaces with the City's SCADA system and meets the City's protocol and specifications.
 - e. Submersible pumps shall be provided with moisture and motor over-temperature sensors.
3. Site Requirements
 - a. A concrete pad will be required at the front of the control cabinet. The pad shall provide a 3-foot working area away from the face of the cabinet and extend the width of the enclosure mounting structure. Pad depth shall be a typical 4 inches.
 - b. A 1-inch minimum potable water service is required. The water service may be set in a standard 18-inch galvanized water meter box with a 1-inch brass angle stop.
 - c. The site shall be graded to drain away from the station to prevent storm-water inflow or infiltration into the wet-well.
 - d. The site shall be located outside of the 100-year floodplain.
 - e. The site shall not be located within 100 feet of an existing or proposed residence, if possible.
 - f. If applicable the lift station site driveway shall include driveway area for maintenance vehicles to park off public roadway while performing maintenance, the minimum driveway length shall be 15 feet.
 - g. A concrete driveway turning area is required where access drives extend more than 20 feet from main roads. The driveway area shall be "T" shaped with the applicable turning radius. The minimum driveway width shall be 15 feet.

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SECTION 4.13 STORM DRAINAGE FACILITIES

A. General

The purpose of this Section is to establish standard principles and practices for the design and construction of storm drainage facilities within the City of Lake Worth. The design factors, formulas, graphs, and procedures described in the following pages are intended to serve as guidelines for the design of the storm drainage facilities provided for developments within the City. Responsibility for the actual design remains with the design engineer. Deviation from the requirements of this Criteria must be approved by the City Council.

All materials, construction, and testing shall be in conformance with the City of Lake Worth Design Standards and the NCTCOG Standard Specifications for Public Works Construction.

B. Hydrology

Drainage Facility	Design Recurrence Interval
Closed Storm Sewer Systems	10-year with 100-year positive overflow for inlets on grade in streets such that the depth of flow in the street does not exceed the top of curb. For inlets at low points or in a roadway sag, the 100-year flow must be captured within the curb.
Culverts and Bridges	100-year
Concrete-lined Chan-	100-year
Earthen Channels	100-year
Detention Facilities	100-year

a. Drainage Area Delineation

- i. The size and shape of each watershed and associated sub-basins (on-site and off-site) shall be determined for each drainage facility. The determination should be based on topographic maps, at a scale of 1 inch = 200 feet (1 in = 200 ft) or greater.
- ii. Inlet placement should also be taken into account during the delineation of drainage areas. Each proposed inlet shall have an independent drainage area.

b. Rainfall

The Intensity-Duration-Frequency (IDF) curve shows anticipated rainfall rates for storm durations from five (5) minutes to 24 hours.

This curve has been prepared using the information derived from Technical Paper No. 40 (Soil Conservation Service, May 1961).

c. Storm Frequency

The drainage system shall provide overflow at all low points and identify the overflow path on the plans and on the plat as applicable. The term "positive

overflow" means that when the inlets do not function properly or when the design capacity of the conduit is exceeded, the excess flow can be conveyed overland along a grassed or paved course. Normally, this would mean along a street or alley. If not, the excess flow path shall require the dedications of drainage easements on private property.

The following guidelines shall be followed to determine the storm frequency to be used to design a storm drainage system.

C. Runoff Calculations

1. Methodology

- a. The selection of method to be used to calculate runoff depends upon the size of the contributing drainage area at the most downstream point of the project.
- b. The Rational Method is acceptable for designing projects with drainage areas of less than 100 acres.
- c. A Unit Hydrograph method is required for projects with larger drainage areas.
- d. Regardless of the method used, runoff computations shall be based upon fully developed conditions in accordance with the ultimate land use assumption in the current Comprehensive Land Use Plan for the City of Lake Worth. The design engineer shall size drainage facilities by disregarding the detention effects of upstream properties and calculating runoff as if the off-site property was developed without any detention. If an approved regional detention/retention facility is in operation, the design engineer may size downstream drainage facilities based on consideration of the detention effects of the regional facility.

2. Procedure for drainage areas less than 100 acres

a. Methodology

The Rational Method is based on the principle that the maximum rate of runoff from a given drainage area for an assumed rainfall intensity occurs when all parts of the area are contributing to the flow at the point of discharge. Therefore, the duration of the storm used is equivalent to the time of concentration of the basin.

The formula for calculation of runoff by the Rational Method is:

$$Q = CIA$$

where, Q = the maximum rate of discharge (cfs)

C = Coefficient of runoff, based on topography, soil, land use, and moisture content of the soil at the time the rainfall producing runoff occurs

I = Intensity of rainfall for the time period it takes for flow from the most hydraulically distant point of the drainage area to reach the point of design (in/hr)

A = Drainage area contributing to the runoff at the specified concentration point/outfall (acres)

b. Runoff Coefficient

The runoff coefficient "C" in the Rational Method equation is dependent on the character of the soil and the degree and type of development in the drainage area. Normally, as a drainage area develops the amount of runoff increases in proportion to the amount of impervious area. The runoff coefficient shall be based on the ultimate land use as recommended in the current City of Lake Worth Comprehensive Plan.

c. Time of Concentration

The time of concentration is the longest time, without interruption of flow by detention devices, for a drop of water to flow from the most hydraulically distant point of the drainage area to the point of concentration (point of design) of the basin. Note that this is not necessarily the point at the longest physical distance from the point of concentration, but the point from which it will take runoff the longest time to reach the concentration point.

SCS methodology is recommended to determine the time of concentration (T_c). This method separates the flow through the watershed into three regimes: sheet flow, shallow concentrated flow, and open channel flow.

i. Sheet Flow

Sheet flow is flow over plane surfaces. It occurs in the uppermost area of the defined basin. The time of concentration in minutes for sheet flow is determined using the following equation:

$$T_{c_{SheetFlow}} = 60 \frac{D}{V}$$

where, D = distance along the flow path (feet)
 V = velocity (feet per second)
 T_c = time of concentration (minutes)

The longest flowpath for the water is determined for each basin begins at the most hydraulically distant point in the basin and ends at the concentration point for the basin. The sheet flow length is then measured along this flowpath from the uppermost part of the basin for a length no more than three hundred (300) feet (At a maximum distance of three hundred (300) feet, sheet flow typically changes to shallow concentrated flow).

A slope should be estimated along this length of flow. A velocity corresponding to this slope was determined using the upland method graph found in Appendix B-1.

iii. Shallow Concentrated Flow

Shallow concentrated flow typically begins where sheet flow ends. A projected slope should be established along the flow-line for the shallow concentrated flow length. A velocity corresponding to this slope is determined from the shallow concentrated flow graph in Appendix B-1. The time of concentration in minutes for shallow concentrated flow is determined by the following equation:

$$T_{c_{ShallowConcentratedFlow}} = 60 \frac{D}{V}$$

where, D = distance along the flow path (feet)

V = velocity (feet per second)

T_c = time of concentration (minutes)

iii. Open Channel Flow

Open channel flow is applicable for large channel sections (and closed storm sewers in some cases). In most cases, it is not applicable for the Rational Method (since large channels indicate large watersheds where a Unit Hydrograph Method is applied in the City of Lake Worth). The time of concentration for open channel flow is determined using the following equations:

$$T_{c_{ChannelFlow}} = 60 \frac{D}{V}$$

where, D = distance along the flow path (feet)

V = velocity (feet per second)

T_c = time of concentration (minutes)

Where V is estimated using a combination of the continuity equation and Manning's equation:

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

where, n = Manning's "n"

R = A/P = hydraulic radius (feet)

A = area (square feet)

P = wetted perimeter (feet)

S = slope (ft/ft)

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iv. Resulting Time of Concentration

The time of concentration is the sum of the sheet flow, shallow flow, and open channel flow segments.

$$T_c = T_{c_{SheetFlow}} + T_{c_{ShallowConcentratedFlow}} + T_{c_{ChannelFlow}}$$

v. Resulting Time of Concentration of Inlets.

When designing inlets and laterals, the time of concentration is equal to the inlet time. The design engineer shall compare the specified inlet times in the table below to the actual calculated inlet time by computing the flow time overland and along the gutter to the first inlet. In no case shall a shorter inlet time or time of concentration be used than the times specified in the table below.

The following table includes the values for coefficient of runoff and minimum inlet time for different land uses in the City.

Land Use	"C"	Inlet Time (min)
Park Areas – No Developed	0.30	15
Developed Park Sites	0.40	15
Single Family Residential	0.55	15
Duplex	0.60	15
Multiple Family	0.80	10
Schools	0.70	10
Churches	0.70	10
Neighborhood Commercial	0.80	10
Office Commercial	0.80	10
Commercial	0.90	10
Industrial	0.90	10

vi. Travel Time

The travel time in a conduit or channel from the inlet to the point of design shall be determined through the use of Manning's equation. When attempting to determine offsite fully developed flow for a currently undeveloped area, or single-family flow for the proposed on-site detention design, travel time can be estimated by assuming an average flow velocity of six (6) feet per second from the inlet to the point of concentration.

d. Procedures for Drainage Areas greater than 100 acres

i. Methodology

A Unit Hydrograph Method is required for drainage areas in excess of 100 acres. The use of a unit hydrograph calculation will be based upon standard and accepted engineering principles subject to the approval of the City Manager or designee. The recommended Unit Hydrograph models are HEC-1 or HEC-HMS.

ii. Rainfall

When using a Unit Hydrograph Method to determine the peak runoff of a basin, a 24-hour storm duration is to be used with a SCS Type II distribution. Rainfall values can be determined using the City of Lake Worth IDF curve, found in Appendix B-1.

iii. Loss Rate

To determine the loss rate of the basin, the SCS Curve Number (CN) method shall be used. CN values shall be taken from TR-55 and should in general correspond with the C factors used in the Rational Method.

iv. Time of Concentration

The time of concentration for use in Unit Hydrograph applications shall be developed using SCS methods. That methodology is described in the Rational Method section of this Ordinance.

v. Routing

The method used for routing of the Unit Hydrograph through the system depends on the system in question. For artificial channels and storm drainage systems, stream routing can be performed using the Muskingum Cunge method. That method uses the Manning's coefficient, reach length, channel slope, and shape of the channel to determine the storage of the channel reach.

In ponds and natural channels, the Modified Puls Routing method should be used. The Modified Puls method uses a stage-storage-discharge method to determine the storage necessary in a channel reach to produce a given discharge.

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D. Detention

1. Definition

Storm water detention basins are used to temporarily detain storm water, thereby reducing peak discharge rates. Detention basins in the City of Lake Worth are required to provide adequate volume and discharge to reduce the 100-year peak discharge rate from newly developed areas one acre or larger to that of a single family development of the same size ($C = 0.55$) to satisfy the following requirements: compliance with City ordinances, preservation of existing floodplains along major creeks, prevention of overloading inadequate downstream storm drainage facilities, and prevention of erosive conditions in water courses. Either regional detention/retention ponds or on-site detention/retention ponds may be used to provide the required detention.

2. Methodology

Basins without upstream regional detention ponds or upstream private detention ponds routed through the site and with drainage areas 100 acres or less can be designed using the Modified Rational Method. Routed Unit Hydrographs must be used in the design of basins with drainage areas greater than 100 acres or basins where the Modified Rational Method may not be applied. The hydrograph routings through the detention basin are to be done using the Modified Puls Method.

3. Criteria

- a. The 100-year inflow and allowable outflow will be determined using the methodology described in the "Hydrology" section of these standards.
- b. A maintenance plan, approved by the City Manager or designee and the Director of Public Works, is required for all detention facilities and shall meet the standards given in this section.
- c. The minimum amount of storage volume of the detention basin shall be that volume required to reduce the 100-year runoff rate to an equivalent single-family rate. In addition, detention basins are required to include one (1) foot of freeboard.
- d. An emergency spillway or overflow area shall be provided at the maximum 100-year pool level. From the spillway, a conveyance path must be provided to the nearest right-of-way or drainage channel.
- e. The outflow structure shall discharge flows into natural streams or unlined channels at a non-erosive rate.
- f. Detention basins shall provide positive drainage throughout the pond with a minimum pond bottom slope of 0.30%. The maximum side slope permitted around the detention pond is 4(H):1(V).
- g. The Developer/Owner shall use low maintenance vegetation for vegetative cover, as approved by the Director of Public Works prior to planting. The selection of materials shall comply with the current ground cover listing for North Central Texas furnished through the Texas Agricultural Extension Service.
- h. A pilot channel shall be used within detention ponds with a bottom width five (5) feet or greater

- i. The design of detention facilities shall include provisions for collecting and removing sediment deposited after collecting and releasing storm water.
- j. The City does not assume maintenance for private detention ponds. All detention ponds must be placed in a private drainage easement dedicated on the final plat. Public storm sewer infrastructure draining to or away from a private detention must be placed in a public drainage easement. In cases where a private detention pond will be used by owners platting separate lots, a Joint Detention Agreement must be in place between the property owners and must be accepted by the City prior to the property being final platted.
- k. Detention is allowed in parking lots. Detention in parking lots may not be deeper than six (6) inches in depth at any location. The exception to the six (6) inch depth is a nine (9) inch maximum in areas designated as truck parking only. Parking spaces inundated by detained storm water may not be counted toward required parking ratios for the development. Warning signs must be placed on the site designating that the area may be inundated in an extreme storm event.
- l. Detention facilities shall be designed to empty in less than 48 hours, unless it is also serving as a sediment control facility.
- m. Detention facilities shall not be counted as an erosion control measure unless:
 - n. the basins are designed to empty a minimum of 24 hours from the storm event, and
 - o. adequate sediment storage areas in the basin have been set aside and are maintained.
- p. The property owner shall maintain all detention facilities. A maintenance plan must be included on the final construction plans outlining these minimum measures:
- q. Facilities shall be mowed at least twice a year to control weeds and discourage woody growth.
- r. Debris, litter, and accumulated sediment shall be removed from detention facilities at least twice a year. Particular attention should be given to removal of debris, litter, and sediment around outlet structures.
- s. Conformance with the maintenance plan as approved by the City Manager or designee is the responsibility of the owner of the detention facility.
- t. An example of the calculations for sizing a detention pond using the Modified Rational Method can be found in Appendix B-5.
- u. Erosion control measures shall be installed in detention ponds to prevent erosion and displacement of sediment to downstream facilities. Erosion control measure shall remain in place until the Director of Public Works determines a vegetative cover is established in the detention pond. Sediment control measures shall be approved by the Director of Public Works.

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E. Hydraulics

1. Refer also to Section 3.2.
2. Property shall be developed so that the rate of runoff created by the development as it leaves the property does not exceed the rate of runoff that would have been created if the property had been developed as a single-family residential property. Detention shall be designed in accordance with the "Detention" section of this document.
3. Runoff calculations must be based on the proposed lot grading for the development. Runoff contributed from off-site sources must be considered in the calculations. All off-site drainage must be calculated at the proposed ultimate land use (fully developed conditions) according to the current City of Lake Worth Comprehensive Land Use plan. Each on-site inlet shall have one contributing drainage area. The terms "ultimate" and "fully developed" are interchangeable with respect to the drainage sections of this Ordinance.
4. All drainage systems must be sized for ultimate conditions without the effects of detention facilities. If an approved regional detention facility is in operation, the design engineer may size drainage facilities based on consideration of the detention effects of the regional facility.
5. All drainage systems shall provide for positive overflow at all low points. Positive overflow means that when the inlets do not function properly or when the design capacity of the conduit is exceeded, the excess flow can be conveyed overland. Additional guidelines for positive overflow are included in the "Hydrology" section.
6. When adjacent to the floodplain, the finished floor (FF) elevation of commercial buildings shall be a minimum of one (1) foot above the 100-year fully-developed water surface elevation (WSE) of the adjacent floodplain. The FF elevation of residential buildings shall be a minimum of two (2) feet above the 100-year fully-developed WSE of the adjacent floodplain.

F. Open Channel

1. General Criteria
 - a. Open channels may be used instead of enclosed systems when the drainage area of the contributing flow is greater than one hundred (100) acres. Open channels shall not be permitted when the drainage area is less than 100 acres. An exception to this guideline is a development draining directly to a receiving creek or open channel.
 - b. Improved open channels shall provide a cross section which reduces all velocities to six (6) feet per second or below for grass-lined channels.
 - c. For channel sections with velocities ranging from six (6) to 15 feet per second, a lined section must be specified for the channel. Lining types such as concrete and gabions may be used upon approval of the City Manager or designee. Channel velocities greater than 15 feet per second will not be permitted.
 - d. The Developer/Owner shall use low maintenance vegetation for vegetative cover, as approved by the Director of Public Works prior to planting. The selection of materials shall comply with the current ground cover list-

ing for North Central Texas furnished through the Texas Agricultural Extension Service.

- e. A pilot channel shall be used in open channels with a bottom width five (5) feet or greater.
- f. In cases when the property boundary follows the centerline of the channel or incorporates only a portion of the channel cross sections, the Developer/Owner shall construct all improvements required on their property for the ultimate channel design. If channel lining is required, the Developer/Owner shall coordinate with adjacent owners in order to construct these features in their entirety at the time of the channel improvements.
- g. At the discretion of the City Manager or designee, fencing and/or guardrails shall be provided for the benefit of public safety along open channels, creek sections, and detention ponds.
- h. Flumes and curb cuts are not recommended. Use of curb cuts and flumes may not be within a public drainage easement. Flumes on private property must be designed to limit erosion at the end of the flume.

2. Design Methodology

- a. Major channels or channels where backwater effects occur must be modeled using a standard backwater model. The U.S. Army Corps of Engineer's HEC-RAS model is preferred. Other models may be used that meet FEMA and standard engineering criteria, if approved by the City Manager or designee.
- b. For collector channels and swales, Manning's equation can be used to determine water surface elevations and velocities, where backwater effects from major channels or creeks are deemed to be negligible.

3. Hydraulic Design Criteria

- a. Improved channels must be designed to convey the 100-year ultimate flow within the channel banks with one (1) foot of freeboard. In bends in the channel, the superelevation of the water must be estimated and added to the freeboard of the channel on the outside of the bend. Calculations to determine the superelevation in the channel can be found in Appendix B 2.
- b. All channels must be designed to have subcritical flow. The maximum allowable Froude number for channel flow is 0.86. The calculation to determine the Froude number in the channel can be found in Appendix B-2. Hydraulic jumps are to be avoided, except at bridges and culverts. When a hydraulic jump is predicted at a bridge or culvert, the channel bottom and side slopes must be protected from erosion with a channel lining.
- c. The preferred channel shape is a trapezoidal section. Unless shown to be feasible in a soils report sealed by a Licensed Professional Engineer in the State of Texas, and approved by the City Manager or designee, improved channels shall have side slopes no steeper than:
 - i. Four (4) feet horizontal to one (1) foot vertical for earthen, grass-lined side slopes.

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- ii. 1.5 feet horizontal to one (1) foot vertical for concrete-lined side slopes.
- d. All unpaved channels shall have sufficient gradient to avoid ponding in low flow conditions. A minimum slope of 0.40% is required for all unpaved channels and swales except those used as part of a wetlands area. A concrete pilot channel shall be included in all improved major earthen channels.
- e. All channel radii shall be a minimum of three (3) times the top width of flow. If the natural channel radius is smaller than three (3) times the top width, care should be provided in the design to protect any structures from channel migration or flooding.

G. Bridges

Design Criteria

1. One (1) foot of freeboard is required between the 100-year water surface elevation and the low chord of the bridge. Exceptions to this requirement must be approved by the City Manager or designee in writing.
2. The skew of the bridge piers and abutments shall be oriented parallel to the normal or flood direction of flow, resulting in an angle of skew as close to zero degrees as possible.
3. Bridges shall be designed using standard methods. If the bridge is located across a major channel or a channel where backwater effects occur, the bridge must be included in the standard backwater model of the channel. If the HEC-2 backwater model is used, the normal bridge option shall be used for bridges without interior piers. The special bridge option shall be used for bridges with interior piers, and for situations where pressure flow and/or weir flow occurs.

H. Culverts

Design Criteria

1. One (1) foot of freeboard is required between the 100-year water surface elevation and the top of road elevation. Exceptions to this requirement must be approved by the City Manager or designee.
2. Culverts shall be designed in accordance with the Federal Highway Administration (FHWA) HDS-5 manual. Standard charts from that manual are provided in Appendix B-4. Standards in the City of Lake Worth will take precedence over the FHWA manual in cases of conflict.
3. The culverts shall be oriented such that the impacts due to the flood and normal flow angles of skew on the structure are minimized.
4. Culverts can be designed in supercritical flow for hydraulic efficiency. However, the outlet of the culvert shall be evaluated for erosion concerns, and the hydraulic jump must be forced at the outlet of the culvert, whether by design grades or an energy dissipater.
5. The maximum allowable velocity of flow through a culvert shall be fifteen (15) feet per second. The maximum allowable discharge velocity for a storm sewer system shall not exceed the permitted velocity of the receiving channel or conduit to

prevent erosion. The maximum outfall velocity of a conduit in partial flow shall be computed for partial depth and shall not exceed the maximum permissible velocity of the receiving channel unless controlled by an appropriate energy dissipater (e.g. stilling basins, impact basins, and/or riprap protection). Minimum flow within a culvert during a design event is two (2) feet per second.

I. Storm Sewer Systems

1. Materials

All storm sewer conduits within dedicated public drainage easements or public right-of-way are to be constructed using reinforced concrete pipe. Other materials are not permitted unless prior approval is obtained from the City Manager or designee.

2. Storm Sewer Design

a. Storm Frequency - Closed storm sewer systems shall be sized as designated in the "Hydrology" section of these guidelines.

b. Velocities and Grades in Storm Sewers

- i. The minimum allowable velocity in a storm sewer conduit shall be 2.5 feet per second.
- ii. The maximum allowable velocity in a storm sewer conduit is 12.5 feet per second.
- iii. The maximum allowable discharge velocity for a storm sewer system shall not exceed the permitted velocity of the receiving channel or conduit to prevent erosion. The maximum outfall velocity of a conduit in partial flow shall be computed for partial depth and shall not exceed the maximum permissible velocity of the receiving channel unless controlled by an appropriate energy dissipater (e.g. stilling basins, impact basins, and/or riprap protection).
- iv. The minimum slopes for various pipe sizes that will maintain the minimum velocity are given in Appendix B-3.
- v. A minimum of two (2) feet of separation is required (outside of pipe to outside of pipe) between storm sewer and other public utilities, except as required by TCEQ regulations. Separation closer than two (2) feet requires concrete or steel encasement of the water or sanitary sewer line.

c. Hydraulic Gradient of Storm Sewers

- i. The Hydraulic Grade Line (HGL) shall be established for all storm drainage design and included in the profile of the storm sewer. The 10-year and 100-year HGLs must be shown on the profiles of public storm sewer systems.
- ii. When performing hydraulic analyses for storm drainage system design, the starting HGL elevation shall be based on the following criteria:
 - When the ratio of the drainage area of the receiving creek (at the confluence location) to the drainage area of the sys-

APPENDIX B DCCS

- tem being designed is 15:1 or greater, the 10-year water surface of the receiving creek shall be used as the starting 100-year HGL elevation for HGL calculations.
- When the ratio of the drainage areas is less than 15:1, the 100-year elevation on the receiving creek shall be used as the starting water surface for design calculations.
- iii. If a system is discharging into an existing downstream storm drain, the HGL shall be tied into the HGL for the 10-year or 100-year event (as applicable) in the downstream storm drain. It is the design engineer's responsibility to evaluate all data employed in the analysis, including any data used from existing plans or provided by the City. If the existing downstream system is undersized, downstream flooding cannot be increased (this may require additional detention than that required by these guidelines) and the proposed system should be designed to accommodate future downstream drainage improvements.
 - iv. Computation of the hydraulic grade line shall proceed from downstream to upstream in a manner consistent with typical engineering methods.
 - v. If at any time the storm sewer system enters partial flow, the HGL at the next most upstream structure (wye, manhole, etc.) will begin again at the top of pipe elevation.
 - vi. Friction head loss throughout the system during pressure flow shall be determined by direct application of Manning's Equation. A Manning's 'n' value of 0.013 is to be used for these calculations when concrete storm sewer is used.
 - vii. The design event flow (cfs), velocity (fps), velocity head (ft), and hydraulic slope (ft/ft) for each portion of the storm drainage system in pressure flow is to be shown on the profile of the system. The design event flow, velocity, depth of flow (ft), and flow capacity of the system for each portion of the storm drainage system in partial flow is to be shown on the profile of the system.
 - viii. In addition to friction losses, minor head losses at points of turbulence shall be calculated and included in the computation of the hydraulic gradient. The following minor losses shall be accounted for in the storm sewer system design. Equations to determine these head losses are located in Appendix B-2.
 - Entrance Losses – Entrance losses to a closed storm sewer system from an open channel, pond, or inlet shall be calculated. The resulting hydraulic grade line shall be compared to inlet control conditions for the storm sewer. The higher of the two values shall be used as the controlling upstream hydraulic grade line.
 - Expansion and Contraction Losses – For locations within the storm sewer system where the flow area available increases or decreases, expansion and contraction head loss shall be calculated.

- Manhole and Bend Losses – Head losses associated with manholes used for pipe direction changes and bends in pipes of equal diameter shall be calculated.
- Junction Losses – Head losses associated with wye connections or manholes with branch laterals entering the main line shall be calculated.

d. Inlet Design

i. Inlet Placement

- Storm sewer inlets shall be located along paved streets at intervals that do not allow the 100-year storm to exceed the top of curb elevation and allow the roadway to meet the required lane opening criteria.
- Inlets shall be generally placed upstream of intersections. A maximum of five (5) cfs will be allowed to cross intersections of residential streets in the 100-year event. However, only one street shall be crossed with surface drainage at any one intersection, and this street shall be the lower classified street. No surface drainage will be permitted to cross a Collector or Arterial roadway.
- When an alley intersects a street, inlets shall be placed in the alley to prevent flow from that alley from causing the capacity of the intersecting street to be exceeded.
- When a driveway (residential or commercial) intersects a street, a maximum of five (5) cfs will be allowed to be discharged into the street. Inlets shall be placed in the driveway whenever flow down that driveway would cause the capacity of the intersecting street to be exceeded.

ii. Inlet Capacity and Size

- The minimum inlet size shall be five (5) feet. Curb inlets shall be five (5), ten (10), fifteen (15), and twenty (20) feet in length. No more than twenty (20) feet of inlet shall be placed along a gutter at any one location.
- The minimum lateral pipe size shall be eighteen (18) inches for use with five (5) foot inlets, 21-inch laterals for use with ten- and fifteen-foot and drop inlets, and 24-inch laterals for use with 20-foot inlets. Where laterals tie into trunk lines, place the laterals on a 60-degree angle with the trunk line and connect them so that the longitudinal centers intersect.
- Curb inlets may not be utilized as junction boxes.
- At sags, the flow into a curb inlet shall be one (1) cfs per linear foot of inlet.
- Additional inlet sizing equations can be found in Appendix B-2.

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- iii. Design
 - City standard curb inlets are required on all public storm sewer systems.
 - Slotted drains and combination inlets are not allowed unless approval is obtained from the City Manager or designee.
 - Drop (wye) and grate inlets may be used in specific situations with the prior approval of the City Manager or designee.
 - All storm drain inlets shall be sized in accordance with the State of Texas Department of Highways and Public Transportation Hydraulic Design Manual Chapter 10 – Storm Drains
- e. Outfall Design
 - i. The flow lines of storm sewer conduits that discharge into open channels shall match the flow line of the channel unless the outfall is submerged beneath the normal water surface elevation or the channel is fully lined.
 - ii. Flumes are not permitted to convey discharge to the flow line of earthen creeks.
 - iii. Pipes may intersect with major creeks at angles not to exceed 60 degrees.
 - iv. Pipes may intersect with minor creeks at angles not to exceed 90 degrees only if the City Manager or designee deems that an angle of intersection greater than 60 degrees will not cause an erosive condition, otherwise the angle may not exceed 60 degrees.
- f. Access
 - i. Access points to a storm drain shall be no greater than 600 feet apart in storm drains less than 24 inches in diameter and no greater than 1200 feet apart in larger conduits.
 - ii. Manhole structures shall be rectangular and as specified in the construction details of these standards (Appendix B-6).

J. Roadway Drainage

1. Design Storm Frequencies – Street sections must be designed to contain the 100-year storm event within the curb.
2. Permissible Spread of Water – The spread of water on the roadway shall be limited to prevent the street from losing its effectiveness as a traffic carrier, which is an important concern in the case of emergency vehicles which may not be able to traverse an inundated roadway. The following table lists the allowable encroachment limits.

Street Classification	Allowable Encroachment (during the 100-yr event)
Local	Maximum depth of six (6) inches or top of curb.
Collector	One twelve (12) foot lane must remain open.
Thoroughfare	One twelve (12) foot lane of traffic in each direction must remain open.

3. Calculation of Flow Depth in Gutters – The flow of storm water in curb and gutter sections is classified as open channel flow. As such, the design calculations are based on a modified form of Manning's equation. The modified Manning's equation to determine gutter discharge is included in Appendix B-2.
4. Alley Flows
 - a. The flow created by the 100-year storm shall be contained within the limits of pavement of all paved alleys.
 - b. Curbs are required for at least ten-feet on either side of an inlet in an alley.
 - c. Design flow in alleys shall be calculated by using the same equation to calculate gutter flow for a straight crown calculated in two triangular sections.

K. Residential Grading and Drainage

1. Surface runoff from residential lots shall cross no more than one additional lot before being directed toward the street or a dedicated drainage system. When the flow reaches the second lot, side lot swales shall be in place to direct the flows to the street or to a dedicated City drainage system within an easement in the rear yard. Where lot to lot drainage occurs, the lot lines shall be aligned and a dedicated private drainage easement shall be provided.
2. Three (3) General Categories of residential lot grading and drainage plans are anticipated within the City of Lake Worth, as shown in Figure No. 1. Specific deviations from these three plans will be considered on an individual basis.
3. When adjacent to the floodplain, the finished floor (FF) elevation of commercial buildings shall be a minimum of 1 foot above the 100-year fully-developed water surface elevation (WSE) of the adjacent floodplain. The FF elevation of residential buildings shall be a minimum of 2 feet above the 100-year fully-developed WSE of the adjacent floodplain.

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SECTION 4.14 DEVELOPMENT IN THE FLOODPLAIN

Site design shall conform to the criteria and standards herein and the regulations in Article 10.400 of the Lake Worth Code of Ordinances and the regulations herein.

A. Development within the Fully Developed Floodplain

1. All development near the Special Flood Hazard Area (SFHA) shall require the approval of the City Manager or designee.
2. The City Manager or designee should be contacted for information on approved floodplain hydraulic models for fully developed watershed conditions for the channels in the City. If a hydraulic model is not available from the City, then it must be provided by the developer of the property.
3. Prior to the approval for preliminary grading for proposed development near the FEMA regulated floodplain, a floodplain study must be submitted to and approved by the City. The floodplain study must verify the 100-year existing and ultimate floodplain limits, as well as the proposed alterations to the floodplain. The floodplain study shall demonstrate that the improvements will not increase the 100-year fully developed floodplain elevation at any location along the channel. No development within the floodway or floodplain will be allowed unless approved by the City Manager. This report must contain the following items:
 - a. Written report describing the project and summarizing the effects of the floodplain study. This narrative should contain tables comparing the pre-and post-project flood elevations.
 - b. A hydraulic model of the existing condition of the floodplain. This model should be produced using the United States Army Corps of Engineers HEC-RAS modeling program. The City will accept any version of HEC-RAS that is accepted by the Federal Emergency Management Agency (FEMA). The cross sections within the modeling must be based on FEMA datum (NGVD 29).
 - c. A hydraulic model of the proposed condition of the floodplain. This model shall take into consideration any changes that are proposed to take place within the floodplain.
 - d. Stream profiles and cross sections generated by the hydraulic modeling software.
 - e. Existing and proposed conditions floodplain work maps. These work maps shall be based on a minimum of 2-foot topographic contours. The topographic contours should be based on FEMA vertical datum. The proposed condition floodplain work map must include the proposed grading to take place within the floodplain and the limits of the proposed development within the floodplain.
 - f. If the 100-year fully developed flow is not available from the City, or if the Developer wishes to update the 100-year fully developed flow for the channel, the report must document the generation of the fully developed peak flow value. The methodology required to

determine these flows is the same as that describe in the “Hydrology” section of this manual.

B. Development within the FEMA Floodplain

1. Development within the FEMA Floodplain is not allowed unless the design engineer can demonstrate that the FEMA floodplain is not accurate, and the development will be located outside the 100-year fully developed floodplain.
2. A Letter of Map Revision (LOMR) submittal to FEMA must be submitted to the City upon completion of the construction. This submittal must follow the criteria set forth by FEMA. The National Flood Insurance Program (NFIP) guidelines 65.3 and associated references are hereby incorporated by reference.
3. A Conditional Letter of Map Revision (CLOMR) may be required for developments that do not encroach upon the FEMA floodway at the City Manager or designee's discretion. If a CLOMR has been required by the City, then the City will not grant a building permit for the subject tract until, at a minimum, the CLOMR has been approved by the City.
4. The CLOMR and LOMR must have properly completed FEMA forms that specify that the City will not perform maintenance within the floodplain.
5. Any development within the floodplain shall only operate with an approved US Army Corps of Engineers jurisdictional determination USACE AJD).

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CHAPTER 5 CONSTRUCTION REQUIREMENTS AND STANDARD DETAILS

SECTION 5.1 CONSTRUCTION REQUIREMENTS

A. Trench Safety

1. In conformance with House Bills 662 and 665 as passed by the Seventieth Legislative Regular Session of the State of Texas, all construction projects within the City of Lake Worth or its extraterritorial jurisdiction is provided by the Municipal Annexation Act (Article 9700, Vernon's Texas Civil Statutes) shall contain provisions for trench safety.
2. On construction projects in which trench excavation will exceed a depth of five (5) feet, the uniform set of general conditions must require that the bid documents and the contract include detailed plans and specifications for adequate safety systems that meet Occupational Safety and Health Administration standards and that these plans and specifications include a pay item for these same safety systems.

B. Erosion Control Plan

1. An erosion control plan or Storm Water Pollution Prevention Plan (SWPPP) shall be provided with each construction plan submitted for review by the City Manager and/or designee.
2. Each erosion control plan shall clearly identify all erosion and sediment control measures to be installed and maintained throughout the duration of the project.
3. The erosion control plan or SWPPP shall meet the requirements outlined in the most recent versions of the NCTCOG *Integrated Stormwater Management Technical and Criteria Manuals* and the EPA *Stormwater Phase II Rule*.

C. Traffic Control Plan

1. A traffic control plan shall be submitted whenever traffic is disrupted as defined in the latest version of the *Texas Manual for Uniform Traffic Control* by the Texas Department of Transportation.
2. It shall be submitted at least 72 hours prior to any activities affecting traffic.

D. Utility Service Interruption

1. The developer and/or a representative of the developer shall provide a minimum of 72-hour notice to the City with required plans and/or documentation prior to interruption of service, such as utilities and road closure. The City may, at its discretion, require a meeting prior to disruption of services.
2. In the event that existing utility service is to be interrupted during construction, official notice as well as meeting with the City and all other applicable parties shall be held 72 hours prior to interruption.

SECTION 5.2 STANDARD DETAILS

Refer to Appendix B-6, Standard Construction Details

APPENDIX B-2 Hydraulic Equations

APPENDIX B-3 Hydraulic Tables

APPENDIX B-4 Hydraulic Figures

APPENDIX B-5 Sample Detention Calculations

APPENDIX B-5 Sample Detention Calculations

APPENDIX B-6 Standard Construction Details

PAVING DETAIL	DETAIL NO.	REVISION DATE
CONCRETE STREET SECTIONS	P-1	MAY 2006
STEEL LAYOUT PLAN	P-2	MAY 2006
INTERSECTION JOINT SPACING	P-3A	MAY 2006
CONCRETE PAVEMENT JOINTS	P-3B	MAY 2006
CONCRETE PAVEMENT JOINTS	P-3C	MAY 2006
STANDARD CURB AND GUTTER	P-4	MAY 2006
LAYDOWN CURB AND RESIDENTIAL DRIVEWAY	P-5A	MAY 2006
LAYDOWN CURB AND COMMERCIAL DRIVEWAY	P-5B	MAY 2006
STREET HEADER	P-6	MAY 2006
TYPICAL ALLEY SECTION	P-7	MAY 2006
WHEELCHAIR RAMP	P-8	MAY 2006
CONCRETE SIDEWALK	P-9	MAY 2006
MANHOLE AND WATER VALVE BOXOUT	P10-A	MAY 2006
MANHOLE AND WATER VALVE BOXOUT	P10-B	MAY 2006
CURB AND GUTTER, SIDEWALK, AND DRIVEWAY TYPICAL JOINT LAYOUT	P-11	MAY 2006
MEDIAN NOSE	P-12	MAY 2006
LEFT TURN LANE IN MEDIAN	P-13	MAY 2006
RIGHT TURN LANE WITHOUT CHANNELIZATION	P-14	MAY 2006
RIGHT TURN LANE WITH CHANNELIZATION	P-15	MAY 2006
CONCRETE VALLEY	P-16	MAY 2006
DEAD END BARRICADE	P-17	MAY 2006
METAL BEAM GUARDRAIL	P-18	MAY 2006
STANDARD WOODEN FENCE	P-19	MAY 2006
STANDARD MASONRY FENCE	P-20A	MAY 2006
STANDARD MASONRY FENCE	P-20B	MAY 2006

Minor Update - City Staff or City Engineer to update page numbers in Appendices B-1 through B-6, detail sheet numbers and dates for all tables once updated regulations are approved.

WATER DETAIL	DETAIL NO.	REVISION DATE
STANDARD WATER LINE EMBEDMENT AND BACK-FILL	W-1A	May 2006
STANDARD WATER LINE EMBEDMENT AND BACK-FILL	W-1B	May 2006
FIRE HYDRANT INSTALLATION	W-2	May 2006
GATE VALVE INSTALLATION	W-3	May 2006
AIR RELEASE VALVE ASSEMBLY (TYPE 1)	W-4A	May 2006
AIR RELEASE VALVE ASSEMBLY (TYPE 2)	W-4B	May 2006
1 INCH THROUGH 2 INCH WATER SERVICE ASSEMBLY	W-5	May 2006
FLUSHING VALVE INSTALLATION	W-6	May 2006
HORIZONTAL AND VERTICAL (DOWNWARD) THRUST BLOCKING	W-7	May 2006
VERTICAL THRUST BLOCK	W-8	May 2006
CONCRETE CRADLE AT VERTICAL BENDS	W-9	Deleted in December 2001
TYPICAL RING CONNECTION	W-10	May 2006
WATER LINE BORE AND CASING DETAIL	W-11	May 2006
3 INCH AND LARGER METER VAULT	W-12	May 2006
BLOW-OFF SUMP MANHOLE INSTALLATION	W-13	May 2006
SERVICE LINE ENCASEMENT	W-14	May 2006
CONCRETE ENCASEMENT	W-15	May 2006

SANITARY SEWER DETAIL	DETAIL NO.	REVISION DATE
STANDARD SANITARY SEWER EMBEDMENT AND BACKFILL	S-1A	May 2006
STANDARD SANITARY SEWER EMBEDMENT AND BACKFILL	S-1B	May 2006
PRECAST SANITARY SEWER MANHOLE	S-2	May 2006
CAST-IN-PLACE SANITARY SEWER MANHOLE	S-3	May 2006
DROP SANITARY SEWER MANHOLE	S-4	May 2006
MANHOLE FRAME AND COVER	S-5	May 2006
EXTENSION RING INSTALLATION	S-6	May 2006
4 INCH SANITARY SEWER SERVICE	S-7	May 2006
SANITARY SEWER MAIN LINE CLEANOUT	S-8	May 2006
ABANDONMENT OF EXISTING MANHOLE	S-9	May 2006
CONCRETE ENCASEMENT	S-10	May 2006
SANITARY SEWER LINE BORE AND CASING	S-11	May 2006

STORM SEWER DETAIL	DETAIL NO.	REVISION DATE
STORM SEWER EMBEDMENT AND BACKFILL	D-1	MAY 2006
STORM SEWER EMBEDMENT AND BACKFILL	D-2	MAY 2006
STORM SEWER EMBEDMENT AND BACKFILL	D-3	MAY 2006
STORM SEWER SUBSURFACE DRAIN	D-4	MAY 2006
STORM SEWER INLET GENERAL NOTES	D-5	MAY 2006
STORM SEWER CURB INLET	D-6	MAY 2006
STORM SEWER RECESSED CURB INLET	D-7	MAY 2006
STORM SEWER CURB INLET	D-8	MAY 2006
STORM SEWER DROP INLET	D-9	MAY 2006
STORM SEWER STORM DRAIN MANHOLE	D-10	MAY 2006
STORM SEWER REINFORCED CONCRETE COLLAR	D-11	MAY 2006
STORM SEWER CURBED FLUME AND PILOT CHANNELS	D-12	MAY 2006
STORM SEWER CONCRETE RIPRAP	D-13	MAY 2006
STORM SEWER SLOPING HEADWALL	D-14	MAY 2006
STORM SEWER VERTICAL HEADWALL	D-15	MAY 2006
STORM SEWER CULVERT SAFETY END TREATMENTS	D-16A	MAY 2006
STORM SEWER SAFETY END TREATMENT RUNNERS	D-16B	MAY 2006

APPENDIX B-1: HYDROLOGY

Drainage and Stormwater

APPENDIX B-1

APPENDIX B-1

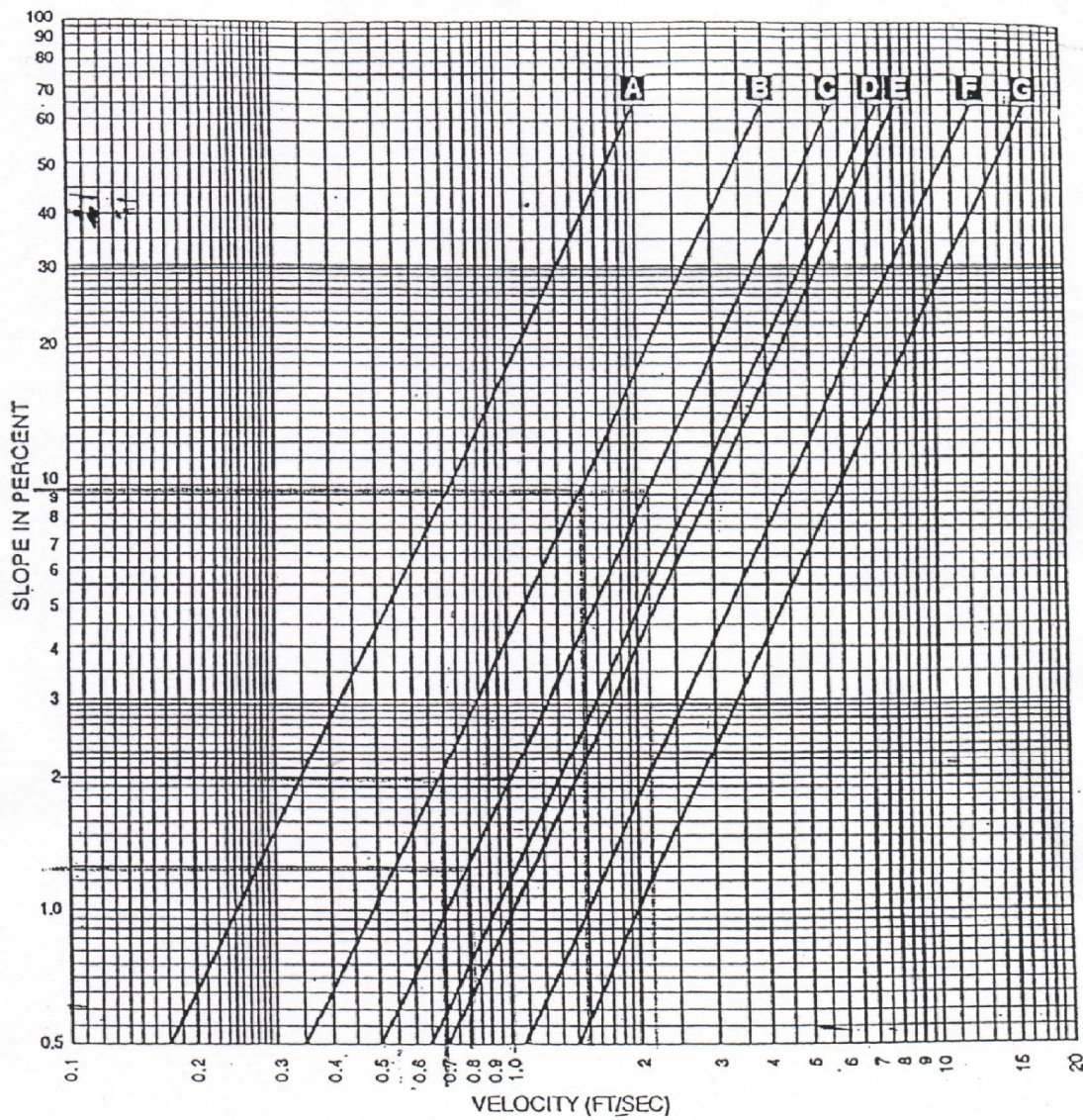
Hydrology

T_c Graph for Sheet Flow (Upland Method)

T_c Graph for Shallow Concentrated Flow

Lake Worth IDF Curve

SCS Curve Numbers



- A** Forest with heavy ground litter & hay meadow (overland flow)
- B** Trash fallow or minimum tillage cultivation; contour or strip cropped & woodland (overland flow)
- C** Short grass pasture (overland flow)
- D** Cultivated, straight row (overland flow)
- E** Nearly bare and untilled (overland flow); alluvial fans western mountain regions
- F** Grassed waterway
- G** Paved area (sheet flow); small upland gullies

FIGURE 2.2-14

Overland Flow Velocities for Upland Method of Estimating T_c

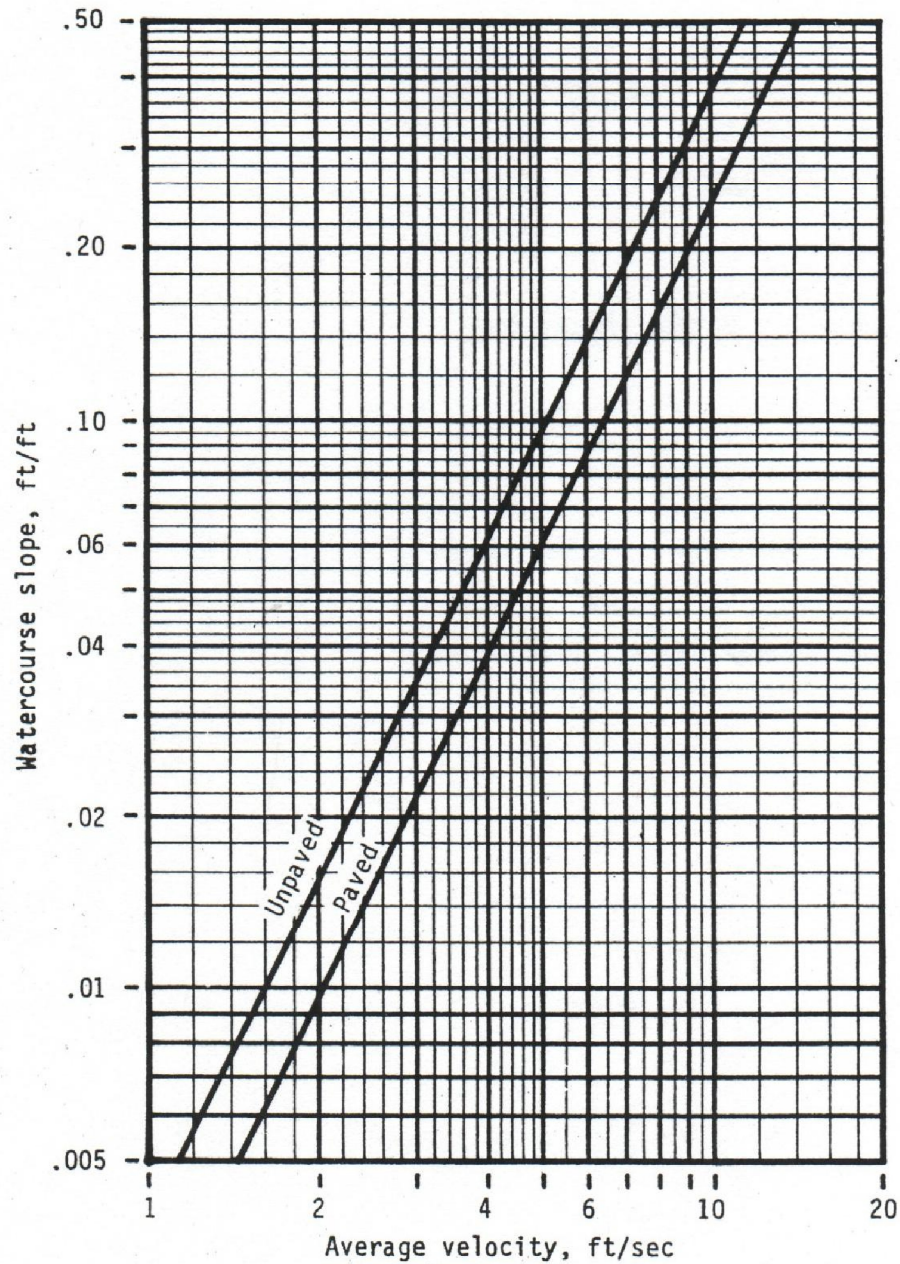


Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

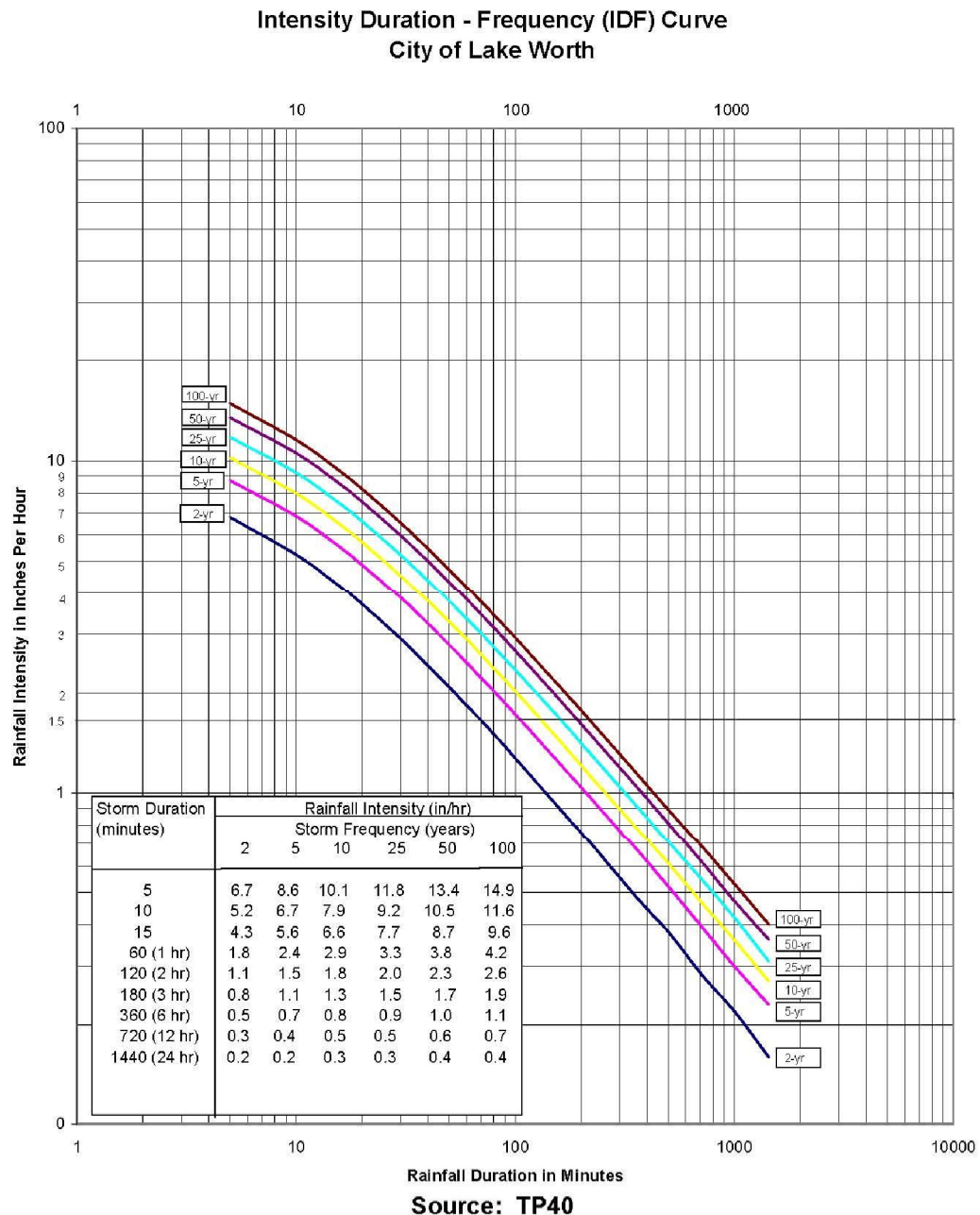


FIGURE 2 - IDF CURVE

Table 2-2a.—Runoff curve numbers for urban areas¹

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area ²	A	B	C	D
<i>Fully developed urban areas (vegetation established)</i>					
Open space (lawns, parks, golf courses, cemeteries, etc.) ³ :					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) ⁴		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
<i>Developing urban areas</i>					
Newly graded areas (pervious areas only, no vegetation) ⁵		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

¹Average runoff condition, and $I_a = 0.2S$.

