

City of Magnolia

Ordinance # 2007 - 106

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF MAGNOLIA, TEXAS, PROVIDING RULES, REGULATIONS, AND REQUIREMENTS WHICH GOVERN THE PLATTING OR REPLATTING OF LAND INTO SUBDIVISIONS WITHIN THE CITY OF MAGNOLIA AND EXTENDING INTO THE CITY'S EXTRATERRITORIAL JURISDICTION; REQUIRING PLATS AND REPLATS TO CONFORM TO SUCH RULES AND REGULATIONS IN ORDER TO PROCURE THE APPROVAL OF THE CITY PLANNING COMMISSION AND THE CITY COUNCIL. ADOPTING SUBCHAPTER B, CHAPTER 212 OF THE TEXAS LOCAL GOVERNMENT CODE WHICH ALLOWS FOR THE REQUIREMENT OF DEVELOPMENT PLATS IN THE CITY AND WITHIN ITS EXTRATERRITORY JURISDICTION; PROVIDING FOR GOVERNMENTAL IMMUNITY; PROVIDING SEVERABILITY; PROVIDING A PENALTY AND SAVINGS CLAUSE; REPEALING ORDINANCE #74 AND ORDINANCE #319; REPEALING ALL ORDINANCES OR PARTS OF ORDINANCES AND RESOLUTIONS OR PARTS OF RESOLUTIONS INCONSISTENT OR IN CONFLICT WITH THIS ORDINANCE; AND PROVIDING AN EFFECTIVE DATE.

Section 1: General Provisions and Requirements

Section 2: Definitions

Section 3: Preliminary Plat Procedures and Conditions for Approval

Section 4: Final Plat Procedures

Section 5: Bonds

Section 6: Subdivision Design Requirements

Section 7: Certifications, Restrictions, and Inscriptions

Section 8: Required Minimum Subdivision Improvements

Section 9: Appeal Process

Section 10: Building Permits, City Acceptance of Dedication and Certificate of Completion

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Appendix "A": Development Standards for the City of Magnolia

Appendix "B": Standard Specifications and Details for the City of Magnolia

State Law reference—Regulation of subdivision and property development, V.T.C.A., Local Government Code, Ch. 212.

**NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF
THE CITY OF MAGNOLIA, TEXAS:**

SECTION 1 - GENERAL PROVISIONS AND REQUIREMENTS

1.1 Title

This article shall be known, cited, and referred to as "The Land Subdivision Regulations of the City of Magnolia, Texas."

1.2 Adoption of Legislative Grants of Power

Sections 212.002 and 212.003 V.T.C.A., Local Government Code, and any amendments thereto, are hereby adopted, and the provisions of this article are adopted in exercise of power granted to municipalities by such statutes, as well as all other powers granted to cities through appropriate provisions of the laws and constitution of the State of Texas. Specifically, but not by way of limitation, the City Council of the City of Magnolia by and through their attorney shall have the power to bring suit in a court of competent jurisdiction to enjoin or abate any violation of a restriction contained or incorporated by reference in a duly recorded plan, plat, replat, or other instrument affecting a subdivision within the boundaries provided by law, to the fullest extent permitted under Chapter 212 of V.T.C.A Local Government Code, to be uniformly applied and enforced as provided therein.

1.3 Purpose

The purpose of this article is to provide for the harmonious development of the City of Magnolia, Texas, and its environs, for the coordination of streets within the subdivisions, and other existing or planned streets or with other features of the comprehensive plan for access to and the extension of public utility facilities, for adequate open spaces for traffic, recreation, light and air; and for the distribution of population and traffic which will tend to create conditions favorable to health, safety, security, morals, the general welfare and economic development of the City of Magnolia, Texas, here in after referred to as the "City."

1.4 Scope and Jurisdiction

Hereafter, before any plan, plat, or replat of a subdivision or addition of land inside the City or within the extraterritorial jurisdiction of the City thereof shall be recorded with the Montgomery County Clerk, it shall be first approved by the Planning Commission and then by City Council in conformance with the provisions of this ordinance. The filing of any plan, plat or replat without complying with the requirements of this ordinance, or the transfer of land by filing of any instrument in the nature of a conveyance without having first complied with the requirement of this ordinance, shall be deemed a violation of the provisions of this ordinance.

1.5 City Participation in Cost

The subdivider will be required to install at his own expense, all water lines, streets, alleys, sewer lines, natural gas lines, underground electrical distribution, storm sewer lines and drainage facilities and structures within the subdivision in accordance with the City's standards governing the same as set forth herein, including all engineering costs covering design, layout, and construction. In addition to the foregoing, in the event that the City will not be the supplier of all utilities within the subdivision, the subdivider shall pay to the City prior to any construction or excavation in the proposed subdivision, an inspection fee equal to two percent (2%) of the total development cost of the subdivision to the subdivider, including the cost of the real estate in question, to compensate for the City's expense in hiring an engineer to provide the inspections and other services provided for herein. Upon completion of the development, subdivider shall certify to the City his total development cost of the subdivision, and any appropriate adjustments in the inspection fee shall be made at that time. Notwithstanding the foregoing, the City may through grant, loan, in cash or in kind contribution, participate in the cost of extension of lines, utilities or other facilities if at the discretion of the City Council, the participation would be for a valid public purpose and be an overall benefit to the City. The City will pay

an increase in cost due to an increase in the capacity of any line if the increase is made at request of the City to serve areas and improvements beyond the subdivision that is the subject of the application.

SECTION 2 - DEFINITIONS

For the purposes of this ordinance, the following terms, phrases, words, and their derivations shall have the meaning given in this ordinance. When not inconsistent with the context, words used in the present tense include the future; words used in the singular number include the plural number; and words used in the plural number include the singular number. Definitions not expressly prescribed herein are to be determined according with customary usage in municipal planning and engineering practices.

2.1 Acceptable Outfall

That point as determined by the City Engineer where storm water can be released to a channel without causing erosion, or resulting sedimentation to the receiving channel or its floodplain. Where necessary, the outlet shall include structural or vegetative measures to assure sub critical velocities.

2.2 Alley

A minor public right-of-way which provides a secondary means of vehicular access to abutting property and which is used primarily for vehicular traffic to the rear of properties which otherwise abut on a "public street" as that term is defined herein.

2.3 Building Official

The City Administrator or designee.

2.4 Building Setback Line

The building setback line is a line on a plat generally parallel to the street right-of-way, indicating the limit beyond which no buildings or structures may be erected. No building or structure including any part of the foundation, roof, porch patio or any architectural features are allowed between a street right-of-way and the building setback line.

2.5 City

Shall refer to the City of Magnolia, Texas.

2.6 City Council

The City Council of the City of Magnolia, Texas.

2.7 City Engineer

A professional engineer employed or designated by the City of Magnolia, to provide professional engineering services for and on behalf of the City.

2.8 City of Magnolia Standards

As used herein, shall mean the standards for streets, alleys, storm sewer lines, utilities, and appurtenant structures, which are set forth herein, such additional standards as may have been or may be adopted by the City Council, which may be amended from time to time, and hereby referred to.

2.9 Cluster Development

A method of development for land that permits variation in lots without an increase in the overall density of population or development. Each lot in cluster sequence should be considered in relation to the entire group of which it is a part. This allows subdivisions with varying lot sizes so as to provide home buyers a choice of lot sizes according to their needs and preserves open space, tree cover, scenic vistas, natural drainage ways and outstanding topography. Such measures prevent soil erosion by permitting development according to the nature of the terrain; provides larger open areas with greater utility for rest and recreation; and encourages the development of more attractive and economic site design.

2.10 Comprehensive Plan

Is any plan officially adopted or amended by City Council for the physical development of the City of Magnolia and includes any unit or part of such plan.

2.11 Development Standards, Standard Specifications and Details

The technical requirements and standards for each aspect of construction and development prepared by the City Engineer and approved by the City Council as those instruments shall be updated and amended from time to time. A copy shall be kept at the City Hall and will be available to any person desiring the same. A personal copy may be obtained by paying for the cost of reproduction. A copy is also available to be downloaded for free on the City's website.

2.12 Easement

Is the area for and a right granted thereon for the purpose of limited public or semi-public use across, over, or under private property for a specified purpose or purposes.

2.13 Filing Date

The filing date is established on the date in which all fees have been paid to the City of Magnolia, all the required documents have been presented to the City Secretary, and all legally required posting notices have been satisfied which are required for preliminary plat approval, replat approval, or final plat approval.

2.14 Floodplain

An area of land that would be inundated by a flood having a 1-percent chance of occurring in any given year – also referred to as the base of 100-year flood.

2.15 Lot

A lot is a physically undivided tract or parcel of land having frontage on a public street or other approved facility and which is, or in the future may be offered for sale, conveyance, transfer or improvements; which is designated as a distinct and separate tract; and which is identified by a tract or lot number or symbol in a duly approved subdivision plat which has been properly recorded.

2.16 Lot Depth

Lot depth is the length of a line connecting the midpoints of the front and rear lot lines, which line shall be at a right angle to the front lot line or radial to a curved lot line.

2.17 Lot Width

Lot width is the length of a line (drawn perpendicular to the lot depth line) connecting the side lot lines at the building setback line or a point no farther than thirty-five (35') feet from the front lot line.

2.18 Masonry Walls

All masonry walls of any type which exceed three (3) feet in height must have an engineered foundation and design.

2.19 Plat

A plat is a complete and exact subdivision plan submitted for approval to the City Council in conformity with the provisions of this ordinance and which, if given final approval, will be submitted by the City to the Montgomery County Clerk for recording. A replat or resubdivision of land or lots which are part of a previously recorded subdivision shall be considered a plat as defined herein.

2.20 Positive Mylar

A mylar which has the waterproof ink on the top surface.

2.21 Residential Use

Residential use shall be construed to include single-family residential uses; two-family; and multi-family residential apartment or townhouse uses.

2.22 Screening Device

A screening device shall consist of a barrier of stone, brick, pierced brick or block, a combination of brick or stone columns and wood sections not to exceed twelve (12) feet in length or other permanent material of equal character, density, and acceptable design at least six feet in height, where the solid area equals 100% of the wall surface. Wrought iron fencing may be used as an alternative with the affirmative vote of the Planning Commission. Such device shall be continually maintained throughout the subdivision. Landscaping material may be placed in front of the screening device but cannot be used in place of the above required materials.

2.23 Shall and May

The word "shall" is mandatory and the word "may" is permissive throughout this article.

2.24 Side and Rear Set Back Line

The side and rear set back lines are lines which are established at a set distance from the property lines. No structures, foundations, roof overhangs, porches, patios, sidewalks, driveways or other architectural features may be located within the area between the setback line and the property line.

2.25 Steep Slope

A steep slope is any area that contain slopes over fifteen percent (15%) and are characterized by increased runoff, erosion and sediment hazards.

2.26 Street, Cul-De-Sac

A public street having but one opening or access to another public street and is terminated by a permanent vehicular turnaround.

2.27 Street, Dead End

That portion of a public street with a temporary cul-de-sac, that initially has only one opening or access to another public street and which will be extended at a later date. Temporary cul-de-sac must be paved in accordance with specification for streets contain within this ordinance.

2.28 Street, Major, Collector, or Secondary

Public streets so designated in the comprehensive plan which provide for expeditious movement of vehicular traffic in the community. This includes streets within, but not limited to, multi-family, industrial and commercial developments.

2.29 Street, Minor

Used primarily for access and circulation to abutting residential properties and which is intended to serve traffic within a limited area.

2.30 Street, Non-Public

Notwithstanding the foregoing definitions, however, the following shall not be considered public streets within the purview of this ordinance.

2.30(A) Any driveway designated or used principally to provide vehicular access to the outbuildings appurtenant to any principal building, or to provide vehicular access to delivery platforms or entrance of a building appropriate for the delivery thereto of goods or merchandise, and located wholly on private property.

2.30(B) An area appurtenant to a store or a group of stores, a theater, a church, or any similar establishment, designed or used primarily for a vehicular parking lot or vehicular parking facilities by customers, patrons, or employees of the establishment or group of establishments in question.

2.30(C) An entrance or roadway designed or used to provide either a vehicular entrance to or communication or passage between several units of a single group of such establishments which are under common control or management; provided, such industrial or commercial entrance way or roadway shall be considered a public street under the terms of this section if the property has an entrance upon two or more public streets unless there are at each of such entrances, gates, chains, or watchmen on duty 24/7 by which all persons are prevented from using the same except those employed by or having business to conduct at such industrial or commercial establishments in question; and

2.30(D) An entrance or driveway, designed or used to provide principal or primary vehicular access to an apartment building or a group of apartment buildings designated for multi-family occupancy and under one ownership. Such an entrance or driveway shall not be used to provide public street access to adjacent areas.

2.31 Street, Public

A public street is any area, parcel, or strip of land which provides primary vehicular access to adjacent property or land and provides general community circulation whether designed as a street, highway, freeway, thoroughfare, avenue, lane, boulevard, road, place, drive, or however otherwise designated, or which is dedicated or granted for public purposes.

2.32 Subdivider or Developer

These terms are synonymous and are used interchangeably and shall include any person, partnership, firm, association, corporation (or combination thereof), or any officer, agent, employee, servant, or trustee thereof, who performs or participates in the performing of any act toward the subdivision of land within the intent, scope and purview of this ordinance.

2.33 Subdivision - Except for property meeting the definition of an acreage subdivision (5 acres or more) as defined below, a "subdivision" is the division of any lot, tract, or parcel

of land by plat, or description, into (2) or more parts, lots, building lots, or sites or building sites, for the purpose, whether immediate or future, of dedication and the laying out (or realignment) of new streets, or other public access ways is a subdivision. This definition also includes the resubdivision and replatting of land or lots which are part of a previously recorded subdivision. Divisions of land for agricultural purposes in parcels of five (5) acres or more which will have access to each part and where no building construction is involved shall not be included within the definition of subdivision, unless any subdivision of five (5) acres or more includes the planning or development of a new street, access easement or realignment of an existing street.

SECTION 3 – PRELIMINARY PLAT PROCEDURES AND CONDITIONS FOR APPROVAL

3.1 Preliminary Plat

A preliminary submittal shall be required for all plats and or replats of existing subdivisions containing major changes in the physical layout, as determined by the City Engineer or Building Official.

3.2 Preliminary Plat Meeting

Prior to preparing or submitting a plat, the developer shall contact the City building official to arrange a preliminary plat meeting. The purpose of the meeting is to meet with the City staff and it is an opportunity for the developer to meet with key people involved in the platting process. The meeting is informal and its purpose is to gather and present information, and inform staff members of the general idea of the developer's platting proposal. The meeting will help insure compliance with the basic requirements of the subdivision ordinance and to arrive at a coordinated plat layout.

3.3 Engineer's Review

Before submittal to Planning Commission for approval all preliminary plats must be reviewed by the City Engineer. After review by the City Engineer and upon completion of any modifications and or required corrections to the preliminary plat and the payment of all fees the preliminary plat is ready for submittal to the Planning Commission for approval.

3.4 Preliminary Plat Submittal

All persons desiring to subdivide land within the area of jurisdiction of this ordinance shall prepare and submit the following information to the City secretary not less than ten (10) days prior to the required Planning Commission meeting posting notice or any state statute that requires a posting notice greater than ten days:

3.4(1) Twelve (12) black line or blue line copies of a preliminary plat covering all of the contiguous land owned or controlled by the subdivider intended to be developed at any time, even though it is intended by the developer to file final plats and install improvements for parts of said tract by sections or units. The preliminary plat shall be in compliance with all applicable provisions of the subdivision design regulations. Topographic contours or not more than five (5') intervals shall be shown.

3.4(2) Three (3) black line or blue line prints of the preliminary plans for the furnishing of water, the installation of sanitary sewer facilities, and provisions for storm sewers and general drainage facilities and associated calculations. Topographic contours of not more than five (5') foot intervals shall be shown.

3.4(3) One (1) Adobe Acrobat pdf. electronic file of each of the pages presented to the City for review. The files may be submitted by email or CD as long as they can be retrieved by the City of Magnolia with its present computer software.

3.4(4) Three (3) original copies of a letter of transmittal in duplicate giving the name and address and contact information of the owner or agent and the same information for the person or firm who prepared the plat. A detailed explanation and description of any variances or special conditions which may be present on the proposed plat. Information on the purpose and intent of use for each section of the plat.

3.4(5) Proof of ownership of the land to be subdivided must be furnished before final plat submittal, the sub divider shall provide a certificate or letter from a title guaranty company certifying to at least the following concerning title to the land: **(a)** a statement of records examined and date of examination; **(b)** description of the property in question by metes and bounds; name of the fee owner as of the date of examination and the date, file number, and volume and page of the recording of the deed involved; **(c)** the name of any lien holder together with the date of filing and volume and page of such lien; and a general description of any easements of fee strips granted, along with the file number date of filing, and volume and page of recording.

3.4(6) In cases where public streets, alleys or easements are proposed to be platted across private easements or fee strips, a copy of the instrument establishing such private easement or fee strip shall be submitted. Where a private easement has no defined location, an effort shall be made to reach agreement on a defined easement. (Agreement must be reached before submission of final plat.)

3.5 Preliminary Plat Specifications

The preliminary plat drawings shall be drawn to a size of **20"x 24"** at a scale not less than 1"= 100'. When more than one sheet is necessary to accommodate the entire area, an index sheet at appropriate scale showing the entire area, is be attached. The following shall be shown on the preliminary plat:

3.5(A) Topographic contours of not greater than five (5) foot intervals.

3.5(B) Title or name of the subdivision.

3.5(C) Names and addresses of owners and or subdividers.

3.5(D) Names and addresses of persons or firms preparing plat.

3.5(E) North Point and Scale.

3.5(F) Key map showing location of subdivision in relation to any existing streets and highways and original survey lines.

3.5(G) The boundary of the subdivision and accurate dimensions, both linear and angular, of the boundary.

3.5(H) All existing utilities, natural water or drainage courses, streets, lots, easements and fee strips as to size and location within the subdivision.

3.5(I) Within 200 feet of the boundaries of the subdivision, all existing utilities, streets and lots, as to size and location and property lines, survey lines, and the names of property owners.

3.5(J) All proposed blocks, lots, alleys, streets, utilities, easements, purposes thereof, drainage or water courses, recreation and special use areas, reserves and their proposed use, proposed land uses, screening devices, setback lines, proposed dedication of areas for public use other than streets and easements, and the approximate dimensions of all proposed items shall be shown. Public facilities and easements included in any City, county or regional plan that are included or adjacent to the land being subdivided shall be shown.

3.5(K) Street names and lot and block numbers.

3.5(L) Proposed sectioning, if any.

3.5(M) Area in subdivisions, total number of lots and total area of reserves.

3.5(N) Boundaries and locations of any floodplains to be shaded in as found by any governmental body or state agency acting in accordance with state law or local ordinance or regulation.

3.5(O) Proposed uses of the land within the subdivision including an outline or brief form of proposed restrictions.

3.6 Approval of a Preliminary Plat

After the preliminary plat meeting has been held and upon receipt of the preliminary plat, the receipt of all required fees and after the required legal postings have been satisfied, the City of Magnolia Planning Commission shall render a decision within thirty days (30) days from the filing date. A decision may consist of approval, disapproval, or conditional approval. Conditional approval shall be considered to be approval of a plat subject to conformity with prescribed conditions, but shall be deemed to be disapproval of such plats until such conditions are complied with. All objections made to the preliminary plat, or conditions imposed, shall be furnished to the subdivider in writing.

3.6(A) When a preliminary plat has been approved, the subdivider shall within six (6) months thereafter file a final plat of sections of the proposed subdivision upon which approval of the preliminary plat has been obtained. When a preliminary plat has been approved and thereafter the subdivider fails to submit a final plat of the subdivision or a section thereof within a period designated, the approval of the preliminary plat shall be void.

SECTION 4 - FINAL PLAT PROCEDURES

4.1 Staking of the Final Plat

All final plats must be in full accordance with the required certification made upon the plat by a registered land surveyor ascertaining that the plat presents a survey made by him and that all necessary monuments are accurately and correctly shown. The surveyor shall place such monuments as required by the City, including all benchmarks as specified by the City Engineer, and they shall be set at all corners and angle points of the boundaries of the original tract to be subdivided and at all street intersections, angle points in street lines and points of curve, and at such intermediate points as shall be required by the City. Such monuments shall be of solid iron rods not less than one-half of an inch (1/2") in diameter and three feet (3') in length, driven securely into solid earth with the grades of same being at grade with established walk, or if walk is not established, flush with natural grade of the earth's surface.

4.2 Final Plat Submittal Requirements

After the foregoing procedure has been complied with and the preliminary plat has been approved by the City Planning Commission and after all required conditions have been met, the subdivider shall prepare and submit the following information to the City Council, not less than ten (10) days prior to the required posting notices for the next regularly scheduled City Council meeting. If state statutes require a longer posting period for a required public hearing then all information required to be submitted with the final plat must be turned in to the City Secretary ten (10) days before the required public hearing posting:

4.2(A) The final plat shall be prepared and bear the seal of a registered professional land surveyor. It shall be drawn in accordance with the associated preliminary plat. The final

plat shall have accurate dimensions, both linear and angular, of all items on the plat. Linear dimensions shall be expressed in feet and decimals of a foot; angular dimensions may be shown by bearing.

4.2(B) Three (3) originals of the final plat shall be drawn on **20" x 24"** positive Mylar and be reproduced by photographic process to scale from an accurate survey made on the ground.

4.2(C) Twelve (12) black or blue line copies of the positive Mylar originals of the final plat.

4.2(D) One (1) 11" x 17" black line or blue line copy of all originals.

4.2(E) One (1) Adobe Acrobat pdf. electronic file of each of the pages presented to the City for review. The files may be submitted by email or CD as long as they can be retrieved by the City of Magnolia with its present computer software.

4.2(F) The final plat must meet all applicable subdivision design requirements, all applicable development standards requirements and be certified and sealed by a State of Texas registered surveyor.

4.2(G) The owner shall submit an affidavit that he has made no conveyance of any interest and that no additional liens are existing on the land within the plat since the date of the original title opinion or, certification.

4.2(H) Tax certificates shall accompany the final plat, indicating that all taxes have been paid.

4.2(I) The owner, developer, or dedicator of any subdivision plat wherein public streets, alleys, or easements are shown crossing private easements or fee strips shall by letter to the City building official assume responsibility for seeing that any adjustments and protection of existing pipelines, or other facilities shall be planned and provided for to the satisfaction of the holder of the private easements of fee strips and the City attorney prior to the approval of the final plat by the City Council and filing of the plat for record.

4.3 Final Plat General Specifications

The final plat shall include the name of the subdivision, name and addresses of owners and/or subdividers, name and address of surveyor preparing plat, a legal description of the plat and the date of preparation or revision.

4.3(A) North point, scale and key map insert.

4.3(B) All certification statements, dedication restrictions and other inscriptions as required by the ordinance must be included.

4.3(C) All lots, blocks, streets, alleys, pipelines, fee strips, water courses, easements, reserves and total area, number of lots and number of blocks. All lots and reserves must include the total acres and square foot notations.

4.3(D) Street names, lot numbers, block numbers and alphabetical identification of reserves must be included.

4.3(E) Setback Lines - All lots must contain front, rear or side setback lines.

4.3(F) Utility Easements - All utility easements must be drawn with dimensions.

4.3(G) Numbering - Blocks are to be numbered consecutively within the overall development and must meet the following:

4.3(G)(1) Lot Numbering - All lots are to be numbered consecutively within each block. Lot numbering may be cumulative throughout the subdivision if the numbering continues from block to block in a uniform manner that has been approved on an overall preliminary plat.

4.3(G)(2) Reserves - Reserves are to be labeled A, B, C, etc., rather than numbered as blocks and lots. This includes all land which is reserved for other purposes or future development.

4.3(H) Streets and Alleys - Streets and Alleys shall include the following:

4.3(H)(1) Complete survey data shown on each side of streets and alleys and or centerline.

4.3(H)(2) The length and bearings of all tangents shall be noted.

4.3(H)(3) Dimensions from all angle points of curve to an adjacent side lot line.

4.3(H)(4) Actual width of all streets and alleys, measured at right angles or radially where curved.

4.3(I) Bearings and Dimensions - Complete bearings and dimensions for front, rear, and side lot lines. The following note for side lot lines may be used in lieu of bearing:

"All side lot lines are either perpendicular or radial to street frontage unless otherwise noted."

4.3(J) Total Square Footage Per Lot - Every lot shall have the total square footage of the lot noted on each individual lot.

4.3(K) Water Courses and Easements - Distance to be provided along the side lot lines from the front lot line to the point where the side line crosses the drainage easement line or the high bank of a stream. Traverse line shall be provided along the edge of all large water courses on a convenient location, preferably along a utility easement if paralleling the drainage easement of a stream.

4.3(L) Pipelines - Pipelines having no defined easement location or width shall be tied by dimensions to all adjacent lot and tract corners. If no agreement can be reached on a defined easement, then building setback lines shall be shown at a distance of twenty (20') feet from and parallel to the centerline of the pipeline.

4.3(M) Tract Boundaries - The boundaries of the tract or tracts that the plat proposes to subdivide shall be shown with heavier solid lines. The boundaries of the plat shall be described with complete and overall dimensions and bearings and be tied to an original corner of the original survey of which the subdivision is a part.

4.3(N) Existing Data - The location, width, and name of existing streets and subdivisions or property ownerships and the location and dimensions of existing lots, easements, pipelines, fee strips, survey lines, building lines, water courses, or other important information shall be shown on all sides of the subdivision for a distance of not less than two hundred feet (200'). The lines of such indication beyond the plat boundary shall be dashed.

4.4 Plans and Specifications – Final plans and specifications for all required improvements with the subdivision including water, sewer, paving, drainage, detention storage, lot grading, etc. shall be submitted with the final plat. Final plans shall include detail design of the aforementioned items and proposed alignment of other required utilities such as phone, TV cable, electrical, gas and internet cable. Proof of coordination with these other utilities shall also be required with plans and specification submittal. Texas Commission on Environmental Quality (TCEQ) submittals for water and sewer improvements shall also be included with the final plans and specifications.

4.5 Approval of a Final Plat

Upon receipt of all fees, positive Mylar originals and all required copies of the final plat and other required information, the City Council shall render a decision thereon within thirty (30) days from the filing date. Such decision may consist of approval, disapproval, or conditional approval. Reasons for disapproval or conditional approval shall be stated to the developer/subdivider in writing. Upon approval by the City Council and provided that

all conditions are met, the Mayor shall within ten (10) days thereafter sign the approved final plat and submit it to the City Secretary for recording purposes.

4.5(A) On approval of the plat, said plat being otherwise fully and properly endorsed, the Mayor and City secretary shall certify in writing said approval. Upon payment of all filing fees by the developer the City shall then cause the plat to be filed for record.

4.5(B) In no case shall the City Council allow said plat to be approved and recorded until the City Engineer has reviewed the plat and given his comments or recommendations.

4.5(C) All fees including impact or capital recovery fees must be paid before the final plat will be filed for record with the Montgomery County Clerk's Office.

4.5(D) No changes, erasures, modifications or revisions shall be made on any plat of a subdivision or to any required instruments after approval has been given by the City Council in writing, unless such change, modification, or revision is first submitted to and approved by the City Council.

4.6 Final Plat Approval Expiration

Final approval will expire two (2) years after the City Council action granting approval of any plat unless the plat has been filed for record with the Montgomery County Clerk's Office.

SECTION 5 - BONDS

5.1 Contractor Bonding

The developer shall require performance and payment bonds from the contractor for one hundred (100%) percent of the cost of improvements, and shall assign them to the City upon completion of construction.

5.2 Warranty

The developer shall also provide to the City a one (1) year warranty against defective materials or workmanship on the improvements constructed. The contractor's performance and payment bonds assigned to the City shall remain in force throughout the warranty period.

5.3 Performance Bond

The owner or developer of the proposed subdivision shall file a performance bond approved by the City Engineer in the form of surety and sureties on such bond, guaranteeing the completion of such improvements as are required to be constructed by the owner or developer under the present City policies in effect and as required by this ordinance. Such a bond shall be in an amount equal to the estimated cost of the entire project and the amount of the bond shall be approved by the City Engineer. Such bond shall be payable to the City, and shall guarantee completion of all required improvements within two (2) years from the date of final approval of such plat. Where for good cause shown to the satisfaction of the City Council, the developer or owner has not completed the required site improvements within two (2) years from the date of the final approval of the plat, the City Council may grant additional time, not to exceed one (1) year, within which to complete said improvement. No such extension shall be granted unless the developer or owner has filed new security in conformance with the conditions applied to the original bond. All bonds shall be kept in the custody of the City Secretary. Bonds shall be released to the principal and/or surety only after all the subdivision requirements have been fulfilled or the money sum of the bond or the amount of the work required yet to be finished has been paid to the City.

5.4 Release of Performance Bonds

The City Engineer shall certify to the City Secretary that all the required work has been accepted and completed. In the event that a money settlement is paid the City in lieu of performing the required work, the City Engineer shall certify to the City Secretary that such sum is adequate compensation and that in his opinion the bond should be released. The following form shall be used in releasing subdivision bonds and signed by the City Secretary.

NAME OF PRINCIPAL: _____

NAME OF SURETY (IES): _____

NAME OF SUBDIVISION: _____

This is to certify that all requirements of the City of Magnolia, Texas, concerning the above named subdivision have been met and such bond is hereby released to the above designated principal and surety (ies).

(Typed Name of City Secretary)
City of Magnolia, Texas

(City Seal)

SECTION 6 - SUBDIVISION DESIGN REQUIREMENTS

6.1 Specifications and Design Standards

All subdivisions, including without limitation, streets, water, storm drainage, sewer, electric and gas systems, shall be designed in conformity with the requirements set forth in the City's Development Standards, Technical Specifications, and Standard Details.

6.2 Oversizing

Where oversizing of a proposed utility is required by the City to meet a future demand or need, the City will pay the cost difference between the utility size needed for the proposed development and the utility size required for the future demand.

SECTION 7 – CERTIFICATIONS, RESTRICTIONS, AND INSCRIPTIONS

7.1 Surveyor Certification

"This is to certify that I, _____, a licensed surveyor of the State of Texas, have platted the above subdivision from an actual survey on the ground; and that all blocks, lot corners, angle points and points of curve are properly marked with one-half inch (1/2") iron rods, three feet (3') long set with the head flush with the ground or sidewalks and that this plat correctly represents that survey made by me."

(Surveyor's Signature)

(Surveyor's Typed Name)

Texas Registration Number _____

7.2 Plat Dedication and Certification

The following form for dedications and certifications shall be utilized on the final plat of subdivisions or resubdivisions:

STATE OF TEXAS

COUNTY OF MONTGOMERY

I (or We), (Name(s) of owner(s) or in the case of corporations, name of "president and secretary" respectively) of (name of "company") owner (or owners) of the property subdivided in the above and foregoing map of the (name of subdivision), do hereby make subdivision of said property (in case of corporation, use words for and on behalf of said name of company), according to the lines, streets, alleys, parks, and easements therein shown, and designate said subdivision as (name of subdivision) in the () Survey, in Montgomery County, Texas; and (in case of corporation, use words on behalf of said name of company; and) dedicate to public use, as such, the streets, alleys, parks and easements shown thereon forever; and do hereby waive any claims for damages occasioned by the establishing of grades as approved for the streets and alleys dedicated, or occasioned by the alteration of the surface of any portion of streets or alleys to conform to such grades and do hereby bind myself (or ourselves), my (or our) heirs and assigns to warrant and forever defend the title to the land so dedicated. There is also dedicated for utilities an unobstructed easement () feet wide from a plane () feet above ground upward located as shown hereon. We have also complied with all regulations hereto before adopted by the City Council of the City of Magnolia, located in Montgomery County, Texas.

7.3 Mortgagee's Statement

The following paragraph is to be used where there is a lien against the property (or a separate instrument may be filed):

"I, (or We), (Name of Mortgagees), owners(s) and holders(s) of a lien(s) upon said property do hereby ratify and confirm said subdivision and dedication and do hereby in all things subordinate to said subdivision and dedication the lien(s) against said owner and held by me (us)." The signature(s) of lien holder(s) are to appear below that of owner's and to be duly acknowledged.

(Owner(s) Signatures)

(Typed Name of the Owner(s))

(Signature of Name of the Mortgagees and/or holder(s) of a lien (s))

(Typed Name of the Mortgagees and/or holder(s) of a lien(s))

7.4 City of Magnolia's Certification

"This is to certify that the City Council of the City of Magnolia, Texas, has approved this plat and subdivision of (name of the subdivision) as shown herein."

"IN TESTIMONY WHEREOF, in witness of the official signatures of the Mayor, and the City Secretary of the City of Magnolia, Texas, this the ____th day of _____, 20____, do approve this plat to be recorded in the official record at the Montgomery County Clerk's Office.

(Signature of the Mayor)

(Typed Name of the Mayor)

(Signature of the City Secretary)

(Typed Name of the City Secretary)

7.5 County Clerk's Certification

STATE OF TEXAS

COUNTY OF MONTGOMERY

"I, (Typed Name of County Clerk), Clerk of the County Court of Montgomery County, Texas, do hereby certify that the written instrument with its certificate of authentication was filed for registration in my office on, this the ____th day of _____, 20 ____, at _____o'clock, __m., recorded as File # _____ in Cabinet _____ as Sheet # _____, of record for Montgomery County."

"WITNESS MY HAND AND SEAL OF OFFICE, at the day and date last above written."

(Signature of Current County Clerk)

(Typed Name of Current Clerk), Clerk, County Court
Montgomery County, Texas

Witnessed By: (Signature of Witness)
Deputy

SECTION 8.0 - REQUIREMENTS PERTAINING TO SUBDIVISION COMPLETION

8.1 Subdivision Construction

Before beginning any construction of the improvements authorized in this article on proposed roadways, public utilities, or drainage facilities, or structures pertaining to any subdivision coming under the provisions of this article and within the City limits, complete plans and specifications for such improvements shall have first been completely approved by the City Engineer as meeting the City's standards in connection with the approval of a final plat of the proposed subdivision by the City Council. The City's Development Standards are contained in Appendix "A" and the City's Standard Specifications and Standard Details are contained in Appendix "B".

8.2 Subdivision Inspections

The City Engineer or his duly authorized representative shall from time to time inspect the construction of all utility facilities and streets in the subdivision during the course of construction to see that the same comply with the standards governing the same, the inspection fee for which shall be paid by the subdivider as provided in Section 1, Paragraph 1.5 hereof. In this regard, free access to the subdivision shall be accorded the City Engineer and his duly authorized representative by the Subdivider, his agents, and employees. Inspection by the City Engineer, or a failure of the City Engineer to inspect construction as required herein shall not in any way impair or diminish the obligation of the subdivider to install improvements in the subdivision in accordance with plans and specifications therefore as approved by the City Engineer and the City Council and in accordance with the City's standards.

8.3 Subdivision Completion - After all required improvements have been certified complete by the developer's engineer in accordance with approved plans, specifications, and change orders; the owner or subdivider of subdivision shall file with the City secretary, within thirty (30) days after completion of all of the required improvements, one (1) complete set of record drawings of all underground utilities and street improvements that have been constructed. In the event exigencies of construction necessitate changes in plans and specifications, approval of the changes must be made by the City Engineer prior to making revisions in the construction.

SECTION 9 – APPEAL PROCESS

Any subdivider contesting any disapproval and/or the interpretation and/or the application of any rule, standard, regulation, determination, requirement, or necessity set forth in this article directly or by delegation of authority shall have the right, after filing a written request with the City secretary, to have a hearing thereon before the City Council no later than twenty-one (21) days after the date of filing of such a request. Decision of the City Council shall be final and such further appeal shall be in accordance with appropriate law.

SECTION 10 - BUILDING PERMITS, CITY ACCEPTANCE OF DEDICATION, CERTIFICATE OF COMPLETION AND UTILITY SERVICE

10.1 Building Permits

No building permits shall be issued until the City Engineer has certified that the subdivision is complete in accordance with the approved plans, specifications and change orders.

10.2 Acceptance

The approval of any plat or replat shall not be deemed an acceptance of the proposed dedications and shall not impose any duty upon the City concerning the maintenance or improvement of any such proposed dedications until the proper authorities of the City shall have made the actual appropriation of the same by entry, use or improvement. If any such plan, plat, or replat is disapproved by the City Council, disapproval shall be deemed as a refusal by the City of the offered dedication shown thereon.

10.3 Certificate of Completion

After construction is completed, the developer shall request an inspection by the City Engineer who will make a written certificate of completion recommendation to the City Council concerning the acceptance of the subdivision. In no case will the City Council consider the acceptability of a subdivision without the City Engineer's certificate of completion.

10.4 Connection to the City Utilities

Unless and until any such plans, plats, or replats, specifications and construction shall have been first approved in the manner and by the authorities provided for herein, it shall be unlawful within the area covered by such plans, plat, or replats for any City official or employee thereof to serve or connect said land or any part thereof with any public utility, such as water, sewer, lights, gas, etc., which may be owned, controlled, regulated or distributed by the City.

SECTION 11 - PENALTIES FOR VIOLATION

11.1 Enforcement

If it appears that a violation or threat of a violation of this subchapter or a plan, rule, or ordinance adopted under this subchapter or consistent with this subchapter exists, the municipality is entitled to appropriate injunctive relief against the person who committed, is committing, or is threatening to commit the violation.

11.2 Suit for Injunctive Relief

A suit for injunctive relief may be brought in the county in which the defendant resides, the county in which the violation or threat of violation occurs, or any county in which the municipality is wholly or partly located.

11.3 Prohibition or Injunction

In a suit to enjoin a violation or threat of a violation of this subchapter or a plan, rule, ordinance, or other order adopted under this subchapter, the court may grant the municipality any prohibitory or mandatory injunction warranted by the facts including a temporary restraining order, temporary injunction, or permanent injunction.

11.4 Class C Misdemeanor

A person commits an offense if the person violates this subchapter or a plan, rule, or ordinance adopted under this subchapter or consistent with this subchapter within the limits of the municipality. An offense under this subsection is a Class C misdemeanor. **Each day the violation continues constitutes a separate offense.**

11.5 Docket Precedence

A suit under this section shall be given precedence over all other cases of a different nature on the docket of the trial or appellate court.

11.6 No Defense

It is no defense to a criminal or civil suit under this section that an agency of government other than the municipality issued a license or permit authorizing the construction, repair, or alteration of any building, structure, or improvement. It also is no defense that the defendant had no knowledge of this subchapter or of an applicable plan, rule, or ordinance.

11.7 Other Penalties

No conviction or convictions under the penal provisions of this article shall ever be considered as any bar to any injunctive or other legal remedy, relief, right, or power existing in the City of enforcing the application and provisions of this article by virtue of the constitution and the laws of the State of Texas, and laws of this City. The City Council may refuse to approve any future plats for any developer or subdivider or any corporation whether a subsidiary of parent wherein the developer or subdivider owns more than fifty percent (50%) interest until any previous delinquencies in specifications for former plats have been corrected.

SECTION 12 – VARIANCE PROCEDURES

12.1 Authority to Grant a Variance

The City Council may authorize a variance from these regulations when, in its opinion, undue hardship will result from requiring strict compliance. In authorizing a variance, the City Council shall prescribe only conditions that it deems necessary or desirable to the public interest. In making the finding herein below required, the City Council shall take into account the nature of the proposed use of the land involved and existing uses of land in the vicinity, the number of persons who will reside or work in the proposed subdivision and the probable effect of such variances upon traffic conditions, public health, safety, and welfare of citizens in the vicinity.

12.2 Requirements to Grant a Variance

No variance shall be granted unless:

12.2(A) There are circumstances or conditions affecting the land involved such that strict application of this chapter would deprive the applicant of reasonable use of his land;

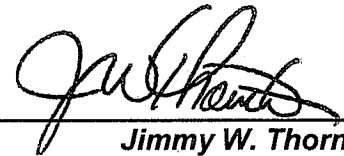
12.2(B) The granting of the variance will not be detrimental to the public health, safety, welfare or injurious to other property in the area; and

12.2(C) The granting of the variance will not have the effect of preventing an orderly subdivision of other land in the area in accordance with the provisions of this chapter.

SECTION 13 – EFFECTIVE DATE

This ordinance will become effective immediately upon the date of publication in the official city newspaper of the City of Magnolia.

**DULY PASSED BY THE CITY COUNCIL OF THE CITY OF MAGNOLIA, TEXAS
ON THIS 20TH DAY OF MARCH 2007.**



**Jimmy W. Thornton, Jr.
Mayor**

ATTEST:



**LuAnn D. Drake
City Secretary**

Seal

AFFIDAVIT OF PUBLICATION

BEFORE ME, the undersigned authority, on this day personally appeared,
Tracy Herron who on her oath stated:

125 Legal Notices

**NOTICE OF PUBLIC
HEARING REGARDING
CITY OF MAGNOLIA
PROPOSED ORDINANCE
2007-106**

The City of Magnolia, Montgomery County, Texas hereby gives notice to conduct a Public Hearing and Adopt an Ordinance providing rules, regulations, and requirements for governing the platting or replatting of land into subdivisions in the City of Magnolia. Requiring plats and replats to conform to such rules and regulations in order to procure the approval of the City Planning Commission and the City Council. Providing a penalty and savings clause and repealing Ordinance #74 and Ordinance #319 repealing all ordinances or parts of ordinances and resolutions or parts of resolutions inconsistent or in conflict with this ordinance. Notice is hereby given that a Public Hearing on the proposed ordinance will be held on Tuesday, February 20, 2007 at 7:00 p.m. at the City of Magnolia Building 3, for the purpose of hearing comments for and against said proposed ordinance.

LuAnn D. Drake
City Secretary
City of Magnolia, Texas

I am the Account Manager of the TOMBALL MAGNOLIA TRIBUNE a newspaper published in the Montgomery County, Texas and know the facts stated in this affidavit. The attached matter is a true and correct copy of the publication of the citation of which it purports to be a copy, as the same appeared in such newspaper in the respective issues of:

2/19, 2007

_____, 2007

Tracy Herron

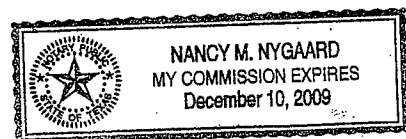
Tracy Herron, Account Manager

Received & Filed
in the Office of

FEB 21 2007

City Secretary
City of Magnolia, Texas

Subscribed and sworn to this 19th day of Feb, 2007.



APPENDIX “A”
DEVELOPMENT STANDARDS FOR THE

CITY OF MAGNOLIA

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CHAPTER 1 – INTRODUCTION

101. GENERAL PROVISIONS

The City of Magnolia Design and Construction Standards outline specific requirements for the improvement, development and subdivision of land within the City of Magnolia corporate limits and extra territorial jurisdiction. This document is intended to be used jointly with the City of Magnolia Standard Details, Standard Specifications, Subdivision Ordinance, and other applicable Federal, State and local regulations.

102. AUTHORITY

This document has been prepared pursuant to authority vested in the City of Magnolia.

103. PURPOSE

The purpose of these of these standards is to achieve uniformity and consistency in the development and subdivision of property in the City of Magnolia corporate limits and extra territorial jurisdiction, to achieve a common standard in the improvement of City infrastructure systems, to provide for and promote growth in accordance with comprehensive planning goals and objectives, to further define requirements of the subdivision ordinance, to assure compliance with applicable Federal, State and local regulations and to serve the citizens in providing for their safety, health and welfare.

104. SCOPE OF THE STANDARDS

These standards are intended to cover all activities related to the improvement, development and subdivision of land in the City of Magnolia corporate limits and extra territorial jurisdiction. This document outlines specific planning, engineering, construction and policy provisions, which are requisite to these activities.

105. APPLICATION OF THE STANDARDS

Any party desiring to improve, develop or subdivide land in the City of Magnolia corporate limits or extra territorial jurisdiction shall incorporate the requirements of these standards into the planning, engineering and construction of their particular project. As previously noted, other pertinent regulations and criteria, including the City of Magnolia Standard Details and Standard Specifications, must be utilized in combination with this document. Questions concerning the contents of these standards or other requirements concerning meaning or applicability shall be directed to the City Manager.

106. PRELIMINARY RESEARCH

106.1

City staff will be available for preliminary meetings to discuss a proposed project with the project engineer and/or developer. This preliminary meeting must be scheduled prior to submittal of any documents for review.

106.2

Research of all existing utility and right-of-way information with city, county, state and other public and private utility agencies shall be completed and documented prior to submittal of any plans to the City.

107. FEES

107.1

Prior to beginning construction on a project, all applicable fees shall be paid to the City.

108. DESIGN REVIEW REQUIREMENTS FOR PUBLIC WORKS PROJECTS

108.1

Submit six (3) copies of construction plans and supporting documentation to the City of Magnolia for review. Plans will be circulated to appropriate departments and comments will be returned to the City Engineer in a timely manner.

108.2

After all comments have been adequately addressed, submit three (3) copies of the revised and final construction plans, with the redline plans to the City of Magnolia.

108.3

Submit original construction plan sheets to the City of Magnolia. All sheets will be signed by the City of Magnolia. A City of Magnolia approval signature block shall be provided on all sheets.

108.4

Submit one copy of the original construction plans and one copy reduced to eleven inches by seventeen inches (11" X 17") to the City of Magnolia after the construction plans have been approved and signed by the appropriate parties.

108.5

All separate or special easements that may be required for construction shall be recorded in the Montgomery County Official Records and a copy of the recorded document from the County Clerk must be presented to the City prior to final approval of the construction plans, except with specific approval of the City.

109. CONSTRUCTION PROCEDURE REQUIREMENTS FOR PUBLIC WORKS PROJECTS

109.1

Construction shall not begin until construction plans are approved by the City and until all permits, licenses, etc. have been obtained.

109.2

A preconstruction meeting is required for the project.

109.3

Notify the City and the assigned inspector at least forty-eight (48) hours prior to beginning construction and at least twenty-four (24) hours prior to each time concrete is placed on the project and prior to all required inspections or tests. Inspections shall be conducted by city staff or any designee as may be approved.

109.4

Notify the City and the assigned inspector at least twenty-four (24) hours prior to any final inspection.

109.5

Within thirty (30) days after completion of the project the project engineer shall provide to the City three (3) sets of project record drawings.

109.6

All delivery tickets for all materials (e.g., concrete, cement stabilized sand) shall be maintained by the contractor and upon written request, be made available for review by the City. These delivery tickets shall be maintained for a maximum of one (1) year from the completion of the project.

109.7

Changes from approved plans shall be approved by City prior to construction. The project engineer shall submit all change order requests to the City of Magnolia for review and consideration. The City Manager or his designee will respond in writing within five (5) working days to determine if City Council approval is required for a project change.

110. ACCEPTANCE AND APPROVAL OF PUBLIC WORKS PROJECTS

110.1

Public Works projects shall have final approval of the City prior to placing the facilities in service.

110.2

Final approval by the City shall be granted when the following items are complete.

- A. Construction is completed in accordance with the approved construction plans and final inspection items have been completed.
- B. All required information including record drawings are submitted to the City. The project engineer shall certify the correctness of the record drawings and compliance of construction in accordance with these Standards.
- C. The City shall require certification from the project engineer or contractor that all materials installed in the project are completely in place in accordance with approved plans and specifications.

110.3

Final approval by the City will be documented in writing.

111. RIGHT-OF-WAY USE PERMITS

111.1

All applicable permits must be obtained from the City of Magnolia, Montgomery County, the Texas Department of Transportation, and/or any other entity or agency having jurisdiction prior to construction of any new facilities within a public right-of-way, or utility easement.

111.2

A request for a right-of-way use permit issued by the City must be submitted with plans and complete supporting information, to the City for consideration. Staff will review the request and submit comments to the Owner and the right-of-way permit will be issued if approved by the City Manager.

111.3

The Owner or authorized agent shall be responsible for the location of all facilities in the area of construction and all disturbed areas are to be restored when construction is completed.

112. APPROVALS

112.1

Approvals required in these Standards are the responsibility of the Owner. Failure to obtain appropriate approvals may be grounds for suspension of construction until appropriate approvals are granted.

112.2

Any work that proceeds without specific approval will be subject to removal and replacement in accordance with these Standards.

112.3

Materials and manufactured items used in construction shall be approved by the City prior to installation.

113. EFFECTIVE DATE

The effective date of these standards will take place upon approval of the City of Magnolia City Council and upon publication in the official city newspaper.

114. DEFINITIONS

Accessory Building – A building or structure customarily incidental and subordinate to the principal structure and located on the same lot as the principal building.

Agriculture – Any land or building used for pasturage, floriculture, dairying, horticulture, forestry, livestock or poultry husbandry.

Alley – A legally established private access easement affording a secondary means of vehicular access to abutting property and not intended for general traffic circulation.

Alterations – Any change, addition or modification in construction or type of occupancy and change in the structural members of a building, such as walls or partitions, columns, beams or girders or any change which may be referred to herein as “altered” or “reconstructed.”

Apartment – A dwelling unit in a “multiple-family dwelling” as defined herein.

Appeal – For the purpose of flood hazard regulation, a request for a review of the Flood Plain Administrator's interpretation of any provision of this document or a request for variance.

Area of Shallow Flooding – a designated AO, AH or VO zone on a community's Flood Insurance Rate Map (FIRM) with a one percent (1%) or greater annual chance of flooding to an average depth of one to three feet (1-3') where a clearly defined channel does not exist, where the path of flooding is unpredictable and where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow.

Area of Special Flood Hazard – The land in the floodplain within a community subject to a one percent (1%) or greater chance of flooding in a given year. The area may be designated as Zone A on the Flood Hazard Boundary Map (FHBM). After detailed rate making has been completed in preparation for publication of the FIRM, Zone A usually is refined into Zones A, AE, AH, AO, A1-99, VO, V1-30, VE or V.

Base Flood – The flood having a one percent (1%) chance of being equaled or exceeded in any given year.

Berm – A man-made, formed, earth mound of definite height and width used for obscuring purposes; the intent of which is to provide a transition between uses of differing intensity.

Block – A tract or parcel of land designated as such on a subdivision plat surrounded by streets or other physical obstructions.

Boundary Sewer Line – A sewer line installed in a street bounding a development or faced on only one (1) side by a development, which can also serve property not included in the development on the opposite side of the street.

Boundary Water Line – A water line, installed in a street bounding a development or faced on only one (1) side by a development, which can also serve property not included in the development on the opposite side of the street.

Buffer Yard – A strip of land, including any specified type and amount of planting or structures which may be required to protect one type of land from another, or minimize or eliminate conflicts between them.

Building – See definition in Building Code.

Building Height – The vertical distance measured from the established grade to the highest point of the roof surface for flat roofs; to the deck line of mansard roofs; and to the average height between eaves and ridges for gable, hip and gambrel roofs. Where a building is located on a sloping terrain, the height may be measured from the average ground level of the grade at the building wall.

Building Line – A line parallel to the front lot line. A minimum building line is the same as the minimum required front setback line.

Building, Principal – A building in which is conducted the main or principal use of the lot on which said building is located.

Certificate of Compliance – A certificate issued by the City to a party or parties intending to initiate any work or change any use of property in the City.

Church – A building wherein persons regularly assemble for religious worship and which is maintained and controlled by a religious body organized to sustain public worship, together with all accessory buildings and uses customarily associated with such primary purpose.

City – The city of Magnolia

City Council – The City Council of the City of Magnolia, Texas

Club – An organization or persons for special purposes or for the promulgation of sports, arts, science, literature, politics or similar activities, but not operated for profit and open only to members and not the general public.

Commercial Building – Any building other than a single-family residence.

Condominium – See unified development.

Critical Feature – Means an integral and readily identifiable part of a flood protection system, without which the flood protection provided by the entire system would be compromised.

Density – The average number of dwelling units, per acre, for the entire development, including streets.

Development – Any man-made change in improved and unimproved real estate, including, but not limited to, mining, dredging, filling, grading, paving, excavation or drilling operations.

Developer – Any person who improves or subdivides a tract of land or improves or takes any action preparatory to the erection, improvement or movement of any building or structure on a tract of land.

District – An area of land for which there are uniform regulations governing the use of buildings and premises, density of development, yard requirements and height regulations.

Dwelling, Multiple-Family – A building used or designed as a residence for three (3) or more families living together independently of each other.

Dwelling, Single-Family – A detached building, designed for or occupied exclusively by one (1) family.

Dwelling, Two-Family – A detached building, designed for or occupied by two (2) families living independently of each other.

Dwelling Unit – One (1) or more rooms with bathroom and principal kitchen facilities designed as a self-contained unit for occupancy by one (1) family for living, cooking and sleeping purposes.

Elevated Building – A non-basement building (i) built, in the case of a building in zones A1-30, AE, A, A99, AO, AH, B, C, X and D, to have the top of the elevated floor, or in the case of a building in Zones V1-390, VE or V, to have the bottom of the lowest horizontal structural member of the elevated floor elevated above the ground level by means of pilings, columns (posts and piers), or anchored so as not to impair the structural integrity of the building during a flood or up to the magnitude of the base flood. In the case of zones A1-30, AE, A, A99, AO AH, B, C, X and D, “elevated building” also includes a building elevated by means of fill or solid foundation perimeter walls with openings sufficient to facilitate the unimpeded movement of flood waters. In the case of Zones V1-30, VE or V, “elevated building” also includes a building otherwise meeting the definition of “elevated building,” even though the lower area is enclosed by means of breakaway walls if the breakaway walls meet the standards of Section 60.3(e) (5) of the National Flood Insurance Program regulations.

Erected – The word “erected” includes built, constructed, reconstructed, moved upon or any physical operations on the premises required for the building. Excavations, fill, drainage and the like, shall be considered a part of erection.

Excavation – Any breaking of ground, except common household gardening, general farming and ground care.

Existing Construction – For the purpose of flood hazard regulation and for the purposes of determining flood insurance rates, structures for which the “start of construction” commenced before the effective date of the FIRM or before January 1, 1975, for FIRMs effective before that date. “Existing construction” may also be referred to as “existing structures.”

Family – An individual, or two (2) or more persons related by blood, marriage, adoption, or parents along with their direct lineal descendants and adopted or foster children (including domestic employees) or a group not to exceed two (2) persons not related by blood or marriage, occupying a premises and living as a single housekeeping unit with single cooking facilities. Every additional group of two (2) or less persons living in such housekeeping unit shall be considered a separate family. Said definition shall no apply in instances of group care centers or licensed residential facilities.

Filling – The depositing or dumping of any mater into or onto the ground except common household gardening and general maintenance.

Flag Lot – A lot which has minimum frontage on a public street, which is reached via a private drive or lane whose width, some distance back from the street right-of-way, meets all ordinance requirements.

Flood or Flooding – A general and temporary condition of partial or complete inundation of normally dry land areas from:

(1) The overflow of inland or tidal waters.

(2) The unusual and rapid accumulation or run-off of surface waters from any source.

Flood Insurance Rate Map (FIRM) – An official map of a community, on which the Federal Emergency Management Agency has delineated both the areas of special flood hazards and the risk premium zones applicable to the community.

Flood Insurance Study – The official report provided by the Federal Emergency Management Agency. The report contains flood profiles, water surface elevation of the base flood, as well as the Flood Boundary-Floodway Map.

Floodplain or Flood-Prone Area – Any land area susceptible to being inundated by water from any source (see definition of flooding).

Flood proofing – Any combination of structural and nonstructural additions, changes or adjustments to structures that reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.

