Jefferson County Drainage District No. 7

Jefferson County, Texas

A Plan Related to Drainage and Flood Damage Reduction

November 2019

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Executive Summary

Jefferson County Drainage District No. 7 undertook preparation of this document to examine how development is reviewed and to lay the groundwork required by statute so that the District can develop, adopt, implement, and enforce regulations relating to its review and approval of development proposals. Chapter 49-211 of the Texas Water Code requires a drainage district to adopt a master drainage plan prior to adopting such rules; this plan constitutes the District's master drainage plan.

The Plan was prepared with guidance by an advisory committee appointed by the District's Board of Directors and composed of staff representatives from the District, Jefferson County, the Cities of Port Arthur, Nederland, Port Neches, and Groves, and representatives of local development, engineering, and surveying communities.

In addition to the development of regulations governing the District's review of drainage reports and plans, this Plan calls for the District to identify priorities for future watershed studies, to coordinate local involvement in the revision of flood maps by the Federal Emergency Management Agency, to formalize how flood conditions are documented, to develop in-house capabilities for using geographic information system technology, and to develop a drainage design criteria manual.

The final draft of the Plan was made available for comment on the District's web site, in District facilities, and in public libraries. The final Plan was presented and adopted at a public meeting of the District's Board of Directors on November 19, 2019. It is available for review at the District Office's located at 4401 Ninth Avenue, Port Arthur, Texas 77642.

District Contact:

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RESOLUTION NO. 452
REGARDING ADOPTION OF MASTER DRAINAGE PLAN

WHEREAS, portions of Jefferson County, Texas, and the incorporated municipalities located within the boundaries of Jefferson County Drainage District No. 7 (the "District") have storm water drainage needs or improvements that must be addressed; and

WHEREAS, future development will impact said drainage and should be coordinated with the drainage activities and the drainage system and facilities of the District; and

WHEREAS, Section 49.211 of the Texas Water Code authorizes a drainage district to adopt rules governing approval of drainage reports if the district adopts a master drainage plan; and

WHEREAS, the Hazard Mitigation Plan (2019), adopted by the Board of Commissioners in September 2019, identifies actions that, over time, will help minimize and reduce public safety threats and damage to private property, including Action #3, "Develop and adopt a master drainage plan in order for the District to exercise the authority granted to drainage districts under Chapter 49.211 of the Texas Water Code;" and

WHEREAS, the local government entities and the engineering community within the District has been provided with opportunities to learn about the master drainage plan and the actions proposed in the plan, and to review and comment on the draft prior to adoption.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COMMISSIONERS OF JEFFERSON COUNTY DRAINAGE DISTRICT NO. 7:

THAT The Plan Related to Drainage and Flood Damage Reduction (November 2019), which constitutes the District's master drainage plan, is hereby adopted as the official plan of the District.

I, Billy Joe Butler, Secretary of the Board of Commissioners of Jefferson County Drainage District No. 7, do hereby certify that the above is a true and correct copy of a resolution adopted by the Board of Commissioners of Jefferson County Drainage District No. 7, at their meeting No. 2311 held on the 19th day of November, 2019, upon motion made by Commissioner Champagne and seconded by Commissioner Moses and adopted unanimously by said Board, a quorum being present.

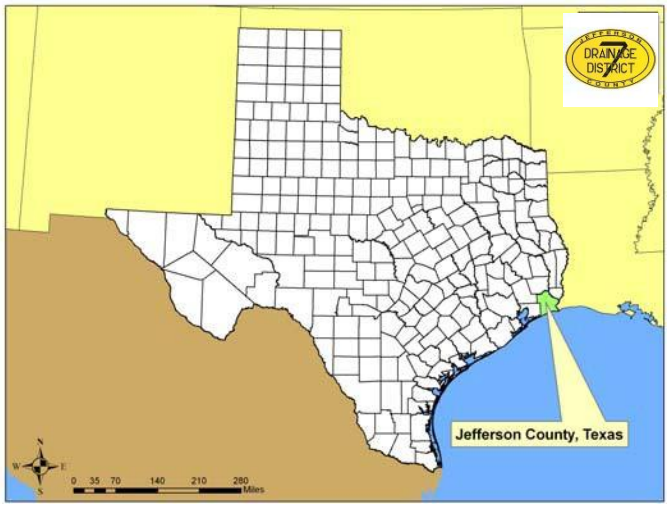
Given under my hand this 19th day of November, 2019.