²The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

³CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

⁴Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

⁵Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b.—Runoff curve numbers for cultivated agricultural lands¹

Cover description			Curve numbers for hydrologic soil group—			
Cover type	Treatment ²	Hydrologic condition ³	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
Small grain	C&T + CR	Poor	65	73	79	81
		Good	61	70	77	80
	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
Close-seeded or broadcast legumes or rotation meadow	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T + CR	Poor	60	71	78	81
		Good	58	69	77	80
	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

¹Average runoff condition, and $I_a = 0.2S$.

²Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

³Hydrologic condition is based on combination of factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes in rotations, (d) percent of residue cover on the land surface (good $\geq 20\%$), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c.—Runoff curve numbers for other agricultural lands¹

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. ²	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. ³	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	⁴ 30	48	65	73
Woods—grass combination (orchard or tree farm). ⁵	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. ⁶	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	⁴ 30	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

¹Average runoff condition, and $I_a = 0.2S$.

²*Poor*: <50% ground cover or heavily grazed with no mulch.

Fair: 50 to 75% ground cover and not heavily grazed.

Good: >75% ground cover and lightly or only occasionally grazed.

³*Poor*: <50% ground cover.

Fair: 50 to 75% ground cover.

Good: >75% ground cover.

⁴Actual curve number is less than 30; use $CN = 30$ for runoff computations.

⁵ CN 's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN 's for woods and pasture.

⁶*Poor*: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.

Fair: Woods are grazed but not burned, and some forest litter covers the soil.

Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d.—Runoff curve numbers for arid and semiarid rangelands¹

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition ²	A ³	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

¹Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.

²*Poor*: < 30% ground cover (litter, grass, and brush overstory).

Fair: 30 to 70% ground cover.

Good: > 70% ground cover.

³Curve numbers for group A have been developed only for desert shrub.

APPENDIX B-2: HYDRAULIC EQUATIONS

Drainage and Stormwater

APPENDIX B-2

APPENDIX B-2

Hydraulic Equations

Manning's Equation

Gutter Discharge

On Grade Curb Inlet Capacity

Grate Inlet Capacity

Height of Superelevation of Water in a Bend

Minor Head Loss Equations

Froude Number Calculation

Manning's Equation

The following is the Manning's Equation:

$$Q = \frac{1.486}{n} AR^{2/3} S_f^{1/2}$$

where,

- Q = Total Discharge (cfs)
- n = Coefficient of roughness (Manning's n)
- A = Cross Section area of flow (SF)
- R = A/P = Hydraulic radius of the flow (ft)
- P = Wetted perimeter (ft)
- S_f = Slope of the frictional gradient (ft/ft)

When combined with the continuity equation (Q = VA), the Manning's Equation can solve for velocity:

$$V = \frac{1.486}{n} R^{2/3} S_f^{1/2}$$

Gutter Discharge

For streets with straight crowns, the gutter section will resemble a triangular channel. The equation to determine gutter discharge is as follows:

$$Q = 0.56 \left(\frac{Z}{n} \right) (S^{1/2}) (Y^{1/2})$$

where,

- Q = Gutter Discharge (cfs)
- Z = Reciprocal of the crown slope (ft/ft)
- n = Coefficient of roughness (Manning's n)
- S = Longitudinal street or gutter slope (ft/ft)
- Y = Depth of flow at curb (ft)

The following table includes values for Manning's 'n' for use in the gutter discharge equation:

Type of Gutter	Manning's 'n'
Concrete gutter with asphalt pavement rough	0.015
Concrete pavement broom finish	0.016

Capacity of Curb Inlet on Grade

To determine the capacity of a curb inlet on grade, first determine the ratio of the flow in the locally depressed gutter section to the total flow in the road.

$$E_o = 1 / \left\{ 1 + \frac{S_w}{S_x} \left[\left(1 + \frac{S_w/S_x}{(T/W) - 1} \right)^{2.67} - 1 \right]^{-1} \right\}$$

where,

E_o = Ratio of flow in the depressed gutter to the total flow

S_w = Gutter cross slope (ft/ft)

S_x = Roadway cross slope (ft/ft)

T = Width of flow in roadway (ft)

W = Width of depressed gutter section (ft)

Then calculate the equivalent cross slope at the depressed curb inlet opening.

$$S_e = S_x + \frac{a}{W} E_o$$

where,

S_e = Equivalent cross slope (ft/ft)

S_x = Roadway cross slope (ft/ft)

a = Gutter Depression Depth (ft)

W = Width of depressed gutter section (ft)

E_o = Ratio of flow in the depressed gutter to the total flow

Then calculate the inlet length required to capture 100% of the gutter flow.

$$L_T = 0.60Q^{0.42} S_L^{0.3} \left(\frac{1}{nS_e} \right)^{0.6}$$

where,

L_T = Required length of inlet (ft)

Q = Total flow in the roadway (cfs)

S_L = Roadway longitudinal slope (ft/ft)

n = Manning's 'n' value

S_e = Equivalent cross slope (ft/ft)

The efficiency of a curb inlet opening shorter than L_T is:

$$E = 1 - \left(1 - \frac{L}{L_T}\right)^{1.8}$$

where,

E = Inlet Efficiency

L = Length of the curb inlet opening (ft)

L_T = Required length of inlet to capture 100% of the roadway flow (ft)

The total flow captured by the curb inlet is:

$$Q_i = EQ$$

where,

Q_i = Flow capture by inlet (cfs)

E = Inlet Efficiency

Q = Total flow in the roadway (cfs)

Grate Inlet Capacity in a Sag

A grate inlet in a sag will either act as a weir or an orifice, depending upon the depth of ponding at the grate. The total flow captured by a grate inlet is equal to the lesser total of these two equations.

$$Q_{iw} = 3.0Pd^{1.5}$$

where,

Q_{iw} = Flow captured by inlet (cfs)

P = Perimeter of the grate ($2W+2L$ -width of bars in grate) (ft)

d = Depth of ponding at the grate (ft)

$$Q_{io} = 0.67A_g(2gd)^{0.5}$$

where,

Q_{io} = Flow captured by inlet (cfs)

A_g = Clear opening of the grate (SF)

P = Perimeter of the grate (ft)

d = Depth of ponding at the grate (ft)

The smaller of these two flow values shall be used to determine the flow captured by a grate inlet. Whichever equation is used, the flow value shall be halved, to take potential grate blockage into account.

Height of Superelevation of Water in a Bend

An equation that can be used to determine the height of the superelevation of the water in a bend is:

$$H_s = \frac{cV^2w}{gr}$$

where,

H_s = height of superelevation of the water around a bend (ft)

c = Coefficient, see table below

V = Velocity around the bend (fps)

w = Top width of flow (ft)

g = Gravity constant, (32.2 ft/s/s)

r = Radius in the bend (ft)

Table for Coefficient, c

Flow Type	Channel Cross-Section	Type of Curve	Value of C
Tranquil	Rectangular	Simple Circular	0.5
Tranquil	Trapezoidal	Simple Circular	0.5
Rapid	Rectangular	Simple Circular	1.0
Rapid	Trapezoidal	Simple Circular	1.0
Rapid	Rectangular	Spiral Transitions	0.5
Rapid	Trapezoidal	Spiral Transitions	1.0
Rapid	Rectangular	Spiral Banked	0.5

Minor Head Loss Equations

Entrance Losses

$$HL = K_e \frac{V_1^2}{2g}$$

where,

HL = Head loss (feet)

V₁ = Velocity in the downstream pipe (fps)

K_e = Head loss coefficient

g = Gravitational acceleration (32.2 ft/sec/sec)

Expansion Losses

$$HL = \frac{(1 - D_1^2)^2}{(D_2)} \frac{V_1^2}{2g}$$

where,

HL = Head loss (feet)

V₁ = Velocity in the upstream pipe (fps)

D₁ = Upstream pipe diameter (ft)

D₂ = Downstream pipe diameter (ft)

g = Gravitational acceleration (32.2 ft/sec/sec)

Bend Losses

Head losses associated with bends in pipes of equal diameter shall be calculated using:

$$HL = K_b \frac{V_2^2}{2g}$$

where,

HL = Head loss (feet)

K_b = Head loss coefficient

V₂ = Velocity in the downstream pipe (fps)

g = Gravitational acceleration (32.2 ft/sec/sec)

Junction Losses

$$HL = \frac{V_2^2}{2g} - \frac{K_j(V_1^2)}{2g}$$

where,

HL = Head loss (feet)

V_1 = Velocity in the upstream pipe (fps)

V_2 = Velocity in the downstream pipe (fps)

K_j = Head loss coefficient

g = Gravitational acceleration (32.2 ft/sec/sec)

Froude Number

The Froude Number can be calculated using the following equation:

$$Fr = \frac{V}{(gy)^{1/2}}$$

where,

Fr = Froude number

V = Velocity (fps)

g = Gravitational acceleration (32.2 ft/sec/sec)

y = Depth of flow (ft)

The Froude Number is used to define the flow regime. The following table gives regime type based on the Froude Number and range for design purposes.

Flow Regime	Fr	Fr for design
Subcritical	$Fr < 1$	$Fr < 0.86$
Critical	$Fr = 1$	NA
Supercritical	$Fr > 1$	NA

APPENDIX B-3: HYDRAULIC TABLES



Drainage and Stormwater

APPENDIX B-3



APPENDIX B-3

Hydraulic Tables

Minimum Slopes in Concrete Pipes

Maximum Permissible Velocities in Conduits Flowing Full and Channels

Entrance Loss Coefficients

Junction or Structure Loss Coefficients

Head Loss Coefficients due to Sudden Expansions and Contractions

Head Loss Coefficients due to Obstructions



Minimum Slopes for Concrete Pipes

to produce a velocity of 2.5 fps or greater (in partial flow conditions)

Pipe Diameter (inches)	Slope (Feet/100 Feet)		Pipe Diameter (inches)	Slope (Feet/100 Feet)
18	.180		42	.056
21	.150		45	.052
24	.120		48	.048
27	.110		51	.045
30	.090		54	.041
33	.080		60	.036
36	.070		66	.032
39	.062		72	.028

Maximum Velocities in Conduits Flowing Full and Channels

	Maximum Flow Velocity (fps)
Culverts	15
Inlet Laterals	10
Storm Sewers	12.5
Earthen Channels	6
Lined Channels	15

Entrance Loss Coefficients

$$HL = K_e \frac{V_1^2}{2g}$$

Type of Structure and Design of Entrance	Coefficient K_e
Concrete Pipe	
Projecting from fill, socket-end (groove-end)	0.2
Projecting from fill, square cut end	0.5
Headwall or headwall and wingwalls	
Socket end of pipe (groove-end)	0.2
Square-edge	0.5
Rounded (radius = 1/12D)	0.2
Mitered to conform to fill slope	0.7
End-section conforming to fill slope	0.5
Beveled edges, 33° to 45° bevels	0.2
Side- or slope-tapered inlet	0.2
Pipe or Pipe-Arch Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square edged	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
End-section conforming to fill slope	0.5
Beveled edges, 33° to 45° bevels	0.2
Side- or slope-tapered inlet	0.2
Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of 1/12 barrel dimension or beveled on 3 sides	0.2
Wingwalls at 30° to 75° to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of 1/12 barrel dimension, or beveled top edge	0.2
Wingwall at 10° to 25° to barrel	
Square-edged at crown	0.5
Wingwall parallel (extension of sides)	
Square-edged at crown	0.7
Side- or slope-tapered inlet	0.2



Junction or Structure Loss Coefficients

Description of Condition	K_j
Inlet on Main Line	0.50
Inlet on Main Line with Lateral	0.25
Manhole on Main Line with 22-1/2° Lateral	0.75
Manhole on Main Line with 45° Lateral	0.50
Manhole on Main Line with 60° Lateral	0.35
Manhole on Main Line with 90° Lateral	0.25
45° Wye Connection or Cut-In	0.75
60° Wye Connection or Cut-In	0.70
Inlet or Manhole at Beginning of Line	1.25

Conduit on Curves	K_b			
	Degree of Pipe Bend			
	90°	60°	45°	22.5°
Pipe Radius = Diameter	0.50	0.43	0.35	0.20
Pipe Radius = 2x to 8x Diameter	0.25	0.21	0.18	0.10
Pipe Radius = 8x to 20x Diameter	0.40	0.34	0.28	0.16

Head Loss Coefficient Due To Sudden Enlargements and Contractions

D_2/D_1^*	Sudden Contractions
	K_j
1.2	0.08
1.4	0.18
1.6	0.25
1.8	0.33
2.0	0.36
2.5	0.40
3.0	0.42
4.0	0.44
5.0	0.45
10.0	0.46
∞	0.47

* D_2/D_1 = Ratio of larger to smaller diameter.



Head Loss Coefficients Due to Obstructions

A/A_0 *	K_i		A/A_0 *	K_i
1.0	0.10		3.0	15.0
1.0	0.21		4.0	27.3
1.2	0.50		5.0	42.0
1.4	1.15		6.0	57.0
1.6	2.40		7.0	72.5
1.8	4.00		8.0	88.0
2.0	5.55		9.0	104.0
2.2	7.05		10.0	121.0
2.5	9.70			

A/A_0 = Ratio of area of pipe to area of opening at obstruction.

APPENDIX B-4: HYDRAULIC FIGURES



Drainage and Stormwater

APPENDIX B-4



APPENDIX B-4

Hydraulic Figures

US DOT Culvert Design Charts

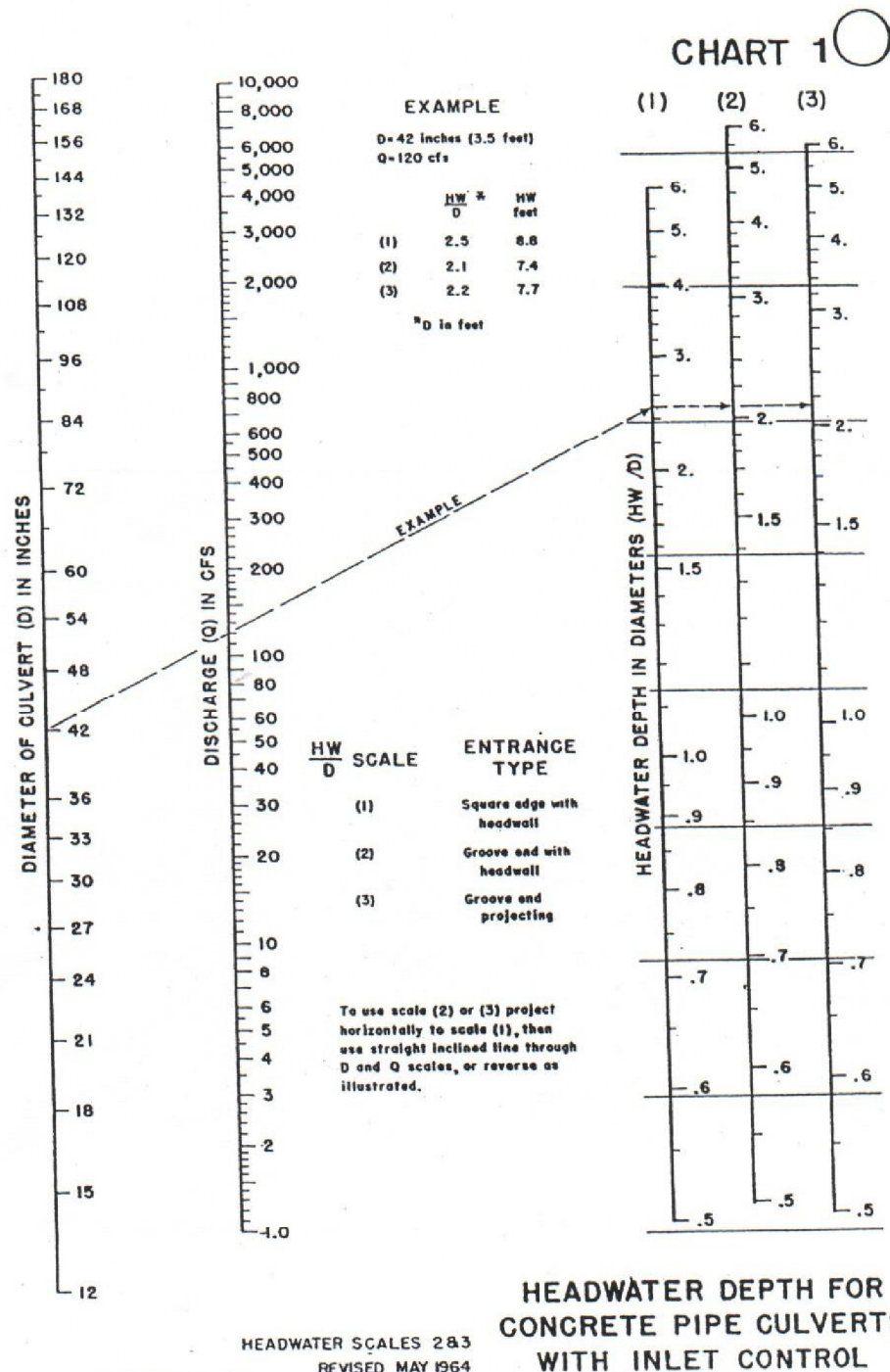
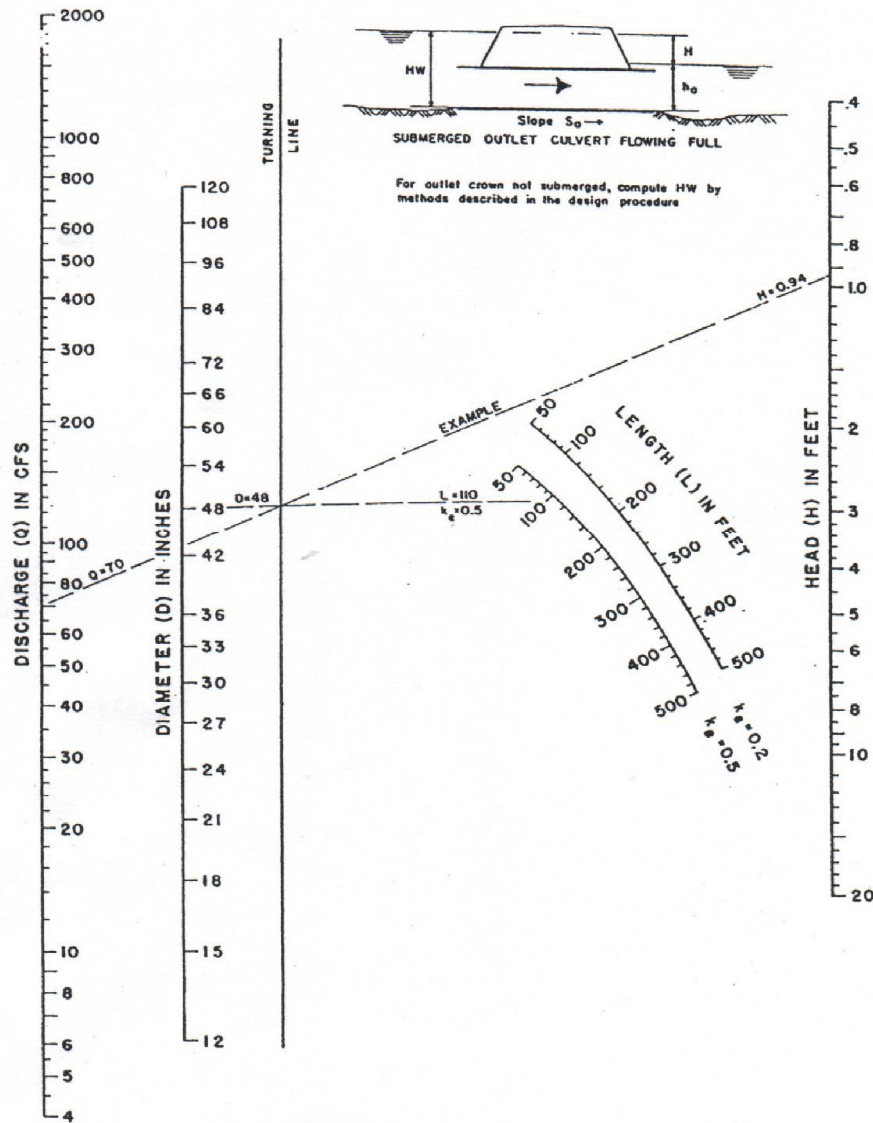
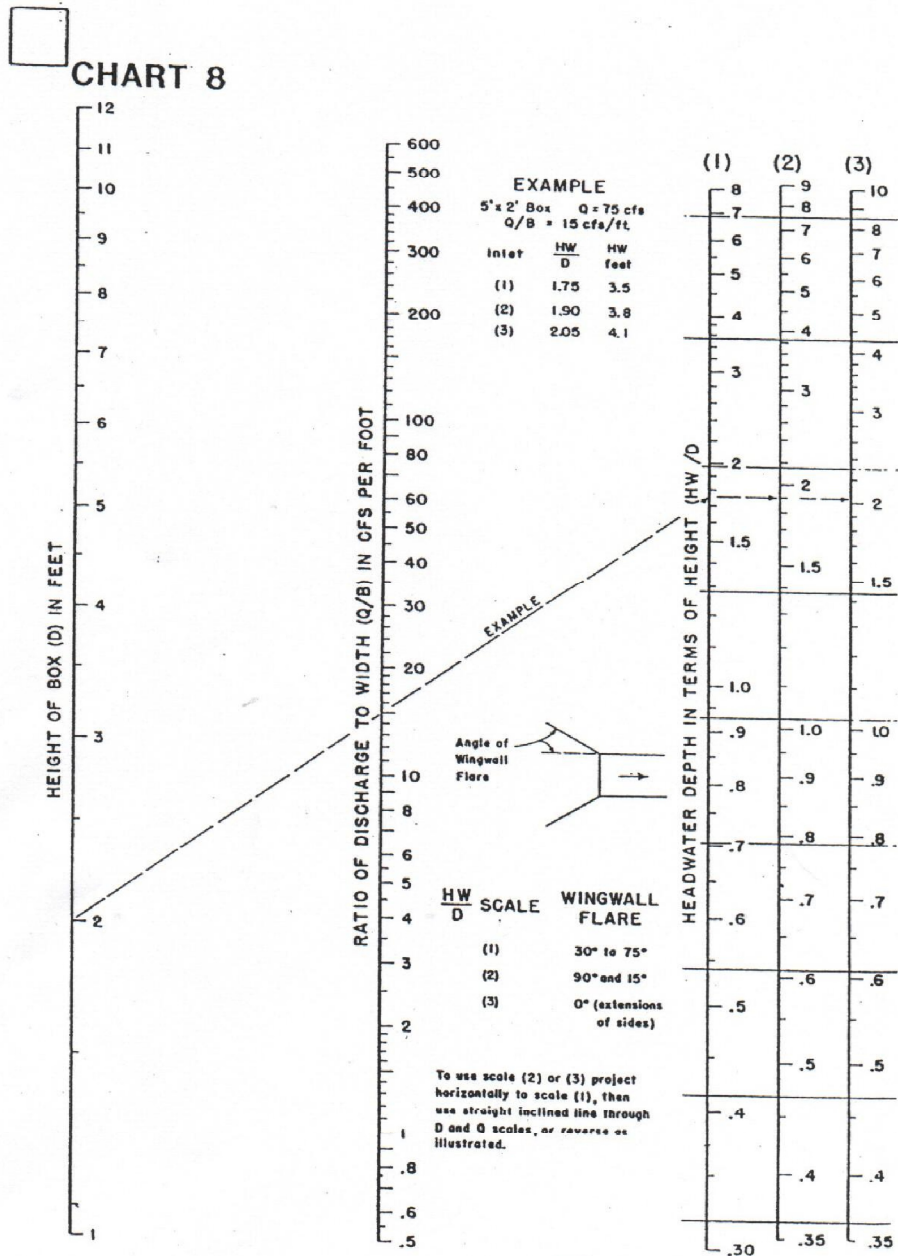


CHART 5



BUREAU OF PUBLIC ROADS JAN. 1963

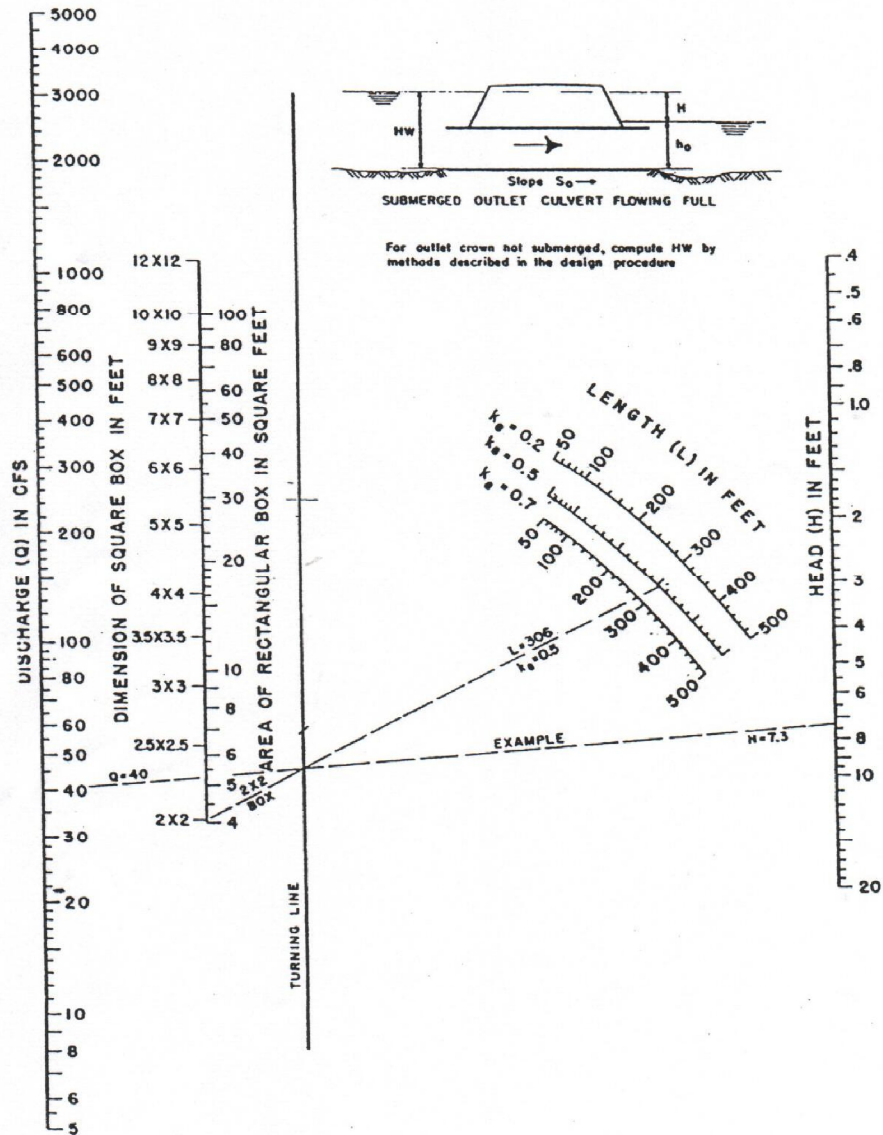
HEAD FOR
CONCRETE PIPE GULVERTS
FLOWING FULL
 $n = 0.012$



BUREAU OF PUBLIC ROADS JAN. 1963

**HEADWATER DEPTH
FOR BOX CULVERTS
WITH INLET CONTROL**

CHART 15



HEAD FOR
CONCRETE BOX CULVERTS
FLOWING FULL
 $n = 0.012$

AU OF PUBLIC ROADS JAN, 1963

APPENDIX B-5: SAMPLE DETENTION CALCULATIONS



Drainage and Stormwater

APPENDIX B-5



APPENDIX B-5

Sample Detention Calculations

Modified Rational Method to Determine Detention Volume Sample Calculation

The following is an example of the calculations of the sizing of a detention pond using the Modified Rational Method:

GIVEN: A 10-acre site is to be developed for Neighborhood Commercial. The entire site contributes to the drainage area of the proposed detention basin.

DETERMINE: Maximum release rate and required detention storage.

SOLUTION:

1. Determine the 100-year peak runoff rate for the site in single family conditions. This is the maximum release rate from the site after development.
2. Determine inflow hydrograph for storms of various durations in order to determine the maximum volume required with the release rate determined in Step 1.

Step 1

Single Family Conditions

$$C = 0.55$$

$$T_c = 15 \text{ minutes}$$

$$I_{100} = 9.6 \text{ in/hr}$$

$$A = 10 \text{ acres}$$

$$Q_{100} = 0.55 \times 9.6 \times 10 = 52.8 \text{ cfs (Maximum release rate)}$$

Step 2

Ultimate Conditions (Neighborhood Commercial)

$$C = 0.80$$

$$T_c = 10 \text{ minutes}$$

$$I_{100} = 11.6$$

$$A = 10 \text{ acres}$$

$$Q_{100} = 0.80 \times 11.6 \times 10 = 81.2 \text{ cfs}$$

Check various duration storms

15 min	$I = 9.6$	$Q = .80 \times 9.6 \times 10 = 76.8 \text{ cfs}$
20 min	$I = 8.2$	$Q = .80 \times 8.2 \times 10 = 65.6 \text{ cfs}$
30 min	$I = 6.6$	$Q = .80 \times 6.6 \times 10 = 52.8 \text{ cfs}$
40 min	$I = 5.5$	$Q = .80 \times 5.5 \times 10 = 44.0 \text{ cfs}$
50 min	$I = 4.8$	$Q = .80 \times 4.8 \times 10 = 38.4 \text{ cfs}$
60 min	$I = 4.2$	$Q = .80 \times 4.2 \times 10 = 33.6 \text{ cfs}$

Maximum storage volume is determined by deducting the volume of runoff released during the time of inflow from the total inflow for each duration.

Inflow = Storm duration x respective peak discharge x 60 sec/min.

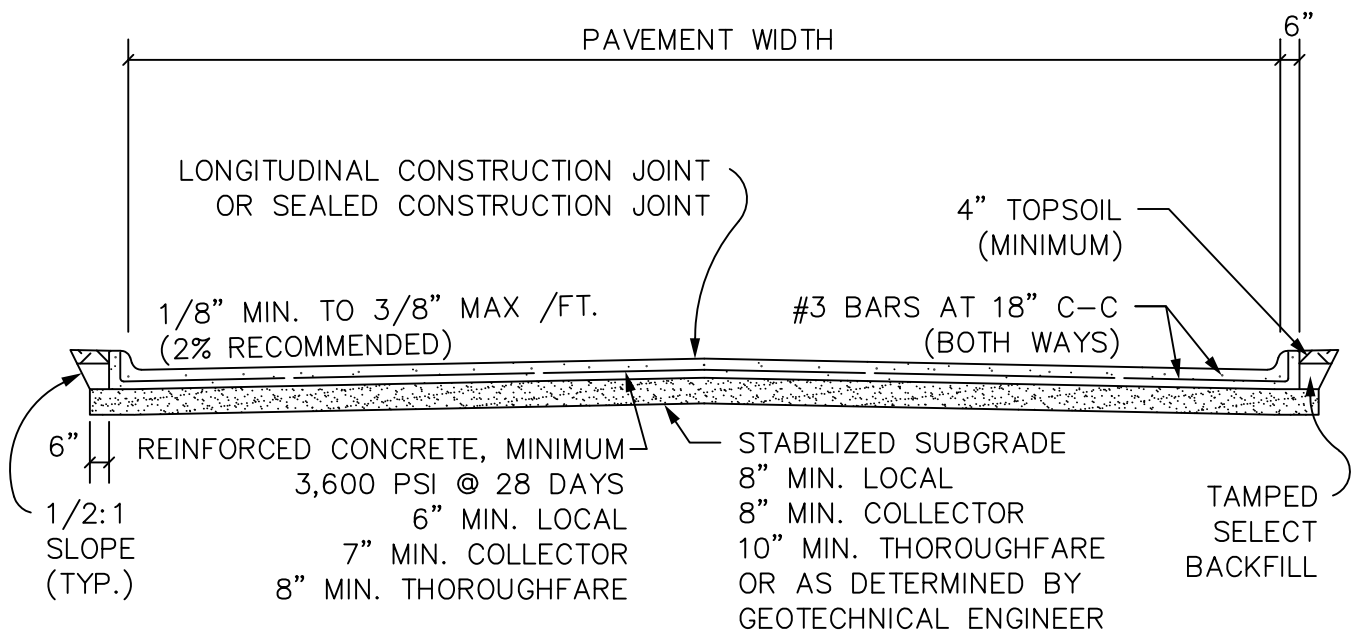
Outflow = Half of the respective inflow duration x control release discharge x 60 sec/min

15 min storm	Inflow 15 x 76.8 x 60 sec/min	= 69,120 cf
	Outflow 0.5 x 25 x 52.8 x 60 sec/min	= <u>39,600 cf</u>
	Storage	= 29,520 cf
20 min storm	Inflow 20 x 65.6 x 60 sec/min	= 78,720 cf
	Outflow 0.5 x 30 x 52.8 x 60 sec/min	= <u>47,520 cf</u>
	Storage	= 31,200 cf
30 min storm	Inflow 30 x 52.8 x 60 sec/min	= 95,040 cf
	Outflow 0.5 x 40 x 52.8 x 60 sec/min	= <u>63,360 cf</u>
	Storage	= 31,680 cf
40 min storm	Inflow 40 x 44.0 x 60 sec/min	= 105,600 cf
	Outflow 0.5 x 50 x 52.8 x 60 sec/min	= <u>79,200 cf</u>
	Storage	= 26,400 cf
50 min storm	Inflow 50 x 38.4 x 60 sec/min	= 115,200 cf
	Outflow 0.5 x 60 x 52.8 x 60 sec/min	= <u>95,040 cf</u>
	Storage	= 20,160 cf
60 min storm	Inflow 60 x 33.6 x 60 sec/min	= 120,960 cf
	Outflow 0.5 x 70 x 52.8 x 60 sec/min	= <u>110,880 cf</u>
	Storage	= 10,080 cf

The maximum volume required is 22,500 cf at the 30 minute storm duration.

APPENDIX B-6: STANDARD CONSTRUCTION DETAILS**APPENDIX B-6: STANDARD CONSTRUCTION DETAILS**

PAVING DETAIL	DETAIL NO.	REVISION DATE
CONCRETE STREET SECTIONS	P-1	MAY 2019
STEEL LAYOUT PLAN	P-2	
INTERSECTION JOINT SPACING	P-3A	
CONCRETE PAVEMENT JOINTS	P-3B	
CONCRETE PAVEMENT JOINTS	P-3C	
STANDARD CURB AND GUTTER	P-4	
LAYDOWN CURB AND RESIDENTIAL DRIVEWAY	P-5A	
LAYDOWN CURB AND COMMERCIAL DRIVEWAY	P-5B	
STREET HEADER	P-6	
TYPICAL ALLEY SECTION	P-7	
WHEELCHAIR RAMP	P-8	
CONCRETE SIDEWALK	P-9	
MANHOLE AND WATER VALVE BOXOUT	P10-A	
MANHOLE AND WATER VALVE BOXOUT	P10-B	
CURB AND GUTTER, SIDEWALK, AND DRIVEWAY TYPICAL JOINT LAYOUT	P-11	
MEDIAN NOSE	P-12	
LEFT TURN LANE IN MEDIAN	P-13	
RIGHT TURN LANE WITHOUT CHANNELIZATION	P-14	
RIGHT TURN LANE WITH CHANNELIZATION	P-15	
CONCRETE VALLEY	P-16	
DEAD END BARRICADE	P-17	
METAL BEAM GUARDRAIL	P-18	
STANDARD WOODEN FENCE	P-19	
STANDARD MASONRY FENCE	P-20A	
STANDARD MASONRY FENCE	P-20B	



TYPICAL URBAN SECTION (CURB AND GUTTER)

NOTE: SEE STANDARD CURB & GUTTER DETAIL. ASPHALT PAVEMENT MAY BE ALLOWED UPON APPROVAL OF CITY STAFF.

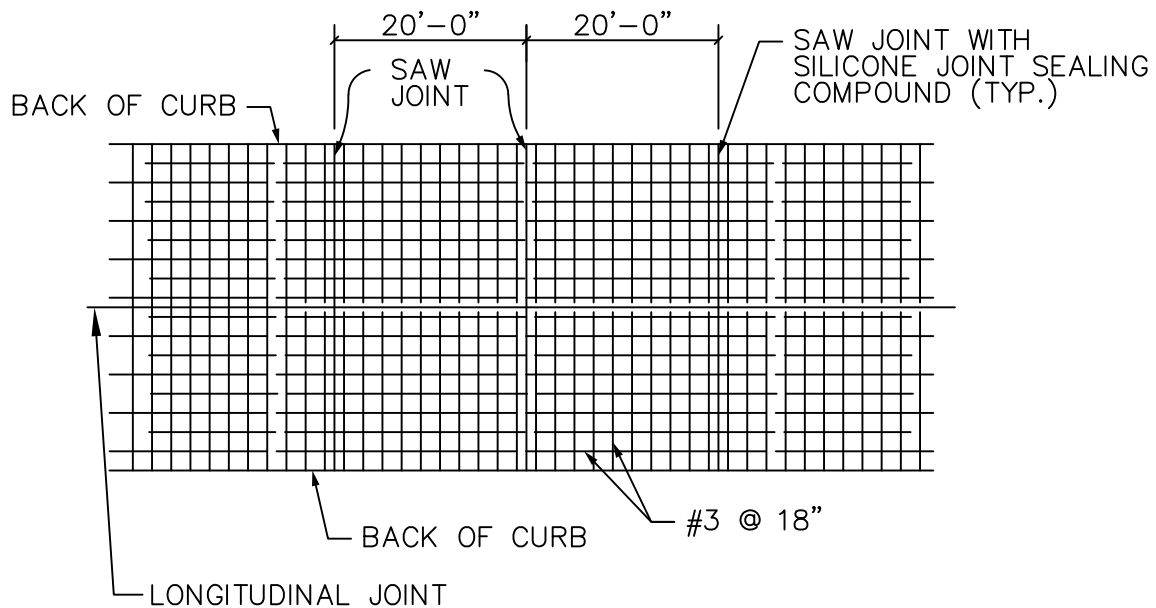


PAVING CONSTRUCTION DETAILS
CONCRETE STREET SECTIONS

REVISED MAY 2019

SCALE: 1" = 5'

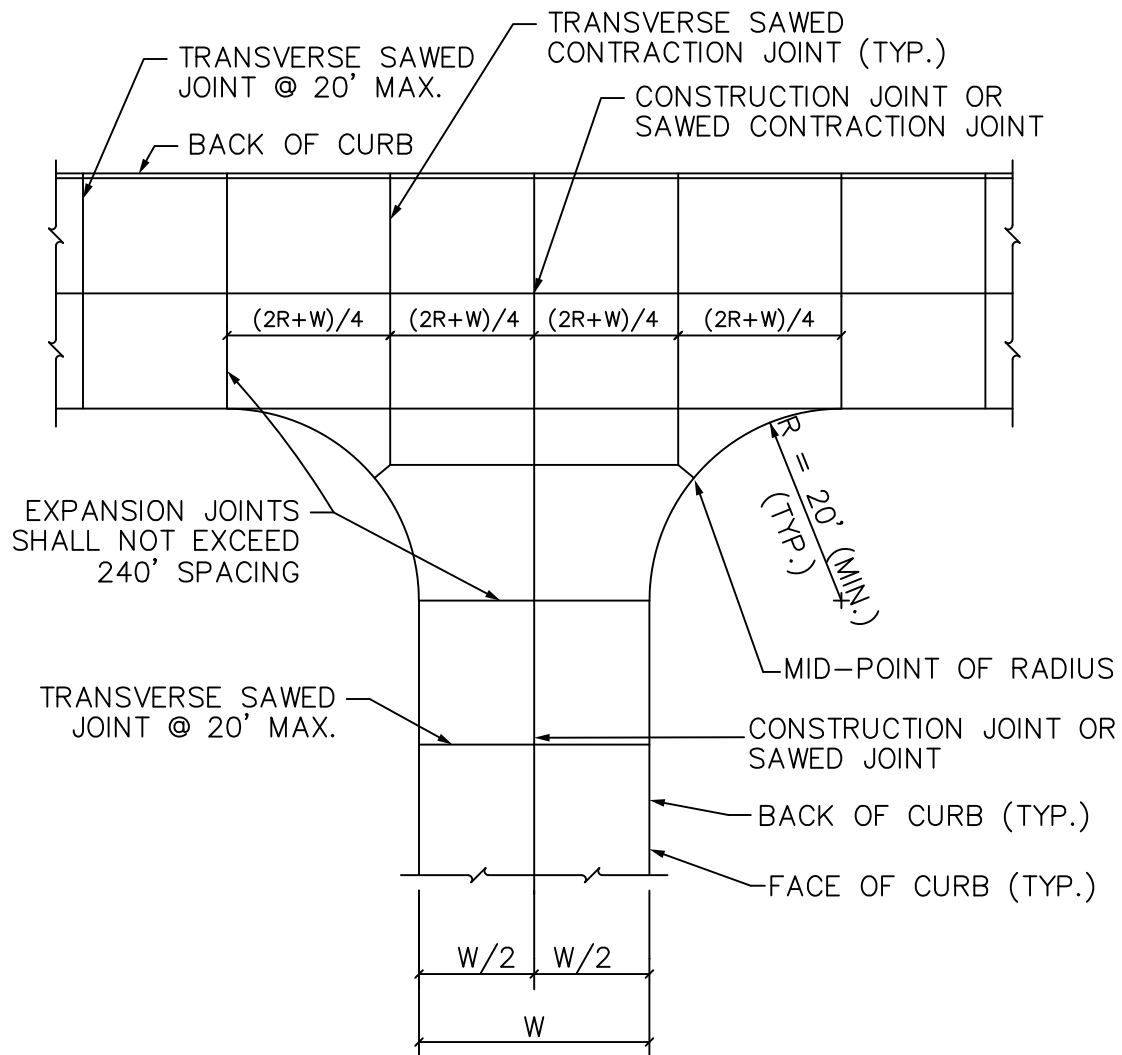
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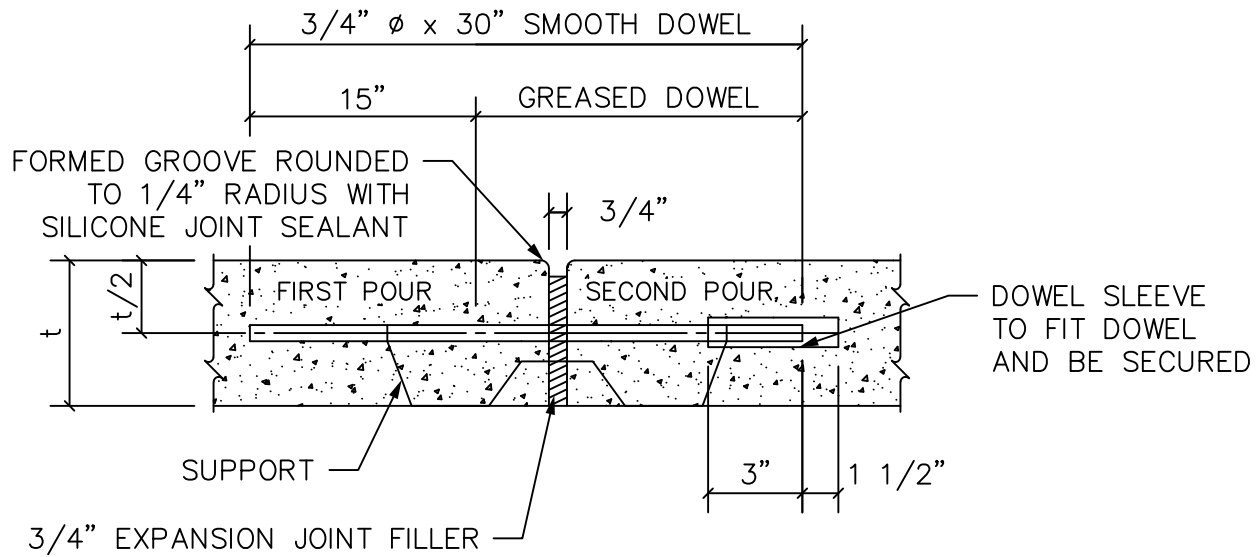


PLAN

NOTES:

1. CONSTRUCT SAW JOINTS AT 20' (MAX).
2. EXPANSION JOINTS TO BE AT INTERSECTIONS, BRIDGES AND OTHER STRUCTURES.
3. EXPANSION JOINT SPACING SHALL NOT EXCEED 240'.
4. ALL JOINTS TO BE PROPERLY SEALED WITH SILICONE JOINT SEALING COMPOUND. SILICONE JOINT SEALING SHALL BE DOW CORNING 890SL, OR APROVED EQUAL.
5. MONOLITHIC CURB SHALL BE USED WITH THIS TYPE OF PAVING.
6. LONGITUDINAL SAW JOINT REQUIRED FOR EACH LANE SEPERATION.