Flood Protection System – Those physical, structural works for which funds have been authorized, appropriated and expended, and which have been constructed specifically to modify flooding in order to reduce the extent of the areas within a community subject to “special flood hazard” and the extent of the depths of associated flooding. Such a system typically includes hurricane tidal barriers, dams, reservoirs, levees or dikes. These specialized flood modifying works are those constructed in conformance with sound engineering standards.

Floodway (Regulatory Floodway) – The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

Functionally Dependent Use – For the purpose of flood hazard regulation, a use which cannot perform its intended purpose unless it is located or carried out in close proximity to water. The term includes only docking facilities, port facilities that are necessary for the loading and unloading of cargo or passengers, and ship building and ship repair facilities, but does not include long-term storage or related manufacturing facilities.

Grade – A ground elevation established for the purpose of controlling the number of stories and the height of any structure. The building grade shall be determined by the level of the ground adjacent to the walls of any structure if the finished grade is level. If the ground is not level, the grade shall be determined by averaging the elevation of the ground for each face of the structure.

Habitable Floor – For the purpose of flood hazard regulation, any floor usable for the following purposes; which includes working, sleeping, eating, cooking or recreation, or a combination thereof. A floor used for storage purposes only is not a “habitable floor.”

Half-Street – A vehicular access-way created if only a portion of the required right-of-way width or pavement width is dedicated and/or constructed.

Highest Adjacent Grade – The highest natural elevation of the ground surface prior to construction next to the proposed walls of a structure.

Improvement – Any physical structure or system, including building, drainage work, water system, sewer system, sidewalks, streets or utility system.

Industrial – A business, plant or enterprise for production of goods, merchandise or machines.

Lease – A contract by which one owning such property grants to another the right to possess, use and enjoy it for a specified period of time in exchange for the periodic payment of a stipulated price.

Levee – A man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control or divert the flow of water so as to provide protection from temporary flooding.

Levee System – A flood protection system, which consists of a levee, or levees, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering practices.

Lot – An 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.

Lot Depth – The distance on a horizontal plane between the midpoint of the front lot line and the midpoint of the rear lot line.

Lot Lines – The lines bounding a lot as defined herein:

- (1) **Lot Line, Front** – In the case of an interior lot, a line separating the lot from the street; as in the case of a corner lot, a line separating the narrowest street frontage of the lot from the street, except in those cases where the deed restrictions specifies another line as the front lot line; provided, however, that

the front lot line of a non-residential lot shall be that side adjacent to the highest volume street.

(2) **Lot Line, Rear** – A lot line opposite and most distant from the front lot line.

(3) **Lot Line, Side** – Any lot line not a front line or rear lot line.

Lot of Record – A lot which is (1) part of a platted subdivision, the plat of which is recorded in the office of the County Clerk; (2) a parcel or lot described by metes and bounds, the deed of which has been recorded in the office of the County Clerk or (3) a lot which is part of an approved Boundary Line Adjustment, the plat of which is filed with the City.

Lot Width – The distance on a horizontal plane between the midpoint of the side lot lines.

Lowest Floor – For the purpose of flood hazard regulation, the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of Section 60.3 of the National Flood Insurance Program regulation.

Manufactured Home – A structure transportable in one (1) or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when connected to the required utilities. For flood plain management purposes the term "manufactured home" also includes park trailers, travel trailers and other similar vehicles placed on a site for greater than 190 consecutive days. For insurance purposes, the term "manufactured home" does not include park trailers, travel trailers and other similar vehicles.

Marquee – A roof-like structure of a permanent nature, projecting from the wall of a building.

Mean Sea Level – For purposes of the National Flood Insurance Program, the National Geodetic Vertical Datum (NGVD) of 1929 or other datum, to which base flood elevations shown on a community's Flood Insurance Rate Map are referenced.

Mobile Home – A movable or portable dwelling structure which is constructed to be towed on its own chassis, is capable of being connected to public utilities, and is designed for year-round living as a single-family dwelling unit without the necessity for a permanent foundation. The term "mobile home" shall not include pick-up campers, travel trailers, motor homes, converted buses, tent trailers or other transportable structures designed for temporary use.

Mobile Home Park – A parcel of land under single ownership on which two (2) or more mobile homes are occupied as residences. Any mobile home facility where two (2) or more units are intended for long-term residential use beyond ninety (90) days is considered a mobile home park for purposes of applying development standards.

New Construction – For flood plain management purposes, structures for which the “start of construction” commenced on or after the effective date of a flood plain management regulation adopted by a community.

Nonconforming Building (Nonconforming Structure) – A building or structure (or portion thereof) lawfully existing at the time of adoption of this document or subsequent amendment thereto, that does not conform to the provisions of this document relative to height, bulk, area, placement or yards for the district in which it is located.

Nonconforming Use – The use of a building or structure or of a parcel of tract or land, lawfully existing at the time of adoption of this document or subsequent amendment thereto, that does not conform to the regulations of the district in which it is situated.

Owner – Any owner, authorized agent or contractor who constructs, enlarges, alters, repairs, moves or changes the occupancy of a building or structure.

Owners Front Footage – The pro rata amount of the cost of a water or sewer line extension that is not reimbursable to the person requesting the extension.

Pavement Width – The portion of the surface of the street available for vehicular traffic; if curbed, it is that portion of street between back of curb and back of curb.

Person – An individual, firm, partnership, corporation, company, association, joint stock association or governmental entity. It includes a trustee, receiver, assignee or similar representative of any of them.

Planned Unit Development (PUD) – See unified development.

Principal Use – The main use to which the premises are devoted and the principal use for which the premises exist.

Private Street – A vehicular access way under private ownership and maintenance providing access to building units in the interior of a lot.

Pro Rata – The Charge per front foot of abutting land to be paid by the lot owner or owner of a development to aid in defraying the cost of supplying sewer service or water service to his lot or site.

- (1) **Single Pro Rata** – The charge based on the front footage of abutting land on only one side of the street or easement.
- (2) **Double Pro Rata** – The charge based on the front footage of abutting land on both sides of the street or easement.

Public Street – A public right-of-way, however designated, dedicated or acquired, that provides vehicular access to adjacent private or public properties.

Public Utility – Any person, firm or corporation, municipal department, board or commission duly authorized to furnish and furnishing under federal, state or municipal regulations to the public; gas, steam, electricity, sewage disposal, communication, telephone, telegraph, transportation or water.

Record Drawings – Plans prepared by a registered professional engineer.

Recreational Vehicle (RV) – A camp car, motor home, pick-up coach, travel trailer, tent trailer or other portable structure, with or without motive power, designed and used for human habitation for recreational occupancy.

Recreational Vehicle (RV) Park – An area set aside and offered by any person for the parking and accommodation of two (2) or more recreational vehicles.

Reserve – A tract of land created within a subdivision plat that is not divided into lots or proposed for development at the time of platting.

Residential – A tract of land designed for or used exclusively to contain a dwelling unit or units. A “primary residential area” shall mean a street or streets in which a majority of the total front footage is used for residential purposes.

Right-of-Way – A street, alley or other thoroughfare or easement permanently established for passage of persons, vehicles or the location of utilities. The right-of-way is delineated by legally established lines or boundaries.

Setback – The minimum unoccupied distance between the lot line and the principal and accessory buildings, as required herein.

Setback, Front – The minimum unoccupied distance, extending the full lot width, between the principal and accessory buildings and the front lot line..

Setback, Rear – The minimum required unoccupied distance, extending the full lot width, between the principal and accessory buildings and the lot line opposite the front lot line.

Setback, Side – The minimum required unoccupied distance, extending from the front setback to the rear setback, between the principal and accessory buildings and the side lot line.

Sign – Any device including words, numerals, figures, designs, pictures or trademarks painted upon or otherwise affixed to a building, wall, board or any structure, so as to inform or attract attention.

Site Plan – A plan showing all salient features of a proposed development, so that it may be evaluated in order to determine whether it meets the provisions of this document.

Start of Construction – For flood plain management purposes [other than for new construction or substantial improvements under the Coastal Barrier Resources Act (Public Law 97-348)], shall include substantial improvement and means that the date the building permit was issued, provided the actual start of construction, repair, reconstruction, placement or other improvement was within one hundred and eighty (180) days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of the slab, or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include excavation for basement, footings, piers or foundations or the erection of temporary forms; it does not include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or part of the main structures.

Street: Arterial – Roads of regional importance or the main roads of a community. Direct access is primarily limited to significant land uses.

Street: Collector – Provides access to nonresidential land uses and connects residential streets to the system's arterial streets.

Street: Local – Provides access to adjacent land. Characterized by a small service and low speeds.

Structure – For flood plain management purposes, means a walled and roofed building, including a gas or liquid storage tank that is principally above ground, as well as a manufactured home.

Subdivision Plat – A map or drawing of a proposed subdivision prepared in a manner suitable for recording in the County records and containing accurate and detailed engineering and survey data, dimensions, dedicatory statements and certificates.

Substantial Improvement – For flood plain management purposes, any repair, reconstruction or improvement of a structure, the cost of which equals or exceeds fifty percent (50%) of the market value of the structure either (1) before the improvement or repair is started or (2) if the structure has been damaged and is being restored, before the damage occurred. For the purpose of this definition "substantial improvement" is considered to occur when the first alteration of any wall, ceiling, floor or other structural part of the building commences, whether or not that alteration affects the external dimensions of the structure. The term does not, however, include either (1) any project for improvement of a structure to comply with existing state or local health, sanitary or safety code specifications which are solely necessary to assure safe living conditions or (2) any alternation of a structure listed on the National Register of Historic Places or a State Inventory of Historic Places.

Type of Service – The characteristics of electrical service described in terms of frequency, phase, nominal system voltage and number of wires.

Unified Development – The separate ownership of single units or apartments in a multiple unit structure or structures with common elements. (See Tex. Rev. Civ. Stat. Art. 1301a).

Variance – Is a grant of relief to a person from the requirements of this document when specific enforcement would result in unnecessary hardship. A variance, therefore, permits construction or development in a manner otherwise prohibited by this document. (For flood plain management purposes, see Section 60.6 of the National Flood Insurance Program regulations for full requirements.)

Violation – Means, for flood plain management purposes, the failure of a structure or other development to be fully compliant with the community's flood plain management regulations. A structure or other development without the elevation certificate, other certifications or other evidence of compliance required in Sections 60.3(b)(5), (c)(4), (c)(10), (d)(3), (e)(2), (e)(4) or (e)(5) is presumed to be in violation until such time as that documentation is provided.

Watercourse – A definite channel of a stream in which water flows within a defined bed and banks, originating from a definite source or sources. (The water may flow continuously or intermittently, and if the latter, with some degree of regularity, depending on the characteristics of the sources.)

Water Surface Elevation – Means the height, in relation to the National Geodetic Vertical Datum (NGVD) of 1929 (or other datum, where specified, of floods of various magnitudes and frequencies in the flood plains of coastal or riverine areas).

CHAPTER 2 – SUBDIVISION STANDARDS

201. GENERAL PROVISIONS

Any party desiring to subdivide property shall comply with the City of Magnolia Subdivision Ordinance. All aspects of these standards shall be construed to provide additional information that is relevant to the subdivision process.

202. COMPREHENSIVE PLAN

The subdivision of property shall comply with applicable requirements of the current City of Magnolia Comprehensive Plan. Particular attention shall be directed to those portions of the Plan pertaining to the thoroughfare system and utility system infrastructure. Additionally, the plan provides valuable information concerning community demographics, goals and directions for growth.

203. PLATTING

Platting or replatting for subdivisions shall comply with the requirements and format outlined in the Subdivision Ordinance. All material submittals and time lines required by the ordinance shall be satisfied to insure a timely and responsive action by the City.

204. PLANNING, DESIGN AND CONSTRUCTION

All subdivisions shall be planned, designed and constructed in accordance with the Subdivision Ordinance, City of Magnolia Standard Details, Standard Specifications and requirements of this document. Improvements not meeting these criteria will not be accepted by the City as part of its infrastructure system.

205. LOTS

- a. General – The lot design should provide for lots of adequate width, depth, and shape to provide open area, to eliminate overcrowding, and to be appropriate for the location of the subdivision and for the type of development and use contemplated. Lots should have the side lot lines at right angles to the streets on which the lot faces of radial to curves street lines.
- b. Rear and Side Driveway Access – Rear and side driveway access to major thoroughfare or freeways shall be prohibited.
- c. Minimum Requirements for Residential Lots
 - (1) Minimum width at building setback lines – sixty feet (60). (At a distance not greater than twenty-five feet (25') from the front lot line.)
 - (2) Minimum width at front lot line – forty feet (40').

- (3) Minimum area of lots within city limits – five thousand four hundred (5,400) square feet.
 - (4) Corner lots siding on minor streets shall have a minimum width at the building setback line of not less than seventy feet (70').
 - (5) Corner lots siding on major thoroughfare or freeway shall have a minimum width at the building setback line of not less than seventy-five feet (75').
 - (6) Minimum length of lots shall be ninety feet (90') except lots facing or backing on a major thoroughfare or freeway shall be not less than one hundred twenty feet (120') deep.
- d. The foundation must be designed for the soil characteristics and wind loads prevalent to the individual site.
 - e. The foundation must be of poured concrete or brick and consist of a retainer wall around the perimeter of the unit which would completely enclose the area beneath that unit, with exceptions of manways. These manways will have a door which can be kept closed when not in use.
 - f. The unit must provide for on property, asphalt or concrete paving that will accommodate the parking two (2) vehicles side by side.
 - g. Lots, blocks and building lines are to be the same as single-family detached.

206. BUILDING SETBACK LINES

For subdivisions for single-family dwellings, building setback lines adjacent to streets shall be shown and labeled on all plats, both preliminary and final. For such dwellings and all residential lots the building setback line shall not be less than twenty-five feet (25') from a front lot line and fifteen feet (15') from a side lot line that is also a street right-of-way line on a corner lot. Building setback lines for all residential lots except as specifically provided elsewhere from side lot lines, except for corner lots, as set forth above, shall be not less than seven and one-half feet (7 1/2') from a side lot line, and shall be so noted on the plat. Building setback lines for apartment or multi-family developments shall be not less than fifteen feet (15') from any side or rear lot lines. Such shall be noted on all plats as a condition to the use of any portion of the property for multi-family or apartment purposes.

CHAPTER 3 – PUBLIC EASEMENT STANDARDS

301. UTILITY EASEMENTS

301.1 Easement Criteria

Easements shall be provided as required by the Subdivision Ordinance. The location and placement of easements shall be coordinated with the City of Magnolia.

301.2 Utility Easement Restrictions

The following statement of restrictions shall be placed on the plat whenever easements are dedicated for public use:

PUBLIC EASEMENTS

All public easements denoted on this plat are hereby dedicated to the use of the public. Any public utility, including the City of Magnolia, 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 parts of its respective system without the necessity, at any time, of procuring the permission of the property owner. Any public utility including the City of Magnolia shall have the right to move and keep moved all or part of any building, fences, trees, shrubs, other growths or improvements that in any way endanger or interfere with the construction, maintenance or efficiency of its respective systems on any of the easements shown on this plat. Neither the City of Magnolia nor any public utility shall be responsible for replacing or reimbursing the property owner due to removal or relocation of any obstructions in the public easement.

301.3 Utilities

All new utilities shall be placed and constructed within designated easements or street rights-of-way.

301.4 Requirements

No structure, foundation, slab or other improvement (including fences) shall be placed within any dedicated public easement without written permission from the City.

302. DRAINAGE/FLOODWAY EASEMENTS

Drainage easements shall be provided along all natural and man-made drainage channels and floodways, which drain two (2) or more lots or tracts of land according to the following criteria:

- a. **Natural Drainage Channels**

Storm drainage easements shall be provided along existing or proposed open channels with sufficient width for the water course to handle the flow from the applicable frequency storm plus a minimum of twenty feet (20') on each side beyond top of bank, for ingress and egress of maintenance equipment, for clearance from fences, for maintenance of the channel bank, and for adequate slopes necessary along the bank.

b. Enclosed Drainage Systems

Where enclosed drainage systems are provided that are not within or adjacent to a public street, storm drainage easements of fifteen-foot (15') minimum width shall be provided. Easements shall be centered on the system. If necessary, the larger easements shall be provided. Easements shall be wide enough to encompass the system plus provide ingress and egress for future maintenance operations.

c. See also Chapter 10, Storm Drainage Standards.

303. FLOOD PLAIN RESTRICTIONS

- a. Flood plain restrictions shall be provided where necessary along natural drainageways and lakes. Flood plain restriction shall encompass the area between the dedicated channel (see Section 302) and the water surface elevation resulting from a one hundred-year (100 yr) design frequency storm. The area encompassing the dedicated channel and the Flood Plain Restriction shall be referred to as the 100-Year Flood Plain. The width of the floodplain shall be substantiated by a drainage study, drainage calculations or other criteria submitted to and approved by the City.
- b. Within the one hundred-year (100 yr.) flood plain, storm drainage easements should be provided (see Section 302) that contain storm water resulting from the one hundred-year (100 yr.) frequency storm less the amount of storm water carried in the enclosed system, if any. The width of the easements shall be substantiated by a drainage study, drainage calculations or other criteria submitted to and approved by the City.
- c. The following restrictions shall be placed in the dedication instrument:

FLOOD PLAIN RESTRICTION

No construction, without the written prior approval of the City of Magnolia shall be allowed within a flood plain, and then only after detailed engineering plans and studies show that no flooding and no obstruction to the natural flow of water will result. If construction is permitted, all finished floor elevations shall be a minimum of one-foot (1') above the one hundred-year (100 yr.) flood elevation.

The existing creeks, lakes, reservoirs or drainage channels, not within a public easement, traversing along or across portions of this subdivision, shall remain as an open channel at all times and shall 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. The City of Magnolia shall not be responsible for the maintenance and operation of said private drainage ways or for the control of erosion. Each property owner shall keep the natural drainage channels, traversing or adjacent to the property, clean and free of debris, silt or any substance, which would result in unsanitary conditions. The City shall have the right of ingress and egress for the purpose of inspection and supervision of maintenance work by the property owner and to alleviate any undesirable conditions that may occur. If the natural drainage channels are subject to storm water overflow and natural bank erosion, the City of Magnolia 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. The natural drainage channel crossing each lot is shown by the flood plain easement line as shown on the plat.

- d. See also, Chapter 10, Storm Drainage Standards.

304. EMERGENCY ACCESS EASEMENTS

Emergency access (fire lane) easements shall be provided as required by the City. These easements shall have a minimum width of twenty-eight feet (28') and a minimum height clearance of fourteen feet (14'). Any emergency access easement shall either connect at each end to a dedicated public street or be provided with a turnaround having a minimum diameter of eighty feet (80') with an additional distance of ten feet (10') on all sides clear of permanent structures. The driving surface within emergency access easements shall be designed and constructed according to standards established for local public streets. All structures shall be located within one hundred fifty feet (150') of a dedicated and improved emergency access easement or public street.

CHAPTER 4 – CONSTRUCTION PLANNING STANDARDS

401. GENERAL

Prior to the construction of any facilities related to the improvement, development or subdivision of land, construction plans and specifications showing sufficient detail shall be submitted to the City and appropriate reviewing agencies for approval. No construction activities shall begin prior to approval.

402. DESIGN CRITERIA

The design criteria to be utilized in the preparation of detailed plans and specifications are those outlined by this document, the City of Magnolia Subdivision Ordinance, Standard Details, Standard Specifications and other applicable Federal, State and local regulations. Other considerations shall include the application of generally accepted engineering standards of practice where specific criteria are not mandated.

403. PROFESSIONAL PREPARATION

All plans and specifications shall be prepared under the direction of a Registered Professional Engineer licensed to practice in the State of Texas. All plans, specifications and studies shall bear the seal, signature and date of preparation by the engineer. Subdivision and survey plats shall be prepared by a Registered Professional Land Surveyor licensed to practice in the State of Texas and bear that individual's seal, signature and date.

404. APPROVALS

All plans and specifications prepared for review shall receive approval from the City and applicable State and Federal agencies. Water and wastewater plans and specifications shall receive approval from the Texas Commission on Environmental Quality. Other agency approvals shall be obtained as individual projects may dictate.

405. STORM WATER POLLUTION PREVENTION

All projects subject to the National Pollutant Discharge Elimination System (NPDES) shall be properly engineered and permitted in accordance with applicable regulations. Provisions to mitigate erosion and control silt problems shall be included in the detailed plans and/or specifications whether or not a NPDES permit is required.

406. OTHER PERMITS

Prior to construction, all required permits shall be obtained from the Texas Department of Transportation, Texas Commission on Environmental Quality, Environmental Protection Agency, Corps of Engineers, Montgomery County, railroad companies, pipeline companies and other affected authorities.

407. ENVIRONMENTAL CLEARANCE

On all projects requiring environmental clearance, the necessary documentation, including assessment or impact statement, shall be completed and approved prior to start of construction.

CHAPTER 5 – WATER SYSTEM STANDARDS

501. GENERAL PROVISIONS

All water supply, distribution, pumping and storage improvements shall be designed and constructed in accordance with this chapter, the City's Standard Details, Standard Specifications and the Texas Commission on Environmental Quality regulations.

502. DESIGN CRITERIA

502.1 Minimum Size, Looped

All water mains shall be a minimum of six inches (6") in size. All water mains shall be looped, except in the case of dead-ends where provisions shall be made for future extension.

502.2 Provision for Future Extensions

All water lines shall be extended, where necessary, to the borders of the development for future extensions of the distribution system. The City may participate in the cost of oversizing lines required to serve land areas or improvements beyond the development.

502.3 Fire Hydrants

Fire hydrants shall be installed as part of the water distribution system. In residential areas, fire hydrants shall be served by a main line of six inches (6") or larger and shall be located at a distance of no greater than five hundred feet (500') on a clear path to each residence. In commercial and industrial areas, main lines shall be eight inches (8") or larger, and fire hydrants shall be located at a distance of no greater than three hundred feet (300') on a clear path to each structure.

502.4 Valves

Valves shall be installed at the intersections of all water mains. In-line valves shall be installed at approximately one thousand-foot (1000') intervals.

502.5 Depth of Cover

The depth of cover of water mains shall be a minimum of forty-two inches (42") below finished grade.

502.6 Air Relief Valves

Air release valves and/or air vacuum relief valves shall be installed at critical water line high points.

502.7 Flush Valves

Blow-offs or flushing valves shall be installed at critical water line low points and dead-ends.

502.8 Public Easement Required

All public water facilities shall be placed in public easements as described in Chapter 3, Easement Standards.

503. INDIVIDUAL WATER SERVICE CONNECTIONS

Service connections shall be installed and marked by stake (water "taps") for each unit (dwelling or commercial/industrial) in the development intended for individual ownership at the time of construction of new water improvements. If individual utility connections for apartments are desired, service connections shall be installed for each apartment at the time of construction of new water improvements. Such service connections shall be the appropriate size to serve the intended use of the property, as approved by the City, and shall extend from the public water main to the lot property line or utility easement line, as the case may be. All corporation stops, service piping, curb stops, meter boxes and vaults and any other material required for the connection shall be included in the service connection installation.

504. ALTERNATIVE POTABLE WATER FACILITIES\

Alternative potable water facilities are prohibited within the City limits of the City of Magnolia or within its extra-territorial jurisdiction unless previously approved in writing by the City of Magnolia before the effective date of this ordinance. No water wells may be drilled in the City of Magnolia or within its extraterritorial jurisdiction.

504.1 Variance Required

A variance from the requirement to provide water facilities may be granted by the City at the time of preliminary plat approval if it is determined that the municipal water system cannot be feasibly made available to the area of development. The City shall be provided with sufficient technical data (topography, water demand, existing water systems, etc.) and construction cost figures to demonstrate the proposed development's need for an alternative to public water facilities. A separate water treatment/distribution system or on-site, individual facilities shall not be constructed unless such separate facilities are more beneficial to the City than constructing an adequate system extended from and connected to the existing municipal system. Any separate water treatment/distribution system or on-site, individual facilities would require approval of the City Council of the City of Magnolia.

504.2 Approval of Water System

The City shall not approve the final plat until the water system plans are approved by the Texas Commission on Environmental Quality.

504.3 Construction to City Standards

All Water lines shall be placed in public rights-of-way or easements and designed/constructed to City standards.

504.4 Dedication of Public Utility Easements

If the City approves an alternative water facility's installation, utility easements shall be dedicated for the future installation of municipal water system improvements. Such easements shall comply with the criteria of Chapter 3 of this document.

CHAPTER 6 – WASTEWATER SYSTEM STANDARDS

601. GENERAL PROVISIONS

Sanitary sewer improvements shall be designed and constructed in accordance with this chapter, the City's Standard Details, Standard Specifications and the Texas Commission on Environmental Quality regulations.

602. DESIGN CRITERIA

602.1 Minimum Size

No public sewer line shall be less than six inches (6") inside diameter.

602.2 Future Extensions

All sewers shall be designed to serve both the subject property and the full sewer shed area tributary to the sewer system. Where necessary, sewer lines shall be extended to the borders of the development to allow for future extensions of the collection system. The City may participate in the cost of any oversizing of lines required to serve land areas or improvements beyond the development.

602.3 Manholes

Manholes shall be installed at all intersections of other sewers six inches (6") in diameter or larger and at intermediate spacing along the line. The maximum spacing shall be in accordance with the Texas Commission on Environmental Quality "Design Criteria for Sewerage Systems." Manholes shall be installed at all changes in grade or direction.

602.4 Alignment

Sewers shall be designed with straight alignment. If horizontal curvatures must be used, the smallest radius shall not exceed that recommended by the pipe manufacturer; provided, however, that any radius shall not be less than one hundred feet (100').

602.5 Hydraulic Slopes

All sewers shall be designed with hydraulic slopes sufficient to give mean velocities, when flowing full or half full, of not less than two feet (2') per second on Ketter's or Manning's formulas using a minimum "n" value of 0.013. Minimum grades shall be those outlined by the Texas Commission on Environmental Quality "Design Criteria for Sewerage Systems."

602.6 Surface Water and Non-Domestic Waste Prohibited

No connection shall be made to any sanitary sewerage system within the city that permits the entrance of surface water or waste of other than domestic sewage characteristics without the specific authorization by the City.

602.7 Backfill

All lines, including all service laterals, shall be installed and backfilled below proposed paved areas to City specifications prior to compaction of subgrade and placement of paving.

602.8 Lift Stations

Lift Stations or Separate Treatment facilities shall not be designed or constructed unless such lift stations or separate facilities are more beneficial to the City than constructing an adequate outfall or approach sewer from the existing system. In determining benefit, the City shall consider power cost for operation, land costs and all other costs of lift stations based on a ten-year (10-yr.) life.

602.9 Public Easements

All public sanitary sewer facilities shall be placed in public easements as described in Chapter 3, Easement Standards.

603. INDIVIDUAL SEWER SERVICE CONNECTIONS

Service connections (sewer "taps") shall be appropriately sized, installed and marked by stake for each building in a development at the time of construction of sewer improvements.

603.1 Duplex and Multi-Family Dwelling Units

Individual sanitary sewer service connections shall be installed for each dwelling unit in duplex or two-family buildings. Buildings containing more than two (2) dwelling units may provide a common sewerage collection system from the building.

603.2 Standards

Each service connection shall serve only on (1) building (no "sharing" of service connections). The individual service connections shall be a minimum of four inches (4") inside diameter and may extend to a common building sewer system or individually to the public sewer. A manhole connection to the public sewer is required for all service connections greater than four inches (4") inside diameter.

604. ALTERNATIVE SEWAGE TREATMENT FACILITIES

Alternative sanitary sewage treatment systems shall consist of individual on-site sewage treatment systems or a common treatment and collection system to provide service to each

lot. The Texas Commission on Environmental Quality shall approve the plans for a separate sanitary sewage system prior to the final plat approval by the City. Nothing in this chapter shall be construed as permission to install an on-site sewage treatment system (including septic tanks) on an individual lot.

The computer program PondPack, provided by Haestad Methods, shall be used to design and analyze proposed detention pond facilities. Submission of proposed detention pond plans shall include hard copies of the PondPack output data calculations along with a CD containing the computer input and output files for review by the City Engineer.

Once the existing condition runoff is determined, the new development with the detention facility shall be designed so that the post-development runoff rate equals or is less than the 10-, 25-, and 100-year storm events (and smaller events if the downstream channel has less than a 10-year capacity). The detention facility shall be sized to allow an appropriate release rate that will not cause any increase in flood levels downstream.

604.1 Hydrology Methods

The method to be used for determining detention pond volume requirements is governed by the size of the total contributing drainage area. For contributing areas up to 10 acres, the Modified Rational Method may be used. For areas greater than 10 acres, the Soil Conservation Service hydrologic methods shall be used.

604.2 Variance Required

A variance from the requirement to provide a public sewage system may be granted by the City at the time of preliminary plat approval if it is determined that the municipal sewage system cannot be feasibly made available to the area of development. The City shall be provided with sufficient technical data (topography, soils, existing sewer system and construction costs) to demonstrate the proposed development's need for an alternative to the public sanitary sewage treatment facilities. Alternative sewage treatment systems shall not be designed or constructed unless such facilities are more beneficial to the City than construction of an adequate system extended from and connected to the existing municipal system.

604.3 Approval by Texas Commission on Environmental Quality

The City shall not approve a final plat until an engineered sewage disposal plan has been approved by the Texas Commission on Environmental Quality.

604.4 Dedication of Utility Easements

If the City approves on-site sewage treatment installations, utility easements shall be dedicated for the future installation of a municipal sewage system. Such easements shall comply with criteria of Chapter 3 of this document.

CHAPTER 7 – STREET SYSTEM STANDARDS

701. GENERAL PRINCIPLES OF STREET SYSTEM LAYOUT

Streets shall be located and aligned to conform to the Infrastructure Master Plan of the City. Streets shall be designated and designed according to their expected traffic capacity and function. Streets shall also be designed and constructed to achieve conformance with requirements of the City of Magnolia Subdivision Ordinance.

701.1 Classification of Street System

The roadways within the City are classified according to the type of service and the expected traffic capacity to be provided. Each roadway classification has its own general design criteria and primary function. Table 7-1, Functional Design Capacity of Streets, provides a summary of street volume operating ranges by street classification.

TABLE 7-1 FUNCTIONAL DESIGN CAPACITY OF STREETS	
STREET CLASSIFICATION	OPERATING VOLUME RANGE (VOLUME / DAY)
Freeway	30,000 -
Principal Arterial	10,000 – 30,000
Minor Arterial	7,000 – 20,000
Major Collector	5,000 – 10,000
Minor Collector	2,000 – 5,000
Local (Residential)	500 – 1,000
Local (Commercial / Industrial)	500 – 2,000

701.2 Construction and Design Standards

All roads, sidewalks, parking lots or other required paving shall conform to this document, Standard Details and Standard Specification of the City.

701.3 Dedication of Street Rights-of-Way

- a. The dedication and/or reservation for acquisition of pedestrian and/or vehicular rights-of-way shall be required of owners or developers of properties. This is necessary and desirable to lessen or control the impact upon the transportation system created by development.
- b. Street right-of-way widths shall meet the requirements established in Table 7-2, Street Rights-of-Way. Minimum required right-of-way shall be determined by the functional classification of the road.
- c. Street right-of-way shall be either dedicated by plat or deed to the city or the anticipated right-of-way area shall be reserved for future acquisition. If reserved for future acquisition, no physical improvements such as buildings, parking lots,

landscaping or storm water retention facilities shall be allowed within the area so reserved. All setbacks shall be calculated from the anticipated right-of-way line.

702. STREET ACCESS

702.1 Direct Public Access

All public streets shall have direct access to another public street.

702.2 Primary Access

Primary access to large subdivisions, commercial tracts and industrial tracts shall be provided from public streets designed to carry fairly high traffic loads such as arterials and collectors. Residential tracts shall be protected from the adverse effects of through traffic by locating lots facing local streets.

702.3 Points of Access

A street system shall be provided within the development with at least one (1) point of access to a public street adjacent to the development: provided, however, that developments containing one hundred and fifty (150) dwelling units or more shall provide at least two (2) points of access to adjacent public streets.

TABLE 7-2 STREET RIGHTS-OF-WAY				
STREET CLASSIFICATION	TRAVEL LANES	PARKING LANES	MINIMUM ROW WIDTH (IN FEET)	MINIMUM PAVEMENT WIDTH (IN FEET)*
ARTERIAL				
Principal	5	2	110	85
Minor	5	0	80	61
COLLECTOR				
Major	2	2	70	41
Minor	2	2	60	39
LOCAL				
Local (Residential)	2	1	60	31
Local (Commercial / Industrial) ⁽¹⁾	2	1	60	37
Alternative Local Residential ⁽²⁾	2	0	60	24
PRIVATE				
Private Streets / Emergency Access Easements	2	0	28	28
⁽¹⁾ With City approval, reduced pavement width may be used if "No Parking" signs are furnished and installed in accordance with City Standards. In no case shall pavement width be less than twenty-eight feet (28'), b-b, and increased driveway and intersection radii may be required for truck turning movements. ⁽²⁾ Alternative construction standards, as established in Section 714.2 and Figure 7-5 may be used where the conditions shown in Section 714 exist. * Back of curb to back of curb or edge to edge				

703. LOCATION OF PUBLIC STREETS

- a. A design for the system of streets shall be submitted with a tract. Certain streets should be planned to carry large volumes of through traffic (arterials, collectors) while other streets (locals) should be laid out to provide access within a development. Arterial and collector streets, if located within a residential subdivision, should follow the continuity of City streets leading to or from the tract and should provide for extensions into adjacent tracts. The City shall approve the final location of all public streets.
- b. Local streets shall be designed to service only the development in which they are contained. Local streets shall
 - (1) Create building lots of desirable elevation, size shape and orientation;
 - (2) Discourage through traffic;

- (3) Insure access by firemen, police and other emergency services to all areas of the tract and
- (4) Insure vision clearance.

704. INTERSECTION OF PUBLIC STREETS

704.1 General

The number of intersections shall be kept to a minimum, consistent with traffic needs. The number of streets permitted to converge at a single intersection shall be minimized. Intersecting streets shall be designed so that they intersect at right angles with variations not to exceed ten degrees (10°). If jogs are necessary, the streets shall be curved as it approaches the intersection, in order to effect a nearly right-angle alignment to the greatest extent possible. Intersections shall be staggered or offset only if the distance between street centerlines is at least one hundred and twenty-five feet ($125'$).

704.2 Local to Collector / Arterial Intersections

Local streets intersecting a collector or arterial street shall have a tangent section of centerline at least fifty (50) feet in length, measured from the right-of-way line of the higher traffic volume street; however, no such tangent is required if the minor street curve has a centerline radius greater than four hundred (400) feet with the center located in the high traffic volume street right-of-way.

704.3 Sight Triangle

- a. In order to provide a clear view of intersecting streets to the motorist, there shall be a triangular area of clear vision formed by two (2) intersecting streets. The size of the triangular area is based on street classification.
- b. On any portion of a lot that lies within the triangular area shown in Figure 7-1, nothing shall be erected, placed, planted or allowed to grow in such a manner as to materially impede vision between a height of three feet ($3'$) and eight feet ($8'$) above the grade at the two (2) street centerlines.
- c. The triangular area shall be formed by a point on each proposed street right-of-way line located 75, 110 or 150 feet from the intersection of the street right-of-way lines, as indicated in Figure 7-1, and connected to the intersection point of the twenty-five-foot ($25'$) setback lines.

704.4 Location of Intersections

a. Arterial Streets

The maximum distance between streets (centerline to centerline measurement) intersecting arterial streets shall be 1,600 feet; the minimum distance shall be 800 feet.

b. Collector Streets

The maximum distance between streets (centerline to centerline measurements) intersecting collector streets shall be 1,600 feet; the minimum distance shall be 800 feet.

c. Local Streets

The maximum distance between streets (centerline to centerline measurement) intersecting local streets shall be 1,200 feet; the minimum desirable distance shall be 600 feet.

705. OFF-SET STREETS

Where it is necessary to create staggered or offset streets, the minimum distance shall be one hundred twenty-five feet (125') centerline to centerline measurement.

706. SIDEWALKS

On local streets, a minimum sidewalk of three feet (3) is required on any newly constructed subdivisions. Property owners may install sidewalks on their respective lot frontages. On arterial and collector streets, the sidewalks shall be installed at the line of street construction by the developer or subdivider. The minimum sidewalk width of four (4) feet is required on any arterial and collector street where the sidewalk is installed at the line of street construction.

707. HALF-STREETS

Half-streets are prohibited. Full street improvements shall be constructed for any development.

708. RESERVE ACCESS STRIPS

Strips of land at the end or alongside offered or existing streets shall not be reserved for ownership for the purpose of controlling access to property unless the reserve access strip is dedicated to the public under conditions approved by the City.

709. ALLEYS

Public alleys shall be prohibited. If secondary access is provided, private alleys shall be constructed to meet or exceed private street standards contained herein.

710. CUL-DE-SAC AND DEAD-END PUBLIC STREETS

710.1 General Standards

The cul-de-sac streets shall be designed to prohibit future extensions by arranging lots around the turnaround. A circular turnaround conforming to City standards for all cul-de-sac and dead-end public streets shall be constructed. The cul-de-sac turnaround shall have a right-of-way radius of fifty feet (50') for single-family and two-family use and sixty feet (60') for other uses.

The dead-end street shall not be designed or constructed unless it is intended to connect with a future street on adjacent land. The temporary turnarounds shall be constructed within the standard right-of-way at the end of any dead-end street. In a commercial / industrial development, however, construction of a temporary turnaround may be waived if adequate alternatives are available for vehicles to turn around

710.2 Length

The length of cul-de-sac and dead end streets is the distance from the right-of-way line of the intersecting street along the centerline of the cul-de-sac or dead-end street to the center of the circular turnaround. The maximum length for cul-de-sacs shall be six hundred feet (600'), except in conditions of unusual topography or in rural areas in the extra territorial jurisdiction where the maximum shall be eight hundred feet (800').

711. PRIVATE STREETS

The private streets shall be designed and constructed in accordance with this section. Private streets shall be designated by plat and in accordance with the City of Magnolia Subdivision Ordinance.

711.1 Layout

The private streets shall be designed to:

- a. Provide adequate vehicular access to all buildings and facilities within the boundaries of the development;
- b. Provide adequate interior traffic circulation and access to all buildings by fire fighting personnel and equipment;

- c. Allow for the smooth flow of vehicular traffic, avoiding such traffic hazards as closely off-set intersections and
- d. Provide direct access to the existing public street system adjacent to the trace boundaries.

711.2 Intersections of Private Streets With Public Streets

Private streets shall not be direct (straight line) projections of any public street. The private street shall offset a minimum distance of one hundred and twenty-five feet (125') center line to center line from right angles with variations not to exceed ten degrees (10°). Right angle intersections of private streets shall have twenty-foot (20') radii from the pavement edge at all corners. Acute angle intersections shall have twenty-five-foot (25') radii for the pavement edge at the acute corner on both public and private streets. The portion of a private street within a public street right-of-way shall be designed and constructed in accordance with City driveway standards.

711.3 Access

A street system shall be provided within the development with at least one (1) point of access to a public street adjacent to the development; provided, however, that developments containing on hundred and fifty (150) dwelling units or more shall provide at least two (2) points of access to adjacent public streets. Private streets shall serve only the land within each development. Private streets shall not be extended into adjacent tracts under a different ownership or a different property owners association.

711.4 Design and Construction Standards

a. Design

Private streets shall be designed according to the geometric and construction standards established for local public streets.

b. Pavement Width

The minimum unobstructed width of any private street shall not be less than twenty-four feet (24'). If parking is proposed along with a private street, the street shall be widened to accommodate such parking.

c. Private Street Easement Width

Private streets shall be located within private access easements of sufficient size to accommodate the private streets and related construction and maintenance activities.

d. Cul-de-Sac and Dead Ends

Cul-de-sac and dead end private streets shall be terminated by a circular turnaround of asphalt or concrete.

e. Construction

Private streets shall be constructed according to the standards for pavement and base for local streets as contained herein.

711.5 Street Lighting

Adequate lighting shall be provided along all private streets so spaced and equipped with luminaries at such mounting heights as will provide the average levels of illumination as defined herein.

712. STREET NAMES

Public streets shall be named in conformance with the following considerations:

- a. Names of new streets, not extensions of existing streets, shall not duplicate any existing street name in the City.
- b. If a new street is a direct or logical extension of an existing street, the existing street name shall be used.
- c. Street name suffixes such as place, court, circle and loop shall be designated on streets that are cul-de-sac or loop streets. Suffixes such as boulevard, parkway, expressway and drive shall be confined to designated arterial or collector streets. Suffixes such as highway or freeway shall be used only on designated highways or freeways falling under the jurisdiction of the Texas Department of Transportation.
- d. Street name prefixes such as North, South, East and West may be used to clarify the general location of the street; however, such prefixes shall be consistent with the existing and established street naming and address numbering system of the general area in which the street is located.
- e. Alphabetical and numerical street names shall not be designated on any development plan unless the street is a direct extension of an existing street with that name.
- f. Street names shall fit in with the names of existing streets in the area, and should, if possible, be named in a manner to provide direction to the general public (i.e., Park Street, Church Street).
- g. Streets should not be named as a memorial to or in honor of a person either living or deceased unless the person being so honored has, in the opinion of the City Council,

made significant contributions to the betterment of the City, State, or Nation. Streets, once named, may not be renamed without a $\frac{3}{4}$ majority of the City Council.

- h. Coordination with the local 911 plan.

712.1 Private Street Names

- a. Private street names shall conform to the same standards applicable to public street names and the following additional criteria:
 - (1) Signs shall be provided for all private streets; the signs shall conform in size, height and material to City standards.
 - (2) Private streets shall be designated as lanes and the suffix "PRIVATE" shall be an integral part of any street sign [example: ROSE LANE (PRIVATE)].
 - (3) The background color for any private street sign shall be blue.
- b. No private street name shall be changed without approval of the City.
- c. No private street sign shall be installed without the approval of the City.
- d. Private street signs not established in conformance with the provisions of this section and installed within the right-of-way of any public street may be removed from the public street right-of-way without notice.

713. GEOMETRIC CRITERIA

Public streets shall be designed according to the minimum geometric criteria established in Table 7-3, Geometric Design for Public Streets, and cross-sections shown in Figures 7-2 through 7-5.

714. CONSTRUCTION STANDARDS AND SPECIFICATIONS

All public streets shall be constructed in accordance with the City's Standard Details and Standard Specifications.

714.1 Non-Curb and Gutter Alternative for Local Residential Streets

Non-curbed and guttered paved streets may be provided in residential subdivisions as defined in the City of Magnolia Subdivision Ordinance.

714.2 Pavement With Alternatives for Local Commercial Streets

With City approval, local commercial streets may be constructed with reduced pavement width if "No Parking" signs are furnished and installed in accordance with City standards. Pavement width may be reduced to a minimum of twenty-eight feet (28'), back of curb to back of curb; provided, however, that increased driveway and intersection radii may be required for truck turning movements.

714.3 Pavement Alternative for Low Density, Rural Subdivisions

Residential subdivisions located in the extra-territorial jurisdiction (EJT) of the City may provide streets constructed according to the low density residential street standards contained in Figure 7-5.

TABLE 7-3 GEOMETRIC DESIGN CRITERIA FOR PUBLIC STREETS			
STANDARD CATEGORY	STREET CLASSIFICATION		
	ARTERIAL	COLLECTOR	LOCAL
Maximum Grade (in %)	6 ⁽¹⁾	8 ⁽¹⁾	10
Minimum Grade (in %)	0.3	0.3	0.3
Minimum Center Line Curve Radius (in feet)	1,000	800	300
Minimum Length of Vertical Curves (in feet) ⁽²⁾	300	100	100
Minimum Sight Distance (in feet)	400	250	250
Minimum Tangent Length Between Curves (in Feet)	300	200	100
Curb Return Radii (in feet) ⁽³⁾	30	25	20
(1)	Where existing topography makes conformance to these grades impractical consideration may be given to allowing an additional two percent (2%) increase in grade for a distance of five hundred feet (500') or less.		
(2)	Arterial - or fifty (50) times the algebraic difference in grades; whichever is greater. Collector or local – or twenty (20) times the algebraic difference in grades; whichever is greater.		
(3)	Acute angle intersection shall have twenty-five-foot (25') radii.		
(4)	Alternative designs using superelevation and other generally accepted transportation methods to reduce radii will be considered by the City on a case-by-case basis.		
See Figures 7-2 through 7-5 for additional details.			

715. STREET STRUCTURAL THICKNESS DESIGN

715.1 Engineered Design of Street Structural Section

- a. Except as provided by Section 715.2, a registered engineer shall design the street structural sections (structural thickness) in accordance with:
- (1) American Association of State Highway & Transportation Officials (AASHTO), Flexible-Pavement Design Method;
 - (2) Asphalt Institute Design Method;
 - (3) Portland Cement Association, Rigid Pavement Design Method or
 - (4) Any other design methods not specifically mentioned in this manual may be used, with prior approval of the City.
- b. The street structural section design shall be based on the total number and weight (plus configuration) of the axles expected to go over the street section during a design life of twenty (20) years. The concept of "Equivalent Axle Loadings" shall be used to express the total number and mixture of loadings that will occur during the street section's expected life. If a roadway is proposed, it will be designated as an arterial, collector or local and the street structural section design shall be based on the loadings shown in Table 7-4, Street Design by Equivalent Axle Loads.

TABLE 7-4 STREET DESIGN BY EQUIVALENT AXLE LOADS (20-YEAR DESIGN LIFE)	
STREET CLASSIFICATION	AXLE LOADS EQUIVALENT TO 18,000 LBS.
Principal Arterial	5,000,000
Minor Arterial	5,000,000
Major Collector	5,000,000
Minor Collector	400,000
Local (Commercial/Industrial)	400,000
Local (Residential)	9,000

715.2 Standard Structural Section Design for Paved Local Streets

In lieu of a designed street structural section, local street pavement sections (see also Sections 715.1 and 715.3) may be designs as follows:

- a. One and one-half inch (1.5") hot mix asphaltic concrete (H.M.A.C.), six-inch (6") flexible base, six-inch (6") stabilized subgrade, where necessary (see Section 715.3);
- b. Six-inch (6") H.M.A.C., six-inch (6") stabilized subgrade, where necessary (see Section 715.3);
- c. Six-inch (6") reinforced Portland cement concrete [with two-inch (2") sand cushion permitted], six-inch (6") stabilized subgrade, where necessary (see Section 715.3).

715.3 Soils Testing and Subgrade Stabilization

- a. A soil test report for each 1,000 square yards of paved surface proposed or for each type of soil encountered in the subgrade shall be submitted to the City.
- b. The following data as part of the soil test report shall be submitted to the City:
 - (1) Soil classification;
 - (2) Optimum moisture/density (Modified Proctor, ASTM D-1557);
 - (3) Atterberg Liquid Limits and Plasticity Index (P.I.)
 - (4) Stabilization requirements for subgrade soil (percent lime for clay or percent cement for sandy soils), if street structural section is to be designed by an engineer;
 - (5) All tests shall be performed by a certified testing laboratory.
- c. All subgrade soils with a P.I. of seventeen (17) or more shall be stabilized.
 - (1) If the standard structural section design for paved local streets is used, five percent (5%) lime by weight may be used, otherwise,
 - (2) A certified testing laboratory shall conduct lime (or other approved material) series test to determine the percent of stabilizing agent necessary to lower the P.I. below seventeen (17).
- d. All subgrade soils with a P.I. under seventeen (17) shall be stabilized with five percent (5%) by weight Portland cement.
- e. Subgrade soils evaluation shall generally apply to the top six inches (6") of soil measured down from the proposed subgrade surface.

715.4 Other Basic Criteria

- a. All subgrade materials shall be compacted to ninety-five percent (95%) relative density, Standard Proctor Test (ASTM D-698).
- b. All individual layers of base and paving materials shall be compacted to ninety-five percent (95%) relative density, Modified Proctor Test (ASTM D-1557).
- c. The total design thickness of the street structural section shall be rounded up to the nearest whole inch.
- d. The total thickness of an asphaltic concrete pavement may be divided into different grades of material. Unless otherwise approved by the City, Type "D" Hot Mix Asphaltic Concrete (H.M.A.C.) per Item 340 Texas Department of Transportation Standard Specifications, shall be used for a surface course.
- e. Asphaltic concrete pavement shall be laid in lifts of no more than three (3) or less than one and one half (1-1/2) inches each, unless otherwise approved by the City.
- f. The area shall be completely cleared and grubbed within the street right-of-way prior to construction of any street improvements.
- g. The design requirements set forth in this chapter are minimum design standards. The City reserves the right to require additional precautions or treatments consistent with sound engineering practice to provide for conditions not specifically covered herein.
- h. Any other design methods not specifically mentioned in this document may be used with prior approval by the City.

715.5 Construction Quality Control and Material Testing

Construction quality control and material testing shall be performed and the results shall be provided to the City to verify acceptability of specific work.

- a. All tests and retests shall be by an approved commercial testing laboratory. All related costs shall be the developer's responsibility.
- b. Copies of all materials test reports shall be submitted to the City.
- c. Subgrade shall be tested a minimum of every five hundred feet (500') for density and depth. The job mix formula shall be designed in accordance with Texas Department of Transportation standards.
- d. Hot mix shall be tested a minimum of every five hundred feet (500') for density and depth. The job mix formula shall be designed in accordance with Texas Department of Transportation standards.
- e. Surface course thickness shall be tested by the coring method.

- f. Concrete shall be tested for compressive strength at seven (7) and twenty-eight (28) days. One (1) set of cylinders [three (3)] shall be tested for each 1,000 square yards of pavement. Structures shall be tested on the basis of one (1) set per one hundred (100) cubic yards.
- g. Concrete pavement shall be tested by coring a minimum of every 1,000 feet for thickness. A minimum of three (3) tests is required.

716. STREET LIGHTING STANDARDS

716.1 Location

Street lights shall be installed at all street intersections, at the end of all cul-de-sac or dead end streets, and at all significant changes in direction of the roadway. All streetlights shall be installed in accordance to Table 7-5, Street Lighting Intensity.

TABLE 7-5 STREET LIGHTING INTENSITY	
STREET CLASSIFICATION	LIGHTING INTENSITY IN FOOT CANDLES (FC)
Arterial	2.0
Collector	1.2
Local Commercial	1.2
Local Residential	0.3
Private Street	0.3

716.2 Installation

Street lights shall be mast arm mounted to the light pole. If the electrical system for the development is installed underground, the electrical service to the street lights shall also be underground. If the electrical system for the development is overhead wires with power poles located along the rear lot lines, the electrical service to the streetlights shall be underground. If the power poles are located adjacent to the street, the electrical service to the streetlights may be overhead and the street light mast arms may be mounted on the power poles provided that the required lighting intensity is maintained.

CHAPTER 8 – OFF-STREET PARKING AND DRIVEWAY STANDARDS

801. OFF-STREET PARKING

801.1 Minimum Number of Parking Spaces

Off-street parking spaces shall be provided in accordance with the standards contain within this document and any other ordinance approved by the City of Magnolia.

801.2 Parking Lots

- a. All parking lots, parking spaces, maneuvering aisles, loading areas and driveways shall be paved with an all-weather surface. Such all-weather surface shall consist, at a minimum of six inches (6") of approved crushed rock base material on compacted or undisturbed subgrade. If such parking lots, spaces, aisles and loading areas are to be paved with asphalt or concrete, the base of such paving shall be the same as, or the approved equivalent to, the all-weather surfacing required above.
- b. Location, size and number of handicapped parking spaces shall conform to the latest building codes, State and Federal laws.
- c. If a development requires ten (10) or more parking spaces, up to ten percent (10%) of those spaces may be designed for "compact cars." Effective stall dimensions shall be a minimum of 7.5 feet by 15 feet and each space shall be signed "COMPACT CARS ONLY."
- d. All other parking spaces and lots shall meet the standards provided in Figure 8-1
- e. All parking spaces whether in a lot consisting of an all-weather surface or a paved surface shall be clearly delineated and designated by means of painted stripes, wheel stops, signs or other approved methods.
- f. Parking lots and loading areas shall be designed to allow all vehicle maneuvers such as backing, parking and turning the vehicle, to take place on the lot.

801.3 Off-Street Loading Requirements

- a. Any use that receives or distributes materials or merchandise by vehicle shall provide off-street loading space in accordance with the requirements detailed below.
 - (1) Industrial uses shall provide one (1) loading space for 10,000 square feet of floor area.

- (2) Business uses shall provide one (1) loading space for each 15,000 square feet of floor area.
- b. The following rules shall be applied in computing the number of off-street loading spaces required:
 - (1) Floor area shall mean the gross floor area of use.
 - (2) Fractional spaces shall be rounded to the next higher whole space.
- c. The required off-street loading spaces shall be located on the same lot as the building or use served.
- d. A loading space shall contain a minimum of 420 square feet and shall be approximately twelve feet (12') in width and thirty-five feet (35') in depth. All loading spaces, maneuvering aisles and driveways shall be paved with an all-weather surface.

802. DRIVEWAY DESIGN STANDARDS

Driveway or other facilities for access to lots shall be designed, constructed, upgraded, reconstructed or repaired according to the standards of this section. Driveways shall be permitted only upon streets where full street improvements exist and are maintained as a public street by the City; provided, however, that low volume (residential) driveways may be permitted on public lanes, alleys or other accepted public access facilities in existence prior to adoption of this document.

802.1 Location and Construction of Driveways

The location of driveways is based on a number of factors, including the location of individual property lines and available street frontage, requirements or internal site design, number of vehicles to be accommodated and traffic safety. As a general rule, the farther from an intersection a driveway can be located, the less it will affect the through traffic and the less delay it will cause to vehicles using the driveway.

- a. High volume driveway approaches shall be located entirely within the frontage of the lot and not less than ten feet (10') from any side property line; provided, however, joint driveway approaches may be permitted where a permanent joint access is provided by the respective property owners either through platting or a mutual access easement (see 802.1.g). Low volume (residential) driveway approaches shall be located entirely within the lot dimensions and not less than five feet (5') from any side or rear property line.
- b. Location of other driveways shall be considered on the opposite side of the street when locating a proposed driveway. Where possible, driveways on both sides of the street shall be aligned in order to minimize adverse effects on through traffic and to

optimize efficiencies of the driveway. Driveways directly opposite each other shall be given preference over staggered driveways. Where it is not possible to place driveways directly opposite each other, a driveway shall be placed so that adequate left turn storage capacity is provided in advance of each driveway in order to avoid the overlap of left turn movements.

- c. Driveway approaches shall be constructed so as not to interfere with pedestrian crosswalks.
- d. Driveways shall be constructed a minimum of three feet (3') from any obstruction such as a street light or utility pole, fire hydrant, traffic signal controller, telephone junction box, etc.
- e. Low volume driveways (single-family residential) shall be constructed to conform to the criteria shown in Figure 8-2.
- f. High volume driveways shall be constructed to conform to the criteria shown in Figure 8-3.
- g. When the owner or owners of two (2) adjacent lots agree to permanently combine access points, the City shall grant an incentive bonus. The total lot width normally required will be reduced by fifteen percent (15%) for each lot. In addition, where the agreement also includes a permanent mutual parking agreement, the required number of parking spaces may be reduced by fifteen percent (15%) for each development.
- h. The maximum number of driveways per lot, based on the street classification and lot width shall be as shown in Table 8-1, Maximum Driveways per Lot.