Billy Joe Butler
Secretary
JEFFERSON COUNTY DRAINAGE DISTRICT NO. 7

1. Introduction

1.1 Overview of the District

Jefferson County Drainage District No. 7 (DD7) is a conservation and reclamation district and a political subdivision of the State of Texas located in the southeast corner of the state. DD7 was established February 1948, after favorable vote by the Jefferson County Commissioners Court. It was created primarily to provide drainage of overflow lands within DD7, including the construction and maintenance of drains, ditches and levees, and other improvements of the District. The District is governed by a five-member Board of Directors that is elected by the voting residents within the boundaries of Jefferson County Drainage District No. 7.



In November 1945, authorization by County Court to set the boundaries for Jefferson County Drainage District No. 7 were outlined and recommendations for drainage improvements given. Proposed improvements to the District would total $1.6 million. Organization of Jefferson County Drainage District No. 7 was voted in February 1946.

In November of 1961 the consolidation of Jefferson County Drainage District No. 4 with Jefferson County Drainage District No. 7 was put to a general election in which consolidation of the two districts was voted in. On November 27, 1961 Jefferson County Drainage District No. 7 assumed the responsibility for the operations of Jefferson County Drainage District No. 4.

After experiencing high tides and spot flooding from Hurricane Carla in 1961, a hurricane protection system was added to the District for a cost of $84 million, with the District supporting 30% of cost.

1.2 Statutory Authorities

Jefferson County Drainage District No. 7 was created under Section 59, Article XVI of the Texas Constitution. Additional powers and duties of drainage districts are enumerated in Title 4, Chapter 49 of the Texas Water Code. For the purposes of this plan related to drainage and flood damage reduction, certain authorities of particular interest are found in chapter 49.211 of the Texas Water Code. Specifically, a district that is established to engage in drainage or flood control activities may adopt a master drainage plan and require district approval of a drainage report for subdivision plats and developments as part of the approval process administered by municipalities and counties.

Texas Water Code: Chapter 49. Provisions Applicable to All Districts Subchapter H. Powers and Duties

§ 49.211. Powers

(a) A district shall have the functions, powers, authority, rights, and duties that will permit accomplishment of the purposes for which it was created or the purposes authorized by the constitution, this code, or any other law.
(b) A district is authorized to purchase, construct, acquire, own, operate, maintain, repair, improve, or extend inside and outside its boundaries any and all land, works, improvements, facilities, plants, equipment, and appliances necessary to accomplish the purposes of its creation or the purposes authorized by this code or any other law.
(c) A district that is authorized by law to engage in drainage or flood control activities may adopt:
(1) a Master Drainage Plan, including rules relating to the plan and design criteria for drainage channels, facilities, and flood control improvements;
(2) rules for construction activity to be conducted within the district that:
(A) reasonably relate to providing adequate drainage or flood control; and
(B) use generally accepted engineering criteria; and
(3) reasonable procedures to enforce rules adopted by the district under this subsection.
d) If a district adopts a Master Drainage Plan under Subsection (c)(1), the district may adopt rules relating to review and approval of proposed drainage plans submitted by property developers. The district, by rule, may require that a property developer who proposes to subdivide land located in the district, and who is otherwise required to obtain approval of the plat of the proposed subdivision from a municipality or county, submit for district approval a drainage report for the subdivision. The drainage report must include a map containing a description of the land to be subdivided. The map must show an accurate representation of:
(1) any existing drainage features, including drainage channels, streams, flood control improvements, and other facilities;