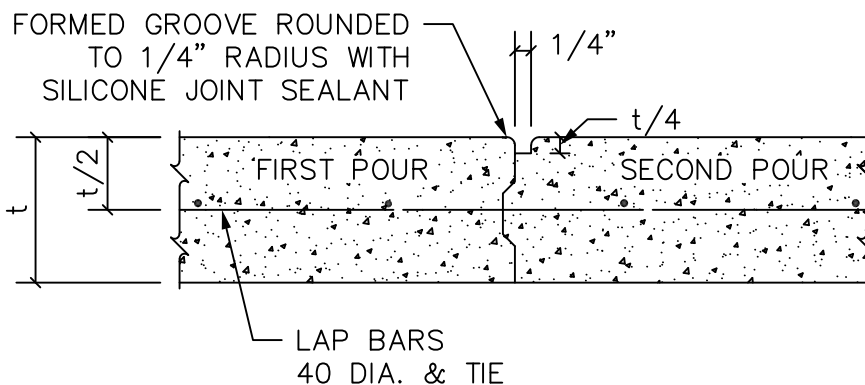




EXPANSION JOINT

NOTE:

1. ALL DOWEL BARS SHALL BE INSTALLED PERPENDICULAR TO JOINT @ 18" SPACING.
2. SILICONE JOINT SEALANT SHALL BE DOW CORNING 890 SL, OR APPROVED EQUAL.



CONSTRUCTION JOINT

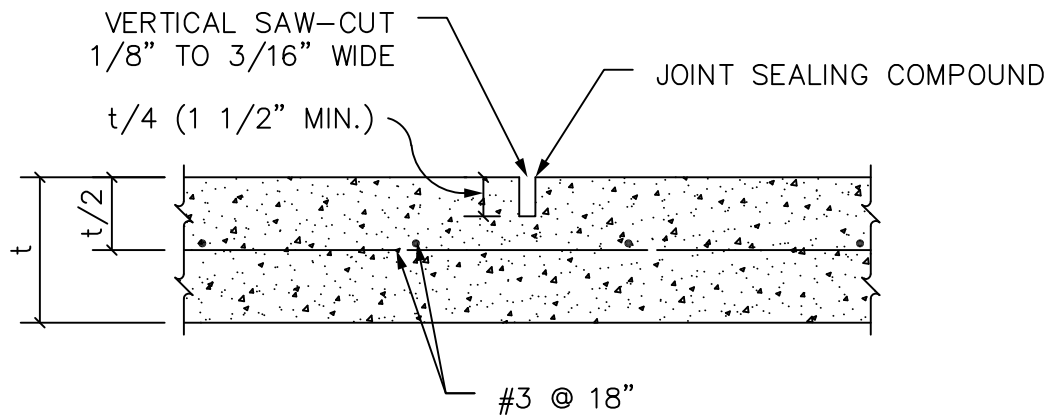


PAVING CONSTRUCTION DETAILS
CONCRETE PAVEMENT JOINTS

REVISED MAY 2019

SCALE: N.T.S.

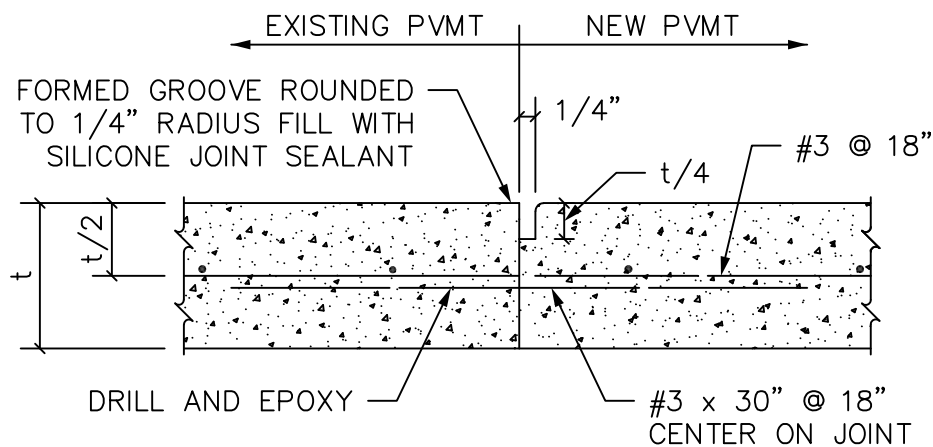
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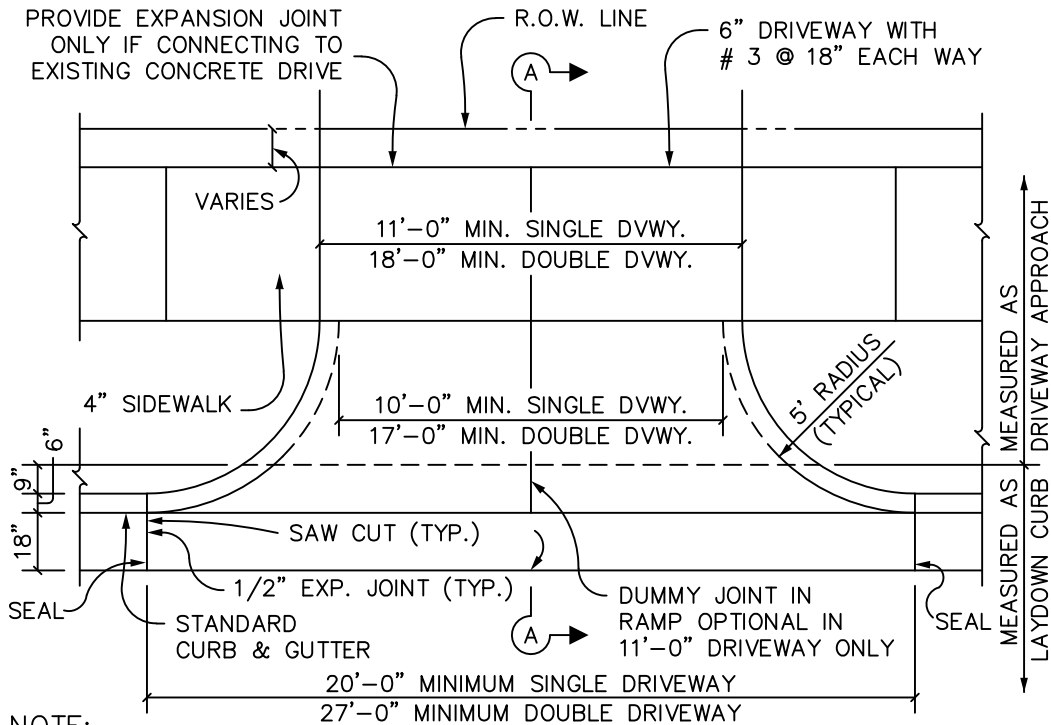
SAW JOINT

NOTE:

1. ALL DOWEL BARS SHALL BE INSTALLED PERPENDICULAR TO JOINT @ 18" SPACING.
2. SILICONE JOINT SEALANT SHALL BE DOW CORNING 890 SL, OR APPROVED EQUAL.

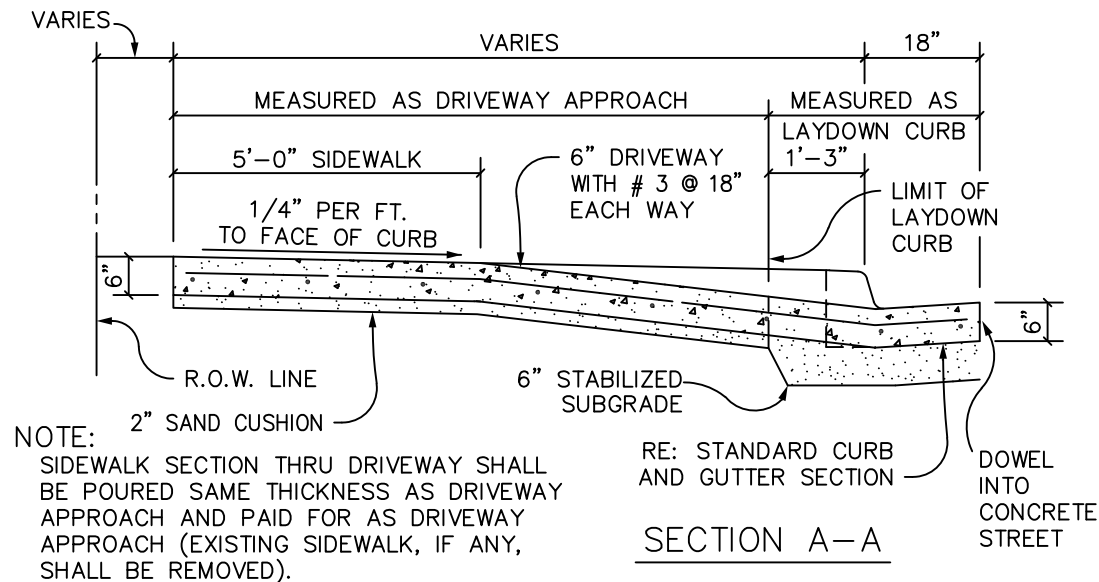


SAWED CONSTRUCTION JOINT



NOTE:
EXISTING CURB AND GUTTER, IF ANY, MUST
BE SAW CUT AS DIRECTED BY THE ENGINEER.

SCALE: 1" = 5'



SCALE: 1" = 2.5'



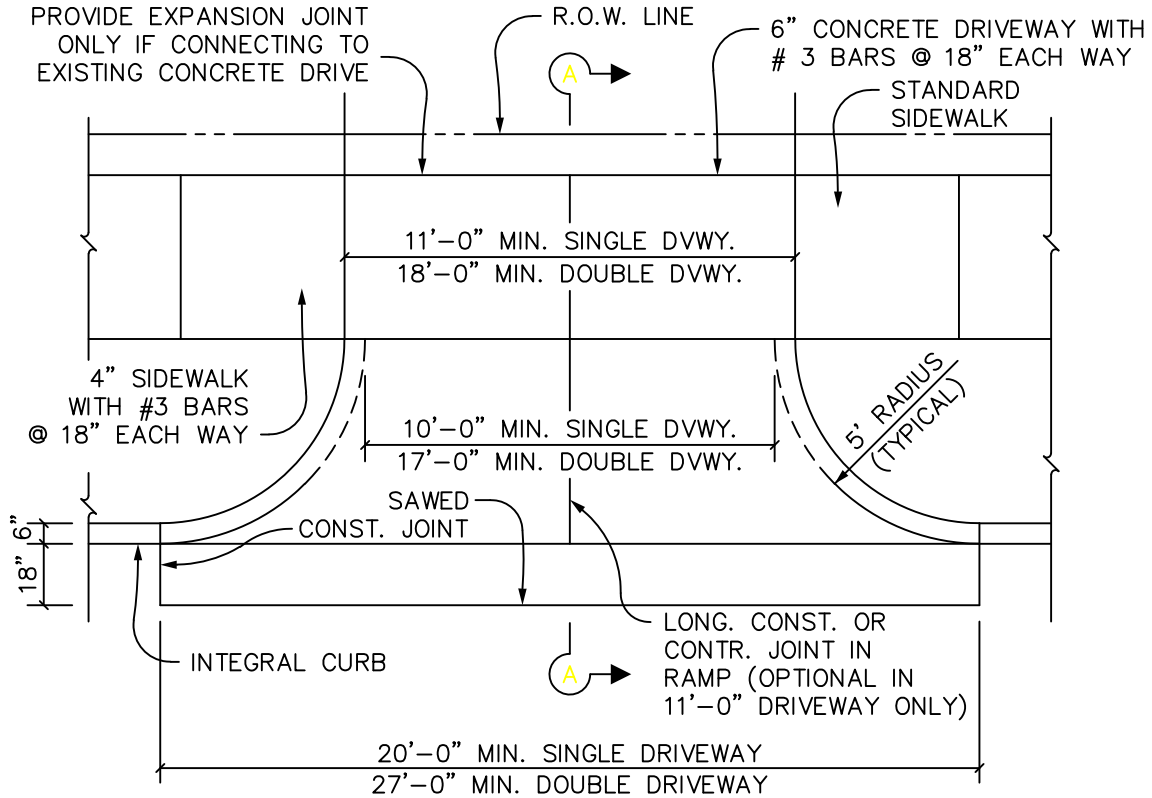
PAVING CONSTRUCTION DETAILS
LAYDOWN CURB AND DRIVEWAY

REVISED MAY 2019

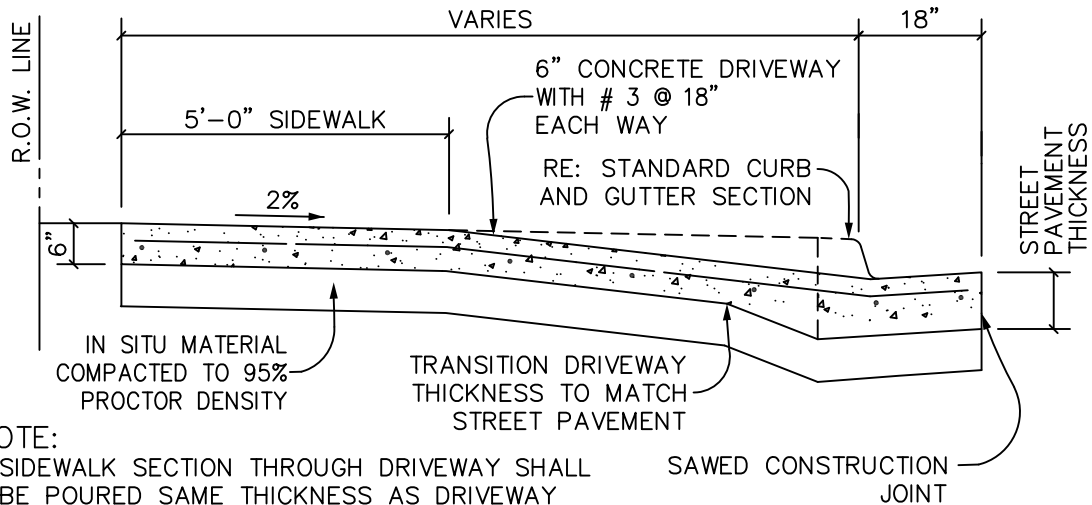
SCALE: AS MARKED

SHEET: P-5

CONCRETE SHALL BE CLASS 'A'
IN ACCORDANCE WITH ITEM 303
(PER NCTCOG)



NOTE: EXISTING CURB AND GUTTER SHALL BE VERTICALLY SAWCUT.
HORIZONTAL SAWCUTTING OF CURB NOT ALLOWED.



NOTE:
SIDEWALK SECTION THROUGH DRIVEWAY SHALL BE POURED SAME THICKNESS AS DRIVEWAY APPROACH (EXISTING SIDEWALK, IF ANY, SHALL BE REMOVED AND REPLACED)

SECTION A-A



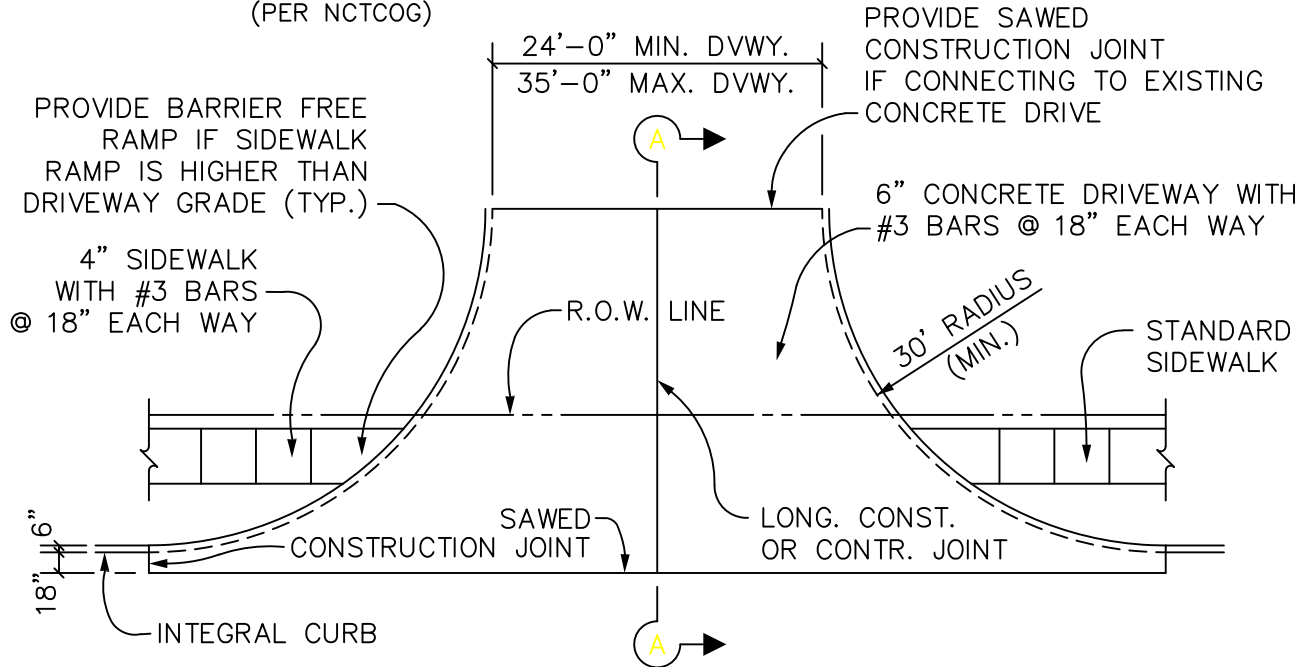
PAVING CONSTRUCTION DETAILS
RESIDENTIAL DRIVEWAY

REVISED MAY 2019

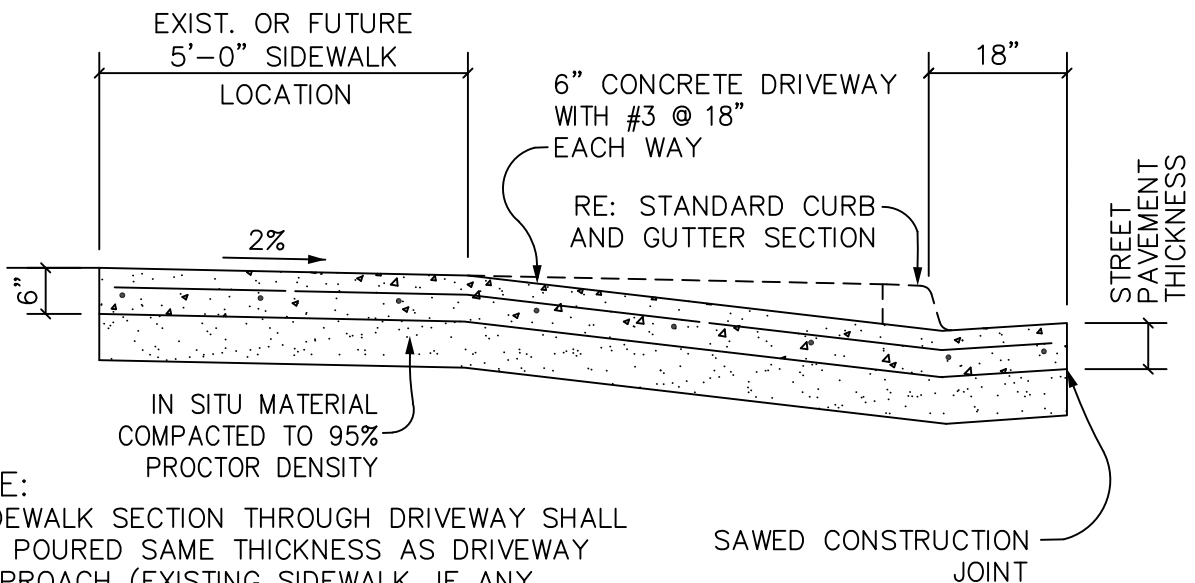
SCALE: N.T.S.

SHEET: P-5A

CONCRETE SHALL BE CLASS 'A'
IN ACCORDANCE WITH ITEM 303
(PER NCTCOG)



NOTE: EXISTING CURB AND GUTTER SHALL BE VERTICALLY SAWCUT.
HORIZONTAL SAWCUTTING OF CURB NOT ALLOWED.



NOTE:
SIDEWALK SECTION THROUGH DRIVEWAY SHALL
BE POURED SAME THICKNESS AS DRIVEWAY
APPROACH (EXISTING SIDEWALK, IF ANY,
SHALL BE REMOVED AND REPLACED)

SECTION A-A

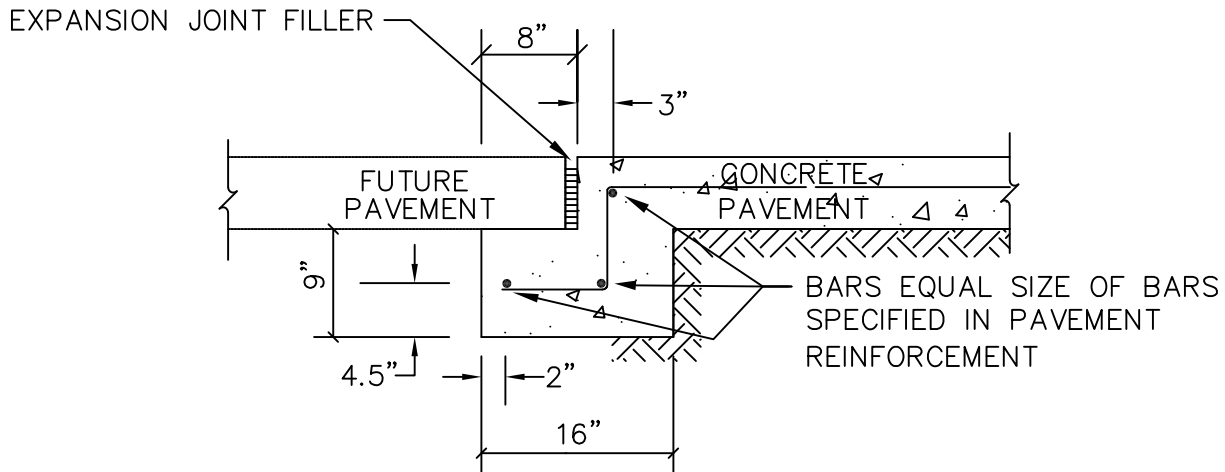


PAVING CONSTRUCTION DETAILS COMMERCIAL DRIVEWAY

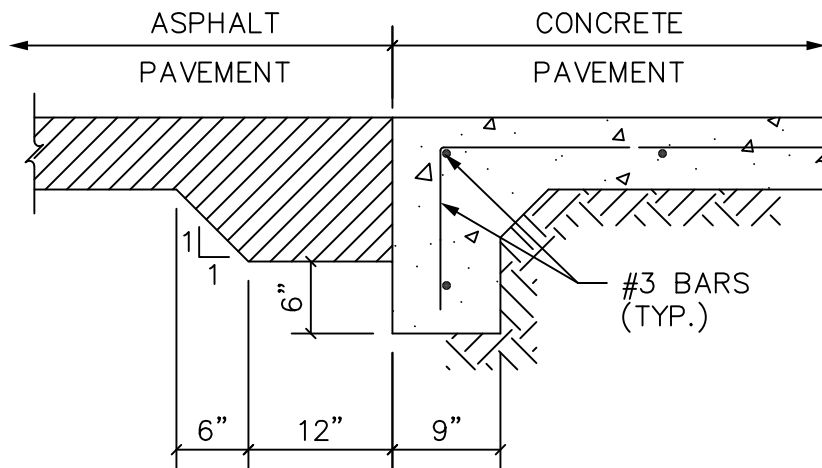
REVISED MAY 2019

SCALE: N.T.S.

SHEET: P-5B



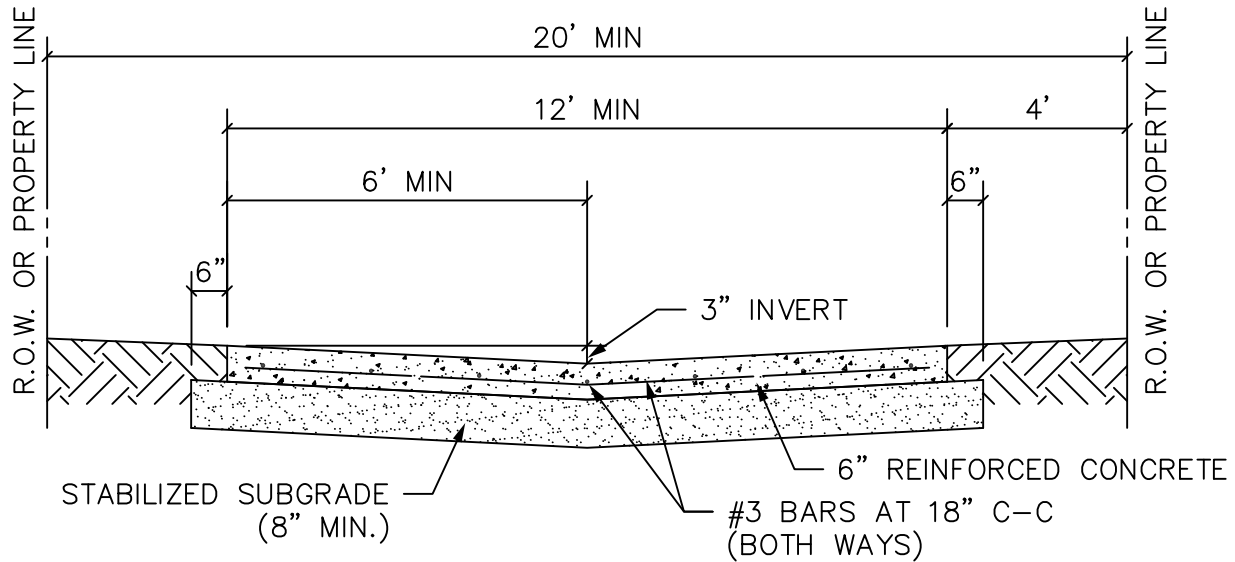
STREET HEADER FOR FUTURE PAVEMENT



ASPHALT TO CONCRETE HEADER

NOTES

1. PAVEMENT BARS TO BE BENT DOWN INTO HEADER.
2. HEADER AND PAVEMENT TO BE MONOLITHIC.



NOTES:

1. CONSTRUCT TRANSVERSE SAWED JOINTS @ 20' (MAX.)
2. REINFORCED WITH #3 BARS AT 18" C-C BOTH WAYS.
3. ALTERNATE REINFORCEMENT - #4 BARS AT 30" C-C BOTH WAYS.
4. EXPANSION JOINTS TO BE PLACED AT ALL INTERSECTIONS AND NOT TO EXCEED 240' BETWEEN JOINTS.
5. CONCRETE FOR ALLEYS SHALL BE MINIMUM 3,600 PSI @ 28 DAYS.

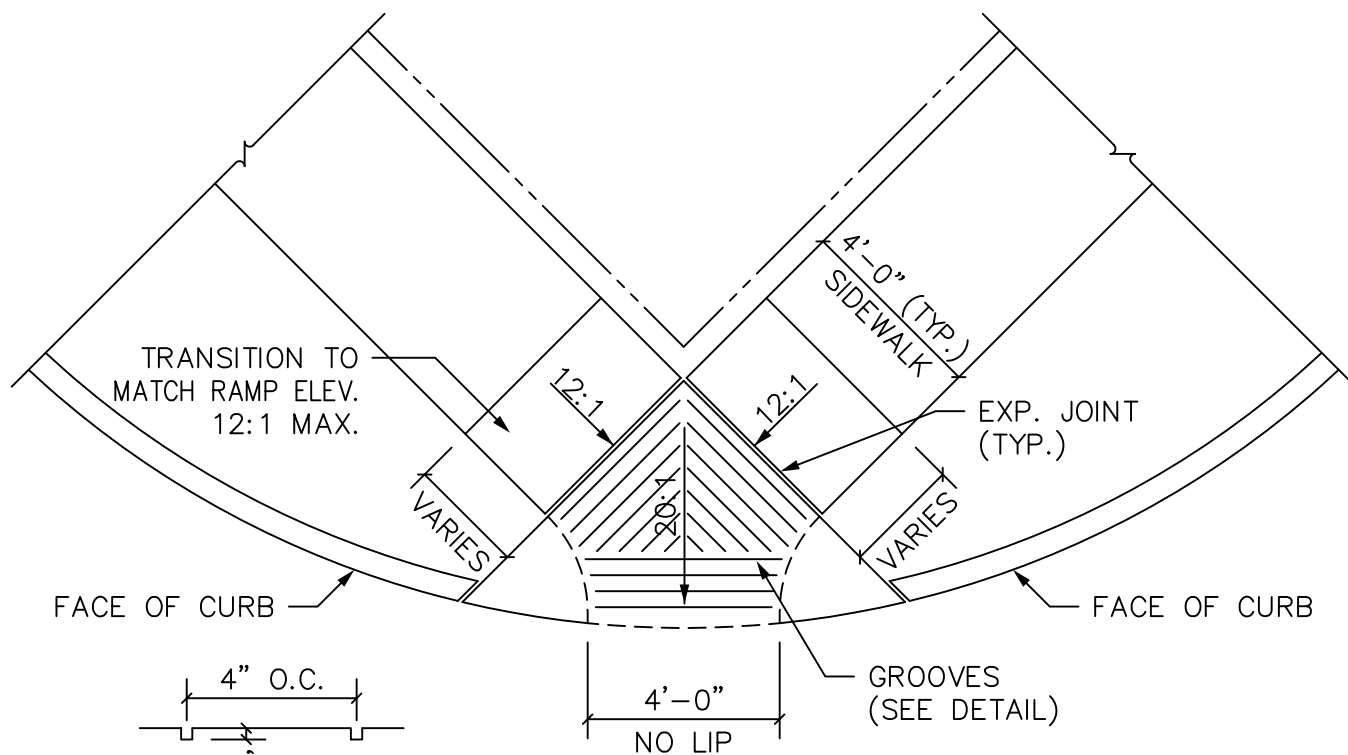


PAVING CONSTRUCTION DETAILS
TYPICAL ALLEY SECTION

REVISED MAY 2019

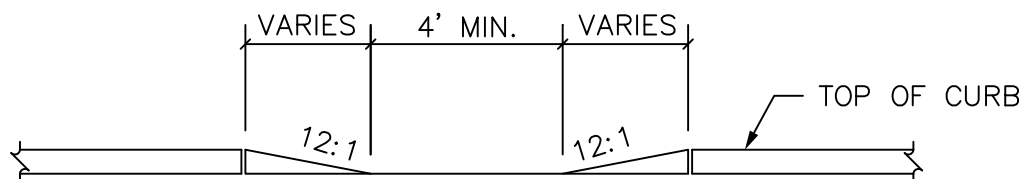
SCALE: 3/8" = 1'

SHEET: P-7



PLAN

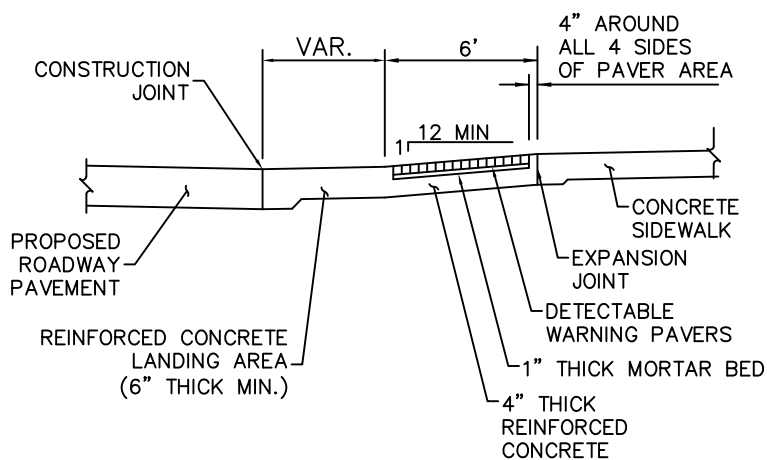
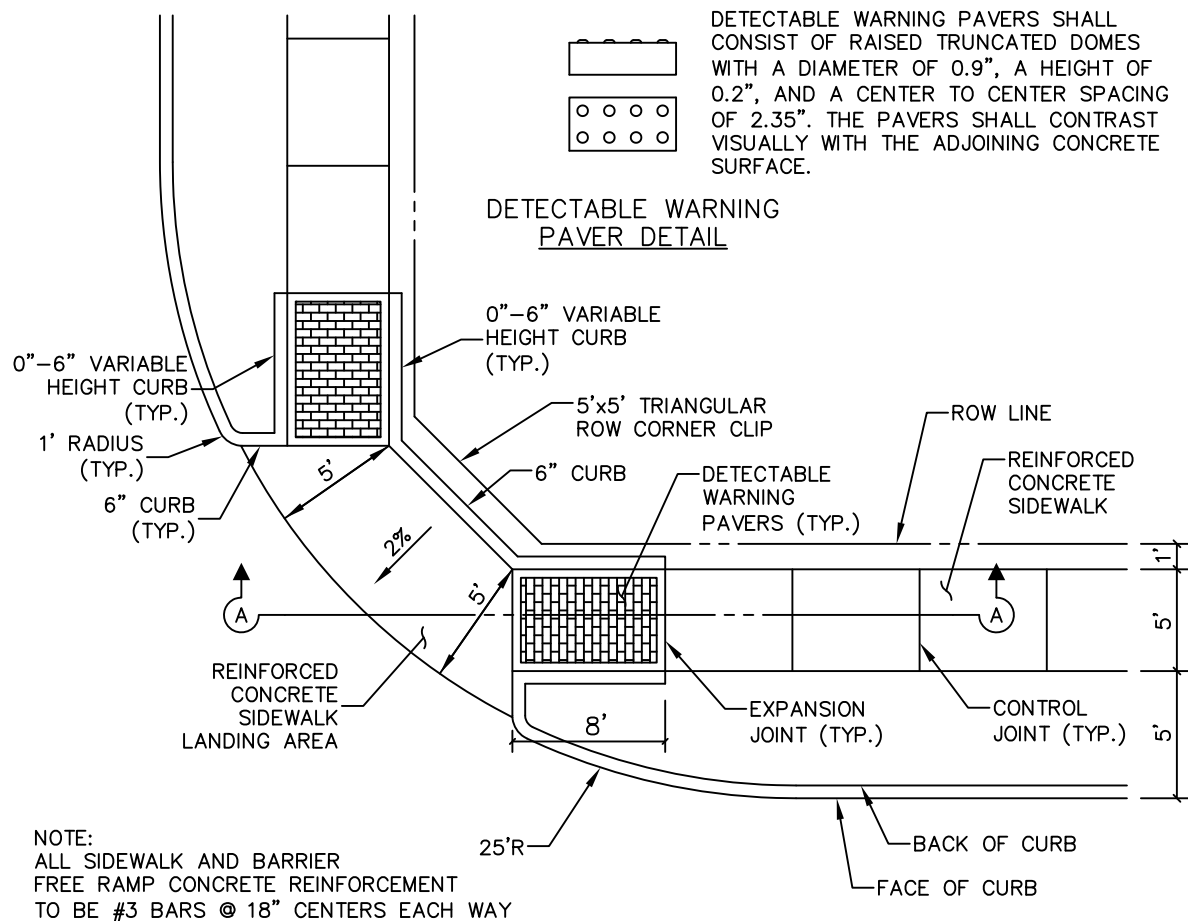
GROOVES SECTION

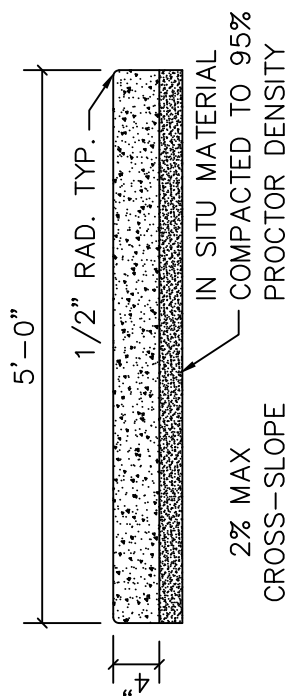


ELEVATION

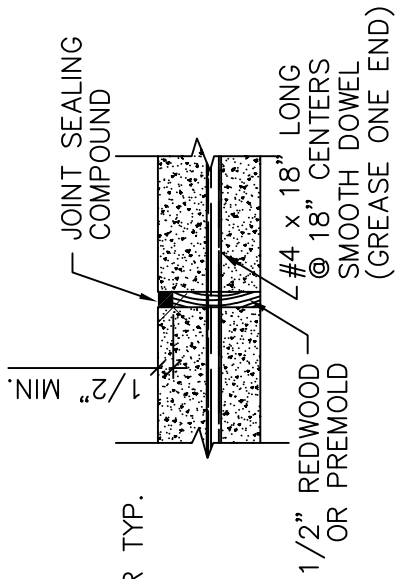
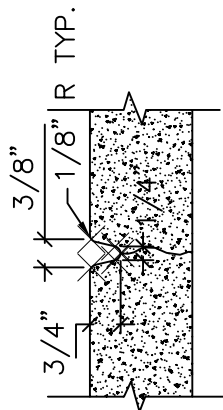
NOTES:

1. INSTALL 1/2" ϕ X 18" SMOOTH DOWELS @ 18" (GREASE ON ONE SIDE) THROUGH EXPANSION JOINTS.
2. 20:1 SLOPE ON WHEELCHAIR RAMP AND 12:1 SLOPE ON RAMP WINGS.
3. RAMPS SHALL HAVE A HEAVY BROOM FINISH WITH GROOVES ALIGNED PERPENDICULAR TO THE DIRECTION OF TRAVEL.
4. ALL RAMPS SHALL COMPLY WITH THE REQUIREMENTS OF THE ARCHITECTURAL BARRIERS ACT.
5. CONCRETE FOR RAMPS SHALL BE MINIMUM 3,600 PSI @ 28 DAYS.

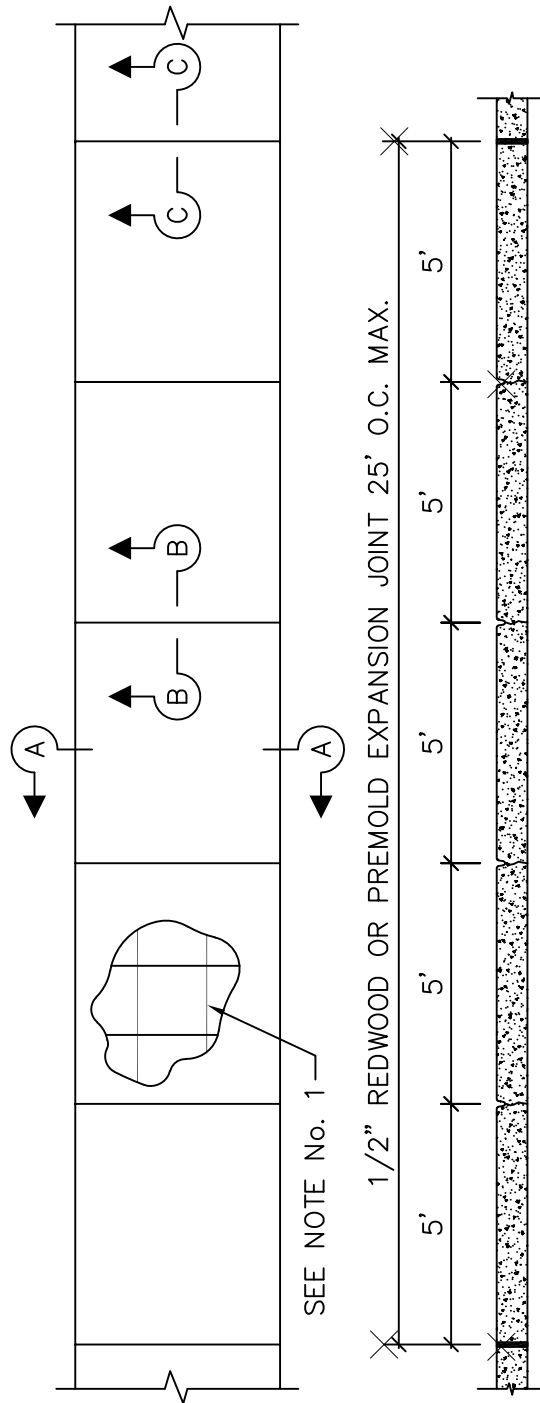




SECTION B-B



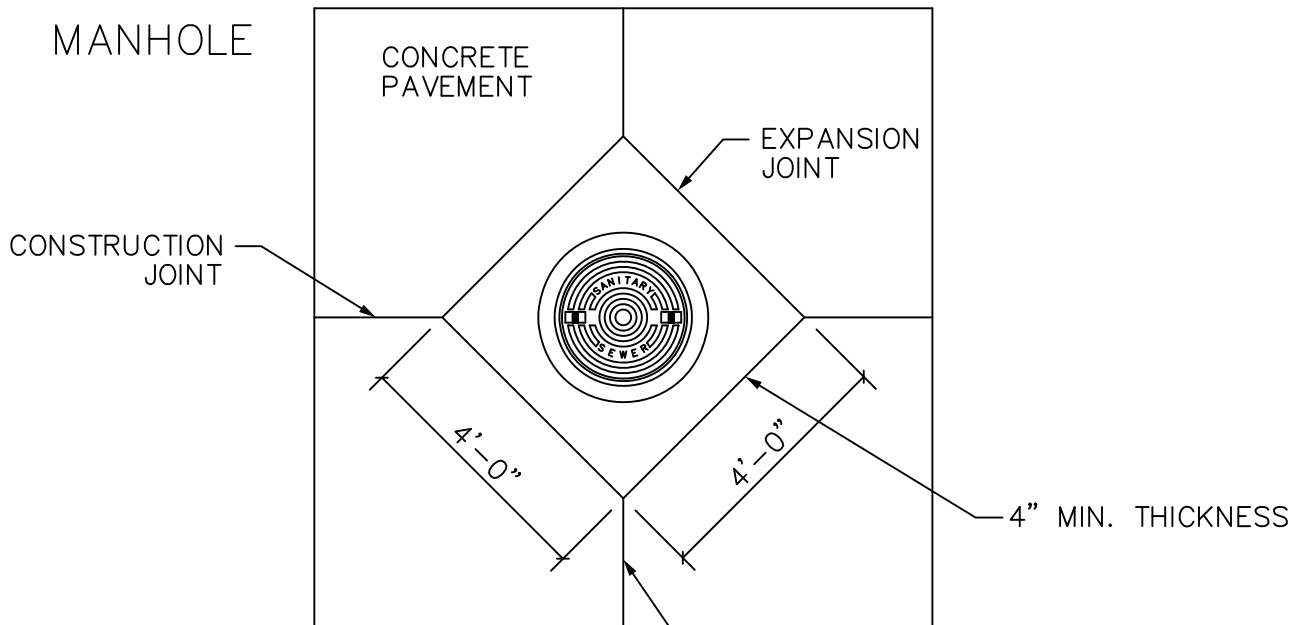
SECTION C-C



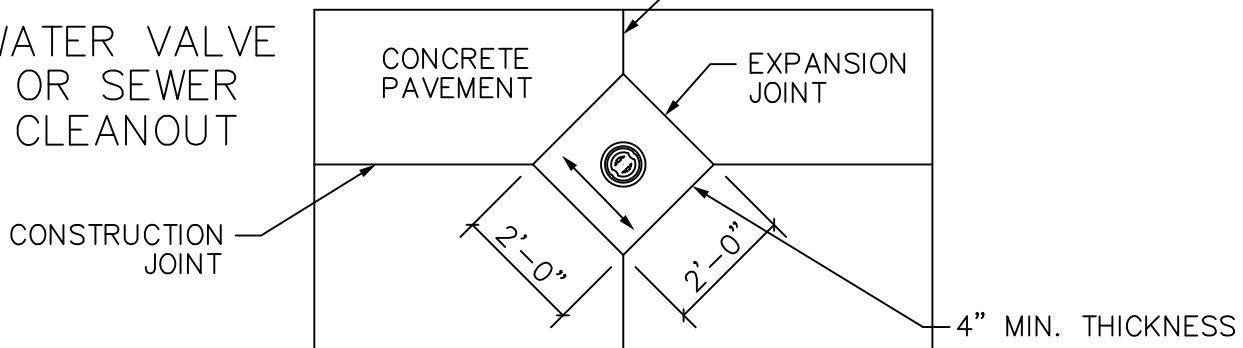
NOTE:

1. REINFORCEMENT SHALL BE #3 BARS @ 18" EACH WAY
2. PROVIDE EXPANSION JOINTS ALSO WHEN CONNECTING TO EXISTING SIDEWALKS, DRIVEWAYS, CURBS AND GUTTER.
3. PROVIDE 5'x5' SIDEWALK PASSING AREAS PER T.A.S. REQUIREMENTS AT REASONABLE INTERVALS NOT TO EXCEED 200' ALONG SIDEWALK.

MANHOLE



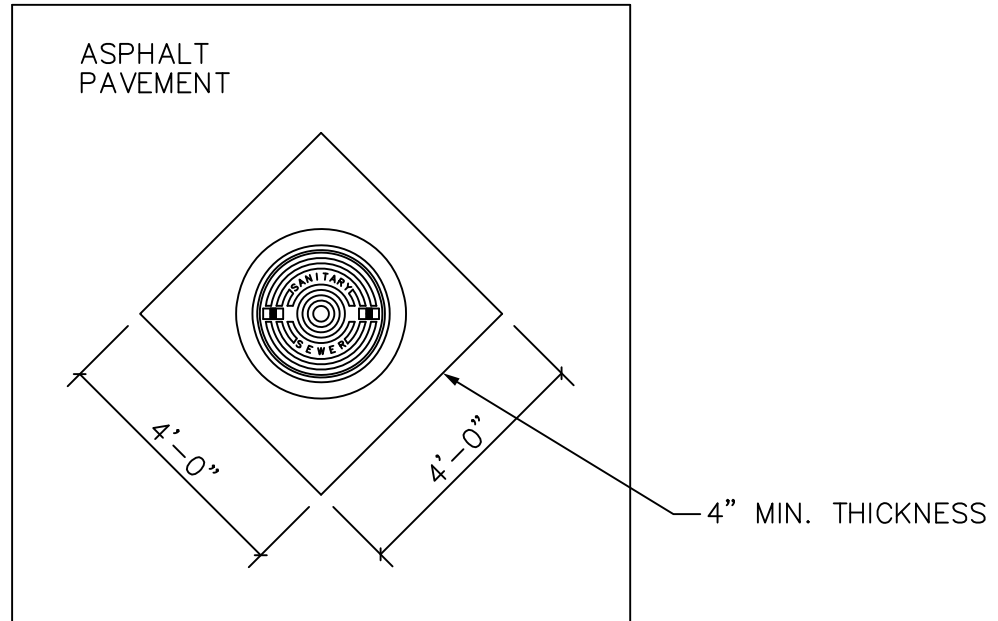
WATER VALVE OR SEWER CLEANOUT



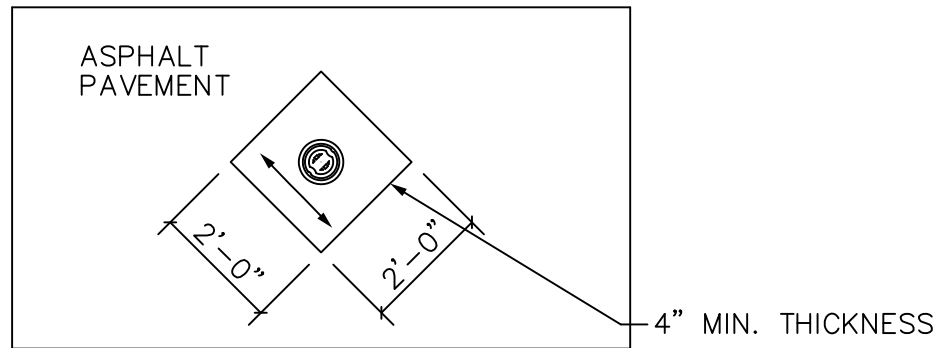
NOTES:

1. ALL CONCRETE PAVEMENT SHALL BE REMOVED ALONG NEAT SAW CUT LINES.
2. MANHOLE BOXOUT REQUIRED FOR ALL MANHOLES (STORM AND SANITARY) AND CLEANOUTS LOCATED IN THE STREET.
3. SEE SHEET P-3 FOR JOINT DETAILS.
4. SEE SHEET W-3 FOR WATER VALVE DETAIL.
5. SEE SHEET S-8 FOR SANITARY SEWER CLEANOUT DETAIL.