TABLE 8-1 MAXIMUM DRIVEWAYS PER LOT		
STREET TYPE	LOT WIDTH	PERMITTED DRIVEWAYS
Local	< 100'	1
	101-200'	2
	Over 200'	1 per additional 100'
Collector	< 100'	1
	100-250'	2
	Over 250'	1 per additional 200'
Arterial	< 100'	1
	101-300'	2
	Over 300'	1 per additional 300'

802.2 Driveway Spacing for High Volume Driveways

High volume driveways shall be designed and constructed according to the spacing standards shown in Figure 8-4.

802.3 Driveway Design

Driveway design will depend on the land use, the volume, the character of both through traffic and driveway traffic and the speed of traffic on the through street. Dependent upon these factors, the critical design elements include radii of curb returns, driveway throat width and the angle between the driveway centerline and the edge of the roadway.

- a. Driveway entrances shall be designed to be able to accommodate all vehicle types having occasion to enter the lot, including delivery vehicles.
- b. Driveways shall be designed with curb return radii according to the type of driveway and the classification of the street as provided in Table 8-2, Minimum Curb Return Radii.

TABLE 8-2 MINIMUM CURB RETURN RADII (IN FEET)		
STREET CLASSIFICATION	LOW VOLUME DRIVEWAY	HIGH VOLUME DRIVEWAY
Local	5	10
Collector	5	10
Arterial	10	20

- c. Tapered or channelized deceleration lanes for vehicles turning right into high volume or intersection type driveways may be required on arterial streets. Where such lanes are necessary, additional right-of-way may also be required.
- d. The use of one-way driveways, supported by an appropriate internal circulation system, is encouraged so that entrances and exits can be separate driveways. This will promote smoother traffic flow into and out of the driveways and reduce traffic congestion in through lanes on the street.
- e. In some cases, where necessary for the safe and efficient movement of traffic, the City may require that special design techniques be employed to restrict or limit turning movements into or out of a driveway before the driveway can be approved. Such restrictions do not affect the number and location of access points as specified elsewhere. Figure 8-5 gives approved minimum design criteria for limited movement driveways. Deceleration lanes may also be required to be incorporated into the design.

- f. Driveway design standards for sites that include fuel pumps parallel to the adjacent street are necessary due to the special access needs that characterize such developments. Sites shall be designed for fuel pumps according to the following standards:
- (1) The minimum corner clearance shall be a distance of thirty-five feet (35') measured from the point of intersection right-of-way lines to the point of tangency of the curb return radii leading to the driveway approach. The point of tangency of the curbline corner radius and that of the curb return radius of the driveway approach shall not be compounded.
 - (2) The minimum spacing between driveway approaches within the same property lines shall be twenty-five feet (25') of tangent curb length.
 - (3) A minimum distance between the fuel pump, island and the right-of-way or property line shall be twenty-five feet (25').

802.4 Restrictive Provisions

Access to public streets will not be provided where the conditions described below restrict or compromise the safety and efficiency of the access.

a. Backing Maneuvers

Access points shall not be approved for parking or loading areas that require backing maneuvers in a public street right-of-way except for single-family or duplex residential uses on local streets.

b. Sight Distance Requirements

The minimum sight distance shall be provided at all access points as shown in Figure 8-6.

c. Signalized Intersections

Access drives within the area of intersection of public streets where traffic signals are installed, or are anticipated to be installed in the future, will not be permitted.

d. Provision of Access

If a lot has frontage on more than one (1) street, access will be permitted only on those street frontages where standards can be met. If a lot cannot be served by any access point meeting these standards, access point(s) shall be designated by the City based on traffic safety, operational needs and conformance to as much of the requirements or these guidelines as possible.

- e. Driveway approaches shall not be constructed or used for the standing or parking of vehicles.
- f. Driveway restrictions along expressway ramps;
 - (1) If a driveway provides access to and from expressway frontage roads, it shall not intersect the frontage road at any point along the curbline of the frontage road, or along the edge of the pavement within 250 feet downstream from an exit ramp measured in the direction of traffic flow on the frontage road, Figure 8-7. This distance is measured from a line perpendicular to the right curbline of the frontage road, drawn through the point of intersection of the right curbline of an exit ramp and left curbline of the frontage road, and located to minimize danger by the crossing, weaving and merging of traffic.
 - (2) If a driveway provides access to and from expressway frontage roads, it shall not intersect the frontage road at any point along the curbline of the frontage road, or along the edge of pavement if there is no curbline, within fifty feet (50') upstream of an entrance ramp, Figure 8-7. This distance is measured on the frontage road upstream from a line perpendicular to the right curbline of the frontage road upstream from a line perpendicular to the right curbline of the frontage road, drawn through the point of intersection of the right curbline of an entry ramp and the left curbline of the frontage road, and located to minimize danger created by the crossing, weaving and merging of traffic.

802.5 Driveway Construction

- a. The portion of the driveway approach within the street right-of-way shall be paved with concrete or asphalt as follows:
 - (1) Commercial, Multi-Family or Industrial: All pavement shall be concrete.
 - (2) Residential: All driveway pavement abutting curb and gutter streets shall be concrete.

All driveway pavement abutting on non-curb and guttered streets may be concrete or asphalt.
- b. Property owners developing multi-family, commercial or industrial driveways located on non-curbed and guttered streets are responsible for all culvert installations.

802.6 Abandoned Driveway Approaches

Whenever the use of any driveway approach is abandoned and not used for ingress and/or egress to the property abutting, it shall be the duty of the property owner of such abutting property to restore the curb according to the City's specifications.

803. REFUSE CONTAINER PADS

Refuse container pads, where necessary, shall be installed according to the standards contained in Figure 8-8.

CHAPTER 9 – STORM DRAINAGE STANDARDS

901. GENERAL PROVISIONS

Drainage facilities shall be designed and constructed in accordance with this chapter and the City's Standard Details and Standard Specifications. The following design criteria are the City's minimum methods and standards. Other hydrologic and hydraulic design methods may be used to satisfy drainage requirements with prior approval of the City.

901.1 Upstream Conditions

All drainage facilities shall be designed based on potential and fully developed upstream conditions. A minimum run-off coefficient of 0.75 shall be used for all undeveloped upstream property.

901.2 Downstream Conditions

Downstream water surface elevations shall be determined for a one hundred-year (100 yr.) design frequency storm in order to define the downstream flood hazards created by the proposed development.

901.3 Protection of Downstream Properties

Downstream drainage improvement or a retention system shall be designed and constructed to protect downstream properties from any increase in storm water run-off level.

901.4 Discharge Points

All drainage improvements shall be terminated at a discharge point approved by the City. Such discharge point, or outlet, shall be designed and constructed to prevent damage to or overflowing into adjacent property. The City may require creek improvement, channel lining, energy dissipaters or other improvements for such outlet to prevent erosion or increase the flow capacity.

901.5 Public Streets as Drainage Facilities

- a. Maximum spread of water to be allowed in local streets at five-year design flow shall allow for one (1) clear lane of traffic [twelve feet (12') wide].
- b. Maximum spread of water in collector streets at ten-year (10 yr.) design flow shall allow for one (1) clear lane of traffic each way [twelve feet (12') wide each].
- c. Maximum spread of water in arterial streets at ten-year (10 yr.) design flow shall allow for two (2) clear lanes of traffic [twenty-four feet (24') wide].

901.6 Drainage Channels and Structures

- a. An underground storm drain on curb and gutter streets shall be installed beginning at the point where the calculated storm water runoff is of such a quantity that it exceeds the height specified above (see also Table 9-2). The storm drain system from this point shall be constructed to an approved outlet.
- b. For non-curb and gutter streets open channel (channel or ditch) methods may be used to dispose of storm water runoff of such a quantity that it exceeds the height specified above. Such channels may be in dedicated drainage easements outside the standard street right-of-way upon City approval of the location and alignment of such easements. Alternatively, the street right-of-way may be widened to accommodate an open channel of greater capacity than the standard street/ditch section (refer to Figures 7-2 to 8-6).
- c. If the channel is located in a widened street right-of-way, the City shall approve the right-of-way width and channel configuration.
- d. All channels shall be designed and constructed to terminate at an approved outlet.

901.7 Habitable Structures

Adequate means for storm water run-off in excess of the streets' "design storm" capacity [i.e., five, ten-year (5, 10 yr.) storm] shall be provided to flow around habitable structures.

- a. If adjacent topography rises away from the street, a grading/drainage plan shall be provided which shows that all building sites can provide a finished floor elevation.
 - (1) at least one foot (1') above the top of the curb using the highest point along the portion of such curb fronting the building site, or
 - (2) at least one foot (1') above the top of ditch elevation, using the highest point along the portion of such ditch fronting the building site.
- b. If adjacent topography falls away from the street, a grading/drainage plan shall be provided which shows that all building sites can provide a finished floor elevation at least one foot (1') above the ground elevation along all sides of the building site.
- c. Provisions shall be made in the subdivision grading plan which will contain storm water on each lot and discharge it to either the street or a drainage way at the rear of the lot. If necessary, drainage swales shall be constructed on the low side of each lot which will prevent storm water migration to adjacent lots.

- d. All streets shall be designed and constructed to minimize any fill required to bring building pads into compliance with this document.
- e. Alternate methods of building protection of those above may be accepted by the City upon submittal of detailed, engineered plans.

901.8 Drainage System Criteria

If an underground drainage system is required, and a sixty-inch (60") or smaller pipe will handle the design flow, pipe shall be used. If a sixty-inch (60") pipe is not adequate, concrete pipe or natural and/or a lined open drainage channel may be utilized. If pipe is selected, the maximum allowable velocity shall be twelve (12) feet per second in the pipe. Lining materials, if used, shall be approved by the City.

901.9 Line of Flow

Water courses shall be allowed to follow their natural lines of flow; provided, however, that re-channeling or rerouting of water courses may be allowed where approved by the City and where the point at which the water course enters the lot and the point at which it leaves the lot are not changed.

901.10 Bridges and Box Culverts

Bridges or box culverts shall be designed and constructed at all street crossings over all drainage ways and flood ways in accordance with Table 9-2, Design Storm Frequency.

901.11 Valley Gutters

Concrete valley gutters shall be provided if the gutter flow must be carried across intersections of curbed streets.

901.12 Public Easements Required

All public drainage facilities shall be placed in public easements as described in Chapter 3, Public Easement Standards.

902. DESIGN CRITERIA

902.1 Basis for Discharge

Drainage improvements shall be designed for watersheds less than one thousand (1,000) acres based on flood discharges determined from the Rational Formula. The Rational Formula for calculating storm flows is shown in Figure 9-1.

Description of Water Course	Velocity of Run - Off in fps for Slope in %			
	0% to 3%	4% to 7%	8% to 11%	Over 12%

Overland Surface
Drainage

5 10 15 18

Channels Determine V by Manning's Formula

Storm Sewers Determine V by Manning's Formula

For street or gutter flow, the velocity shall be based on the grade of the street. In the absence of detailed calculation by Manning's Formula for the specific street section, the average velocities shown in Table 9-1 may be used.

TABLE 9-1 AVERAGE VELOCITIES OF RUNOFF	
% SLOPE OF GUTTER	ASSUMED VELOCITY (FT. / SEC.)
0.5%	1.5
1.0%	2.2
2.0%	3.1
3.0%	3.8
4.0%	4.3
5.0%	4.9
6.0%	5.3
8.0%	6.1
10.0%	6.9

FIGURE 9-1

THE RATIONAL FORMULA

$$Q = CIA$$

where:

Q = The maximum storm flow rate at a given point (in cubic feet per second).

C = A run-off coefficient which varies with the topography, land use and moisture content of the soil at the time. The run-off coefficient shall be based on the ultimate use of the land. The run-off coefficient can be selected from the major use classification shown below.

Shopping Centers	0.95
Business Areas	0.80
Industrial Areas	0.70
Residential Areas	
(1) less than 2 lots/acre	0.40
(2) greater than 2 lots/acre but less than 4 lots/acre	0.50
(3) greater than 4 lots/acre but less than 8 lots/acre	0.60
(4) greater than 8 lots/acre	0.75
Apartments	0.75

I = The average intensity of rainfall in inches per hour for a period equal to the time of concentration of flow from the farthest point of the drainage area to the point under consideration.

$$I = \frac{b}{(t + d)^e}$$

where

	<u>5-Year</u>	<u>10-Year</u>	<u>25-Year</u>	<u>50-Year</u>
e =	0.749	0.753	0.724	0.728
b =	70	81	81	91
d =	7.7	7.7	7.7	7.7

t = Time of concentration in minutes.

A = The drainage area, in acres, tributary to the point under design calculated from the drainage map of the area. This drainage map shall be submitted with any drainage map of the area. This drainage map shall be submitted with any drainage plans submitted for consideration by the City.

Using the average velocities in Table 9-1, the time of concentration shall be calculated by the formula shown in Figure 9-2 or by other recognized methods such as the Texas Department of Transportation formulas unless more data is shown on the plans for calculating time of concentration.

902.3 Storm Frequency

Design storm frequencies for storm drainage improvements are shown in Table 9-2.

TABLE 9-2 DESIGN STORM FREQUENCY		
TYPE OF FACILITY	DESCRIPTION OF AREA TO BE DRAINED	MINIMUM DESIGN FREQUENCY (YEARS)
Streets and Storm Sewers or Side Ditches, Combined*	Residential, Commercial and Industrial	Local – 5 Collector – 10 Arterial – 10
Culverts, Bridges, Channels and Creeks	Any Type of Area Greater Than 1,000 Acres	25
Culverts, Bridges, Channels and Creeks	Any Type of Area Greater Than 1,000 Acres	100
* If in a storm drain, an inlet is located at a low point so that flow in excess of the storm drain capacity would be directed onto private property, and such overflow could cause damage or serious inconvenience in the opinion of the City, the design frequency shall be twenty-five (25) years.		

902.4 Underground Drainage Facility Design

The underground drainage facility (storm drain) capacity shall be calculated by Manning's Formula as follows:

$$Q = \frac{1.486 AR^{2/3} S^{1/2}}{n}, \text{ where:}$$

- Q = The discharge in cubic feet per second
A = The cross-sectional area of flow in square feet
R = The hydraulic radius in feet equals area / wetted perimeter.
S = The slope of the hydraulic gradient in feet per foot.
n = The coefficient of roughness

The elevation of the hydraulic gradient of the storm sewer shall be a minimum of 1.0 feet below the elevation of the adjacent street gutter. Storm water pipe shall be sized so that the average velocity in the pipe will not exceed twelve (12) feet per second.

FIGURE 9-2

TIME OF CONCENTRATION

$$T = \frac{D}{V \times 60}$$

where:

T = Time of concentration in minutes for use in Figure 9-1

D = Distance in feet from point of concentration to the most hydraulically distant part of the drainage basing under construction.

V = Velocity in feet per second from Section 902.2 or velocity calculated by an engineer for streets and/or storm sewers.

902.5 Open Channel Design

Open channel facilities shall be designed and constructed based on frequencies shown in Table 9-2 and calculated by Manning's Formula with roughness coefficients and velocities as shown in Table 9-3. Side slopes of channels shall be no steeper than 3:1 in earth and 1:1 when lined with concrete

902.6 Culvert Design

Enclosed culverts shall be installed if a creek or ditch crosses proposed roadway improvements. The quantity of flow to be carried by the culvert shall be determined by the Rational Formula. The size of the culvert required shall be the larger size, checking both inlet and outlet flow control.

TABLE 9-3 COEFFICIENT OF ROUGHNESS		
OPEN CHANNELS	MAXIMUM PERMISSIBLE VELOCITY IN FEET / SECOND	COEFFICIENT* “n”
Paved		
Concrete	8	0.011 to 0.020
Asphalt	8	0.013 to 0.017
Rubble or Riprap	8	0.017 to 0.030
Earth		
Bare, Sandy Silt, Weathered	2.0	0.020
Silt Clay or Soft Shale	3.5	0.020
Clay	6.0	0.020
Soft Sandstone	8.0	0.020
Clean Gravelly Soil	6.0	0.030 to 0.150
Turf		
Shallow Flow	6.0	0.06 to 0.08
Depth of Flow Over 1 Foot	6.0	0.04 to 0.06
* Will vary with straightness of alignment, smoothness of bed and side slopes, and whether channel has light vegetation or is choked with weed and brush.		

903. MINIMUM DESIGN STANDARDS

The design requirements set forth in this chapter are minimum design standards. The City reserves the right to require additional precautions or treatments consistent with sound engineering practice to provide for condition not specifically covered in this chapter.

TABLE 9-4 CULVERT DISCHARGE – VELOCITY LIMITATIONS	
CULVERT DISCHARGING	MAXIMUM ALLOWABLE

ON TO	VELOCITY (fps)
Earth	6
Sod Earth	8
Paved or Riprap Apron	8
Shale	8
Rock	8

904. STORM WATER DETENTION

904.1 General

When physical, topographic, and economic conditions allow it, channel improvements downstream of the development shall be used to prevent increased flooding. When this is not feasible, runoff detention storage shall be used, wherein the storm volume is held back in the watershed and released at an acceptable rate. This section presents information on storage techniques, including guidance for the design of appropriate storm runoff storage facilities.

904.2 Storage Classification

Storage systems may be classified as either on-line or off-line facilities.

The purpose of detention storage is to hold runoff back but release it continuously at an acceptable rate through a flow-limiting outlet structure, thus controlling downstream peak flows.

904.3 On-Line Storage

An on-line storage facility is one in which the total storm runoff volume passes through the detention facility's outflow structure.

904.4 Off-Line Storage

An off-line storage design is one in which storm runoff does not begin to flow into the storage facility until the discharge in the channel reaches some critical value above which unacceptable downstream flooding will occur. An off-line facility serves to store only the runoff volume associated with the high flow rate portions of the flood event.

904.5 Design Procedures

The following design procedures are intended to insure that new development, with detention, will not cause any adverse impacts on existing flooding conditions downstream. The computer program PondPack, provided by Haestad Methods, shall be used to design and analyze proposed detention pond facilities including pond size and outfall orifice size.

Submission of proposed detention pond plans shall include hard copies of the PondPack output data calculations along with a CD containing the computer input and output files for review by the Director of Public Works or his designated representative. Alternate detention pond sizing programs may be used with prior approval of the Director of Public Works or his designated representative. (Note: the design engineer should contact the City of Magnolia for any specific requirements for the watershed in which the proposed facility is to be located).

904.6 Hydrology Methods

The method to be used for determining detention pond volume requirements is governed by the size of the total contributing drainage area. For contributing areas up to 10 acres, the Modified Rational Method may be used. For areas greater than 10 acres, the Soil Conservation Service hydrologic methods shall be used.

904.07 Design Tailwater Depth

In order to route the inflow hydrograph through the detention facility, a relationship must be established between the volume of storage in the pond and the corresponding amount of discharge through the outflow structure. In most cases, this relationship is directly dependent on the elevation of the tailwater at the outlet of the outflow structure.

For the purpose of establishing an outflow rating curve, the tailwater in the receiving channel shall be assumed to be at all times at the level of the same frequency storm being analyzed. In certain situations where this assumption may be shown not to be reasonable, an alternative tailwater condition can be presented for approval to the City of Magnolia Director of Public Works.

904.8 Final Sizing of Pond Storage and Outflow Structure

Detention facilities shall be sized such that at least one foot of freeboard shall be maintained during the 100-year storm event, as measured from the top of the detention or retention facility berm.

The minimum recommended outflow pipe for a detention facility is 12 inches. When further flow restriction is necessary, the restriction should be located at a separate manhole outside of the receiving channel.

904.9 Storm sewer Hydraulic Gradients

The hydraulic gradients in storm sewers shall be determined using procedures outlined in previous sections of these guidelines. The starting water surface elevation for these calculations shall be the 25-year maximum pond elevation.

904.10 Allowances for Extreme Storm Events

Design consideration must be given to storm events in excess of the 100-year flood. An emergency spillway, overflow structure, or swale must be provided as necessary to effectively handle the extreme storm event. In places where a dam has been utilized to provide detention directly in a channel, due consideration must be given the consequences of a failure, and if a significant hazard exists, the dam must be adequately designed to prevent such hazards.

In addition, detention facilities which measure greater than six feet in height are subject to Title 31 Texas Administrative Code (TAC) Chapter 299 (Sub chapters A through E), which went into effect May 13, 1986, and all subsequent changes. The height of a detention facility or dam is defined as the distance from the lowest point on the crest of the dam (or embankment), excluding spillways, to the lowest elevation on the centerline or downstream toe of the dam (or embankment) including the natural stream channel. Subchapters A through E of Chapter 299 classify dam sizes and hazard potential and specify required failure analyses and spillway design flood criteria.

904.11 Erosion Controls

The erosional tendencies associated with a detention pond are similar to those found in an open channel. For this reason the same types of erosion protection are necessary, including the use of backslope swales and drainage systems, proper re-vegetation, and pond surface lining where necessary. Proper protection must especially be provided at pipe outfalls into the facility, pond outlet structures and overflow spillways where excessive turbulence and velocities will cause erosion.

904.12 Multipurpose Land Use

The amount of land required for a storm water detention facility is generally quite substantial. For this reason, it is logical that storage facilities could serve a secondary role as parks or recreational areas whenever possible. Such dual use areas will be allowed only after proper review of the design scenario and approval of the specific project by the City of Magnolia Director of Public Works.

When a dual use facility is proposed, a joint use agreement is required between the City of Magnolia and the entity sponsoring the secondary use. This agreement must specify the maintenance responsibilities of each party.

904.13 Approval of Private and Dual-Use Facilities

For privately maintained or dual use systems, each storm water detention facility will be reviewed and approved only if:

1. The facility has been designed to meet or exceed the requirements contained within this document; and
2. Provisions are made for the facility to be adequately maintained.

904.14 Maintenance

In general, the City of Magnolia will only be responsible for maintenance of storm water detention basins which serve public facilities such as dedicated public streets or parks and recreational areas. Responsibility for the maintenance of any portion of a facility not designed for flood control will not rest with the City, nor will the City be responsible for any damage which may occur resulting from flooding of the facility.

A 30-foot wide access and maintenance easement shall be provided around the entire detention pond. This is in addition to the dedication required for the pond itself.

904.15 Pump Detention

Pumped detention systems will not be maintained by the City of Magnolia under any circumstances and will be approved for use only under the following conditions:

1. A gravity system is not feasible from an engineering and economic standpoint;
2. At least two pumps are provided, each of which is sized to pump the design flow rate; if a triplex system is used, any two of the three pumps must be capable of pumping the design flow rate;
3. The selected design outflow rate must not aggravate downstream flooding. (Example: A pump system designed to discharge at the existing 100-year flow rate each time the system comes on-line could aggravate flooding for more frequent storm events).
4. Fencing of the control panel is provided to prevent unauthorized operation and vandalism;
5. Adequate assurance is provided that the system will be operated and maintained on a continuous basis;
6. Emergency source of power is provided.

It is recommended that if a pump system is desired, review by the City of Magnolia Director of Public Works of the preliminary conceptual design be obtained before any detailed engineering is performed.

904.16 General Requirements For Detention Pond Construction

The structural design of detention facilities is very similar to the design of open channels. For this reason, all requirements pertaining to the design of lined or unlined channels shall also apply to lined or unlined detention facilities.

In addition, the following guidelines are applicable:

1. Pond Bottom Design – A pilot channel shall be provided in detention facilities to insure that proper and complete drainage of the storage facility will occur.

Concrete pilot channels shall have a minimum depth of two inches and a minimum flowline slope of .0005 ft/ft. Unlined pilot channels shall have a minimum depth of two feet, a minimum flowline slope of .001 ft/ft, and maximum sideslopes of 3:1.

The bottom slopes of the detention basin should be graded toward the pilot channel at a minimum slope of 0.005 ft/ft, and a recommended slope of 0.0075 ft/ft.

Detention basins which make use of a channel section for detention storage may not be required to have a pilot channel, but should be built in accordance with the requirements for open channels.

2. Outlet Structure – The outlet structure for a detention pond is subject to higher than normal head water conditions and erosive velocities for prolonged periods of time. For this reason the erosion protective measures are very important.

Reinforced concrete pipe used in the outlet structure should conform to ASTM C-76 Class III with compression type rubber gasket joints conforming to ASTM C-443. Pipes, culverts and conduits used in the outlet structures should be carefully constructed with sufficient compaction of the backfill material around the pipe structure. Generally, compaction density should be the same as the rest of the structure. The use of cement stabilized sand backfill around the outlet conduit should be considered where soil types or conditions may prevent satisfactory backfill compaction. Cement stabilized sand backfill should also be used where headwater depths could cause backfill to wash out around the pipe.

CHAPTER 10 – BUFFER ZONES, PARK AND OPEN SPACE

1001. BUFFER STANDARDS

A buffer is a specified land area together with the planting and landscaping required on the land. A buffer may also contain a barrier, such as a berm or a fence, where such additional screening is necessary to achieve the desired level of buffering between various activities.

1001.1 Purpose

Requirements are set for this section for the provision of buffers between certain land uses. The requirement of a buffer is designed to reduce nuisances between adjacent land uses or between a land use and a public road by separation of land uses through a required buffer. Such nuisances may include dirt, litter, noise, lights, signs, unsightly buildings or parking areas. Buffers provide spacing to reduce potentially adverse impacts of noise, odor or danger from fires or explosions.

1001.2 General Standards

a. Location and Design

Buffers shall be located on the outer perimeter of a lot or parcel, extending to the lot or parcel boundary line. Buffers shall not be located on any existing, dedicated or reserved public or private street or right-of-way or easements.

b. Use of Buffers

A buffer may be used for some forms of passive recreation; it may contain pedestrian, bike or equestrian trails, provided that:

- (1) No plant material is eliminated.
- (2) The total width of the buffer is maintained.
- (3) All other regulations of the document are met.

With written permission of the City and full compliance with standards of Chapter 9, a required buffer may include a storm water retention area. In no event, however, shall the following uses be allowed in buffers; play fields, stables, swimming pools, tennis courts or similar active recreation uses.

c. Ownership of Buffers

Buffers shall remain in the ownership of the original owner (and assigns) of a lot or development. Buffers may be subjected to deed restrictions and subsequently be freely conveyed. They may be transferred to any consenting grantees, such as adjoining landowners, or an open-space or conservation group, provided that any

such conveyance adequately guarantees the protection or the buffer for the purposes of this document.

d. Maintenance

The owner of a bufferyard, provided in compliance with this document, shall provide adequate maintenance of the bufferyard to ensure survival of the plantings. In the event that any of the plantings do not survive, they shall be replaced.

1002. PARKS AND RECREATION AREAS

1002.1 Dedication

Residential lots shall have dedicated land for park uses at locations designated in the comprehensive plan or otherwise where such dedications are approved by the City at a rate of one (1) acre per one hundred (100) dwelling units or ten percent (10%) of the total development (as shown on the preliminary plat) whichever is less, up to a maximum of six (6) acres, dedicated to the City for public park and recreational purposes. A maximum of fifty percent (50%) of the dedicated area may be dedicated as open space. The area may be dedicated in stages if the development contains two (2) or more phases. The area shall be marked on the final plat as DEDICATED FOR PARK AND RECREATION AREA PURPOSES.

1002.2 Money in Lieu of Land

a. Variance Required

A variance from the requirement to provide parkland may be granted by the City at the time of preliminary plat approval if the dedication of park land, as required in Section 1102.1 is determined to work an undue hardship on the development or the tract size is inadequate for park and/or recreational purposes and a park site is available within one-half (1/2) mile of the development. Where a variance is granted, a cash payment in lieu of land dedication shall be deposited with the City, prior to final plat approval. A sum of money equal to the current assessed value of the land in the development according to the Wharton County Appraisal District based on the pro-rated amount of land required in Section 1002.1 shall be deposited with the City.

b. Neighborhood Park and Recreation Improvement Fund

Such deposit shall be placed in a Neighborhood Park and Recreation Improvement Fund established by the City. The deposit shall be used by the City for improvement and/or acquisition of a neighborhood park, playground or recreation area. Such deposit shall be used by the City for facilities that will be actually available to, and benefit, the persons in said development.

1002.3 Quality of Park Site

With concurrence of the City, extensive improvements to recreational facilities may be made or provided as desired. Land for recreation purposes of a character and location suitable for use as a playground, play field or for other recreation purposes shall be dedicated. The recreation site shall be relatively level and dry with a total frontage on one (1) or more streets of at least two hundred feet (200') in depth and no other dimension of the site shall be less than one hundred feet (100') in depth. With the City's permission, the tract may be located at a suitable place on the periphery of the development, so a more usable tract will result when additional park land is obtained when adjacent land is developed.

1002.4 Credit for Private Parks and Recreational Areas

If private open space for park and recreational purposes is provided and such space is to be privately owned and maintained by the future residents of the development, such areas shall be credited against the requirement of dedication for park and recreational land provided that the following standards are met:

- a. That yards, court areas, setbacks and other open spaces required in developments are not included in the computation of such private open spaces.
- b. That the private ownership and maintenance of the open space is adequately provided for by written agreement.
- c. That the use of the private open space is restricted for park and recreational purposes by recorded covenants which run with the land in favor of the future owners of the property within the development.

CHAPTER 11 – CONSTRUCTION SAFETY STANDARDS

1101. GENERAL PROVISIONS

The construction of facilities to improve, develop or subdivide land shall be conducted in a safe manner to protect human life and property.

1102. TRANSPORTATION SAFETY

All projects undertaken on or near public rights-of-way shall be controlled in accordance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD). Traffic control plans and measures, including but not limited to, signing, marking, barricading, flagging, detouring and closure shall all be conducted in accordance with TMUTCD criteria.

1103. EXCAVATION AND TRENCH SAFETY

In projects where mass excavation or trenching is required, provision to comply with Occupational Safety Health Administration (OSHA) shall be specifically addressed during construction. Contractors shall comply with specific OSHA regulations set forth in 29 CFR, Part 1926.

1104. PROTECTION OF LIFE AND PROPERTY

Construction activities shall progress in a manner, which places the highest priority on the protection of human life and property. Work shall be conducted in a manner, which complies with OSHA standards and other applicable Federal, State and local regulations.

1105. INSURANCE

Companies that construct facilities to improve, develop or subdivide property shall provide written proof of insurance coverage for no less than the statutory amounts required by law.

APPENDIX “B”

STANDARD SPECIFICATIONS AND STANDARD DETAILS FOR THE

CITY OF MAGNOLIA

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SECTION 01560

STORM WATER POLLUTION PREVENTION

PART 1 GENERAL

1.01 SUMMARY

This section covers the minimum requirements and responsibilities of the Contractor (Operator) for storm water pollution prevention.

1.02 MEASUREMENT AND PAYMENT

The cost for performing the storm water pollution prevention requirements set forth herein shall be included in related items of work unless specifically shown otherwise on the Bid Form.

1.03 REFERENCES

The applicable regulations of the following agencies shall apply as if written here in their entirety:

TCEQ	Texas Commission on Environmental Quality
US EPA	United States Environmental Protection Agency

1.04 SYSTEM DESCRIPTION

The Contractor shall take all necessary measures to prevent storm water pollution and comply with the applicable requirements of the controlling regulatory agencies as required for the project and any other requirements set forth herein.

1.05 SUBMITTALS

The Contractor shall submit one copy each to the City of Magnolia and the Engineer, or the designated representative of the Engineer, a Storm Water Pollution Prevention Plan (SWP3) when a SWP3 is required for the project. The Contractor shall also submit three (3) copies of all required supporting documents including, but not limited to, a Notice of Intent (NOI) and a Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under the Texas Pollutant Discharge Elimination System.

1.06 PROJECT/SITE CONDITIONS

Contractor shall develop and implement a storm water pollution prevention plan based on the actual conditions encountered on the project and shall implement the plan and any other requirements in accordance with all applicable laws and regulations. Contractor shall be responsible for determining the area (acres) that will be disturbed to prosecute the work required for the project and take the appropriate actions as outlined in this section based on the disturbed area as described in subsequent paragraphs of this specification.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

For a project where a SWP3 is required to be prepared and implemented by the Contractor, all methods, materials and equipment used to prevent storm water pollution shall be the sole responsibility of the Contractor. Typical drawings and notes may be shown on the plans and/or in this specification and may include locations or types of typical structural controls such as silt fencing, sedimentation basins, straw bales, rock berms, and other methods for preventing storm water pollution prevention. The typical drawings and notes that may be shown shall be considered as methods that may be selected for use by the Contractor. Nothing shown on drawings or described in the specifications for this project relieves the Contractor from sole responsibility for preventing storm water pollution in accordance with the applicable laws and regulations. Alternate or additional methods, materials and equipment may be developed and used by Contractor to prevent storm water pollution. Any alternate or additional methods, materials and equipment shall be detailed in the SWP3 that is to be prepared by the Contractor and submitted to the City of Magnolia and Engineer.

PART 3 EXECUTION

3.01 STORM WATER POLLUTION PREVENTION REQUIREMENTS

Contractor has the sole responsibility for preventing storm water pollution and following all applicable city, state and federal regulations in preventing storm water pollution. The Contractor is hereby designated as the "Operator" of the construction site and has sole responsibility for determining the area that will be disturbed to prosecute the work. The following paragraphs provide a general description of the requirements for obtaining authorization to discharge storm water under a Texas Pollutant Discharge Elimination System (TPDES) permit based on the size of the project:

- A. Large Projects. Large projects are those projects that disturb five (5) acres or more. The Contractor (Operator) shall comply with the following:

1. Obtain a copy of the most recent version of the TCEQ Construction General Permit and comply with all requirements set forth therein.
2. Develop and implement a Storm Water Pollution Prevention Plan (SWP3).
3. Complete and submit a Notice of Intent (NOI) to the TCEQ using the appropriate TCEQ form and instructions.
4. When applicable, provide notification to the operator of any Municipal Separate Storm Sewer System (MS4) when storm water from the project site will be discharging into the MS4.
5. Submit a Notice of Termination (NOT) to the TCEQ using the appropriate TCEQ form and instructions once the project site has reached final stabilization.
6. Pay all fees that may be associated with complying with the requirements for a Large Project including application fees and annual fees.

B. Small Projects. Small projects are those projects that disturb one (1) or more acres, but less than five (5) acres. The Contractor (Operator) shall comply with the following:

1. Obtain a copy of the most recent version of the TCEQ Construction General Permit and comply with all requirements set forth therein.
2. Develop and implement a Storm Water Pollution Prevention Plan (SWP3).
3. Complete and post a site notice using the appropriate TCEQ form.
4. When applicable, provide notification to the operator of any Municipal Separate Storm Sewer System (MS4) when storm water will be discharging into the MS4.

C. Projects With A Larger Common Plan of Development. Contractor (Operator) shall comply with the Large Project requirements listed in Paragraph 3.01.A of this specification on those projects that will disturb one (1) or more acres, but less than five (5) acres, and are part of larger common plan of development that will disturb five (5) or more acres.

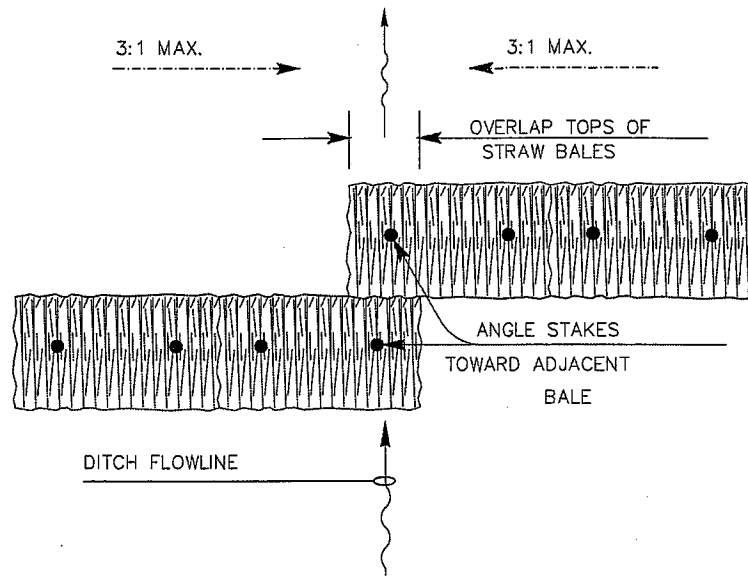
3.02 STORM WATER POLLUTION PREVENTION DETAILS AND NOTES.

The details and notes mentioned in Paragraph 2.01 of this specification are included on the following pages and are only intended to represent minimum requirements.

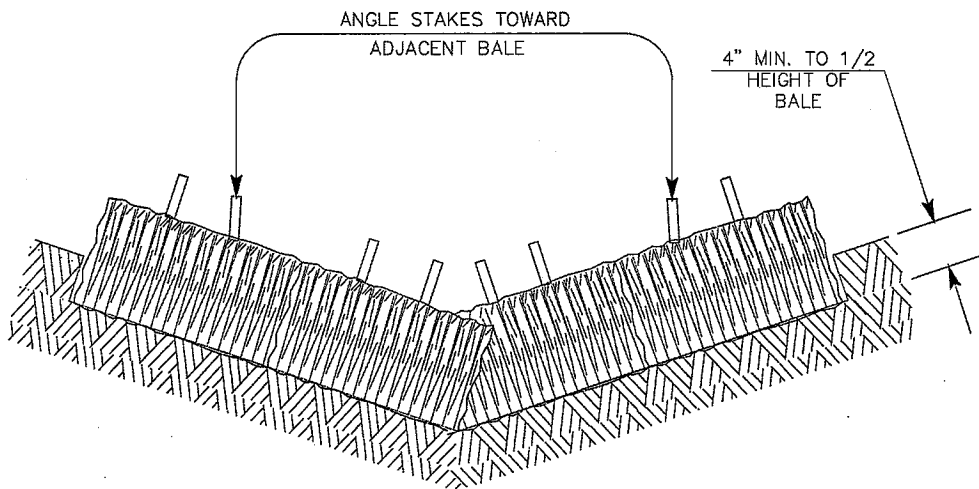
3.03 REMOVAL

The storm water pollution prevention features installed under this section shall be removed and disposed of by the Contractor after vegetation has been restored to a minimum of 70% of the disturbed area and runoff sediment has been eliminated.

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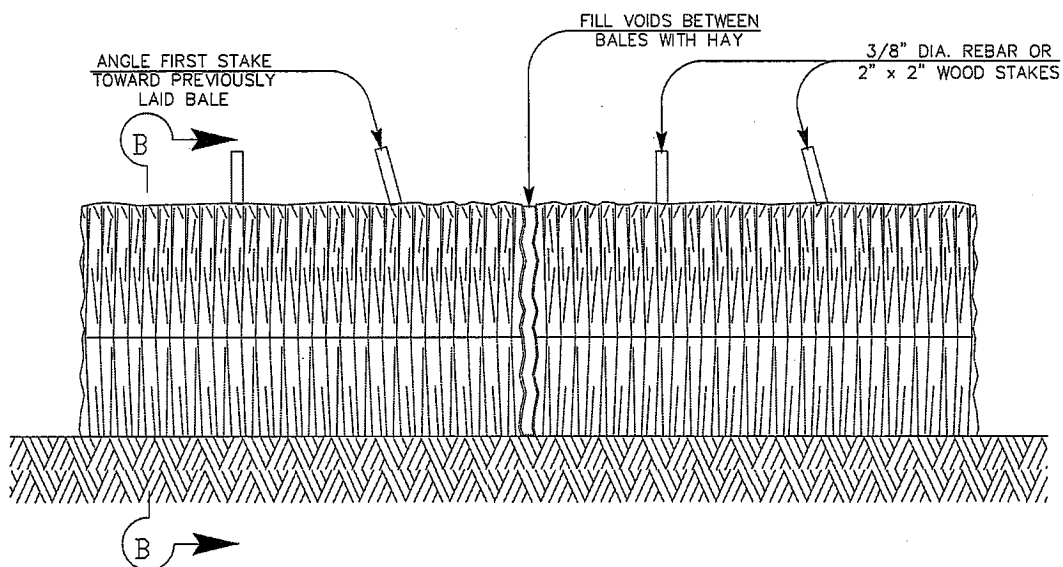
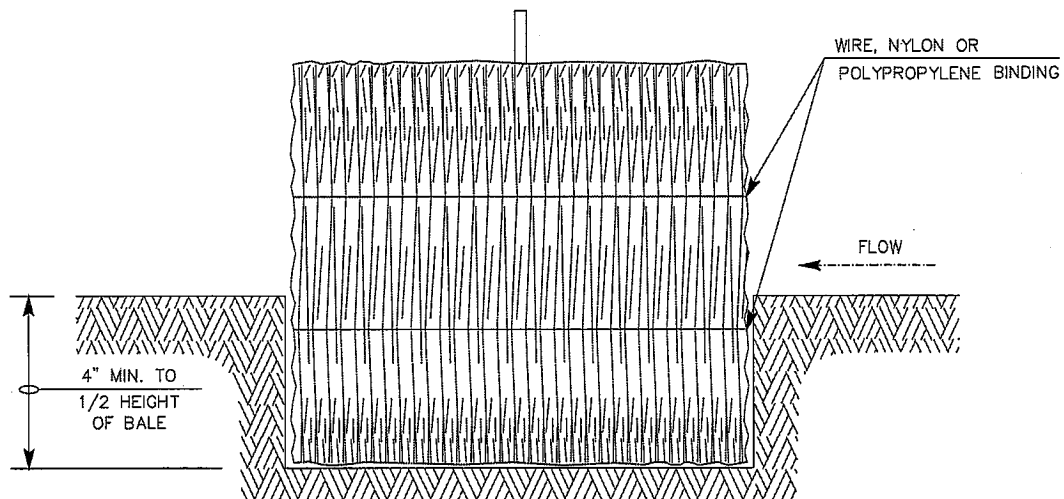


PLAN VIEW



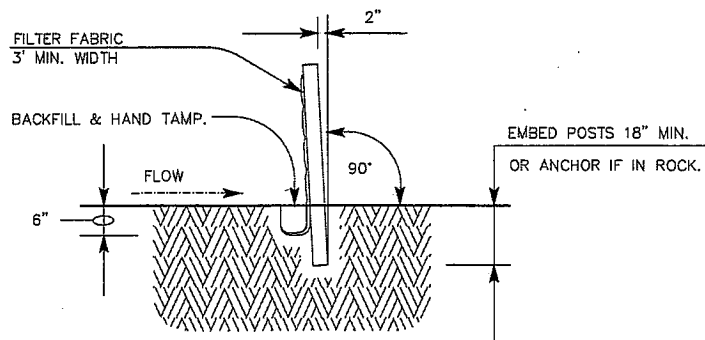
PROFILE VIEW

BALED STRAW FOR EROSION CONTROL

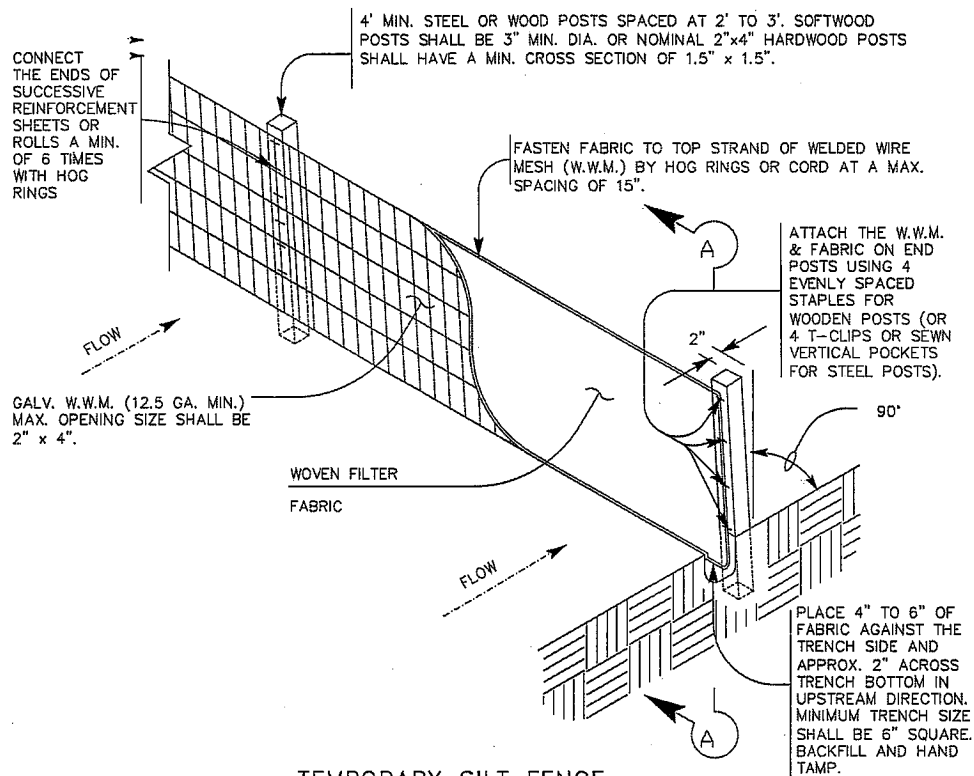


GENERAL NOTES

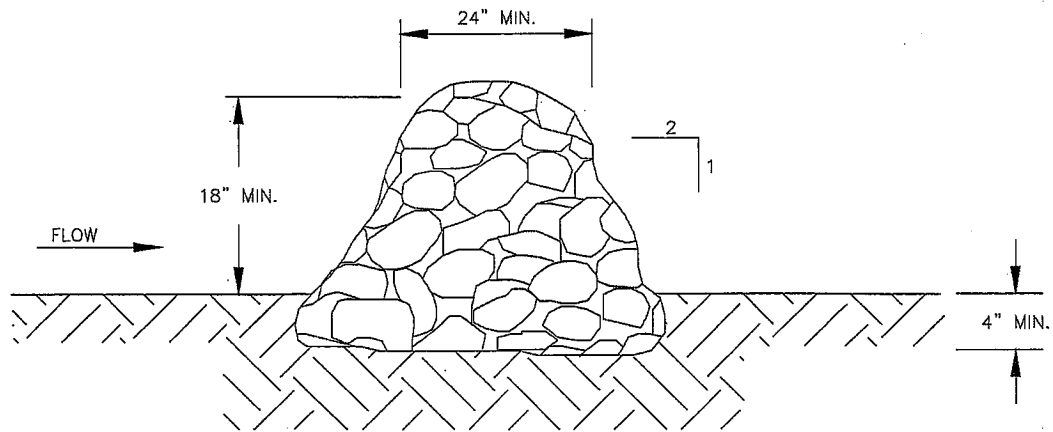
1. STRAW BALES SHALL BE A MINIMUM OF 30" IN LENGTH AND WEIGH A MINIMUM OF 50 LBS.
2. STRAW BALES SHALL BE BOUND BY EITHER WIRE OR NYLON OR POLYPROPYLENE STRING. THE BALES SHALL BE COMPOSED ENTIRELY OF VEGETABLE MATTER.
3. STRAW BALES SHALL BE EMBEDDED IN THE SOIL A MINIMUM OF 4" AND WHERE POSSIBLE 1/2 THE HEIGHT OF THE BALE.
4. STRAW BALES SHALL BE PLACED IN A ROW WITH ENDS TIGHTLY ABUTTING THE ADJACENT BALES. THE BALES SHALL BE PLACED WITH BINDINGS PARALLEL TO THE GROUND.
5. STRAW BALES SHALL BE SECURELY ANCHORED IN PLACE WITH 3/8" DIA. REBAR OR 2" x 2" WOOD STAKES, DRIVEN THROUGH THE BALES. THE FIRST STAKE SHALL BE ANGLED TOWARDS THE PREVIOUSLY LAID BALE TO FORCE THE BALES TOGETHER.



SECTION A-A



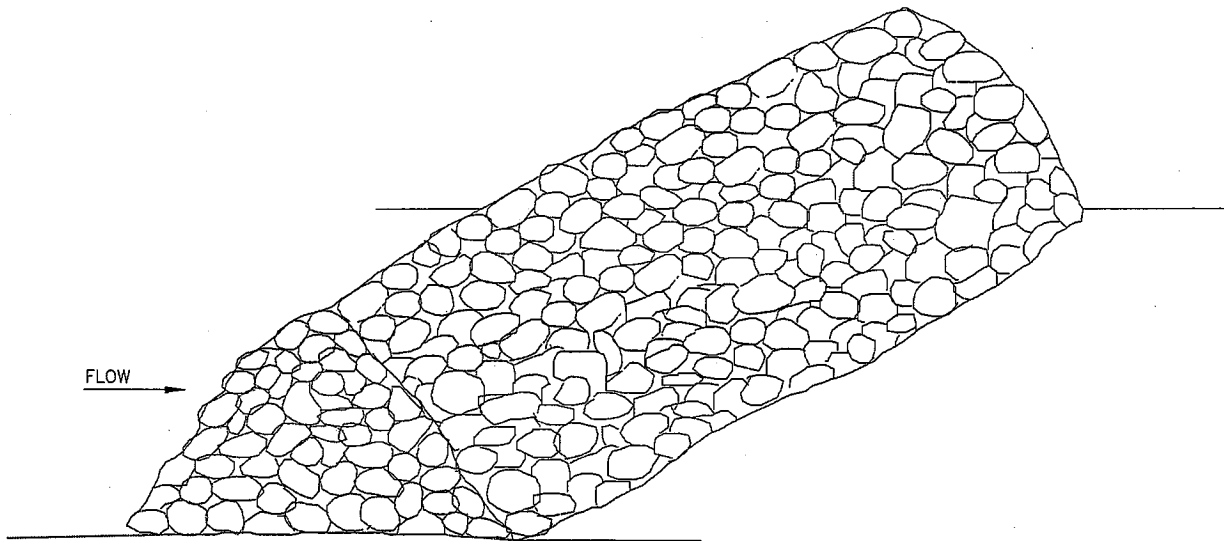
TEMPORARY SILT FENCE



SECTION

NOTES:

1. USE ONLY OPEN-GRADED ROCK, WITH MOST OF THE FINES REMOVED.
2. STONE SHALL BE CRUSHED AND, UNLESS OTHERWISE SPECIFIED, SHALL BE AT LEAST 3 INCHES IN DIAMETER AND LESS THAN 1 CUBIC FOOT IN VOLUME.
3. THE ROCK BERM SHALL BE EMBEDDED INTO SOIL A MINIMUM OF 4 INCHES.
4. THE STONE SHALL BE REPLACED WHEN THE STRUCTURE CEASES TO FUNCTION AS INTENDED.



ROCK BERM DETAIL

END OF SECTION

SECTION 02222

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES

PART 1 GENERAL

1.01 SUMMARY

This section covers the requirements for the excavation, trenching and backfilling of the following utilities and their respective appurtenances:

1. Storm sewers,
2. Sanitary sewers,
3. Water lines.

1.02 RELATED SECTIONS

Section 01560 - Storm Water Pollution Prevention

Section 02229 - Excavation Safety

1.03 MEASUREMENT AND PAYMENT

The cost for performing the work described in this Section shall be included in related items of work unless specifically shown otherwise on the Bid Form. All excavation required for locating existing underground utilities will not be measured or paid for as a separate item of work unless specifically shown otherwise on the Bid Form. Include cost for locating existing underground utilities in related items of work.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

ASTM	American Society for Testing of Materials
OSHA	Occupational Safety and Health Administration
AASHTO	American Association of State Highway and Transportation Officials

1.05 SUBMITTALS

When requested, submit adequate amounts of backfill material for evaluation by the Engineer or the designated representative of the Engineer.

1.06 COMPLIANCE WITH REGULATORY AGENCIES

The Contractor shall comply with the requirements of all pertinent regulatory agencies as applicable to the project.

1.07 SCHEDULING

No open excavation or trenches shall be left overnight without proper lighting and barricades. Schedule backfilling such that there is a minimum of excavations and trenches that are left open during times when no work is occurring.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Cement Stabilized Sand. When required, provide cement-stabilized sand backfill material in accordance with Section 02240, Cement Stabilized Sand.
- B. Bank Sand. When required, provide clean bank sand from an approved source that is free of clay, organic material or other foreign substances. The bank sand shall be such that not more than 12 percent by weight passes the 200 mesh sieve and the plasticity index (P.I.) shall not exceed 4.0.
- C. Select Material. Select material shall be excavated trench material or imported material which is free from rock fragments and clods that will not break down when compacted unless the rocks or clods are 1-1/2 inches or smaller and scattered in the spoil. Select material shall be free of organic materials and free of sharp or angular materials that could damage the utility being installed or any coating/cover on the utility being installed.
- D. Common Backfill. Common backfill shall be excavated trench material free of organic, soft, or spongy materials.
- E. Embedment Materials. Soils to be used for embedment material shall be classified according to the Unified Soils Classification System (USCS) in ASTM D2487, Standard Method for Classification of Soils for Engineering Purposes. The following USCS Soils Classifications correspond to the soil classifications required for the various types of embedments shown on the plan details and/or listed in other sections of these specifications:
 - 1. Class I Soils. Manufactured angular, granular material, 1/4 to 1-1/2 inches size, including materials having regional significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Class I soils are not defined in ASTM D2487 and are subject to approval before being used.

2. Class II Soils. In accordance with ASTM D2487, less than 5% pass No. 200 sieve.
 - a. GW Soil Type: Well-graded gravels and gravel-sand mixtures, little or no fines. 50% or more retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
 - b. GP Soil Type: Poorly graded gravels and gravel-sand mixtures, little or no fines. 50% or more retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
 - c. SW Soil Type: Well-graded sands and gravelly sands, little or no fines. More than 50% passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
 - d. SP Soil Type: Poorly graded sands and gravelly sands, little or no fines. More than 50% passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
3. Class III Soils. In accordance with ASTM D2487, more than 12% pass No. 200 sieve. Soils with 5% to 12% pass No. 200 sieve fall in borderline classification, for example, GP-GC.
 - a. GM Soil Type: Silty gravels, gravel-sand-silt mixtures. 50% or more retained on No. 4 sieve. More than 50% retained on No. 200 sieve.
 - b. GC Soil Type: Clayey gravels, gravel-sand-clay mixtures. 50% or more retained on No. 4 sieve. More than 50% retained on No. 200 sieve.
 - c. SM Soil Type: Silty sands, sand-silt mixtures. More than 50% passes No. 4 sieve. More than 50% retained on No. 200 sieve.
 - d. SC Soil Type: Clayey sands, sand-clay mixtures. More than 50% passes No. 4 sieve. More than 50% retained on No. 200 sieve.
4. Class IV Soils.
 - a. ML Soil Type: Inorganic silts, very fine sands, rock flour, silty or clayey fine sands. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
 - b. CL Soil Type: Inorganic clays of low to medium plasticity, gravel clays, sandy clays, silty clays, lean clays. Liquid limit 50% or less.

50% or more passes No. 200 sieve.

- c. MH Soil Type: Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
- d. CH Soil Type: Inorganic clays of high plasticity, fat clays. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.

5. Class V Soils.

- a. OL Soil Type: Organic silts and organic silty clays of low plasticity. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
- b. OH Soil Type: Organic clays of medium to high plasticity. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
- c. PT Soil Type: Peat, muck and other highly organic soils.

- E. Concrete Embedment. Concrete used for utility embedment shall have minimum strength of 3,000 psi at twenty-eight (28) days. Dry mix will not be permitted. The concrete cushion portion of the embedment or encasement shall be mixed moist or damp such that a slump of not more than 1-inch is achieved. Concrete for the sides and top, if required, shall be mixed such that a slump of not less than 1-inch, and not more than 3-inches, is obtained.