MANHOLE

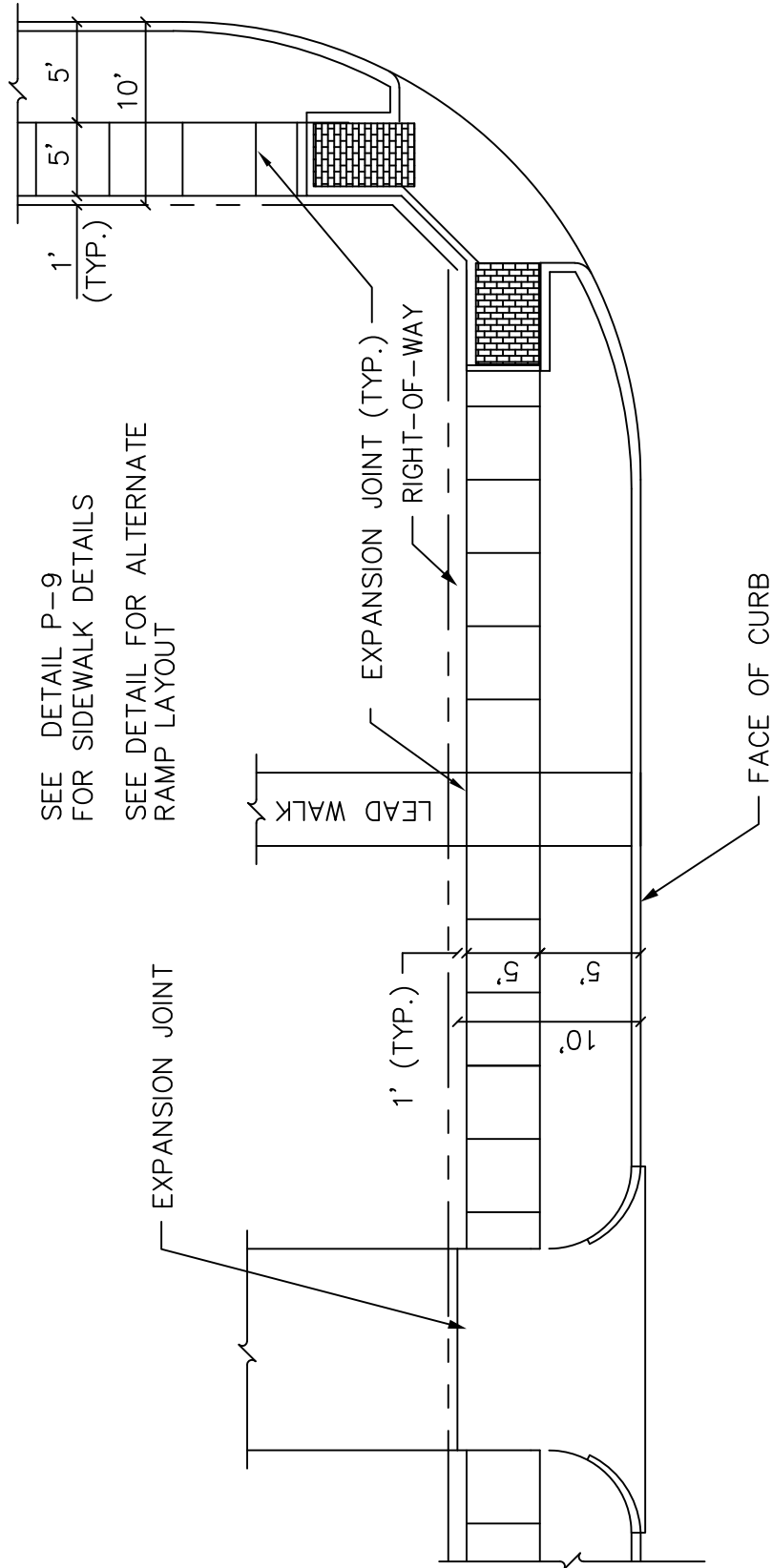


WATER VALVE OR SEWER CLEANOUT



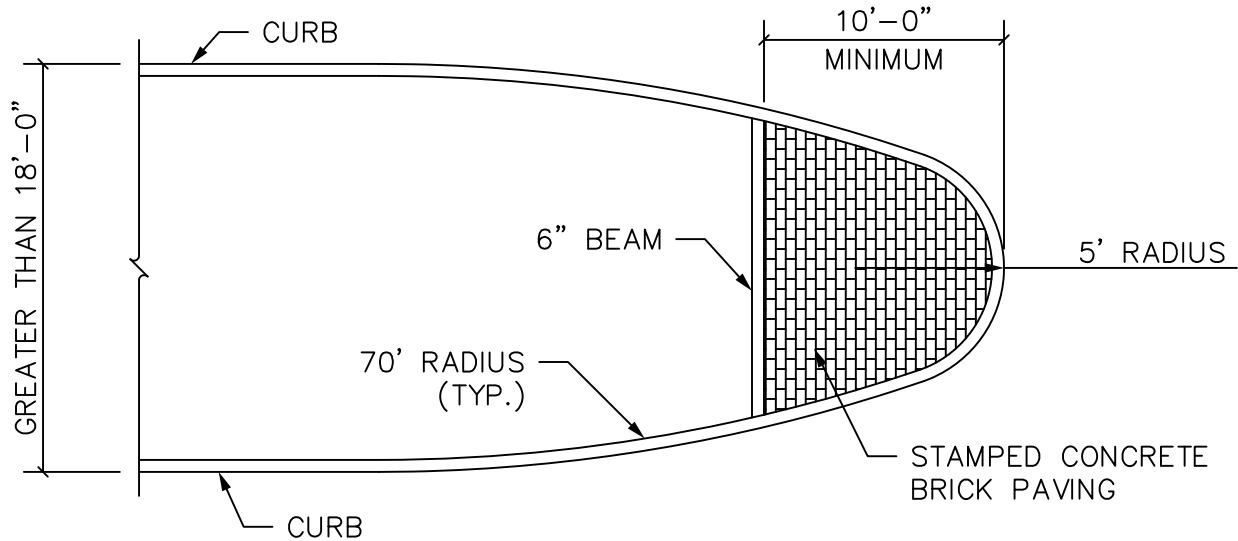
NOTES:

1. ALL ASPHALT PAVEMENT SHALL BE REMOVED ALONG NEAT SAW CUT LINES.
2. MANHOLE BOXOUT REQUIRED FOR ALL MANHOLES (STORM AND SANITARY) AND CLEANOUTS LOCATED IN THE STREET.
3. SEE SHEET P-3 FOR JOINT DETAILS.
4. SEE SHEET W-3 FOR WATER VALVE DETAIL.
5. SEE SHEET S-8 FOR SANITARY SEWER CLEANOUT DETAIL.

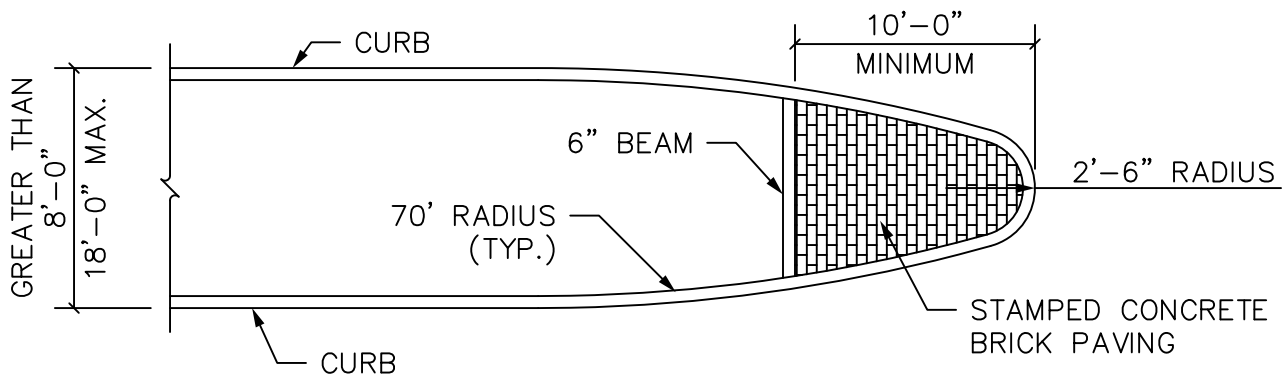


NOTES:

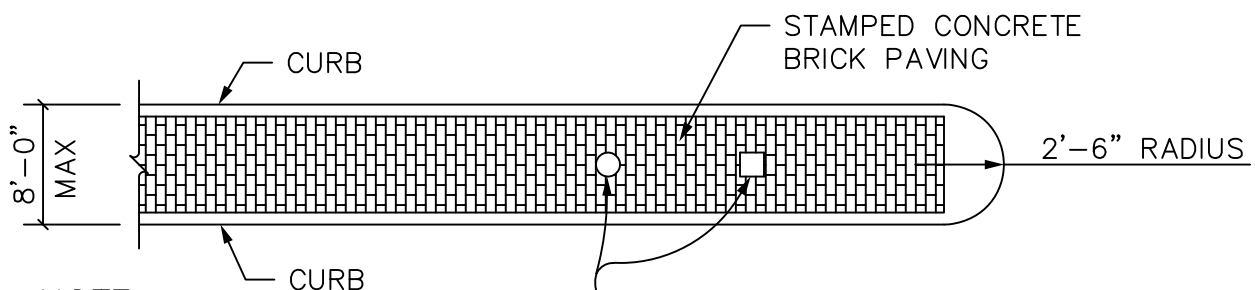
1. REINFORCE ALL SIDEWALKS WITH #3 BARS @ 18" C-C
2. INSTALL #4 X 18" DOWELS @ 18" WHEN CONNECTING TO EXISTING CONCRETE.
3. INSTALL 1/2" ϕ X 18" SMOOTH DOWELS @ 18" (GREASE ONE END) THROUGH EXPANSION JOINTS.
4. CURB AND GUTTER PLACED MONOLITHICALLY WITH PAVEMENT SHALL BE REINFORCED AND JOINTED IN ACCORDANCE WITH PAVEMENT DETAILS.



MEDIAN NOSE TYPE "C"



MEDIAN NOSE TYPE "B"



NOTE:

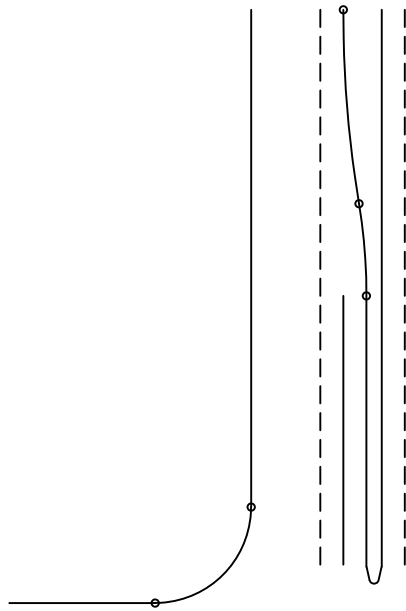
1. PAVING IS TO BE EXTENDED TO THE P.R.C. OF THE MEDIAN IN LEFT TURN LANES.

BLOCKOUT MEDIAN PAVING FOR TRAFFIC SIGNAL BASE/FOUNDATION, PULL BOX, OR LUMINARY BASE (IF LOCATIONS ARE KNOWN AND NOT INSTALLED WITH PAVING)

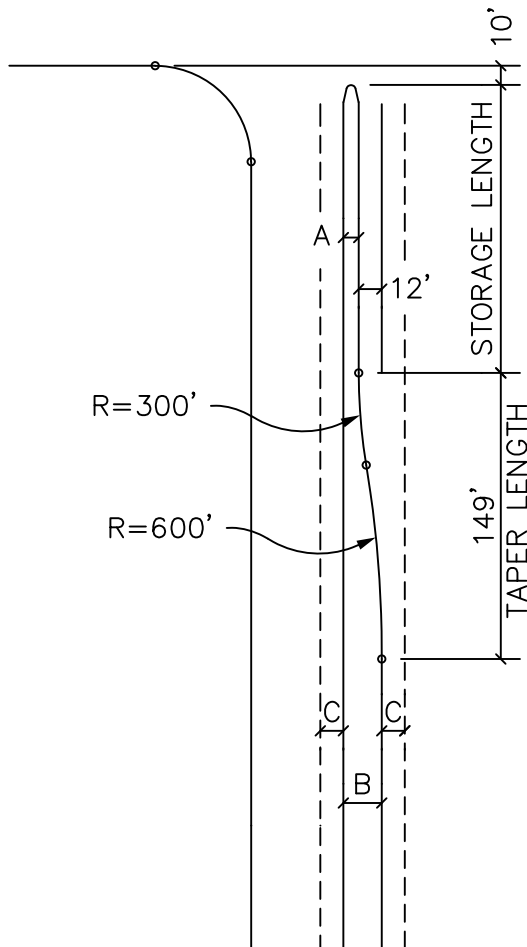
MEDIAN NOSE TYPE "A" (STANDARD LEFT TURN LANE MEDIAN)

NOTES:

1. ONLY MAJOR THOROUGHFARES AND MAJOR COLLECTORS MAY USE MEDIANS FOR LEFT TURN LANES.
2. THE NUMBER OF LANES VARIES BY STREET CLASSIFICATION.
3. MINIMUM REQUIRED STORAGE LENGTH IS BASED ON CROSS STREET CLASSIFICATION.
4. MEDIAN NOSE SHALL BE IN ACCORDANCE WITH MEDIAN NOSE DETAIL SHEET P-12.



CROSS STREET



CROSS STREET

MINIMUM STORAGE LENGTH

MAJOR THOROUGHFARE	200'
MAJOR COLLECTOR	150'
MINOR COLLECTOR	100'
LOCAL	60'

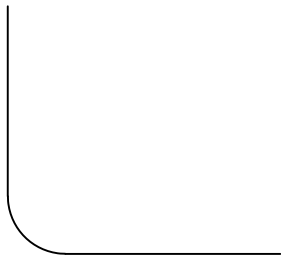


PAVING CONSTRUCTION DETAILS
LEFT TURN LANE IN MEDIAN

REVISED MAY 2019

SCALE: 1" = 100'

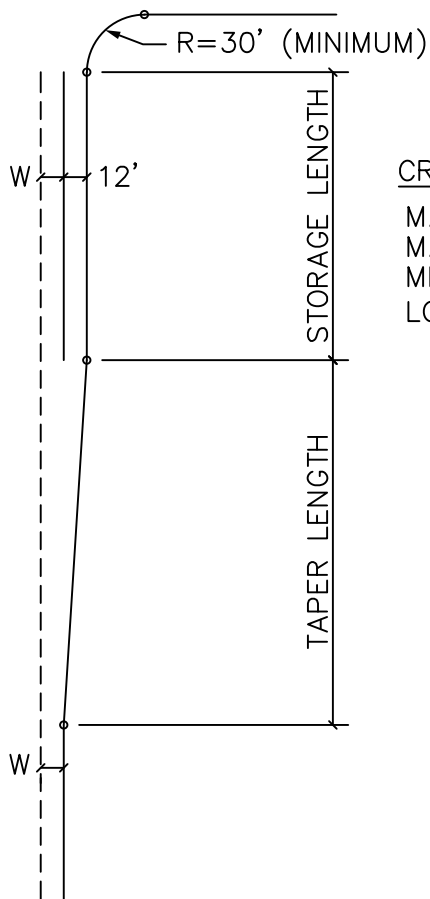
SHEET: P-13



NOTES:

1. THE NUMBER OF ADJACENT LANES VARIES WITH STREET CLASSIFICATION.
2. MINIMUM REQUIRED STORAGE LENGTH IS BASED ON CROSS STREET CLASSIFICATION.

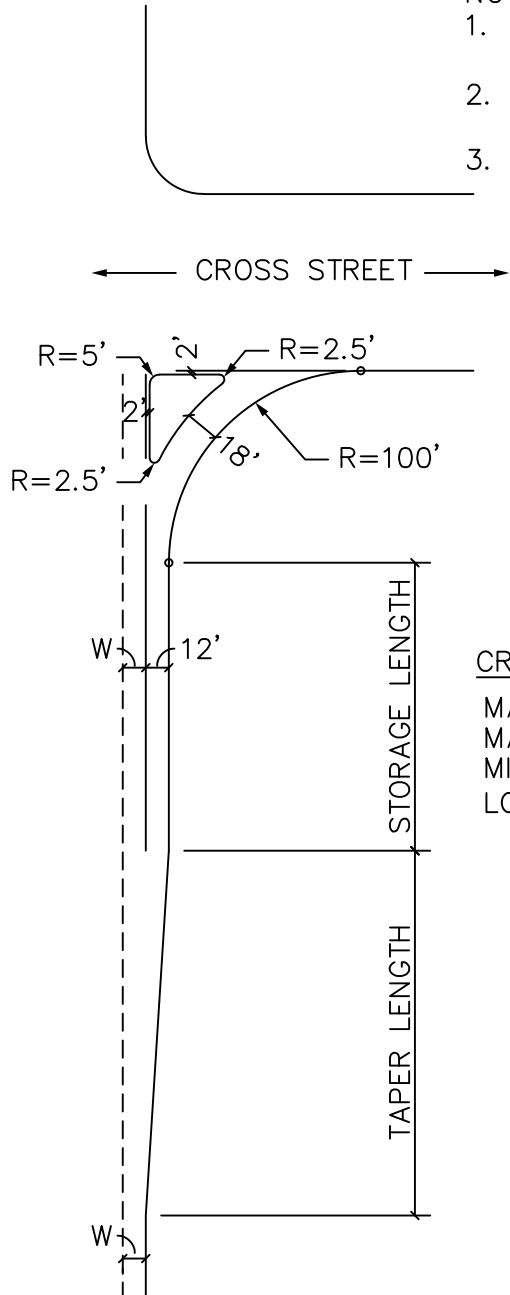
← CROSS STREET →



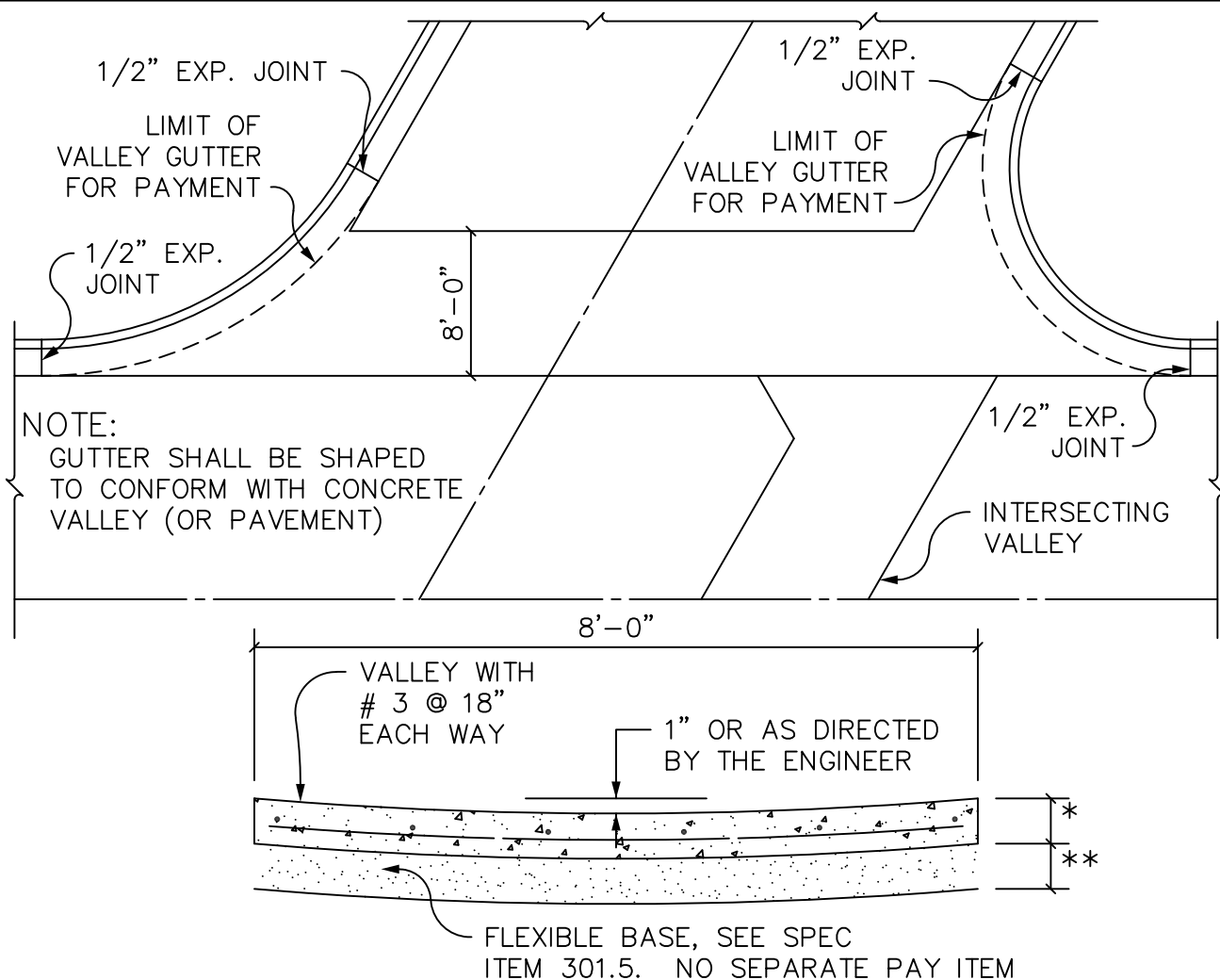
CROSS STREET	MIN. STORAGE LENGTH
MAJOR THOROUGHFARE	200'
MAJOR COLLECTOR	150'
MINOR COLLECTOR	100'
LOCAL	60'

NOTES:

1. ONLY MAJOR THOROUGHFARES AND MAJOR COLLECTORS MAY UTILIZE CHANNELIZED RIGHT TURN LANES.
2. THE NUMBER OF ADJACENT LANES VARIES WITH STREET CLASSIFICATION.
3. MINIMUM REQUIRED STORAGE LENGTH IS BASED ON CROSS STREET CLASSIFICATION.



CROSS STREET	MINIMUM STORAGE LENGTH
MAJOR THOROUGHFARE	200'
MAJOR COLLECTOR	150'
MINOR COLLECTOR	100'
LOCAL	60'



THE REINFORCED CONCRETE VALLEY SHALL REPLACE THE TOP OF THE PAVEMENT WITH THE REMAINING PORTION OF THE PAVEMENT TO BE CONSTRUCTED INCLUDING SUBGRADE TREATMENT, IN ACCORDANCE WITH THE TYPICAL PAVING SECTION. THE CONCRETE VALLEY WILL BE GOVERNED ACCORDING TO CITY STANDARDS FOR CONCRETE CURB AND GUTTER.

TRANSITION SECTION FOR VALLEYS CROSSING MAJOR STREETS	
DIST. FROM CL OF DIP	CROWN
0 FT	0.000 FT
5 FT	0.041 FT
10 FT	0.083 FT
20 FT	0.208 FT
30 FT	0.333 FT
40 FT	0.458 FT
50 FT	0.500 FT

* 6" FOR LOCAL STREETS
7" FOR COLLECTOR STREETS
8" FOR THOROUGHFARE STREETS

** 8" FOR LOCAL STREETS
8" FOR COLLECTOR STREETS
10" FOR THOROUGHFARE STREETS
OR AS DETERMINED BY
GEOTECHNICAL ENGINEER

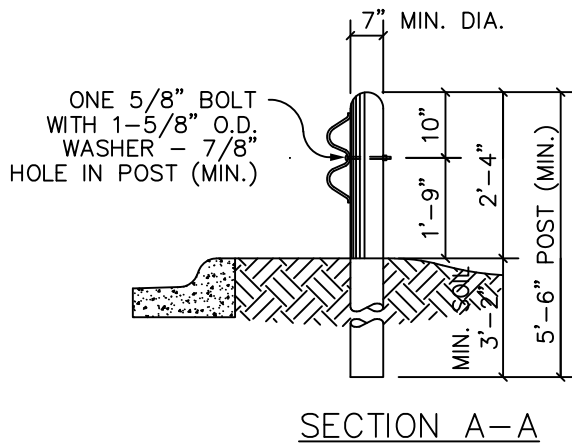
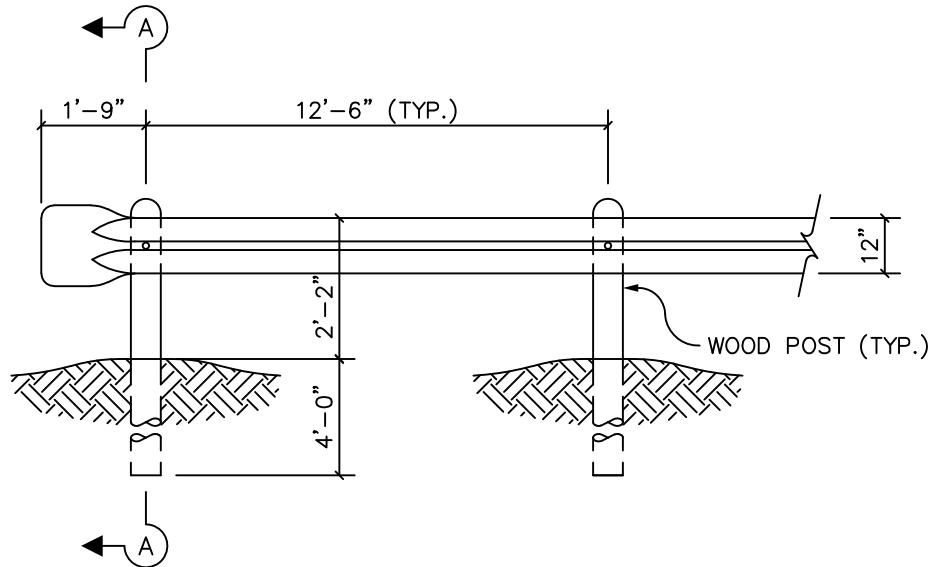


PAVING CONSTRUCTION DETAILS
CONCRETE VALLEY

REVISED MAY 2019

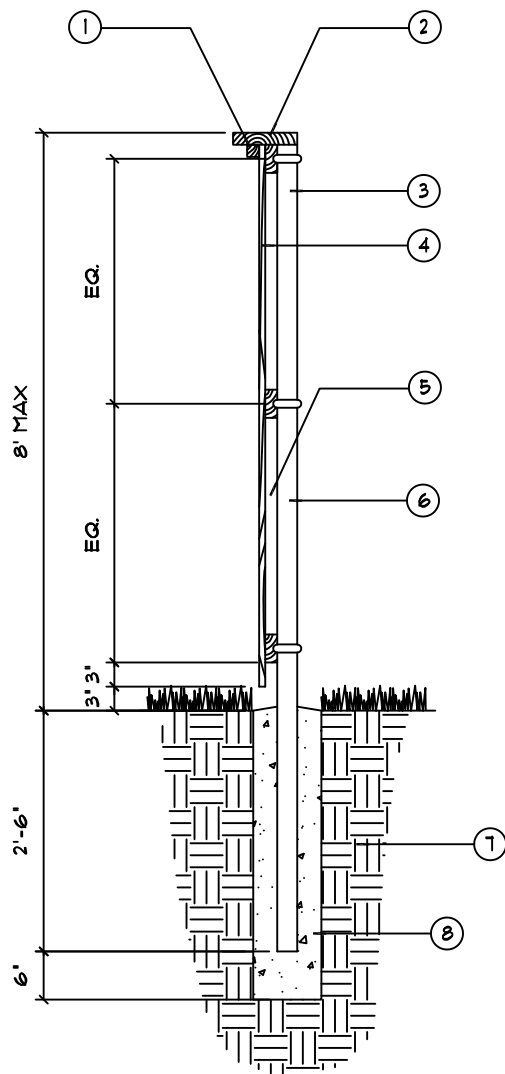
SCALE: N.T.S.

SHEET: P-16



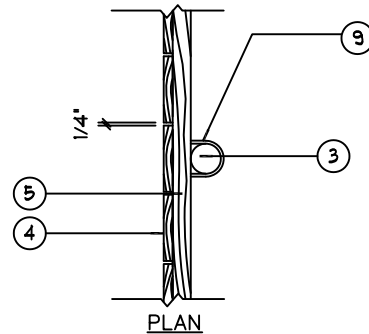
NOTES:

1. METAL BEAM GUARD RAIL SHALL CONFORM TO THE TxDOT OPERATIONS AND PROCEDURES MANUAL (4-700).
2. VERTICAL SUPPORTS MAY BE OF EQUAL ALTERNATE DESIGN APPROVED BY THE CITY ENGINEER.
3. END POST SHALL BE 8" DIA. INTERMEDIATE POST ARE 7" DIA.



NOTES:

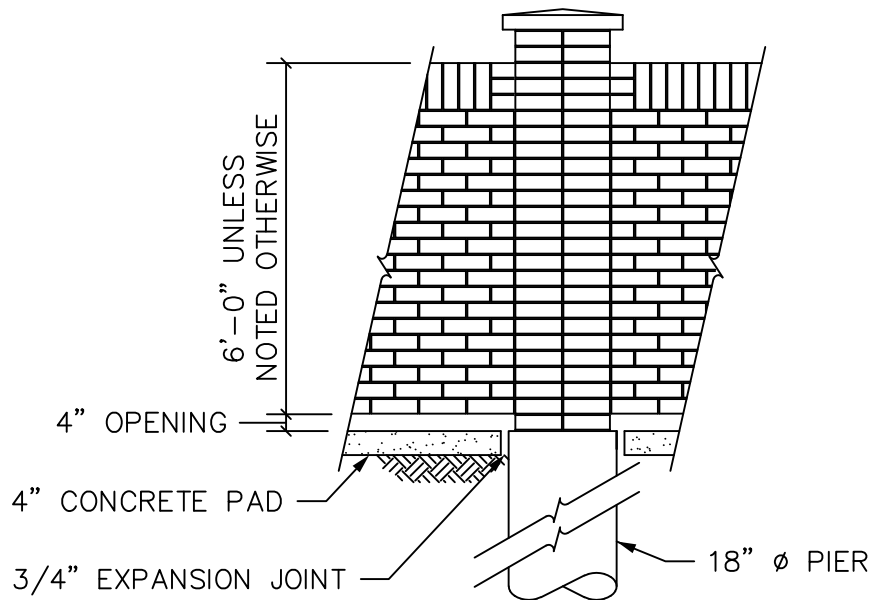
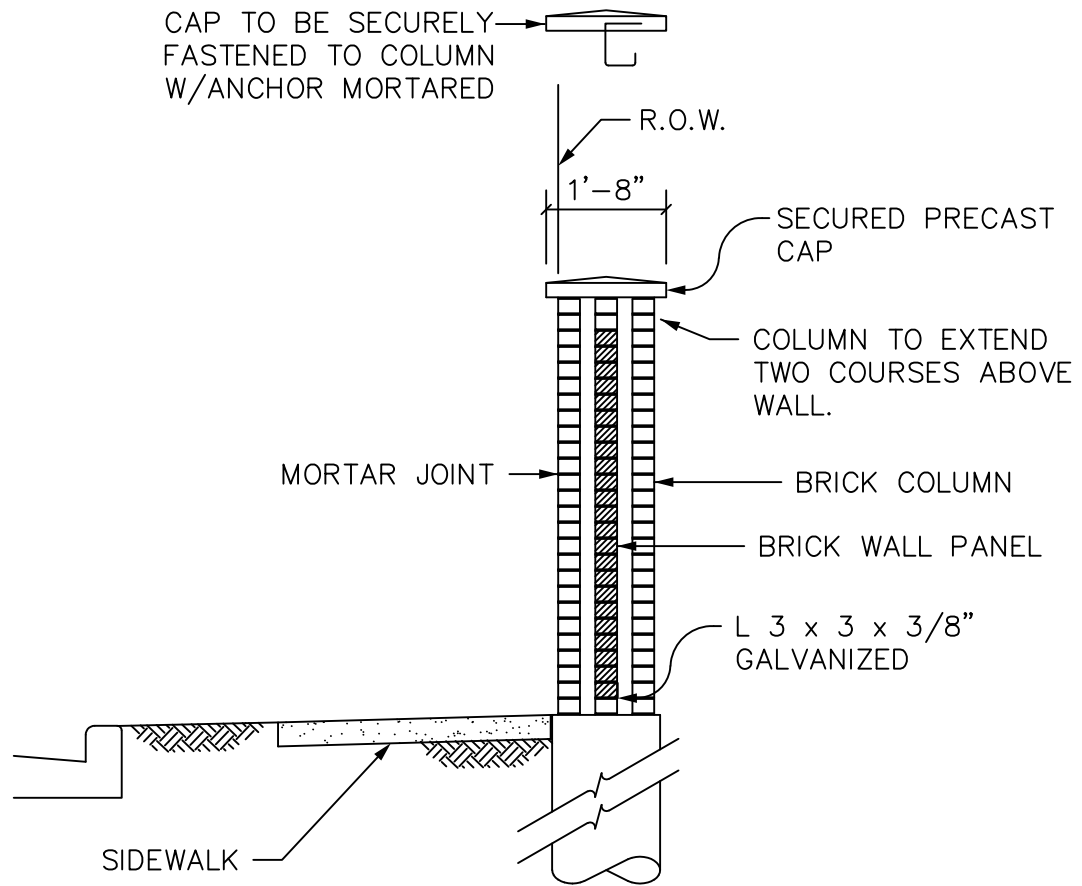
1. FENCE TO BE REDWOOD OR CEDAR
2. HARDWARE TO BE HOT DIPPED GALV.
3. FENCE STAIN TO BE DETERMINED.

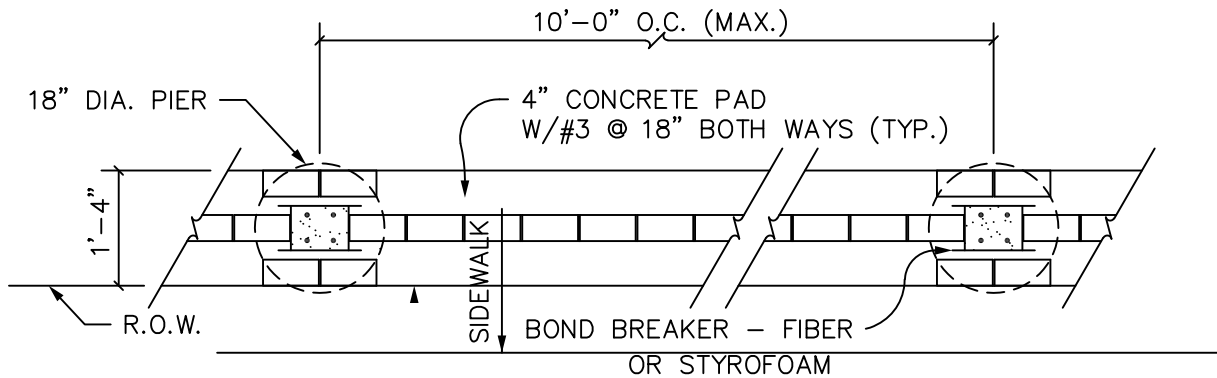


- ① 2"x2" TRIM
- ② 2"x8" CAP (TOP OF FENCE TO BE LEVEL)
- ③ 2" DIA. ~ S.S. 20 GALV. POST WITH CAP. POST SHALL BE FLUSH WITH BOTTOM OF 2"x6" CAP.
- ④ 1"x6" PICKET
NOTE: TO BE 3" ABOVE FINISH GRADE TYP.
- ⑤ (3) 2"x4" RAILS.
- ⑥ WACKER CLAMPS WITH COUNTER-SINK NUTS.
- ⑦ COMPACTED SOIL.
- ⑧ 12" DIA. CONCRETE FOOTING.
- ⑨ "U" BOLTS

COLUMN DESIGN:

1. BRICK COLUMNS SHALL BE SPACED @ 32' ON CENTER MAX.
2. BRICK COLUMNS SHALL BE PLACED ON 18" DIA. DRILLED PIERS REINFORCED WITH 4-#4 BARS (BARS ARE TO BE CONTINUOUS THROUGH BRICK COLUMN) #2 SPIRAL REINFORCING WITH 12" PITCH (PIERS ONLY).
3. COLUMN CAP SHALL BE PERMANENTLY ATTACHED TO THE BRICK COLUMN BY THE USE OF STANDARD MASONRY ANCHORS.

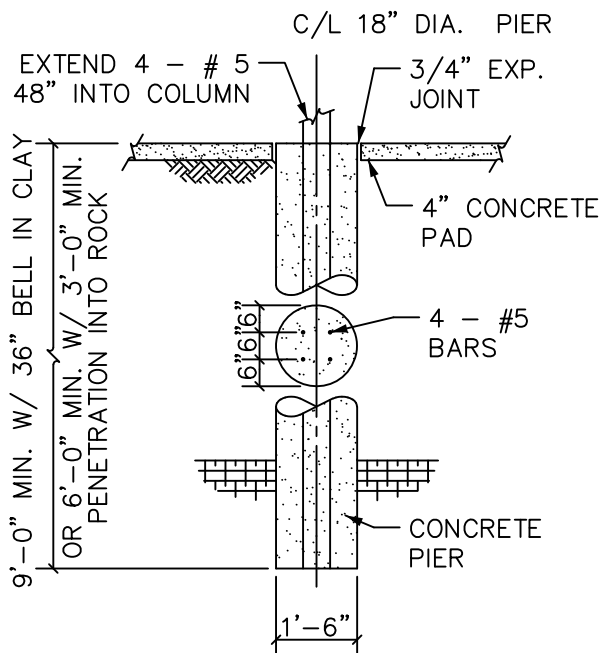




TYPICAL WALL & COLUMN LAYOUT PLAN

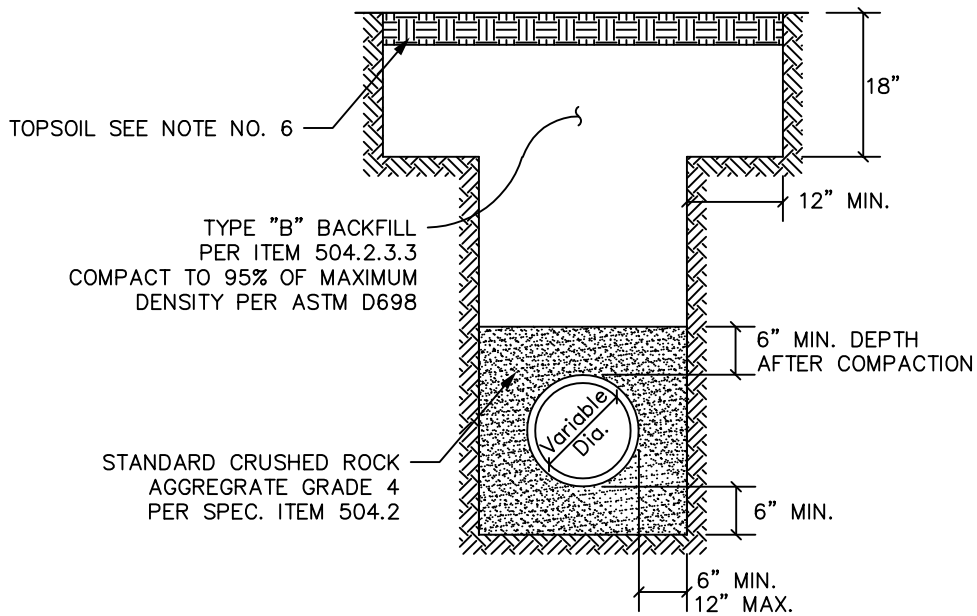
GENERAL NOTES:

1. CONCRETE SHALL BE CLASS "A" PER ITEM 303.
2. ALL CONCRETE REINFORCING STEEL SHALL BE OF DOMESTIC MANUFACTURE AND SHALL CONFORM TO THE REQUIREMENTS OF ASTM A615, GRADE 60.
3. DETAILING OF CONCRETE REINFORCEMENT AND ACCESSORIES SHALL BE IN ACCORDANCE WITH ACI PUBLICATION 315.
4. COMPLETE PIER INSTALLATION, INCLUDING DRILLING, SETTING REBAR, AND PLACING CONCRETE, WITHIN 8 HOURS.
5. BRICK MASONRY SHALL BE ASTM C216, GRADE SW.
6. MORTAR SHALL BE ASTM C270, TYPE "S".
7. CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE "RECOMMENDED PRACTICE FOR ENGINEERED BRICK MASONRY" - BRICK INSTITUTE OF AMERICA.
8. ALL MASONRY (WALL & COLUMN) SHALL BE REINF. W/ 9 GAUGE, MILL GALVANIZED, HORIZONTAL WIRE REINF. (TRUSS TYPE) EVERY COURSE.
9. DESIGN WIND PRESSURE - 20 P.S.F.
10. SCREENING WALL DESIGN SHALL BE SUBMITTED TO THE CITY FOR REVIEW AND APPROVAL.

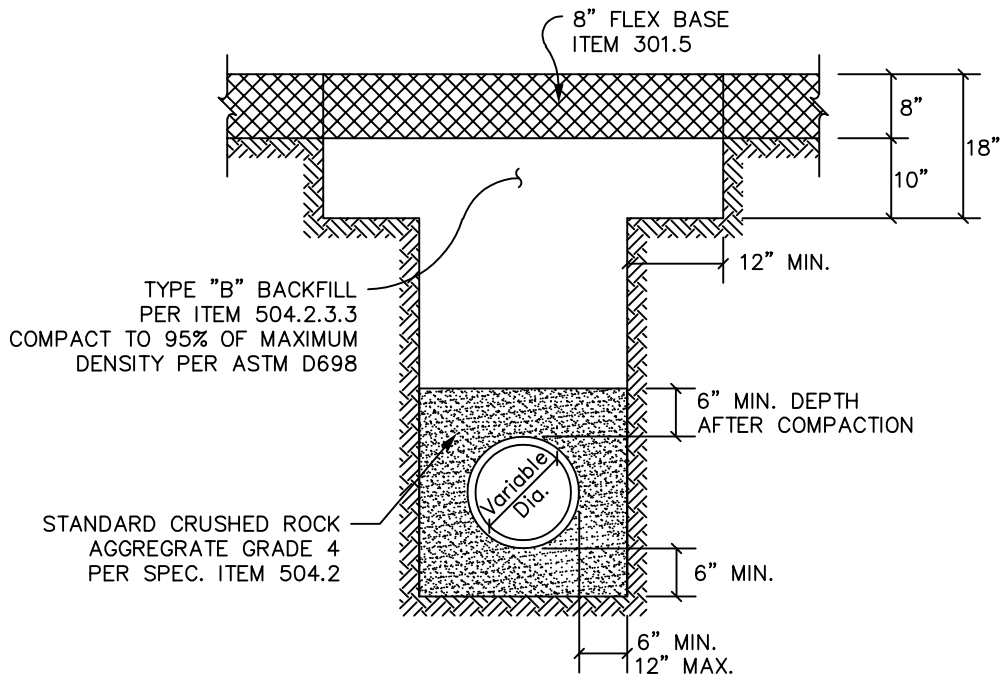


Pier DETAIL

STORM SEWER DETAIL	DETAIL NO.	REVISION DATE
STORM SEWER EMBEDMENT AND BACKFILL	D-1	<div>-----</div> <div>MAY 2019</div>
STORM SEWER EMBEDMENT AND BACKFILL	D-2	
STORM SEWER EMBEDMENT AND BACKFILL	D-3	
STORM SEWER SUBSURFACE DRAIN	D-4	
STORM SEWER INLET GENERAL NOTES	D-5	
STORM SEWER CURB INLET	D-6	
STORM SEWER RECESSED CURB INLET	D-7	
STORM SEWER CURB INLET	D-8	
STORM SEWER DROP INLET	D-9	
STORM SEWER STORM DRAIN MANHOLE	D-10	
STORM SEWER REINFORCED CONCRETE COLLAR	D-11	
STORM SEWER CURBED FLUME AND PILOT CHANNELS	D-12	
STORM SEWER CONCRETE RIPRAP	D-13	
STORM SEWER SLOPING HEADWALL	D-14	
STORM SEWER VERTICAL HEADWALL	D-15	
STORM SEWER CULVERT SAFETY END TREATMENTS	D-16A	
STORM SEWER SAFETY END TREATMENT RUNNERS	D-16B	



UNPAVED AND FUTURE PAVED AREAS



NOTES: EXISTING FLEXBASE SURFACE

1. AT THE END OF EACH WORK DAY ALL SPOILS SHALL BE REMOVED FROM THE CITY & TxDOT R.O.W. UNLESS PRIOR WRITTEN PERMISSION IS OBTAINED FROM THE OWNER TO STORE SPOILS IN DESIGNATED SPOIL STORAGE AREAS THAT DO NOT OBSTRUCT AUTOMOBILE OR PEDESTRIAN TRAFFIC.
2. ALL BACKFILL SHALL BE PER SPEC. ITEM 504 AND SHALL BE COMPACTED PER SPEC. ITEM 504. ROCKS GREATER THAN 4" IN DIA. SHALL BE REMOVED FROM ANY NATIVE MATERIAL USED AS BACKFILL.
3. ALL PAVEMENT SHALL BE REMOVED ALONG NEAT SAW-CUT LINES PER SPEC. ITEM 402.3.
4. A MAXIMUM OF 200 FT. OF OPEN TRENCH WILL BE ALLOWED AT ANY TIME, UNLESS APPROVED BY THE CITY ENGINEER.
5. IN SANDY SOILS THE CRUSHED ROCK EMBEDMENT SHALL BE WRAPPED IN A FILTER FABRIC.
6. TOPSOIL SHALL BE 4 INCHES IN DEPTH AND SHALL BE LOOSE AND FREE OF ROCKS OR CLODS GREATER THAN 1/4" IN DIAMETER. ALL TOPSOIL SHALL BE APPROVED BY THE OWNER PRIOR TO INSTALLATION.

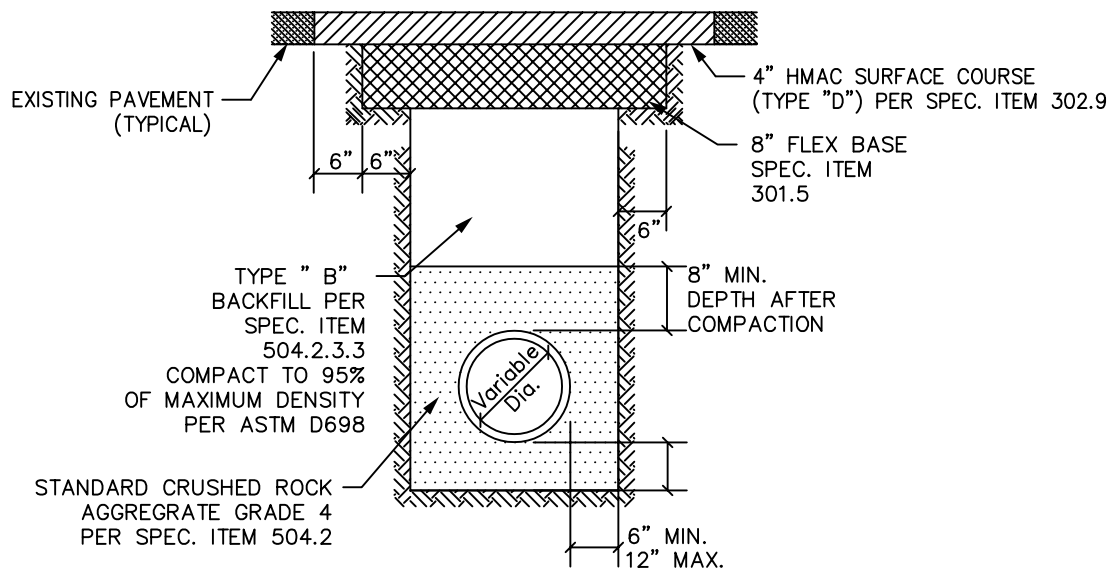


DRAINAGE SYSTEM CONSTRUCTION DETAILS STORM SEWER EMBEDMENT & BACKFILL

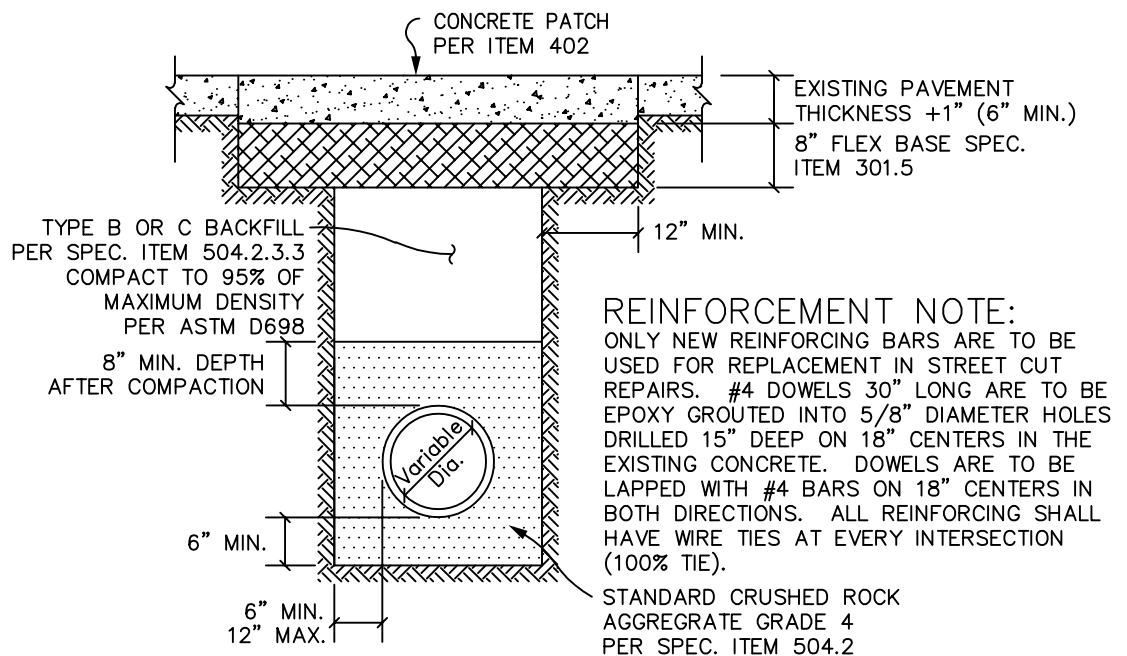
REVISED MAY 2019

SCALE: 1" = 2'

SHEET: D-1



EXISTING ASPHALT PAVEMENT



REINFORCEMENT NOTE:

ONLY NEW REINFORCING BARS ARE TO BE USED FOR REPLACEMENT IN STREET CUT REPAIRS. #4 DOWELS 30" LONG ARE TO BE EPOXY GROUTED INTO 5/8" DIAMETER HOLES DRILLED 15" DEEP ON 18" CENTERS IN THE EXISTING CONCRETE. DOWELS ARE TO BE LAPPED WITH #4 BARS ON 18" CENTERS IN BOTH DIRECTIONS. ALL REINFORCING SHALL HAVE WIRE TIES AT EVERY INTERSECTION (100% TIE).

EXISTING CONCRETE PAVEMENT

NOTES:

1. AT THE END OF EACH WORK DAY ALL SPOILS SHALL BE REMOVED FROM THE CITY & TxDOT R.O.W. UNLESS PRIOR WRITTEN PERMISSION IS OBTAINED FROM THE OWNER TO STORE SPOILS IN DESIGNATED SPOIL STORAGE AREAS THAT DO NOT OBSTRUCT AUTOMOBILE OR PEDESTRIAN TRAFFIC.
2. ALL BACKFILL SHALL BE PER SPEC. ITEM 504 AND SHALL BE COMPACTED PER SPEC. ITEM 504. ROCKS GREATER THAN 4" IN DIA. SHALL BE REMOVED FROM ANY NATIVE MATERIAL USED AS BACKFILL.
3. ALL PAVEMENT SHALL BE REMOVED ALONG NEAT SAW-CUT LINES PER SPEC. ITEM 402.3.
4. A MAXIMUM OF 200 FT. OF OPEN TRENCH WILL BE ALLOWED AT ANY TIME, UNLESS APPROVED BY THE CITY ENGINEER.
5. IN SANDY SOILS THE CRUSHED ROCK EMBEDMENT SHALL BE WRAPPED IN A FILTER FABRIC.

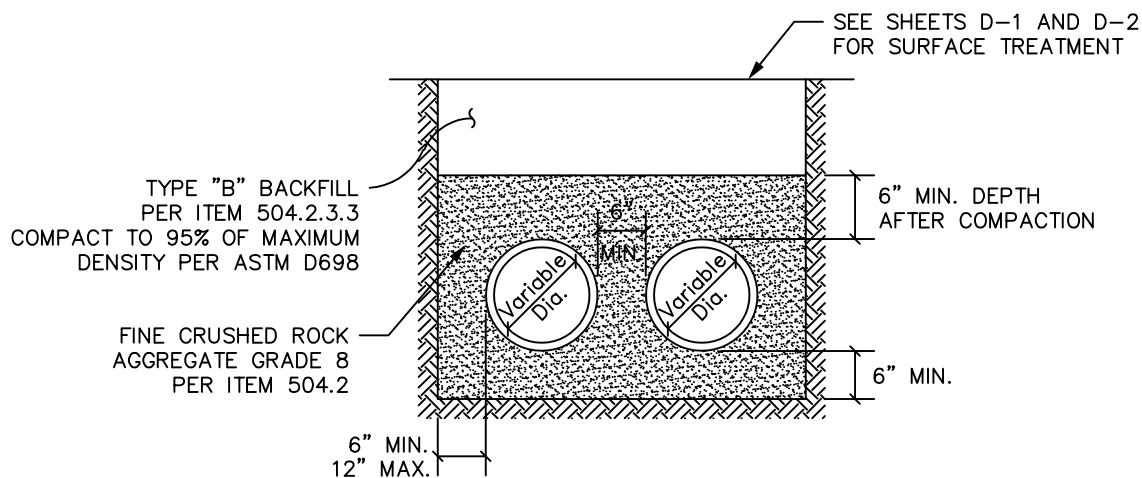


DRAINAGE SYSTEM CONSTRUCTION DETAILS STORM SEWER EMBEDMENT & BACKFILL

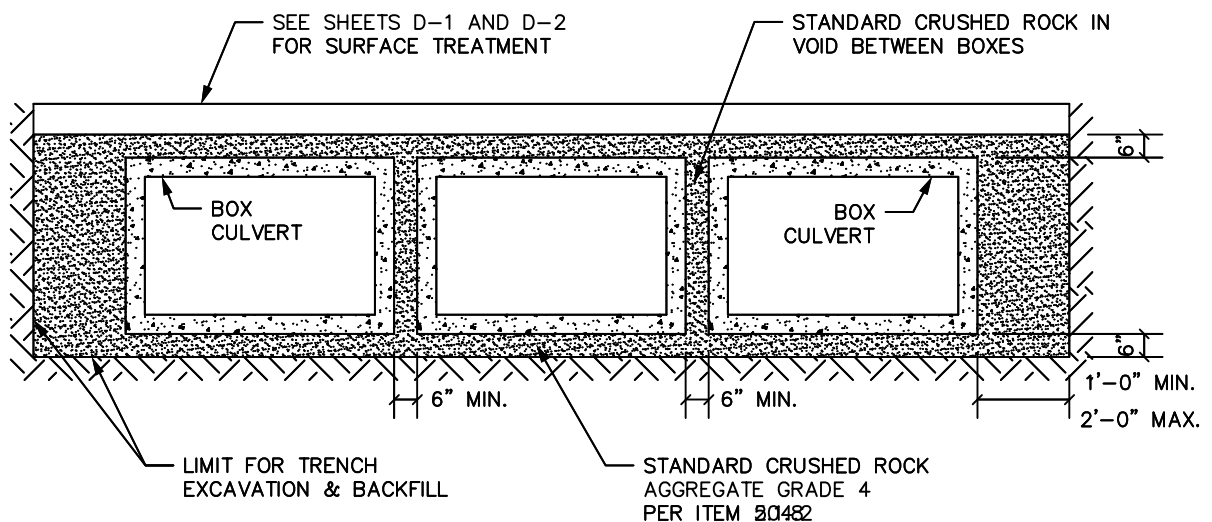
REVISED MAY 2019

SCALE: 1" = 2'

SHEET: D-2



MULTIPLE PIPE EMBEDMENT



MULTIPLE BOX EMBEDMENT

NOTES:

1. AT THE END OF EACH WORK DAY ALL SPOILS SHALL BE REMOVED FROM THE CITY & TxDOT R.O.W. UNLESS PRIOR WRITTEN PERMISSION IS OBTAINED FROM THE OWNER TO STORE SPOILS IN DESIGNATED SPOIL STORAGE AREAS THAT DO NOT OBSTRUCT AUTOMOBILE OR PEDESTRIAN TRAFFIC.
2. ALL BACKFILL SHALL BE PER SPEC. ITEM 504 AND SHALL BE COMPACTED PER SPEC. ITEM 504. ROCKS GREATER THAN 4" IN DIA. SHALL BE REMOVED FROM ANY NATIVE MATERIAL USED AS BACKFILL.
3. ALL PAVEMENT SHALL BE REMOVED ALONG NEAT SAW-CUT LINES PER SPEC. ITEM 402.3.
4. A MAX. OF 200 FT. OF OPEN TRENCH WILL BE ALLOWED AT ANY TIME, UNLESS APPROVED BY THE CITY ENGINEER.
5. IN SANDY SOILS THE CRUSHED ROCK EMBEDMENT SHALL BE WRAPPED IN A FILTER FABRIC.
6. TOPSOIL SHALL BE 4 INCHES IN DEPTH AND SHALL BE LOOSE AND FREE OF ROCKS OR CLODS GREATER THAN 1/4" IN DIAMETER. ALL TOPSOIL SHALL BE APPROVED BY THE OWNER PRIOR TO INSTALLATION.

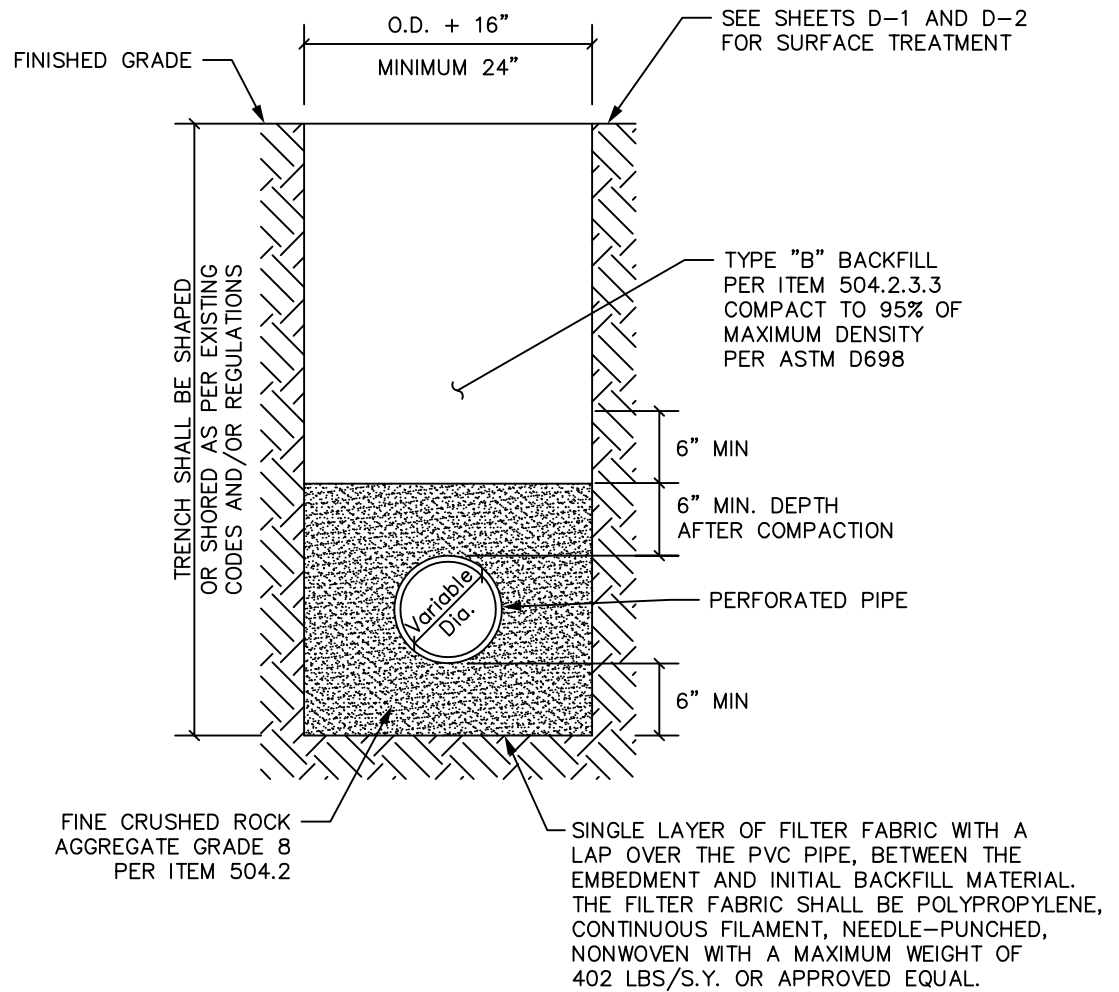


DRAINAGE SYSTEM CONSTRUCTION DETAILS STORM SEWER EMBEDMENT & BACKFILL

REVISED MAY 2019

SCALE: 1" = 2'

SHEET: D-3



NOTES:

1. WHERE THE CONTRACTOR ENCOUNTERS UNDERGROUND WATER, A SUBSURFACE DRAINAGE SYSTEM SHALL BE INSTALLED, WITH THE DISCHARGE OF SAID SYSTEM BEING CARRIED TO THE NEAREST STORM DRAIN SYSTEM OR NATURAL WATER SHED SYSTEM.
2. THE SUBSURFACE DRAINAGE SYSTEM SHALL BE CONSTRUCTED WITH A MINIMUM SIZE OF SIX (6) INCH DIAMETER TYPE PS-46 PVC PIPE, OR APPROVED EQUAL. THE PIPE SHALL MEET ALL CURRENT ASTM F758 REQUIREMENTS, AND SHALL HAVE GASKET TYPE JOINTS. THE PERFORATED AND CONDUCTING PIPES SHALL BE WHITE IN COLOR.
3. IN SANDY SOILS THE CRUSHED ROCK EMBEDMENT SHALL BE WRAPPED IN A FILTER FABRIC.
4. CLEANOUTS SHALL BE INSTALLED AT THE END OF EACH PIPING SYSTEM.
5. FRENCH DRAINS SHALL BE SHOWN ON ALL RECORD DRAWINGS.

GENERAL NOTES:

1. IN GENERAL, INLET REINFORCING STEEL SHALL BE #4 BARS ON 12" CENTERS BOTH WAYS FOR GUTTER, BOTTOM SLAB ENDS, FRONT AND BACK WALLS, AND #4 BARS ON 6" CENTERS BOTH WAYS FOR TOP SLAB. AN ADDITIONAL #6 BAR SHALL BE PLACED IN THE FRONT EDGE OF THE TOP SLAB IN THE INLETS AND ADDITIONAL REINFORCING STEEL SHALL BE PLACED AROUND MANHOLES AS SHOWN.
2. ALL REINFORCING STEEL SHALL BE GRADE 60.
3. ALL CONCRETE SHALL BE CLASS "A" PER ITEM 303. ALL EXPOSED CORNERS SHALL BE CHAMFERED 3/4".
4. ALL REINFORCING STEEL SHALL HAVE A MINIMUM COVER OF 2" TO THE CENTERS OF THE BARS.
5. 10'-0" OF EXISTING CURB AND GUTTER UPSTREAM AND 10'-0" OF EXISTING CURB AND GUTTER DOWNSTREAM SHALL BE REMOVED AND REPOURED INTEGRALLY WITH EACH INLET.
6. ALL BACK FILLING SHALL BE IN ACCORDANCE WITH ITEM 504 TO 95% STANDARD PROCTOR DENSITY.
7. CENTER BEAM IS REQUIRED FOR ALL INLET OPENINGS GREATER THAN 10'-0".
8. TWO MANHOLE FRAMES AND COVERS ARE REQUIRED WHEN INLET OPENING IS GREATER THAN 10'-0".
9. ALL INLET FLOORS ARE TO HAVE A 2% SLOPE TOWARDS THE OUTLET PIPE.
10. MINIMUM INLET OPENING SIZE IS 5'-0".
11. MAXIMUM INLET OPENING SIZE IS 20'-0".
12. OUTLET PIPE TO BE PLACED AT LOWEST END OF FLOOR INLET. MANHOLE COVER TO BE PLACED ABOVE OUTLET END OF INLET.
13. MANHOLE FRAME AND COVER SHALL BE CAST IRON, VULCAN V-1874 OR BASS AND HAYES PATTERN 103 OR APPROVED EQUAL.
14. MANHOLE COVERS SHALL HAVE CHAINS ATTACHED TO PREVENT COVERS FROM BEING WASHED AWAY DURING FLOOD CONDITIONS.

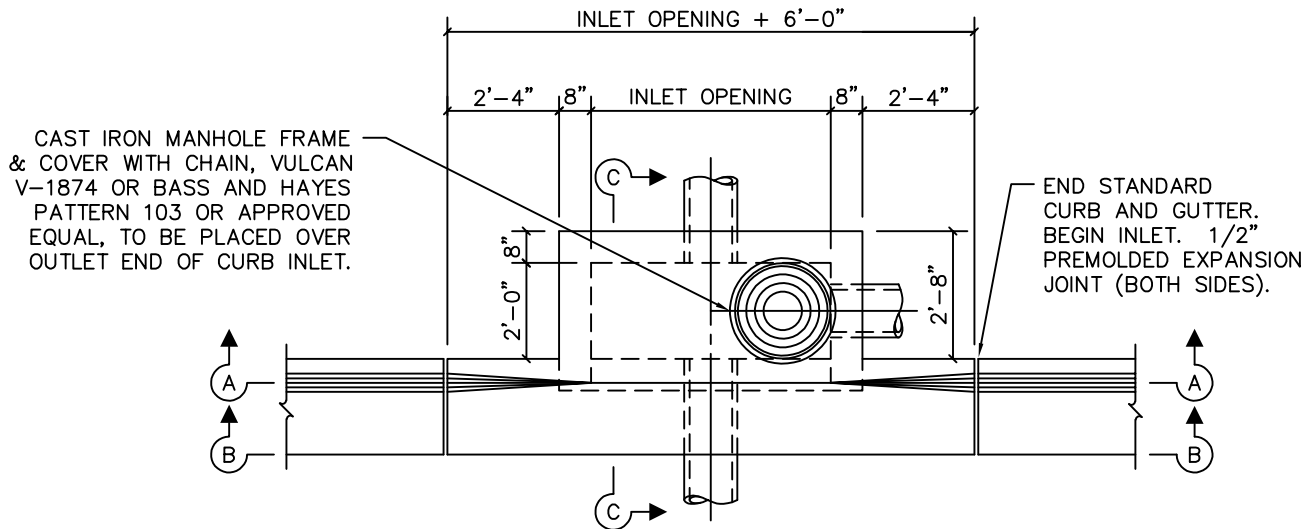


DRAINAGE SYSTEM CONSTRUCTION DETAILS STORM SEWER INLET GENERAL NOTES

REVISED MAY 2019

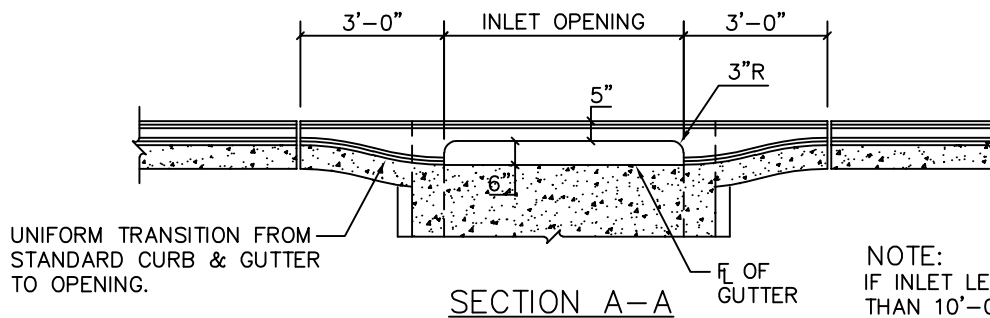
SCALE: N/A

SHEET: D-5



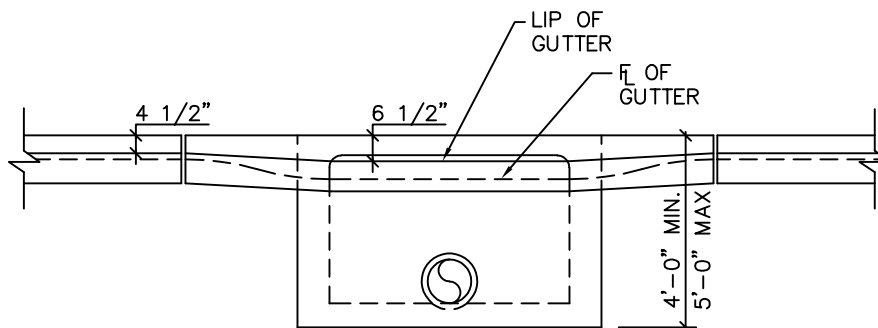
SEE SHEET D-8 FOR SECTION C-C

PLAN VIEW



SECTION A-A

NOTE:
IF INLET LENGTH IS GREATER THAN 10'-0", PLACE TWO (2) MANHOLE FRAMES AND COVERS ON TOP OF INLET BOX.



SECTION B-B

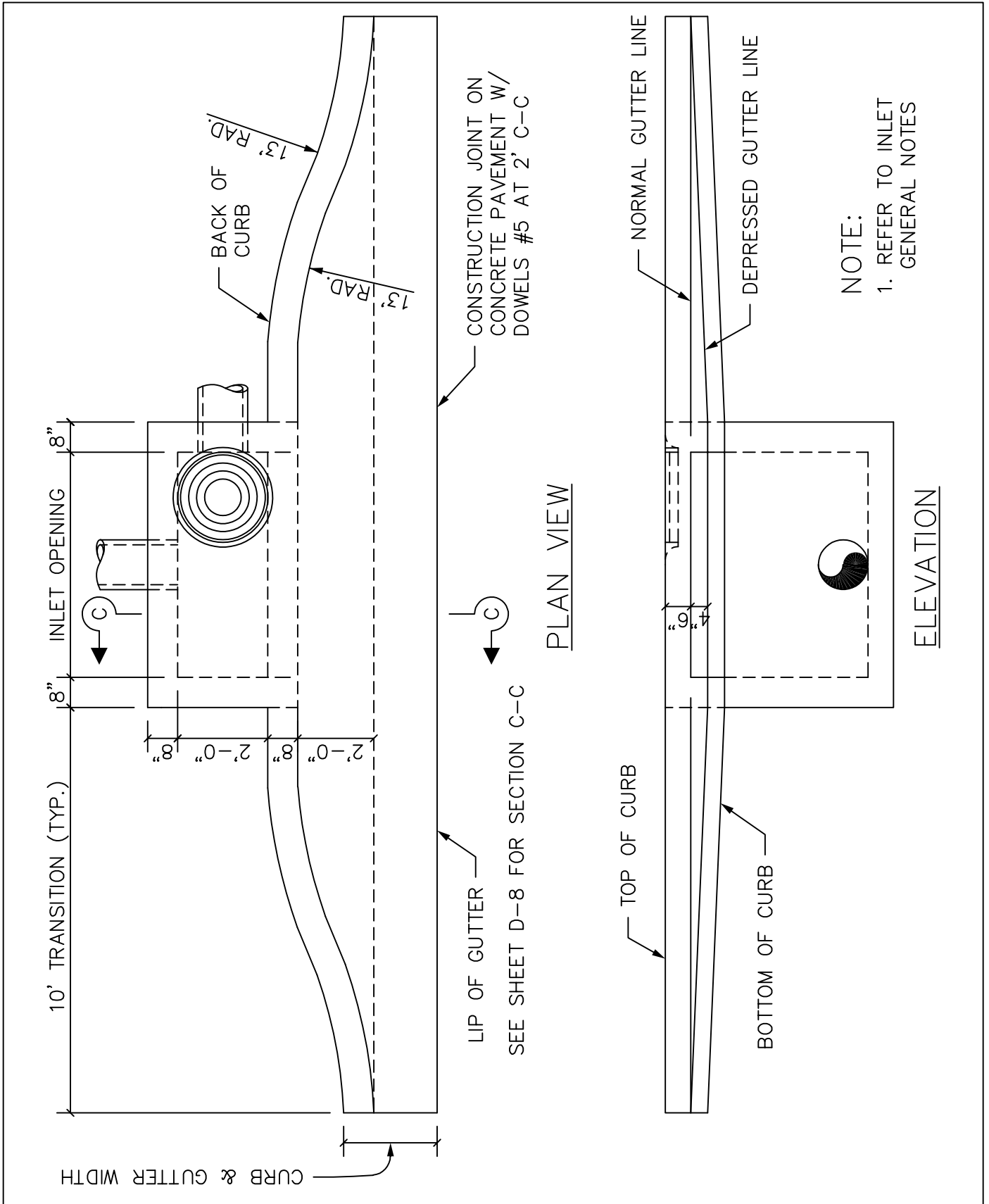


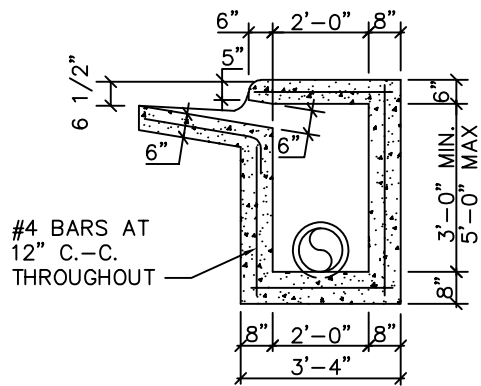
DRAINAGE SYSTEM CONSTRUCTION DETAILS
STORM SEWER CURB INLET

REVISED MAY 2019

SCALE: 1/4" = 1'

SHEET: D-6

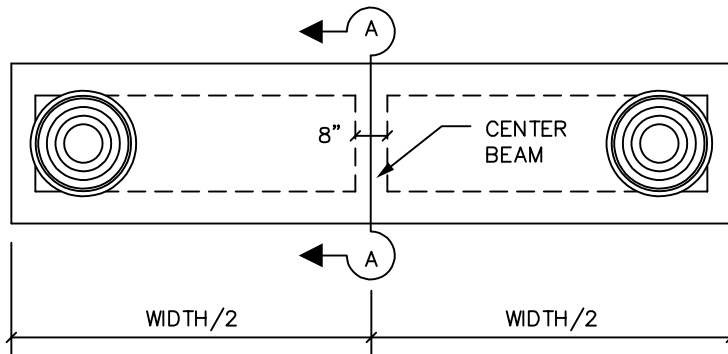




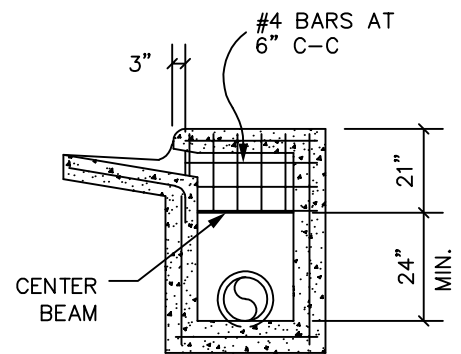
SECTION C-C

NOTE

SEE SHEET D-5 FOR GENERAL INLET INFORMATION



PLAN VIEW



SECTION A-A

CENTER BEAM DETAIL

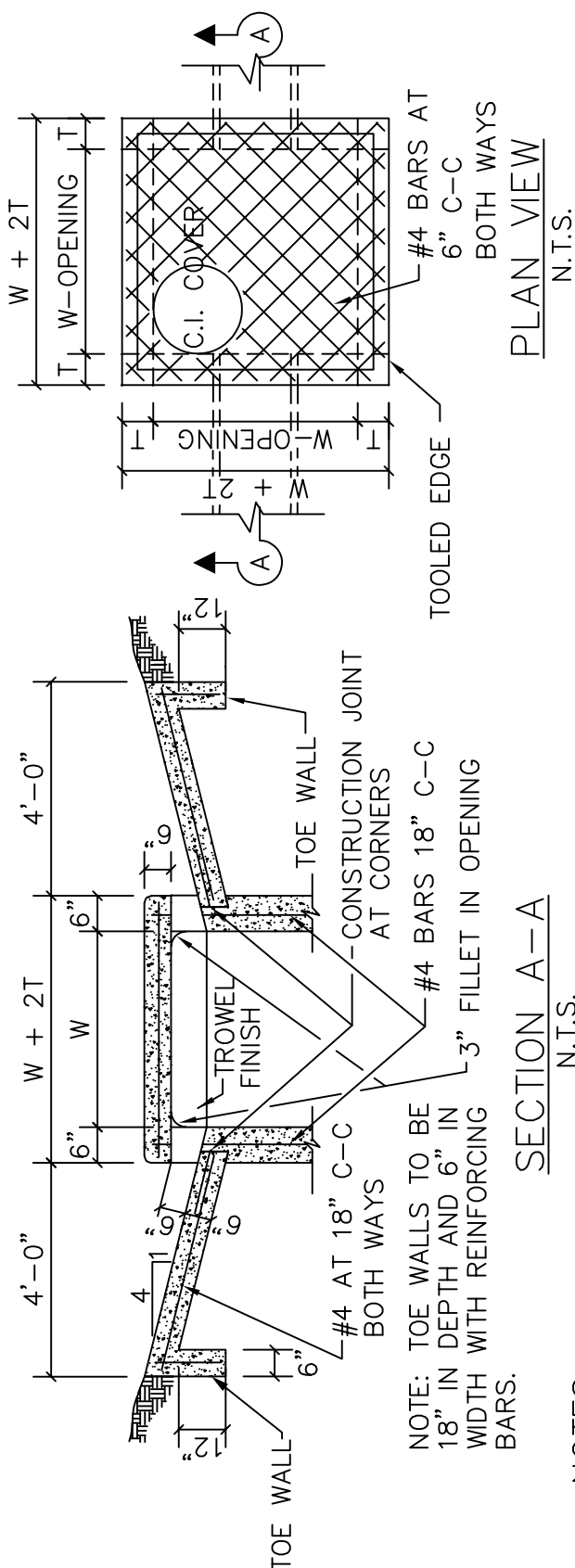


DRAINAGE SYSTEM CONSTRUCTION DETAILS
STORM SEWER CURB INLET

REVISED MAY 2019

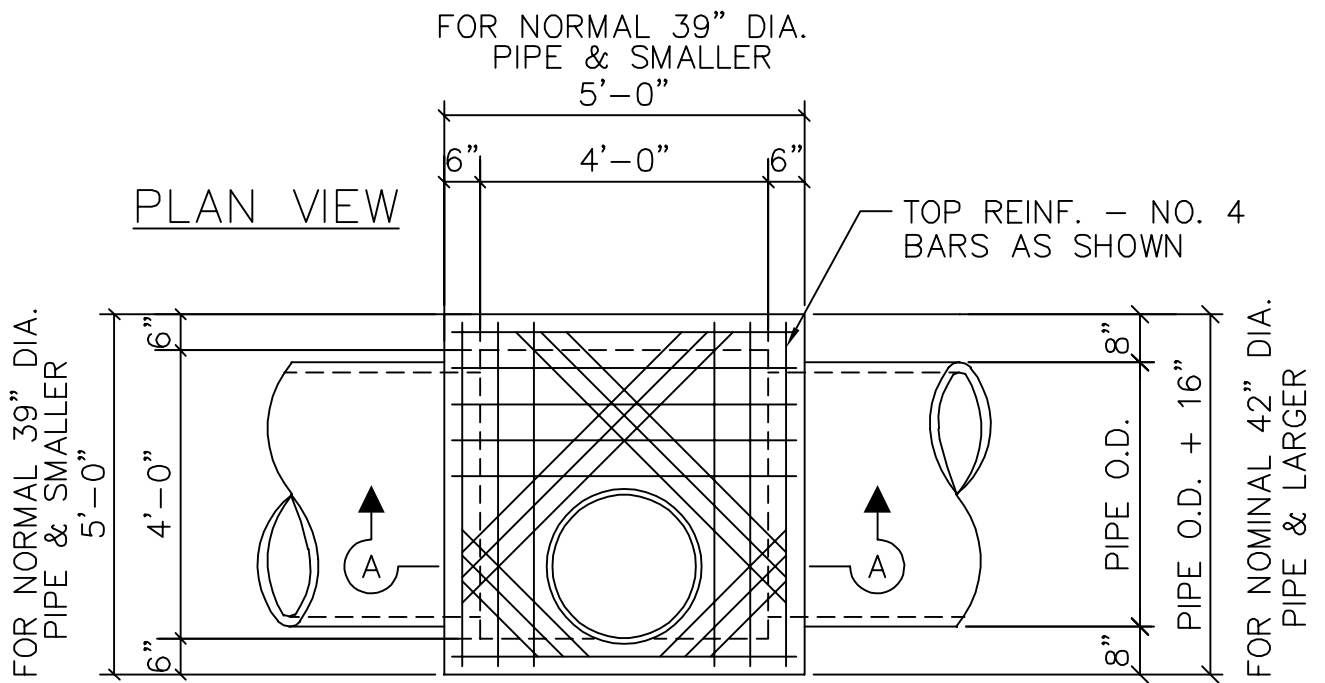
SCALE: 1/4" = 1'

SHEET: D-8



INLET SIZE	T	W
2' SQUARE	7"	2'-0"
4' SQUARE	7"	4'-0"
5' SQUARE	8"	5'-0"
6' SQUARE	9"	6'-0"
7' SQUARE	9"	7'-0"
8' SQUARE	9"	8'-0"

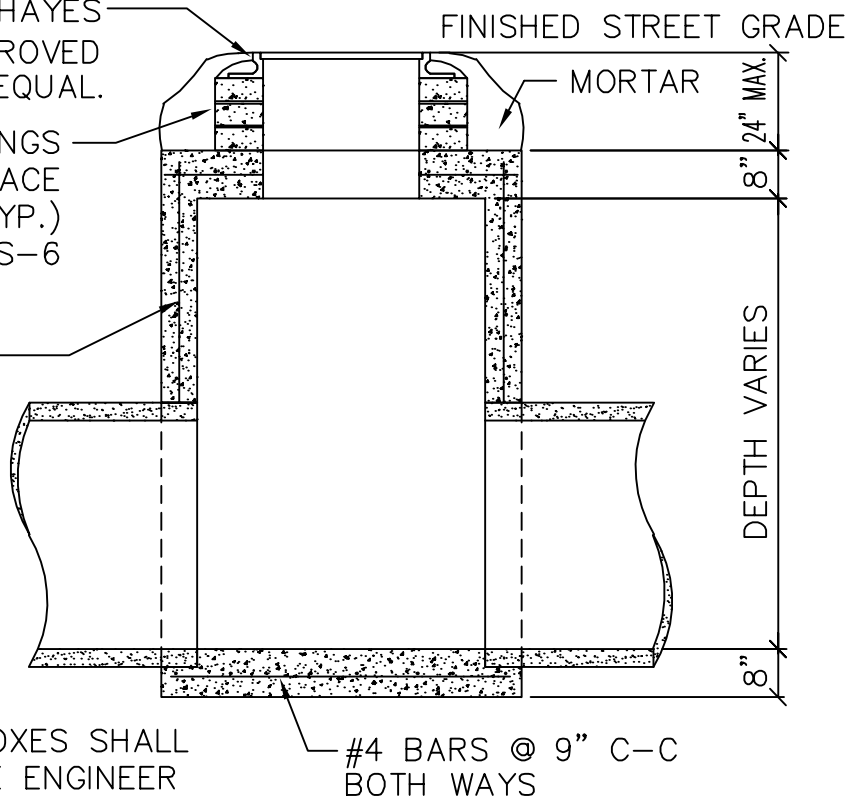
FOR LOWER PORTION OF 2' SQUARE
DROP INLET USE REINF. STEEL DETAILS
OF 4' SQUARE MANHOLE AND ELIMINATE
INLET RING AND COVER.



MANHOLE FRAME AND COVER SHALL BE CAST IRON VULCAN V-1874 OR BASS AND HAYES PATTERN 103 OR APPROVED EQUAL.

CONCRETE EXTENSION RINGS PRECAST OR CAST IN PLACE (8" WIDTH TYP.) SEE SHEET S-6

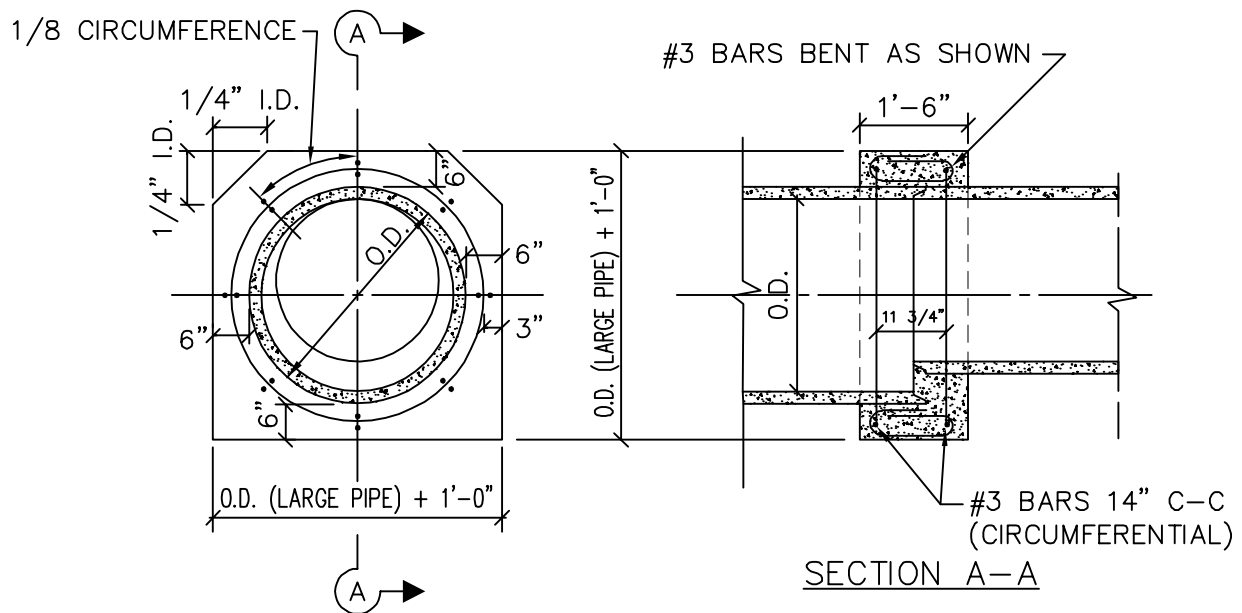
#4 BARS @ 9" C-C BOTH WAYS



NOTES:

1. LARGER JUNCTION BOXES SHALL BE DESIGNED BY THE ENGINEER AND SUBMITTED TO THE CITY ENGINEER FOR REVIEW.

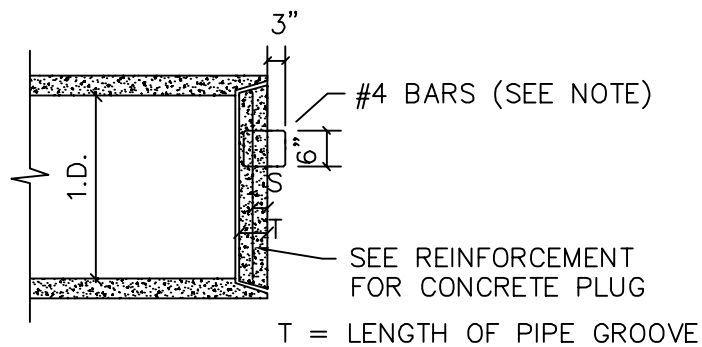
SECTION A-A



REINFORCED CONCRETE COLLAR

NOTE:

COLLARS MAY ONLY BE USED TO REDUCE THE DIAMETER ONE PIPE SIZE.
A JUNCTION BOX IS REQUIRED FOR REDUCING MORE THAN ONE PIPE SIZE.



REINFORCED CONCRETE PIPE PLUG

PIPE SIZE	REINF. BAR	DISTANCE C-C BOTH WAYS	S
18"-33"	# 2	12"	1/2 T
36"-54"	# 3	12"	1/3 T
60"	# 4	12"	1/4 T

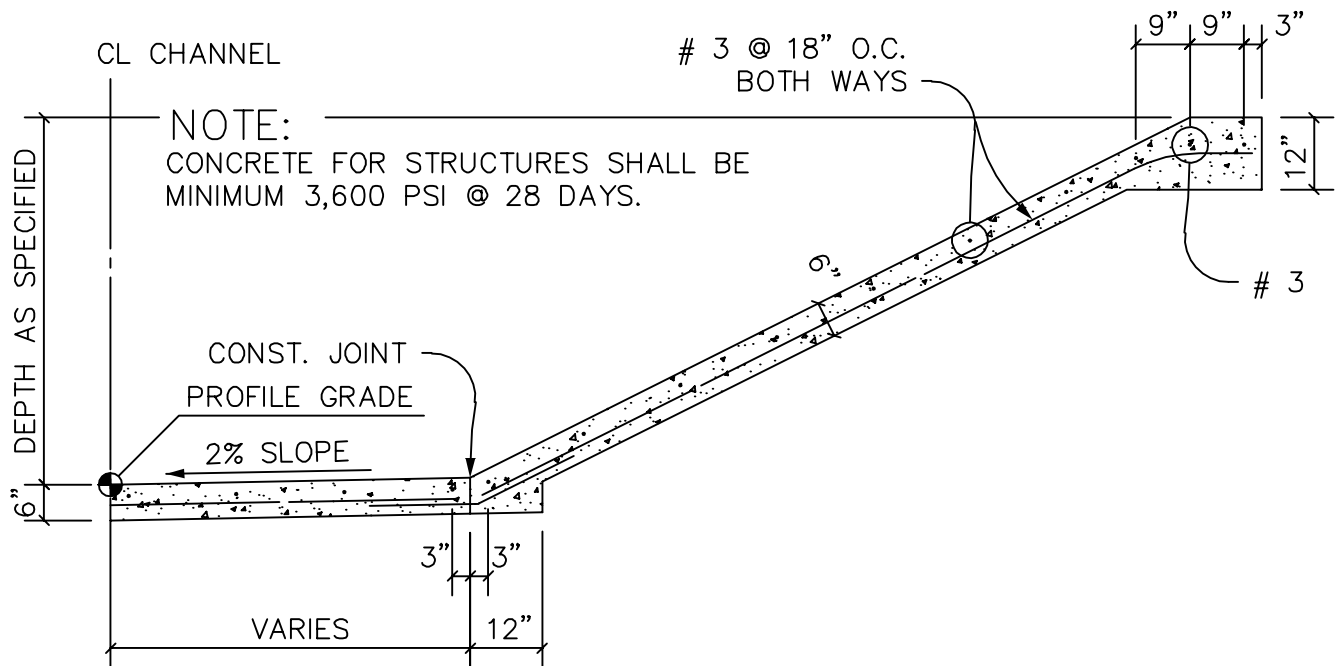
NOTE:

STEEL HANDLE FOR REINFORCED CONCRETE PIPE PLUG SHALL BE LOCATED 1/4 I.D. ABOVE CENTER POINT OF PLUG. TWO (2) STEEL HANDLES WILL BE REQUIRED ON PLUGS OF 36" DIA. PIPES OR LARGER AND SHALL BE PLACED 1/4 I.D. APART AND 1/4 I.D. ABOVE CENTER OF PLUG.



DRAINAGE SYSTEM CONSTRUCTION DETAILS
STORM SEWER REINFORCED
CONCRETE COLLAR

REVISED MAY 2019
SCALE: 3/8" = 1'
SHEET: D-11

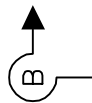


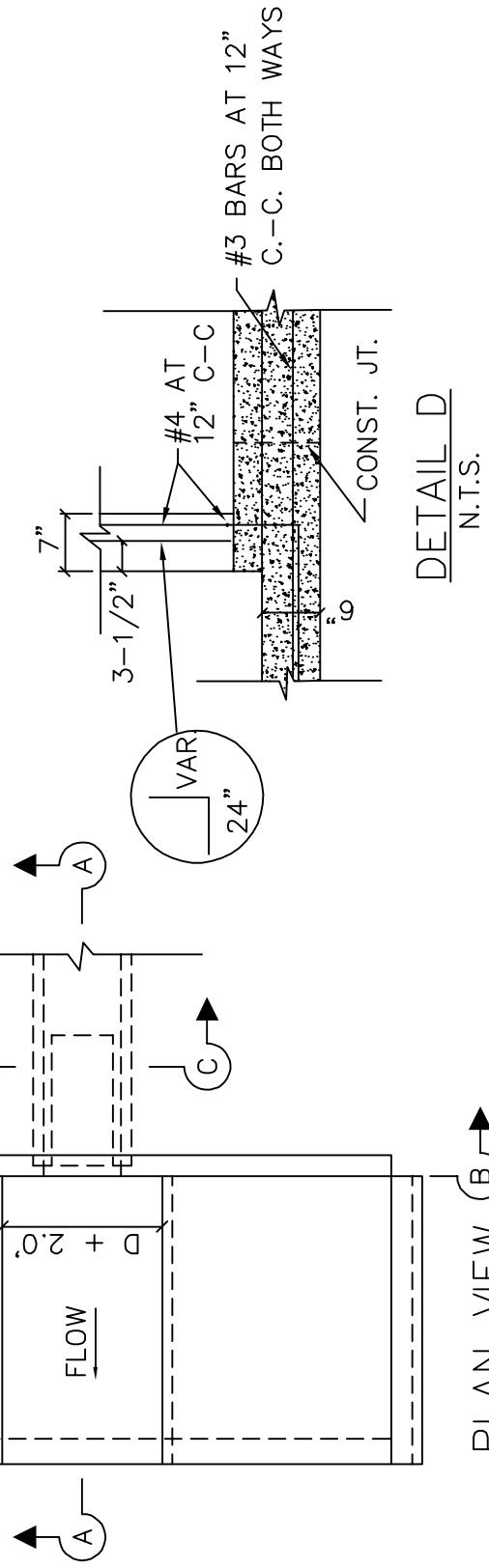
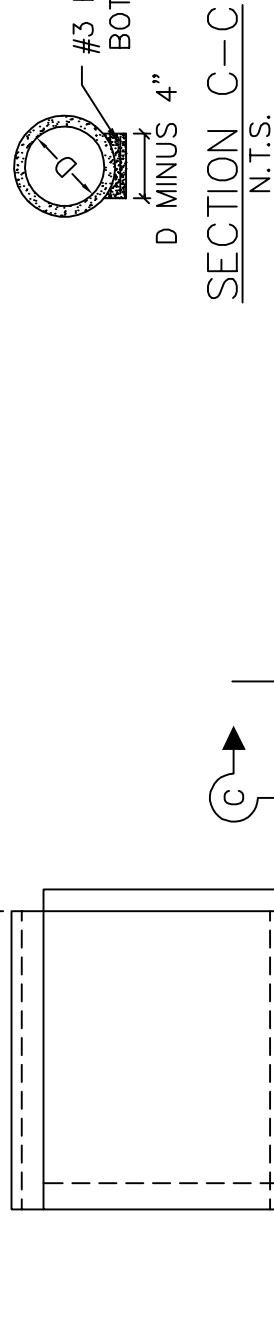
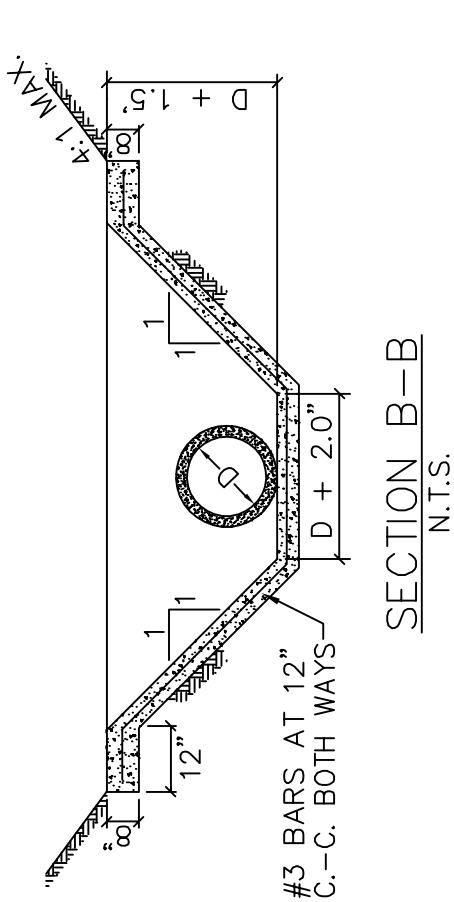
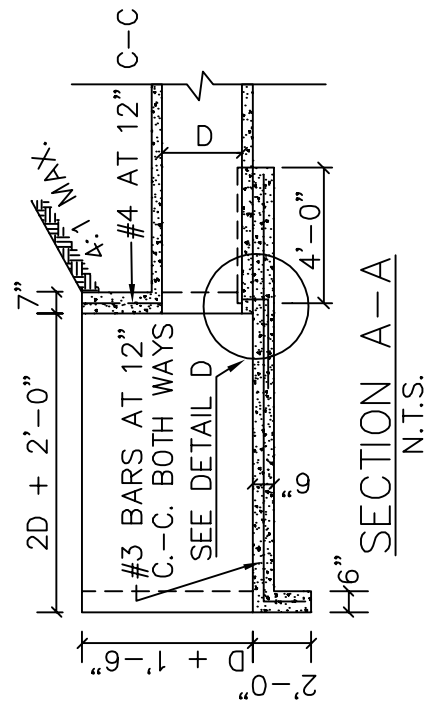
NOTE:
 RIPRAP TO BE FORMED ON UNDISTURBED
 SOIL CUT TO GRADE. IF TO BE PLACED ON
 FILL, ALL FILL SHALL BE PLACED ON BENCHES
 CUT IN UNDISTURBED SOIL AND FILLED IN
 8" LOOSE LIFTS, EACH COMPACTED TO 95%
 STANDARD PROCTOR DENSITY. THE FILL SO
 COMPACTED SHALL THEN BE CUT TO GRADE.