PART 3 EXECUTION

3.01 PREPARATION

- A. Location of Existing Utilities. Contractor shall verify the existence and location of all existing underground utilities along the route of the work.
- B. Protection of Existing Utilities. Contractor shall take the necessary precautions to protect all existing utilities from damage due to his operations. Any damage to the existing utilities will be repaired at the Contractor's expense by qualified personnel. In order to protect existing utilities that are required to be exposed, Contractor's operation shall be such that a sufficient distance back from the edge of the excavation is maintained to avoid overloading and to prevent slides or caving. No unnecessary excavation or exposing of existing underground utilities will be allowed.
- C. Convenience to Public. All trenching and excavating shall be performed in a manner that will cause as little inconvenience to the public as possible. All excavated material shall be kept trimmed such that minimum inconvenience is caused to the public or adjoining property owners. At street crossings, sidewalks and other points deemed necessary by the Engineer or the designated representative of the Engineer, trenches and excavations shall be bridged in a secure manner so as to prevent serious interruption of travel and to provide access to fire hydrants, public property, and private property. All bridging shall be preapproved by the Engineer or the designated representative of the Engineer.
- D. Erosion Control: The Contractor shall conform to the provisions described in technical specification Section 01560, Storm Water Pollution Prevention and any additional provisions for erosion control that may be shown on the plans or described in the technical specifications. All erosion control and storm water pollution prevention measures shall begin at the onset of the project and be maintained throughout the duration of the work until the disturbed area is stabilized at which time they shall be removed unless specifically required otherwise.
- E. Traffic Control: Provide and maintain traffic control in conformity with the applicable statutory requirements and within highway right-of-way as required by the authority having jurisdiction over the right-of-way. Adequate traffic control devices shall be in place prior to: 1) removal of any existing control devices, 2) construction equipment move in, and 3) any work within public right-of-way. Traffic control shall be in accordance with the latest version of the Texas Manual on Uniform Traffic Control Devices. The Contractor shall notify all emergency service providers in the event of a road closure or other activity that may impair the emergency travel of the emergency service provider.
 - 1. Maintenance of Traffic. Conduct work in a manner that will interfere as

little as possible with public travel, whether vehicular or pedestrian, whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private. The Contractor shall, at his own expense, provide and maintain suitable and safe bridges, detours, or other temporary structures for the accommodation of public and private travel and shall give reasonable notice to owners of private drives before interfering with them; provided however, that such maintenance of traffic will not be required at any point where the Contractor has obtained permission from the owner and tenant of the private property involved, to obstruct traffic at any designated point thereon and for the duration of whatever period of time as may be agreed on.

2. Barricades, Lights, and Signs. All streets, roads, highways, and other public thoroughfares that are closed to traffic shall be protected by means of effective barricades on which shall be placed acceptable warning signs. Barricades shall be located at the nearest intersection, public highway or street on each side of the blocked section. All open trenches or other excavations shall be provided with suitable barriers, signs, and lights to the extent that adequate protection is provided to the public. Obstructions, such as material piles and equipment, shall be provided with similar warning lights and signs. All barricades and obstructions shall be illuminated by means of warning lights. Materials stored upon or alongside public streets and highways shall be so placed, and the work conducted at all times, as to cause minimum obstruction and inconvenience to the traveling public.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

A. EXCAVATION.

1. General: Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles that may obstruct the line of work, and the excavation and removal of all earth, rock or other material to the extent necessary to install the utility and all appurtenances in conformance with the line and grades shown on the plans or as specified herein.
2. Trench Width: The sides of all trenches shall be cut as near vertical as possible. Whenever the prescribed maximum trench width is exceeded for pipe utilities, except as such excess may be required for compliance with plans or specifications, the pipe shall be cradled with 2,000 psi concrete at the expense of the Contractor. Unless shown or specified otherwise, the maximum and minimum trench widths for the associated utility shall be measured at 12-inches above the top of the utility line and shall be as follows:
 - a. Storm sewers.

Minimum width: 16-inches plus O.D. of Pipe.
Maximum width: 24-inches plus O.D. of Pipe.

b. Sanitary sewers.

Minimum width: 16-inches plus O.D. of Pipe.
Maximum width: 24-inches plus O.D. of Pipe.

c. Water lines.

Minimum width: 16-inches plus O.D. of Pipe.
Maximum width: 24-inches plus O.D. of Pipe.

3. Trench Depth. Unless shown or specified otherwise, trenches shall be excavated to a depth such that the following minimum depths of cover are maintained on the associated utility (as measured from final grade):

a. Water mains: 42-inches of cover.

b. Sewage force mains: 42-inches of cover.

4. Trench Bottom. Accurately grade trench bottom such that uniform bearing and support is provided for the utility being installed. Trench bottom shall be such that the utility is supported along its entire length by undisturbed soil except where bell holes or depressions are required. When bell holes or depressions are required for the proper installation of a utility, the trench bottom shall be completely graded before the bell hole or depression is excavated. Bell holes or depressions shall be no larger than required for the proper installation of the utility. The following procedures shall be used when various types of trench subgrades are encountered:

- a. Earth Subgrade. Where a firm and stable foundation for the utility being installed can be obtained in the natural soil and where special embedment is not shown on the plan details or specified herein, the bottom of the trench shall be carefully trimmed to fit the lower portion of the utility line. Should the excavation be carried below grade, except when otherwise detailed on the plans or specified herein, the Contractor shall refill it with Class I embedment material and compact it until the bottom of the trench is firm and unyielding.
- b. Rock Subgrade. Where the bottom of the excavation for the utility line is in rock or other hard material, the rock or other hard material shall be removed to a depth not less than four (4") inches below subgrade and the bottom of the trench brought to true subgrade elevation by filling with Class I embedment or other suitable materials as approved by the Engineer. The fill shall be compacted until a firm and uniformly unyielding foundation is established for the utility line being installed.

- c. Soft Subgrade. Where a soft or spongy material is encountered in the excavation at subgrade level, it shall be removed only upon the direction of the Engineer or the designated representative of the Engineer. When directed, remove the soft material and replace it with Class I embedment or other suitable materials as approved by the Engineer or the designated representative of the Engineer. The fill replacing the soft material shall be compacted and shall be to a depth that will result in a true trench subgrade that provides a firm and uniformly unyielding foundation for the utility being installed.
- 5. Sheeting, Shoring, and Bracing. Shore all excavations in accordance with OSHA Standards and the applicable section, or sections, of these specifications. When excavations are made adjacent to existing buildings or other structures, or in paved roadways, particular care shall be taken to adequately sheet, shore, and brace the sides of the excavation to prevent undermining of, or the settlement beneath, the structures or pavements. Underpinning of adjacent structures or pavement, and the costs associated with it, shall be the responsibility of the Contractor. All sheeting, shoring, and bracing shall be done in such a manner that will not cause any caving or sliding of banks and will not endanger any human life or damage any existing structures or property. Fill and compact all holes or voids left by the removal of sheeting, shoring or bracing with suitable materials. If for any reason, the Contractor, with the approval of the Engineer or the designated representative of the Engineer, elects to leave in place the sheeting, shoring or bracing, no payment will be allowed for such material left in place.
- 6. Dewatering Excavations. Immediately remove all surface water, ground water or seepage water from sewers, drains, ditches, or other sources which may accumulate in the excavation during construction. Removal of water shall be done by pumping, bailing, draining, well pointing, or other approved methods. The Contractor shall have available, at all times, sufficient equipment in proper working order for dewatering excavations. Disposal of all water from excavations shall be in a legal and safe manner. All dewatering of excavations including pumping, bailing, draining, ditching, well pointing, underdrains, etc., is incidental work and will not be paid for separately.
- 7. Open Cut Excavations. Except where otherwise shown on the plans, all utility installations shall be accomplished by open cut. In all cases where open cuts are allowed through pavements, the methods of construction must meet the requirements of the appropriate regulating agency in all respects including deviations from these specifications or plans. Open cut excavations crossing paved or unpaved public roadways and driveways shall

be done such that inconvenience to users is minimized. Repair all open cut pavements in accordance with the plan details or to the original condition, whichever is more stringent. Repair all open cut pavements in a timely fashion. Where a utility line is to be installed across a paved roadway by open cut, the Contractor, with the approval of the Engineer or the designated representative of the Engineer, may elect to install the utility by boring and in such case will be paid for the corresponding pavement repair if provided for in the bid form.

8. Boring, Jacking or Drilling. When shown on the plans, the utility line shall be installed by boring, jacking or drilling under roadways, streets or railroads, or the line shall be installed in a casing that has been placed by boring, jacking or drilling in accordance with requirements of all regulating agencies.
9. Excavation of Appurtenances. Excavate as required for appurtenances of the utility being installed. For manholes and other similar structures leave at least two (2) feet clear between the outer surfaces and the embankment or timber that may be used to hold or protect the banks. Any over excavating below appurtenances is not allowed. If over excavating of appurtenances occurs, the excavation will be refilled with cement stabilized sand or concrete. The cost for this refilling shall be the responsibility of the Contractor.
10. Explosives. The use of explosives to aid excavation work is strictly prohibited.

B. EMBEDMENT

All embedment for utilities shall be in accordance with the plan details and shall use the materials outlined in this specification. In general, the embedment zone of a utility line is 4-inches below the bottom of the utility to 12-inches above the top of the utility. All materials for the embedment of a utility being installed shall be placed in layers, or lifts, that do not exceed 6-inches in thickness unless otherwise indicated on the plans or herein. Compaction of embedment zone material shall be in strict accordance with the plan details.

C. BACKFILLING

1. General. The three (3) types of backfill that may be used include: cement stabilized sand, bank sand, and common backfill. Install the various types of backfill material in accordance with and at the locations detailed on the plans. Backfilling shall include the refilling and consolidation of the required fill in trenches/excavations from the top of the embedment zone of

the utility being installed up to the surrounding ground surface or to the bottom limits of a required pavement repair as detailed on the plans.

2. Cement Stabilized Sand. Installation of cement stabilized sand backfill shall be in conformance with the applicable paragraphs of technical specification Section 02240, Cement Stabilized Sand, and shall be installed in accordance with and at the locations shown on the plans.
3. Bank Sand. Install approved bank sand backfill in accordance with and in the locations shown on the plan details. Place sand backfill in maximum 8-inch loose layers/lifts above the embedment zone and compact each layer to 95% Standard Proctor.
4. Common Backfill. Unless specified or shown otherwise on the plan details, backfill all trenches with approved common backfill material from the trench excavation. Place common backfill in 8-inch layers/lifts above the embedment zone and compact each layer to 92% Standard Proctor.
5. Compaction and Consolidation of Backfill. Compact each layer of backfill with mechanical equipment to the required density. As an option, the Contractor may elect to consolidate the backfill by jetting and flooding until full settlement has been reached. Jetting and flooding will not be allowed in any areas where the utility system is being installed under a paved section. If used, jetting shall be accomplished by pumping water through a pipe that is slowly inserted vertically into the backfill. The end of the pipe shall be lowered to a point near the top of the embedment zone, taking care not to disturb the bedding or cause the utility to float. The trench shall then be flooded in puddles until no more appreciable absorption of water into the backfill occurs.
5. Excess Material: Excavated material unsuitable for backfilling and excess material shall be disposed of in a manner approved by the Engineer or the designated representative of the Engineer. Acceptable surplus spoil may be neatly distributed and spread on the right-of-way in open areas or pastures.

3.03 REPAIR / RESTORATION

Restore surfaces at construction sites to a condition equal to condition prior to construction.

3.04 ADJUSTING / CLEANING

All premises shall be left in an "as found" condition.

END OF SECTION

SECTION 02223

EXCAVATING, BACKFILLING, AND COMPACTING FOR PAVEMENT

PART 1 GENERAL

1.01 SUMMARY

This section describes the requirements for the excavation, backfilling, embankment, and compacting for all types of pavement including, but not limited to, concrete pavement and hot mix asphalt concrete pavement. Also included in this specification are the requirements for clearing and grubbing for roadway construction and the requirements for traffic control in the construction of a roadway.

1.02 RELATED SECTIONS

Section 01560 Storm Water Pollution Prevention
Section 02229 Excavation Safety

1.03 MEASUREMENT AND PAYMENT

Roadway excavation shall be paid for by the cubic yard as measured in its original undisturbed position unless specifically shown otherwise on the Bid Form. Roadway embankment and backfill shall be paid for by the cubic yard as measured in its final compacted in place position unless specifically shown otherwise on the Bid Form. If a unit price per cubic yard is bid, it shall be full compensation for removing, transporting, placing, compacting and shaping the material including all incidentals necessary to complete the work.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

ASTM	American Society of Testing and Materials
AASHTO	American Association of State Highway and Transportation Officials
OSHA	Occupational Safety and Health Administration

1.05 DEFINITIONS

A. Embankment. Embankment is hereby defined as any additional placement and compaction of material required to construct a designated roadway section, a

roadway embankment, levee and/or dike.

- B. Backfill. Backfill is hereby defined as any additional placement and compaction of material required to install all structures associated with the construction of a designated roadway section such as curb and gutters, storm sewer inlets, guardrail or other similar roadway structures.
- C. Excavation. Excavation is hereby defined as the removal and subsequent handling of all materials excavated or otherwise removed in the performance of the work, regardless of type, character, composition or condition thereof. All excavation shall be unclassified and includes the removal of all material regardless of the nature of the material unless otherwise indicated in the bid form.
- D. Borrow. Borrow is hereby defined as the material which is stripped, excavated, transported and properly utilized as backfill or embankment material and is obtained only from an approved and/or designated source.

1.06 SUBMITTALS

When requested, submit adequate amounts of backfill material for evaluation by the Engineer or the designated representative of the Engineer.

1.07 COMPLIANCE WITH REGULATORY AGENCIES

The Contractor shall comply with the requirements of all pertinent regulatory agencies as applicable to the project.

1.08 DELIVERY, STORAGE, AND HANDLING

All material used for embankment or backfill shall be delivered, stored, and handled in a manner that will prevent any harmful contamination of the material or damage to any adjacent property or structures. The delivery, storage, and handling of embankment and backfill materials is subject to the approval of the Engineer or the designated representative of the Engineer.

1.09 PROJECT / SITE CONDITIONS

Contractor shall be responsible for locating all underground utilities that are in conflict with the proposed work.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Embankment. Furnish embankment material which is obtained from roadway, borrow, channel and/or structural excavations. Embankment material shall be obtained only from an approved source and shall meet the approval of the Engineer or the designated representative of the Engineer. In general, embankment material shall consist of earth that is free from rocks, clods, vegetation or other foreign material. Each layer of embankment shall be uniform as to material, density and moisture content and shall be suitable for forming a stable embankment. Other requirements, if any, for embankment material shall be as shown on the plans.
- B. Backfill. Furnish backfill material in accordance with plan requirements. Backfill material shall be obtained only from an approved source and shall meet the approval of the Engineer or the designated representative of the Engineer. Obtain approved backfill material from roadway, borrow, channel and/or structural excavations.
- C. Subgrade Material. Use existing subgrade material, or when necessary furnish subgrade material, which contains sufficient fines to form a firm subgrade capable of being shaped and compacted to the lines, grades and densities shown on the plans.
 - 1. Lime Stabilization. If required, lime stabilization of subgrade shall be in accordance with Section 02244, Lime Stabilization of Materials in Place.
 - 2. Cement Stabilization. If required, cement stabilization of subgrade shall be in accordance with Section 02242, Cement Stabilization of Materials in Place.
- D. Topsoil. Furnish topsoil material that is capable of sustaining vegetation. All topsoil material and the source from which it comes shall meet with the approval of the Engineer or the designated representative of the Engineer and shall be obtained from roadway, borrow, channel and/or structural excavations. When acceptable to the Engineer or the designated representative of the Engineer, the top four (4) inches of roadway, channel and structural excavations shall be stripped and separately stockpiled for later use as topsoil. When the Engineer or the designated representative of the Engineer determines that the top four (4) inches of roadway, channel and/or structural excavations do not provide the necessary material for sustaining vegetation OR if there is insufficient topsoil material, then topsoil shall be obtained from an approved borrow source. All existing large vegetation or other unsuitable material shall be removed from topsoil before it is stockpiled or transported.

PART 3 EXECUTION

3.01 PREPARATION

- A. Rights-of-Way. The necessary rights-of-way for the work will be provided by the Owner. The Contractor shall confine his construction operations to the immediate vicinity of the location shown on the plans, and shall use due care in placing construction tools, equipment, excavated materials, and paving materials and supplies, so as to cause the least possible damage and interference with traffic. The placing of such tools, equipment, and materials shall be subject to the approval of the Engineer or the designated representative of the Engineer.
- B. Work Within Highway Right-of-Way. All work performed, and all operations of the Contractor, his employees, or his subcontractors, within the limits of highway right-of-way shall be in conformity with the requirements of the highway authority owning, or having jurisdiction over, the right-of-way in each case.
- C. Bench Marks, Stakes, and Monuments. No work shall be performed that will destroy or disturb any benchmarks or property line monuments. In the event that it becomes necessary to remove any benchmark or property line monument in the performance of the work, the Contractor shall notify the Engineer or the designated representative of the Engineer prior to removal so that such points may be referenced in preparation for replacement. All costs to reestablish disturbed or destroyed benchmarks and property line monuments shall be the responsibility of the Contractor.
- D. Clearing and Grubbing. All trees and vegetation, except such trees and vegetation that are to remain in place as designated by the Engineer or the designated representative of the Engineer, shall be removed from the site. Trees and other vegetation to be left standing shall be protected from damage by the erection of barriers or by such other means, as the circumstances require, as directed and approved by the Engineer or the designated representative of the Engineer. Clearing operations shall be conducted so as to prevent damage by falling trees to trees that are to be left standing, to existing structures and equipment, and to structures that are under construction. Perform clearing operations so as to provide safety for employees and other bystanders. All roots, stumps and other debris shall be removed to a depth of two (2) feet below the lowest elevation of an excavation or below the existing surface in the area to receive embankment. All depressions resulting from these removals shall be filled with suitable materials and compacted to make the surface conform to the surrounding grounds.
- E. Protection and Maintenance of Public and Private Property. The Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground facilities uncovered or otherwise affected by the construction work performed by him. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, and other surface structures affected by the construction operations in connection with the performance of the contract, together with all sod and shrubs in yards and parking areas removed or otherwise

damaged, shall be restored to the original condition thereof as determined and approved by the Engineer or the designated representative of the Engineer. All replacements of such underground construction and surface structures, or parts thereof, shall be made with new materials conforming to the requirements of these specifications or, if not specified, as approved by the Engineer or the designated representative of the Engineer. The Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property facilities, regardless of location or character, which may be caused by moving, hauling, or otherwise transporting equipment, materials or men to or from the work or any part or site thereof, whether by him or his subcontractor(s). The Contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property or facility concerning its repair or replacement or payment of costs incurred with said damage. All fire hydrants and water control valves shall be kept free from obstructions and available for use at all times.

- F. Erosion Control. The Contractor shall conform to the provisions described in technical specification Section 01560, Storm Water Pollution Prevention AND any additional provisions for erosion control that may be shown on the plans or described in the technical specifications. All erosion control and storm water pollution prevention measures shall begin at the onset of the project and be maintained throughout the duration of the work until the disturbed area is stabilized at which time they shall be removed unless specifically required otherwise.
- G. Traffic Control. Provide and maintain traffic control in conformity with the applicable statutory requirements and, within highway right-of-way, as required by the authority having jurisdiction thereover. Adequate traffic control devices shall be in place prior to removal of any existing control devices, construction equipment move-in or any work within public right-of-way. Traffic control shall be in accordance with the Texas Manual on Uniform Traffic Control Devices. The Contractor shall notify all emergency service providers in the event of a road closure or other activity that may impair the emergency travel of the emergency service provider.
 - 1. Maintenance of Traffic. Conduct work in a manner that will interfere as little as possible with public travel, whether vehicular or pedestrian, whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private. The Contractor shall, at his own expense, provide and maintain suitable and safe bridges, detours, or other temporary structures for the accommodation of public and private travel and shall give reasonable notice to owners of private drives before interfering with them; provided however, that such maintenance of traffic will not be required at any point where the Contractor has obtained permission from the owner and tenant of the private property involved, to obstruct traffic at any designated point thereon and for the duration of whatever period of time as may be agreed on.

2. Barricades, Lights, and Signs. All streets, roads, highways and other public thoroughfares that are closed to traffic shall be protected by means of effective barricades that are equipped with acceptable warning signs. Barricades shall be located at the nearest intersection, public highway or street on each side of the blocked section. All open trenches or other excavations shall be provided with suitable barriers, signs, and warning lights to the extent that adequate protection is provided to the public. Obstructions, such as material piles and equipment, shall be provided with similar barriers, signs and warning lights. All barricades and obstructions shall be illuminated by means of warning lights. Materials stored upon or alongside public streets and highways shall be so placed, and the work conducted at all times, as to cause minimum obstruction and inconvenience to the traveling public.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. General. Perform all excavations, construction of embankments, backfilling, compacting and subgrade preparation to the lines, grades, and densities shown on the plans. All work performed under this specification shall be completed in strict accordance to the rules and regulations of the Federal Occupational Safety and Health Act.
- B. Excavation. All excavations for pavement and associated structures shall be held to the minimum required for the proper performance of the work. Blasting is hereby strictly prohibited to aid in the performance of the excavation work. The Contractor is expected to familiarize himself completely with the type of excavation to be performed and the type of materials to be handled. There will be no consideration of claims for extra compensation due to encountering difficult or unstable material in the excavations to be made.
- C. Subgrade Preparation. Uniformly place and spread approved subgrade material which has been obtained from a borrow source and compact to the required thickness using approved compacting equipment. Subgrade material which is existing or is hauled in from another source, and is not to be cement or lime stabilized, shall be within 2% of optimum moisture content and shall be compacted to 95% Standard Proctor as determined by ASTM D 698. Compaction of subgrade that is to be cement stabilized shall be in accordance with Section 02242, Cement Stabilization of Materials in Place. Compaction of subgrade that is to be lime stabilized shall be in accordance with Section 02244, Lime Stabilization of Materials in Place.
- D. Embankments. No embankment work shall be performed without the approval of the embankment material by the Engineer or the designated representative of the Engineer. Unless otherwise shown on the plans, embankments shall be constructed

in successive layers for the full width of the cross section and in appropriate lengths that are suitable for the sprinkling and compaction methods being used. Maximum depth of layers before compaction shall be six (6) inches. Form each successive layer of embankment by utilizing equipment that will evenly spread and distribute the piles or windrows of material that have been placed from excavations or hauling equipment. All embankment material shall be placed by blading or some other approved similar method. All clods and lumps shall either be removed or broken and then subsequently blended into the embankment material by blading, harrowing or other approved method such that each layer is of uniform density. When necessary, the Contractor shall evenly sprinkle each layer of embankment material to obtain the required moisture content that will allow for maximum compaction. Contractor shall be responsible for obtaining a uniform moisture content within 2% of optimum moisture, unless indicated otherwise on the plan, throughout each successive layer of embankment material by using such methods as may be necessary. Each layer of embankment

shall be compacted to 92% Standard Proctor as determined by ASTM D 698 unless indicated otherwise on the plans.

- E. Backfilling and Compacting. No backfilling and compacting around any pavement or associated structures shall be done without the prior approval of the Engineer or the designated representative of the Engineer. Place and compact approved backfill at all required locations including behind curbs and around inlets when necessary. Unless otherwise shown on the plans, backfill shall be placed and compacted in maximum eight (8) inch layers to the density of the surrounding earth or the density shown on the plans.
- F. Grading. Upon the completion of the pavement, grade the surrounding earth and ditches to the finished line and grade as shown on the plans. Evenly spread the stockpiled topsoil over all embankments, berms, slopes and surrounding grounds. The topsoil shall be harrowed and dragged so as to break up all lumps in preparation of sodding or seeding. Unless specifically shown on the plans, drainage shall be away from all structures and slabs.

3.03 REPAIR / RESTORATION

The Contractor shall correct any erosion of embankments or other areas during the progress of construction and up to the final stabilization of the entire project.

3.04 FIELD QUALITY CONTROL

Placement of any backfill or embankment materials shall not be done without the prior approval of the Engineer or the designated representative of the Engineer. Contractor is responsible for notifying the Engineer or the designated representative of the Engineer prior to starting backfill operations. Notification will be such that will allow the Engineer

or the designated representative of the Engineer sufficient time to inspect the excavated areas prior to the beginning of backfill operations. Density testing will be performed by the Owner or its designated representative. Contractor shall pay for failed tests and Owner will pay for passing tests.

3.05 ADJUSTING / CLEANING

Dispose of excess or unsuitable excavated materials at a location away from the project site limits and in a legal manner. Upon approval of the Engineer or the designated representative of the Engineer, disposal of such materials may be within the site limits.

END OF SECTION

SECTION 02224

PIPELINE INSTALLED BY BORING

PART 1 GENERAL

1.01 SUMMARY

This section pertains to furnishing all labor, materials, equipment, supervision, and tools for the installation of pipe within an encasement pipe or within a bored or tunneled hole without encasement. Steel encasement pipe shall be installed at the locations designated on the plans.

1.02 RELATED SECTIONS

Section 02222 Excavation, Trenching, and Backfilling for Utilities
Section 02229 Excavation Safety

1.03 MEASUREMENT AND PAYMENT

Unless otherwise indicated on the Bid Form, the measurement and payment for the work specified in this Section shall be as follows:

Casing pipe installed by bore, including carrier pipe, and the construction of a bored hole for pipe without casing, including the pipe within the bored hole, shall be measured by the linear foot. Payment shall be made at the unit price bid for all labor, materials, equipment, etc. required for the completed casing with carrier pipe or carrier pipe installation by bore. Where installation of the casing pipe is allowed by open cut, payment shall be made at the unit price bid for casing installed by open cut, including the carrier pipe. When required at railroad crossings, no separate payment shall be made for any cathodic protection when required for the carrier pipe or casing.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society of Testing and Materials
AWWA	American Water Works Association

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Casing Pipe. Uncontaminated used welded steel pipe may be used for casing as long as it meets the minimum thickness and no indentations exceed 1/2". The inside surface of the casing shall be free from burrs or other projections which could damage the carrier pipe. Field cut casing pipe ends shall be ground smooth. Encasement pipe shall be welded steel pipe with the wall thickness as shown on the plans. If a minimum wall thickness is not shown on the plans, casing shall comply with the following:

MINIMUM WALL THICKNESS	DIAMETER OF CASING PIPE
1/4" (0.2500")	12" or less
5/16" (0.3125")	over 12" - 18"
3/8" (0.3750")	over 18" - 22"
7/16" (0.4375")	over 22" - 28"
1/2" (0.5000")	over 28" - 34"
9/16" (0.5625")	over 34" - 42"
5/8" (0.6250")	over 42" - 48"

1. The criteria for casing shown in the above table are intended to be minimum requirements only and shall be applicable unless more stringent requirements are designated on the plans or on the Bid Form. The Contractor shall be responsible for insuring that the casing materials are of sufficient strength for the installation method he chooses and for the soil conditions encountered. Casing shall be clean inside and outside with exception of minor rust and scale.
 2. In railroad right-of-ways, encasement pipe shall be ASTM A36 steel (minimum yield strength of 36,000 psi), unless specifically stated otherwise in the permit issued by the Railroad Company.
- B. Casing Spacers/Insulators. Casing spacers shall provide electrical insulation between the carrier pipe and casing. They shall be made of high density polyethylene or other approved material. The casing spacers shall be "RACI" as manufactured by Public Works Marketing, Inc., or approved equal. The spacer

shall be sized such that the bell of the carrier pipe will be held a minimum of one fourth (1/4) of an inch from the bottom of the casing, and the spacer O.D. shall not be less than the casing I.D. minus three fourths (3/4) of an inch. The design and type of spacer shall be suitable for the type, size, and weight of the carrier pipe and its contents. Insulators shall dielectrically insulate the carrier pipe in the casing pipe and shall adequately support the pipe under all working installation conditions.

- C. Casing Seals: Casing seals shall be manufactured rubber seals for the size of casing specified and shall be configured so they can be fastened to the casing and carrier pipe with stainless steel bands.
- D. Cathodic Protection: When required by railroad or TxDOT permit, steel pipes and/or casings shall be protected from corrosion by cathodic protection. This shall include a buried 32-pound packaged magnesium anode, #12 lead wire, a Fink test station, and a test station marker.

PART 3 EXECUTION

3.01 PREPARATION

Permits for pipelines installed within State, Railroad and County right-of-way shall be obtained by the Owner. All work performed within State, Railroad and County right-of-way shall be completed according to the requirements contained in the permits of the appropriate agency or company. For installation in railroad owned property, the Contractor shall first determine and then obtain all necessary insurance to the minimum coverage requirements, as required by the railroad, in order to perform work within the railroad property. The Contractor shall also, when required, execute any Agreements with the railroad to perform work within its right-of-way.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. Casing or Carrier Pipe by Bore or Tunneling. Installation by bore or tunneling of casing or carrier pipe shall be true to line and grade. The Contractor shall conform to the permit requirements of the appropriate Agency as to the construction methods used. After pipeline installation, immediate backfilling shall be performed on all pits and trenches excavated for the boring operation. For excavations performed by tunneling and jacking, the excavation for the underside of the pipe for at least one third of the circumference of the pipe shall conform to the contour and grade of the pipe.
- B. Grout Around Casing or Carrier Pipe. If the bored or tunneled hole exceeds the outside diameter of the casing pipe or the outside diameter of the carrier pipe barrel by more than one inch, the space between the outside wall of the casing and the excavation shall be completely filled with grout consisting of 1 part of portland

cement to 3.5 parts of clean sand by volume. This requirement does not apply to carrier pipes installed by bore under trees unless the hole exceeds the diameter of the pipe bell by more than one inch.

C. Installing Carrier Pipe in Casing.

1. Casing spacers shall be installed on the carrier pipe. The spacers shall be installed in accordance with the pipe manufacturer's recommendations to prevent the pipe from bearing on the bells, to position the pipe within the casing, and to prevent floating within the casing if the casing is filled with water. Casing spacers shall be installed such that the distance between the spacers does not exceed the maximum distance recommended by the manufacturer of the carrier pipe and by the spacer manufacturer dependent on potential weight of the carrier pipe full of water, except the distance between spacers shall not exceed seven (7) feet. A casing spacer shall be installed within one (1) foot of the end of each joint of nonwelded carrier pipe, and two adjacent spacers shall be installed on the carrier pipe at each end of the casing such that the last spacer is within one (1) foot of the end of the casing.
2. Lubricants such as flax soap or drilling mud may be used when installing the carrier pipe. No petroleum products shall be used for this purpose. After installation is completed on the carrier pipe, the ends of the casing shall be sealed with a mechanical casing seal.

C. Installing Split Steel Casing on Existing

Carrier Pipe

1. Installation of split steel casing shall follow the same general procedures for installing carrier pipe in casing, except that the casing shall be rejoined with a continuous weld, thereby making the steel casing water tight.

END OF SECTION

SECTION 02229

EXCAVATION SAFETY

PART 1 GENERAL

1.01 SUMMARY

This section covers the minimum requirements and responsibilities of the Contractor for excavation safety.

1.02 MEASUREMENT AND PAYMENT

The cost for performing the safety requirements set forth herein shall be paid separately as stipulated on the Bid Form. Trench safety shall be paid for on a linear foot basis according to the depth of cut as described on the Bid Form. Safety for open excavations that are not considered trenches shall be paid for separately as indicated on the Bid Form. The bid price(s) for excavation safety shall include all labor, materials, services, and equipment necessary to perform the work.

1.03 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

OSHA Occupational Safety and Health Administration, 29CFR, Part 1926

1.04 SYSTEM DESCRIPTION

The Contractor shall shore or otherwise protect all excavations from cave-ins, protect employees from exposure to vehicular traffic, falling loads, hazardous atmospheres, water accumulation and unstable structures in and adjacent to excavations and provide acceptable means of access to and egress from excavations. Notwithstanding these suggestions, the Contractor is solely responsible for the safety of his employees and the general public as they interface with this construction project.

1.05 SUBMITTALS

The Contractor shall furnish an excavation or trench safety plan for any excavation that exceeds twenty-foot (20') depth and the plan shall be properly designed and certified by a Texas licensed professional engineer that is duly qualified to perform the design of such plan.

1.06 QUALITY ASSURANCE

- A. Excavation safety system shall meet the current standards established by OSHA, 29CFR, Part 1926, Subpart P-Excavations.
- B. Any construction not in accordance with OSHA regulations may not be eligible for payment and delays in construction to bring the project into OSHA regulations will not be the responsibility of the City of Magnolia or their representatives.

1.07 PROJECT/SITE CONDITIONS

Contractor shall develop and implement an excavation safety program based on the actual conditions encountered on the project.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

Contractor has sole responsibility for providing an adequate excavation safety system. The Contractor agrees that neither the City of Magnolia, the Engineer, or the designated representative of the Engineer has such responsibility for providing or verifying an adequate excavation safety system. The Contractor shall not rely on the City of Magnolia nor any of their representatives for inspection, design, supervision, construction or any other aspect of excavation safety.

END OF SECTION

SECTION 02230

FLEXIBLE BASE

PART 1 GENERAL

1.01 SUMMARY

This section covers construction of a foundation course for a pavement surface course or other base courses. The base shall be composed of either caliche, crushed stone, gravel, iron ore topsoil, shell, etc., and shall be constructed in one or more courses to the lines and grades shown on the plans. All construction procedures and materials shall be in accordance with TxDOT Item 247.

1.02 RELATED SECTIONS

Section 02223 Excavation, Backfilling and Compacting for Pavement

1.03 MEASUREMENT AND PAYMENT

Unless specifically stated otherwise on the Bid Form, the accepted materials and work described in this Section will be measured by the square yard of the compacted in place flexible base to the thickness shown on the plans and/or listed on the Bid Form. The price bid for the work described in this Section shall be full compensation for furnishing all materials; for delivery on the road; for spreading, shaping, compacting, and finishing; and for all manipulations, labor, tools and incidentals necessary to complete the work.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

TxDOT Texas Department of Transportation Standard Specifications for
Construction of Highways, Streets and Bridges

1.05 SUBMITTALS

Submit certification from supplier or manufacturer that base material meets the requirements of this section.

1.06 QUALITY ASSURANCE

Provide samples of flexible base material delivered for incorporation into the project for testing by the Owner or its designated representative. Contractor shall pay for failed tests and the Owner shall pay for passing tests.

1.07 DELIVERY, STORAGE, AND HANDLING

Handle and store base material to prevent segregation of aggregate.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

The materials will consist of crushed or uncrushed coarse aggregate mixed with any approved binding material necessary to meet the specified requirements.

- A. Material Types. Type A material shall consist of broken or crushed aggregate. Type B material shall consist of gravel aggregate. Type C material shall consist of iron ore topsoil. Type D material shall consist of shell aggregate with sand admixture. Type E material shall consist of shell aggregate with sand and caliche admixture. The Contractor may use any one of these types, unless the plans specify a particular one to be used. All material used must meet the requirements specified in the test limitations tabulation.
- B. Grades. The base material shall consist of Grades 1 or 2, unless specified otherwise on the plans. All grades shall meet the requirements in the specification test limit tabulation, according to standard Texas Department of Transportation Laboratory test procedures. When pilot grading is designated in the plans, the City of Magnolia, Engineer or the designated representative of the Engineer will specify the grading and allowable tolerances to be achieved during production. When necessary, the Engineer or the designated representative of the Engineer may vary the pilot grading to insure the base material produced shall meet the physical requirements specified.
- C. Physical Requirements For Flexible Base Materials. The physical properties for flexible base material shall conform to the following:

TYPES Grade 1:

(Triaxial Class 1) Min.
compressive strength,
psi: 45 to 0 psi lateral
pressure and 175 at 15 psi
lateral pressure

Grade 2:

(Triaxial Class 1 to 2.3)
Min. compressive strength,
psi: 35 to 0 psi lateral
pressure and 175 at 15 psi
lateral pressure

TYPE A Retained on

	<u>Square Sieve</u>	<u>Percent</u>
Crushed	1-3/4"	0
or Broken	7/8"	10 - 35
Aggregate	3/8"	30 - 50
	No. 4	45 - 65
	No. 40	70 - 85
	Max. LL	40
	Max. PI	12
	*Max Wet Ball Mill	40

Retained on

	<u>Square Sieve</u>	<u>Percent</u>
	1-3/4"	0 - 10
	No. 4	45 - 75
	No. 40	60 - 85
	Max. LL	45
	Max. PI	15
	*Max Wet Ball Mill	50

*Unless otherwise shown on plans, the maximum increase in material retained on the number 40 sieve resulting from the Wet Ball Mill Test shall not exceed 20.

TYPE B**Retained on**

	<u>Square Sieve</u>	<u>Percent</u>
Gravel	1-3/4"	0 - 10
Aggregate	No. 4	30 - 75
	No. 40	70 - 85
	Max. LL	45
	Max. PI	15

TYPE C**Retained on**

	<u>Square Sieve</u>	<u>Percent</u>
Iron Ore	2-1/2"	0
Topsoil	No. 40	50 - 85
	Max. LL	45
	Max. PI	15

TYPE D**Retained on**

	<u>Square Sieve</u>	<u>Percent</u>
Sand-Shell	1-3/4"	0 - 10
	No. 4	45 - 65
	No. 40	50 - 70
	Max. LL	45
	Max. PI	15

TYPE E**Retained on**

	<u>Square Sieve</u>	<u>Percent</u>
Shell with	1-3/4"	0
Sand and	No. 40	40 - 65
Caliche	Max. LL	45
Admixture	Max. PI	15

1. Materials with plasticity greater than those specified may be accepted if the PI is lowered

by addition of lime. The lime for this purpose shall be furnished at the Contractor's expense.

2. The Engineer or the designated representative Engineer may accept the material, provided not more than two (2) out of ten (10) consecutive gradation tests performed are outside of the specified limit on any individual or combination of sieves by no more than five (5) percent and where no two (2) consecutive tests are outside the specified limits.
3. The Engineer or the designated representative of the Engineer may accept the material provided not more than two (2) out of ten (10) consecutive plasticity index samples tested are outside of the specified limit by no more than two (2) points and where no two consecutive tests are outside the specified limits.

- D. Contractor shall supply pneumatic and/or steel wheel rollers of sufficient weight to apply a minimum compression of 325 pounds per linear inch of wheel width. Rolling shall start longitudinally at the sides and proceed toward the center, overlapping on successive trips to provide a uniform final surface of the base. Operate rollers at a velocity that optimizes compaction.

2.02 SOURCE QUALITY CONTROL

- A. The material shall be secured from the sources approved by the Engineer or the designated representative of the Engineer. The pits which the acceptable material to be used shall be taken from, shall be opened up to immediately expose the vertical faces of all of the strata and the material shall be secured in successive vertical cuts extending through all exposed strata, unless otherwise directed.

- B. Testing.

1. Testing of the flexible base materials shall be in accordance with the following Texas Department of Transportation standard laboratory test procedures:

Preparation for Soil

Moisture Content	Tex-103-E	
Liquid Limit		Tex-104-E
Plastic Limit		Tex-105-E
Plasticity Index	Tex-106-E	
Sieve Analysis		Tex-110-E
Moisture Density Determination		Tex-113-E
Wet Ball Mill	Tex-116-E	
Triaxial Test		Tex-117-E (part II)

2. Job control samples for testing Soil Constants, Gradation and Wet Ball Mill shall be completed prior to the compaction operations, unless otherwise specified.

3. Job control samples for triaxial tests shall be taken from the production stockpile and/or from the temporary stockpile on site, unless directed otherwise by the City of Magnolia, Engineer or the designated representative of the Engineer.

PART 3 EXECUTION

3.01 PREPARATION

The subgrade shall be completed within specification and approved by the Engineer or the designated representative of the Engineer prior to placement of the base material.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. The base material shall be placed in lifts not exceeding 8-inches compacted thickness. The material shall be delivered in uniform capacity on approved vehicles. The Contractor shall insure that the required amount of the specified material is uniformly placed for each one hundred foot (100-ft) station. The material placed upon the subgrade shall be spread and shaped on the same day, unless it is impractical to do so or otherwise directed by the Engineer or the designated representative of the Engineer. If it is impractical to spread the material during the first twenty-four (24) hour period, due to poor weather or an unforeseen circumstance, then the material must be scarified and spread as directed by the Engineer or the designated representative of the Engineer. The material shall meet the specified moisture content, and then be manipulated, bladed, rolled and shaped to achieve the sections required on the plans. Areas of segregated coarse and fine material shall be corrected or removed and replaced with well-graded material.
- B. After the material is spread and shaped, it may be essential or desirable for additional binder material to be added. The additional binder will be furnished and applied as directed by the Engineer or the designated representative of the Engineer. The binder material shall be carefully and evenly incorporated with the material in place by scarifying, harrowing, brooming, or other approved methods. The course shall be rolled and sprinkled as required in order to achieve a uniform compaction. The shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and in conformity with the typical sections on plans and to the established lines and grades.
- C. The base course shall be kept open for all traffic, unless otherwise directed by the Engineer or the designated representative of the Engineer. The surface shall be kept free from irregularities and ruts by sprinkling and blading.
- D. Compact flexible base to 95% Modified Proctor density as determined by ASTM D-1557 at a moisture content of 0% to +3% above optimum unless specifically shown otherwise on the plans.

3.03 REPAIR / RESTORATION

In areas on which surface pavement is to be placed, any deviation over three-eighths (3/8) inch in sixteen (16) feet shall be corrected by loosening, adding or removing material, reshaping, and re-compacting by rolling and sprinkling. The surface course shall be checked for deviations by using a straightedge or template. All depressions, irregularities, or weak spots that develop shall be corrected by scarifying the areas, adding approved material required, reshaping and re-compacting by rolling and sprinkling. Additional base courses may be added once the preceding course has been compacted, cured and is approved by the Engineer or the designated representative of the Engineer.

3.04 FIELD QUALITY CONTROL

Allow access to completed portions of flexible base for field density testing by nuclear method.

END OF SECTION

SECTION 02240

CEMENT STABILIZED SAND

PART 1 GENERAL

1.01 SUMMARY

This section provides the requirements for use of cement stabilized sand as a utility bedding or backfill material or for structural backfill.

1.02 RELATED SECTIONS

Section 02222 Excavation, Trenching and Backfilling for Utilities

1.03 MEASUREMENT AND PAYMENT

There will be no separate measurement or payment for work performed under this section unless otherwise shown on the Bid Form.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety :

ASTM American Society of Testing Materials

1.05 SYSTEM DESCRIPTION

Provide sand - cement mixture that will produce a minimum unconfined compressive strength of 100 pounds per square inch (psi) in forty-eight hours (48 hrs).

1.06 SUBMITTALS

Upon request of the Engineer or the designated representative of the Engineer, the Contractor or his supplier will furnish samples of the sand and cement for testing before and/or during project construction. Samples shall be submitted three (3) days prior to stabilized sand being delivered to the project site.

1.07 QUALITY ASSURANCE

If the material source is changed during project construction, the Engineer or the designated representative of the Engineer shall be notified and new samples shall be submitted if requested.

1.08 DELIVERY, STORAGE AND HANDLING

Material not in place within three (3) hours of mixing will be rejected and shall be removed from the project site.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

A. Sand. Use clean durable sand that conforms with the following:

1. Deleterious Materials.
 - (a) Clay lumps, ASTM C-142; less than 0.5 percent (0.5%).
 - (b) Lightweight pieces, ASTM C-123; less than five percent (5.0%).
 - (c) Organic impurities, ASTM C-40; shall not show a color darker than the standard color.
 - (d) Other deleterious materials such as coal, shale, coated grains of soft flaky particles; less than two percent (2.0%).
2. Plasticity index shall be four (4) or less when tested in accordance with ASTM D-43 and ASTM D-424.
3. Gradation Requirements.

<u>Sieve Designation</u>	<u>% Retained</u>
3/8-inch sieve	0%
1/4-inch sieve	0% - 5%
10-mesh sieve	5% - 35%
20-mesh sieve	15% - 55%
40-mesh sieve	35% - 85%
60-mesh sieve	60% - 95%
100-mesh sieve	80% - 97.5%
200-mesh sieve	95% - 100%
270-mesh sieve	100%
4. Color test ASTM C40. Color not darker than standard color.

B. Portland Cement. Furnish Portland cement that conforms with ASTM C-150, Type 1.

C. Water. Water shall be reasonably clean and free from injurious amounts of oil,

acid, alkalies, salt, organic matter, or other deleterious material. Water shall meet the approval of the City of Magnolia, Engineer or the designated representative of the Engineer.

PART 3 EXECUTION

3.01 PREPARATION

Add not less than 1-1/2 sacks of Portland cement to stabilize one cubic yard (1 cu.yd.) of sand mixture. Mix thoroughly in an approved pug-mill type mixer or by another method specifically approved by the Engineer or the designated representative of the Engineer. Batch tickets shall be stamped with the time of loading.

3.02 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

A. Bedding

1. Place cement-sand in a trench or excavation prepared for utility pipe to the depth shown on the drawings.
2. After bedding material is in place, set pipes in position to grade.
3. Add additional cement-sand material around pipe, filling to at least twelve inches (12") above pipe crown. Place cement-sand material at optimum moisture content, and in layers not to exceed six-inches (6") measured loose.
4. Compact with mechanical hand tamps to at least 92 percent (92%) of Standard Proctor Density, ASTM D-698 unless specifically designated otherwise on the plans.

B. Foundations

Use cement stabilized sand for stabilizing below the foundation for pre-cast manholes, inlets or concrete structures.

C. Backfill

1. When required, place cement-sand in utility trenches as backfill for lines under existing or future pavement.
2. Place cement-sand material at optimum moisture content in layers not to exceed twelve inches (12"), measured loose.

3. Compact with mechanical hand tamps to at least 92 percent (92%) of Standard Proctor Density, ASTM D-698 unless specifically designated otherwise on the plans.

3.03 FIELD QUALITY CONTROL

Allow access to completed portions of bedding or backfill for field density testing by the Owner using the nuclear method. Contractor shall pay for failed tests and Owner will pay for passing tests.

END OF SECTION

SECTION 02244

LIME STABILIZATION OF MATERIALS IN PLACE

PART 1 GENERAL

1.01 SUMMARY

This item specifies the requirements for the addition and mixing of lime with subgrade materials and compacting the mixed subgrade material.

1.02 MEASUREMENT AND PAYMENT

Unless otherwise indicated on the Bid Form, the measurement and payment for the work specified in this Section shall be as follows:

Lime stabilization of subgrade shall be measured and paid for by square yard of surface area to the lines shown on the plans and to the depth and at the percentage of lime (by dry solids weight) specified. The unit price bid per square yard shall include full compensation for supplying the lime, for all mixing, shaping, compacting, and for all incidentals necessary to complete the work.

1.03 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

AASHTO	American Association of State Highway and Transportation Officials
TxDOT	Texas Department of Transportation - Standard Specifications for Construction of Highways, Streets and Bridges

1.04 SYSTEM DESCRIPTION

Contractor shall provide a completed course of treated subgrade material containing a consistent lime mixture, having no loose or segregated areas, of uniform density and moisture, well compacted to its full depth, and having a smooth surface adequate for placing additional subbase, base or surface courses. The Contractor shall be responsible for regulating the sequence of the work, for processing a sufficient quantity of material to provide a full depth stabilized subgrade as shown on the plans, using the appropriate amount of lime, maintaining the work, and performing any reworking of the courses if necessary to meet the requirements.

1.05 SUBMITTALS

Weight certificates from certified public scale for lime delivered in trucks.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Hydrated lime shall be stored and handled in closed, waterproof containers until immediately before distribution. Hydrated lime bags must be stored in waterproof buildings and protected against ground dampness. If storage bins are used, they must be completely enclosed.
- B. If lime is delivered in bags, then each bag must have the manufacturer's certified weight. Bags that vary more than five percent (5%) from the Manufacturer's weight can be rejected. The average weight of the bags in any shipment, as calculated by weighing fifty (50) bags at random, shall not be less than the manufacturer's certified weight.
- C. If lime is furnished in trucks, each truck shall have the certified weight from a certified public scale or the Contractor must supply a set of standard platform truck scales or hopper scales at a location approved by the City of Magnolia, Engineer or the designated representative of the Engineer. The scales shall meet the criteria of TxDOT Item 520.

1.07 PROJECT / SITE CONDITIONS

Mixing of the lime-treated subgrade shall not be performed when the atmospheric temperature is forty (40) degrees Fahrenheit and falling, or when the weather indicates that within the next twenty-four (24) hours the weather will fall below forty (40) degrees Fahrenheit. Mixing shall also not occur when it is foggy or raining, or when the soil or subgrade is frozen.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Lime. The lime shall meet the requirements of TxDOT Item 264 for Type A - Hydrated Lime, Type B - Commercial Lime Slurry or Type C - Quicklime, Grade DS or S. Type C - Grade S, Quicklime shall not be used for dry placing.
- B. Water. Water shall be reasonably clear without oil, salt, acid, alkali, organic matter, and other injurious substances. Water shall be tested in accordance with AASHTO T-26. The Engineer or the designated representative of the Engineer may elect to omit the test on the water if it is from a commonly known potable water source such as a public water supply system. All water shall meet with the approval of the Engineer or the designated representative of the Engineer regardless of the source.

- C. Equipment. The equipment necessary for performing the work shall be on the project site prior to the beginning of construction operations. All machinery, tools and equipment shall be maintained in acceptable working condition. The Contractor shall conduct his operations in a workmanlike manner and shall use approved methods to perform the work.

PART 3 EXECUTION

3.01 PREPARATION

The subgrade shall be shaped to the sections, lines and grades shown on the plans, prior to applying lime.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. Lime may only be spread on areas where the mixing operations will be completed on the same working day. The application and mixing of lime with the material shall be accomplished by either "Dry Placing" or "Slurry Placing". Hydrated lime that has been exposed to open air for six (6) hours or more or to excessive loss due to washing or blowing will not be accepted for payment.
1. Dry Placing. Spreading of the lime shall be accomplished by an approved spreader or by bag distribution at the rates specified on the plans. The lime shall be distributed at a uniform rate and in such a way as to minimize the scattering by wind. No application of lime shall occur when the wind conditions are in such a manner that blowing lime becomes objectionable to traffic and adjacent property owners. Quick lime may be spread by approved distributor or by motorized grader to achieve uniform distribution. The material shall be sprinkled with approved water until the proper moisture content has been established.
 2. Slurry Placing. The lime shall be mixed with approved water in approved distributor trucks and distributed as a thin water suspension or slurry. The required rate of lime distribution shall be achieved by successive passes over a measured area until the proper lime content and moisture have been obtained. On steep slopes, prevent runoff of slurry.
- B. Mixing. The subgrade material, lime and approved water shall be thoroughly mixed and blended by an approved pulverizing mixer to the depth specified on the plans. Mixing shall proceed until a homogenous, friable mixture is obtained such that after removal of non-slaking material, 100 percent of the material passes the 1-3/4" sieve and a minimum of 85 percent passes the 3/4" sieve. If Type C - Grade DS Quicklime is used, moist cure the material for two (2) to seven (7) days and remix to the above required gradation.

- C. Compaction. The mixture shall be compacted after final mixing and not later than three (3) calendar days after final mixing unless approved by the Engineer or the designated representative of the Engineer. The material shall be aerated or sprinkled with approved water as necessary in order to achieve optimum moisture. If the total thickness of the material cannot be mixed in one mixing, then the previously mixed material shall be bladed to a windrow from the area to be treated and the lime mixing for the next layer will begin. The first layer of treated material shall not be mixed with the underlying material. Compaction of the mixture shall begin at the bottom and continue for the entire depth until a uniform compaction to not less than 95% of Standard Proctor Density from 0% to 3% above optimum moisture content as determined by ASTM D-698 is achieved or to the density shown on the plans.
- D. Finishing, Curing and Preparation for Surfacing. After the final layer or course of subbase or base has been compacted, it shall be brought to the required lines and grades in compliance with the typical sections. Completed sections shall be finished and rolled with a pneumatic roller or other suitable roller light enough to prevent hair cracking. Moist curing for the completed section shall be a minimum of seven (7) days before any other course is placed or traffic is permitted unless otherwise approved by the Engineer or the designated representative of the Engineer. Moist curing shall be accomplished by sprinkling with water to prevent the surface from drying out or by addition of an asphalt material to retain moisture in the subbase or base. Layers on which the subbase sets up sufficiently to prevent unacceptable damage from traffic, may be opened up to traffic two (2) days after completion. If treated material is required to be sealed or covered by other courses of material, then such seal or course shall be applied within fourteen (14) days after compaction unless otherwise directed by the Engineer or the designated representative of the Engineer.

3.03 REPAIR / RESTORATION

The course surface shall be maintained in a smooth condition, free from ruts and undulations, until it is accepted and/or another course is laid. If the material should lose the required stability, density and finish for any reason, before the work is accepted or the next course is placed, then it shall be recompacted and refinished at the expense of the Contractor

3.04 FIELD QUALITY CONTROL

Allow access to completed portions of work for field density testing by the Owner using the nuclear method. Contractor shall pay for failed tests and Owner will pay for passing tests.

END OF SECTION

SECTION 02244

LIME STABILIZATION OF MATERIALS IN PLACE

PART 1 GENERAL

1.01 SUMMARY

This item specifies the requirements for the addition and mixing of lime with subgrade materials and compacting the mixed subgrade material.

1.02 MEASUREMENT AND PAYMENT

Unless otherwise indicated on the Bid Form, the measurement and payment for the work specified in this Section shall be as follows:

Lime stabilization of subgrade shall be measured and paid for by square yard of surface area to the lines shown on the plans and to the depth and at the percentage of lime (by dry solids weight) specified. The unit price bid per square yard shall include full compensation for supplying the lime, for all mixing, shaping, compacting, and for all incidentals necessary to complete the work.

1.03 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

AASHTO	American Association of State Highway and Transportation Officials
TxDOT	Texas Department of Transportation - Standard Specifications for Construction of Highways, Streets and Bridges

1.04 SYSTEM DESCRIPTION

Contractor shall provide a completed course of treated subgrade material containing a consistent lime mixture, having no loose or segregated areas, of uniform density and moisture, well compacted to its full depth, and having a smooth surface adequate for placing additional subbase, base or surface courses. The Contractor shall be responsible for regulating the sequence of the work, for processing a sufficient quantity of material to provide a full depth stabilized subgrade as shown on the plans, using the appropriate amount of lime, maintaining the work, and performing any reworking of the courses if necessary to meet the requirements.

1.05 SUBMITTALS

Weight certificates from certified public scale for lime delivered in trucks.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Hydrated lime shall be stored and handled in closed, waterproof containers until immediately before distribution. Hydrated lime bags must be stored in waterproof buildings and protected against ground dampness. If storage bins are used, they must be completely enclosed.
- B. If lime is delivered in bags, then each bag must have the manufacturer's certified weight. Bags that vary more than five percent (5%) from the Manufacturer's weight can be rejected. The average weight of the bags in any shipment, as calculated by weighing fifty (50) bags at random, shall not be less than the manufacturer's certified weight.
- C. If lime is furnished in trucks, each truck shall have the certified weight from a certified public scale or the Contractor must supply a set of standard platform truck scales or hopper scales at a location approved by the City of Magnolia, Engineer or the designated representative of the Engineer. The scales shall meet the criteria of TxDOT Item 520.

1.07 PROJECT / SITE CONDITIONS

Mixing of the lime-treated subgrade shall not be performed when the atmospheric temperature is forty (40) degrees Fahrenheit and falling, or when the weather indicates that within the next twenty-four (24) hours the weather will fall below forty (40) degrees Fahrenheit. Mixing shall also not occur when it is foggy or raining, or when the soil or subgrade is frozen.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Lime. The lime shall meet the requirements of TxDOT Item 264 for Type A - Hydrated Lime, Type B - Commercial Lime Slurry or Type C - Quicklime, Grade DS or S. Type C - Grade S, Quicklime shall not be used for dry placing.
- B. Water. Water shall be reasonably clear without oil, salt, acid, alkali, organic matter, and other injurious substances. Water shall be tested in accordance with AASHTO T-26. The Engineer or the designated representative of the Engineer may elect to omit the test on the water if it is from a commonly known potable water source such as a public water supply system. All water shall meet with the approval of the Engineer or the designated representative of the Engineer regardless of the source.

- C. Equipment. The equipment necessary for performing the work shall be on the project site prior to the beginning of construction operations. All machinery, tools and equipment shall be maintained in acceptable working condition. The Contractor shall conduct his operations in a workmanlike manner and shall use approved methods to perform the work.

PART 3 EXECUTION

3.01 PREPARATION

The subgrade shall be shaped to the sections, lines and grades shown on the plans, prior to applying lime.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. Lime may only be spread on areas where the mixing operations will be completed on the same working day. The application and mixing of lime with the material shall be accomplished by either "Dry Placing" or "Slurry Placing". Hydrated lime that has been exposed to open air for six (6) hours or more or to excessive loss due to washing or blowing will not be accepted for payment.
1. Dry Placing. Spreading of the lime shall be accomplished by an approved spreader or by bag distribution at the rates specified on the plans. The lime shall be distributed at a uniform rate and in such a way as to minimize the scattering by wind. No application of lime shall occur when the wind conditions are in such a manner that blowing lime becomes objectionable to traffic and adjacent property owners. Quick lime may be spread by approved distributor or by motorized grader to achieve uniform distribution. The material shall be sprinkled with approved water until the proper moisture content has been established.
 2. Slurry Placing. The lime shall be mixed with approved water in approved distributor trucks and distributed as a thin water suspension or slurry. The required rate of lime distribution shall be achieved by successive passes over a measured area until the proper lime content and moisture have been obtained. On steep slopes, prevent runoff of slurry.
- B. Mixing. The subgrade material, lime and approved water shall be thoroughly mixed and blended by an approved pulverizing mixer to the depth specified on the plans. Mixing shall proceed until a homogenous, friable mixture is obtained such that after removal of non-slaking material, 100 percent of the material passes the 1-3/4" sieve and a minimum of 85 percent passes the 3/4" sieve. If Type C - Grade DS Quicklime is used, moist cure the material for two (2) to seven (7) days and remix to the above required gradation.

- C. Compaction. The mixture shall be compacted after final mixing and not later than three (3) calendar days after final mixing unless approved by the Engineer or the designated representative of the Engineer. The material shall be aerated or sprinkled with approved water as necessary in order to achieve optimum moisture. If the total thickness of the material cannot be mixed in one mixing, then the previously mixed material shall be bladed to a windrow from the area to be treated and the lime mixing for the next layer will begin. The first layer of treated material shall not be mixed with the underlying material. Compaction of the mixture shall begin at the bottom and continue for the entire depth until a uniform compaction to not less than 95% of Standard Proctor Density from 0% to 3% above optimum moisture content as determined by ASTM D-698 is achieved or to the density shown on the plans.
- D. Finishing, Curing and Preparation for Surfacing. After the final layer or course of subbase or base has been compacted, it shall be brought to the required lines and grades in compliance with the typical sections. Completed sections shall be finished and rolled with a pneumatic roller or other suitable roller light enough to prevent hair cracking. Moist curing for the completed section shall be a minimum of seven (7) days before any other course is placed or traffic is permitted unless otherwise approved by the Engineer or the designated representative of the Engineer. Moist curing shall be accomplished by sprinkling with water to prevent the surface from drying out or by addition of an asphalt material to retain moisture in the subbase or base. Layers on which the subbase sets up sufficiently to prevent unacceptable damage from traffic, may be opened up to traffic two (2) days after completion. If treated material is required to be sealed or covered by other courses of material, then such seal or course shall be applied within fourteen (14) days after compaction unless otherwise directed by the Engineer or the designated representative of the Engineer.

3.03 REPAIR / RESTORATION

The course surface shall be maintained in a smooth condition, free from ruts and undulations, until it is accepted and/or another course is laid. If the material should lose the required stability, density and finish for any reason, before the work is accepted or the next course is placed, then it shall be recompacted and refinished at the expense of the Contractor

3.04 FIELD QUALITY CONTROL

Allow access to completed portions of work for field density testing by the Owner using the nuclear method. Contractor shall pay for failed tests and Owner will pay for passing tests.

END OF SECTION

SECTION 02274

RIPRAP

PART 1 GENERAL

1.01 SUMMARY

This section describes the furnishing and placing of riprap of the type and in accordance with details shown on the plans and this section. Types of riprap furnished under this section shall be Concrete Riprap or Grouted Stone Riprap.

1.02 RELATED SECTIONS

Section 03100 CONCRETE FORMWORK
Section 03200 CONCRETE REINFORCEMENT
Section 03300 CAST-IN-PLACE CONCRETE

1.03 MEASUREMENT AND PAYMENT

Materials furnished and work performed under this section will be paid for as indicated on the Bid Form.

1.04 REFERENCES

The applicable provisions of the following shall apply as if written here in their entirety:

ASTM	American Society for Testing and Materials
TxDOT	Texas Department of Transportation - Standard Specifications for Construction of Highways, Streets and Bridges

1.05 DEFINITIONS

Grouted Stone Riprap is defined as stone of the type shown on the plans, or as described in this specification, with voids around the stone filled with grout after all the stone is in place. Concrete riprap is defined as monolithic reinforced concrete of the thickness and with reinforcing as shown on the plans.

1.06 SYSTEM DESCRIPTION

Riprap shall include all earthwork, riprap materials, and concrete finishing as required by the plans and this specification section. The finished product is to provide erosion protection from and velocity dissipation of stormwater flows.

1.07 SUBMITTALS

Submit the following information for the review and approval of the City of Magnolia, Engineer or the designated representative of the Engineer:

- A. Cement. Submit certified test reports for the cement to be used on the project.
- B. Admixtures. Submit brochures, manufacturer's instructions for use, and performance data on all proposed admixtures.

The number of copies of all submittals that are required to be submitted shall be as stipulated by the Engineer or the designated representative of the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Concrete Riprap. Concrete shall be Class B unless otherwise shown on the plans. Wire reinforcement used in Concrete Riprap shall consist of welded wire fabric meeting the requirements of ASTM A185.
- B. Stone Riprap. Unless otherwise shown on the plans, stone for riprap shall meet the following requirements:
 - 1. Riprap stone shall be a durable, natural stone and have a minimum bulk specific gravity of 2.40.
 - 2. Stones shall not be less than 0.33 cubic feet in volume and not less than four (4) inches in their least dimension. The width of the stone shall not be less than twice its thickness. The material may consist of broken up concrete removed under the contract or obtained from other approved sources.
 - 3. A verification test for the size and type of finished riprap stone shall be performed by the Contractor with the Engineer or the designated representative of the Engineer present. The stone shall be stockpiled at the construction site and the Contractor shall give the Engineer or the designated representative of the Engineer 24 hours notice of the verification test.
- C. Grout. Grout shall consist of one (1) part Portland cement, two (2) parts finely graded sand, and sufficient water to provide the desired consistency. Grout shall have a consistency such that the grout will flow into and completely fill all voids. Water in grout shall be from a potable water source that meets the approval of the

Engineer or designated representative of the Engineer.

PART 3 EXECUTION

3.01 PREPARATION

- A. The areas to be protected shall be dressed to the line and grade shown on the plans prior to the placing of riprap. Riprap shall be placed in accordance with the details and to the dimensions shown on the plans, or as established by the Engineer, or as specified herein.
- B. Riprap shall not be placed on embankment areas until the embankment has been compacted to the satisfaction of the Engineer or the designated representative of the Engineer.
- C. No grout shall be placed when the air temperature is below 35-degrees F. The work shall be protected from rapid drying at least three days after placement.
- D. All formwork shall meet the applicable requirements of Section 03100 Concrete Formwork.

3.02 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

A. Concrete Riprap.

All steel reinforcement shall meet the requirements of Section 03200 Concrete Reinforcement.

Bar reinforcement shall be supported properly throughout the placement to maintain its position approximately equidistant from the top and bottom surface of the slab.

If the ground is dry and not consolidated properly, the Engineer may require the entire area to be sprinkled and consolidated before the concrete is placed. All surfaces shall be moist when concrete is placed.

After the concrete has been placed, compacted and shaped to conform to the dimensions shown on the plans, and after it has set sufficiently to avoid slumping,

the surface shall be finished with a wooden float to secure a reasonably smooth surface or broom finished as approved by the Engineer.

Immediately following the finishing operation the riprap shall be cured in accordance with Section 03300 Cast-in-Place Concrete.

B. Grouted Stone Riprap.

The base course of stone shall be bedded well into the ground with their edges in contact. Each succeeding course shall be well bedded into and placed on even contact with the preceding course. The finished surface shall present an even, tight surface true to the line and grades of the plans.

To provide for proper grouting, care shall be taken to prevent earth or sand from filling the spaces between the stones. After the stones are in place, the stones shall be wetted thoroughly and the spaces between the stones shall be completely filled with grout. The surface of the riprap shall be swept with a stiff broom after grouting.

END OF SECTION

SECTION 02242

CEMENT STABILIZATION OF MATERIALS IN PLACE

PART 1 GENERAL

1.01 SUMMARY

This section covers the requirements for treating subgrade by pulverizing, adding cement, mixing, wetting, and compacting the mix to the required density.

1.02 MEASUREMENT AND PAYMENT

Unless otherwise indicated on the Bid Form, the measurement and payment for the work specified in this Section shall be as follows:

Work performed and material furnished for cement stabilization of subgrade shall be measured and paid for by the square yard of surface area of completed and accepted work. The unit price bid per square yard shall include full compensation for preparing the roadbed, furnishing all material, for pulverizing, mixing and sprinkling the cement, compacting, finishing, labor, equipment, and incidentals necessary to complete the work.

1.03 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

ASTM American Society of Testing and Materials
TxDOT Texas Department of Transportation - Standard Specifications for Construction of Highways, Streets
and Bridges

1.04 SYSTEM DESCRIPTION

Contractor shall provide a completed course of treated subgrade material containing a consistent cement mixture having no loose or segregated areas, of uniform density and moisture content, well bound and compacted for its full depth and with a smooth surface suitable for placing subsequent courses. The Contractor shall be responsible for regulating the sequence of his work, for processing a sufficient quantity of material to provide a full depth as shown on plans, using the proper amount of Portland cement, maintaining the work, and reworking of the courses as necessary to meet the requirements.

1.05 SUBMITTALS

Weight certificates/tickets from certified public scale for cement delivered in trucks.

1.06 DELIVERY, STORAGE, AND HANDLING

Adequate storage facilities must be provided to protect the cement on the project from exposure to air and moisture until immediately before it is applied. If storage bins are used, they shall be totally enclosed. Sacked cement shall be stored in watertight buildings.

1.07 PROJECT / SITE CONDITIONS

Cement shall not be placed or mixed when the atmospheric temperature is forty (40) degrees Fahrenheit and falling, but it may be placed and mixed when the atmospheric temperature is thirty-five (35) degrees and rising, if other weather conditions are suitable. The temperature shall be taken in the shade away from artificial heat.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

A. Materials.

1. Subgrade. The subgrade shall consist of approved material free from vegetation, or other questionable matter encountered in the existing roadbed, and other acceptable material used in preparation of the roadbed.
2. Portland Cement. Portland cement shall be Type 1 of a standard brand and conform to the requirements of ASTM C-150. One (1) sack containing one (1) cubic foot of cement, shall be considered as weighing ninety-four (94) pounds net. One (1) barrel of cement shall be considered as weighing three hundred seventy-six (376) pounds net, and containing four (4) cubic feet. The Contractor may use bulk cement, provided the apparatus for handling, weighing and spreading the cement is acceptable to the City of Magnolia, Engineer or the designated representative of the Engineer.
3. Water. Water shall be reasonably clear without oil, salt, acid, alkali, organic matter, and other injurious substances. Water shall be tested in accordance with AASHTO T-26. The Engineer or the designated representative of the Engineer may elect to omit the test on the water if it is from a commonly known potable water source such as a public water supply system. All water shall meet with the approval of the Engineer or the designated representative of the Engineer regardless of the source.

- B. Equipment. Equipment necessary for the proper construction of the work shall be on the project prior to the start of construction operations. All equipment shall be maintained in a satisfactory working condition.

PART 3 EXECUTION

3.01 PREPARATION

The subgrade shall be shaped to the sections, lines and grades shown on the plans, prior to applying cement.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. Pulverization. Soil shall be pulverized so that at the completion of moist-mixing, one hundred (100) percent by dry weight passes a one (1) inch sieve, and a minimum of eighty (80) percent passes a No. 4 sieve, excluding gravel or stone retained on the sieves.
- B. Application of Cement. Portland cement shall be spread uniformly on the soil at the rate specified on the plans. If a bulk cement spreader is used, it shall be positioned by string lines, or other approved methods, during spreading to insure a uniform distribution of cement. Cement shall only be applied to an area that all the operations can be continuous and completed in daylight within six (6) hours of application. At the time of application, the moisture percentage in the soil shall not exceed the quantity that will permit uniform and thorough mixture of soil and cement during dry mixing operations, and it shall not exceed the specified optimum moisture content for the soil cement mixture. Only equipment used in spreading and mixing will be allowed to pass over the freshly spread cement.
- C. Mixing and Processing. Either a multiple-pass traveling mixing plant or a single-pass traveling mixing plant can be used. The cement shall be dry mixed with the soil to prevent the formation of cement balls when water is applied. Any mixture of soil and cement that has not been compacted and finished shall not remain undisturbed for more than thirty (30) minutes. The necessary amount of water shall be applied and incorporated into the mixture immediately after the dry mixing of soil and cement is complete. The water supply and distribution equipment provided shall be sufficient to ensure continuous application of the required amounts of water to sections being processed within three (3) hours of application of the cement. Care shall be exercised to insure proper moisture distribution at all times. After the last increment of water has been added, mixing shall continue until a thorough and uniform full depth mix has been obtained.
- D. Compaction and Finishing. Unless specifically stated otherwise on the plans, the material shall be compacted to not less than 95% of Standard Proctor Density as determined by ASTM D-698 within two (2) hours of mixing. When compaction begins, the percentage of moisture in the mixture and unpulverized soil lumps, based on oven-dry weights, shall not be greater than two (2) percentage points above or below the specified optimum moisture content and shall be less than that quantity which will cause the soil cement mixture to become unstable during compaction and finishing. If the uncompacted soil cement mixture is wetted by rain so that the average moisture content exceeds the allowable tolerance at the time of final compaction, then the entire section shall be reconstructed at the expense of the Contractor. After the soil and cement mixture is compacted, water shall be applied uniformly as needed and mixed in thoroughly. The surface shall be reshaped to the required lines, grades and cross section and lightly scarified to loosen any imprint left by the compacting or shaping equipment. Surface compaction and finishing shall proceed in such a manner as to produce, in not more than two (2) hours, a smooth, closely knit surface, free of cracks, ridges or loose material conforming to the crown, grade and line shown on the plans.
- E. Curing. After cement treatment course has been finished, the surface shall be protected against rapid drying by one (1) of the following curing methods for a period as shown on the plans, but in no case less than three (3) days or until the surface or subsequent courses are placed:
 - 1. Sprinkling to maintain a thorough and continuously moist condition.
 - 2. Apply a two (2) inch layer of earth on the completed course and maintain in a moist condition.

3. An asphalt membrane may be applied to the treated course. The type and quantity of asphalt shall be sufficient to completely cover and seal the total surface of the subgrade and fill all voids. The use of an asphalt membrane must be approved by the Engineer or the designated representative of the Engineer prior to placement. If approved, the asphalt membrane shall be protected from being picked up by traffic by sanding or dusting the surface. The asphalt membrane may remain in place when the proposed surface or other base courses are placed.

Base courses may be applied on the finished subgrade as soon after completion as operations will permit.

- F. Construction Joints. At the end of each day's construction a straight transverse construction joint shall be formed by cutting back into the total width of completed work to form a true vertical face free of loose and shattered material.

Cement treatment for large, wide areas shall be built in a series of parallel lanes of convenient length and width.

- G. Traffic. Local traffic and construction equipment may travel on completed sections of cement treated material in place, and all traffic may travel on the completed section after the curing period, provided the cement treated course has hardened sufficiently to prevent being damaged.

3.03 REPAIR / RESTORATION

The Contractor shall maintain the cement stabilized material in good condition until all work has been completed and accepted. Maintenance shall include immediate repairs of any defects that may occur. This work shall be repeated as often as necessary and at the expense of the Contractor. Faulty work shall be replaced for the full depth of treatment. The Contractor shall construct the plan depth of cement stabilization in one homogeneous mass, so the addition of thin stabilized layers will not be permitted in order to provide the minimum specified depth.

3.04 FIELD QUALITY COTROL

Allow access to completed portions of work for field density testing by the Owner using the nuclear method. Contractor shall pay for failed tests and Owner will pay for passing tests.

END OF SECTION

SECTION 02510

HOT MIX ASPHALTIC CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SUMMARY

This section describes the requirements for furnishing and installing a surface for pavement consisting of a compacted mixture of coarse and fine aggregates and asphaltic material. Paving construction will be on stabilized subgrades and/or base to conform to the lines, grades, compaction thickness and the typical cross sections as shown on the plans.

1.02 MEASUREMENT AND PAYMENT

The work performed and materials furnished for hot mix asphaltic concrete pavement shall be measured and paid for in accordance with the Bid Form. Prime and/or tack coat shall be considered a part of the asphaltic concrete surface course and no separate payment will be made for this work and materials unless specifically indicated otherwise on the Bid Form. The bid price will be complete compensation for all equipment, materials, labor, and supervision required to construct asphaltic concrete surface course as shown on the plans.

1.03 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

AASHTO	American Association of State Highway and Transportation Officials
TxDOT	Texas Department of Transportation Construction Bulletin No. 14
TxDOT	Texas Department of Transportation - Standard Specifications For Construction of Highways, Streets and Bridges

1.04 SYSTEM DESCRIPTION

Hot mix asphaltic concrete pavement shall include prime coat and/or tack coat, and asphaltic mixture. Adjustment of the elevation of manhole frames and covers, valve boxes, and other such utility access structures to match the surface elevation of the new pavement shall be considered a part of the pavement operation.

1.05 SUBMITTALS

Submit the following for the review and approval of the City of Magnolia, Engineer or the designated representative of the Engineer:

- A. Samples and tests of coarse aggregate and fine aggregate.
- B. Samples of any mineral filler.
- C. Hot mix asphaltic concrete mix design and test results.

The number of copies of all submittals that are required to be submitted shall be as stipulated by the Engineer or the designated representative of the Engineer. The Engineer or designated representative of the Engineer shall also determine the quantities of material samples that are to be submitted for testing or visual inspection.

1.06 QUALITY ASSURANCE

The Contractor shall provide and pay for laboratory test results for all the materials to be incorporated into the asphaltic concrete as well as the asphaltic concrete mix. The Contractor must furnish, operate, and maintain templates, straight edges, scales, and other measuring and weighing devices necessary for proper construction and checking of work.

1.07 PROJECT / SITE CONDITIONS

No asphaltic mixture, prime coat, nor tack coat shall be placed when the air temperature is 50° F or below and falling but it may be placed when the temperature is 40°F and rising. Temperature readings shall be taken in the shade away from artificial heat. Place asphaltic mixtures only when weather conditions are suitable, in the opinion of the Engineer or the designated representative of the Engineer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

Both the materials and the source of the supply must be approved by the Engineer or the designated representative of the Engineer prior to the delivery of any materials.

2.02 MATERIALS AND/OR EQUIPMENT

- A. Aggregate. Composition of the mineral aggregate shall be of both a coarse aggregate and a fine aggregate and may include a mineral filler.
 - 1. Coarse Aggregate. The coarse aggregate shall consist of that part of the aggregate retained on a No. 10 sieve. The coarse aggregate shall consist of

clean, tough, durable fragments of stone, crushed gravel, or a combination of both, as specified herein, and shall be of a uniform quality throughout free from dirt, organic or other injurious matter occurring either freely in the material or as a coating of the aggregate. The coarse aggregate shall have a maximum percent abrasion of 40 when subjected to the Los Angeles Abrasion Test (Tex-410-A) and a maximum percent loss of 30 when subjected to the 5 cycle Magnesium Sulfate Soundness Test (Tex-411-A).

2. Fine Aggregate. The fine aggregate shall be that part of the aggregate passing the No. 10 sieve and consist of sand and fine aggregate particles from the coarse aggregates' material sources or a combination thereof. The sand shall be composed of durable particles free from injurious foreign matter and shall be limited to 15% of the total fine aggregate. Screenings shall be of the same or similar materials as specified for coarse aggregates. The plasticity index of that passing the No. 40 sieve shall be a maximum six (6) when tested by AASHTO T-89 and T-90. Unless otherwise shown on the plans, stone screenings are required and shall be the result of a rock crushing operation and meet the following gradation requirements, when tested in accordance with Test Method Tex-200-F, Part I.

Percent by Weight

Passing the 3/8" sieve100
 Passing the No. 10 sieve 70-100
 Passing the No. 200 sieve 0-15

3. Mineral Filler. The mineral filler shall consist of thoroughly dry stone dust, portland cement, fly ash or other mineral dust approved by the Engineer or the designated representative of the Engineer. The mineral filler shall be free from foreign and other injurious matter. The mineral filler shall meet the following grading requirements when testing in accordance with Tex-200-F, unless the plans show otherwise:

Percent by Weight

Passing a No. 30 sieve

95 to 100

Passing a No. 80 sieve, not less than75
 Passing a No. 200 sieve, not less than55

- B. Asphalt. The grade of the asphalt shall be AC-20. If more than one (1) type of asphaltic concrete mixture is specified for the project, only one (1) grade of asphalt will be required for all types of mixtures. The asphaltic materials shall be homogeneous, free from water, and shall not foam when heated to 350° F. The material shall meet the following requirements:

ASPHALT CEMENT

Viscosity Grade

⇒

AC-20

Property

Min.

Max.

Viscosity,		
140° F, poises	1600	2400
275° F, poises	2.5	---
Penetration, 77° F		
100 g, 5 sec	55	---
Flash Point, C.O.C., F	450	---
Solubility in		
Trichloroethylene, %	99.0	---
Spot Test	Negative	
Tests on Residue from		
Thin Film Oven Test:		
Viscosity, 140° F, poises	---	6000
Ductility, 77° F, 5 cm per min., cm	70	---

All asphalt shall be obtained from TxDOT pretested stock.

Asphalt material for the prime coat shall be MC-30 and asphalt material for the tack coat shall be RC-250 or SS-1 and must meet the following requirements:

CUTBACK ASPHALT

<u>Type-Grade</u> ⇒	<u>MC-30</u>		<u>RC-250</u>	
<u>Property</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Kinematic Viscosity @ 140° F, cst	30	60	250	400
Water, percent	---	0.2	---	0.2
Flash Point, T.O.C., F	100	---	80	---
Distillation Test:				
	Distillate, percentage by volume of total distillate to 680° F			
to 437° F	---	25	40	75
to 500° F	40	70	65	90
to 600° F	75	93	85	---
Residue from distillation, volume %	50	---	70	---
Tests on Distillation Residue:				
Penetration, 100 g, 5 sec., 77° F	120	250	80	120
Ductility, 5 cm/min, 77° F, cm	100*	---	100	---
Solubility in Trichloroethylene, %	99.0	---	99.0	---
Spot Test	Negative		Negative	

*If the penetration is more than 200 and the ductility at 77° F is less than 100 cm, the material will be acceptable if its ductility at 60° F is more than 100.

ANIONIC EMULSIONS

<u>Type-Grade</u> ⇒	<u>SS-1</u>	
<u>Property</u>	<u>Min</u>	<u>Max</u>
Viscosity, Saybolt Furol at 77° F, sec	20	100
Sieve Test, %	-	0.10
Miscibility (Standard Test)	Passing	
Cement Mixing, %	-	2.0
Storage Stability, 1 day, %	-	1
Freezing Test, 3 cycles*	Passing	
Distillation Test:		
Residue by Distillation, % by weight	60	-
Oil Distillate, % by volume of emulsion	-	
1/2		
Tests on Residue from Distillation:		
Penetration at 77°F, 100g, 5 sec	120	160
Solubility in Trichlorethylene, %	97.5	-
Ductility at 77°F, 5 cm/min, cm	100	-

*Applies only when the material is designated for winter use.

All prime coat or tack coat materials shall be obtained from TxDOT pretested stock.

C. Hot-Mix Asphalt Concrete.

Design Mixes. After being tested in accordance with these specifications and current Texas Department of Transportation methods, the design mixes and

materials are subject to approval of the Engineer or the designated representative of the Engineer. Design mixes and density and stability tests are the Contractor's responsibility and made at his expense. All certified test results, stating compliance with the specified requirements, for both the asphaltic materials and aggregates shall be furnished to the City of Magnolia, Engineer or the designated representative of the Engineer.

Density and Stability Requirements. Laboratory density and stability of the mixture shall be designed and tested in accordance with the methods outlined in the Texas Department of Transportation C-14 and meet the following:

Density %		<u>Optimum</u>	Stability %
<u>Min.</u>	<u>Max.</u>		<u>Not Less Than</u>
95	99	96	35

The compacted thickness of the mixture(s) used shall be as specified on the plans.

1. Hot-Mix Asphaltic Concrete Base Course - Type "B".

Master Grading Requirements for the Aggregates

<u>Sieve Sizes</u>	<u>Total Percent Passing, by Weight</u>
1-1/2 inch	---
1-1/4 inch	---
1-inch	100%
7/8-inch	95 - 100%
5/8-inch	75 - 95%
1/2-inch	---
3/8-inch	60 - 80%
1/4-inch	---
No. 4	40 - 60%
No. 10	27 - 40%
No. 40	10 - 25%
No. 80	3 - 13%
No. 200	1 - 6%*
VMA % Minimum	12

*2 - 8 when Test Method Tex-200-F, Part II (Washed Sieve Analysis) is used.

The asphaltic material shall form three percent (3%) to eight percent (8%) of the mixture by weight.

2. Hot-Mix Asphaltic Concrete Surface Course - Type "D"

Master Grading Requirements for the Aggregates.

<u>Sieve Sizes</u>	<u>Total Percent Passing, by Weight</u>
1-1/2 - inch	---
1-1/4 - inch	---
1 - inch	---
7/8 - inch	---
5/8 - inch	---
1/2 - inch	100%
3/8 - inch	85 - 100%
1/4 - inch	---
No. 4	50 - 70%
No. 10	32 - 42%
No. 40	11 - 26%
No. 80	4 - 14%
No. 200	1 - 6%*
VMA % Minimum	14

*2-8 when Test Method Tex-200-F, Part II (Washed Sieve Analysis) is used.

The asphaltic material shall form four percent (4%) to eight percent (8%) of the mixture by weight.

- D. Type of Plant. Mixing plants must be approved by the Engineer or the designated representative of the Engineer and have the capacity for producing mixtures that meet the specifications. Continuous mixing type and weight batching-type are both acceptable. The plant must have acceptable conveyors, power units, aggregate handling equipment, hot aggregate screens and bins, and dust collectors. The plant must provide equipment to adequately supply materials in accordance with the plant's rated capacity and produce finished material within the specified tolerances. Essential equipment includes cold aggregate bins and proportioning device, dryer, screens, aggregate weight box and batching scales, mixer, asphalt storage and heating devices, and asphalt measuring devices.

2.03 FABRICATION

- A. Screening and Proportioning. Screening capacity and bin sizes shall be adequate to screen and store the amount of aggregate required to properly operate and keep the plant in continuous operation at full capacity.
- B. Drying. The mineral aggregate drying shall be done in a manner such that fine particles will not be lost with the furnace gases. A dust collector system will be required if forced draft is used. The Engineer or the designated representative of

the Engineer may require that a dust collector system be used during forced draft if a substantial amount of the finer particles are escaping. The aggregate shall be continuously agitated during heating in a suitable apparatus in which the temperature can be efficiently controlled so that the aggregate will not be damaged and the finished mixture will have a temperature of between 250 degrees and 375 degrees Fahrenheit.

A recording thermometer shall be used to record the temperature of the aggregate as it leaves the dryer. The temperature record shall be a 24-hour chart, and may be equipped to record both the temperature of the rock and the temperature of the aggregate incorporated into the batch. The dryer(s) shall be of adequate size to heat and dry the required amount of aggregate to keep the plant in continuous operation.

- C. Weigh Box. Tight cut-off gates shall be provided on the storage bins so that mineral aggregates will not leak into the weigh box. The weigh box shall be of a sufficient capacity to hold a complete batch of aggregate without wasting or leveling by hand. The weigh box shall be designed so that the entire batch will quickly discharge into the mixer. The weigh box shall have an open top so that any excess of one (1) size of mineral aggregate may be removed by the operator, during charging. The weigh box shall have a close fitting and quick operating cut-off gate so that no mineral aggregate will leak into the mixer.
- D. Scales. Either the springless dial type or the multibeam-type scales may be used for weighing the different grades of mineral aggregate. If using a springless dial type, an adjustable indicating pointer shall be required for each grade of the mineral aggregate allowing for an accurate setting of the weight. If using a multibeam-type, there shall be sufficient weighing beams to weigh each grade of aggregate separately. All scales shall have a tare beam for balancing. The beam scale is also required to be equipped with a tell-tale dial indicator of the springless dial type indicating over and under load of at least 50 pounds. Scales that are not accurate within four (4) pounds per 1,000 pounds net load will not be considered adequate. The scales shall be insulated against shock or vibration so that neither case shall interfere with accurate weighing.
- E. Mixing.
 - 1. The mixer shall be the twin-pug-mill type and shall have a capacity of not less than 2,000 pounds in a single batch. The positioning and number of blades shall be sufficient to give a uniform and complete circulation of the batch in the mixer from the center to the four (4) ends of the mixer arms and then back to the center. A mixer will be considered inadequate if it fails to perform a uniform and thorough mixing with the asphalt cement and the aggregate, or it has a tendency to segregate mineral aggregate. Mixer determination will be made by mixing a standard batch for the required

time, and then dumping out the batch in order to take samples from different parts of the batch for testing.

2. All mixers shall be provided with automatic time locks on the discharge gates and weigh box and will be locked for a period of 45 seconds after all of the mineral aggregate have been introduced into the mixer. The mixture shall have a temperature of 300 degrees to 375 degrees when discharged. The mixer dump door shall be tight to the dry mineral aggregate or dust so that there will be no spilling from the pug mill. All mineral aggregate shall be thoroughly mixed for a period of five (5) to ten (10) seconds before the asphalt cement is added. Mixing will then continue for the required time, or longer if necessary to produce a mixture with uniform consistency.

F. Heating and Weighing Asphalt.

1. Storage for the asphalt cement shall be adequate to meet the requirements of the plans. Asphalt cement in storage shall be heated by steam coils, tight enough to prevent moisture from leaking into the asphalt. Steam for heating shall not be at a temperature in excess of 400 degrees Fahrenheit. Direct fire heating of asphalt shall not be permitted.
2. The steam heating system shall insure that uniform draw-off heat of the asphalt cement is maintained between 250 degrees and 350 degrees Fahrenheit at the asphalt cement bucket. The temperature shall be maintained with an efficient and positive control of the heat beyond 250 degrees Fahrenheit, either before or during mixing with the mineral aggregate.
3. The asphalt cement draw-off valve shall be of a quick cutoff type that will not leak any asphalt into the bucket after the required weight of the asphalt cement has been drawn. The asphalt supply line must be of a circulating type, and must be equipped with a recording thermometer indicating the temperature of the asphalt at the draw-off valve. The recording thermometer may be a combination thermometer used for recording the temperature of the aggregate.
4. The asphalt cement shall flow from the asphalt cement weigh bucket into the mixer for approximately the full width of the mixer so as not to deposit the asphalt cement in the mixer in one (1) place. Scales used for weighing the asphaltic cement shall be of springless dial type arranged for quick adjustment at zero to provide for the change in tare. A pointer will indicate the weight of the asphaltic cement required in one (1) batch.

PART 3 EXECUTION

3.01 PREPARATION

Prior to placing any pavement, manhole frames and covers, valve boxes, and other such utility access structures shall be adjusted in elevation by the Contractor if needed to match the surface of the new pavement. For overlaying existing pavement, cast iron or ductile iron extensions rated for not less than H-20 loading shall be used and shall meet the approval of the City of Magnolia, Engineer or the designated representative of the Engineer. The Contractor shall adjust the height of manhole frames and covers, valve boxes, and other such utility access in a manner acceptable to the Engineer or the designated representative of the Engineer to the grades required for the new pavement placed on either a base course or an existing asphalt course.

The base course or asphalt course to be overlaid shall be cleaned by sweeping or other methods approved by the Engineer or designated representative of the Engineer. The base course shall be lightly sprinkled immediately before the prime coat is applied. All rate of application and pressure gauges will be inspected and calibrated prior to applying the prime or tack coat. MC-30 prime coat shall be applied at a rate of 0.30 gallons per square yard at a temperature between 70° and 150° Fahrenheit. The prime coat shall be allowed to dry for a period of forty-eighty (48) hours or shall be allowed to dry longer if required by conditions in the opinion of the Engineer or the designated representative of the Engineer. RC-250 tack coat shall be applied at a rate of 0.10 gallons per square yard at a temperature between 70° and 150° Fahrenheit. The prime and tack coats will be applied in strict accordance with the requirements of Item 310 of the Texas Department of Transportation Standard Specifications for Construction of Highways, Streets and Bridges.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

A. Laying.

1. The asphaltic concrete mixture shall be hauled to the worksite in vehicles cleaned of all foreign materials and, if required by the Engineer or the designated representative of the Engineer, covered with a canvas that is sufficient to protect the entire load. The vehicle dispatching the material shall be arranged so that all material delivered may be placed and initially rolled in the daylight. The mixture shall be deposited directly into the "lay down" machine or placed on the prepared base in windrows that will be spread to the line, grade and crown as specified on the plans. Transfer of mixture from dispatching vehicle to "lay down" machine using front-end loaders or other equipment shall not be allowed unless specifically approved by the Engineer or the designated representative of the Engineer. The mixture shall be spread without segregation or tearing. The mixture must be at a temperature between 200 degrees and 350 degrees Fahrenheit.
2. The base, or initial, course of asphaltic concrete mixture shall be spread in one (1) lift so that when compacted, the finished course will be smooth, of

uniform density, and will be to section, line and grades as shown on the plans.

3. A surface course of two (2) inches or less in thickness may be spread in one (1) lift. All lifts shall be spread such that when compacted, the finished course will be smooth, of uniform density, and will be to section, line and grades as shown on the plans.
4. Asphalt base and surface courses may be spread and finished by hand if use of paving equipment is impractical. Steel or wood forms, rigidly supported to assure correct grade and cross-section, shall be used. Place the materials carefully in order to avoid segregation of the mix. Broadcasting of the material shall not be permitted. Any lumps that do not break down must be removed. Asphalt courses must be put down in the same sequence as if placed by machine.

B. Rolling. Rolling equipment shall consist of pneumatic tire and steel wheel rollers.

1. Pneumatic tire rollers shall have equal size and diameter pneumatic tires that are capable of exerting a contact pressure varying from 40 to 110 psi by adjusting ballast and/or tire pressure. Wheel spacing will be such that one (1) pass will accomplish one (1) complete coverage equal to the width of the roller and have a 1/4-inch (1/4") minimum overlap. None of the wheels shall wobble. The tire pressure and operating weight shall be sufficient to achieve the desired density. The roller shall be self-propelled.
2. Steel wheel rollers shall be a three (3) wheel roller two-axle tandem roller or three-axle tandem roller weighing not less than eight (8) tons and capable of developing a compression in the rear wheels of 250 to 350 pounds per inch of roller width. The rollers shall have power units and be equipped with the means of keeping the wheel wet to prevent the mixes from sticking to the rollers. The rollers shall also be equipped with wheel scrapers to assist in keeping the wheels clean.
3. Rolling shall start at the sides longitudinally and proceed toward the center of the pavement, overlapping on successive trips by at least 1/2 of the width of the rear wheels. Alternate trips of the roller shall be slightly different in length. Continue rolling until no further compression can be obtained and all roller marks are eliminated. The roller motion shall be slow enough to insure no displacement of the hot mixture. The roller must not sit on completed pavement that has not cooled to the normal atmospheric temperature. The wheels shall be properly moistened with water to prevent the hot mixture from sticking to the rollers, but an excess of water shall not be permitted.
4. If the asphalt is not being compacted properly, in the opinion of the

Engineer or the designated representative of the Engineer, then cores will be taken and tested in order to determine the relative densities of the course at various locations.

5. The completed course shall have a uniform density over the entire roadway area. The Engineer or the designated representative of the Engineer may, after testing under acceptable practices, have all or parts of the course removed and replaced on areas where the density is found to vary. The task of removing and replacing of the course because of unacceptable density variations shall be completed at the cost of the Contractor.
- C. Hand Tamping. In areas where compaction by a roller is not easily accomplished, such as along walls, curbs, headers, etc., a vibrating plate compactor or lightly oiled tamps shall be used to thoroughly compact the mixture in three-inch (3") layers.
- D. Density. The base course, binder course and surface course shall be compacted to a minimum density of 95 percent (95%) of the maximum possible density of a voidless mixture composed of the same materials in like proportions. If the results of the density tests for the base course, binder course or surface course indicate that the minimum density of 95 percent (95%) has not been obtained, additional rolling with a three-wheel or pneumatic roller will be required before the mix cools.
- E. Surface Requirements. The finished surface of plane areas shall not vary more than 1/4-inch (1/4") from a 16-foot (16') straightedge applied to the surface. The straightedge must overlap the previous test by 1/4 of its length. Any irregularities which vary more than 3/16-inch (3/16") in 10-feet (10') or 1/4-inch (1/4") in 16-feet in accordance with the grade, valley and crown shown on the plans shall be corrected.
- F. Construction Joints. Each course shall be placed as nearly continuous as possible. The roller shall only pass over the unprotected end of the freshly laid mixture when the laying of the course is discontinued for such a length of time as to allow for the mixture to become chilled. In such cases, when the work is resumed, the material laid shall be either cut back in order to obtain a beveled edge for the full thickness of the course or an acceptable lap joint shall be made.
- G. No portion of the finished asphalt course shall be opened to traffic until 12-hours after rolling has been completed, except where shown on the plans or in an emergency.

3.03 REPAIR / RESTORATION

Pavement sections not meeting the specified densities shall be recompact or replaced with new asphaltic concrete material. Pavement not having an acceptable surface course texture, not meeting surface test requirements, or not meeting the minimum thickness shall

be replaced with new material sections of surface course.

3.04 FIELD QUALITY CONTROL

- A. Extraction Test. The percentage of bitumen in any mixture shall not vary more than 1/2 of one percent (1%) from the proportion established by the Engineer or the designated representative of the Engineer. Samples of the hot mixture may be taken from the trucks or from the finished pavement, when required by the Engineer or the designated representative of the Engineer. The minimum weight of the test specimen in grams shall be determined by multiplying 3,000 by the maximum size aggregate in inches; and when tested by standard laboratory methods (in which benzol may be used as the solvent), it shall not vary from the grading proportions specified, according to the mix being tested, by more than five percent (5%) in any particular case.

- B. Cores may be taken from the finished hot-mix asphalt concrete. The quality and thickness of the cores will govern the acceptance of the pavement.

END OF SECTION

SECTION 02513

SINGLE COURSE ASPHALTIC SURFACE TREATMENT

PART 1 GENERAL

1.01 SUMMARY

This section describes the furnishing and installing of a surface for pavement consisting of a single application of asphalt covered with aggregate for the sealing of existing pavements. Paving construction will be on existing pavements and repaired pavement areas to conform to the lines, grades, and the typical cross sections as shown on the plans.

1.02 MEASUREMENT AND PAYMENT

Unless otherwise indicated on the Bid Form, the measurement and payment for the work specified in this Section shall be as follows:

The work and materials related to single course asphaltic surface treatment (pavement) shall be measured and paid for by the square yard at the unit price bid for asphalt and aggregate of the class, type and grade specified. Measurement will be from the edges of the in place asphaltic surface treatment. The unit price bid will be complete compensation for all equipment, materials, labor, and supervision required to construct the asphaltic surface treatment course as shown on the plans and for all equipment, materials, labor, and supervision required to adjust the elevation of manhole frames and covers, valve boxes, and other such utility access structures.

1.03 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

AASHTO	American Association of State Highway and Transportation Officials
TxDOT	Texas Department of Transportation Construction Bulletin No. 14
TxDOT	Texas Department of Transportation - Standard Specifications For Construction of Highways, Streets and Bridges

1.04 SYSTEM DESCRIPTION

Single course asphaltic surface treatment shall include asphalt cement and aggregate. Adjustment of the elevation of manhole frames and covers, valve boxes, and other such

utility access structures to match the surface elevation of the new pavement is a part of the pavement operation.

1.05 SUBMITTALS

When requested, submit the following for the review and approval of the City of Magnolia, Engineer or the designated representative of the Engineer:

A. Tests of asphalt cement.

B. Samples and tests of aggregate.

The Engineer or designated representative of the Engineer shall determine the quantities of material samples that are to be submitted for testing or visual inspection.

1.06 QUALITY ASSURANCE

The Contractor shall provide at his expense, laboratory test results for all the materials to be incorporated into the asphaltic surface treatment. The Contractor must furnish, operate, and maintain templates, straight edges, scales, and other measuring and weighing devices necessary for proper construction and checking of work.

1.07 PROJECT / SITE CONDITIONS

No asphaltic surface treatment shall be applied when the air temperature is 50° F or below and falling, but it may be applied when the temperature is 40° or above and rising. Temperature readings shall be taken in the shade away from artificial heat. Place asphaltic surfaces only when weather conditions are suitable, in the opinion of the Engineer or the designated representative of the Engineer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

Both the materials and the source of the supply must be approved by the Engineer or the designated representative of the Engineer prior to the delivery of any materials.

2.02 MATERIALS AND/OR EQUIPMENT

- A. Bituminous Materials. Bituminous materials for the surfacing shall be 120-250 penetration asphalt cement. The Engineer or the designated representative of the Engineer will designate the asphalt penetration to be used. The asphalt material specified herein shall be either a naturally homogenous oil or a homogenous residue from oil. It shall not have been distilled at a temperature high enough to injure the oil, and shall not foam when heated to 347° F. It shall be free from water and shall meet the following requirements:

	A.A.S.H.T.O.			
	Test			
	<u>Method</u>	<u>135</u>	<u>175</u>	<u>230</u>
Penetration at 77° F, 100 gms. 5 sec.	T-49	120-150	150-200	210-250
Ductility at 77° F, cms., not less than	T-51	100	70	70
Flash Point, degrees F, not less than	T-79	450	450	450
Melting Point, degrees F	T-53	104-140	95-130	86-122
Solubility in Carbon Tetra- chloride not less than	T-44 ¹	99.5%	99.5%	99.5%
Loss on heating at 325° F 5 hrs. not more than	T-47	.75%	.75%	.75%
Penetration of residue from loss on heating 77° F, 100 gpms., 5 sec. as compared to penetration before heating not less than	T-49	70%	90%	125%
Oliensis Spot Test	T-102	Neg.	Neg.	Neg.

¹Except CCL₄ is used instead of CS₂

- B. Precoated Aggregate. The aggregate shall be composed of sound and durable particles of gravel or stone, shall be free from organic matter, clay, loam, or pebbles

coated therewith, and shall not contain more than five (5) percent of slate, shale, schist, or soft particles of sandstone. No local caliche or other material and dust coated character shall be used. The material shall be of source proven satisfactory for this use. When tested by approved laboratory methods, each shall meet the requirements specified below:

SEAL COAT

Aggregate - Retained on 3/8" screen	0%
Retained on 1/4" screen	2-20%
Retained on 10 mesh sieve.....	70-100%
Retained on 20 mesh sieve.....	95-100%

The natural limestone rock asphalt aggregate shall have an average bitumen content from 4 to 8 percent by weight of naturally impregnated asphalt, as determined by Test Method Tex-215-F, and shall contain not more than 2 percent by weight of any one of or combination of iron pyrites or other objectionable matter, as determined by Test Method Tex-217-F, Part I.

The percent of wear, as determined by Test Method Tex-410-A, for each of the materials shall not exceed 35 percent.

The percent of wear on natural limestone rock asphalt aggregate as determined by Test Method Tex-410-A shall be made on that portion of the material retained on the No. 4 sieve, having a naturally impregnated asphalt content of less than 1 percent.

Crushed gravel shall have a minimum of 85 percent of the particles retained on the No. 4 sieve with more than one crushed face, as determined by Test Method Tex-413-A (Particle Count).

PART 3 EXECUTION

3.01 PREPARATION

Prior to placing any pavement, manhole frames and covers, valve boxes, and other such utility access structures shall be adjusted in elevation by the Contractor if needed to match the surface of the new pavement. For overlaying existing pavement, cast iron or ductile iron extensions rated for not less than H-20 loading of a manufacturer and model approved by the Engineer or the designated representative of the Engineer may be used. For other than overlaying of existing pavement, the Contractor shall adjust the height of manhole frames and covers, valve boxes, and other such utility access in a manner acceptable to the Engineer or the designated representative of the Engineer to the grades required for the new pavement.

The area to be treated shall be cleaned by sweeping or other methods approved by the Engineer or the designated representative of the Engineer. Edges of existing pavement to be surfaced shall be bladed to remove vegetation. Pot holes shall be filled with hot mix/cold laid asphalt at the direction of the Engineer or the designated representative of the Engineer. All rate of application and pressure gauges will be inspected and calibrated prior to applying the asphalt cement.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. Application. Asphaltic surfaces shall be constructed in strict accordance with Item 316 of the TxDOT Standard Specifications for Construction of Highways, Streets and Bridges.

All storage tanks, piping, retorts, booster tanks, and distributors used in storing or handling asphalt shall be kept clean and in good operating condition at all times, and they shall be operated in such a manner that there will be no contamination of the asphalt with foreign material. Asphalt is not to be heated above three hundred fifty (350) degrees Fahrenheit at any time, and when applied, it shall be a temperature of not less than two hundred seventy-five (275) degrees Fahrenheit and not more than three hundred fifty (350) degrees Fahrenheit. The Engineer or the designated representative of the Engineer will select the temperature of application, and the Contractor shall apply the asphalt at a temperature within five (5) degrees of the temperature selected. All asphalt material heated above three hundred fifty (350) degrees Fahrenheit will be rejected.

Asphalt shall be applied on the clean surface by an approved type of self-propelled pressure distributor so operated as to distribute the material in the quantity specified, evenly and smoothly, under a pressure necessary for proper distribution. The Contractor shall provide all necessary facilities for determining the temperature of the asphalt in all of the heating equipment and in the distributor, for determining the rate at which it is applied, and for securing uniformity at the junction of two distributor loads. Asphalt shall be applied for the full width of the surface treatment in one application unless the width exceeds twenty-two (22) feet.

The asphaltic material shall be AC-5 applied at the rate of 0.35 gal/S.Y. Asphaltic material shall not be applied until immediate covering with aggregate is assured.

The aggregate shall be immediately and uniformly applied with an approved self-propelled mechanical spreader at the rate of 1 C.Y./100 S.Y.

- B. Brooming and Rolling. The entire surface shall then be broomed and rolled as follows:

The initial rolling shall be with steel wheel rollers and all additional rolling

shall be with pneumatic wheel rollers. The brooming and pneumatic wheel rolling shall continue for three (3) days after the date of application of the aggregate. All surplus aggregate shall be removed before final rolling in order to leave the surface free from loose aggregate. The surplus shall be stockpiled for the City of Magnolia to use in case spots should start bleeding.

The rolling equipment shall be approved by the Engineer or the designated representative of the Engineer and shall be as follows:

Steel Wheel Roller shall be self-propelled three wheeled, having a gross weight of not less than six (6) tons and not more than twelve (12) tons.

Pneumatic Wheel Roller shall have a gross weight of not less than ten (1) tons and not more than twenty-five (25) tons. The Contractor shall use one (1) roller per day for each 9,000 S.Y. or major part thereof surface to be worked.

3.03 REPAIR/RESTORATION

Pavement sections not having an acceptable coverage of aggregate or experiencing excess asphaltic cement shall be corrected by the Contractor at the direction of the Engineer or the designated representative of the Engineer.

3.04 FIELD QUALITY CONTROL

The asphaltic material shall be delivered in sealed tank cars or trucks and shall be tested and sealed at the point of loading by an approved testing laboratory. The asphaltic material will be accepted by the City of Magnolia only upon receipt of the certificate of test that shows that it conforms to the above specifications. The Contractor will order all asphaltic materials and make his own arrangements for delivery and storage. The Contractor shall be responsible for the safe and proper storage of asphaltic material. All oil used by the Contractor for heating purposes or for operation of equipment shall be kept in tanks separate and apart from the asphaltic material.

END OF SECTION

SECTION 02520

CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SUMMARY

This section gives requirements for Portland cement concrete pavement, with or without curbs, on a prepared subgrade and/or base material.

1.02 RELATED SECTIONS

Section 02223 Excavating, Backfilling, and Compacting for Pavement
Section 03300 Cast-In-Place Concrete

1.03 MEASUREMENT AND PAYMENT

Unless otherwise indicated on the Bid Form, the measurement and payment for the work specified in this Section shall be as follows:

- A. Measurement. Concrete pavement work performed under this section will be measured by the square yard (SY) of surface area of completed and accepted pavement of the designated thickness. The designated thickness shall mean the minimum allowable thickness. When the plans call for the construction of curbs with the pavement, the limits of pavement measurement will be from back to back of curb. When curb and gutter is to be constructed, the limits of measurement for concrete pavement shall be from lip to lip of the gutters.
- B. Payment. All work performed and material furnished as prescribed by this specification, and measured as provided paragraph 1.03.A, "Measurement," shall be paid for at the unit price bid for concrete pavement. Such payment shall be full compensation to the Contractor for shaping and fine grading the subgrade, for furnishing, mixing, placing, finishing and curing all concrete including curbs, where indicated on the plans; for furnishing, placing, finishing and sealing all joints required by the plans; for furnishing and placing all reinforcing steel; for all barricading and safety measures; for all form removal and cleanup; for all labor, equipment, appliances, tools and incidentals necessary to complete the work.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

ACI	American Concrete Institute
ASTM	American Society for Testing of Materials
AASHTO	American Association of State Highway and Transportation Officials
TxDOT	Texas Department of Transportation - Standard Specifications for Construction of Highways, Streets and Bridges
CRSI	Construction Reinforcing Steel Institute

1.05 QUALITY ASSURANCE

It shall be the responsibility of the Contractor to produce concrete pavement of the strength, durability, workability and specified finish; furnish representative materials for specimens in quantities required by the testing laboratory; take samples of materials for testing; check proportions of mix and immediately notify the City of Magnolia, Engineer or the designated representative of the Engineer if proportions appear improper in any respect.

The Contractor shall comply with all testing laboratory findings and the decisions of the Engineer or the designated representative of the Engineer in reference to these findings.

The Contractor shall pay for the redesign of the concrete mix due to a change in the source of materials.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Reinforcing Steel. All steel reinforcement shall be stored above the ground on platforms, skids or other supports as approved by the Engineer or designated representative of the Engineer. Reinforcement shall be stored in a location such that it is protected from mechanical injury and rust. When placed in the work, steel reinforcement shall be free from dirt, scale, rust, oil, paint and other objectionable material.
- B. Miscellaneous Materials. All miscellaneous materials that are to be used to properly execute the work required to construct concrete pavement shall be stored and handled in accordance with the manufacturer's instructions and/or in a manner that meets with the approval of the Engineer or the designated representative of the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Concrete. Provide concrete in accordance with the applicable provisions of Section 03300, Cast-In-Place Concrete. Concrete pavement shall be "Normal Weight Structural Concrete" and shall have a minimum twenty-eight (28) day compressive strength of 3,500 pounds per square inch (psi) unless specifically designated otherwise on the plans.
- B. Reinforcing Steel and Related Materials. Provide the following steel reinforcing items and related materials:
 - 1. Reinforcing Steel. All steel reinforcing shall be open hearth, new billet steel manufactured in the United States and conforming to ASTM A615. All bars shall be Grade 60 with a minimum yield strength of 60,000 pounds per square inch (psi). Unless otherwise shown on the plans, all deformed steel reinforcing shall be #4 bars (minimum). All smooth steel reinforcing for doweling expansion and contraction joints shall be plain steel bars conforming to ASTM A-306, Grade 70, shop cut to length, straight, clean and free of rust, scale or other objectionable material.
 - 2. Supports for Reinforcing. Supports for reinforcing bars shall be the correct type as intended and represented by the manufacturer. Bar supports shall be uniform high density polyethylene or fiberglass reinforced plastic and conform to CRSI Class 1, Maximum Protection. Concrete blocks or bricks will not be accepted.
 - 3. Tie Wire. Use 18-gauge annealed steel for tie wire.
- C. Expansion Joints. In addition to dowels, provide the following material for expansion joints:
 - 1. Joint Filler Material. Filler material shall be preformed expansion joint filler of the bituminous type that conforms to the requirements of ASTM D1751. Unless otherwise shown on the plans, the thickness of the filler material shall be 3/4-inch.
 - 2. Joint Sealing Compound. Joint sealing compound shall conform to the requirements of ASTM C-920, Type S, Grade P or NS. Color of sealant shall meet with the approval of the Engineer or the designated representative of the Engineer.
 - 3. Backer Rods and Backing Materials. Provide a compressible type material such as closed-cell, resilient foam or sponge rubber stock of vinyl, butyl or

neoprene, or expanded polyethylene or polyurethane. The diameter of the backer rod shall be at least twenty-five (25) percent larger than the joint reservoir and shall be capable of holding the fluid joint sealing compound in open joint in place. Backer rods shall be of such a type that it will not bond to the joint sealing compound.

4. Sleeves. Sleeves for expansion joints shall be 26-gauge steel or rigid PVC tubes which are capped at one end. Sleeves shall be in accordance with ASTM A120.

- D. Forms. Provide metal or wooden forms to construct the concrete pavement. Wooden forms shall be of sound 2 X material of a depth equal to the required edge thickness of the pavement, free from warps, twists, loose knots, splits or other defects and constructed to provide a straight edge on the concrete. Metal forms shall be of an approved shape and section with a depth of the form equal to the edge depth of the pavement. The metal forms shall be free from warps, bends and kinks and shall be constructed to provide a straight edge on the concrete.