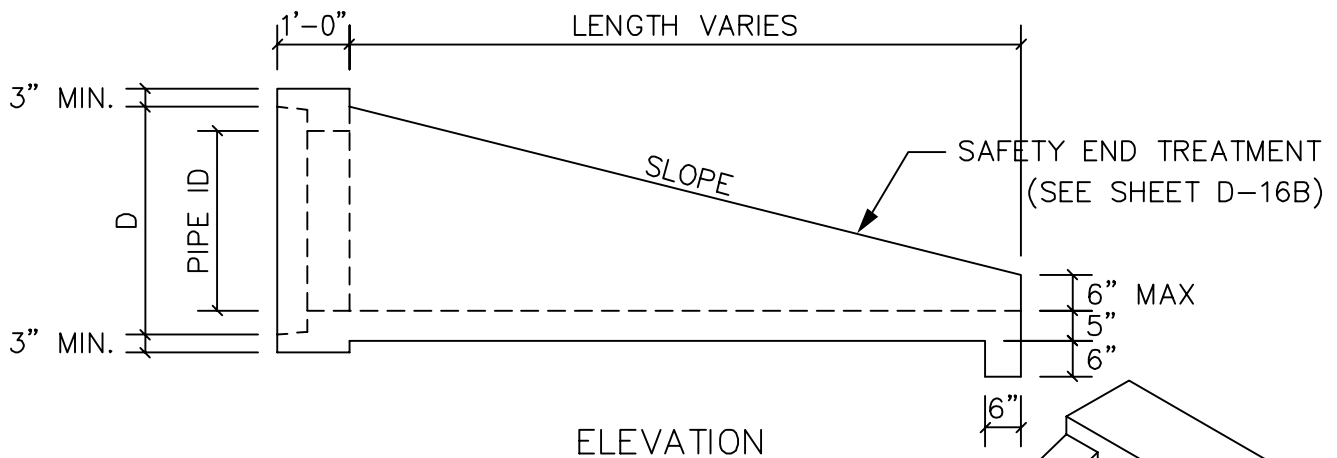
DRAINAGE SYSTEM CONSTRUCTION DETAILS
 STORM SEWER CONCRETE RIPRAP

REVISED MAY 2019
 SCALE: 3/8" = 1'
 SHEET: D-13



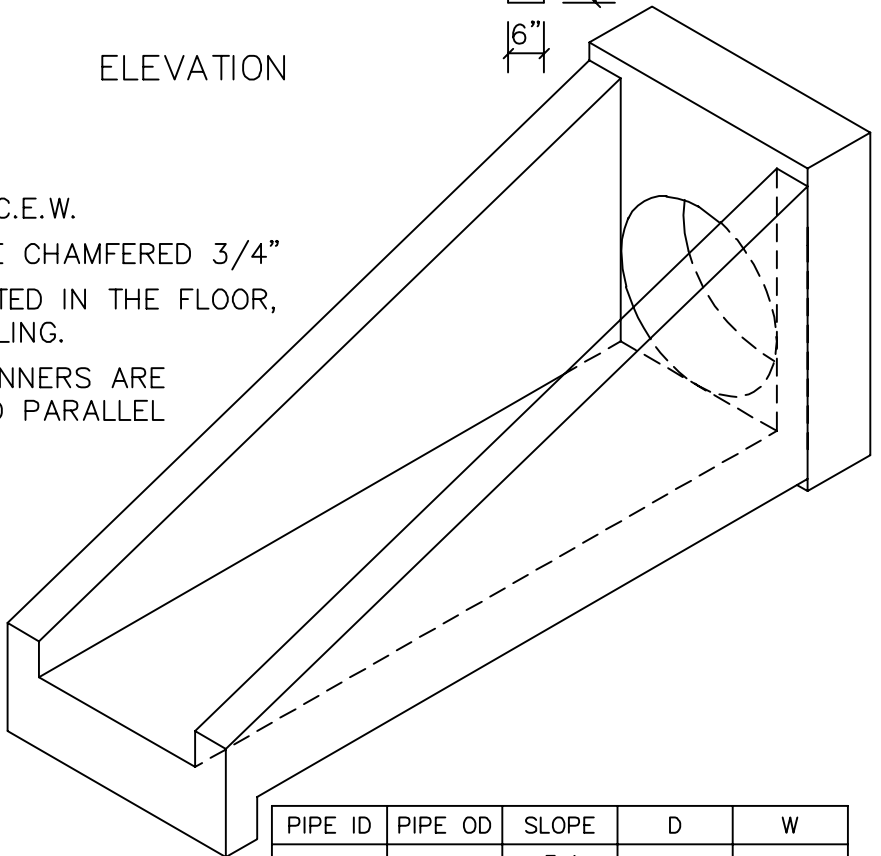
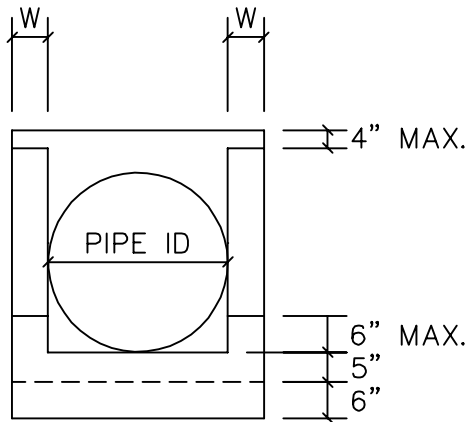


DETAIL D
N.T.S.



NOTES:

1. 4500 PSI CONCRETE
2. #4 GRADE 60 REBAR 9" O.C.E.W.
3. ALL EXPOSED CORNERS ARE CHAMFERED 3/4"
4. SWIFT LIFT ANCHORS, LOCATED IN THE FLOOR, SHALL BE USED FOR HANDLING.
5. GALVANIZED STEEL PIPE RUNNERS ARE AVAILABLE FOR CROSS AND PARALLEL DRAINAGE APPLICATIONS.



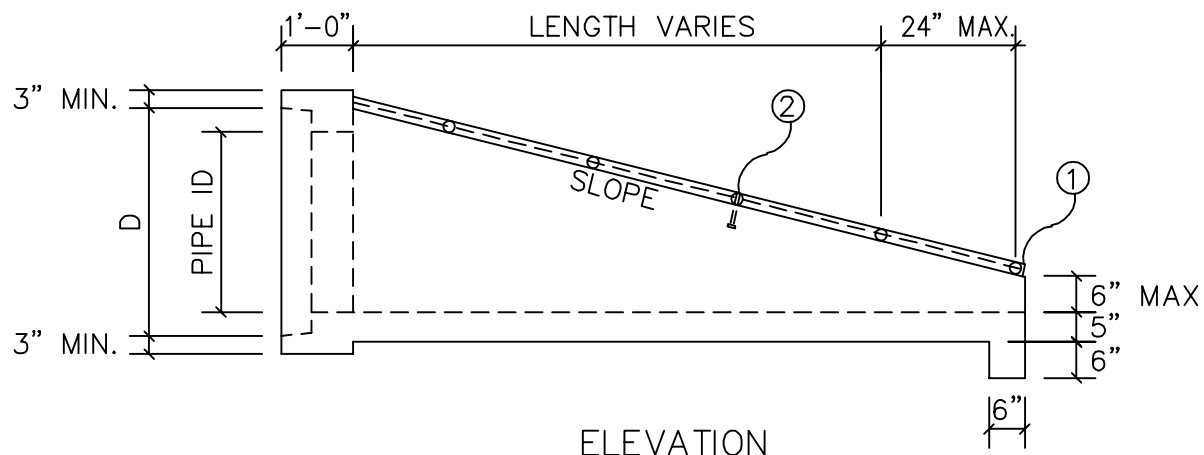
PIPE ID	PIPE OD	SLOPE	D	W
30"	37"	3:1	38"	6"
		4:1		
		6:1		
36"	44"	3:1	45-1/2"	6"
		4:1		
		6:1		
42"	51"	3:1	52-3/4"	8"
		4:1		
		6:1		
48"	58"	3:1	60"	8"
		4:1		
		6:1		
54"	65"	3:1	67"	8"

PIPE ID	PIPE OD	SLOPE	D	W
18"	23"	3:1	24"	5"
		4:1		
		6:1		
24"	30"	3:1	31"	5"
		4:1		
		6:1		



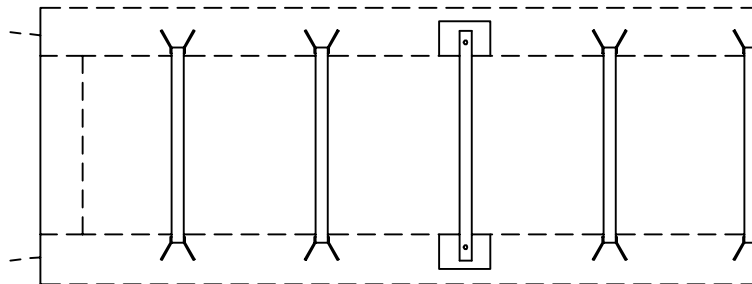
DRAINAGE SYSTEM CONSTRUCTION DETAILS
CULVERT SAFETY END TREATMENTS

REVISED MAY 2019
SCALE: 3/8" = 1'
SHEET: D-16A



① TOP OF SAFETY PIPE RUNNER (TYP)

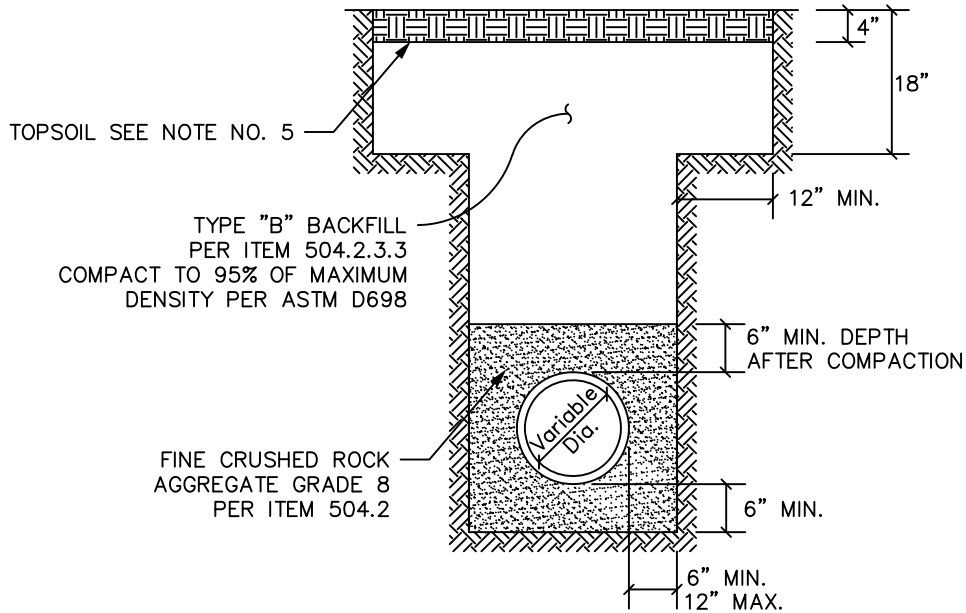
② THIRD PIPE RUNNER SHALL ALWAYS HAVE BOLTED CONNECTION FOR CLEAN OUT ACCESS



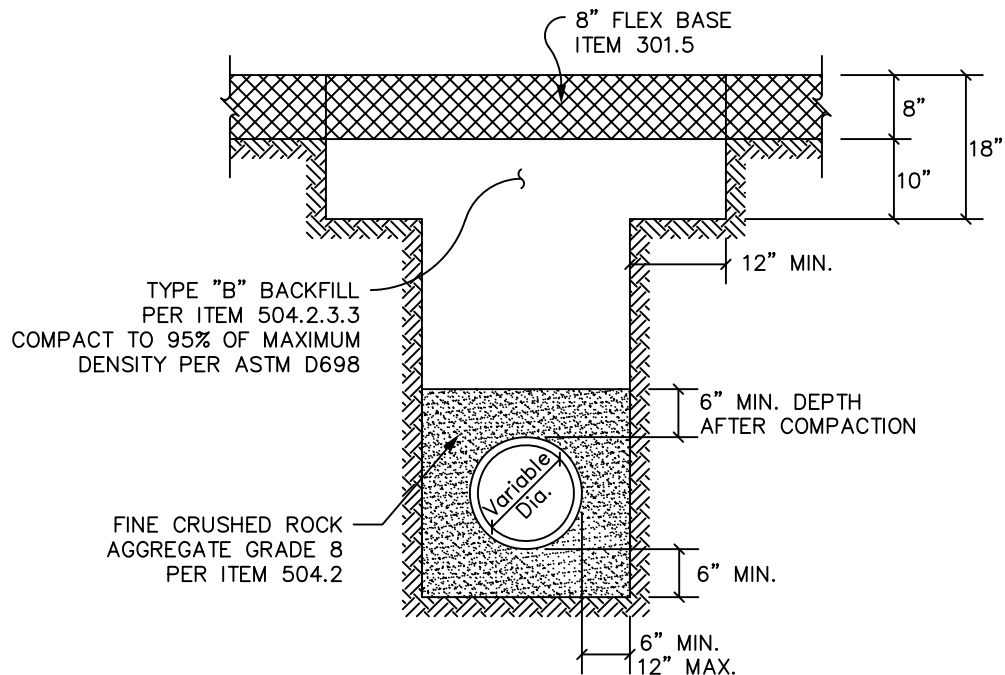
NOTES:

1. SAFETY END PIPE SHALL BE 2" DIAMETER.
2. PIPE AND BOLTS SHALL BE GALVANIZED STEEL.

SANITARY SEWER DETAIL	DETAIL NO.	REVISION DATE
STANDARD SANITARY SEWER EMBEDMENT AND BACKFILL	S-1A	MAY 2019
STANDARD SANITARY SEWER EMBEDMENT AND BACKFILL	S-1B	
PRECAST SANITARY SEWER MANHOLE	S-2	
CAST-IN-PLACE SANITARY SEWER MANHOLE	S-3	
DROP SANITARY SEWER MANHOLE	S-4	
MANHOLE FRAME AND COVER	S-5	
EXTENSION RING INSTALLATION	S-6	
4 INCH SANITARY SEWER SERVICE	S-7	
SANITARY SEWER MAIN LINE CLEANOUT	S-8	
ABANDONMENT OF EXISTING MANHOLE	S-9	
CONCRETE ENCASEMENT	S-10	
SANITARY SEWER LINE BORE AND CASING	S-11	



UNPAVED AND FUTURE PAVED AREAS



NOTES:

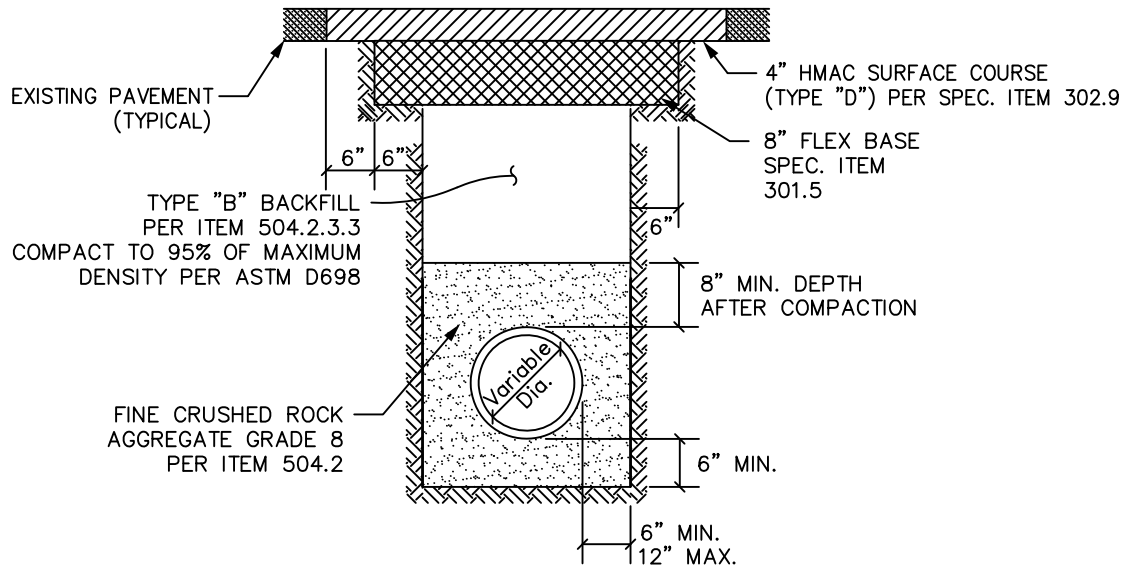
EXISTING FLEXBASE SURFACE

1. AT THE END OF EACH WORK DAY ALL SPOILS SHALL BE REMOVED FROM THE CITY & TXDOT R.O.W. UNLESS PRIOR WRITTEN PERMISSION IS OBTAINED FROM THE OWNER TO STORE SPOILS IN DESIGNATED SPOIL STORAGE AREAS THAT DO NOT OBSTRUCT AUTOMOBILE OR PEDESTRIAN TRAFFIC.
2. ALL BACKFILL SHALL BE PER SPEC. ITEM 504 AND SHALL BE COMPACTED PER SPEC ITEM 504. ROCKS GREATER THAN 4" IN DIAMETER SHALL BE REMOVED FROM ANY NATIVE MATERIAL USED AS BACKFILL.
3. ALL PAVEMENT SHALL BE REMOVED ALONG NEAT SAW CUT LINES PER SPEC ITEM 402.3.
4. A MAXIMUM OF 200-FT OF OPEN TRENCH WILL BE ALLOWED AT ANY TIME, UNLESS APPROVED BY THE CITY ENGINEER.
5. TOPSOIL SHALL BE 4 INCHES IN DEPTH AND SHALL BE LOOSE AND FREE OF ROCKS OR CLODS GREATER THAN 1/4" IN DIAMETER. ALL TOPSOIL SHALL BE APPROVED BY THE OWNER PRIOR TO INSTALLATION.

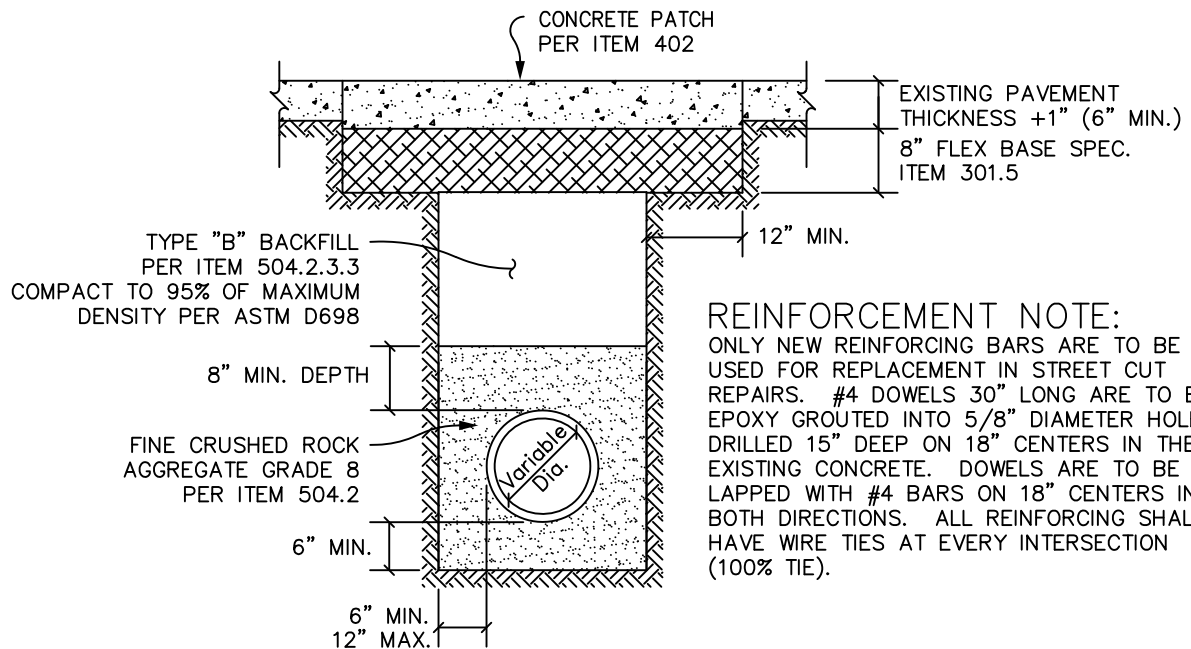


SEWER SYSTEM CONSTRUCTION DETAILS STANDARD SANITARY SEWER EMBEDMENT AND BACKFILL

REVISED MAY 2019
SCALE: 1/2" = 1'
SHEET: S-1A



EXISTING ASPHALT PAVEMENT



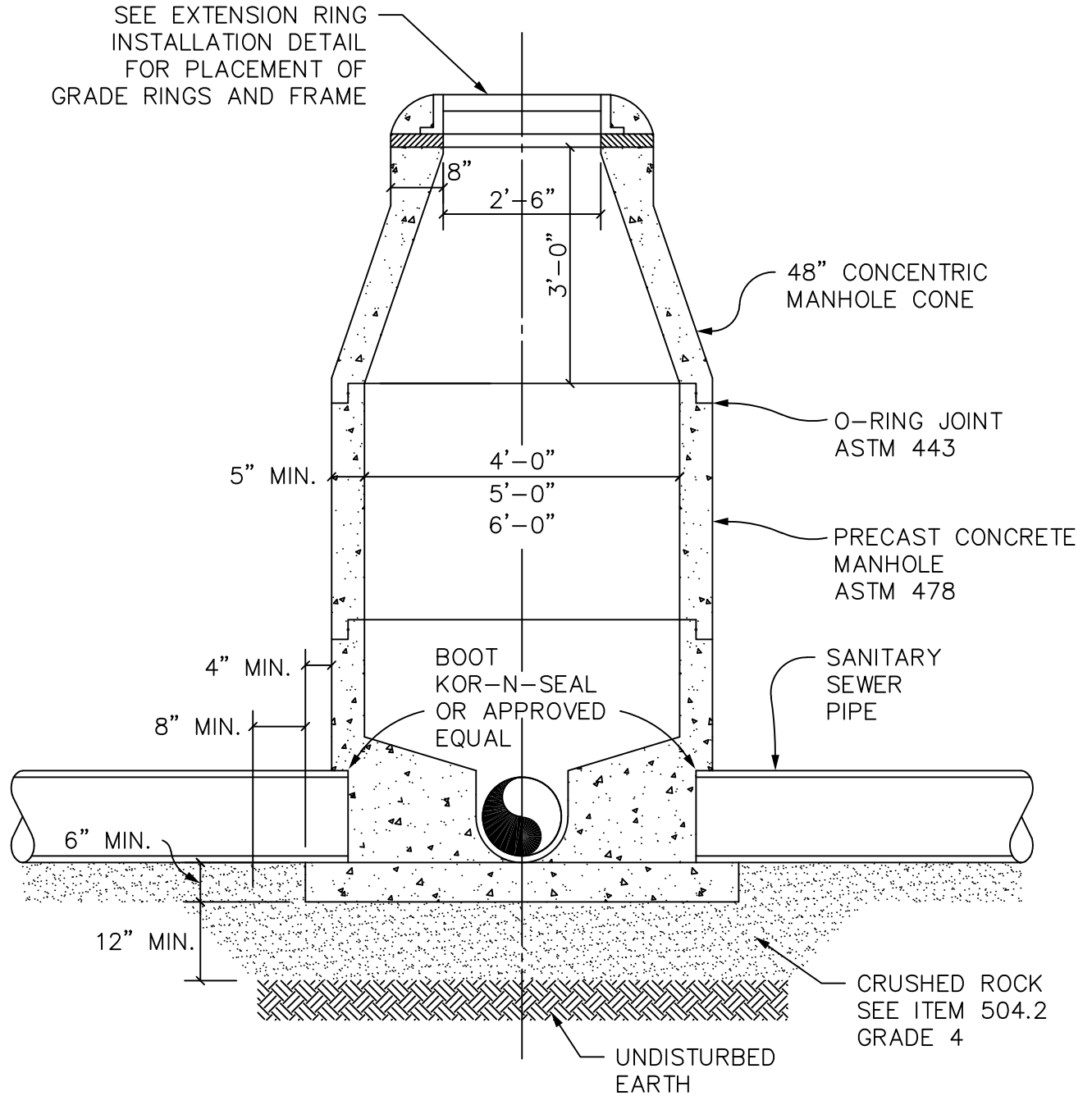
REINFORCEMENT NOTE:

ONLY NEW REINFORCING BARS ARE TO BE USED FOR REPLACEMENT IN STREET CUT REPAIRS. #4 DOWELS 30" LONG ARE TO BE EPOXY GROUTED INTO 5/8" DIAMETER HOLES DRILLED 15" DEEP ON 18" CENTERS IN THE EXISTING CONCRETE. DOWELS ARE TO BE LAPPED WITH #4 BARS ON 18" CENTERS IN BOTH DIRECTIONS. ALL REINFORCING SHALL HAVE WIRE TIES AT EVERY INTERSECTION (100% TIE).

NOTES:

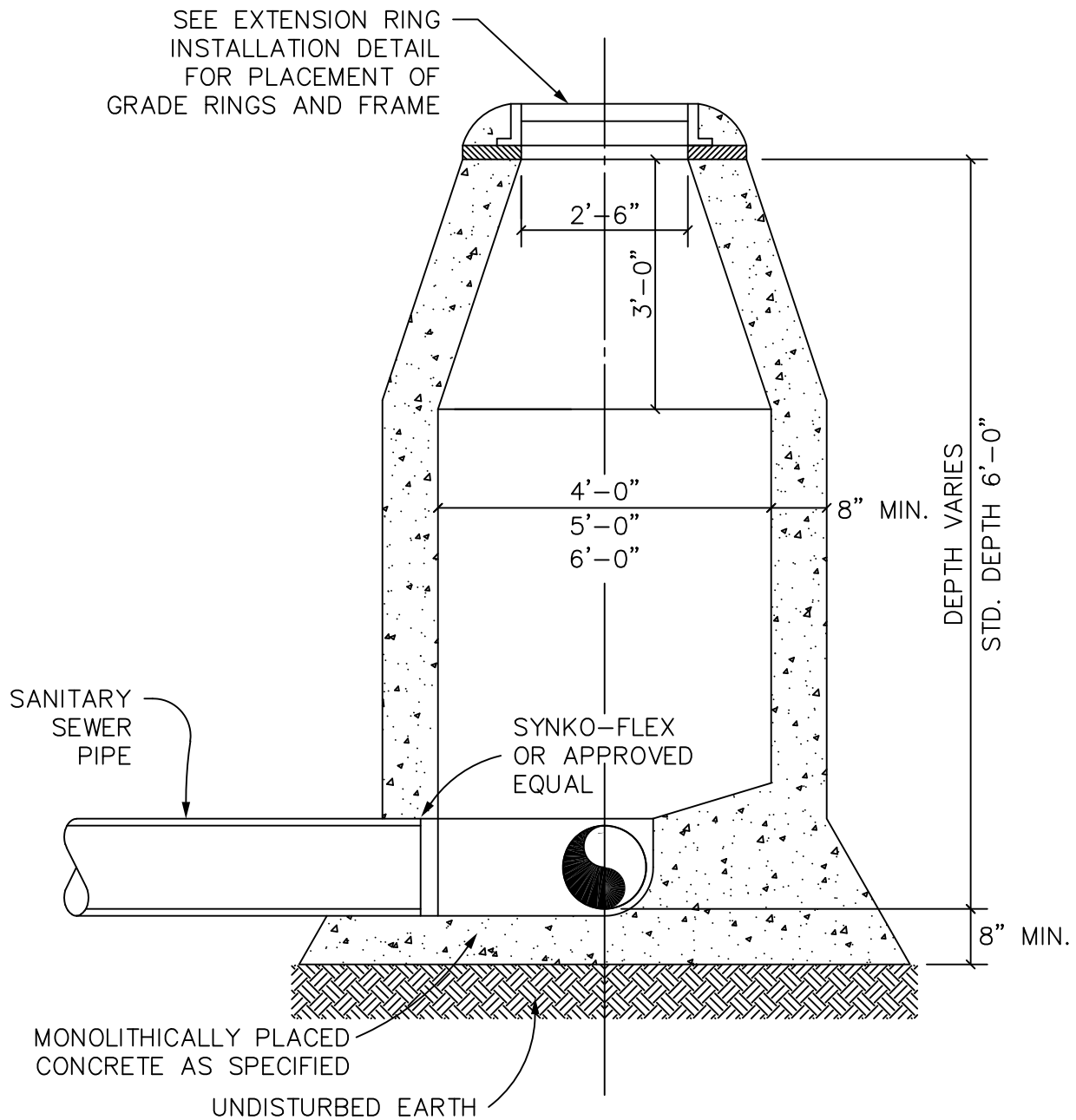
EXISTING CONCRETE PAVEMENT

1. AT THE END OF EACH WORK DAY ALL SPOILS SHALL BE REMOVED FROM THE CITY & TXDOT R.O.W. UNLESS PRIOR WRITTEN PERMISSION IS OBTAINED FROM THE OWNER TO STORE SPOILS IN DESIGNATED SPOIL STORAGE AREAS THAT DO NOT OBSTRUCT AUTOMOBILE OR PEDESTRIAN TRAFFIC.
2. ALL BACKFILL SHALL BE PER SPEC. ITEM 504 AND SHALL BE COMPACTED PER SPEC ITEM 504. ROCKS GREATER THAN 4" IN DIAMETER SHALL BE REMOVED FROM ANY NATIVE MATERIAL USED AS BACKFILL.
3. ALL PAVEMENT SHALL BE REMOVED ALONG NEAT SAW CUT LINES PER SPEC ITEM 402.3.
4. A MAXIMUM OF 200-FT OF OPEN TRENCH WILL BE ALLOWED AT ANY TIME, UNLESS APPROVED BY THE CITY ENGINEER.



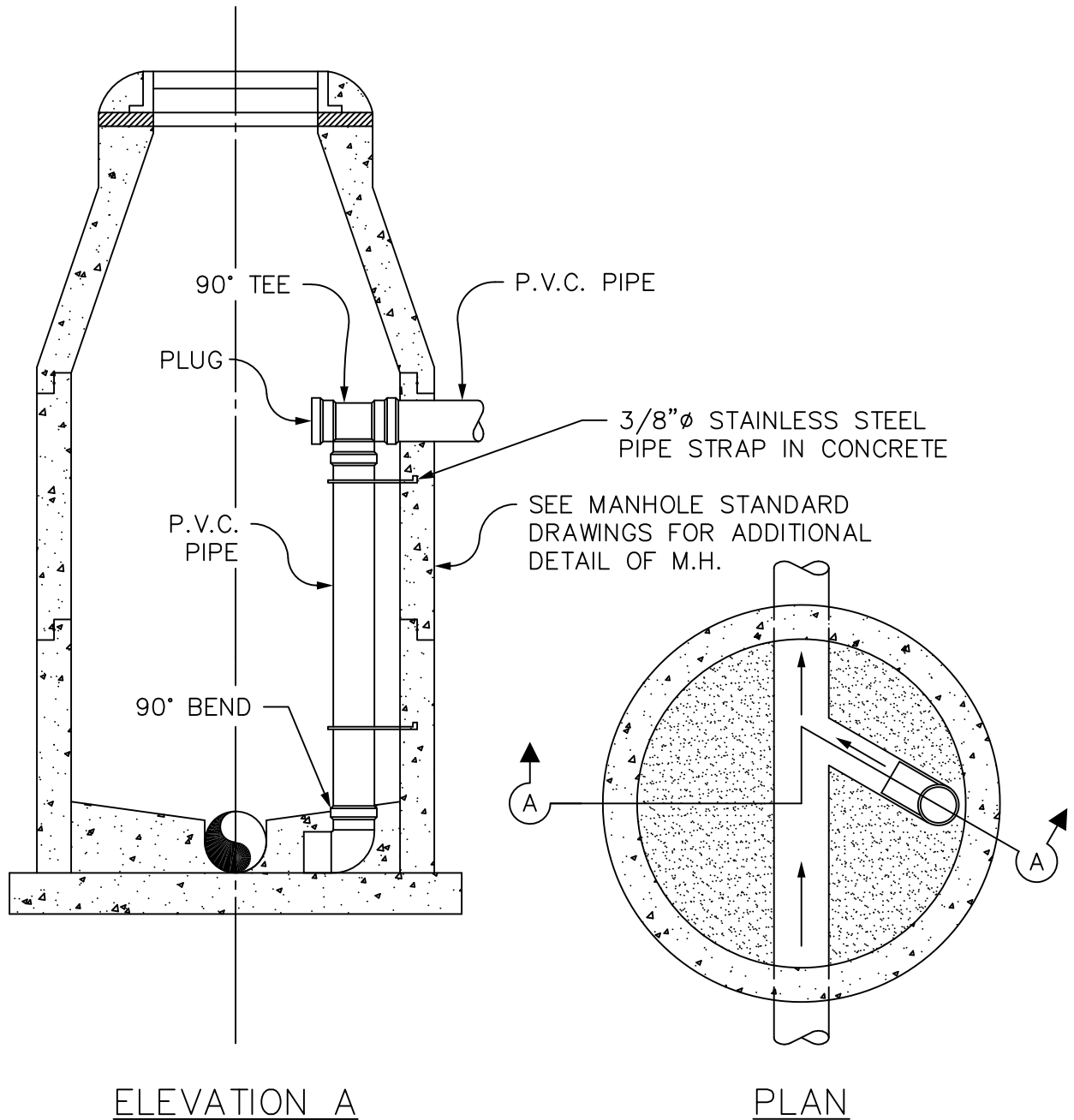
NOTES:

1. MAXIMUM CHIMNEY HEIGHT SHALL BE 12".
2. MANHOLES SHALL BE CONCENTRIC UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
3. TRANSITIONS TO 5' AND 6' BARREL DIAMETERS SHALL OCCUR JUST BELOW THE CONE SECTION.
4. INVERTS SHALL BE EQUAL TO OR GREATER THAN THE PIPE DIAMETER.



NOTES:

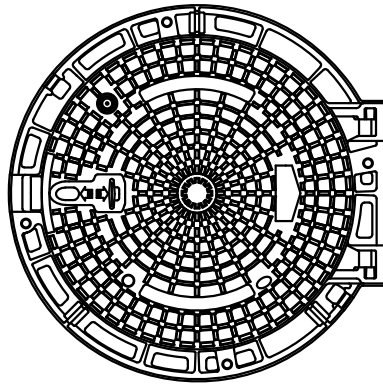
1. MAXIMUM CHIMNEY HEIGHT SHALL BE 12".
2. MANHOLES SHALL BE CONCENTRIC UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
3. INVERTS SHALL BE EQUAL TO OR GREATER THAN THE PIPE DIAMETER.
4. FOR MANHOLE DEPTHS GREATER THAN 12 FEET ADD AN ADDITIONAL 4" INCHES OF CONCRETE TO THE WALL THICKNESS FOR EACH ADDITIONAL 6 FEET OF DEPTH.



NOTES:

1. P.V.C. PIPE WITHIN MANHOLE SHALL BE SDR-26.
2. MANHOLE MAY BE EITHER PRECAST OR MONOLITHIC TYPE.
3. CL OF SURCHARGE LINE NORMALLY PLACED AT TOP OF EXISTING WASTEWATER LINE UNLESS NOTED OTHERWISE ON PLANS.

MANHOLE COVER
AND FRAME

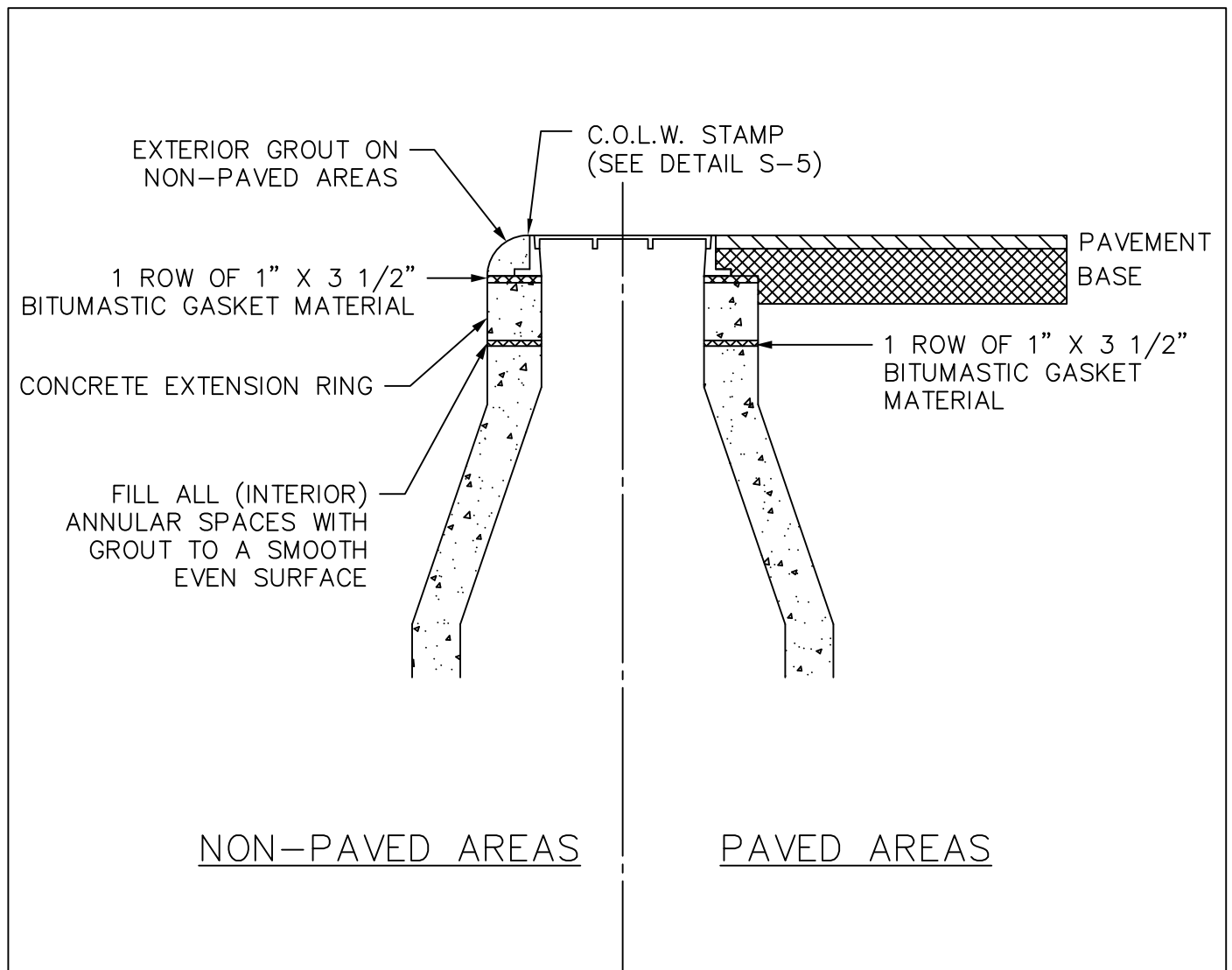


FRAME WEIGHT = 107 LBS.
COVER WEIGHT = 162 LBS.
TOTAL WEIGHT = 269 LBS.



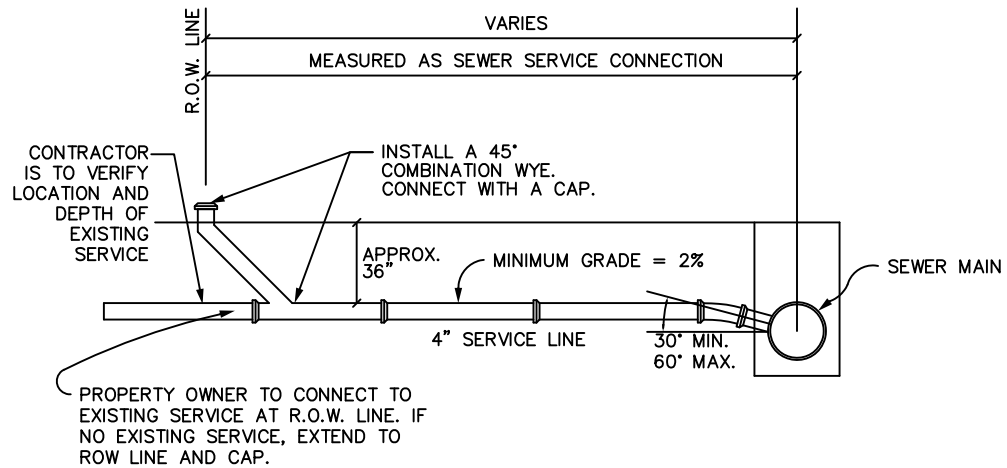
NOTES:

1. MANHOLE COVER AND FRAME SHALL BE PAMREX OR APPROVED EQUAL. COVER AND FRAME SHALL BE MANUFACTURED FROM DUCTILE IRON.
2. COVERS SHALL BE DUALY HINGED AND INCORPORATE A 90° BLOCKING SYSTEM TO PREVENT ACCIDENTAL CLOSURE.
3. ALL COMPONENTS SHALL BE COATED BLACK.
4. MANHOLE LID SHALL BE INSTALLED SUCH THAT THE HINGED SIDE IS UPSTREAM WITH RESPECT TO TRAFFIC FLOW.
5. NO WATERTIGHT MANHOLE INSERT IS REQUIRED WITH THIS LID.



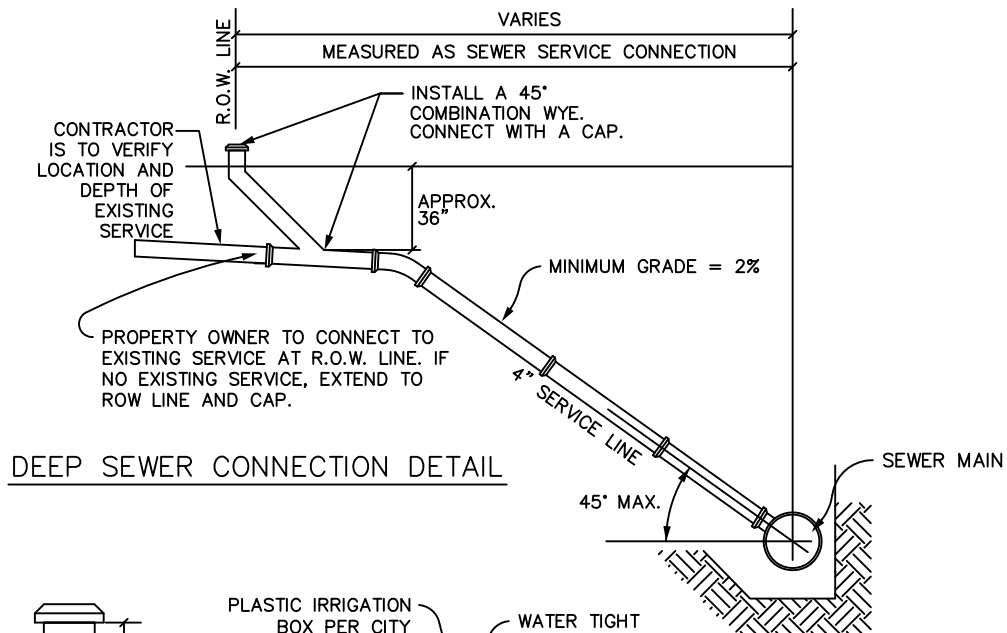
NOTES:

1. NO GAPS WILL BE ALLOWED IN BITUMASTIC GASKET.
2. THERE SHALL BE SMOOTH TRANSITION BETWEEN THE FRAME AND CONE OR GRADE RING, OR THE GRADE RING AND THE CONE.
3. CONCRETE EXTENSION RINGS MAY BE PRECAST OR CAST-IN-PLACE. BRICK EXTENSION RINGS WILL NOT BE ALLOWED.
4. STANDARD EXTENSIONS SHALL BE 2", 3", 4", 6", AND 12". EXTENSIONS SHALL BE SIZED TO MINIMIZE THE NUMBER REQUIRED TO RAISE THE MANHOLE. NO MORE THAN 1-2" EXTENSION WILL BE ALLOWED ON ANY MANHOLE.