PART 3 EXECUTION

3.01 PREPARATION

- A. General. In addition to any instructions specified herein, the preparations detailed in Section 03300, Cast-In-Place Concrete, paragraph 3.01, shall also apply here as if written in their entirety. This includes, but is not limited to, the minimum twenty-four (24) hour notification that shall be given to the Engineer or the designated representative of the Engineer before any concrete is placed.
- B. Subgrade Preparation and Protection. Excavate, prepare, shape, and compact the subgrade to the grades and densities shown on the plans and in accordance with Section 02223, Excavating, Backfilling, and Compacting for Pavement. Subgrade shall be wetted sufficiently to minimize moisture loss from the concrete to the subgrade. Water puddles or muddy areas will not be allowed. Maintain the subgrade in a smooth, compacted condition at the proper grades until the concrete has been placed. No ready mix trucks or other equipment shall be allowed to operate within the forms unless clearance or other job conditions will not allow operation from outside the forms. If trucks must operate between the forms, the subgrade shall be protected from damage by use of runways. Any ruts or irregularities in the subgrade caused by equipment or by trucking material shall be corrected by second rolling or hand tamping.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. Placing of Reinforcing Steel. Reinforcing steel to be used in the construction of

concrete pavement shall be placed in accordance with the plan details. Unless otherwise shown on the plans, reinforcing shall be #4 deformed bars spaced eighteen (18) inches center to center; installed in a criss-cross pattern such that the longitudinal steel is parallel and the transverse steel is perpendicular to the centerline of the pavement section; and have twelve (12) inch lap splices when joining two (2) individual lengths of rebar together. Lap splices in adjacent bars shall be staggered such that splices do not occur in the same location in adjacent bars and, where possible, use full length reinforcing steel for executing the work. Steel reinforcing bars shall be tied together at all points of intersection with the specified tie wire and be securely held in place with bar supports (chairs), or other approved methods, during the placement of the concrete.

- B. Placement of Concrete. Place concrete for the construction of concrete pavement in accordance with the applicable provisions for "Normal Weight Structural Concrete" outlined in Section 03300, Cast-In-Place Concrete.
- C. Concrete Pavement Finish. The pavement shall be struck-off and consolidated with mechanical finishing machines or by hand-finishing methods. Associated concrete curbs shall be given the same finish as the concrete pavement.
 - 1. Mechanical Finishing. When mechanical finishing machines are used for finishing, the concrete shall be struck-off at such a height that after consolidation and final finishing, it shall be at the exact elevation as shown on the plans. The mechanical finishing machines shall consist of a power driven transverse finishing machine and a longitudinal finishing machine. Finishing machines shall be equipped with rubber tires for rolling on concrete pavement. The transverse finishing machine shall be provided with two (2) screeds that are accurately adjusted to the pavement slope or crown as indicated on the plans. The transverse finishing machine shall ride on the forms and be so designed and operated as to strike off and consolidate the concrete. The Contractor shall make at least two (2) trips over the pavement area with the transverse finisher but, shall make as many trips over the pavement area as required to obtain the required grades. The longitudinal finishing machine shall ride on the forms and be equipped with a longitudinal float not less than ten (10) feet in length. The machine shall be so designed and operated as to finish the pavement to the grades and elevations shown on the plans. Just before the concrete becomes non-plastic, the pavement surface shall be belted with a canvas belt with a width between six (6) and ten (10) inches wide and a length at least two (2) feet longer than the pavement width. The belt shall be moved with short strokes transversely across the pavement and advanced rapidly in the longitudinal direction to produce a gritty, textured surface.
 - 2. Hand Finishing. When the pavement is finished by hand, the concrete shall be struck-off with a screed of an approved cross section and a length at least

two (2) feet longer than the pavement width. The strike-off screed shall be moved forward with combined transverse and longitudinal motion in the direction the work is progressing, maintaining the screed in contact with the forms and keeping a slight excess of material in front of the cutting edge. The concrete shall then be tamped with an approved tamping template to thoroughly compact it and eliminate surface voids. The surface shall then be screeded to the required section. After completion of the strike-off, tamping and transverse screeding, a longitudinal float shall be operated to level the surface to the required grade. Just before the concrete becomes non-plastic, the surface shall be belted with a canvas belt as described in the preceding subparagraph to produce a gritty, textured surface.

- D. Curing of Concrete. All concrete pavement shall be cured for a period of not less than seventy-two (72) hours. Curing of all exposed concrete surfaces shall begin immediately after the completion of the finishing operations. The following are acceptable methods for curing concrete:
1. Polyethylene Film Curing. After completion of the finishing and after initial set of the concrete, apply a fine spray of water to the concrete and cover it with a polyethylene film. Place and secure polyethylene film in direct contact with the concrete surface such that an airtight seal is maintained for the entire duration of the specified curing time. Contractor is responsible for preventing and repairing any damage to the polyethylene film during the entire curing time. The polyethylene film blankets are subject to the approval of the Engineer or the designated representative of the Engineer. The film blankets shall be rejected at any time when, in the opinion of the Engineer or the designated representative of the Engineer, the required airtight seal is not maintained.
 2. Curing Compound. After completion of the finishing operations and the disappearance of the free surface moisture, uniformly spray the concrete surface with an approved curing compound. The curing compound membrane shall be applied in accordance with the manufacturer's instructions. If water drops do not bead or water soaks into concrete after application of the curing compound, a full additional coat of compound shall be applied. Contractor is responsible for preventing and repairing any damage to the curing compound membrane during the entire duration of the specified curing time.
- E. Joints. All joints shall be of the types shown and at the location and spacing indicated on the plans. All joints shall be constructed true to line with their faces perpendicular to the pavement. Transverse joints shall be at right angles to the centerline of the pavement and shall extend the full width of the slab. Longitudinal joints shall be installed parallel to the centerline of the pavement. Transverse joints in succeeding lanes shall be placed in line with similar joints in the existing

pavement. All joints shall be so prepared, finished and cut to provide a groove of sufficient width and depth to receive and retain joint sealing material.

1. Construction Joints. Transverse construction joints of the types shown on the plans shall be placed wherever the placing of concrete is suspended for a period of more than thirty (30) minutes. These transverse joints, when planned, shall be placed at either an expansion joint or at a contraction joint. The joint shall not be allowed within eight (8) feet of a regularly spaced transverse joint. If the pouring of concrete is stopped and a joint is required in these limits, then it shall not be installed and the fresh concrete shall be removed back to the previously spaced regular joint. Dowel assemblies or other approved load transfer devices shall be installed at the joint as required by the plans. Longitudinal construction joints necessary for lane construction shall be of the dimensions and type shown on the plans. These joints shall be either a keyed joint or a butt type joint with dowels. The keyed joint shall be formed by placing a deformed metal plate against the form when the first lane adjacent to the joint is placed. This plate is to be removed with the forms. The edge of the joint shall be finished with an edging or grooving tool and a slot, of the dimensions indicated, shall be formed to receive joint sealing material.
2. Expansion Joints. Transverse and longitudinal expansion joints shall be installed at the location and spacing as shown on the plans and shall be installed and finished to insure complete separation of the slabs. The expansion joint material shall be of the preformed type conforming to these specifications. If joints are to be equipped with dowels, they shall be at the spacing and location indicated on the plans. They shall be firmly supported in place, accurately aligned parallel to the pavement grade and the centerline of the pavement by means of dowel support which will remain in the pavement and will insure that the dowels are not displaced during construction. One-half of each dowel shall be painted with rust preventative paint and greased with an approved lubricant and, in expansion joints, shall be equipped with the specified tight fitting 26-gauge steel or PVC sleeve. The sleeve shall provide for an unobstructed expansion space of one (1) inch to permit dowel movement. The closed end of the sleeve shall be watertight. In the construction of transverse joints in pavement with integral curbs, special care shall be taken to see that all transverse joints extend continuously through the pavement curb. When dowels are not specified, the thickness of the concrete at these joints shall be increased by at least twenty-five (25) percent of the normal pavement thickness to the nearest inch, but not more than two (2) inches. This increased thickness shall slope to the normal pavement thickness in not less than five (5) feet from the joint or to the nearest joint. Following the placement of the concrete, all excess concrete shall be cleaned from the top of the expansion joint material, and before opening to traffic, this space shall be swept clean and filled with a

joint sealing compound as specified herein. Following the removal of the forms, any concrete bridging the joint space at the ends shall be removed.

3. Contraction Joints. Transverse contraction joints shall be of the sawed or formed dummy groove type and shall be at the locations and spacing and of the dimensions shown on the plans. The joints shall consist of a groove in the top of the slab sawed in the hardened concrete or formed in plastic concrete. When sawed, the groove shall be straight, of a uniform width and depth, and shall be sawed as soon as possible after the placement of the concrete to prevent contraction cracks in the slab. When formed, the groove shall be true to line and shall be uniform in width and depth. The sides of the groove shall be finished even and smooth with an edging tool. Reinforcing steel shall be continued through all contraction joints. Dummy groove contraction joints shall extend vertically downward 1/4 of the slab depth from the surface and prior to opening for traffic shall be cleaned and filled with the specified joint sealing material. Longitudinal contraction joints shall be of the deformed metal strip type located in accordance with plan details.

- F. Opening to Traffic. The Contractor shall erect and maintain barricades to keep public and construction traffic from traveling on the newly placed concrete pavement. All barricades are subject to the approval of the Engineer or the designated representative of the Engineer. Prior to allowing traffic on the pavement, all joints shall first be sealed, the pavement cleaned, and earth placed against the pavement edges. If approved by the Engineer or the designated representative of the Engineer, traffic will be allowed on the pavement after the concrete has been in place for ten (10) days, but will be limited to vehicles with a gross weight of 14,000 pounds or less. After fourteen (14) days, if approved by the Engineer or the designated representative of the Engineer, the pavement shall be opened to all traffic except any equipment not licensed for operation on public highways. The opening of the pavement to traffic shall in no way relieve the Contractor from his responsibilities for the work as stated in the Contract and any Conditions thereto.

3.03 REPAIR / RESTORATION

Contractor shall repair any pavement that does not meet the specified thickness.

3.04 FIELD QUALITY CONTROL

- A. General. Field quality control shall be in accordance with the applicable provision of Section 03300, Cast-In-Place Concrete, and any other provisions specified herein.
- B. Cores. The thickness of the completed pavement will be determined prior to final

acceptance by the measurement of cores taken at such points as the Engineer or the designated representative of the Engineer may select. These cores, if taken, shall be at the rate of at least one (1) core for each five-hundred (500) square yards of pavement.

END OF SECTION

SECTION 02521

CONCRETE CURBS AND GUTTERS AND VALLEY GUTTERS

PART 1 GENERAL

1.01 SUMMARY

This specification covers the requirements for concrete curbs and gutters and for valley gutters.

1.02 RELATED SECTIONS

Section 02223 Excavation, Backfilling and Compacting for Pavement
Section 03200 Concrete Reinforcement
Section 03300 Cast-In-Place Concrete

1.03 MEASUREMENT AND PAYMENT

Unless otherwise indicated on the Bid Form, the measurement and payment for the work specified in this Section shall be as follows:

- A. Curb and Gutter. Measurement and payment of curb and gutter will be by the linear foot measured along the face of curb and payment will be by the unit price bid per linear foot. Where omission of the vertical portion of the curb and gutter occurs, the length shall be measured along a line one (1) foot six (6) inches from the inside edge of the gutter. No deductions or additions from the unit price bid will be made for omissions of the vertical portions of the curb and gutter occurring at driveways and other locations. The unit price shall include compensation for all labor, tools, equipment, materials, excavation and backfill, reinforcing steel, expansion joint filler and other incidentals necessary to complete the work. Inlet structures shall be paid for separately, and their length shall not be included in the length for curb and gutter. The difference in the cost for the variable height curb and gutter shall be included in the price for the inlet.
- B. Valley gutters will be measured and paid for at the unit price per each valley gutter regardless of length. The unit price shall include compensation for all labor, tools, equipment, materials, earthwork, removal and replacing of existing asphalt pavement and base, reinforcing steel, premolded expansion joint filler and other incidentals necessary to complete the work.
- C. The removal of existing concrete driveways will be measured and paid for at the unit price per square yard regardless of the thickness. Measurement will be the

actual amount of concrete driveway removed. Payment for this item will be complete compensation for tools, labor, equipment, disposal of removed materials and all other incidentals necessary to complete the work.

- D. Replacement of concrete driveways will be measured by the square yard. Payment will be at the unit price per square yard. The unit price will include full compensation for labor, tools, equipment, materials, reinforcing mesh and all incidentals necessary to complete the work.
- E. Replacement of Existing Facilities: There will be no separate payment to remove and replace existing asphalt surface or base material in order to remove and replace existing curb and gutter, valley gutters, driveway approaches, and like structures. The cost for asphalt and base replacement shall be included in the unit price bid for removing and replacing curb and gutter, valley gutters, driveway approaches, and like structures.
- F. Adjustment of Utility Access Structures: There will be no separate payment to extend or adjust the height of existing manhole frames and covers, valve boxes, and other such utility access structures. The cost for such materials and work shall be included in the work of which it is a component.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

ACI	American Concrete Institute
ASTM	American Society for Testing of Materials
AASHTO	American Association of State Highway and Transportation Officials
TxDOT	Texas Department of Transportation - Standard Specifications for Construction of Highways, Streets and Bridges
CRSI	Construction Reinforcing Steel Institute

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Concrete. All curbs and gutters and valley gutters shall be constructed of Class D concrete unless specifically noted otherwise on the plans. Refer to specification Section 03300, "Cast-In-Place Concrete" for information on the requirements related to Class D concrete.
- B. Expansion Joints. Expansion joints shall consist of three-fourths (3/4) inch premolded bituminous expansion joint filler per ASTM D-1751. Seal with joint

sealing compound meeting ASTM C920, Type S, Grade P or NS.

- C. Expansion Joint Dowels. Plain steel bars conforming to ASTM A-306, grade 70. Cut dowels to length at shop or mill before delivery to the site. Dowels must be straight and clean, free of loose flaky rust and loose scale. Dowels may be sheared to length provided deformation from true shape caused by shearing does not exceed 0.04-inches from the end. Provide an approved rigid dowel sleeve with inside diameter 1/16" larger than dowel to provide free movement of dowel for a distance of 150 percent of the joint width. Grease dowel in sleeve with approved lubricant.
- D. Asphalt and Base Material: Where asphalt and base material removal and replacement is necessary for construction of new curb and gutter and like structures, the asphalt and base material shall be of equal or better quality than the existing asphalt and base material.

PART 3 EXECUTION

3.01 PREPARATION

Prior to placing any pavement, manhole frames and covers, valve boxes, and other such utility access structures shall be adjusted in elevation by the Contractor if needed to match the surface of the new pavement. For overlaying existing pavement, cast iron or ductile iron extensions rated for not less than H-20 loading of a manufacturer and model approved by the Engineer or the designated representative of the Engineer may be used. For other than overlaying of existing pavement, the Contractor shall adjust the height of manhole frames and covers, valve boxes, and other such utility access in a manner acceptable to the Engineer or designated representative of the Engineer and to the grades required for the new pavement. Stabilize and compact subgrade or base material as shown on plans for pavement. Dry subgrade or base to be moistened prior to concrete placement.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. Curbs and Gutters. The curbs and gutters shall be of the thickness, width, and at the locations and elevations shown on the plans. With the aid of a straight edge, steel trowel and steel "gooseneck," all curbs and gutters will be finished true to line, grade and cross section. The straight edge will be used for the face of the curb and in the gutter. The curb and gutter shall be worked with a steel trowel and "gooseneck" to give the work the appearance of a trowel finish, then edged and jointed.
 - 1. Forms. Forms shall be of metal or wood and shall be clean and straight. Wood forms for straight sections shall be 2" nominal thickness. Securely stake forms to line and grade and maintain position during concrete placement. Lightly oil forms before use.

2. Reinforcing Steel. Reinforce all curbs and gutters and valley gutters. The reinforcing steel shall be accurately placed and secured in position in the forms. Plastic chairs or spacers shall be used to keep the reinforcing steel in proper position. Bars shall be lapped at least twenty-four (24) bar diameters where splicing is necessary, unless otherwise noted. No bar shall be spliced at points of maximum tension. The concrete covering the reinforcing steel shall have a minimum thickness as indicated on the plans, or if not shown, the applicable requirements of ACI Building Code 318-63 shall govern.
 3. Joints. Joints shall be provided as specified herein and where directed on the plans. An edging tool shall be used to provide the joints with rounded edges of one-eighth (1/8) inch radius.
 - a. Dummy Groove. Dummy groove joints shall be placed at ten (10) foot intervals in curbs and gutters. The dummy groove joints shall not be less than one (1) inch in depth.
 - b. Expansion. Curbs and gutters shall be provided with the three-fourth (3/4) inch premolded expansion joints at intervals not exceeding sixty (60) feet, unless otherwise shown on plans. The filler shall extend the full depth of the concrete but shall be one-fourth (1/4) inch below the finish surface of the concrete. Seal all expansion joints with specified sealer.
 4. The plans indicate the presence and approximate locations of existing driveways. Driveways widths may vary. Whenever the presence of a driveway is indicated on the plans, the vertical sections of the curb and gutter shall be omitted for the distance as indicated on the plans, or as approved by the Engineer or the designated representative of the Engineer. When removing and replacing a portion of an existing concrete driveway is necessary, as indicated on the plans or approved by the Engineer or the designated representative of the Engineer, that portion shall be removed along a neat, straight line and replaced in a workmanlike manner between that line and the new construction. The removed portion of the driveway shall be disposed of by the Contractor. The new section of the driveway shall be equal in quality and appearance to that portion which was removed.
 5. When the grade of an existing dirt, gravel or iron ore driveway must be altered in order to conform to the proposed construction, the work shall be performed by the Contractor and a driveway must be produced that is equal to the one removed. There will be no separate payment for this work.
- B. Valley Gutters. The plans shall indicate the valley gutters' thickness, widths, lengths, locations, and elevations.

1. Forms shall be placed along all the edges of the valley except where they will connect to existing curbs and gutters. Premolded expansion joint material shall be placed against these edges to serve as edge forms during construction. An approved method must be used to form a neat line between the new construction and the existing pavement when removal of existing asphalt surface and base is necessary to install a valley gutter. The cost for removal and replacement of the asphalt surface and base will be included in the unit price bid for the valley gutters.
 2. Repairs and alterations to existing valley gutters shall be indicated on the plans or directed by the Engineer or the designated representative of the Engineer. The alterations shall conform to the applicable requirements specified for new valley gutters.
- C. Asphalt and Base Material: When existing base and asphalt are removed and replaced, suitable means shall be used to form a neat line where the new construction and the existing pavement adjoins without damaging the existing pavement which is to remain.

3.03 FIELD QUALITY CONTROL

Notify DPW or the designated representative of the Engineer prior to placing concrete to allow inspection of forms, reinforcing and joints.

END OF SECTION

SECTION 02580

PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SUMMARY

This section covers the requirements for pavement markings. Pavement markings are required for roadway striping, parking spaces, handicapped aisles, loading zones, crosswalks, and as otherwise may be shown on the plans. Pavement markings include internationally recognized handicapped parking signs and van accessible signs.

1.02 MEASUREMENT AND PAYMENT

The cost for performing the work described in this Section shall be included in related items of work unless specifically shown otherwise on the Bid Form. Contractor is responsible for furnishing all materials, tools, equipment, labor, and incidentals for successfully completing the work associated with pavement markings.

1.03 REFERENCES

The applicable provisions of the following standards shall apply as if written in their entirety:

TxDOT	Texas Department of Transportation - Standard Specifications for Construction of Highways, Streets, and Bridges
ASTM	American Society of Testing of Materials

1.04 QUALITY ASSURANCE

The supplier of the products used on the project shall provide written certification that the products meet the requirements of the specifications.

1.05 DELIVERY, STORAGE, AND HANDLING

The products shall be delivered to and stored at the site at the temperature and under conditions as recommended by the manufacturer of the product.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

A. General: Pavement markings shall conform, except as noted, to the requirements of Item 670, "Pavement Markings (Reflectorized Paint)" of the Standard Specifications for Construction of Highways, Streets and Bridges of the Texas Department of Transportation.

B. Materials: Article 670.1 Materials is supplemented as follows:

1. Traffic stripe reflective glass spheres.

a. Imperfect glass sphere test: The glass spheres shall not contain more than thirty (30) percent (by weight) irregular shaped particles when tested by ASTM D-1155-53. Spheres shall be essentially free of sharp angular particles, and particles showing milkiness or surface scarring or scratches. Spheres shall be water white in color.

b. Gradation Test: The glass spheres shall meet the following gradation requirements when tested:

<u>Opening - U.S. Std. Sieves</u>	<u>Percent Passing</u>
#20	100
#30	80 - 100
#50	18 - 35
#100	0 - 4

c. Index of Refraction Test: The spheres, when tested by the liquid immersion method at 25° C shall show an index of refraction within the range of 1.50 to 1.98.

d. Material Requirements: The spheres shall be capable of being readily wet with water when tested according to test Method Tex-82-B. The spheres shall show no tendency toward decomposition, surface etching, change in retro-reflective characteristics, or change in color after 24 hours exposure (according to test method Tex-833-B) to weak alkali, or 100 hours of weather-o-meter exposure.

e. General Requirements: Moisture content, spheres shall contain less than 1/4 of 1% moisture by weight; spheres shall be manufactured from glass, shall be free of trash, dirt, etc. and shall show no evidence of objectionable static electricity when flowing through a regular traffic bead dispenser.

- f. Recommended Application Rate: Six (6) pounds per gallon paint.
- 2. Traffic Marking Paint
 - a. Scope and Classification
 - (1) Scope. It is the intent of these specifications to describe minimum requirements for white and yellow traffic marking paint to be used for marking concrete and asphaltic street surfaces.
 - (2) Classification. The paint shall be suitable for application by means of spray-type pavement marking equipment used by the Contractor and when applied by such equipment shall be capable of producing a solid, full width line of required thickness.
 - b. Applicable Specifications
 - (1) The paint shall be capable of being broken up and mixed without difficulty by use of a paddle or paint shaker and show the desired characteristics at any time within a period of six (6) months from day of delivery. If it becomes necessary during the six (6) month period, the paint shall be tested in accordance with ASTM designation D-869 and paint rated below four (4) shall be considered unsatisfactory.
 - (2) All materials required to meet Federal or ASTM specifications must meet the specification as shown.
 - ASTM Spec. D-476-73, Type II
 - Federal Spec. TT-P-463A, Type I
 - National Bureau of Standards - Chromatic Standard No. Sch-30
 - Federal Spec. TT-P-403A
 - Federal Spec. MIL-C-429C, Type I
 - ASTM Spec. D-362-75
 - ASTM Spec. D-740-69
 - ASTM 600-73
 - Tex-806-B
 - Tex-811-B
 - c. Functional Requirements
 - (1) The paint shall be homogeneous, shall be well ground to a uniform and smooth consistency, and shall not skin or settle badly, nor cake, sliver, thicken, curdle, or gel in the container.

- (2) The paint, when applied to a bituminous pavement surface under normal field conditions at the required rate of 0.15 inches wet film thickness, shall have a maximum "no pickup" drying time of fifteen (15) minutes to prevent displacement or discoloration under traffic.
- (3) In preparation of the paint, the pigments shall be dispersed in the vehicle by appropriate methods so that the fineness reading of not less than four (4) is obtained with a Hegman grind gauge.
- (4) Consistency viscosity as determined by the Stromer Viscosimeter at 25° C shall be from 85 to 100 KU.
- (5) A thin film of paint spread on a glass plate and allowed to dry thoroughly shall not darken or show discoloration when subjected to ultra-violet rays for a period of five minutes.

d. Material Requirements

- (1) Raw Materials:
 - (a) Substitutions - The exact brand and types of raw materials used in the wet standards are listed for the purpose of facilitating the selection of parallel materials equal, not only in quality and composition, but also in physical and chemical behavior after aging in the finished product.
 - (b) It shall be the responsibility of the contractor to utilize materials that not only meet the individual raw material specification, but also that produce a coating that meets the specific formula requirements.

- (c) Materials required to meet Federal and ASTM specifications must meet the specification as shown.

2. Pigments

a. White

- (1) Lead free zinc oxide: Shall meet Federal Specification TT-P-463A, Type I, March 3, 1961.
- (2) Pure Titanium Dioxide, Rutile, Non-Chalking: Shall meet ASTM specification D-476-73, Type II.

b. Medium Chrome Yellow - Color

Characteristics and Color. The luminance factors of the pigment shall be within the limits listed below when tested before and after exposure.

	<u>Min.</u>	<u>Max.</u>
Initial	53	59.0
Final	45	

In addition, the allowable change between the initial and final luminance factors shall be no more than 9 units.

The initial x, y chromaticity color coordinates of the pigments shall be within the rectangle defined by the sets of coordinates shown below.

<u>X</u>	<u>Y</u>
0.490	0.455
0.511	0.433
0.514	0.480
0.535	0.458

Method of Test: The pigments shall be tested according to test method Tex-810-B.

Color Standard: National Bureau of Standards Chromatic Standard No. Sch-30.

The formation of the test enamel using the pigments to be tested is as follows:

<u>Materials</u>	<u>Part by Weight</u>
Medium Chrome Yellow	54.0
Long Oil Alkyd Resin (1)	31.5
4% Calcium Drier	0.6
6% Colbalt Drier	0.3
Anti-Livering Agent	0.1
Anti-Skinning Agent	0.2
Mineral Spirits (2)	13.3(3)

- (1) Alkyd Resin Solution meeting Federal specification TT-R226-D, Type I, Class A, November 17, 1971.
- (2) Mineral Spirits meeting Federal specification TT-T-291E, October 12, 1970, amend-1 6/12/75.
- (3) The amount of mineral spirits may be varied slightly to produce the desired grinding consistency. Number of coats: Two (2).

3. Inert

(a) Talc, paint-grade magnesium silicate: Shall meet Federal Specification TT-P-403A.

(b) Calcium Carbonate:

C_aCO_3	Minimum 97.0%
H ₂ O	Maximum 0.4%
Specific Gravity	2.63 - 2.73

Weight retained on #325 Screen Maximum 0.75%.

Color: Equal to material listed in standard formula. Substitution in standard formula shall not result in viscosity variation greater than 4 K.U.

4. Resins:

(a) Chlorinated Paraffin: Shall meet Federal Specification MIL-C-429C, Type I, May 6, 1969.

(b) Chlorinated Rubber: Viscosity @ 25°C *20% solution with Toluene* 406 cups.

*Toluene shall meet ASTM Specification D-362-75.

(c) Traffic paint alkyd resin solution:

(1) General:

Type: Pure, drying alkyd

Length: Medium

Type Oil: Soya, linseed or tall. No mixture of two or more oils will be permitted.

Type Solvent: Toloul

Compatibility: A solution of one part 75% traffic alkyd and five parts toloul shall be clear.

A solution containing the equivalent of 150 grams of 5 cps chlorinate rubber, 130 grams of 75% traffic alkyd, 200 grams of methyl ethyl ketone shall be clear, transparent, and show no separation after 24 hours of storage in a 3/4 full test tube at 80 degrees, plus or minus 5 degrees F. This rubber-alkyd-solvent solution shall produce a clear film upon drying.

(2) Solid Resin Basis:

Percent Phthalic Andydrides	33 to 37
Percent Oil Acids	48 to 55
Acid number, maximum	8.0
Ash residue, maximum	0.10%
Unsaponifiable, maximum	2.0%
Iodine number of fatty acids, minimum	115
Retractive Index of fatty acids, minimum	1.4660
Percent Rosin based on fatty acids (tall oil alkyds), maximum	1.0

(3) 45% Solids Basis:

Color: Gardner 1953 Standard - 9 maximum

Drying Time: A wet film 3 mils thick shall set to touch in not more than 90 minutes.

[Driers: Based on the resin solids present, add the equivalent of 0.06% Cobalt (metal) and 1.0% lead (metal).]

(4) Turbidity: In addition to the above requirements, the traffic alkyd resin shall meet the following % transmittance requirements when tested according to test methods Tex-814-B, utilizing methyl alcohol as primary solvent, and methyl alcohol as precipitating agent.

<u>% Transmittance</u>	<u>Minimum</u>	<u>Maximum</u>
------------------------	----------------	----------------

T1
T2

10%

70%

Calcium volume in milliliters of precipitating agent as follows: $V1 - 91X$.

Where $V1$ = volume of precipitating agent required for T1

X = grams of alkyd resin solids and $V2 = 1.398 V1$

Where $V2$ = additional volume of precipitating agent required for T2.

(5) Thinners:

- a) Methyl Ethyl Ketone: Shall meet ASTM Specification D-740-69 (Reapproved 1974).
- b) Aromatic Naphtha:

Appearance	clear, free of sediment
Color	water , white
Boiling Range	360 deg. F- 415 deg. F
Kauri Butanol Value	88 min.
Specific Gravity, 25 C	0.884 - 0.894
Flash Point deg. F (TCC)	140 min.

(6) Additives and Chemicals:

- a) Driers: Shall pass ASTM 600.73.
- b) Additives: The additives below must be supplied by the manufacturer, as listed:
 - 1) Themolite 813 - Available from: M & T Chemicals, Inc. 530 Exchange Bank & Trust Tower Dallas, Texas 75235
 - 2) Treated Bentonite Clay
 - (i) Bentone 34, N.L. Industries
 - (ii) Claytone 40, Southern Clay Products

(7) Formula:
a) White Traffic Paint:

	<u>Pounds</u>
Traffic Alkyd, 75% Solids	130
Chlorinated Rubber, 5 cps. Hercules, Parlon S-5	150
Chlorinated Paraffin, Type I, Hercules, Chlorafin 40	75
Treated Bentonite Clay	5
Titanium Dioxide, Rutile, DuPont, R-900	200
Lead Free Zinc Oxide, ASARCO, AZO-33	50
Talc, Nytal 300	225
Calcium Carbonate, T.W., Snowflake White	250
24% Lead Drier	3
6% Colbalt Drier	2
Thermolite 813, M & T Chemical Inc.	0.75
Aromatic Naphtha, SC-150	5
Methyl Ethyl Ketone	<u>245</u>
	1,340.75

Grind 4 minimum particles: 8 maximum (Test method Tex 806-B)
Gallon Weight + 0.05 of theoretical gallon weight
Consistency: 85 to 100 K.U.
Skinning: No skinning within 48 hours (Test Method Tex 811-B)

b) Yellow Traffic Paint:

	<u>Pounds</u>
Traffic Alkyd, 75% Solids	130
Chlorinated Rubber 5 cps., I.C.I. Allporene X-5	150
Chlorinated Paraffin, Type I, I.C.I. Cereclor 42	75
Treated Bentonite Clay	5
Titanium Dioxide, Rutile, DuPont, R-900	25
Lead Free Zinc Oxide, ASARCO, AZO-33	50
Medium Chrome Yellow, DuPont, Y-469-D	175
Calcium Carbonate, T.W., Snowflake White	250
Talc, Nytal 300	250
24% Lead Drier	3
6% Cobalt Drier	2
Thermolite 813, M & T Chemical Inc.	0.75
Aromatic Naphtha, SC-150	5
Methyl Ethyl Ketone	<u>255</u>
	1,370.75

Grind 4 minimum particles: 8 maximum (Test Method Tex 806-B)

Gallon Weight ∇ 0.05 of theoretical gallon weight

Consistency: 85 to 100 K.U.

Skinning: No skinning within 48 hours (Test Method Tex 811-B)

PART 3 EXECUTION

3.01 PREPARATION

Contractor shall verify that conditions are suitable for application of the pavement markings. Contractor shall be responsible for any damage caused by paint drift or any such damage caused by his operations.

3.02 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

Surfaces to receive pavement markings shall be completely dry and thoroughly cleaned prior to application of the markings. All products shall be applied according to the manufacturer's recommendations. Traffic shall be kept off the markings until they are completely set and/or dried and durable, all in accordance with the manufacturer's recommendations.

3.03 REPAIR/RESTORATION

Markings which fail to adhere or otherwise fail during the warranty period shall be replaced by the Contractor according to the specifications for no additional cost.

3.04 FIELD QUALITY CONTROL

When handling, mixing and applying the pavement marking products, the Contractor shall have on-site with the products the written handling, storage, mixing, and application recommendations of the product manufacturer. Material Safety Data Sheets shall also be kept on site. All personnel applying the product shall have complete knowledge of the product and its application.

END OF SECTION

SECTION 02581

PARKING PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SUMMARY

This specification describes the procedures and product for the marking (painting) of pavement for parking spaces, crosshatched handicapped aisles, crosshatched crosswalks, loading zones, and other markings shown on the plans. Included is the installation of handicapped signs as shown on the plans. A handicapped sign is to be placed at each handicapped parking space. For van accessible spaces, a van accessible sign is required and is to be mounted on the same pole as a handicapped sign.

1.02 MEASUREMENT AND PAYMENT

The cost for performing the work described in this Section shall be included in related items of work unless specifically shown otherwise on the Bid Form. Contractor is responsible for furnishing all materials, tools, equipment, labor, and incidentals for successfully completing the work associated with parking pavement markings.

1.03 SUBMITTALS

Product data sheets shall be submitted to the City of Magnolia, Engineer or to the designated representative of the Engineer. The Engineer shall determine the number of copies of the data sheets that are to be submitted for review and approval.

PART 2 PRODUCTS

2.01 MANUFACTURERS

Pavement marking paint:

White - Sherwin Williams product no. TM 2136 or approved equal.

Yellow - Sherwin Williams product no. TM 2155 lead free or approved equal.

PART 3 EXECUTION

3.01 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

All markings shall be applied and surfaces prepared as recommended by the product manufacturer. Stripe width for parking spaces and similar type markings shall be a minimum of four (4) inches. Diagonal stripes at 45° shall be painted on handicapped access aisles at handicapped parking spaces, on crosswalks, and on pedestrian loading zones. Perpendicular distance between diagonal stripes shall be 36" C-C (48" along the

line to which the diagonal line connects).

END OF SECTION

SECTION 02605

CONDUCTIVE TRACE WIRE FOR NONMETALLIC PIPE INSTALLATION

PART 1 GENERAL

1.01 SUMMARY

This section covers the requirements for installation of a conductive trace wire with underground, nonmetallic pipe.

1.02 MEASUREMENT AND PAYMENT

Work performed under this section shall be paid for under the lump sum bid price or included in the unit price for pipe installation as applicable, unless otherwise indicated on the Bid Form.

1.03 SYSTEM DESCRIPTION

Install electrically continuous trace wire, with access points as described herein, to be used for locating nonmetallic pipe with an electronic pipe locator after installation.

PART 2 PRODUCTS

Trace wire to be twelve (12) gauge minimum solid copper with thermoplastic insulation recommended for direct burial. Wire connectors to be 3M DBR, or approved equal and shall be watertight and provide electrical continuity.

PART 3 EXECUTION

3.01 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

Trace wire shall be installed in the same trench and inside bored holes and casing with nonmetallic pipe during pipe installation. It shall be secured to the pipe, as required, to insure that the wire remains directly adjacent to the pipe. The trace wire shall be securely bonded together at all wire joints with an approved watertight connector to provide electrical continuity, and it shall be accessible at all new water valve boxes, water meter boxes, fire hydrants, sewer manholes, sewer cleanouts, gas valves and gas meter risers as applicable to the utility line being installed. At manholes, the wire shall be installed from the exterior of the manhole to the interior by installing the wire underneath the manhole frame. For lines with more than 5 feet of cover, the wire shall be installed directly over the pipe at a depth of 5 feet. If the spacing of valves and meters is greater than one mile, the trace wire shall be looped up in a 2" PVC pipe to be located at the right-of-way fence line or at a cross fence line, as applicable, for protection. A cap shall be placed on the 2" pipe when used, but it shall not be solvent welded onto the pipe. Where access points for trace

wire on gas lines exceeds 500', install test lead boxes such that maximum access point spacing is 500'.

3.02 TESTING

Contractor shall perform a continuity test on all trace wire in the presence of the Engineer or the designated representative of the Engineer.

3.03 REPAIR/RESTORATION

If the trace wire is found to be not continuous after testing, Contractor shall repair or replace the failed segment of the wire.

END OF SECTION

SECTION 02660

WATER SUPPLY LINES AND PIPING

PART 1 GENERAL

1.01 SUMMARY

This section covers furnishing all labor, materials, equipment, supplies, supervision and tools and performing all operations in connection with the installation of water supply lines, couplings, fittings, and other related appurtenances of the types and pressure classes as shown on the plans or on the Bid Form

1.02 RELATED SECTIONS

Section 02222 - Excavation, Trenching and Backfilling for Utilities

Section 02605 - Conductive Trace Wire for Non-Metallic Pipe Installation

Section 02675 - Sterilization of Water Lines

Section 02676 - Hydrostatic Testing of Water Lines

1.03 MEASUREMENT AND PAYMENT

Unless otherwise indicated on the Bid Form, the measurement and payment for the work specified in this Section shall be as follows:

- A. Pipe: Measure and pay for by linear foot from centerline of fitting to centerline of fitting along pipe of size and type installed. All trenching, bedding, backfill and concrete blocking shall be included in the unit price bid per linear foot of pipe.
- B. Fittings: Ductile iron and cast iron fittings, excluding tees in fire hydrant units, will be measured by the ton and paid for at the unit price bid per ton of fittings. Concrete thrust blocking and joint restraints at fittings shall be included in the bid price per ton of fittings.
- C. Valves: Valves with valve boxes, concrete collars, valve markers and, when required, operator extensions will be measured per each, excluding valves in fire hydrant units, for each size furnished and installed and will be paid for at the unit price bid per each.
- D. Fire Hydrant Unit: Fire hydrant units, including tee, lead, valve, valve operator extensions, valve box, and fire hydrant will be measured per each and paid for at the unit price bid per each.
- E. Miscellaneous Valves: Measure miscellaneous valves with valve boxes and concrete collars furnished and installed as shown on Plans per each and pay for

each at the unit price bid.

- F. Water Meters: Measure water meters including meter boxes per each and pay for meters at the unit price bid per each.
- G. Water Service: Measure and pay for water service per each. A water service consists of tapping saddle on water main, corporation stop, or gate valve (on large services) and either a curb stop or an angle stop connected to water meter according to plans. Service line will be measured and paid for by the linear foot.
- H. Insulation: There will be no separate payment for insulation.
- I. Conductive Trace Wire: There will be no separate payment for conductive trace wire.
- J. Casing Spacers: There will be no separate payment for casing spacers.
- K. Flush Valve Unit: Flush valve unit, including tee or saddle, valve, riser, valve box with concrete collar and valve marker will be measured per each and paid for at the unit price bid per each. No separate payment will be made for temporary flush valves required during construction for flushing and cleaning of lines.
- L. Wet Connection: Wet connections to main lines shall be paid for at the unit price bid per each and shall include new pipe to replace the section of pipe removed. The new pipe shall be coupled to the existing line with a solid D.I. sleeve which will be paid for as an iron fitting.
- M. Hose Bibbs & Vacuum Breakers: There shall be no separate payment for hose bibs and vacuum breakers unless indicated otherwise on the Bid Form.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

ANSI	American National Standards Institute
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
NSF	National Sanitation Foundation

1.05 SUBMITTALS

Submit shop drawings showing materials being offered, including dimensions and catalog data verifying the products meet the requirements of this section. The number of copies of submittals that are required to be submitted for review and approval shall be determined by the Engineer or the designated representative of the Engineer.

1.06 QUALITY ASSURANCE

- A. Pipe shall bear the NSF seal of approval for potable water pipe. Pipe manufacturer shall mark pipe with appropriate ASTM designation.
- B. Contractor shall notify the City of Magnolia, Engineer or the designated representative of the Engineer not less than 24 hours before each load of pipe is to be delivered to the jobsite to allow for inspection. When a load of pipe is found to have inadequate wall thickness or tolerances greater than specified, randomly selected samples of the pipe shall be immediately sent to the National Sanitation Foundation, with instructions to check the pipe for compliance with not only National Sanitation Foundation specifications but other specifications for the specific contract. When the National Sanitation Foundation or other commercial laboratory selected concurs that the pipe does not meet specifications, it shall be immediately removed and replaced by the Contractor at no additional cost to the Owner.

1.07 DELIVERY, STORAGE AND HANDLING

Handle and store pipe and appurtenances in accordance with manufacturer's recommendations. Interiors of pipe and appurtenances shall be kept clean prior to and during construction. Protect PVC pipe and gaskets from excessive exposure to heat and sunlight.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

Pipes and related products must conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and must be certified by an organization accredited by ANSI. Pipe shall be of domestic origin.

- A. PVC Pipe: PVC water lines shall be of the type designated on plans or in the bid form.

- 1. C-900 PVC: C-900 PVC water line shall meet the requirements of AWWA C-

900 (latest revision), "Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water" and shall be approved by the State Board of Insurance and Underwriters Laboratories for fire service without penalty. All Class 150 pipe shall meet the requirements of DR 18 and Class 200 pipe shall meet the requirements of DR 14. Pipe shall bear the NSF seal of approval indicating that the pipe is suitable for conveying potable water.

- a. Joints: Pipe joints shall be push-on type with one elastomeric gasket, or coupling type with two elastomeric gaskets furnished with each coupling. Joints and gaskets shall conform to AWWA C-900.
 - b. Fittings-Full Body: Unless otherwise shown on Plans, fittings shall be cast or ductile iron mechanical joint type. Cast or ductile iron push-on type and mechanical joint type fittings shall conform to ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11. Class 250 for 4" through 12" and Class 150 for 14" and larger unless otherwise shown on plans.
 - c. Fittings-Short Body: Unless otherwise shown on plans, ductile iron short body fittings may be used and shall be mechanical joint type. Push on and mechanical joint ductile iron short body fittings shall conform to ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/21.11, Class 350 for all sizes.
 - d. Coating, Lining and Encasement for Cast Iron and Ductile Iron Fittings: Fittings shall be asphalt coated outside in accordance with ANSI/AWWA C151/A21.51 except for above ground fittings which are to be painted. All uninsulated above ground D.I./C.I. fittings shall be painted. Fittings shall have cement mortar lining inside in accordance to ANSI/AWWA C104/A21.4. Underground fittings shall be wrapped with 8 mil low density polyethylene or 4 mil high density polyethylene in accordance with ANSI/AWWA C105/A21.5.
2. C-900 PVC Pressure Pipe: PVC pressure pipe shall meet the requirements of ASTM D2241 "Specification for Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR) and shall bear the NSF seal of approval indicating that the pipe is suitable for conveying potable water. The following standards shall also apply to the installation of PVC pressure pipe:
- a. Joints: Unless otherwise shown on Plans, pipe joints for 2" and larger pipe shall be push-on type conforming to ASTM D-3139, "Standard Specification for Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals." Joints for pipe smaller than 2" shall be solvent weld. Solvent weld joints shall meet the requirements of ASTM 2672, "Standard Specification for Bell End Polyvinyl Chloride (PVC) Pipe.

- b. Gasket: ASTM F-477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- c. Fittings: Fittings for 4" and larger pipe shall be cast iron or ductile iron. PVC fittings may be used for pipe 3" or smaller.
 - (1) Ductile Iron and Gray Iron Fittings-Full Body: Unless otherwise shown on Plans, fittings shall be mechanical joint type. Cast or ductile iron push-on type and mechanical joint type fittings shall conform to ANSI/AWWA C110/A21.10 and ANSI/AWWA C11/A21.11. Class 250 for 4" through 12" and Class 150 for 14" and larger unless otherwise shown on plans.
 - (2) Ductile Iron Fittings-Short Body: Unless otherwise shown on plans, ductile iron short body fittings may be used and shall be mechanical joint type. Push on and mechanical joint ductile iron short body fittings shall conform to ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/21.21.11, Class 350 for all sizes.
 - (3) PVC Fittings: PVC fittings shall be Class 200 minimum rubber gasket type, except PVC fittings for pipe smaller than 2" shall be solvent weld. For special applications and with the approval of the Engineer or the designated representative of the Engineer, solvent weld fittings may be acceptable for pipe size as large as 3".
- d. Coating, Lining and Encasement for Cast (Gray) Iron and Ductile Iron Fittings: Fittings shall be asphalt coated outside in accordance with ANSI/AWWA C151/A21.51, except for above ground uninsulated fittings which shall be painted. Fittings shall have cement mortar lining inside in accordance with ANSI/AWWA C104/A21.4, and shall be wrapped with 8 mil low density polyethylene or 4 mil high density polyethylene in accordance with ANSI/AWWA C105/21.5.
- e. PVC Material: ASTM D-1784, "Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds".

B. Ductile Iron Pipe: Unless otherwise shown on Plans, ductile iron pipe shall be pressure Class 350 in accordance with ANSI/AWWA C151/A21.51.

- 1. Joints: Unless otherwise shown on Plans, pipe joints shall be push-on type conforming to ANSI/AWWA C111/A21.11. Mechanical joint pipe shall conform to ANSI/AWWA C111/A21.11 and flanged joint pipe shall conform to ANSI/AWWA C115/A21.15.

2. Fittings-Full Body: Unless otherwise shown on Plans, fittings shall be cast iron or ductile iron mechanical joint type. Mechanical joint and push-on fittings shall conform to ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11, Class 250 for 4" through 12" and Class 150 for 14" and larger unless shown otherwise on Plans. Flanged fittings to be in accordance with ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11, Class 250 for 4" through 12" and Class 150 for 14" and larger unless shown otherwise on plans, both with one hundred twenty-five (125) pound template flanges. Flanged fittings shall have tapping bosses.
 3. Fittings-Short Body: Unless otherwise shown on plans, ductile iron short body fittings may be used and shall be mechanical joint type. Mechanical joint and push-on ductile iron short body fittings shall conform to ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/21.11, Class 350 for all sizes. Flanged fittings shall have full body dimensions.
 4. Coating, lining and encasement for Pipe and Fittings: Pipe and fittings shall be asphalt coated outside in accordance with ANSI/AWWA C151/A21.51 except for above ground pipe and fittings which are to be painted. All uninsulated above ground D.I./C.I. fittings and pipe shall be painted. Pipe and fittings shall have cement mortar lining inside in accordance to ANSI/AWWA C104/A21.4. Underground pipe and fittings shall be wrapped with 8 mil low density polyethylene or 4 mil high density polyethylene in accordance with ANSI/AWWA C105/A21.5.
 5. Gaskets: Gaskets for push-on and mechanical joints shall conform to ANSI/AWWA C111/A21.11. Gaskets for flanged joints shall be 1/8 inch thick rubber, either ring or full face, conforming to dimensions in Appendix to ANSI/AWWA C115/A21.15.
- C. Steel Pipe: Steel pipe, 6 inches diameter and larger shall be Grade "A", seamless pipe conforming to AWWA C200 and shall have a minimum wall thickness as shown on Plans.
1. Joints: Unless otherwise shown on Plans, joints shall be butt-welded field joints in accordance with AWWA C206. All welders assigned to apply metal arc welding to pipe joints under this specification shall have been tested under the American Welding Society "Standard Qualifications Procedures." The Contractor shall provide copies of certificates showing that all welders are qualified under the above standards.
 2. Fittings: Steel flanges and fittings shall conform to AWWA C207 and C208.
 3. Coatings and Lining for Pipe and Fittings: All interior and exterior surfaces of pipe and fittings shall receive shop applied coatings of Coal Tar Epoxy

conforming to the requirements of AWWA C210. Weld joints and damaged coating shall be field repaired using materials and procedures recommended by the manufacturer of the coating used on the pipe.

4. Holiday Detection: Prior to installation, the coated pipe and fittings shall be holiday detected with a wet sponge holiday detector and all holidays shall be repaired in accordance with the requirements of AWWA C210.
- D. Copper Tubing: Copper tubing shall conform to the requirements of ASTM B-88, Type "K". Joints for underground work shall be compression-pattern, flared, for soft copper tubing and shall be made with fittings meeting approved standards. Tubing shall be cut off square and expanded with a proper flaring tool.
- E. Polyethylene Tubing: Polyethylene tubing shall be SDR 9, Class 200, meeting ASTM D-2737, P.E. 3408 tubing, CTS-OD, AWWA C901 compression type connections.
- F. Gate Valves: Gate valves 2 inches and larger shall be iron-body, resilient rubber seat, non-rising stem and shall conform to AWWA C-509. Smaller valves shall be brass double disc with brass body, non-rising stem with square nut adapter and shall conform to AWWA C-500. Valves shall have ends as required for the piping in which they will be installed. Gate valves shall have a clear waterway equal to the full nominal diameter of the valve and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow cast in the metal indicating the direction of opening. Valves located inside structures shall be wheel operated and underground valves shall be nut operated. For nut operated valves installed with the nut more than 30" from finished grade, provide nut operator extension so nut operator is 30" or less below finished grade. Each valve shall have the maker's initials, pressure rating, and year of manufacture cast on the body. Valves 3 inches through 12 inches shall have a 200 psig working pressure and valves 16 inches and larger shall have 150 psig working pressure. Prior to shipment from the factory each valve shall be tested by hydraulic pressure equal to twice the specified water working pressure. Gate valves shall be American Darling, Mueller, or preapproved equal.
- G. Check Valves:
1. Swing Check Valves: Valves 2" in diameter and larger shall be iron body, bronze mounted, horizontal swing check valves with balanced weight and lever arm. They shall have a 150 p.s.i. working pressure and meet the requirements of AWWA C-508.
 2. Silent Check Valves:
 - a. Wafer Style - Wafer style silent check valve shall be designed with semi-

steel bodies, bronze seat, bronze plug and stainless steel spring. The valve plug must be center guided at both ends with a thru integral shaft and spring loaded for guaranteed silent shut-off operation.

The spring must be helical or conical. The seat and plug shall be hand replaceable in the field for ease of maintenance. The flow area thru the body shall be 3% greater than the cross-section area of the equivalent pipe size.

Check valve must be capable of silent operation when installed in vertical or horizontal position - flow up or flow down.

All materials of construction shall be certified in writing to conform to A.S.T. M. specifications as follows:

Body	Cast Iron	ASTM A126 Gr. B
Plug & seat	Bronze	ASTM B584 C83600
Spring	Stainless Steel	ASTM A276 T316
Exterior paint	Phenolic Primer	FDA Approved for
	Red Oxide	Potable Water Contact

The valve shall be suitable for use with 125# flanges. The valve shall be APCO Series 300, as manufactured by Valve and Primer Corporation, Schaumburg, Illinois, U.S.A., or approved equal.

- b. Globe Style: Globe style silent check valves shall be designed with semi-steel bodies, bronze seat, bronze plug and stainless steel spring. The valve plug must be center guided at both ends with a thru integral shaft and spring loaded for guaranteed silent shut-off operation.

The spring must be helical or conical. The seat and plug shall be hand replaceable in the field for ease of maintenance. The flow area thru the body shall be 10% greater than the cross-sectional area of the equivalent pipe size.

All materials of construction shall be certified in writing to conform to A.S.T.M. specifications as follows:

Body	Cast iron	ASTM A126 Gr. B
Plug & seat	Bronze	ASTM B584 C83600
Spring	Stainless steel	ASTM A276 T316
Exterior paint	Phenolic Red	FDA Approved for
	Oxide	Potable Water Contact

The valve shall have 125# flanges. The valve shall be APCO Series 600, as manufactured by Valve & Primer Corporation, Schaumburg, Illinois, U.S.A., or approved equal.

- H. Backflow Preventers: All types of backflow prevention assemblies shall meet the standards of AWWA and the Specifications of Backflow Prevention Assemblies contained in the Manual of Cross Connection Control, latest edition, published by Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California. Backflow preventers shall be as manufactured by Cla Val Company, Watts, or approved equal provided the backflow prevention assemblies meet the requirements contained herein.
- I. Butterfly Valves: Butterfly valves shall be cast iron body, rubber-seated, short body, pressure Class 150 meeting the requirements of AWWA C-504. Valves shall have gear operators unless noted otherwise on plans and shall have nut operators when underground and hand wheel operators above ground. Butterfly valves shall be Dezurik, Pratt, Keystone, or approved equal. When called for on plans, provide pneumatic operator or electric motor operator by the same manufacturer as the valve.
- J. Plug Valves: Plug valves shall be cast iron body, stainless steel seat and Buna N plug. Plug valves to be by Dezurik, Pratt, Keystone or approved equal.
- K. Miscellaneous Valves: Flush, blow off, air relief and pressure regulating valves shall be of the types and sizes and at the locations shown on the Plans.
- L. Fire Hydrants: Fire hydrants shall be dry barrel, compression type, 150 psi working pressure, traffic model, with 5-1/4" valve opening and shall meet the requirements of AWWA C-502. Pumper Nozzle shall match standard nozzle used on the City of Magnolia's system. Rotate fire hydrant barrel to face direction directed by the Engineer or the designated representative of the Engineer. Fire hydrants shall be American Darling, Mueller or preapproved equal.
- M. Valve Boxes: Valves buried underground shall be provided with adjustable cast iron valve boxes of proper dimensions to fit over the valve and to extend to finished grade or slightly above as directed by the Engineer or the designated representative of the Engineer. Valve boxes to have lids cast with the word "Water".
- N. Water Meters: Water meters 5/8" through 2" shall be sealed register, displacement type and conform to AWWA C-700. Compound meters 2" to 6" shall conform to AWWA C-702. Meter size and type shall be as shown on Plans.
- O. Tapping Sleeves: Tapping sleeves shall be stainless steel body with ductile iron flange, 200 psi working pressure with 125 pound outlet flange, Smith-Blair, Ford or preapproved equal.

- P. Service Fittings: Tapping saddles, corporation stops and curb stops shall conform to AWWA C800. All corporation stops, curb stops and angle stops shall have the same rated pressure as the main line pipe to which the water service is attached.
- Q. Joint Restraints. EBAA Iron Model 2000 or preapproved equal.
- R. Insulation System: Two (2) inch thick rigid wrap as manufactured by E. O. Wood Co., Fort Worth, Texas or preapproved equal. Aluminum jacketing with integrally bonded moisture barrier as manufactured by Childers, 1100, 3003, 3105, 5005 or 5010 aluminum alloy, 0.016 inch minimum thickness. Mastic coating system to be Childers Vi-Cryl CP-11 and glass cloth membrane to be Chil-Glas #10.
- S. Casing Spacers: Casing spacers shall provide electrical insulation between the carrier pipe and casing. They shall be made of high density polyethylene or other approved material. The casing spacers shall be "RACI" as manufactured by Public Works Marketing, Inc., or approved equal.
- The spacer shall be sized such that the bell of the carrier pipe will be held a minimum of one fourth (1/4) inch from the bottom of the casing, and the spacer O.D. shall not be less than the casing I.D. minus three fourths (3/4) of an inch. The design and type of spacer shall be suitable for the type, size, and weight of the carrier pipe and it's contents.
- T. Hose Bibs with Vacuum Breakers: Hose bibs (125 psi rating) shall be equipped with all brass vacuum breakers (125 psi rating) and shall have brass bodies. Hose bibs and vacuum breaker to be manufactured by Watts Industries, or approved equal.

PART 3 EXECUTION

3.01 PREPARATION

Expose all underground utilities that may be in conflict with proposed water lines prior to installing new lines.

3.02 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

- A. General: All pipe shall have a cover of at least 42 inches from finished grade unless shown otherwise on the plans. The pipe depth of cover shall not exceed 48 inches from finished grade unless approved by the City of Magnolia, Engineer or the designated representative of the Engineer OR unless specifically shown otherwise on the plans. No pipe shall be laid in water or when trench condition or weather is unsuitable for such work and pipe shall be kept clean before, during and after laying. Sanitary precautions shall be taken during water line installation as called for by AWWA Standards. Do not install pipe with radius of curvature less than the minimum recommended by pipe manufacturer.
1. PVC Pipe: PVC pipe shall be uniformly and continuously supported by stable soil. Bedding in the pipe zone from 4 inches below bottom of pipe up to 12 inches above top of pipe shall be hand placed select material free from rocks, organic refuse, or lumps greater than 1-1/2 inches, which will not break down readily when compacted. Bedding shall be placed in thin (approximately 4-inch) layers, moistened if necessary, and thoroughly compacted under and on each side of the pipe to provide support that is free from voids. The balance of the ditch may be machine backfilled unless otherwise shown on Plans.
 2. Ductile Iron and Steel Pipe: Lay pipe on firm earth foundation and carefully backfill to 6" over pipe with acceptable material free from clods, rocks, or other sharp debris which may damage protective coating or cause pipe to shift. The balance of the trench may be machine backfilled unless otherwise shown on Plans.
 3. Valves, Valve Boxes and Fire Hydrants: Install valves, valve boxes and fire hydrants plumb. Place valve boxes directly over valve stem. Before installation of valves or fire hydrants, clean all foreign material from interior and open and close valves to insure that they are in good working order. Hand tamp backfill around valve boxes and fire hydrants out to undisturbed trench face. For all nut operated valves below ground, provide and install a valve operator extension on any valve that is installed where the operating nut is more than 30 inches below surrounding finished grade.
- B. Conductive Trace Wire: Install conductive trace wire with all nonmetallic main water lines and with all service lines.