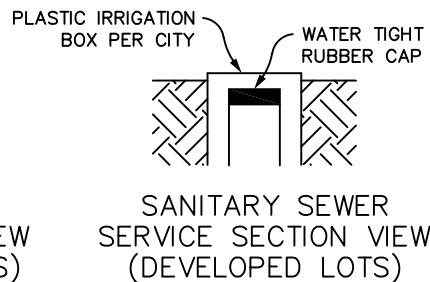
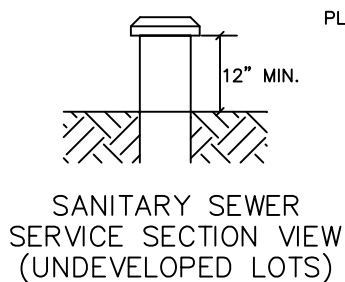


STANDARD SEWER CONNECTION DETAIL

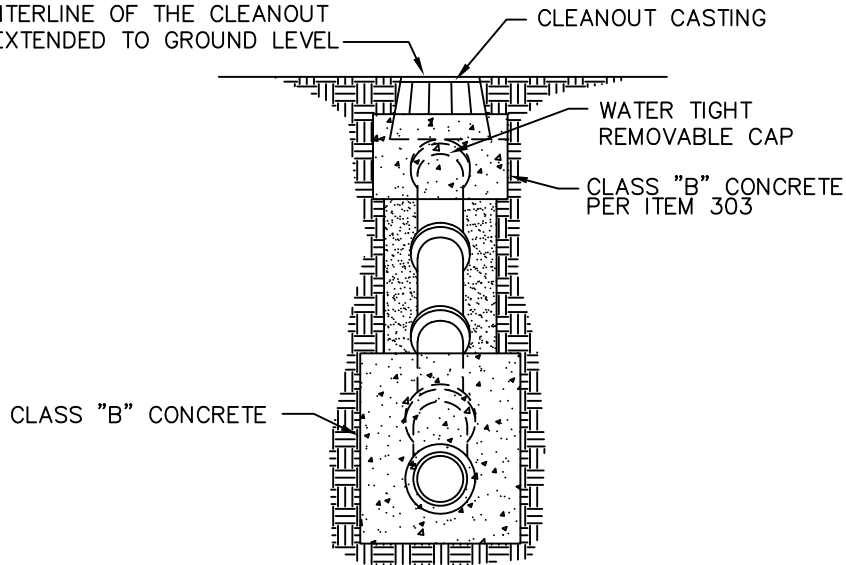
NOTE: EITHER WYE FITTING OR WYE SADDLE MAY BE USED FOR CONNECTION. NO TEES WILL BE ALLOWED. ALL PIPE AND FITTINGS REQUIRED SHALL BE CONSIDERED SUBSIDIARY TO THE ITEM "SEWER SERVICE CONNECTIONS". NO DEDUCTION FROM THE LENGTH OF SEWER MAIN WILL BE MADE FOR THE LENGTH OF WYE, IF INSTALLED. CONNECTIONS TO SEWER MAINS FROM 0' TO 7' DEEP SHALL CONFORM TO THE STANDARD SEWER CONNECTION DETAIL. CONNECTIONS TO SEWER MAINS DEEPER THAN 7' SHALL CONFORM TO THE DEEP SEWER CONNECTION DETAIL. ALL CONNECTIONS SHALL BE COUNTED AS "SEWER SERVICE CONNECTIONS" REGARDLESS OF DEPTH.



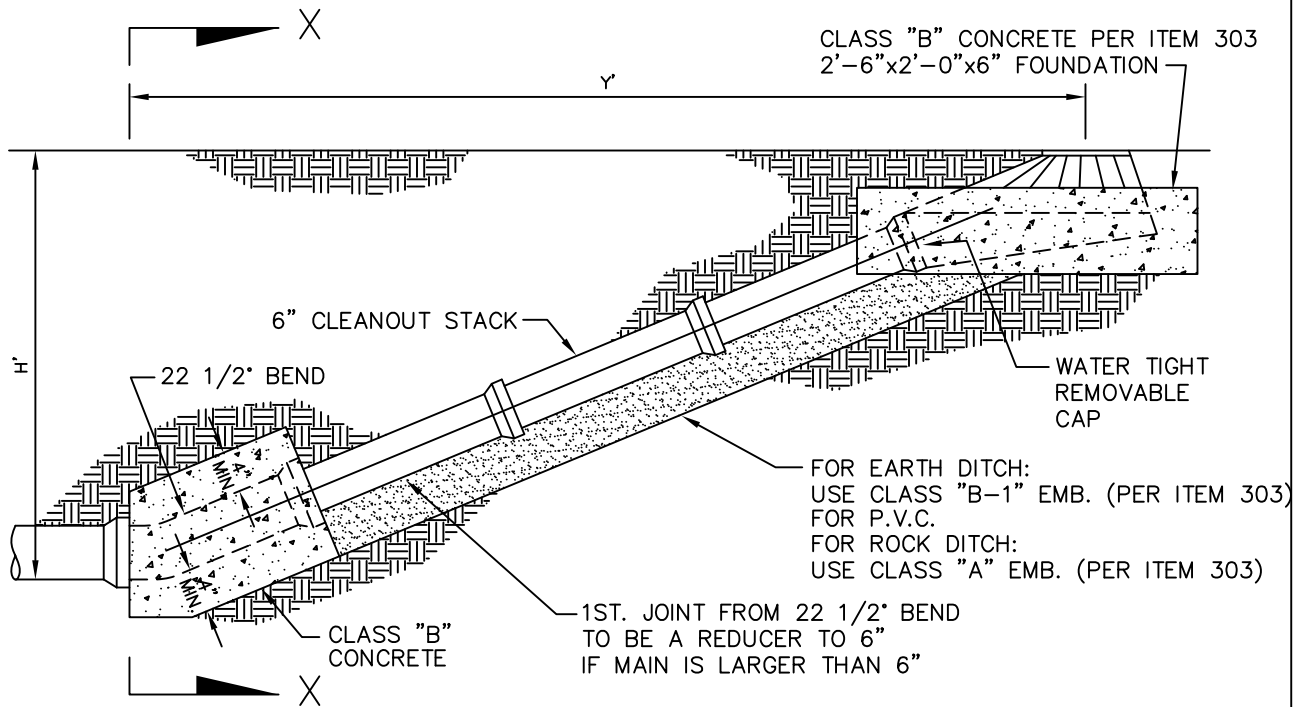
DEEP SEWER CONNECTION DETAIL



CLEANOUT CASTING OPENING TO
BE INSTALLED CENTERED OVER
THE CENTERLINE OF THE CLEANOUT
STACK EXTENDED TO GROUND LEVEL



SECTION "X-X"



PROFILE VIEW

H'	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	H'
Y'	10	12	14	17	19	22	24	27	29	31	34	36	39	41	43	46	48	Y'

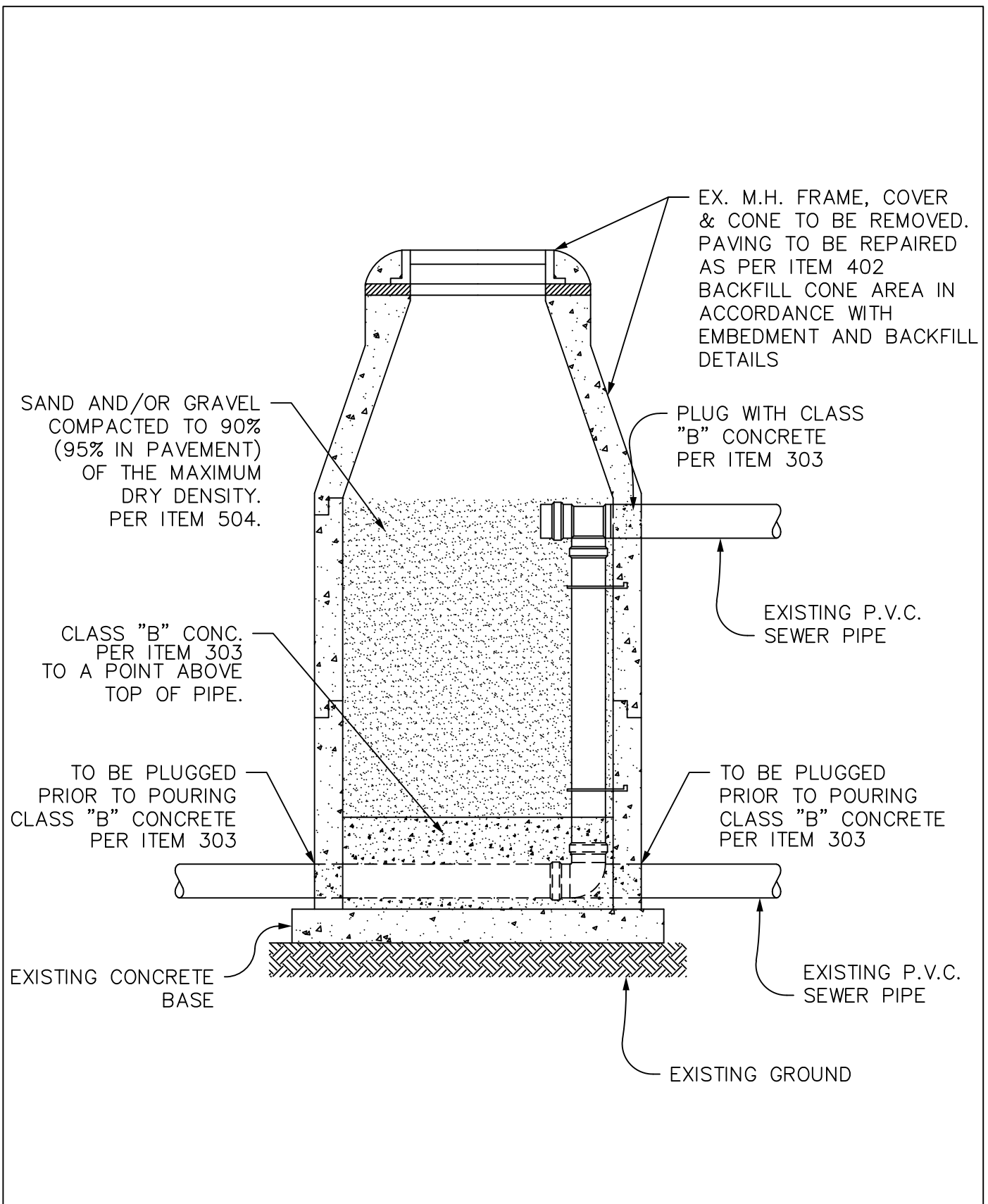


SEWER SYSTEM CONSTRUCTION DETAILS
SANITARY SEWER MAIN LINE
CLEANOUT

REVISED MAY 2019

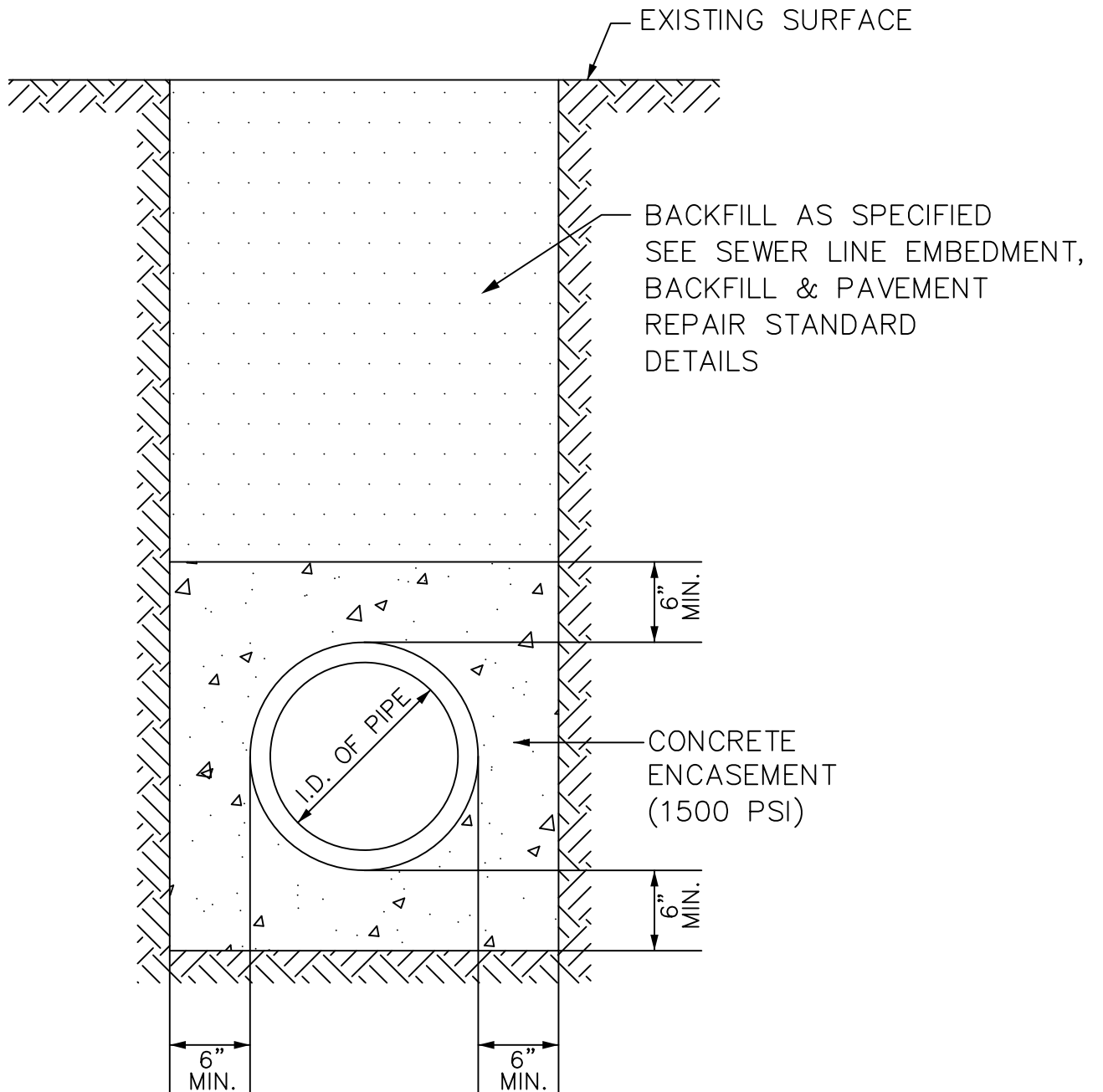
SCALE: N.T.S.

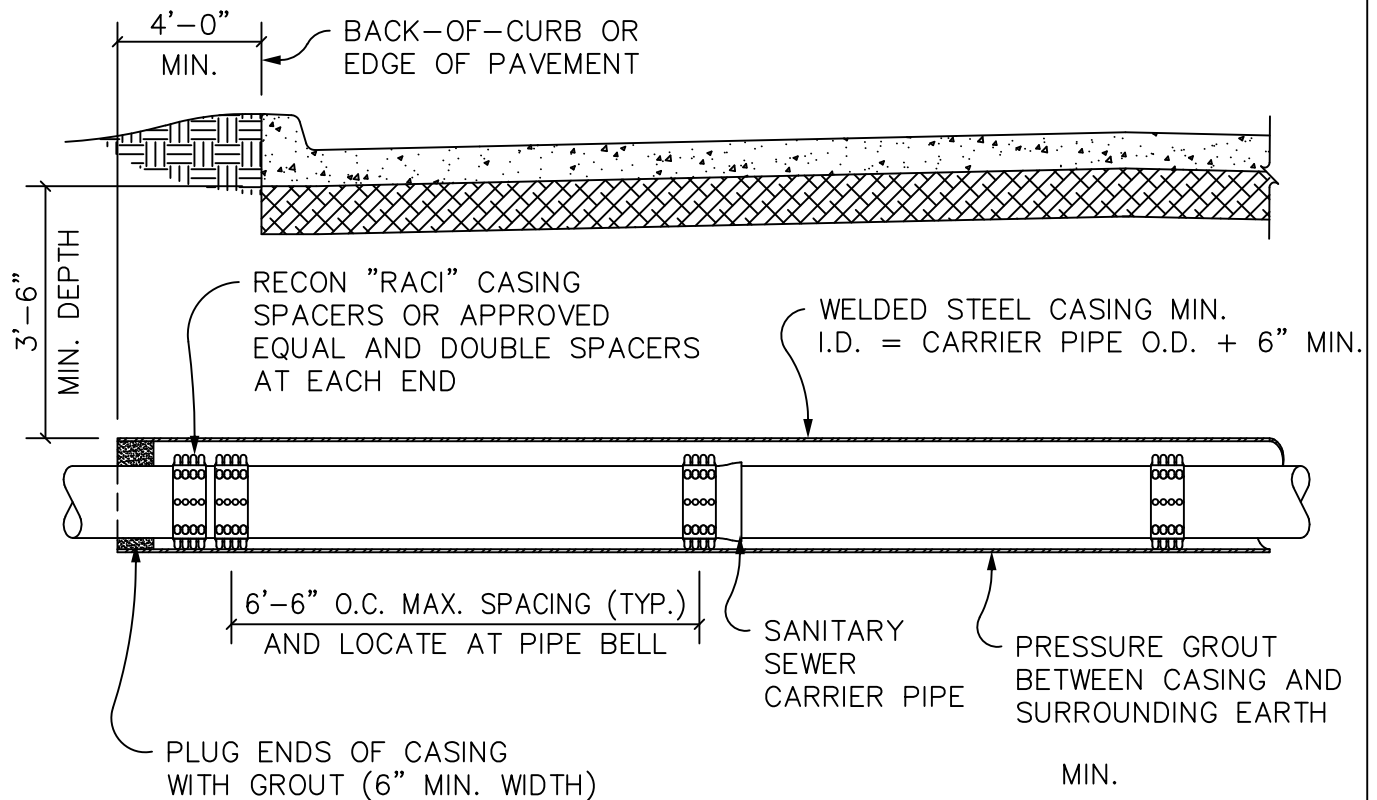
SHEET: S-8



SEWER SYSTEM CONSTRUCTION DETAILS
ABANDON OF EXISTING
MANHOLE

REVISED MAY 2019
SCALE: 1/2" = 1'
SHEET: S-9



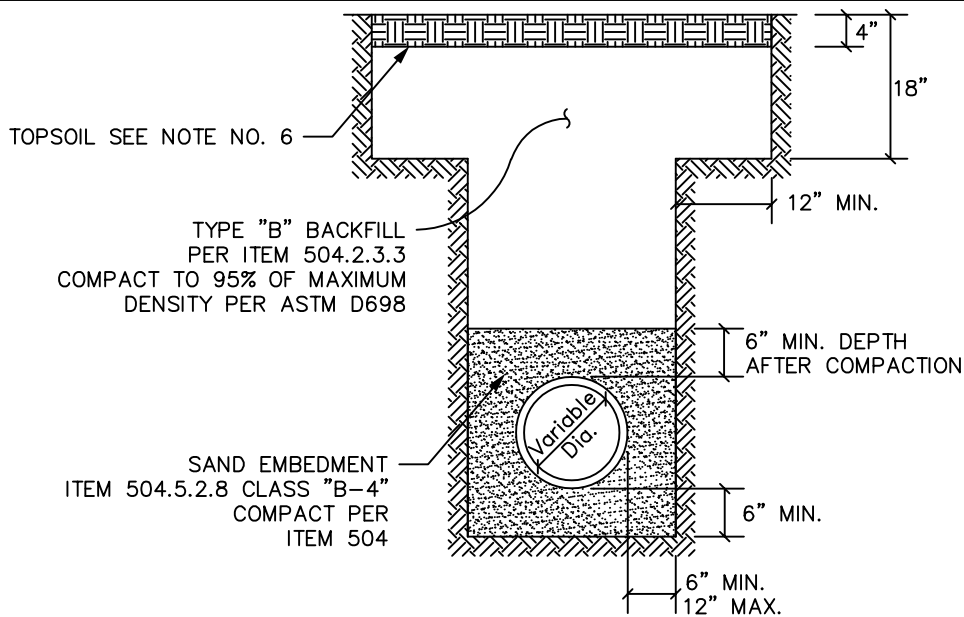


CASING DIAMETER	MIN. WALL THICKNESS
12" OR LESS	0.25"
OVER 12" - 18"	0.3125"
OVER 18" - 22"	0.375"
OVER 22" - 28"	0.4375"
OVER 28" - 34"	0.5"
OVER 34" - 42"	0.5625"
OVER 42" - 48"	0.625"
OVER 48" - 60"	0.6875"

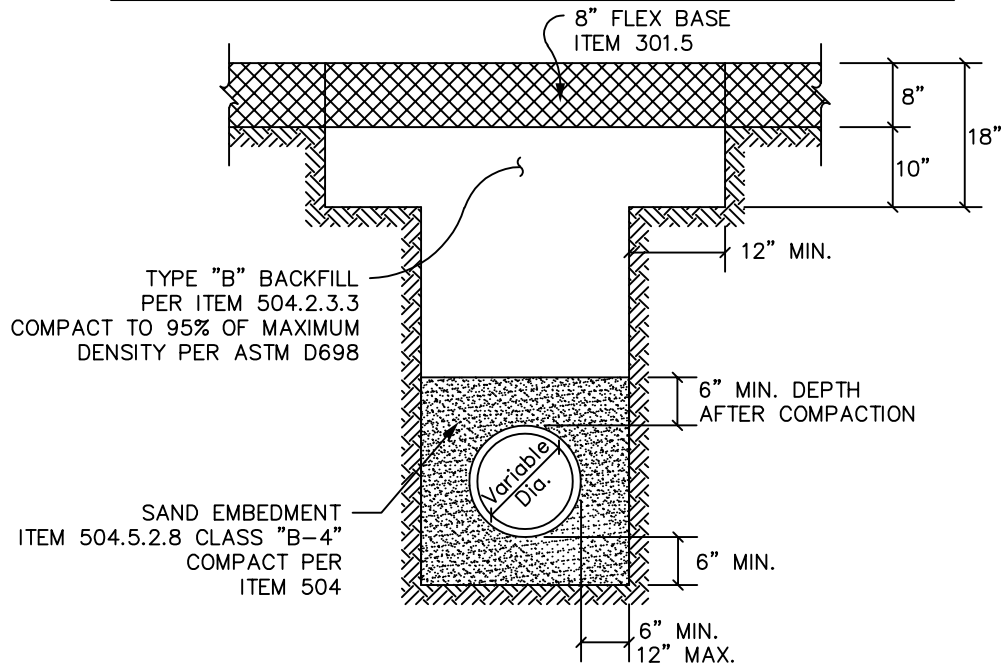
NOTES:

1. WHERE A BORE PIT EXCEEDS 5 FEET IN DEPTH THE CONTRACTOR SHALL INSTALL SHORING OF THE PIT WALLS AS REQUIRED BY OSHA.
2. WHERE A BORE IS TO BE PARTIALLY OR COMPLETELY ABANDONED, SAID BORE SHALL BE COMPLETELY FILLED WITH HYDRAULICALLY PLACED CEMENT GROUT.
3. CASING SHALL BE EXTENDED TO THE RIGHT-OF-WAY LINE FOR STATE HIGHWAY AND RAILROAD CROSSINGS.
4. THE EDGE OF BORE PIT SHALL BE A MINIMUM OF 4' BEHIND THE BACK OF CURB OR EDGE OF PAVEMENT.
5. STEEL CASING PIPE SHALL HAVE A MINIMUM YIELD STRENGTH OF 35 KSI.

WATER DETAIL	DETAIL NO.	REVISION DATE
STANDARD WATER LINE EMBEDMENT AND BACKFILL	W-1A	MAY 2019
STANDARD WATER LINE EMBEDMENT AND BACKFILL	W-1B	
FIRE HYDRANT INSTALLATION	W-2	
GATE VALVE INSTALLATION	W-3	
AIR RELEASE VALVE ASSEMBLY (TYPE 1)	W-4A	
AIR RELEASE VALVE ASSEMBLY (TYPE 2)	W-4B	
1 INCH THROUGH 2 INCH WATER SERVICE ASSEMBLY	W-5	
FLUSHING VALVE INSTALLATION	W-6	
HORIZONTAL AND VERTICAL (DOWNWARD) THRUST BLOCKING	W-7	
VERTICAL THRUST BLOCK	W-8	
CONCRETE CRADLE AT VERTICAL BENDS	W-9	
TYPICAL RING CONNECTION	W-10	
WATER LINE BORE AND CASING DETAIL	W-11	
3 INCH AND LARGER METER VAULT	W-12	
BLOW-OFF SUMP MANHOLE INSTALLATION	W-13	
SERVICE LINE ENCASEMENT	W-14	
CONCRETE ENCASEMENT	W-15	



UNPAVED AND FUTURE PAVED AREAS



NOTES:

EXISTING FLEXBASE SURFACE

1. AT THE END OF EACH WORK DAY ALL SPOILS SHALL BE REMOVED FROM THE CITY & TXDOT R.O.W. UNLESS PRIOR WRITTEN PERMISSION IS OBTAINED FROM THE OWNER TO STORE SPOILS IN DESIGNATED SPOIL STORAGE AREAS THAT DO NOT OBSTRUCT AUTOMOBILE OR PEDESTRIAN TRAFFIC.
2. ALL BACKFILL SHALL BE PER SPEC. ITEM 504 AND SHALL BE COMPACTED PER SPEC ITEM 504. ROCKS GREATER THAN 4" IN DIAMETER SHALL BE REMOVED FROM ANY NATIVE MATERIAL USED AS BACKFILL.
3. ALL PAVEMENT SHALL BE REMOVED ALONG NEAT SAW CUT LINES PER SPEC ITEM 402.3.
4. COATED TRACER WIRE (MIN. 10-GAUGE) SHALL BE INSTALLED IN THE EMBEDMENT MATERIAL ABOVE THE PVC PIPE WITH THE TRACER WIRE TERMINATING IN IN-LINE GATE VALVE BOXES ACCESSIBLE BY CITY STAFF. BLUE UNDERGROUND WATER LINE WARNING TAPE OF MIN. 4" WIDTH SHALL BE INSTALLED ABOVE THE EMBEDMENT MATERIAL.
5. A MAXIMUM OF 200-FT OF OPEN TRENCH WILL BE ALLOWED AT ANY TIME, UNLESS APPROVED BY THE CITY ENGINEER.
6. TOPSOIL SHALL BE 4 INCHES IN DEPTH AND SHALL BE LOOSE AND FREE OF ROCKS OR CLODS GREATER THAN 1/4" IN DIAMETER. ALL TOPSOIL SHALL BE APPROVED BY THE OWNER PRIOR TO INSTALLATION.

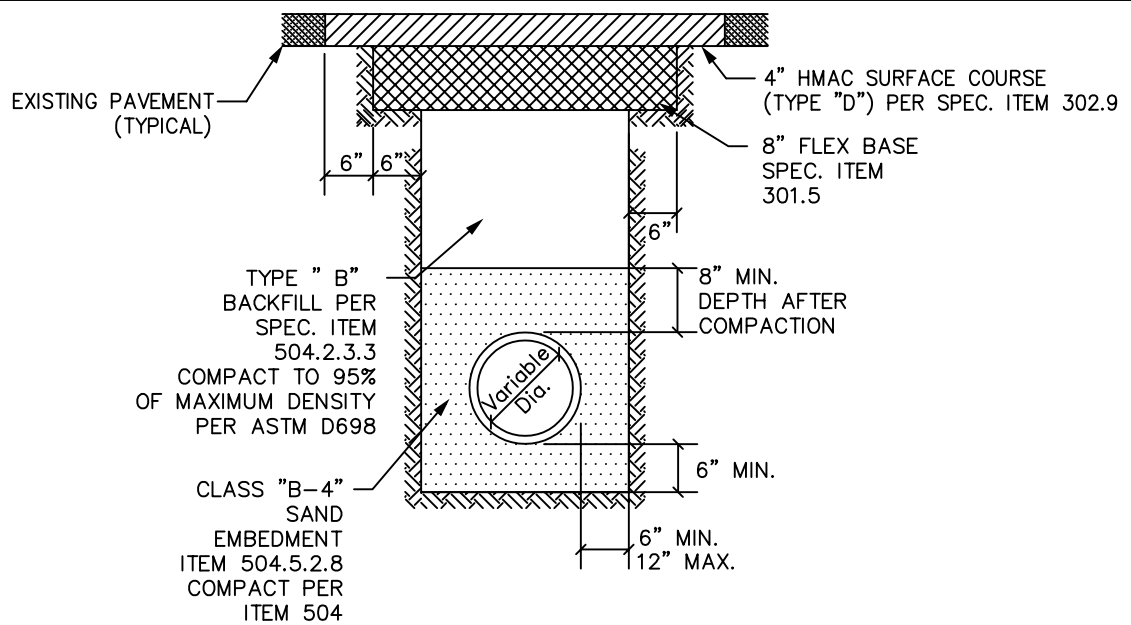


WATER SYSTEM CONSTRUCTION DETAILS STANDARD WATER LINE EMBEDMENT AND BACKFILL

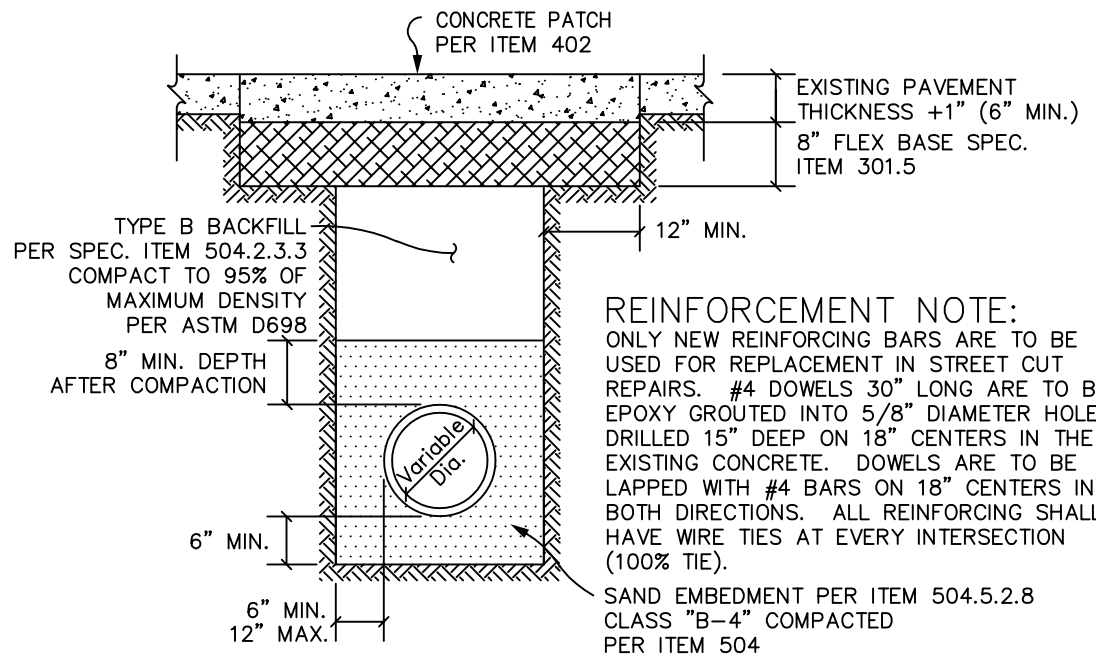
REVISED MAY 2019

SCALE: 1/2" = 1'

SHEET: W-1A



EXISTING ASPHALT PAVEMENT



REINFORCEMENT NOTE:
ONLY NEW REINFORCING BARS ARE TO BE USED FOR REPLACEMENT IN STREET CUT REPAIRS. #4 DOWELS 30" LONG ARE TO BE EPOXY GROUTED INTO 5/8" DIAMETER HOLES DRILLED 15" DEEP ON 18" CENTERS IN THE EXISTING CONCRETE. DOWELS ARE TO BE LAPPED WITH #4 BARS ON 18" CENTERS IN BOTH DIRECTIONS. ALL REINFORCING SHALL HAVE WIRE TIES AT EVERY INTERSECTION (100% TIE).

NOTES:

EXISTING CONCRETE PAVEMENT

1. AT THE END OF EACH WORK DAY ALL SPOILS SHALL BE REMOVED FROM THE CITY & TXDOT R.O.W. UNLESS PRIOR WRITTEN PERMISSION IS OBTAINED FROM THE OWNER TO STORE SPOILS IN DESIGNATED SPOIL STORAGE AREAS THAT DO NOT OBSTRUCT AUTOMOBILE OR PEDESTRIAN TRAFFIC.
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5. A MAXIMUM OF 200-FT OF OPEN TRENCH WILL BE ALLOWED AT ANY TIME, UNLESS APPROVED BY THE CITY ENGINEER.

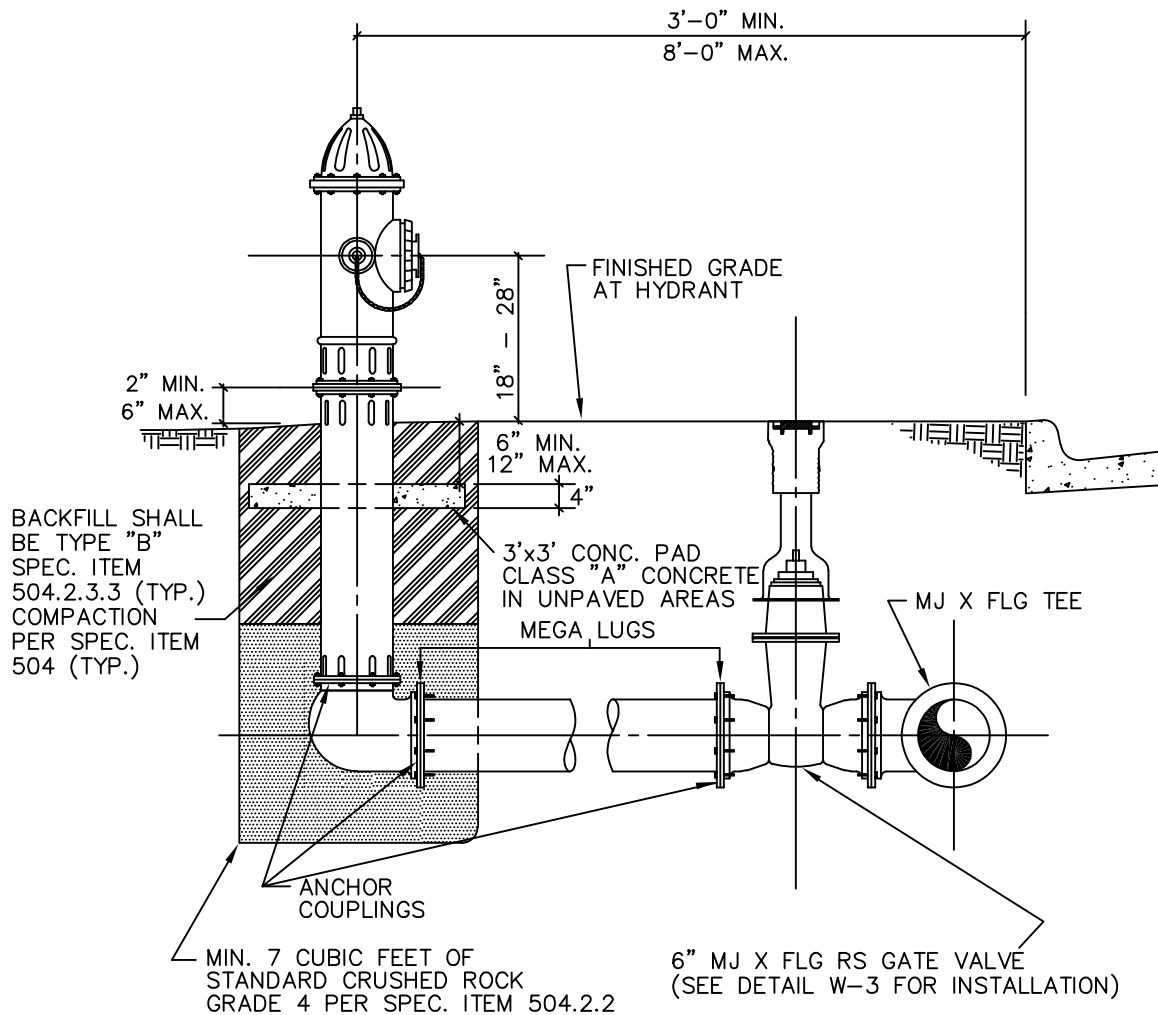


WATER SYSTEM CONSTRUCTION DETAILS STANDARD WATER LINE EMBEDMENT AND BACKFILL

REVISED MAY 2019

SCALE: 1/2" = 1'

SHEET: W-1B



NOTES:

1. ALL FIRE HYDRANTS SHALL CONFORM TO AWWA STANDARD SPECIFICATIONS FOR FIRE HYDRANTS, C-502. FIRE HYDRANTS SHALL HAVE A 5 1/4" MIN VALVE OPENING AND AN INSIDE BARREL DIAMETER OF APPROXIMATELY 7". ALL HYDRANTS SHALL BE EQUIPPED WITH A BREAKAWAY FLANGE.
2. ACTUAL VALVE LOCATION WILL DEPEND ON LOCATION OF WATER MAIN.
3. FIRE HYDRANT NO CLOSER THAN 18" TO EXISTING OR PROPOSED SIDEWALKS. (TYPICAL)
4. BURY DEPTH SHALL NOT EXCEED 7-FEET.
5. FIRE HYDRANT SHALL BE PLACED ON THE EXTENDED LOT LINE WHEN POSSIBLE.
6. ALL BELOW GROUND IRON ASSEMBLES SHALL BE WRAPPED IN POLYETHYLENE ACCORDING TO AWWA C105.
7. FIRE HYDRANT SHALL BE LOCATED A MINIMUM OF 1 FOOT OUTSIDE OF THE AREA BETWEEN THE P.C.'S OF THE CORNER TURNING RADIUS AT THE INTERSECTIONS.
8. FIRE HYDRANT SHALL BE AT LEAST 42-INCHES FROM ANY ABOVE GROUND OBSTRUCTIONS, SUCH AS GUARDRAILS, RETAINING WALLS, BOLLARDS, ETC.
9. ALL FIRE HYDRANTS SHALL BE MANUFACTURED BY M&H OR MULLER (M&H MODEL 129, OR MULLER SUPER CENTERION 200).
10. ALL HYDRANTS SHALL OPEN BY TURNING THE OPERATING-STEM NUT TO THE RIGHT (CLOCKWISE). A CLEARLY VISIBLE CURVED ARROW AND THE WORD "OPEN" SHALL BE CAST IN RELIEF ON TOP OF THE HYDRANT TO INDICATE THE DIRECTION OF OPENING.

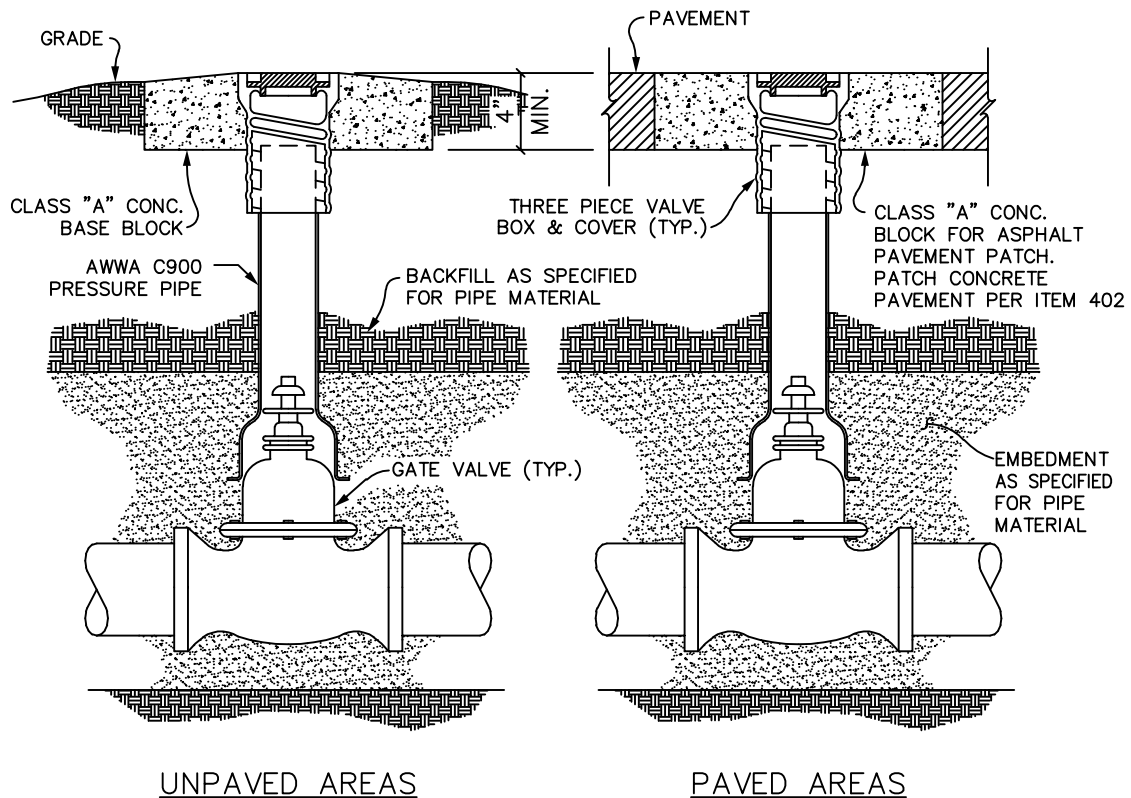
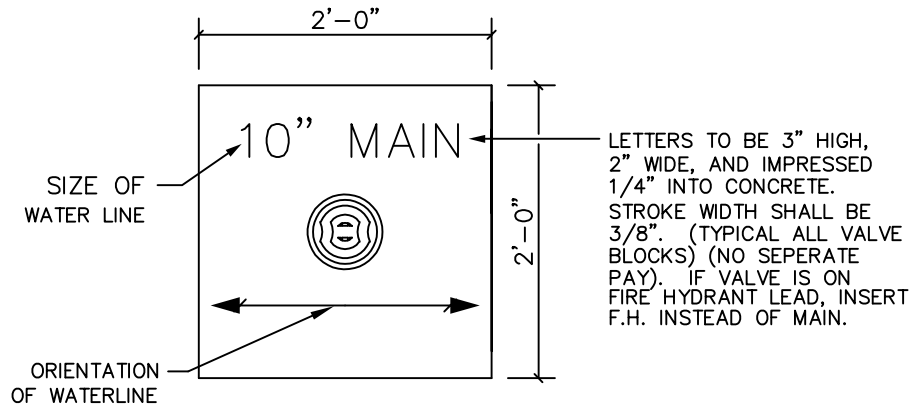


WATER SYSTEM CONSTRUCTION DETAILS
FIRE HYDRANT
INSTALLATION

REVISED MAY 2019

SCALE: 3/8" = 1'

SHEET: W-2



NOTES:

1. THE VALVE AND JOINT ASSEMBLIES SHALL BE WRAPPED IN POLYETHYLENE ACCORDING TO AWWA C105.
2. THE JOINT TYPE SHALL BE MECHANICAL JOINT UNLESS OTHERWISE SPECIFIED IN THE PLANS.
3. VALVE BOX SHALL BE TYLER PIPE 6850 SERIES OR APPROVED EQUAL.
4. GATE VALVE SHALL BE RESILIENT SEAT TYPE WITH A NON RISING STEM AND A 2-INCH SQUARE OPERATOR. RESILIENT SEAT GATE VALVE SHALL CONFORM TO AWWA C509.
5. A PERMANENTLY ATTACHED VALVE EXTENSION STEM SHALL BE REQUIRED FOR ANY VALVE WITH AN OPERATING NUT LOCATED IN EXCESS OF 4 FEET BELOW THE TOP OF VALVE BOX. THIS EXTENSION SHALL BE SUFFICIENT LENGTH TO ENSURE THAT ITS TOP IS WITHIN 4 FEET OF VALVE BOX LID.
6. 16" AND LARGER GATE VALVES REQUIRE CONCRETE BLOCK UNDER THE VALVE BODY.
7. ALL VALVE COVERS SHALL BE PAINTED BLUE.
8. A "V" SHALL BE SAW CUT IN THE CURB AT ALL VALVE LOCATIONS AND PAINTED BLUE.
9. REFERENCE DESIGN CRITERIA FOR ALLOWABLE GATE VALVE MANUFACTURERS.