- C. Separation of Water and Sewer Lines: The following criteria shall be followed for water and sewer line separations:

When water mains and sanitary sewers are installed, they shall be installed no closer to each other than nine feet in all directions and parallel lines must be installed in separate trenches. Where the nine-foot separation distance cannot be achieved, the guidelines in this subsection shall apply. The guidelines are listed in tabular form in the following table:

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TABLE I
SEPARATION OF WATER & SEWER LINES

CONDITION	LOCATION	MATERIAL <u>WATER</u> <u>SEWER</u>	SEPARATION (MIN)		
			<u>VERT.</u>	<u>HORZ.</u>	
<u>COMMENTS</u>					
NEW WATER & NEW SEWER SYSTEM					
Sewer Force Trenches	Water above Std.	CI, DI	2'	4'	Separate
Main and GravitySewer Sewer Parallel to Water Main		150 PSI			PVC;
Gravity San. one joint	Water above Std.	CI, DI	6"	NA	Center
Sewer Crossing pipe on	Sewer or	PVC;			of sewer
Water Main main	Sewer Above	150 PSI			water
Gravity Sewer stabilize	Water Water above Std.	ABS,	2'	NA	Cement
Crossing Water backfill	Sewer	Clay			sand
Main backfill zone		Conc.			initial
		Composite			of sewer
for 9 ft.					on each
side of					crossing.
Center one					joint of
sewer pipe					on water
main.					
<u>NEW WATER & EXISTING SANITARY SEWER</u>					
New Water shows no	Water AboveStd.	Clay,	2'	4'	If sewer
Parallel leakage, then	Sewer	Concrete			sign of
Existing sewer alone. If		ABS, CI,			leave
Sewer shows signs of		DI, PVC			sewer
then repair or					leakage,
	replace.				
New Water	Water above Std.	ABS,	2'	NA	If sewer
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shows no sign Crossing leakage, then leave Existing alone. If sewer Sewer signs of leakage	Sewer		Clay, Concrete Composite		of sewer shows then
repair or replace. New Water existing sewer Crossing joint CI, DI, Existing 150 PSI, Sewer centering over water line.	Sewer Above Water	Std.	ABS, 2' Clay, Concrete Composite	NA	Replace with one PVC-
New Water existing sewer Parallel DI, PVC-150 to Existing psi or cement stabilized Sewer backfill in initial backfill zone of sewer where parallel closer than 9', or encase the water in 150 PSI pipe two nominal sizes larger.	Sewer Above Water	Std.	ABS, 2' Clay, Composite	4' Concrete	Replace with CI, sand

<u>CONDITION</u>	<u>LOCATION</u>	<u>MATERIAL</u>	<u>SEPARATION (MIN)</u>			
<u>COMMENTS</u>		<u>WATER</u>	<u>SEWER</u>	<u>VERT.</u>	<u>HORZ.</u>	
<u>EXISTING WATER & NEW SANITARY SEWER</u>						
New Sewer	Water AboveStd.	CI, DI		2'	4'	Separate
Parallel Existing	Sewer or Sewer	PVC,				trenches
Water	Above Water	150 PSI				
New Sewer	Water AboveStd.	CI, DI		6"	NA	Center
one joint of						
Crossing Existing	Sewer or	PVC,				sewer
pipe on water						
Water	Sewer Above	150 PSI				line.
	Water					
New Sewer	Water AboveStd.	ABS,		2'	NA	Cement
stabilize sand						
Crossing	Sewer	Clay,				backfill
initial zone of						
Existing		Concrete				sewer
for 9 ft. each						
Water		Composite				side of
crossing.						
						Center
one joint of						
						sewer
pipe on water						main.

1. Where a sanitary sewer parallels a water line, the sewer shall be constructed of cast iron, ductile iron or PVC meeting ASTM specifications with a pressure rating for both the pipe and joints of 150 psi. The vertical separation shall be a minimum of two feet between outside diameters and the horizontal separation shall be a minimum of four feet between outside diameters. The sewer shall be located below the water line.
2. Where a sanitary sewer crosses a water line and the sewer is constructed of cast iron, ductile iron or PVC with a minimum pressure rating of 150 psi, an absolute minimum distance of six inches between outside diameters shall be maintained. In addition, the sewer shall be located below the water line where possible and one length of the sewer pipe must be centered on the water line.

3. Where a sewer crosses under a water line and the sewer is constructed of ABS truss pipe, similar semi-rigid plastic composite pipe, clay pipe or concrete pipe with gasketed joints, a minimum two-foot separation distance shall be maintained. The initial backfill shall be cement stabilized sand (two or more bags of cement per cubic yard of sand) for all sections of sewer within nine feet of the water line. This initial backfill shall be from one-quarter diameter below the centerline of the pipe to one pipe diameter (but not less than 12 inches) above the top of the pipe.
4. Where a sewer crosses over a water line all portions of the sewer within nine feet of the water line shall be constructed of cast iron, ductile iron or PVC pipe with a pressure rating of at least 150 psi using appropriate adapters. In lieu of this procedure, the new conveyance may be encased in a joint of 150 psi pressure class pipe at least 18 feet long and two nominal sizes larger than the new conveyance. The space around the carrier pipe shall be supported at five feet intervals with spacers or be filled to the spring line with washed sand. The encasement pipe should be centered on the crossing and both ends sealed with cement grout or manufactured seal.
5. The sewer need not be disturbed where a new water line is to be installed parallel to an existing sewer that shows no evidence of leakage and the water line is installed above the sewer a minimum of two feet vertically and four feet horizontally. Should excavation for the water line produce evidence that the sewer is leaking, the sewer must be repaired or replaced as described in subparagraphs 1 or 4 of this paragraph.
6. The sewer need not be disturbed where a new water line is to cross over (by two feet or more) existing sewer showing no evidence of leakage. Should excavation for the water line produce evidence that the sewer is leaking, then the sewer must be repaired or replaced as described in subparagraphs 3 or 4 of this paragraph.
7. Unless sanitary sewer manholes and the connecting sewer

can be made watertight and tested for no leakage, they must be installed so as to provide a minimum of nine feet of horizontal clearance from an existing or proposed water line. Where the nine-foot separation distance cannot be achieved, an encasement pipe as described above may be used for the water line.

8. Fire hydrants shall not be installed within nine feet vertically or horizontally of any sanitary sewer regardless of construction.

D. Thrust Blocking and Joint Restraint:

Concrete blocking and joint restraints shall be installed at all bends, tees, points where reducers or changes in pipe diameter occur, fire hydrants or valves and all plugged openings. Use concrete having compressive strength not less than 2,000 pounds per square inch. Place blocking against undisturbed solid ground, with area of bearing on pipe and on ground as required by manufacturer's recommendation for the type of soil encountered. Place blocking so that pipe and fitting joints will be accessible for repair. See detail sheet for minimum sizing.

E. Insulation:

4" diameter or smaller water lines and fittings and all sizes of valves installed above ground, shall be insulated to provide protection from freezing temperatures. The installation shall consist of a minimum 2 inch thick layer of Rigid-Wrap fiberglass insulation as manufactured by E.O. Wood Co., Fort Worth, Texas or a preapproved equal. All installation shall be weather proofed with Childers' aluminum jacketing or preapproved equal. The jacketing is to be manufactured from 1100, 3003, 3105, 5005 or 5010 aluminum alloy and have a minimum thickness of 0.016 inches. All jacketing shall have an integrally bonded moisture barrier over the entire surface in contact with the insulation.

Encapsulation of insulation around fittings shall be accomplished utilizing a two coat vinyl-acrylic mastic coating system, Vi-Cryl CP-11, as manufactured by Childers or a preapproved equal. A glass cloth membrane, Chil-Glas #10, shall be embedded on to the first coat. The minimum dry film thickness of the vinyl-acrylic

mastic shall be 1/16 inch. There shall be no voids or holidays and the mastic shall be trowelled, sprayed or wet brushed to a smooth even finish.

All of the above specified insulation, jacketing and encapsulation shall be installed in strict accordance with manufacturer's recommendations to provide a waterproof membrane around the insulation.

- F. Casing Spacers: Casing spacers shall be installed on all carrier pipe which is installed inside a casing. Casing spacers shall be installed such that the distance between spacers does not exceed the maximum distance recommended by the manufacturer of the carrier pipe and by the spacer manufacturer dependent on potential weight of the carrier pipe full of water, except the distance between spacers shall not exceed seven (7) feet. A casing spacer shall be installed within one (1) foot of the end of each joint of nonwelded carrier pipe, and two adjacent spacers shall be installed on the carrier pipe at each end of the casing such that the last spacer is within one (1) foot of the end of the casing.
- G. Hose Bibbs and Vacuum Breakers: Install hose bibbs at the locations shown on the plans. Install vacuum breakers at all hose bib location on the supply side of the hose bib to prevent backflow of contaminated water into the water supply system.
- H. Testing of Backflow Preventers: After installation, backflow preventers shall be tested by a backflow prevention assembly tester licensed in the State. Testing shall be in accordance with the Manual of Cross-Connection Control, latest edition, published by Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California; with the American Water Works Association – Recommended Practice for Backflow Prevention and Cross-Connection Control (Manual M14); and with local codes and requirements. Backflow preventers shall not be put into service until after passing the required testing.

3.03 REPAIR/RESTORATION

Sections of water line determined to be defective either prior to or during hydrostatic pressure test shall be replaced with sound materials at no expense to the City of Magnolia. No repair clamps will be allowed on new construction.

3.04 FIELD QUALITY CONTROL

Prior to final acceptance, hydrostatic pressure test and sterilize waterlines according to the applicable technical specification sections.

3.05 ADJUSTING/CLEANING

Adjust all fire hydrants, valve boxes and meter boxes to proposed or existing grade as applicable. Upon completion of water line construction, all debris and surplus materials resulting from the work shall be removed from the project site.

END OF SECTION

SECTION 02675

STERILIZATION OF WATER LINES

PART 1 GENERAL

1.01 SUMMARY

This section covers the procedures for sterilization of water lines and appurtenances.

1.02 RELATED SECTIONS

Section 02660 Water Supply Lines and Piping
Section 02676 Hydrostatic Testing of Water Lines

1.03 MEASUREMENT AND PAYMENT

There will be no separate measurement and payment for sterilization of water lines unless specifically indicated otherwise on the Bid Form. Include cost for sterilization of water lines in related items of work or in the lump sum bid price as applicable.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

AWWA American Water Works Association

1.05 SYSTEM DESCRIPTION

Furnish pump, pipe connections, gauges, meters, appurtenances and chlorinating agent to sterilize water lines and make bacteriological analyses to check effectiveness.

1.06 DELIVERY, STORAGE AND HANDLING

Store chlorinating agent in a safe place according to manufacturer's recommendation.

1.07 SCHEDULING

Perform final flushing and bacteriological testing after successful hydrostatic test of line segment(s).

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

Chlorinating agent to be liquid chlorine, sodium hypochlorite solution or calcium hypochlorite granules or tablets.

PART 3 EXECUTION

3.01 PREPARATION

Remove, by flushing or other means, contaminating materials that may have entered the water line during construction. Where necessary, install temporary flush valves at the end of new lines for flushing and sampling prior to tying into existing system.

3.02 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

A. Application Procedure - Apply chlorinating agent by one of the following procedures:

1. Tablet Method - Place calcium hypochlorite granules or tablets in the water line at the upstream end of the first section of pipe, at the upstream end of each branch and at 500 foot intervals such that when the pipe is filled with potable water the dose will be a minimum of 25 mg/l for 24 hours. Fill pipe such that water velocity does not exceed one (1) foot per second.
2. Continuous Feed Method - Fill line with water, eliminate air pockets and flush water line at a minimum velocity of 2.5 feet per second to remove particulates. Feed chlorine water solution having a free chlorine concentration of 25 mg/l into line until entire line is filled with heavily chlorinated water. Retain chlorinated water in line for 24 hours after which time the free chlorine residual shall not be less than 10 mg/l.
3. Slug Method - Place calcium hypochlorite granules in the line during construction, completely fill the line to eliminate all air pockets, flush the line to remove particulates and slowly flow a slug of water dosed with chlorine to a concentration of 100 mg/l through the line such that all parts of the line and appurtenances will be exposed to no less than 50 mg/l of free chlorine for not less than 3 hours.

- B. Chlorination of Appurtenances - Operate valves and hydrants several times while exposed to the required chlorine concentration to assure disinfection of appurtenances and pipe branches.
- C. Final Flushing - In order to prevent damage to pipe and linings, flush heavily chlorinated water from system until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system.
- D. Bacteriological Test - After final flushing, collect samples and test for presence of coliform organisms. A minimum of one sample shall be collected from each 1,000 feet of water line or at the next available sampling point beyond 1,000 feet as designated by the City of Magnolia, Engineer or the designated representative of the Engineer.

3.03 REPAIRS/RESTORATION

If initial disinfection fails to produce tests showing absence of coliform organisms, the new line may be reflushed and shall be resampled. If check samples also fail to produce acceptable results, the main shall be rechlorinated until satisfactory results are obtained.

3.04 FIELD QUALITY CONTROL

Testing for bacteriological quality shall be in accordance with Standard Methods for the Examination of Water and Wastewater. Collection of samples shall conform to the applicable AWWA standard and shall meet with the approval of the DPW or designated representative of the DPW.

END OF SECTION

SECTION 02676

HYDROSTATIC TESTING OF WATER LINES

PART 1 GENERAL

1.01 SUMMARY

This section covers the procedure for hydrostatic pressure testing of all new water lines and appurtenances.

1.02 RELATED SECTIONS

Section 02660 Water Supply Lines and Piping

1.03 MEASUREMENT AND PAYMENT

There will be no separate measurement and payment for hydrostatic testing of water lines unless specifically indicated otherwise on the Bid Form. Include cost for hydrostatic testing of water lines in related items of work or in the lump sum bid price as applicable.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

AWWA American Water Works Association

1.05 SYSTEM DESCRIPTION

Furnish pump, pipe connections, gauges, meters, appurtenances and labor as required to perform pressure test and measure leakage on completed water line segments.

1.06 SCHEDULING

Perform hydrostatic pressure test on newly laid pipe or any valved section of piping after complete installation of pipe and all appurtenances, but prior to final sterilization or connecting to water system.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 PREPARATION

After new water line has been laid and backfilled, but prior to replacement of pavement, fill each valved section of pipe slowly with water. Before commencing test, expel all air from line. If necessary, tap pipe at points of highest elevation to expel all air. On completion of tests, taps to be tightly plugged with brass fittings.

3.02 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

Apply specified test pressure by means of pump connected to pipe. Provide means to measure or meter water pumped into the line to the nearest 0.1 gallon and a pressure gauge with a 6" minimum face and calibration marks at 1 psi intervals. At intervals during test, inspect route of pipe to locate any leaks or breaks.

3.03 REPAIR/RESTORATION

Remove and replace defective joints, cracks, or defective pipe or fittings. Should any test of sections of pipe disclose leakage greater than that specified, locate and repair defective joints or defective pipe until test proves that leakage is within specified allowance.

3.04 FIELD QUALITY CONTROL

Hydrostatic pressure test shall be at 150% of working pressure at point of test, but not less than 75% of the rated pressure of the pipe at the highest elevation of the segment being tested. Test pressure shall not exceed the rated pressure of the pipe at any time at any location on the segment being tested. Test pressure shall not vary ± 5 pounds per square inch for the duration of the test. Duration of test shall be two (2) hours.

The maximum allowable leakage for a test section shall not exceed the amount determined from the following formula:

$$L = \frac{N \times D \times \text{Square Root of } P}{7,400}$$

where "L" is the allowable leakage, in gallons per hour; "N" is the number of joints in the length of pipe tested (pipe and fittings); "D" is the nominal diameter of the pipe, in inches; and "P" is the average test pressure in pounds per square inch gauge.

END OF SECTION

SECTION 02720

STORM SEWERS AND APPURTENANCES

PART 1 GENERAL

1.01 SUMMARY

This specification covers storm sewers, headwalls, inlets, culverts, culvert extensions, alterations of existing structures, and miscellaneous items that are related to a storm water drainage system.

1.02 RELATED SECTIONS

Section 02222 Excavation, Trenching, and Backfilling for Utilities

Section 02229 Excavation Safety

1.03 MEASUREMENT AND PAYMENT

Unless otherwise indicated on the Bid Form, the measurement and payment for the work specified in this Section shall be as follows:

- A. Storm Sewers and Culverts. Storm sewer length will be measured by the linear foot from the inner face of the inlets to the outer face of existing conduits and/or headwalls. No length deductions will be made for fittings such as wyes or tees. Storm sewers and culverts shall be measured and paid for according to diameter and type of pipe regardless of the trench depth. The unit price for each individual pipe size shall include all work required for trenching operations, furnishing and installing pipe and all operations not designated to be paid for separately. Trench sheeting and shoring of depths less than five (5) feet and dewatering will be included in the unit prices for storm sewers. Fittings shall not be paid for separately.
- B. Connection to Existing Culvert. Unless a separate unit price is established in the proposal, then connections to existing culverts will be included in the unit price for pipe. The unit price shall include removing the existing culvert wall, grouting the new lead pipe in place, and all other related work as shown on the plans. Separate payment will be made for the lead pipe.
- C. Culvert Extension. Culvert extensions will be paid for at the unit price stated in the bid form. The unit price shall include the furnishing of all necessary materials, tools, labor and equipment, removing the existing headwall and a

portion of the existing culvert barrel, disposal of the removed materials, constructing an extension to the existing culvert, grading the road ditch and all other necessary work needed to complete the operation as directed on the plans.

- D. Headwalls. Headwalls will be paid for per each at the unit price bid. The price shall include all excavation, materials, labor and equipment to construct the headwalls and regrade the adjacent ditch.
- E. Curb Inlets. Curb inlets will be paid for per each at the unit price bid. The unit price shall include cutting and removing pavement, disposal of the materials removed, excavation, backfill, construction of the curb inlet structure as shown on the plans, and all appurtenant work. The height variance from the curb at the inlet to the standard curb and gutter shall be included in the unit price. Payment for the lead pipe from the inlet to the storm sewer main shall be paid for separately.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in there entirely:

AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society of Testing and Materials
TxDOT	Texas Department of Transportation Standard Specifications for Construction of Highways, Streets and Bridges

1.05 SUBMITTALS

Submit manufacturer's certification that pipe meets the specified standards. The City of Magnolia, Engineer or the designated representative of the Engineer shall determine the number of copies of submittals that are required to be submitted for review and approval.

1.06 DELIVERY, STORAGE, AND HANDLING

Handle pipe according to manufacturer's recommendations. Protect rubber gaskets from excessive heat and sunlight.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Reinforced Concrete Pipe. Unless otherwise shown on plans, use reinforced concrete pipe (RCP), ASTM C76, Class III, with rubber gasket joints.
- B. High Density Corrugated Polyethylene Pipe (HDCPP).
 - 1. Pipe and fitting material shall be high-density polyethylene meeting ASTM D3350 minimum cell classification 324420C for 4 through 10-inch diameters or 335420C for 12 through 60-inch diameters.
 - 2. Fittings shall conform to AASHTO M294. Fabricated fittings shall be welded on the interior and exterior at all junctions.
 - 3. Pipe shall be joined with a bell-and-spigot type joint meeting the requirements of AASHTO M294. The joint shall be watertight according to the requirements of ASTM D3212. 30" through 60" pipe joints shall be watertight according to ASTM D3212 with the exception that the joint be tested using 5.0 psi (34.5 kPa) and the test apparatus shall meet the ASTM C1103 requirements. Gaskets shall be made of polyisoprene meeting the requirements of ASTM F477 with the condition that the gaskets shall not have any visible cracking when tested according to ASTM D1149 after 72 hour exposure in 50 PPHM ozone at 104° Fahrenheit. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. Joints shall remain watertight when subjected to a 1.5° axial misalignment. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.
- C. PVC Pipe. PVC pipe and fittings shall be manufactured from 12454B or 12454C all class material per ASTM D1784 and shall have a minimum stiffness of 46 16/in./in. at 5% deflection in accordance with ASTM D2412. Joints may be external plastic sleeve with gaskets or an integral bell, gasketed joint. Joints shall be watertight in accordance with ASTM D3212.
- D. Precast Concrete Box Culverts. Precast concrete boxes shall conform to ASTM C789 or C850. Unless otherwise shown on plans, design for earth dead load plus HS20 live load.
- E. Rubber Joint Gaskets. Gaskets for joints in bell and spigot concrete pipe shall meet ASTM C-443.

- F. Materials for Drainage Structures. The mortar used for other drainage structure connections shall consist of one (1) part by volume of Portland cement and two (2) parts of sand. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of AASHTO Specification M-45. Hydrated lime may be added to the sand and cement mixture in an amount of ten (10) percent of the volume of cement used. The hydrated lime shall comply with ASTM Specification C207, Type S requirements. The water quantity mixture shall be adequate to produce a stiff workable mortar, but shall not be greater than six (6) gallons of water per sack of cement. Water shall be clean and free of acids, alkalies, and organic impurities. The mortar shall be used within thirty (30) minutes from the time the ingredients are mixed with water. The mortar shall be protected on the outside in order to obtain a sufficient curing time.

2.03 SOURCE QUALITY CONTROL

Control cylinders of the reinforced concrete pipe (RCP) shall obtain a compressive strength of at least eighty (80) percent of the specified minimum strength before any concrete pipe can be delivered to the work site.

PART 3 EXECUTION

3.01 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. Laying pipe. The ends of the pipe shall be cleaned before the pipe is placed. The pipe shall be laid on a prepared foundation starting at the outlet end with the spigot ends pointed in the direction of the flow and shall continue toward the inlet end with the adjoining sections matched properly. The pipe shall be laid true to the lines and grades indicated on the plans. The mouth of the pipe shall be protected to prevent earth and bedding material from entering the pipe as each section is laid. The pipe shall be matched and fitted to form a smooth, uniform conduit when placed in the bed. The trench bottom shall be shaped and the excavation shall be performed as specified under Section 02222 "Excavation, Trenching and Backfilling for Utilities". No pipe shall be laid on unsuitable soft material, under any circumstances. Proper facilities are to be provided for hoisting and lowering the pipe sections into the trench without disturbing the prepared trench bottom or sides. The Contractor shall be responsible for dewatering of the trenches and the diversion of drainage during construction. Any pipe section that is laid and found to be defective or damaged shall be taken up and replaced or relaid at the cost of the Contractor.

- B. Jointing. Assemble rubber gasket joints in accordance with recommendations of gasket manufacturers.
- C. Inlets, headwalls, and other miscellaneous alterations and connections to existing drainage structures shall conform to the dimensions, locations and elevations and be constructed of the materials specified herein and shown on the plans.
- D. Stub ends. Stubs for connection of future storm sewer pipe shall have watertight plugs installed in the end of the pipe such as a double course of brick or precast concrete plug.

3.02 REPAIR / RESTORATION

Any line in which opening or faulting of the joints occurs during backfilling or before the final inspection and acceptance, such that infiltration of materials or a change in flow characteristics results, may be repaired or replaced by the Contractor to the satisfaction of the Engineer or the designated representative of the Engineer.

END OF SECTION

SECTION 02730

SANITARY SEWERAGE SYSTEM

PART 1 GENERAL

1.01 SUMMARY

This section applies to the construction of sanitary sewers, including installation of pipe, valves, fittings, manholes, cleanouts and other incidentals and testing of the installations. The work performed under this section applies to both gravity sewers and force mains.

1.02 RELATED SECTIONS

Section 02222 Excavation, Trenching and Backfilling for Utilities

Section 02229 Excavation Safety

Section 02605 Conductive Tracer Wire

1.03 MEASUREMENT AND PAYMENT

Unless otherwise indicated on the Bid Form, the measurement and payment for the work specified in this Section shall be as follows:

- A. Sanitary Sewer Pipe. Measurement and payment will be by the linear foot for each size sanitary sewer pipe required including service line, without deductions for space occupied by manholes. Gravity sewer line classification will be established according to the depth of cut that is required in bid form. The unit price per linear foot for various sizes, types, and depths of sanitary sewer shall include compensation for furnishing all equipment, tools, materials and labor necessary to construct the sewer and place in the backfill, including the disposal of surplus excavated material, in compliance with the plans and specifications. The unit price shall also include connections with existing sewers and between non-compatible new pipe and costs for the appropriate tests to be conducted. Unless it is specified as a bid item, no compensation shall be given for rock excavation, bedding, backfill, or clearing and grubbing. There will be no separate payment for conductive trace wire required on force mains.
- B. Manholes. Measurement of standard manholes will be taken at the center of the manhole, from the invert to the rim of the frame. Payment for standard manholes shall be at the contract unit price per each including manholes six (6) feet or less in depth, complete in place, according to the diameter. Payment for extra depth of standard manholes more than six (6) feet in depth will be paid for according to the

diameter, on the basis of the unit contract price per foot of depth in excess of six (6) feet, as actually constructed. The unit price shall include compensation for furnishing all labor, materials, tools, equipment, and incidentals and performing all work necessary for the completion of the manholes in accordance with the provisions of the plans and these specifications.

- C. Cleanouts. Cleanouts for both the main lines and service lines shall be measured for payment per each, complete in place, regardless of depth. Payment will be made at the unit contract price for the furnishing of all labor, tools, equipment, pipe fittings and incidental materials necessary to complete the work including earth excavation and disposal of surplus materials and backfill as specified and shown on the plans. All pipe required for constructing cleanouts shall be paid for on a linear foot basis.
- D. Drop Connections. Drop connections will be measured per each and shall be paid for at the unit price per each installed for drop connections five (5) feet height or less measured from the flowline of the sewer main to the flowline of the drop pipe at the manhole wall. Payment for extra depth of drop connections over five (5) feet will be per vertical foot of height as constructed.
- E. Service Connections. Service connections shall consist of installing a wye fitting or saddle on the main line including tie-in to customer's service line and shall be measured per each and paid for at the unit price bid per each.
- F. Testing. There will be no separate payment made for testing sanitary sewers, but the testing will be included in the unit cost bid for sanitary sewer pipe.
- G. Casing Spacers: There will be no separate payment for casing spacers.
- H. Valves: There will be no separate pay for valves (including operator extensions, valve boxes and handwheel operators) unless otherwise indicated in the bid form.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

ANSI	American National Standards Institute
ASTM	American Society of Testing and Materials
AWWA	American Water Works Association

1.05 SUBMITTALS

The pipe manufacturer shall furnish copies of a certification that the pipe is in full compliance with the commercial standards applicable to the pipe specified. The manufacturer shall furnish copies of data showing the physical properties of the pipe. Properties should include normal bursting pressure, manufacturer's maximum working pressure, physical dimensions, and tolerances. The City of Magnolia, Engineer or the designated representative of the Engineer shall determine the number of copies of submittals that are required to be submitted for review and approval.

1.06 DELIVERY, STORAGE, AND HANDLING

The Contractor shall notify the Engineer or the designated representative of the Engineer of pipe delivery to the job site in advance in order to allow inspection of the pipe by the Engineer or the designated representative of the Engineer prior to unloading of the pipe. Store pipe on a flat surface away from sunlight and heat. Do not stack bundles of pipe. Use a tarp to cover all pipe left for prolonged periods of time.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

A. Pressure Rated PVC Pipe. Pressure rated PVC pipe, used for force mains or gravity lines, shall be polyvinyl chloride Type 1, Grade 1. The pipe shall meet AWWA specifications and bear the seal of the National Sanitation Foundation on each joint. The diameter and applicable commercial standard shall be shown on each length of pipe. The type of PVC pressure rated pipe required for the project shall be as shown on the plans.

1. Schedule 40 PVC Pipe. Schedule 40 PVC pipe shall conform to the requirements of ASTM D-1785. Joints for schedule 40 PVC shall be solvent weld with recessed bells. Pipe and fittings shall be made of PVC plastic having cell classification of 12454-B as specified in ASTM D-1784.
2. ASTM D-2241 PVC Pipe. Pipe other than schedule 40 PVC shall comply with the requirements of ASTM D-2241. The pressure rating of the pipe shall be SDR 21 (Class 200) for four inch (4") and smaller pipe and SDR 26 (Class 160) FOR SIX INCH (6") and larger pipe unless otherwise shown on the plans or in the bid form. Joint seals for ASTM D-2241 PVC pipe shall conform to ASTM F-477. Pipe and fittings shall be made of PVC plastic having cell classification of 12454-B as specified in ASTM

D-1784.

- B. Non Pressure Rated PVC Pipe. Pipe for gravity sewers shall conform to ASTM D-3034 or ASTM F-675, SDR 26 unless otherwise shown on the plans. Pipe shall have fluid tight gasket type joints with joint bells formed integrally with the pipe. Joint seals shall conform to ASTM F-477. Pipe and fittings shall be made of PVC plastic having cell classification of 12454-B as specified in ASTM D-1784. The diameter and applicable commercial standard shall be shown on each length of pipe.
- C. PVC Fittings. PVC fittings for the pipe shall be constructed of the same material as the pipe. Fittings shall be of the molded type or machined from extruded stock. PVC fittings for pressure rated PVC pipe conforming to ASTM D-2241 used for gravity lines shall have a minimum pressure rating of 150 p.s.i. PVC fittings for pressure rated PVC pipe conforming to ASTM D-2241 used for force mains shall be rubber gasket and shall have a minimum pressure rating of 200 p.s.i. PVC fittings for Schedule 40 PVC pipe shall normally be Schedule 40 solvent weld, but rubber gasket fittings may be used in some applications. Fittings for ASTM D-3034 and ASTM D-2241 PVC pipe shall be push on type and have elastomeric seals and shall be compatible with the pipe. The seals shall meet ASTM F-477 for elastomeric seals. Fittings shall have smooth interior free of ridges or obstructions to sewer flow.
- D. Ductile Iron Pipe. Ductile iron pipe shall be thickness Class 50 per ANSI/AWWA C151/A21.51, unless shown otherwise on the plans. Pipe joints shall be push on joint per ANSI/AWWA C111 unless shown otherwise. Interior flange pipe shall conform to ANSI/AWWA C115.
 - 1. Coating, Lining and Encasement. Underground pipe and fittings shall be asphaltic coated outside per ANSI/AWWA C151/A21.51 unless shown otherwise. Inside lining shall consist of a 30 mil dry film thickness of polyurethane high solids, high build two component coating (Corropipe II TX Five Minute Number 17115) as manufactured by Madison Chemical Industries, Inc., or 24 mil dry film thickness epoxy coating. Applicators of polyurethane and epoxy lining shall be approved by the pipe manufacturer. Encase pipe with 8 mil low density or 4 mil high density polyethylene in accordance with ANSI/AWWA C105/21.5.
 - 2. Ductile Iron Fittings - Full Body. Fittings shall be cast iron or ductile iron push-on type conforming to ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11, unless shown otherwise on the plans. Mechanical joint fittings shall conform to ANSI/AWWA C110/A21.10

and ANSI/AWWA C111/A21.11, Class 250 for 4" through 12" and Class 150 for 14" and larger unless shown otherwise on the plans. Flanged fittings to be in accordance with ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11, Class 250 for 4" through 12" and Class 150 for 14" and larger unless shown otherwise on plans, both with one hundred twenty-five (125) pound template flanges.

3. Ductile Iron Fittings - Short Body. "Short body" fittings shall be ductile iron push-on type conforming to ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/21.11, Class 350 for all sizes, unless shown otherwise on the plans. Mechanical joint ductile iron short body fittings shall conform to ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/21.11, Class 350 for all sizes. Flanged fittings shall have full body dimensions.
 4. Gaskets. Flanged joint gaskets shall be of SBR or Neoprene rubber. Gaskets shall extend to the full flange with holes to match ANSI A21.10 or B16.1 Class 125 flange drilling. Gaskets shall be rated for 250 psi water working pressure as a minimum.
- E. Concrete. All concrete shall meet the requirements specified in Section 03300, Cast-In-Place Concrete.
- F. Mortar. Mortar shall conform to the current specification for Mortar for Unit Masonry, ASTM Designation C270, Type S. Mortar shall be composed of two parts of fine aggregate thoroughly mixed with one part Portland cement and the amount of water required to produce a homogeneous mixture of such consistency that it can be easily handled and spread by trowel. Aggregate for the mortar shall meet ASTM C-144.
- G. Manhole Covers. Manhole covers and rings shall be made of the best quality of gray iron, ASTM A-48, Class 35B. The covers shall possess a tensile strength of not less than eighteen thousand (18,000) pounds per square inch. All casting shall conform to the shape and dimensions shown on the plans and shall be clean and perfect without defects of any kind. All sanitary sewer manhole covers must include the words "Sanitary Sewer". See detail drawings for required make and model of cover.
- H. Cleanout Covers. Cleanout covers shall be made of the best quality of gray cast iron. The cover shall be free from perforations and shall conform to the detail specified in the plans.

- I. **Fiberglass Manholes.** Use manufactured reinforced fiberglass plastic as manufactured by Fluid Containment, Inc. formerly known as Owens-Corning Tanks Division, or preapproved equal. A traffic model designed for H2O wheel loading is required when installed in a traveled way.
- J. **Precast Concrete Manholes.** Precast concrete manholes shall meet the requirements of ASTM C-478. Ring sections shall be of the diameter specified. Precast concrete manholes joint gasket connections shall be made with an O-Ring type rubber gasket meeting ASTM C361-89 and C443-85 as manufactured by Press-Seal Gasket, Inc. or approved equal. Precast manhole sections shall be specifically manufactured for O-Ring application. Installation shall be in accordance with the manufacturer's recommendations.
- K. **Grade Rings.** Precast concrete grade rings shall be used to adjust all types of manholes to final grade. Bricks shall not be used to adjust manhole grades.
- L. **Manhole Coating.** The interiors of precast or cast-in-place concrete manholes shall be coated with a 10 mil thickness of coal tar epoxy, Pittsburgh two (2) part "Coal Cat", component "A" is No. 97-640 and component "B" is No. 97-641; Tnemec two (2) part "Tneme-Tar", No. 46-413; or approved equal.
- M. **Gate Valves.** Gate valves 2-inches and larger shall be iron-body, resilient rubber seat, non-rising stem and shall conform to AWWA C-509. Gate valves smaller than 2-inches shall be brass double disc with brass body, non-rising stem with 2" square nut adapter and shall conform to AWWA C-500. Valves shall have the required ends for the piping in which they shall be installed. Gate valves shall have a clear waterway equal to the full nominal diameter of the valve and shall be opened by turning counterclockwise. An arrow shall be cast in the metal of the operating nut or wheel to indicate the direction to open. Underground valves shall be nut operated and valves located in structures shall be wheel operated. Each valve shall have the maker's initials, pressure rating, and year of manufacture cast on the body. Valves 2 inches through 12 inches shall have a 200 psig working pressure and valves 16 inches and larger shall have a 150 psig working pressure. Prior to shipment from the factory each valve shall be tested by hydraulic pressure equal to twice the specified water working pressure. Gate valves shall have the same exterior coating as the pipe and an 8 to 10 mil dry film thickness epoxy interior coating.
- N. **Check Valves.** Check valves two and one-half (2-1/2) inches in diameter and larger shall be iron body, bronze mounted, horizontal swing check valves with balanced weight and lever arm designated for one hundred fifty (150) pounds

working pressure, unless otherwise designated on the plans . Check valves shall have the same exterior coating as the pipe and an 8 to 10 mil dry film thickness epoxy interior coating.

- O. Plug Valves. Plug valves shall be manufactured by Dezurik or preapproved equal. Plug valves shall have the exterior coating same as the pipe and an 8 to 10 mil dry film thickness epoxy interior coating.
- P. Valve Boxes. All valves buried in the ground shall be provided with cast iron boxes of proper dimensions to fit over the valve. The tops shall be complete with covers and adjustable.
- Q. Shear Gates. Shear gates shall be all iron, Clow No. F-3000; Neenah Foundry Company, R-5005 Series; Olympic shear gate; or approved equal. Shear gates shall have lifting handle extension where required.
- R. Combination Sewer Air Valves. Combination air valves for sanitary sewer force mains shall be A.R.I. Model D-025 or preapproved equal. All valves shall come equipped with backwash assemblies and shall be rated for sewer service.
- S. Casing Spacers: Casing spacers shall provide electrical insulation between the carrier pipe and casing. They shall be made of high density polyethylene or of other approved material. The casing spacers shall be "RACI" as manufactured by Public Works Marketing, Inc., or approved equal.

The spacers shall be sized such that the bell of the carrier pipe will be held a minimum of one fourth (1/4) inch from the bottom of the casing, and the spacer O.D. shall not be less than the casing I.D. minus three fourths (3/4) of an inch. The design and type of spacer shall be suitable for the type, size, and weight of the carrier pipe and it's contents.

PART 3 EXECUTION

3.01 PREPARATION

Expose all underground utilities which may be in conflict with proposed sanitary sewer lines prior to installing new lines. If faults, caverns or subsidence are discovered during construction, halt work to allow features to be inspected by the Engineer or the designated representative of the Engineer. Construction may only be resumed with approval of Engineer or the designated representative of the Engineer.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. Pipe Laying and Jointing. Once the foundation has been prepared, pipe shall be laid with the spigot ends in the direction of the outlet or low end of the pipeline. The interior of the pipe shall be free from all dirt, joint material and foreign material as the work progresses and shall be clean upon its completion. Inside surfaces of adjacent sections of pipe shall be constructed in such a manner to provide the best possible flow conditions. Tight fitting stoppers or bulkheads shall be placed in the ends of all pipelines when the work has stopped, to prevent dirt or trash from entering the pipe.
- B. PVC Pipe. Bedding of the pipe shall be as detailed on the plans for the laying conditions.
1. Solvent Weld Joints. When joints are made, the pipe fittings and couplings shall be at the same temperature. All joints shall be tested for a snug dry fit before solvent is applied. If the dry fit is such that the couplings are loose or if force is required to test dry fit, the pipe shall be rejected. A nonsynthetic brush shall be used to apply solvent cement in accordance with the manufacturer's recommendations. Lightly apply cement to the inside of the fitting and more generously to the outside of the pipe. The joint shall then be stabbed into the fitting and given a quarter turn. If sufficient cement has been used, a small bead will form between the pipe and the shoulder of the fitting. Remove this excess solvent. The joint shall not be moved until the cement weld has set. Fittings for service lines or laterals shall be assembled so that no strain is placed on the pipe during or after the backfill operation.
 2. Push-On Joints. Before jointing, both bell and spigot ends shall be thoroughly cleaned and a lubricant supplied by the pipe manufacturer shall be applied according to the manufacturer's recommendations. Spigot end shall be beveled so it will not dislodge or damage gasket. To insure proper sealing of the joint, sufficient pressure shall be applied until reference mark on spigot is flush with end of bell.
 3. Cutting Pipe. If it is necessary to cut the pipe, a fine tooth hacksaw shall be used and the burrs removed with a file. The outer surface of the pipe and the inner surface of the fittings shall be wiped with a clean cloth to remove all foreign matter and moisture before application of the solvent cement, for solvent weld joints. Bevel end of pipe per manufacturer's recommendations for push-on joints.
- C. Ductile Iron Pipe. Bedding of the pipe shall be as detailed on the plans for the

laying conditions.

1. Before jointing, both bell and spigot ends shall be thoroughly cleaned and a lubricant supplied by the pipe manufacturer shall be applied according to the manufacturer's recommendations. Spigot end shall be beveled so it will not dislodge or damage gasket. To insure proper sealing of the joint, sufficient pressure shall be applied until reference mark on spigot is flush with end of bell.
 2. Mechanical Joints. Joints shall be made in a workmanlike manner, using rubber gasket seals, follower glands, and standard bolts. Overstressing of bolts to stop leaks resulting from poor installation practice will not be permitted.
 3. Wall Sleeves. At all points where the pipe must pass through a wall of a structure, the Contractor shall furnish and install suitable sleeves and wall castings, unless otherwise shown on the plans. The wall sleeve or wall casting shall be a mechanical joint and/or flange fitting flush with the wall, with flanges tapped for studs.
- D. Conductive Trace Wire. Install conductive trace wire in compliance with Section 2605 - Conductive Trace Wire for Underground Pipe Installation with all force mains and gravity lines. Cad-weld trace wire to manhole frames.
- E. Curved Alignment. For curved sewer lines, the Contractor shall not exceed the pipe manufacturer's recommended maximum deflection at each joint. Each joint shall be pushed "home" prior to deflecting the pipe and pipe shall not be stressed or bent to achieve curvature. The Contractor shall reduce the pipe lengths according to the manufacturer's recommendations, if the radius of curvature cannot be achieved without exceeding the maximum deflection using standard length joints of pipe.
- F. Valve Boxes and Operator Extensions. Valves buried in the ground shall be provided with cast iron valve boxes of proper dimensions to fit over the valve, and to extend to such elevation, at slightly above the finished ground line. Valve boxes shall be set vertical and centered with the valve stem. Provide and install a valve operator extension on any buried valve that is installed with the nut operator more than 30-inches below surrounding finished grade.
- G. Thrust Blocking. Thrust blocking for pressure sewers (force mains) shall be in accordance with the pipe manufacturer's recommendation.

H. Embedment and Encasement. Embedment and encasement shall be placed at the locations shown on the plans and in conformance with Section 02222 Excavation, Trenching and Backfilling for Utilities. If the maximum width is exceeded at any point, the Contractor shall use the next number of embedment higher than that designated on the plans. The additional cost for using the higher type of embedment required because of over cutting will be at the expense of the Contractor.

1. Typical DIP Embedment. Unless otherwise shown on plans use Type 2 embedment in accordance with ASTM A746.
2. Typical PVC Embedment. Pipe shall be imbedded in sand or gravel with fines meeting the designation of Class I or II Soil per ASTM D-2321 compacted to a minimum of eighty-five (85) percent Standard Proctor. The embedment shall extend from four (4) inches below the pipe to a point twelve (12) inches above the top of the pipe.

I. Fiberglass Manhole Construction.

1. The manhole shall be constructed on a concrete foundation of the size and shape shown on the plans. The foundation shall be placed against undisturbed earth and the thickness shall be a minimum of eight (8) inches below the bottom of the outside diameter of the sewer pipe or bottom edge of manhole section. If the manhole is over twelve (12) feet deep, then the foundation thickness shall be a minimum of twelve (12) inches below the bottom of the sewer pipe's outside diameter or bottom edge of manhole section.
2. The base of the reinforced fiberglass manhole shall be cut to accommodate the size of the sewer pipe indicated on the plans. The maximum tolerance for the cutout is one-half (1/2) inch greater than the required opening. The base shall be embedded in a concrete foundation to a minimum depth of six (6) inches. The base and foundation shall be placed as soon as practicable after the sewer line is completed through the manhole location. To get the proper seal where the manhole cutout fits over the pipe, fresh concrete which is monolithic with slab concrete must be used as shown on the outside of the manhole and waterstop gaskets shall be installed on all pipes penetrating the manhole. Manholes will be rejected if this seal is not made when the slab is poured and the manhole is placed. Grout with a cold joint between grout and the concrete slab is not acceptable.
3. Where sewer pipe for a drop connection enters a manhole other than at

bottom cut out, a saddle type connection to the manhole for the pipe size will be provided as shown. Connections depending upon grout for sealing will not be allowed.

4. Manholes shall be installed as one basic unit. The Contractor is responsible for verifying the correct manhole depth before construction. Top of fiberglass portion of manhole shall not be less than twelve (12) inches nor greater than eighteen (18) inches from final grade. The Contractor is responsible for the correct depth of manholes relocated in the field because of unforeseen conflicts. Manhole tops shall be adjusted with precast concrete rings and be set as follows:
 - a. Developed Areas. Manhole tops shall be set one (1) inch higher than the existing elevation of natural ground or other final grade, unless shown otherwise on the plans.
 - b. Undeveloped Areas. Manhole tops shall be set flush with paved surfaces and one (1) inch higher than shoulder and/or proposed final grade elevations in easement or other unpaved areas. Where manholes are located in a ditch bottom, set manhole top a minimum of twelve (12) inches above the ditch bottom and reshape the ditch around the manhole.
5. Backfill around manholes and drop connections immediately after mortar and concrete have set. Place backfill around the manhole evenly in six (6) inch layers and in such a manner that no torque is applied to the manhole. For manholes in paved areas backfill around manholes shall be of same material and compaction as specified for sewer line in paved areas. Where a proposed sewer line connects to an existing manhole at or near a manhole invert, reshape the invert of the existing manhole so that no turbulence is created in the manhole as a result of the connection.
6. Precast concrete rings shall be used to adjust the top of the manhole to the proposed grade if necessary.
- J. Precast Manholes. Construction of precast concrete manholes shall follow the general procedures for fiberglass manholes except that precast manhole bottoms may be used if cast as an integral part of the bottom ring.
- K. Cast-in-Place Manholes. Manholes shall be constructed of concrete conforming to Section 03300, Cast-in-Place Concrete. Manholes shall be poured in place as shown on the plan sanitary sewer detail sheet. The foundation shall be placed against undisturbed earth and shall be a minimum of eight (8) inches thick below

the bottom of the sewer outside diameter, except if the manhole is over twelve (12) feet deep make the foundation twelve (12) inches thick below the bottom of the sewer pipe outside diameter. The manhole foundation, walls and cone section shall be constructed in a single continuous monolithic concrete pour.

L. Construction Methods For All Manholes.

1. Manhole Connections. Watertight, size-on-size resilient connectors allowing for differential settlement shall be used to connect pipe to manholes. Pipe to manhole connectors shall conform to ASTM C-923. Water stop gaskets shall be installed on the pipe for connection to existing manholes and shall be grouted in place with non-shrink grout having a minimum thickness of one (1) inch around the gasket.
2. Manhole Inverts. The bottom of the manhole shall be provided with a "U" shaped channel that is as much as possible a smooth continuation of the inlet and outlet pipes. For manholes connected to pipes less than fifteen (15) inches in diameter the channel depth shall be at least half the largest pipe diameter. For manholes connected to pipes greater than twenty-four (24) inches in diameter the channel depth shall be at least equal to the largest pipe diameter. Invert flow channels shall be on an even slope from pipe to pipe. The bench provided above the channel shall be sloped at a minimum of 0.5 inch per foot. Where sewer lines enter the manhole higher than twenty-four (24) inches above the manhole invert, the invert shall be filleted to prevent solids deposition. Where the main sewer (lowest line) passes straight through the manhole and the degree of deflection of the main sewer is less than five (5) degrees, and no other line or stub out is shown entering the manhole below the center line of the main sewer, lay the sewer continuously through the manhole. After the manhole walls have been completed, cut out and remove the top half of the barrel of the sewer pipe that was previously laid through the manhole. Use concrete with one (1) inch mortar topping and construct the remainder of invert as shown on plans. Where the main sewer (lowest line) alignment deflects greater than five (5) degrees at the manhole or where another sewer or stub out enters at or below the center line of the main sewer, terminate the main sewer pipe laying in such a manner that the ends of pipe protrude inside of the manhole. The invert shall be constructed with concrete and topped with one (1) inch of mortar. The invert shall be shaped to allow for a smooth flow across the floor of the manhole and slope the side as required to prevent deposition of solids.
3. Stubs Outs. Stub outs shall be installed to line and grade where shown.

One (1) full joint of pipe, of the size indicated, will be used for the stub out. Seal the stub out with a plug. The plug shall be installed in such a manner as to prevent seepage or leakage through stub outs. The plug shall be installed such that it may easily be removed in the future without damaging the bell or groove end of the stub out.

4. Contractor shall meet all OSHA requirements relating to entry into confined spaces prior to personnel entering manhole for any reason.

M. Cleanout Structures. Cleanout structures shall be constructed where shown on the plans and as specified. Cleanouts shall consist of six (6) inch riser pipe laid on an angle on undisturbed natural ground. Machine tamp all backfill around and above the pipe in layers six (6) inches or less in depth so that no settlement shall occur after the cleanout is constructed. Other construction details shall conform to the cleanout detail shown on the plans.

N. Connections.

1. Drop Connections. Drop connections on manholes shall be constructed according to the plans and these specifications. The connection shall include the indicated fittings and necessary backfill material.
2. Service Connections. Standard service connections shall consist of a wye and forty-five (45) degree bend and the necessary four (4) inch diameter PVC sewer pipe to reach the property line, or be plugged and sealed at the end. The plans may require a larger service line. Install a larger service line when shown on the plans. If required, the Contractor shall raise the lateral by means of a steeper grade from the main. Locations of the service outlets and the depth to the top of the lateral pipe, if depth is not shown on the plans, will be designated at the time of construction. Minimum depth of cover over the end of the lateral pipe shall be five (5) feet.

O. Separation Distances. The following are separation distances that shall apply between potable water and wastewater treatment plants, and water lines and sanitary sewers.

1. Potable Water Treatment Plant Separation. Sanitary sewers located within 50 feet of any underground treatment plant units shall be constructed of ductile iron or PVC with a minimum pressure rating of 150 pounds per square inch and watertight joints.

2. Water Line / New Sewer Line Separation. Sanitary sewers shall not be installed within nine (9) feet, in all directions, to existing water lines. Sewer lines parallel to water lines must be installed in separate trenches. If the nine (9) feet separation distance cannot be achieved, the following guidelines apply.
- a. Where a sanitary sewer parallels a water line, the sewer shall be constructed of cast iron, ductile iron or PVC meeting ASTM specifications with a pressure rating of 150 psi for both the pipe and joints. A minimum vertical distance of two (2) feet and a minimum horizontal distance of four (4) feet between the outside diameters of the pipes is required. The sewer shall be located below the water line.
 - b. Where a sanitary sewer crosses a water line, and the sewer is constructed of cast iron, ductile iron or PVC with a minimum pressure rating of 150 psi, an absolute minimum distance of six (6) inches between the outside diameters shall be maintained. The sewer line shall be placed below the water line if possible, and one length of the sewer pipe must be centered on the water line.
 - c. Where a sewer line crosses under a water line and the sewer line is constructed of ABS truss pipe, similar semi-rigid plastic composite pipe, or concrete pipe with gasketed joints, a minimum separation distance of two (2) feet must be maintained. The initial backfill shall be cement stabilized sand (two and one-half bags of cement per cubic yard of sand) for all sections of sewer within nine feet of the water line. This initial backfill shall be from one quarter diameter below the centerline of the pipe to one pipe diameter (but not less than twelve (12) inches) above the top of the pipe.
 - d. Where a sewer crosses over a water line all portions of the sewer within nine (9) feet of the water line shall be constructed of cast iron, ductile iron, or PVC pipe with a pressure rating of at least 150 psi using appropriate adapters. In lieu of this procedure the new conveyance may be encased in a joint of 150 psi pressure class pipe at least eighteen (18) feet long and two (2) nominal sizes larger than the new conveyance. The space around the carrier pipe shall be supported at five (5) foot intervals with spacers or be filled to the springline with washed sand. The encasement pipe should be centered on the crossing and both ends sealed with cement grout.

or manufactured seal.

3. Water Line / Manhole Separation. If the sanitary sewer manholes and the connecting sewer cannot be made watertight and tested for no leakage, then a minimum horizontal separation distance of nine (9) feet must be provided between the manhole and the water line. If the minimum distance of nine (9) feet cannot be achieved, then a carrier pipe as specified in the preceding subsection shall be used.

- P. Casing Spacers: Casing spacers shall be installed on all carrier pipe which is installed inside a casing. Casing spacers shall be installed such that the distance between spacers does not exceed the maximum distance recommended by the spacer manufacturer dependent on potential weight of the carrier pipe and casing, both full of water, except the distance between spacers shall not exceed seven (7) feet. A casing spacer shall be installed within one (1) foot of the end of each joint of nonwelded carrier pipe, and two adjacent spacers shall be installed on the carrier pipe at each end of the casing such that the last spacer is within one (1) foot of the end of the casing.

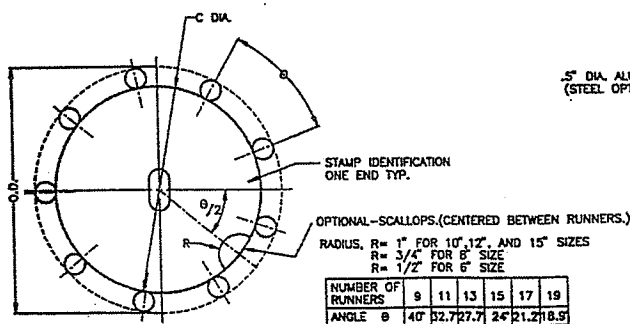
3.03 FIELD QUALITY CONTROL

- A. Test For Deflection of PVC Pipe. All PVC pipe installed for gravity sewers will be tested for deflection according to this specification after the pipe segment has been in place for a minimum of thirty (30) days. Maximum allowable deflection shall not exceed five percent (5%) of the inside diameter of the pipe. The inside diameter shall be the average outside diameter minus two (2) minimum wall thicknesses for outside diameter controlled pipe or the average inside diameter for inside diameter controlled pipe. A "go, no-go" mandrel will be used to check the deflection of an installed section of PVC pipe. The mandrel will be sized so that it will not "go" when encountering a deflection that is greater than permissible. The mandrel must be of such design as to minimize the possibility of it being hung up in the pipe by silt or other residues. A design sized to permit up to five percent (5%) deflection in pipe is shown in Figures 3.03A & 3.03B. Table 3.03A showing the required dimensions of mandrels for various pipes is attached. Suggested instructions for its use are as follows:

1. Completely flush the line making sure the pipe is clean of any mud or debris that would hinder the passage of the mandrel.
2. During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line.

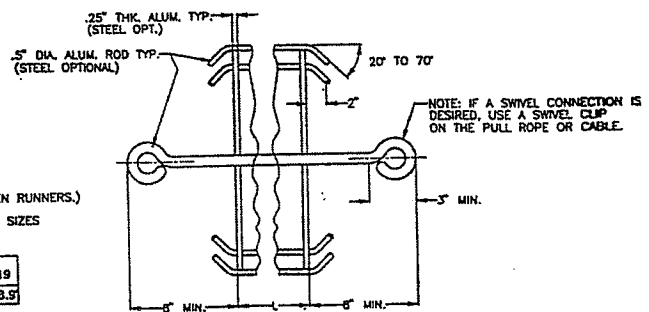
3. Once the rope is threaded through the line, connect the pull rope to the mandrel and place the mandrel in the entrance of the pipe.
4. Connect a retrieval rope to the back of the mandrel to pull it back, if necessary.
5. Remove all slack in the pull rope and place a tape marker on the rope at the ends of the pipe where the mandrel will exit, determining the location of the mandrel in the line.
6. Draw the mandrel through the sewer line by hand pulling only. If any irregularities or obstructions are encountered in the line, the Engineer or designated representative of the Engineer should establish the corrective action, if required.
7. If a section with excessive deflection is found, locate it; dig down and uncover the pipe; inspect the pipe, if any damaged pipe is found, replace it; if pipe is not damaged, replace and thoroughly tamp the haunching and initial backfill; replace remainder of backfill.
8. Retest this section for deflection a minimum of thirty (30) days after completing the repair.