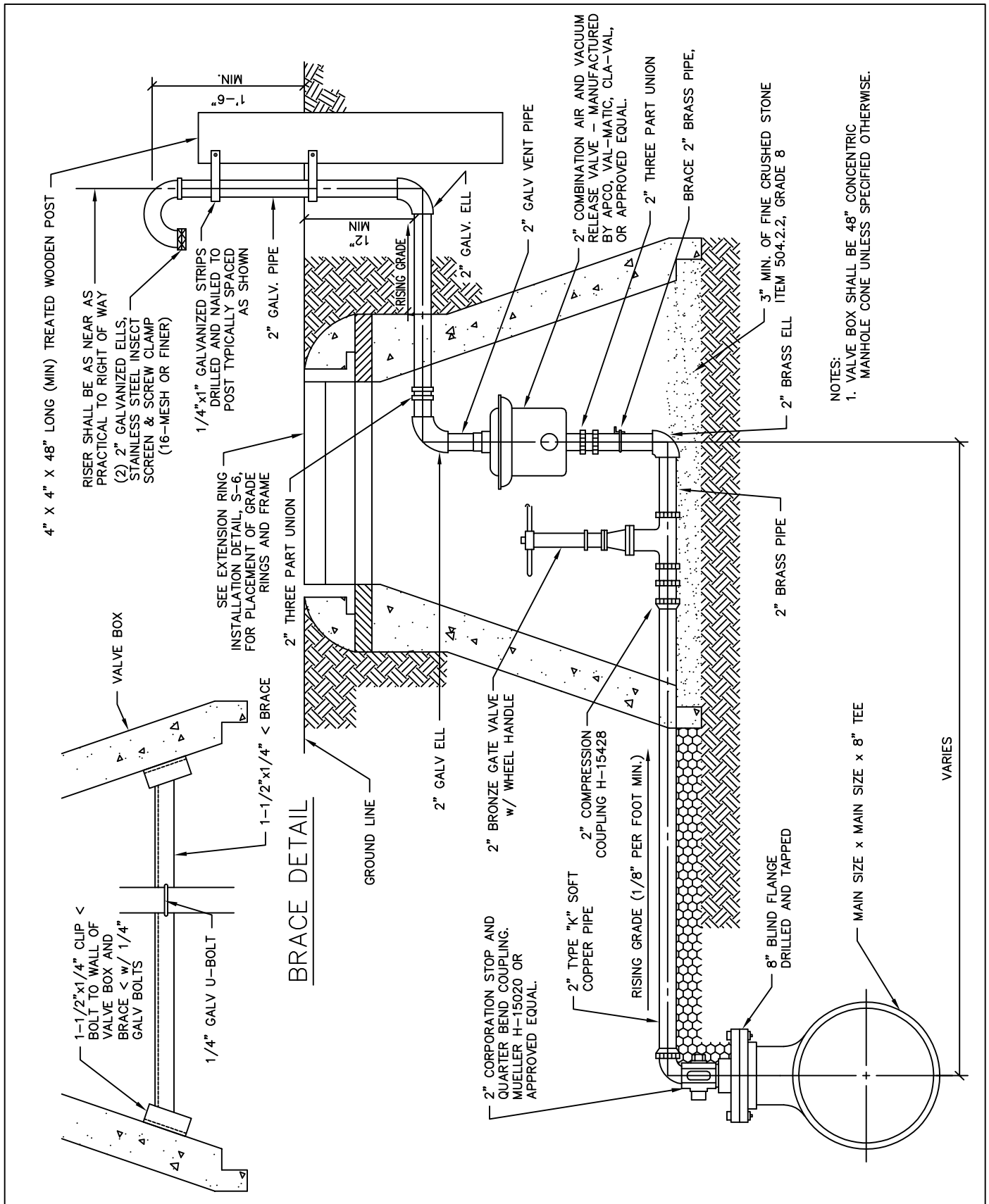
WATER SYSTEM CONSTRUCTION DETAILS

GATE VALVE INSTALLATION

REVISED MAY 2019

SCALE: 3/4" = 1'

SHEET: W-3



WATER SYSTEM CONSTRUCTION DETAILS
AIR RELEASE VALVE ASSEMBLY
TYPE 1

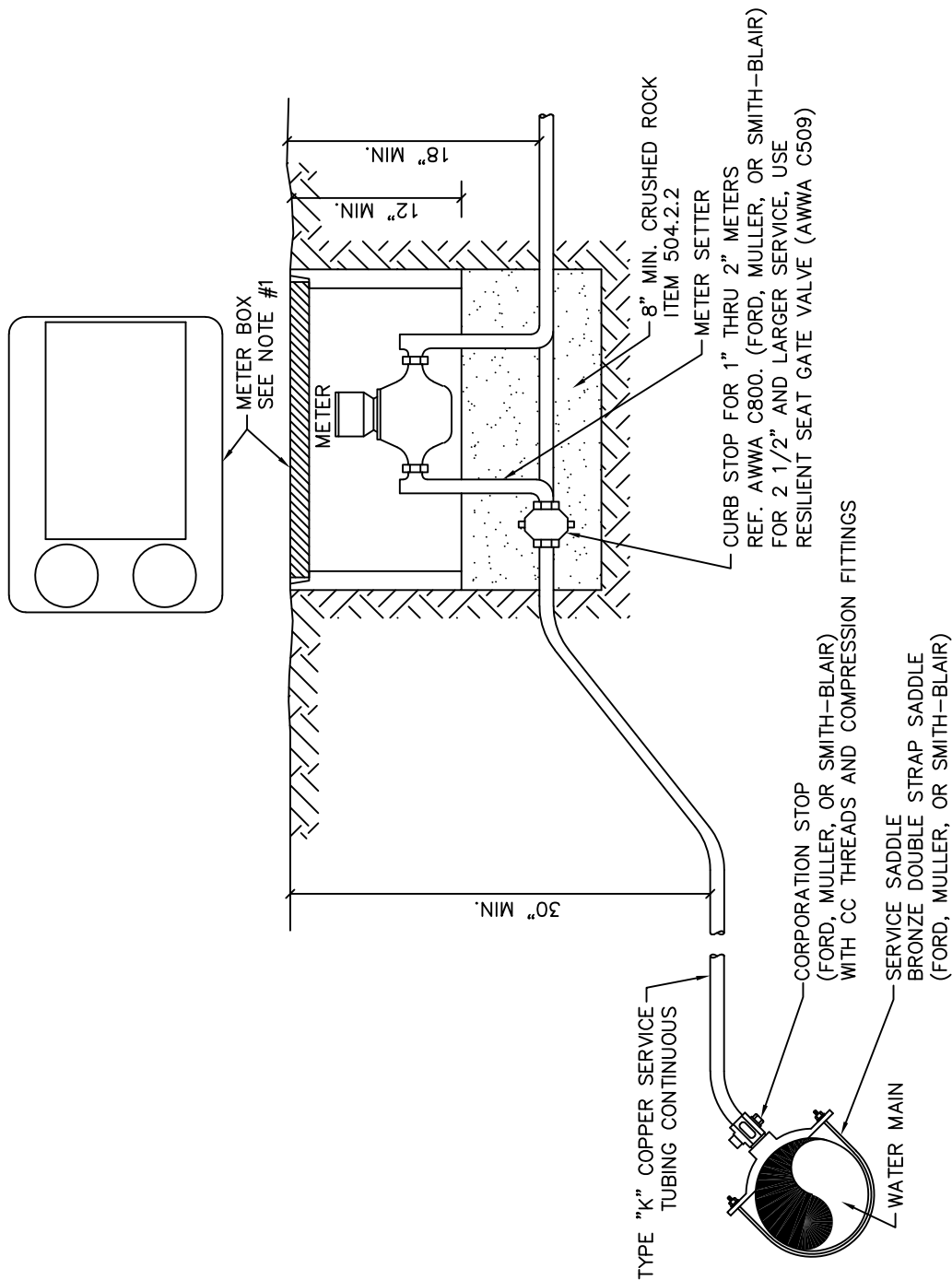
REVISED MAY 2019

SCALE: 3/4" = 1'

SHEET: W-4A

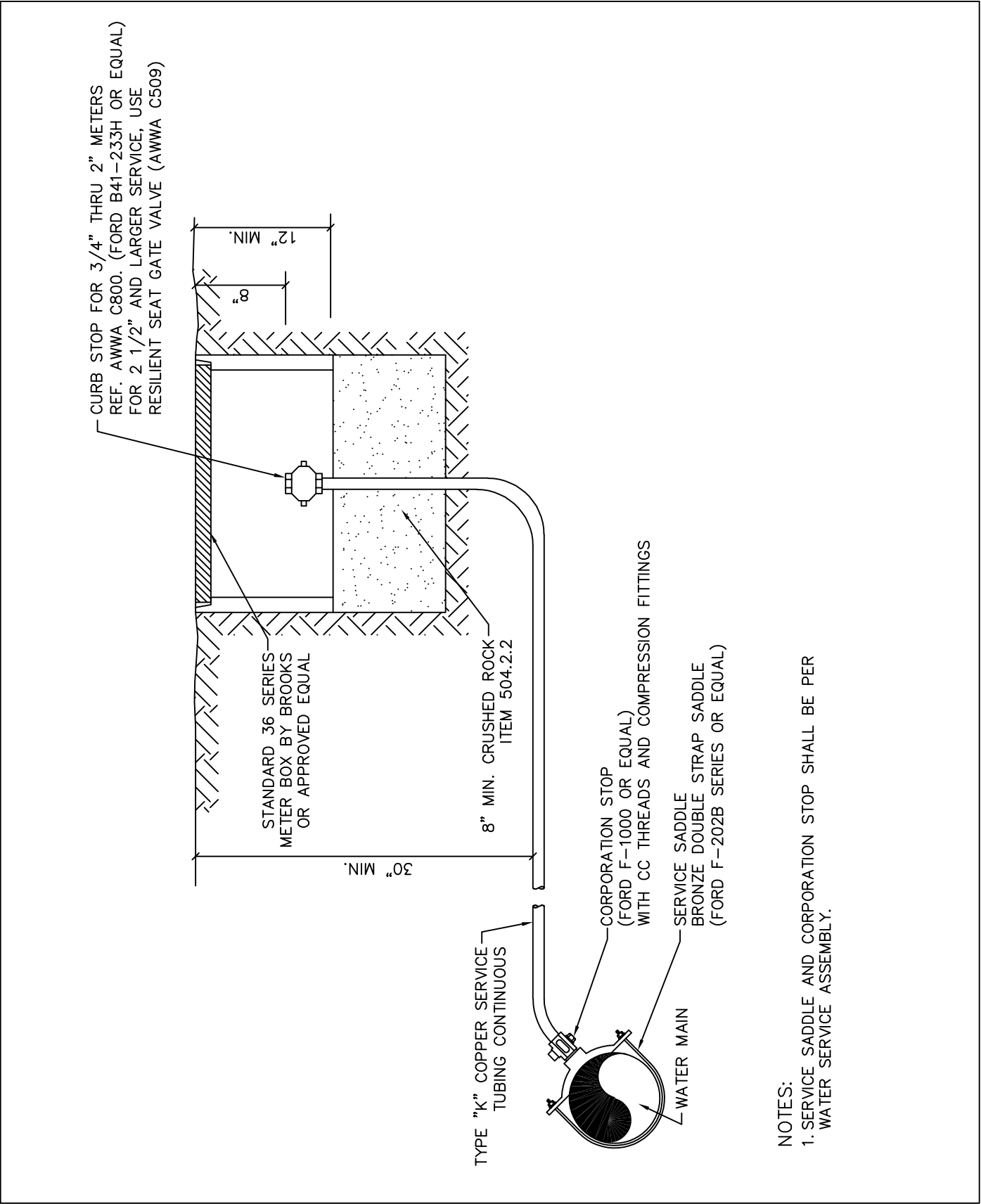


SHEET: W-4B



NOTES:

1. METER BOX FOR 1" METER SHALL BE AMR 16-DFW-1600AMRXT.12.10RION OR APPROVED EQUAL. METERS 1"-1.5" SHALL BE AMR-DFW65C-14-IDF.SMALL.
2. INSTALL CURB STOP FOR 1" THRU 2" METERS (AWWA C800) WITH LOCKING MECHANISM AND COMPRESSION FITTINGS. FOR LARGER THAN 2" SERVICE, INSTALL RESILIENT SEAT GATE VALVE (AWWA C509).
3. METER BOX SHALL BE A MINIMUM OF 12" BEHIND THE BACK OF CURB WITH THE WATER SERVICE NOT LESS THAN 18" BELOW GRADE.
4. SERVICES ALONG ROADWAYS WITHOUT CURB AND GUTTER SHALL BE LOCATED A MINIMUM OF 18" BELOW THE DITCH FLOWLINE.
5. SERVICE LINES CROSSING UNDER THE ROADWAY SHALL BE LOCATED A MINIMUM OF 30" BELOW GRADE AND BE ENCASED (SEE DETAIL W-14).
6. ALL WATER METERS SHALL BE BADGER METERS SPECIFIED BY THE CITY.
7. WATER SERVICE AND WATER METER LOCATIONS SHALL BE MARKED/STAMPED WITH A BLUE "WM".

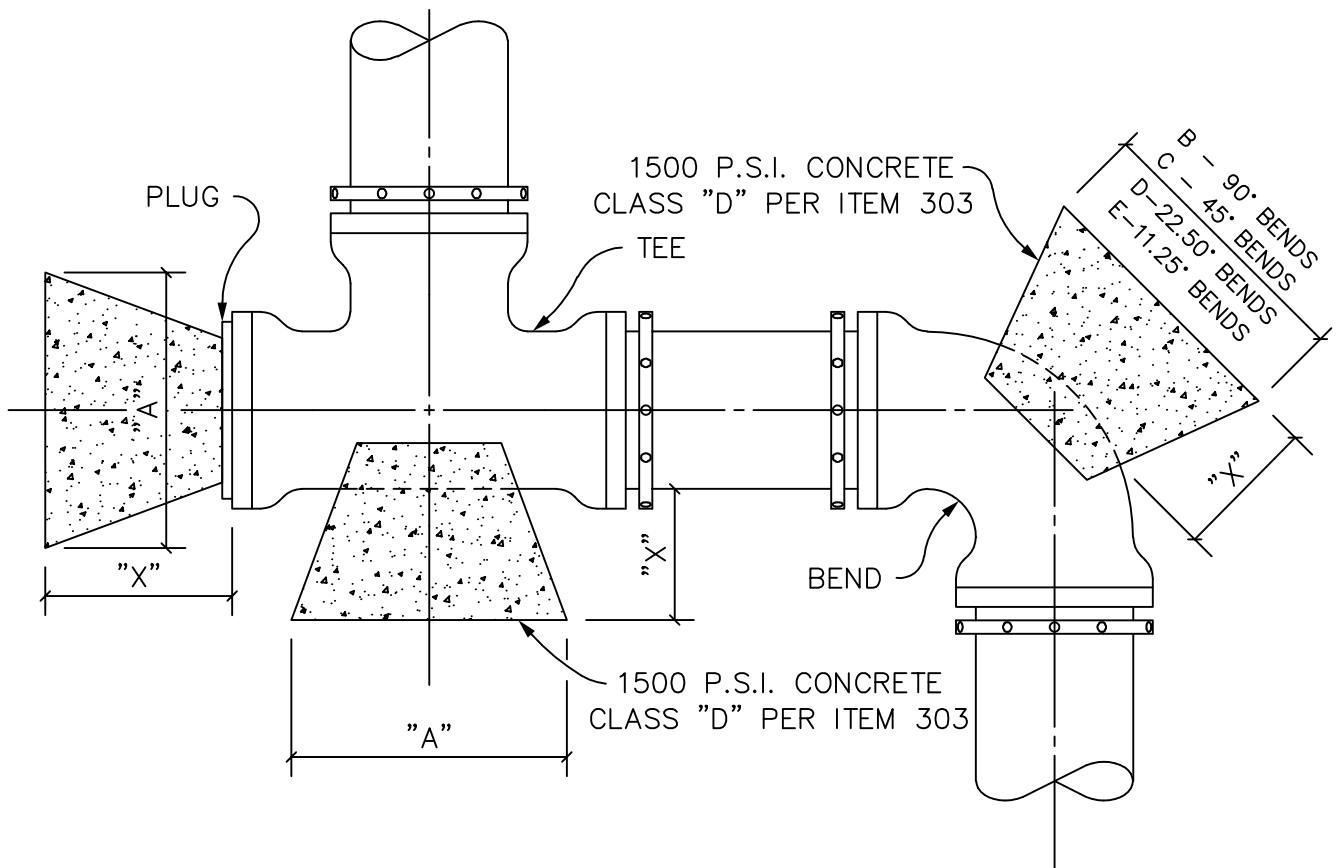


NOTES:
 1. SERVICE SADDLE AND CORPORATION STOP SHALL BE PER WATER SERVICE ASSEMBLY.



WATER SYSTEM CONSTRUCTION DETAILS
 FLUSHING VALVE
 INSTALLATION

REVISED MAY 2019
SCALE: 1" = 1'
SHEET: W-6



HORIZONTAL BLOCKING TABLE

DIMENSION "X" TO BE A MINIMUM OF (1) FOOT, BUT IS TO BE INCREASED WHERE NECESSARY TO PROVIDE BEARING AGAINST UNDISTURBED TRENCH WALL.

PIPE SIZE	"X" DIM.	PLUGS & TEES		90° BENDS		45° BENDS		22.50° BENDS		11.25° BENDS	
		"A"	MIN. AREA sf	"B"	MIN. AREA sf	"C"	MIN. AREA sf	"D"	MIN. AREA sf	"E"	MIN. AREA sf
6"	1'-6"	1'-0"	1.06	1'-2"	1.50	1'-0"	.83	1'-0"	.83	1'-0"	.83
8"	1'-6"	1'-3"	1.89	1'-6"	2.66	1'-3"	1.44	1'-0"	.83	1'-0"	.83
10"	1'-6"	1'-9"	2.95	2'-0"	4.17	1'-6"	2.26	1'-3"	1.15	1'-0"	.83
12"	1'-6"	2'-0"	4.25	2'-3"	6.00	1'-9"	3.25	1'-3"	1.65	1'-0"	.83
16"	2'-0"	2'-7"	7.54	3'-0"	10.65	2'-3"	5.76	1'-8"	2.94	1'-2"	1.48

NOTES:

1. BEARING AREAS SHOWN ARE BASED ON 150 PSI TEST PRESSURE AND 3000 PSF ALLOWABLE SOIL BEARING PRESSURE.
2. WRAP ALL BELOW GROUND IRON ASSEMBLIES IN POLYETHYLENE ACCORDING TO AWWA C105.
3. ALL TEES, BENDS, PLUGS, ETC. SHALL BE MECHANICALLY RESTRAINED BY MEGALUG OR APPROVED EQUAL.

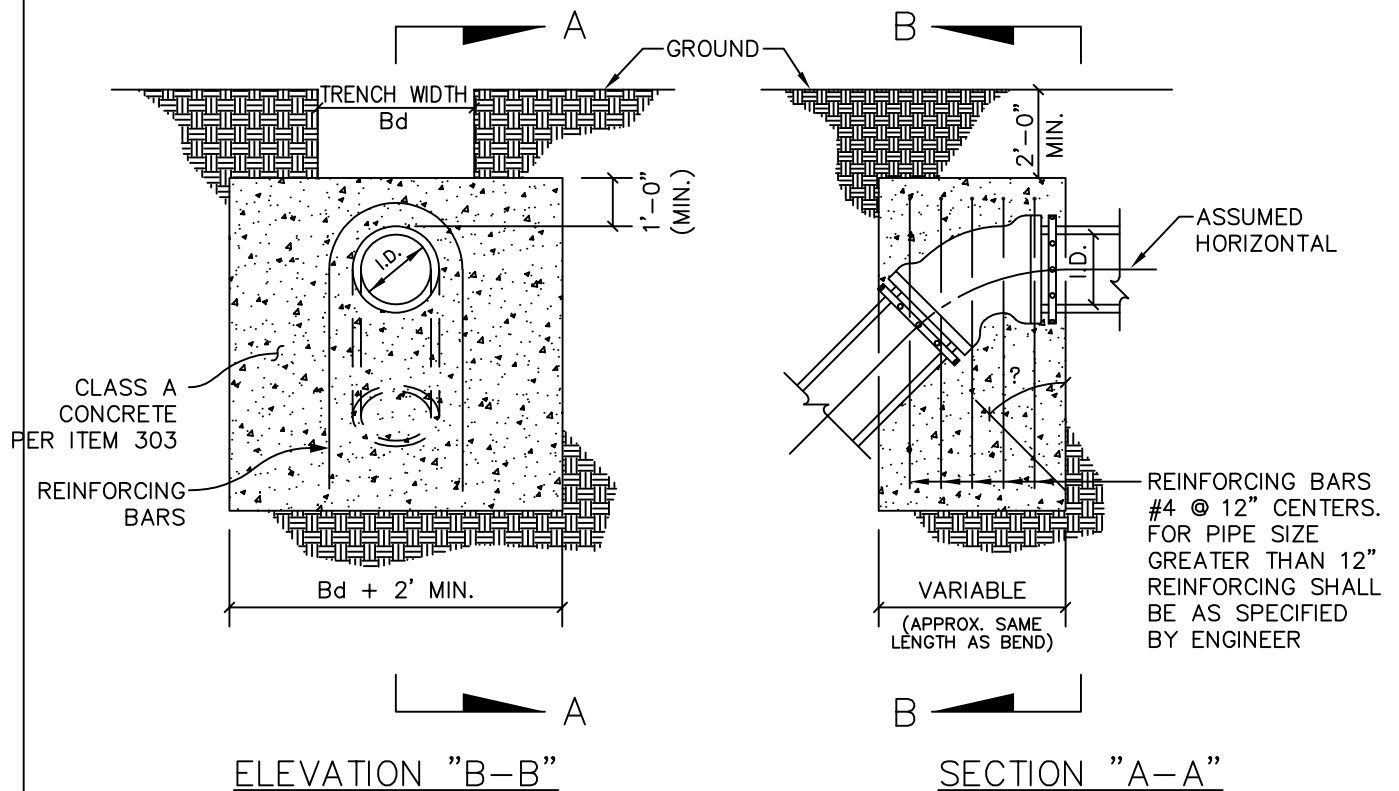


WATER SYSTEM CONSTRUCTION DETAILS
HORIZONTAL AND VERTICAL (DOWNWARD)
THRUST BLOCKING

REVISED MAY 2019

SCALE: N.T.S.

SHEET: W-7



VERTICAL THRUST BLOCK TABLE

△→	11.25'		22.50'		30.00'		45.00'		67.50'		90.00'		←△
I.D. (IN.)	THRUST (TONS)	VOL. (C.Y.)	THRUST (TONS)	VOL. (C.Y.)	THRUST (TONS)	VOL. (C.Y.)	THRUST (TONS)	VOL. (C.Y.)	THRUST (TONS)	VOL. (C.Y.)	THRUST (TONS)	VOL. (C.Y.)	I.D. (IN.)
4,6,8	1.0	0.5	2.0	1.0	2.5	1.3	3.6	1.8	4.6	2.3	5.0	2.5	4,6,8
10,12	2.2	1.1	4.3	2.2	5.7	2.8	8.0	4.0	10.5	5.2	11.3	5.7	10,12

NOTES:

1. WRAP ALL BELOW GROUND IRON ASSEMBLIES IN POLYETHYLENE ACCORDING TO AWWA C105.
2. ALL TEES, BENDS, PLUGS, ETC. SHALL BE MECHANICALLY RESTRAINED BY MEGALUG OR APPROVED EQUAL.



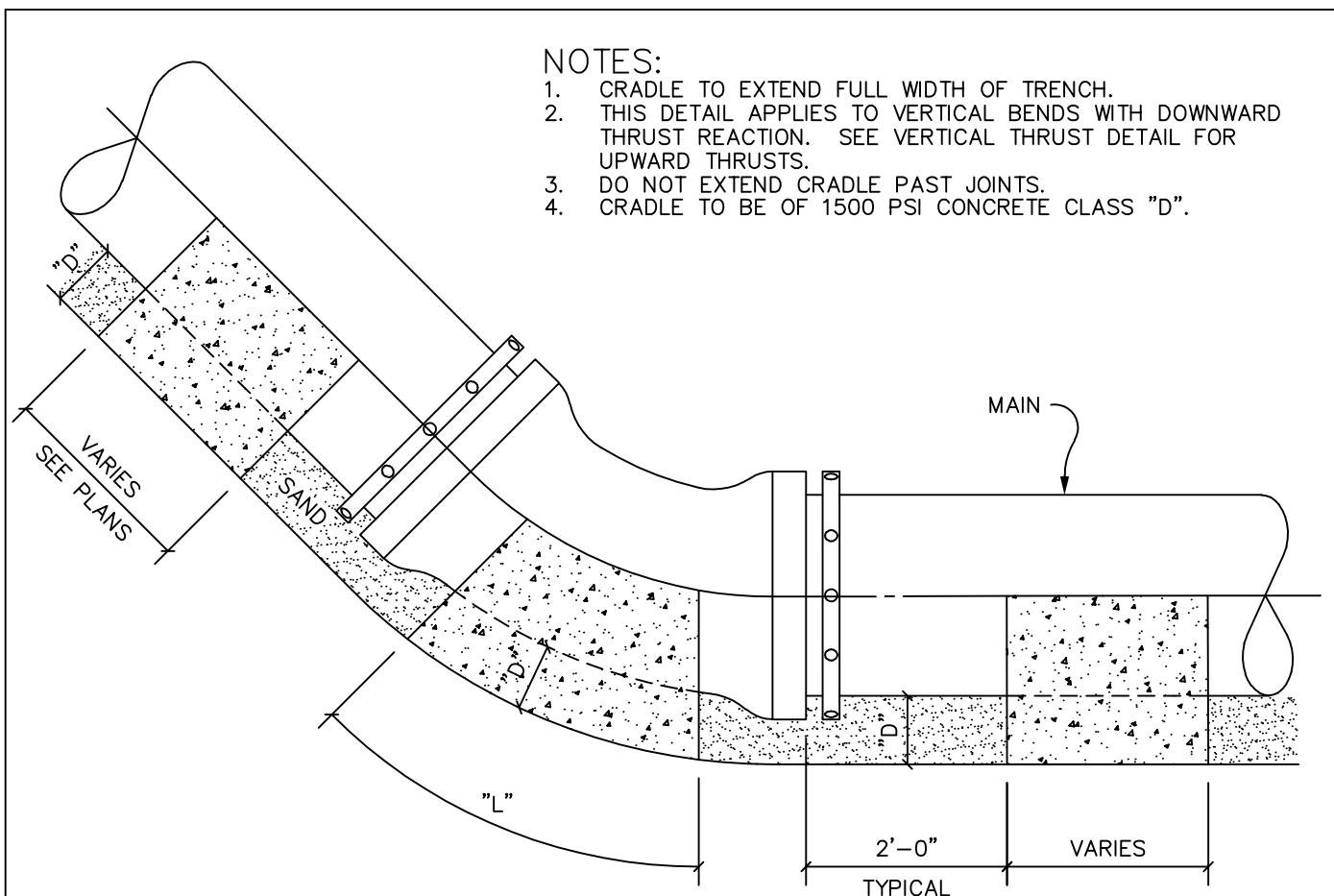
WATER SYSTEM CONSTRUCTION DETAILS

VERTICAL THRUST BLOCK

REVISED MAY 2019

SCALE: N.T.S.

SHEET: W-8



NOTES:

1. CRADLE TO EXTEND FULL WIDTH OF TRENCH.
2. THIS DETAIL APPLIES TO VERTICAL BENDS WITH DOWNWARD THRUST REACTION. SEE VERTICAL THRUST DETAIL FOR UPWARD THRUSTS.
3. DO NOT EXTEND CRADLE PAST JOINTS.
4. CRADLE TO BE OF 1500 PSI CONCRETE CLASS "D".

"D" = 6" MINIMUM OR
TO UNDISTURBED SOIL

CONCRETE CRADLE TABLE

PIPE SIZE	90° BENDS		45° BENDS		22.50° BENDS		11.25° BENDS	
	"L"	MIN. AREA sf	"L"	MIN. AREA sf	"L"	MIN. AREA sf	"L"	MIN. AREA sf
6"	6"	1.50	1'-0"	.83	1'-0"	.83	1'-0"	.83
8"	1'-6"	2.66	1'-3"	1.44	1'-0"	.83	1'-0"	.83
10"	2'-0"	4.17	1'-6"	2.26	1'-3"	1.15	1'-0"	.83
12"	2'-3"	6.00	1'-9"	3.25	1'-3"	1.65	1'-0"	.83
16"	3'-0"	10.65	2'-3"	5.76	1'-8"	2.94	1'-2"	1.48

NOTES:

1. BEARING AREAS SHOWN ARE BASED ON 150 PSI TEST PRESSURE AND 3000 PSF ALLOWABLE SOIL BEARING PRESSURE.
2. WRAP ALL BELOW GROUND IRON ASSEMBLIES IN POLYETHYLENE ACCORDING TO AWWA C105.
3. ALL TEES, BENDS, PLUGS, ETC. SHALL BE MECHANICALLY RESTRAINED BY MEGALUG OR APPROVED EQUAL.

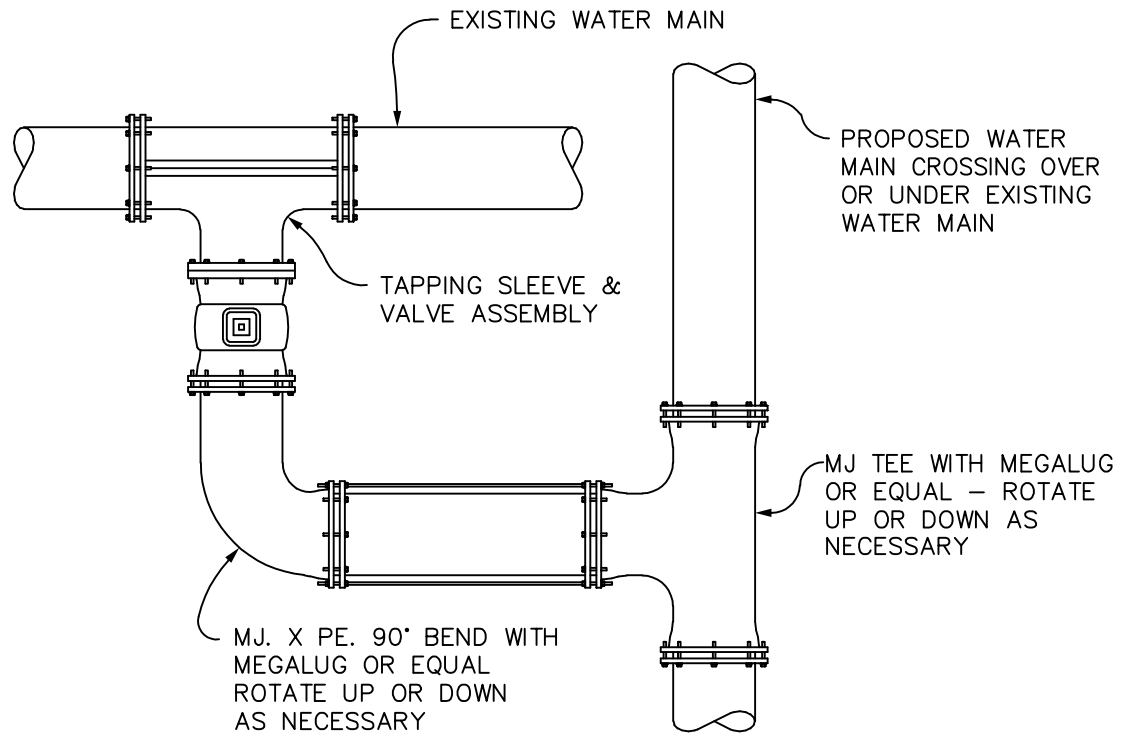


WATER SYSTEM CONSTRUCTION DETAILS CONCRETE CRADLE AT VERTICAL BENDS

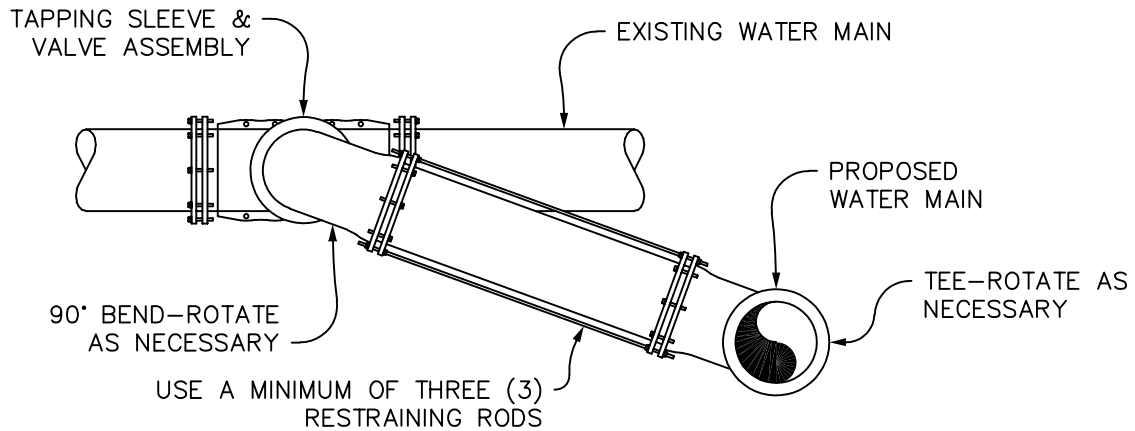
REVISED MAY 2019

SCALE: N.T.S.

SHEET: W-9



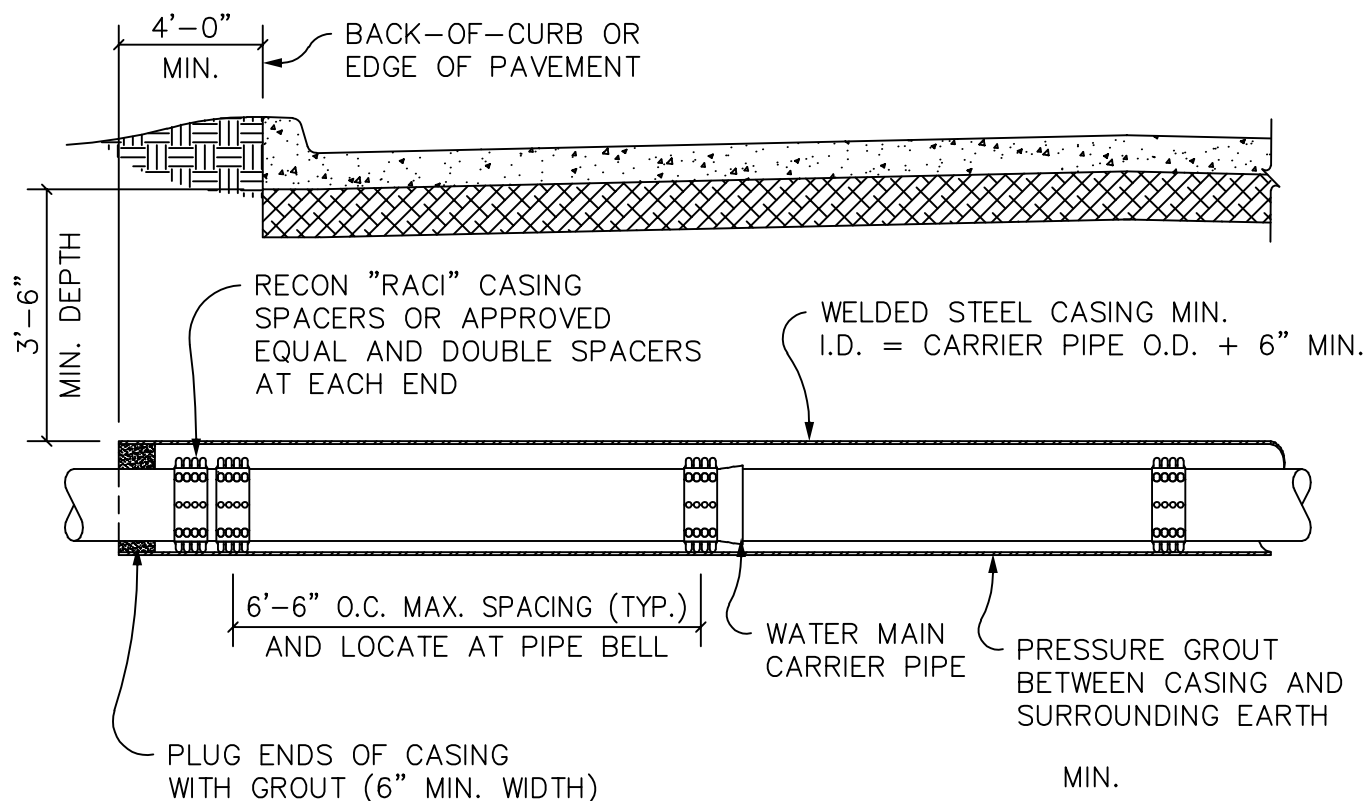
PLAN



SECTION

NOTES:

1. WRAP ALL BELOW GROUND ASSEMBLIES IN POLYETHYLENE ACCORDING TO AWWA C105.
2. THE DIAMETER OF THE CONNECTING PIPE BETWEEN THE PROPOSED AND EXISTING WATER MAINS SHALL HAVE A DIAMETER EQUAL TO THE SMALLER OF THE TWO MAINS TO BE CONNECTED THROUGH THE PROPOSED RING CONNECTION.



CASING DIAMETER	MIN. WALL THICKNESS
12" OR LESS	0.25"
OVER 12" - 18"	0.3125"
OVER 18" - 22"	0.375"
OVER 22" - 28"	0.4375"
OVER 28" - 34"	0.5"
OVER 34" - 42"	0.5625"
OVER 42" - 48"	0.625"
OVER 48" - 60"	0.6875"

NOTES:

1. WHERE A BORE PIT EXCEEDS 5 FEET IN DEPTH THE CONTRACTOR SHALL INSTALL SHORING OF THE PIT WALLS AS REQUIRED BY OSHA.
2. WHERE A BORE IS TO BE PARTIALLY OR COMPLETELY ABANDONED, SAID BORE SHALL BE COMPLETELY FILLED WITH HYDRAULICALLY PLACED CEMENT GROUT.
3. CASING SHALL BE EXTENDED TO THE RIGHT-OF-WAY LINE FOR STATE HIGHWAY AND RAILROAD CROSSINGS.
4. THE EDGE OF BORE PIT SHALL BE A MINIMUM OF 4' BEHIND THE BACK OF CURB OR EDGE OF PAVEMENT.
5. STEEL CASING PIPE SHALL HAVE A MINIMUM YIELD STRENGTH OF 35 KSI.



WATER SYSTEM CONSTRUCTION DETAILS WATER LINE BORE AND CASING

REVISED MAY 2019

SCALE: 3/8" = 1'

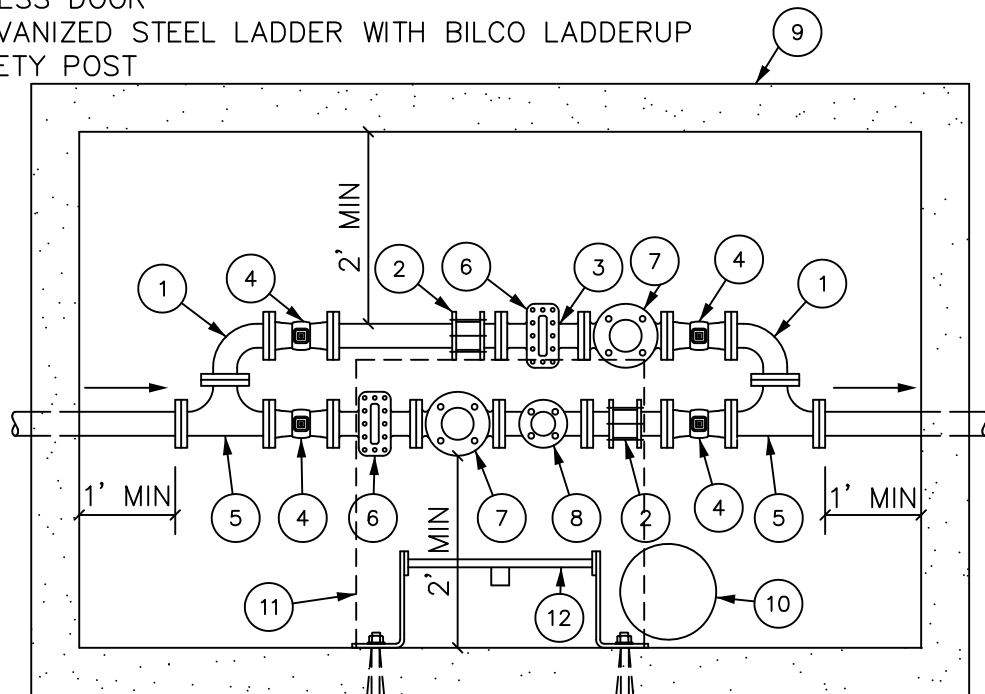
SHEET: W-11

MATERIALS LIST:

- 1 – D.I. 90° BEND FLG. x FLG.
- 2 – RESTRAINED COUPLING OR EXPANSION JOINT
- 3 – BYPASS LINE
- 4 – GATE VALVE OS&Y W/ CHAIN & LOCK FLG. X FLG.
- 5 – D.I. TEE FLG. X FLG.
- 6 – STRAINER
- 7 – COMPOUND OR TURBINE METER
- 8 – TESTING TEE FLG. X FLG. WITH 2" GATE VALVE AND FLG. X THREADED END DISCHARGE PIPE
- 9 – PRECAST METEER VAULT
- 10 – 12" SUMP x 24" DEEP (12" R.C.P. OR EQUAL)
- 11 – ACCESS DOOR
- 12 – GALVANIZED STEEL LADDER WITH BILCO LADDERUP SAFETY POST

MINIMUM VAULT SIZE

METER	VAULT
3 INCH	6'X8'
4 INCH	6'X8'
6 INCH	8'X10'



NOTES:

1. A J-4AL BILCO DOOR (3'x3') SHALL BE SPECIFIED FOR 3" AND 4" METER VAULTS. A JD-2AL BILCO DOOR (4'x4') SHALL BE SPECIFIED FOR 6" AND 8" METER VAULTS OR APPROVED EQUAL. DOOR SHALL BE DESIGNED FOR AASHTO H-20 WHERE APPLICABLE.
2. ALL VAULTS SHALL BE BROOKS, AMERICAN OR APPROVED EQUAL AND DESIGNED FOR AASHTO H-20 OR H-20-44 LIVE LOADS.
3. DOOR DRAIN SHALL BE PLUMBED TO OUTSIDE OF VAULT.
4. ALL WALL PENETRATIONS SHALL BE SEALED WITH LINK SEAL OR APPROVED EQUAL.
5. PIPE AND FITTINGS SHALL BE CONSTRUCTED A MIN. OF 1' ABOVE THE VAULT FLOOR. A CONCRETE PEDESTAL SHALL BE INSTALLED AT THE MID POINT OF THE PIPING ASSEMBLY FOR HORIZONTAL SUPPORT.
6. BYPASS LINE SHALL BE SAME SIZE AS MAIN LINE.
7. METERS SHALL BE BADGER SPECIFIED BY THE CITY.



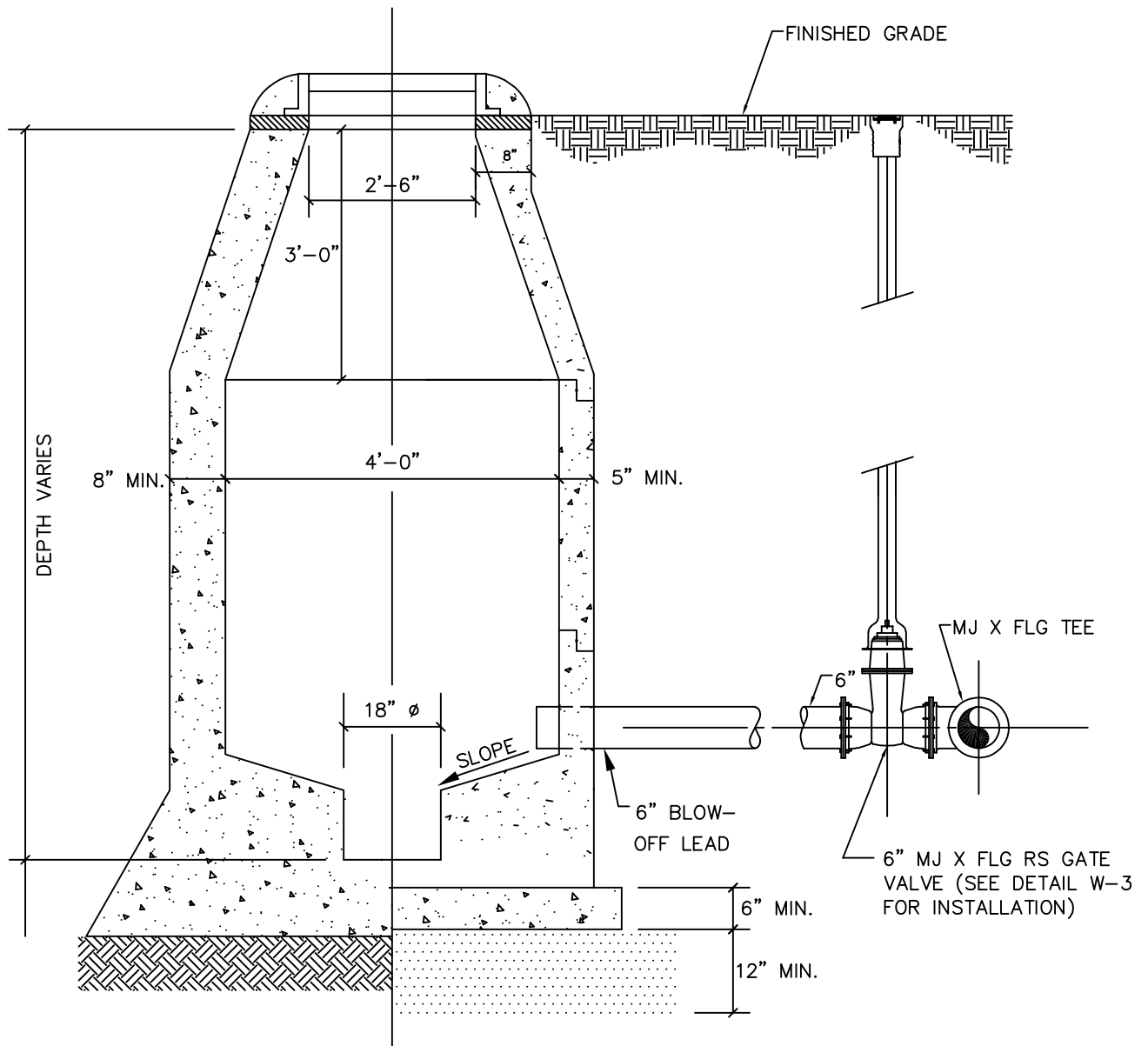
WATER SYSTEM CONSTRUCTION DETAILS

3" AND LARGER METER VAULT

REVISED MAY 2019

SCALE: 1/2" = 1'

SHEET: W-12



CAST-IN-PLACE

1/2 SECTION

SEE DETAIL S-3, CAST-IN-PLACE
SANITARY SEWER MANHOLE

PRECAST

1/2 SECTION

SEE DETAIL S-2, PRECAST
SANITARY SEWER MANHOLE

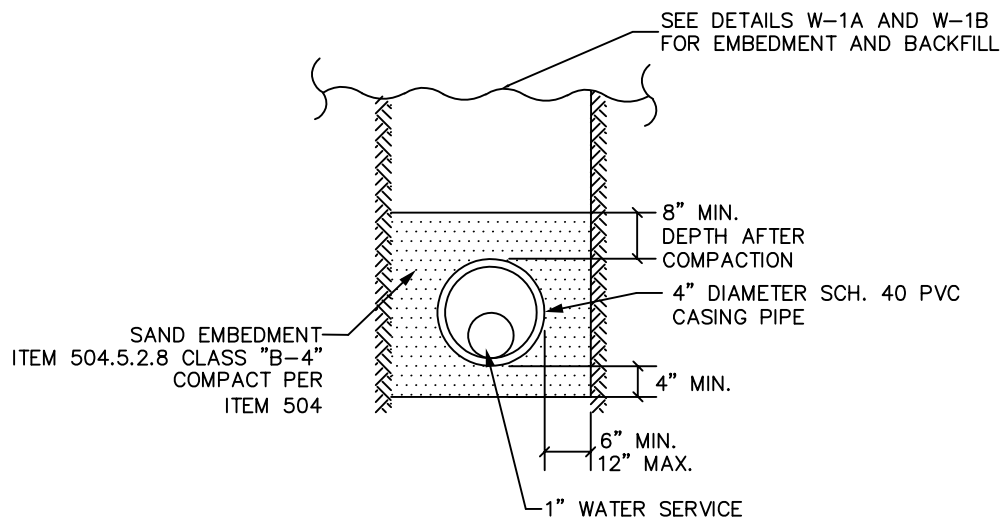
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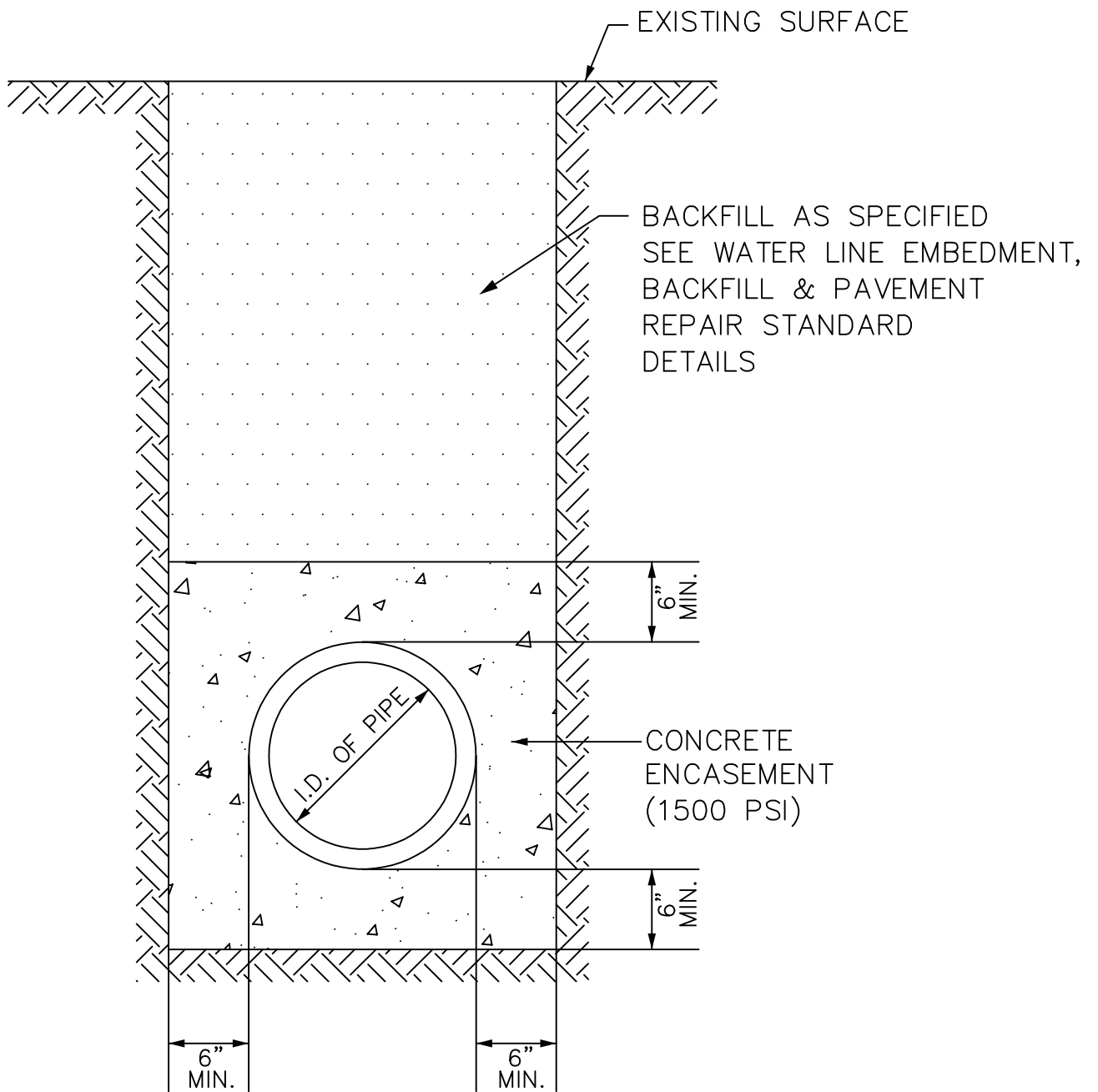
1. LOCATE THE BLOW-OFF SUMP MANHOLE NEAR PROPERTY LINE WITHOUT DISRUPTION TO SERVICE LINES.
2. ACTUAL VALVE LOCATION WILL DEPEND ON LOCATION OF THE WATER MAIN.



WATER SYSTEM CONSTRUCTION DETAILS
BLOW-OFF SUMP MANHOLE INSTALLATION

REVISED MAY 2019
SCALE: 3/4" = 1'
SHEET: W-13





WATER SYSTEM CONSTRUCTION DETAILS

CONCRETE ENCASEMENT

REVISED MAY 2019

SCALE: N.T.S.

SHEET: W-15