Figure 3.03 A



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Figure 3.03 B



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Storm Water
Pollution Prevention

B. Testing Pressure Sewers For Leakage. All pressure sewers shall be tested for leakage with a hydrostatic test to be completed in the presence of the Engineer or designated representative of the Engineer. Leaks demonstrated by the tests are to be repaired at the expense of the Contractor.

1. Performance. Newly laid pipe or any valved section of piping shall be subjected for one (1) hour to a hydrostatic pressure test of twenty-five (25) pounds per square inch gauge or 1.5 times the maximum force main design pressure, whichever is larger. The following formula shall be used to determine the permissible leakage that shall not be exceeded:

$$L = (S)(D)(P^{0.5}) / 133,200$$

Where, L = leakage in gallons per hour

S = length of pipe in feet

D = inside diameter of pipe in inches

P = pressure in pounds per square inch

2. Execution. Fill test section of pipe with water and expel the air from the pipe. Apply the specified test pressure by means of a pump connected to the pipe. The Contractor shall furnish the necessary pump, pipe connections, gauge and meter and shall conduct the test. If force main is tapped to perform test, plug taps with brass fittings upon completion of test.
 - a. Inspect the route of the pipe during the test period to locate any leaks or breaks. The Contractor shall replace any cracked or defective pipe, fittings or valves disclosed in the pressure test.
 - b. When the one (1) hour test period is completed, bring the pressure in the pipe up to the specified test pressure and determine the amount of water lost during the test. No piping installation shall be accepted until the leakage amount is less than that specified. Should any test of combined sections or individual sections of pipe show leakage greater than the specified limit, the Contractor shall locate and repair the defective joints or defective pipe until the test proves that the leakage is within the specified allowance.

C. Testing Gravity Sanitary Sewers For Leakage. The Contractor shall test all gravity sewer lines using either the infiltration method, exfiltration method, or the

low pressure air test, in the presence of the Engineer or designated representative of the Engineer or his representative. Additionally, all new manholes shall be tested. The Engineer or designated representative of the Engineer shall be notified no later than the preceding day, of the date and approximate time the tests will be made. Sewers shall not show leakage of more than fifty (50) gallons per inch diameter per mile of pipe per twenty-four (24) hours at a minimum test head of two (2) feet above the crown of pipes at the upstream manhole using the infiltration or exfiltration test except for pipes installed in the 25 year flood plain, which shall show leakage less than 10 gallons per inch diameter per mile of pipe per twenty four (24) hours. For the air test, leakage shall not exceed the amount specified herein for the length and diameter of the pipe tested. The Engineer or designated representative of the Engineer may vary the procedures for "Infiltration Test," "Exfiltration Test," and "Air Test" provided the methods used give an accurate measurement of the leakage.

1. Preparation for Testing. The Contractor shall supply all water for the tests, all equipment and labor necessary to convey the water into the sewer, and all labor and equipment to install test plugs, and other incidental work in conducting the tests and the cost thereof shall be included in the price for constructing the sewer. The Contractor shall supply the test plugs and the risers for the tests and will conduct the tests.
 - a. Before testing is observed by the Engineer or designated representative of the Engineer, sewers shall be completely backfilled, except for the stacks, but not necessarily water tamped. The Contractor may make preliminary tests with a minimum of eighteen (18) inches of backfill over the pipe to determine if any repairs are necessary. These tests are for the Contractor's information and shall not be performed in lieu of the tests to be observed by the Engineer or designated representative of the Engineer. These line tests will be made between the inlet side of the downstream manhole and the outlet side of the next upstream manhole.
 - b. Unless the Contractor has been notified that the tests will be made by the infiltration method, he shall leave the tops of stacks exposed and unplugged until after the leak test has been made. If a stack terminates below the test level, they shall be temporarily extended upward by installing an additional length of pipe in the top.
 - c. The Contractor shall provide suitable means to determine the groundwater level at any time until the testing is completed. As an

example, a pipe not less than three (3) inches in diameter, such as a downspout pipe, closed at the bottom and perforated for at least the lower three (3) feet, with the perforations wrapped with at least two (2) thicknesses of filter fabric, set in the trench prior to backfilling. These pipes shall than be removed or cut off at least two (2) feet below the ground after testing has been completed. Prior to removal, the pipes shall be protected against damage and earth or other material excluded therefrom. Generally one pipe shall be installed in each run of pipeline between manholes.

- d. Stubs or house connections connected to the section being tested for leakage which are below the test water level, will be considered in computing the allowable leakage but the Contractor will not be held responsible for excess leakage in sewers not laid by him which have been connected to the lines being tested. The Engineer or designated representative of the Engineer may request individual stubs or house connections in the system that were constructed under this contract to be tested. Prior arrangements for access to the ends of the pipe will be made for these tests.

2. Infiltration Test. For the Infiltration Test, all pumps must be stopped and the groundwater allowed to return to its normal level and to remain so for at least 24 hours. Before the test is started, the pipe will be filled with water to a depth that will cause leakage to flow at a uniform rate through an opening in the plug in the downstream end of the section of sewer being tested. Leakage will be determined by measuring the flow through the opening in the downstream plug during a given time. Five measurements will be taken. The average of the measurements will be used. If one of the five measurements varies by more than fifty percent (50%) of the other four, then that measurement will be discarded, except for the last measurement taken. If the results of the tests are satisfactory, but the last of the five measurements shows leakage in excess of that permitted, tests shall be continued to determine if additional leaks may have developed during testing.

<u>Size of Pipe</u>	<u>Allowable Leakage*, Gallon Per Minute Per 100 Ft.</u>
6"	0.0039
8"	0.0053
10"	0.0066
12"	0.0079
15"	0.0099

18"	0.0118
21"	0.0138
24"	0.0158
27"	0.0178
30"	0.0197
36"	0.0237

*Equivalent to 50 gal. per inch diameter per mile per 24 hours

For other diameters, multiply square of diameter by value for 1" diameter.

3. Exfiltration Test. In order to permit absorption by the pipe, the Contractor may keep the pipe full of water for 24 hours prior to the test. The Engineer or designated representative of the Engineer shall be notified by the Contractor before backfilling is completed that the pipe will be filled and will be given 48 hours before the test to allow time for filling and soaking the pipe. At least two (2) hours before the tests start, the water will be bled off below the level of the top of the pipe at its lower end and allowed to remain so until the water level remains static at this level or continues to fall. The test shall be made in the following manner.
 - a. A watertight plug, equipped with a pipe riser will be inserted and braced in the inlet opening in the downstream manhole and a similar plug equipped with a suitable vent pipe that will permit the escape of air in the pipe at its upper end, will be inserted and braced in the outlet in the upstream manhole. Fill the sewer and riser with water up to a level either four (4) feet above the crown of the sewer pipe at its lower end or two (2) foot above the crown of the sewer pipe at its upper end, whichever is higher, plus the vertical distance from the invert of the sewer at its lower end up to the level of the groundwater where such groundwater exists above the invert of the sewer.
 - b. The sewer will be filled with water as a continuous operation, as rapidly as the supply will permit, and the test measurement will be started as soon as the water is at the required level. This will be completed in not less than two (2) hours for sewers twelve (12) inches or smaller, not less than three (3) hours for sewers fifteen (15) inches through twenty-four (24) inches and not less than four (4) hours for larger sewers. A measurement of the water level will be recorded at each minute for five (5) minutes or until the level

has dropped twelve (12) inches, whichever occurs first. The water will then be brought back to the required level and the test shall be repeated until five (5) such tests have been performed. Use the average of these results, discarding any of the five (5) observations that varies by more than fifty percent (50%) from the average of the other four (4) except for the last one. If the results of the tests are otherwise satisfactory, but the last of the five (5) measurements shows leakage in excess of that permitted, the tests will be continued to determine if additional leaks may have developed during testing.

- c. The total leakage in cubic inches shall be the total cross-sectional area in square inches of the inside of the two (2) risers and of any stacks in the sewer multiplied by the drop in water level in inches.

Table For Measuring Leakage in Sewers

Volume Per Inch of Depth		Diameter of Riser
Or Stack	Cu. Inch	Gallons
1"	0.7854	0.0034
2"	3.1416	0.0136
2-1/2"	4.9087	0.0212
3"	7.0686	0.0306
4"	12.5664	0.0544
5"	19.6350	0.0850
6"	28.2743	0.1224
8"	50.2655	0.2176

4. Air Test. The air test shall be performed as follows.
 - a. To perform the air test, all the water should be flushed and drained from the line being tested prior to beginning the test. All pipe outlets, especially laterals and services, shall be plugged. Air shall be added until the internal air pressure of the sewer line is 4.0 psi greater than the pressure exerted on the pipe by the groundwater above the pipe. Allow the air pressure to stabilize after it has reached 4 psig. As the air temperature stabilizes, the air pressure will normally drop. When the pressure has stabilized at 3.5 psig,

allow the pressure to drop to 2.5 psig. The time it takes the pressure to drop from 3.5 psig to 2.5 psig shall be recorded. If the time it takes the pressure to drop exceeds the time permitted, the line has passed. If the time is less than allowable, the line has failed.

- b. The air pressure test should not be used when the pipe is submerged in groundwater, because the static water pressure will greatly affect the results. The water infiltration test will be used in this case.
- c. For sections of pipe less than 36-inch average inside diameter, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be computed from the following equation:

$$T = 0.085(D)(K)/(Q)$$

where,

T = time for pressure to drop 1.0 pound per square inch gauge in seconds

K = 0.000419(D)(L), but not less than 1.0

D = average inside diameter in inches

L = length of line in feet of same pipe size being tested

Q = rate of loss, 0.0015 cubic feet per minute per square foot internal surface shall be used

- d. Since a K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as follows:

Air Test Table

Pipe Diameter (inches)	Minimum Time (seconds)	Length Time for Minimum Time (feet)	for Longer Length (seconds)
------------------------------	------------------------------	--	-----------------------------------

6	340	398	0.855(L)
8	454	298	1.520(L)
10	567	239	2.374(L)
12	680	199	3.419(L)
15	850	159	5.342(L)
18	1020	133	7.693(L)
21	1190	114	10.471(L)
24	1360	100	13.676(L)
27	1530	88	17.309(L)
30	1700	80	21.369(L)
33	1870	72	25.856(L)

- e. For sections of pipe with an average inside diameter less than thirty-six (36) inches, the test may be stopped if no pressure loss has occurred during the first twenty-five percent (25%) of the calculated testing time. If any pressure loss has occurred during the first twenty-five percent (25%) of the testing period, then the test shall be continued for the entire required time.
 - f. Lines with an average inside diameter of twenty-seven (27) inches or larger may be air tested at each joint. Pipe with an inside diameter greater than thirty-six (36) inches shall be tested for leakage at each joint. A visual inspection of the line between the joints shall be performed immediately after an air test. Regardless of pipe size there shall be a minimum of ten (10) seconds allowable for the pressure to drop from 3.5 psig to 2.5 psig during a joint test.
5. Retests. Sewers which fail to meet the requirements of the leak test will be tested again for leakage, after repairs have been completed by the Contractor. If a sewer fails to pass the requirements of the leak test a second time, and additional repairs and retests are performed, then the sum of fifty dollars (\$50.00) will be deducted from the amounts due the Contractor to compensate the Owner for the costs of making additional retests.
 6. Manhole Test. All manholes shall be tested for leakage by plugging the lines entering the manhole and completely filling the manhole with water. If leakage exceeds 0.025 gallons per foot of diameter per foot of head per hour, repairs shall be made to make the manhole water tight, and a retest shall be performed. Concrete manholes may be filled for 24 hours before the test.

SECTION 02931

HYDROMULCH SEEDING

PART 1 GENERAL

1.01 DESCRIPTION

Hydromulching shall consist of preparing the ground, furnishing and applying the fertilizer, seed, mulch cover, emulsified asphalt and water on all areas indicated on the plans or as designated by the City of Magnolia Engineer or the designated representative of the Engineer. The mulch, fertilizer, and seed may be incorporated into one (1) operation, or if the Contractor so elects, the fertilizer may be applied during preparation of the seed bed at the rate of four hundred (400) pounds per acre.

1.02 MEASUREMENT AND PAYMENT

The cost for performing the hydromulch seeding requirements set forth herein shall be included in related items of work unless specifically shown otherwise on the Bid Form.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

A. All seed shall be labeled in accordance with the current regulations of the Texas Seed Law and shall be free of noxious weeds. Seed shall be furnished in sealed, standard containers unless otherwise authorized by the Engineer or designated representative of the Engineer in writing. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be acceptable. The minimum percentage by weight of pure live seed shall not be less than eighty-five (85) when tested according to current regulations under Federal Seed Act. All legumes must be inoculated with an approved culture as per the manufacturer's recommendations.

B. Seed shall be composed of the varieties and amounts by weight as shown below:

<u>VARIETY</u>	<u>WEIGHT</u> <u>(LBS. PER ACRE)</u>
Tall Fescue (Ky 31)	35
Red Top (Common)	15
Crimson Clover	2
Bermuda (Common)	10

- C. For maximum soil holding ability the mulch shall be a wood cellulose fiber. This mulch shall be applied at the rate of 1,200 pounds per acre on four to one (4:1) slopes or flatter or at one thousand five hundred (1,500) pounds per acre on slopes steeper than four to one (4:1).
- D. Fertilizer shall be standard pelleted or granulated commercial fertilizer supplied separately or in a mixture containing the percentages of nitrogen, available phosphoric acid and water-soluble potash of 12-12-12.

2.02 SOURCE QUALITY CONTROL

When requested by the Engineer or designated representative of the Engineer, submit acceptable amounts of samples of the hydromulch and fertilizer for analysis and testing prior to planting.

PART 3 EXECUTION

3.01 PREPARATION

Planting Season: All planting shall be done between the average date of the last freeze in the spring and six (6) weeks prior to the average date for the first freeze in the fall according to the Texas Almanac or U.S. Weather Bureau for the area in which the project is located except as specifically authorized in writing.

3.02 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

After the designed areas have been completed to the lines, grades and cross sections shown on the plans and as provided for in other items of this contract, sodding of the type specified shall be performed in accordance with the requirements hereinafter described.

- A. Construction Method: The area to receive hydromulch shall be brought to a smooth and uniform surface to conform to an elevation four (4) inches below the finished grade indicated on the plans. The surface of the topsoil stockpile shall be thoroughly disked to a depth of six (6) inches prior to loading. The topsoil shall then be dumped upon the prepared area and spread to a uniform depth of four (4) inches. Ground cover shall then be applied by hydromulching as described above. Contractor shall maintain dike slopes and channels to grade until 70% vegetation cover over each square yard is established.
- B. Maintenance: After application of the mulch cover, water shall be applied as

necessary at the direction of the Engineer or designated representative of the Engineer for a period of at least three (3) weeks or such time as may be required to achieve cover over areas specified. The time required for application of water will not be included in the computations of contract time for completion of the project provided all other work under the contract has been completed. Fertilizer shall be a commercial grade, uniform in composition, free flowing, and suitable for application with mechanical equipment, delivered to the site in labeled containers, to current Texas Fertilizer Laws and bearing the name, trademark, and warranty of the producer.

3.03 REPAIR/RESTORATION

Any areas damaged by erosion or that do not achieve 70% coverage over each square yard shall be hydromulched again for no additional compensation.

END OF SECTION

SECTION 02933

SEEDING

PART 1 GENERAL

1.01 SUMMARY

This specification describes the requirements for the seeding, application of fertilizer, and other management practices to establish ground cover in areas as shown on the plans and as designated in the specifications.

1.02 MEASUREMENT AND PAYMENT

The cost for performing the seeding requirements set forth herein shall be included in related items of work unless specifically shown otherwise on the Bid Form. Provide all materials, equipment, tools, labor, superintendence, maintenance, and incidentals as required to complete the work.

1.03 QUALITY ASSURANCE

A tag with written certification of guaranteed product content shall be attached to the product bags or containers, or a separate written certification of guaranteed product content shall be provided by the product supplier or manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

All materials shall be transported, stored, and handled according to the written recommendation of the manufacturer or supplier.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Seed. The seed shall be common Bermuda grass (hulled) and ryegrass. All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing purity, germination, name and type of seed. Seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within nine (9) months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers.

- B. Fertilizer. The fertilizer shall be standard pelleted or granulated commercial fertilizer supplied separately or in mixture containing the percentages of total nitrogen, available phosphoric acid, and water soluble potash of 12-12-12.

2.02 SOURCE QUALITY CONTROL

When requested by City of Magnolia, Engineer or the designated representative of the Engineer, submit acceptable amounts of seed samples and fertilizer for analysis and testing prior to planting.

PART 3 EXECUTION

3.01 PREPARATION

Planting Season. The ryegrass shall be planted between September 1 and May 1. Bermuda grass shall be planted between December 1 and April 1 when planting seasons overlap, plant both Ryegrass and Bermuda.

3.02 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

- A. Application Rates. Application rates shall be comply with the following:
 - 1. Seed for areas outside of TxDOT right-of-way:
 - a. Bermuda Grass: Not less than five (5) pounds pure live seed per acre.
 - b. Ryegrass: Not less than thirty (30) pounds pure live seed per acre.
 - 2. Seed for areas within TxDOT right-of-way: Seeding in TxDOT right-of-way shall be in accordance with Item 164 of the latest version of TxDOT's Standard Specifications for Construction of Highways, Streets, and Bridges.
 - 3. Fertilizer: Not less than three hundred (300) pounds per acre.
- B. Seed Bed Preparation: A good seed bed to enhance seed germination and root establishment shall be prepared by lightly disking with a disk harrow type plow or by other proven means.
- C. Broadcast Seeding: The seed or seed mixture in the quantity specified shall be uniformly distributed over the areas to be seeded. If the sowing of seed is by hand, rather than by mechanical methods, the seed shall be sown in two directions

at right angles to each other. If mechanical equipment is used, all varieties of seed as well as fertilizer may be distributed at the same time provided that each component is uniformly applied at the specified rate. After planting, the planted area shall be rolled with a corrugated roller of the "Cultipacker" type. All rolling of slope areas shall be on the contour.

3.03 REPAIR/RESTORATION

Any areas damaged by erosion or that do not achieve coverage as detailed below shall be replanted.

3.04 FIELD QUALITY CONTROL

Work under this section shall achieve a ground cover of at least 70% throughout the area to be seeded as determined by the percent of area covered in any selected square yard of seeded area.

END OF SECTION

SECTION 02934

SODDING FOR EROSION CONTROL

PART 1 GENERAL

1.01 SUMMARY

This specification describes the requirements for providing and planting St. Augustine grass or other acceptable sod along or across such areas as designated on the plans and in accordance with specification requirements herein outlined.

1.02 MEASUREMENT AND PAYMENT

The cost for performing the sodding requirements set forth herein shall be included in related items of work unless specifically shown otherwise on the Bid Form. Provide all materials, equipment, tools, labor, superintendence, maintenance, and incidentals as required to complete the work.

1.03 DELIVERY, STORAGE AND HANDLING

Care shall be taken at all times to retain the native soil on the roots of the sod during the process of excavating, hauling, and planting. Sod material shall be kept moist from the time it is dug until planted. When so directed by the City of Magnolia, Engineer or the designated representative of the Engineer, the sod existing at the sources shall be watered to the extent required prior to excavating.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. The sod shall consist of live, growing St. Augustine grass or other acceptable sod secured from sources where the soil is fertile. St. Augustine sod shall have a healthy, virile root system of dense, thickly matted roots throughout the soil of the sod for a minimum thickness of one (1) inch. The Contractor shall not use sod from area where the grass has been thinned, nor where the grass roots have been dried out by exposure to the air and sun to such an extent as to damage its ability to grow when transplanted. The sod shall be free from noxious weeds or other grasses and shall not contain any matter deleterious to its growth or which might affect its subsistence or hardness when transplanted. Unless the area has been closely pastured, it shall be closely mowed and raked to remove all weeds and long-standing stems. Sources from which sod is to be secured shall be approved

by the Engineer or designated representative of the Engineer.

- B. Fertilizer. The fertilizer shall be standard pelleted or granulated commercial fertilizer supplied separately or in mixture containing the percentages of total nitrogen, available phosphoric acid, and water soluble potash of 12-12-12.

2.02 SOURCE QUALITY CONTROL

When requested by City of Magnolia, Engineer or the designated representative of the Engineer, submit acceptable amounts of sod samples and fertilizer for analysis and testing prior to planting.

PART 3 EXECUTION

3.01 PREPARATION

Planting Season: All planting shall be done between the average date of the last freeze in the spring and six (6) weeks prior to the average date for the first freeze in the fall according to the Texas Almanac or U.S. Weather Bureau for the area in which the project is located except as specifically authorized in writing.

3.02 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

After the designed areas have been completed to the lines, grades and cross sections shown on the plans and as provided for in other items of this contract, sodding of the type specified shall be performed in accordance with the requirements hereinafter described.

At locations shown on the plans or where directed, sod blocks shall be carefully placed on the prepared areas. The fertilizer shall then be applied in accordance with the applicable provisions of this section and thoroughly watered. When sufficiently dry, the sodded area shall be rolled or tamped to form a thoroughly compacted solid mat. Any voids left in the block sodding shall be filled with additional sod and tamped. Surfaces of block sod, which, in the opinion of the Engineer or designated representative of the Engineer, may slide due to the height and slope of the surface or nature of the soil, shall upon direction of the Engineer or designated representative of the Engineer, be pegged with wooden pegs driven through the sod blocks into firm earth sufficiently close to hold the block sod firmly in place. Edges along curbs and drives, walkways, etc., shall be carefully trimmed and maintained until accepted.

The sodded areas shall be watered at such times and in the manner and quantity as directed by the Engineer or designated representative of the Engineer.

Where applicable, the shoulders, slopes and ditches shall be smoothed after planting has been completed and shaped to conform to the desired cross sections. Any excess dirt from planting operations shall be spread uniformly over adjacent areas or disposed of as directed by the Engineer or designated representative of the Engineer so that the completed surfaces will present a neat appearance.

3.03 REPAIR/RESTORATION

Any areas damaged by erosion or that do not achieve a stable root growth over 70% of each square yard shall be resodded.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SUMMARY

This section defines the requirements and limitations for the design, construction, erection, and removal of concrete formwork.

1.02 RELATED SECTIONS

Section 03300 CAST-IN-PLACE CONCRETE

1.03 MEASUREMENT AND PAYMENT

There will be no separate measurement or payment for work performed under this section unless otherwise shown on the Bid Form.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

ACI 347 American Concrete Institute, " Recommended Practice for
Concrete Formwork"

1.05 SYSTEM DESCRIPTION

All formwork shall be designed for the loads, lateral pressure, and allowable stresses described in the reference standard (ACI 347) and the applicable requirements of local building codes. The maximum allowable deflection for concrete surfaces exposed to view is 1/240 of the span between structural members.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Forms. Full size, moisture resistant, three-fourths (3/4) inch thick, 5-ply Douglas fir form plywood shall be used as form lumber. Joints in forms shall be horizontal or vertical. Metal or other types of forms are allowed only with the

prior approval

of the City of Magnolia, Engineer or designated representative of the Engineer and shall produce surfaces equal to those by the specified wood forms.

1. Exposed Surfaces. Form lumber for exposed surfaces shall meet the above size and type requirements and be faced Grade B, or better, plywood. Do not use material with raised grain, torn surfaces, patches, dents, warps, knots, or other defects.
 2. Unexposed Surfaces. Undressed lumber may be used for forming unexposed surfaces.
- B. Form Ties. Form ties for exposed surfaces shall be threaded rod type or snap ties and shall be of sufficient strength to withstand the pressure resulting from the placement of the concrete. Threaded rod type form ties shall be at least one and one-half (1-1/2) inches shorter than the wall thickness. Form ties shall be such that when forms are removed, no metal is closer than three-quarters (3/4) inch from the surface and shall leave a small, clean hole to be grouted. Securing forms with wire is strictly prohibited.
- C. Form Coating. Use commercial formulation of form oil or form-release agent having proven satisfactory performance. Coating must not bond with, stain, or adversely effect the concrete surfaces and shall not impair the use of bonding agents and curing compounds. If form oil is used, all excess oil shall be wiped off leaving the surface just oily to the touch.
- D. Chamfer Strips. Provide chamfer strips in corners of forms to produce beveled edges on permanently exposed surfaces. Size of chamfer shall be three-quarters (3/4) inch unless shown otherwise on the plans. Interior corners and edges of formed joints do not require any beveling unless shown otherwise on the plans.
- E. Earth Cuts for Forms. Use earth cut forms for beams under slabs on grade when the beam has sloped sides and is integral with the slab. Earth cut forms are allowable for sides of footings if the sides of the excavation are stable such that there is no caving or sloughing.
- F. Slip Forms. Slip forming is not permitted.

PART 3 EXECUTION

3.01 PREPARATION

- A. General. At least 24 hours prior to scheduled concrete placement, notify the Engineer or designated representative of the Engineer that formwork is ready to be inspected. Do not place concrete until forms have been inspected and approved by the Engineer or designated representative of the Engineer.
- B. Preparation of Form Surfaces. Clean all surfaces of forms and embedded objects before placement of concrete. Remove accumulated mortar, grout, rust, debris and any other foreign material. Coat forms for exposed or painted surfaces with form oil or other form-release agent before placing concrete. Form oil, or other form-release agent, shall be used in strict accordance with the manufacturer's printed instructions. Do not allow excess form coating material to accumulate in forms or come in to contact with previously placed hardened concrete against which fresh concrete will be placed. No form coating material shall be placed on the reinforcement. Other than retained-in-place metal forms, forms for unexposed concrete surfaces may be wetted with water immediately prior to placement of concrete in lieu of using a form coating material. Such wetting of forms with water is not allowed when the possibility of freezing temperatures exists.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. General. Construct forms to the shape, lines and dimensions of the members as shown on the plans. Forms shall be sufficiently tight to prevent the leakage of mortar. Temporary openings shall be provided at the base of column and wall forms or at other required points to facilitate the cleaning and inspection immediately before placement of concrete.
- B. Facing Material. Facing material for exposed surfaces shall be placed in an orderly and symmetrical fashion. Full size pieces shall be used except where small pieces will cover an entire area. Facing material shall be adequately supported to prevent deflection. Facing material for exposed surfaces shall be installed in such a manner that will allow the Engineer or designated representative of the Engineer access to inspect the exposed surface forms before the back form is in place.
- C. Bracing of Forms. Anchor, brace, and tie all formwork to shores, members, or other supporting surfaces to prevent the upward movement of the forms during the placement of concrete. Tighten forms to close joints and insure conformance to the specified lines and shapes. All forms that cannot be properly tightened shall be removed and rebuilt. All forms shall be securely braced to prevent lateral deflections during placement of concrete. Use wedges or jacks to provide positive adjustment of shores and struts. For wall openings, construct wood

forms that facilitate loosening to counteract swelling of forms.

- D. Shoring of Forms. When shoring is permitted or required, construction shall follow a planned sequenced. Such plan shall be provided by the Contractor and shall be approved by the Engineer or designated representative of the Engineer prior to construction.
- E. Removal of Forms. Forms for structural slabs and beam bottoms shall remain in place for a period of fourteen (14) days or until cylinder tests have shown that the concrete has reached eighty (80) percent of 28-day design strength as evidenced by laboratory test reports. In no case shall forms be removed in less than four (4) days.
- F. Form Reuse. Approval is required before reusing any forms. Do not reuse forms that are worn or damaged beyond repair. Thoroughly clean and recoat forms before reuse. For wood forms to be used for exposed surfaces, sand or otherwise dress the surface to be in contact with the concrete to the original condition or provide form liner facing material. Before reusing metal forms, straighten, remove dents and clean such that the forms are returned to original condition.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

This section gives the requirements for the concrete reinforcement to be used in cast-in-place concrete.

1.02 RELATED SECTIONS

Section 03300 Cast-In-Place Concrete

1.03 MEASUREMENT AND PAYMENT

There will be no separate measurement or payment for work performed under this section unless otherwise shown on the Bid Form.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

A. American Society for Testing and Materials.

ASTM A-615, "Deformed and Plain Billet-Steel Bars for Concrete Reinforcement"

ASTM A-185, "Specification for Welded Steel Wire Fabric for Concrete Reinforcement"

ASTM A-306, "Specification for Carbon Steel Bars Subject to Mechanical Property Requirements"

B. American Concrete Institute.

ACI 315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures"

ACI 318, "Building Code Requirements for Reinforced Concrete"

C. Concrete Reinforcing Steel Institute.

CRSI 163, "Recommended Practice for Placing Reinforcing Bars"

CRSI 165, "Recommended Practice for Placing Bar Supports, Specifications and Nomenclature"

1.05 SUBMITTALS

When required by the City of Magnolia, Engineer or designated representative of the Engineer, submit detailed shop drawings showing the bar locations, splices, sizes, length, type and spacing. Detailing of reinforcement shall be in accordance with the applicable American Concrete Institute (ACI) reference standard. The number of copies of shop drawings shall be as requested by the Engineer or designated representative of the Engineer.

1.06 QUALITY ASSURANCE

When required by the Engineer or designated representative of the Engineer, submit the manufacturer's certificates showing the properties of the steel proposed for use. The certificates shall show the manufacturer's test and heat number, chemical analysis, yield point, tensile strength and percent elongation.

1.07 DELIVERY, STORAGE, AND HANDLING

All steel reinforcement shall be stored above the ground on platforms, skids or other supports as approved by the Engineer or designated representative of the Engineer. Reinforcement shall be stored in a location such that it is protected from mechanical injury and rust. When placed in the work, steel reinforcement shall be free from dirt, scale, dust, oil, paint and other material. Store steel reinforcement in an orderly fashion so that bars may be easily identified.

1.08 SCHEDULING

Schedule the delivery of materials to the site and the installation of the reinforcement such that a minimum time of site storage is maintained for the reinforcement during the entire duration of the project.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Steel Reinforcing Bars. All steel reinforcing bars shall be open hearth new billet steel conforming to ASTM A615. All bars shall be deformed and be Grade 60 with a minimum yield strength of 60,000 psi.
- B. Welded Wire Fabric. Wire for fabric reinforcement shall be cold drawn from rods hot rolled from open hearth billets and shall conform to ASTM A82 and be fabricated in accordance with ASTM A185. Wire for fabric reinforcement shall be #4 gauge or have a nominal diameter of 0.2253-inch. Welded wire fabric shall be supplied in flat mats. Rolled fabric will not be accepted.
- C. Supports. Supports for reinforcing bars shall be the correct type as intended and represented by the manufacturer. Bar supports shall be uniform high density polyethylene or fiberglass reinforced plastic and conform to CRSI Class 1, Maximum Protection.
- D. Spacers. Reinforcing bars shall be spaced the proper distance from the face of the forms by means of approved galvanized metal spacers or approved mortar or concrete blocks. Precast mortar or concrete blocks shall be cast in individual molds, in the form of a frustrum of a cone or pyramid, with suitable tie wire to be used for anchoring the block to the steel. The precast blocks shall be properly cured and aged before use in spacing the steel.
- E. Tie Wire. Use 18-gauge annealed steel for tie wire.
- F. Bar Splices. Splicing of bars will not be permitted without the written approval of the Engineer or designated representative of the Engineer. When splicing of bars is unavoidable, the number of splices shall be kept to a minimum and shall be located at points of minimum stress. When practicable, splices in adjacent bars shall be staggered. Lap splices shall have a minimum splice length of not less than twenty-four (24) bar diameters when being used in 3,000 psi concrete and shall be in accordance with ACI 318. Mechanical splices shall be installed in strict accordance with the manufacturer's instructions and recommendations and shall be as follows:
 - 1. Mechanical Bar Splices. Use Cadweld splices manufactured by Erico Products, Inc., or preapproved equal. Splices must develop a minimum of 125% of specified yield strength of the spliced bars.

2. Threaded Bar Splices. Use a metal coupling sleeve with internal threads which receive the threaded ends of the bars to be splice. Splices must develop a minimum of 125% of specified yield strength of the spliced bars.

2.02 FABRICATION

Reinforcement shall be bent cold to the shapes indicated on the plan details. Bends shall be true to the shapes indicated and any irregularities shall be cause for rejection. Unless otherwise shown, bends for stirrups or ties shall be made around a pin having a diameter of not less than two (2) times the bar size. Hooks shall be a complete semi-circular turn of a diameter equal to six (6) times the bar diameter, plus an extension of at least four (4) bar diameters at the free end of the bar.

PART 3 EXECUTION

3.01 PREPARATION

Notify the Engineer or designated representative of the Engineer at least 24-hours before concrete placement so that reinforcement may be inspected and errors corrected without delaying the work.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. General. Carefully and accurately place the reinforcement in the positions indicated on the plan details. All reinforcing steel shall be securely wired together at all intersections and be held securely in place during the pouring of concrete.
- B. Vertical Stirrups. Vertical stirrups shall always pass around the main tension members and be securely attached thereto.
- C. Spacers. No galvanized spacers shall be installed in concrete that will be exposed to the weather.
- D. Welded Wire Fabric. Where welded wire fabric is used as reinforcement, the mesh shall be placed in the longest practical lengths and shall be overlapped and securely fastened at the ends to maintain a uniform strength. A minimum of one (1) mesh overlap is required.
- E. Construction Joints. Reinforcing shall extend through construction joints.

- F. Welding of Reinforcing. No welding of reinforcing steel or splices shall be allowed without the prior approval of the Engineer or designated representative of the Engineer.
- G. Conflicts with the Reinforcement. Where there are conflicts between the location of reinforcing steel and other concrete embedded items, the Contractor shall immediately notify the Engineer or designated representative of the Engineer so that revisions can be made before placing the concrete. Cutting of any reinforcement is strictly prohibited without the prior approval of the Engineer or designated representative of the Engineer.

3.03 FIELD QUALITY CONTROL

Place all reinforcing steel within the specified tolerances as outlined in the referenced standards. Variations from these tolerances will be cause for rejection of the work.

END OF SECTION

SECTION 03250

CONCRETE JOINTS AND EMBEDDED ITEMS

PART 1 GENERAL

1.01 SUMMARY

This section specifies requirements for construction joints, expansion joints and embedded items for concrete. Review drawings and specifications for additional requirements for joints and embedded items.

1.02 RELATED SECTIONS

Section 03300 Cast-In-Place Concrete

1.03 MEASUREMENT AND PAYMENT

There will be no separate measurement or payment for work performed under this section unless otherwise shown on the Bid Form.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

A. American Society for Testing and Materials (ASTM).

1. ASTM A-120, "Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses."
2. ASTM A-306, "Carbon Steel Bars Subject to Mechanical Property Requirements."
3. ASTM D-994, "Preformed Expansion Joint Filler for Concrete (Bituminous Type)."
4. ASTM D-1751, "Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextending and Resilient Bituminous Types)."

5. ASTM D-1752, "Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction."

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Expansion Joint Filler. Use 3/4-inch thick asphalt impregnated fiberboard or redwood in accordance with ASTM D-1751.
- B. Expansion Joint Sealer. Use joint sealing compound conforming to ASTM C920, Type S, Grade P or NS.
- C. Expansion Joint Dowels. Use plain steel bars conforming to ASTM A-306, grade 70. Cut Dowels to length at shop or mill before delivery to the site. Dowels must be straight and clean, free of rust and scale.
- D. Sleeves. Provide sleeves which are 26-gauge steel or PVC tubes and are capped at one end. Sleeves shall be in accordance with ASTM A-120.
- E. Waterstops. Unless otherwise shown on the plan details waterstops shall be polyvinylchloride and be Seal-Tight, Type No. 6DS, as manufactured by W.R. Meadows, Inc.; Type No. 6, wide flange (PVC), as manufactured by Duro-Wal; Type CB 1-1/8, as manufactured by Williams Products; or a preapproved equal.

PART 3 EXECUTION

3.01 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. General. Place embedded items as shown on the plan details and in such a manner that will not impair the strength of the structure. Should locations of embedded items conflict with reinforcement or be detrimental to strength of the structure, notify the City of Magnolia, Engineer or designated representative of the Engineer so the items can be relocated. Notification shall be such that the scheduled concrete placement is not delayed and there is adequate time to relocate the embedded items. Adequately secure all embedded items to prevent displacement during concrete placement.
- B. Conflicts with Reinforcement. Do not cut or reposition reinforcing steel to facilitate the installation of inserts, conduits, sleeves, anchor bolts, mechanical openings and similar items without the prior approval of the Engineer or designated representative of the Engineer.

- C. Construction Joints. Make construction joints only at locations shown the plan details or as specified in these specifications. Relocation of construction joints is strictly prohibited without the prior approval of the Engineer or designated representative of the Engineer. Install construction joints in compliance with the following procedures:
1. Locate joints in such a manner that will least impair the strength of the structure being constructed.
 2. Place all joints perpendicular to main reinforcement. Reinforcing shall be extended through all joints unless otherwise directed.
 3. Prepare joints by removing loosened particles of aggregates or damaged concrete at the surface.
 4. Install any joint filler on expansion joints to full depth of the concrete section with the top held down 3/4-inch to provide recess for sealant.
- D. Waterstops. Install waterstops in the locations shown and in a manner that will develop effective watertightness. Position and support waterstops against any displacement during placement of concrete.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

This section gives requirements for normal weight structural concrete, concrete riprap, and pneumatically placed concrete.

1.02 RELATED SECTIONS

Section 03100 Concrete Formwork
Section 03200 Concrete Reinforcement
Section 03250 Concrete Joints and Embedded Items

1.03 MEASUREMENT AND PAYMENT

There will be no separate measurement and payment for work performed under this section unless otherwise shown on the Bid Form.

1.04 REFERENCES

The applicable provisions of the following standards shall apply as if written here in their entirety:

ACI American Concrete Institute
ASTM American Society for Testing and Materials

1.05 SYSTEM DESCRIPTION

Four (4) classes of concrete designated by the minimum seven (7) day and twenty-eight (28) day compressive strength in pounds per square inch (psi) are covered by this specification and are as follows:

<u>Class</u>	<u>Compressive Strength (psi)</u>	
	<u>7 days</u>	<u>28 days</u>
A	1,350	2,000
B	1,700	2,500
C	2,000	3,000
D	2,350	3,500

Unless shown otherwise on the plans, concrete shall be Class "D".

1.06 SUBMITTALS

Submit the following information for the review and approval of the City of Magnolia, Engineer or designated representative of the Engineer:

- A. Cement. Submit certified test reports for the cement to be used on the project.
- B. Aggregate. Submit certified test reports for the aggregate to be used on the project. Testing of aggregate shall be conformance with ASTM C33.
- C. Admixtures. Submit brochures, manufacturers instructions for use, and performance data on all proposed admixtures.
- D. Design Mix. Submit test data on proposed design mixes for each class of concrete to be used on the project. Test data shall include both the 7-day and 28-day compressive strength tests results to establish a quality control standard for use during the construction period. No concrete shall be placed before the design mix is submitted and approved. An analysis showing the relationship between the water-cement ratio and the compressive strength of the concrete mix shall be submitted with the design mix.

The number of copies of each submittal shall be as requested by the Engineer or designated representative of the Engineer.

1.07 QUALITY ASSURANCE

It shall be the responsibility of the Contractor to produce concrete of the strength, durability, workability and specified finish; furnish representative materials for specimens in quantities required by the testing laboratory; take samples of materials for testing; check proportions of mix and immediately notify the Engineer or designated representative of the Engineer if proportions appear improper in any respect. The Contractor shall comply with all testing laboratory findings and the decisions of the Engineer or designated representative of the Engineer in reference to these findings. The Contractor shall pay for the redesign of the concrete mix due to a change in the source of materials.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Cement. Store cement in weathertight buildings, bins or silos to provide

protection from dampness and contamination and to minimize warehouse set.

- B. Aggregate. Arrange and use aggregate stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Do not use frozen or partially frozen aggregates.
- C. Sand. Sand shall be stored such that it maintains a uniform moisture content.
- D. Admixtures. Store and handle admixtures in accordance with manufacturer's instructions.
- E. Batch Tickets. Batch tickets shall be delivered with each load of concrete and shall include the weights of each ingredient for the batched load of concrete and the date and time the load was batched. The testing agency representative shall keep at least one (1) copy of the batch ticket.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

- A. Portland Cement. Portland cement shall be Type I or Type III and be in accordance with the current specifications for Portland cement in ASTM C150. Type IA or Type IIIA Portland cement shall be used when air entrainment is specified and shall conform to the current specifications for Portland cement in ASTM C175.
- B. Fly Ash. When fly ash is used, "cement" shall be defined as "cement plus fly ash". Fly ash shall be Type C from a source approved by the Texas Department of Transportation and shall not exceed 25% of the absolute volume of the "cement plus fly ash". Fly ash is not permitted when white Portland cement is required.
- C. Water. Water used for mixing in concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances that may be deleterious to concrete or reinforcement. Water which is suitable for drinking or ordinary household uses is acceptable. Nonpotable water shall not be used for mixing in concrete. The maximum water/cement ratio shall be 0.50.
- D. Admixtures. Calcium chloride or admixtures containing chloride are strictly prohibited. Provide admixtures in accordance with the following:
 - 1. Air-entraining Admixtures. Use admixture which conforms to the requirements of ASTM C260.

2. Chemical Admixtures. Chemical admixtures used as retarders, accelerators, water-reducing agents, or a combination of these, shall conform to the applicable provisions of ASTM C494 and/or ASTM C1017.
 3. Admixtures shall be charged into the mixer as solutions and shall be measured accurately. The liquid shall be considered a part of the mixing water.
- E. Aggregates. Use coarse aggregate from only one (1) source and fine aggregate from only one (1) source for all exposed concrete in a single structure. Use of pit run gravel as an aggregate will not be permitted. Both fine and coarse aggregates in normal weight concrete shall conform to the requirements of ASTM C33 and shall be as follows:
1. Coarse Aggregate. Coarse aggregates shall consist of crushed stone, gravel, crushed gravel or a combination of these. Gravel and crushed gravel shall consist of clean, hard, durable particles, free from adherent coating, thin or elongated pieces, soft or disintegrated particles, dirt, organic or injurious matter. Crushed stone shall consist of the clean, dustless product resulting from crushing stone. There shall be no adherent coatings, clay, loam, organic or injurious matter.
 2. Fine Aggregate. Fine aggregate shall consist of a sand or mixture of sand with or without a mineral filler. The sand or mixture of sand in fine aggregate shall be clean, hard, durable, uncoated grains that are free from lumps.
- F. Curing Compound. When required, provide commercial curing compound that will not permanently discolor the concrete and is in accordance with the provisions set forth in ASTM C309.
- G. Sheet Material for Curing Concrete. When required, provide waterproof paper, polyethylene film or white burlap-polyethylene sheeting in accordance with provisions set forth in ASTM C171.
- H. Patching Grout. Provide a non-shrink, non-slump, quick-setting patching mortar to repair small defects in concrete work. Master Builders' "Embeco 153," or preapproved equal, is acceptable for use as a patching grout. Sand used in patching grout shall be in accordance with the provisions set forth in ASTM C144.

I. Proportioning and Mixing of Concrete. Proportion and mix ingredients in a manner that will produce a concrete having the proper placability, durability, strength, appearance, and other specified properties. Proportion ingredients to produce a homogenous mixture that will readily work into corners and angles of forms and around reinforcement when placed and consolidated and will not segregate or have excessive water collect on the surface. Proportion materials in accordance with the procedures outlined in ACI 613, "Recommended Practice for Selecting Proportions for Concrete." All materials will be proportioned and mixed with the intention of producing a concrete with the minimum specified twenty-eight (28) day compressive strength, or greater.

1. Normal Weight Structural Concrete. In addition to the above requirements for proportioning and mixing concrete, normal weight structural concrete shall be mixed in accordance with the provisions of ASTM C94, "Standard Specification for Ready-Mixed Concrete." The use of an on site batch plant is strictly prohibited without the prior approval of the Engineer or designated representative of the Engineer. Any specified or approved admixtures shall be mixed and proportioned in the concrete in accordance with the manufacturer's instructions and the applicable reference standards.
2. Concrete Riprap. Concrete riprap shall be proportioned and mixed in accordance with the provisions for normal weight concrete.
3. Pneumatically Placed Concrete. In addition to any of the following requirements, the cement, sand, admixtures, and water to be used for pneumatically place concrete shall conform to the requirements previously outlined in this specification. Pneumatically placed concrete shall be proportioned as follows:
 - a. Type I. One (1) part cement (minimum) to four (4) parts sand (by volume).
 - b. Type II. One (1) part cement (minimum) to five (5) parts sand (by volume).

The type to be used shall be designated on the plans. At the time of mixing, the sand shall contain from three (3) to six (6) percent moisture. When visual inspection indicates that lumps or oversized particles are going into the machine, all materials shall be thoroughly mixed and passed through a 1/4-inch sieve before being placed in the machine. The

minimum mixing time for each batch shall not be less than 1-1/2 minutes after the sand and cement are in the drum when the drum rotates at a peripheral speed of two-hundred (200) feet per minute. Completely discharge each batch before recharging. Clean the mixer at regular intervals to remove all adherent material from the mixing vanes and from the drum. No water shall be added to the mix after mixing and before application. Discard any mixed material that has exceeded the forty-five (45) minute maximum time to placement.

PART 3 EXECUTION

3.01 PREPARATION

- A. General. Mix concrete only in quantities for immediate use and discard any concrete that has set or is not completely discharged at the site within the maximum time allowed for placement. Retempering of any set concrete is strictly prohibited. When concrete arrived at the project with a slump below that specified, water may be added only if neither the maximum permissible water-cement ratio or the maximum slump is exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required.
- B. Notification. The placement of concrete without the prior approval of the Engineer or designated representative of the Engineer is strictly prohibited. The Contractor shall notify the Engineer or designated representative of the Engineer a minimum of twenty-four (24) hours before placing concrete.
- C. Protection from Adverse Weather. Unless adequate protection is provided, or approval is obtained, do not place concrete during rain, sleet, snow or freezing weather. Do not permit rainwater to increase the amount of mixing water or to damage the surface finish. If rainfall occurs after placing operations begin, provide adequate covering to protect the work from any adverse damage.
- D. Placing Temperatures. All concrete shall be placed in accordance with the following provisions:
 - 1. Cold Weather Placement. Unless special provisions are made for heating the concrete mix and the concrete in forms, do not place any concrete when the air temperature is below 40° F or is predicted to be below 40° F within forty-eight (48) hours of placement.
 - 2. Hot Weather Placement. When the air temperature is above 85°F, use an approved retarding agent in all concrete. Concrete temperature prior to

placement shall not exceed 95° F.

- E. Maximum Time to Placement. Any concrete that has attained its initial set or has contained its mixing water or cement for more than forty-five (45) minutes shall not be placed in the work. The addition of an approved retarding agent may be proposed by the Contractor to increase the maximum time to placement. The increase of time to placement shall be proposed the Contractor and approved by the Engineer or designated representative of the Engineer when the design mix is submitted for approval.

3.02 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. Placement of Concrete. The placement of concrete shall be in accordance with the following procedures:
1. Normal Weight Structural Concrete. Place concrete only upon a subgrade or surface approved by the Engineer or designated representative of the Engineer. All forms shall be clean of dirt, and other construction debris, and all water shall be removed or drained from the forms before concrete is placed. Concrete shall be handled from mixer to transport vehicle to final place of deposition in a continuous manner and as rapidly as possible without segregation or loss of ingredients until the approved unit of operation is completed. Placing will not be permitted when, in the opinion of the Engineer or designated representative of the Engineer, the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper finishing and curing of the concrete. Forms or reinforcement shall not be splashed with concrete in advance of pouring. Concrete shall be deposited in uniform layers and as close as practicable to its final position. Immediately after placing, concrete shall be compacted and consolidated by vibration, spading, rodding, or forking such that the concrete is worked around reinforcement, embedded items and into the corners of the forms. The method used to consolidate and compact concrete shall meet with the approval of the Engineer or designated representative of the Engineer and shall be done so as not to cause segregation of the concrete. Special care shall be taken in placing and spading concrete against forms and all the joints to prevent the formation of voids and honeycombs. Tapping or other external vibration of forms will not be permitted. Vibrators shall not be used to move concrete in the forms. Concrete shall not be placed on concrete that is sufficiently hard to cause the formation of seams and planes of weakness within the section. Concrete shall not be allowed to drop freely more than five (5) feet in unexposed work nor more than three (3) feet in exposed work. Where greater drops are required, a tremie or

other approved means shall be employed. The discharge of the tremies shall be controlled so that the concrete may be effectively compacted into horizontal layers not more than twelve (12) inches thick and the spacing of the tremies shall be such that cavities do not occur. Concrete to receive other construction shall be screeded to proper level to avoid excessive shimming or grouting.

2. Concrete Riprap. Place concrete on the slopes and other areas to be protected as shown on the plan details and as approved by the Engineer or designated representative of the Engineer. All surfaces shall be moist when the concrete is placed. If the surfaces are dry and not consolidated properly, the Engineer or designated representative of the Engineer may require the entire area to be sprinkled or sprinkled and consolidated before the concrete is placed. After the concrete has been placed, compacted and shaped to conform to the dimensions shown on the plans and after it has set sufficiently to avoid slumping, the surface shall be finished with a wooden float to secure a reasonably smooth surface. Concrete riprap which is pneumatically placed shall conform to the requirements of subparagraph 3 "Pneumatically Placed Concrete."
3. Pneumatically Placed Concrete. The compressor or blower used to supply air for placing concrete shall be capable of delivering a sufficient volume at a pressure range of thirty (30) to sixty (60) pounds per square inch (psi) as required by the size of the nozzle being used. When a hose length of one-hundred (100) feet is used, the pneumatic pressure at the nozzle shall be forty-five (45) pounds per square inch (psi), or more, as necessary to efficiently prosecute the work. For lengths over one-hundred (100) feet, the pressure shall be increased five (5) pounds per square inch (psi) for each additional fifty (50) feet of hose required. Steady pressure must be maintained throughout the placing process. The water pump shall be of sufficient size and capacity to deliver the water to the nozzle at a pressure of not less than fifteen (15) pounds per square inch (psi) in excess of the required air pressure. Proper consistency of the concrete shall be controlled at the nozzle valve by the operator and a low water-cement ratio must be maintained. The mix shall be sufficiently wet to properly adhere and sufficiently dry so that it will not sag or fall from vertical or inclined surfaces or separate in horizontal work. In covering vertical or inclined surfaces, placing of the concrete shall begin at the bottom and be completed at the top. The nozzle shall be held at such distance (2 to 4 feet) and position that the stream of flowing concrete shall impinge as nearly as possible at right angles to the surface being covered. Any deposit of loose sand shall be removed prior to placing any original or

succeeding layers of pneumatically placed concrete. Should any deposit of loose sand be covered with pneumatically placed concrete, the concrete shall be removed and replaced with a new coat of pneumatically placed concrete after the receiving surface has been properly cleaned. Before channel lining or riprap is placed, the slopes shall be thoroughly and uniformly consolidated and moistened. Sprinkling or sprinkling and consolidation may be required by the Engineer or designated representative of the Engineer before placement of concrete. The subgrade for lining shall be excavated and fine graded to the required section. The use of forms for lining will not be required. The surfaces of pneumatically placed concrete for both channel lining and riprap shall be accurately finished by hand floating methods before the concrete has attained its initial set. The original surface and each surface which is permitted to harden before applying succeeding layers shall be washed with water and blasted with air, or a stiff hose stream, and all loosened material removed. Sand which rebounds and does not fall clear of the work or which collects on horizontal surfaces shall be blown off from time to time to avoid leaving sand pockets. Rebound which is recovered and is clean and free of foreign matter may be reused as sand in a quantity not to exceed twenty (20) percent of the total sand requirement. Pneumatically placed concrete shall not be applied to a surface containing frost or ice. Where standing or running water is encountered, it shall be removed before pneumatically applying the concrete. Only experienced foremen, gunmen, nozzle men, and rodmen shall be employed and satisfactory written evidence of such experience shall be furnished to the Engineer or designated representative of the Engineer upon request.

B. Surface Finish on Concrete.

1. Monolithic Slab Finishes.

- a. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
- b. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete sidewalks, platforms, steps, and elsewhere as indicated.
 - (1) Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer or designated representative of the Engineer

before application.

2. Finishing Formed Surfaces.

- a. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.
- b. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- c. Smooth-Rubbed Finish: Not later than one day after form removal, provide smooth-rubbed finish on concrete surfaces that have received smooth-formed surface but are not scheduled to be coated or covered.
 - (1) Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

C. Curing of Concrete.

- 1. Moist Curing. All freshly placed concrete shall be cured by keeping the exposed surfaces, edges and corners continuously moist for a minimum duration of seven (7) days by spraying, ponding or covering with waterproof paper, polyethylene film or wet burlap. The temperature of the concrete shall maintained above 50° F for the seven (7) day curing period. All materials for protecting and curing the concrete shall be on hand and ready for use before concreting begins. Wood forms left in place will not be considered adequate for moist curing. Ceilings and inside walls may be

cured by leaving the forms on for at least four (4) days.

2. Curing Compound. In lieu of moist curing, a curing compound which is acceptable to the Engineer or designated representative of the Engineer as to color, quality, and moisture retention, may be used. Apply curing compound in accordance with manufacturer's instructions.

3.03 FIELD QUALITY CONTROL

- A. General. The Owner shall obtain the services of an independent qualified testing laboratory to perform the required testing and inspection of the concrete. All construction materials necessary for tests shall be provided by the Contractor at no additional expense to the Owner or the testing laboratory.
- B. Slump Test. Contractor shall perform slump tests on each batch of concrete delivered to the job site. Slump tests shall be performed under the guidance and supervision of the testing laboratory representative and/or Engineer or designated representative of the Engineer. The maximum permissible slump for concrete prior to addition of water reducing agents shall be as follows:

<u>Location of Concrete</u>	<u>Maximum Slump (in.)</u>
Reinforced foundation walls and footings	5"
Plain footings and piers	5"
Slabs, beams and reinforced walls	5"
Pavements	4"

Water reducing admixtures (plasticizer) may be added as allowed by the concrete producer after the initial slump test. The maximum slump after adding water reducing admixtures shall be 8".

- C. Field Test Cylinders. The testing laboratory shall prepare one (1) set of concrete test cylinders, consisting of a minimum of three (3) cylinders, for each one-hundred (100) cubic yards (CY) of concrete pour or major fraction thereof. If the quantity of concrete poured in a day is less than one-hundred (100) cubic yards (CY), one (1) set of concrete tests cylinders is required. Each concrete test cylinder shall be made in accordance with the provisions outlined in ASTM C31. Test cylinders shall be cured under laboratory conditions except when, in the opinion of the Engineer or designated representative of the Engineer, prevailing

job site conditions necessitate cylinders be cured under job conditions. Testing of concrete test cylinders shall be done by the testing laboratory in accordance with the provisions outlined in ASTM C39. One (1) cylinder shall be tested for compressive strength at the age of seven (7) days and a minimum of one (1) cylinder shall be tested for compressive strength at the age of twenty-eight (28) days. If any cylinder test is below the specified strength requirements, the Engineer or designated representative of the Engineer shall have the right to require changes in the mix design, require additional curing time, change the batching process, or take other necessary actions to insure that the concrete being placed in the work will meet the specified strength requirements.

3.04 ADJUSTING / CLEANING

All tie holes and other surface defects shall be repaired immediately after form removal. Approved patching grout shall be used to fill the minor voids left by form ties and all protruding defects left by forms shall be removed with a rubbing stone.

END OF SECTION