(2) any additional drainage facilities or connections to existing drainage facilities proposed by the property developer's plan for the subdivision; and

(3) any other parts of the property developer's plan for the subdivision that may affect drainage

(e) The district shall review each drainage report submitted to the district under this section and shall approve a report if it shows compliance with:

(1) the requirements of this section;

(2) the district's Master Drainage Plan adopted under subsection (c)(1); and

(3) the rules adopted by the district under Subsections (c)(2) and (d).

(f) On or before the 30th day after the date a drainage report is received, the district shall send notice of the district's approval or disapproval of the drainage report to:

(1) the property developer; and

(2) each municipal or county authority with responsibility for approving the plat of the proposed subdivision.

(g) If the district disapproves a drainage report, the district shall include in the notice of disapproval a written statement:

(1) explaining the reasons for the rejection; and

(2) recommending changes, if possible, that would make a revised version of the drainage report acceptable for approval.

1.3 Overview of the Plan

This plan provides a concise summary of the following:

- **Chapter 1 - Introduction.** The statutory authorities summarized are those under which DD7 operates and which call for a master drainage plan as a requirement for adoption of drainage regulations.

- **Chapter 2 - Goals.** The goals established in the District's *Hazard Mitigation Plan (2019)* are summarized; this plan was identified in that document as a high priority action. The primary purpose for its development is to allow DD7 to develop, adopt and implement rules relating to its review of drainage plans.

- **Chapter 3 - Jefferson County Drainage District No. 7.** This brief description of the District and the region includes information about the major watersheds and the population. A small increase in population is anticipated, a factor that influences the amount of development anticipated.

- **Chapter 4 - The Planning Process.** An established process was followed to develop this document. A committee representing various interests was formed and a series of meetings was held. The public was given the opportunity to comment at the outset and prior to adoption.

- **Chapter 5 - How Development is Managed.** This chapter summarizes how Jefferson County and the Cities of Groves, Nederland, Port Neches and Port Arthur process their reviews of drainage plans for subdivision proposals. Each of these jurisdictions require that developers obtain DD7 review. DD7's typical review process also is summarized.

- **Chapter 6 - Flood and Drainage Conditions.** A summary of the types of drainage and flooding problems is presented to illustrate the wide range of problems that are taken into consideration as the District implements its responsibilities and that are important in the consideration of drainage and flood-damage reduction measures to be addressed in development proposals.

- **Chapter 7 - Factors Influencing Future Problems.** Factors that contribute to drainage and flooding problems are described, including new development and increased runoff, new construction in flood-prone areas, and the District's drainage system improvements and ongoing maintenance program.

- Chapter **8 - Meeting the Goals: Actions.** Six actions are identified to help the District meet stated goals related to facilitation of development reviews; to recognize existing stormwater and flooding problems while avoiding creating new problems or worsening existing problems. The actions include:

    A. Develop and implement drainage regulations
    B. Identify watershed study needs
    C. Coordinate flood map revisions
    D. Document flood conditions
    E. Develop GIS capabilities
    F. Develop drainage design criteria manual

1.4 Acknowledgements

DD7 acknowledges the support of the cities of Port Arthur, Port Neches, Groves, Nederland, and of Jefferson County.

2. Goals: Managing Drainage, Protecting Lives and Property

Runoff of excessive rainfall, drainage, and flooding are inextricably linked processes. The purpose of both natural and manmade drainage and stormwater management systems is to convey and/or store runoff. When the capacity of those drainage systems is exceeded, normally dry lands are inundated by floodwater. Manmade stormwater and drainage works usually are designed to handle runoff from frequent rainfall events such as the 5-year or 10-year frequency storm. Some drainage systems are designed to convey less frequent floods, such as the 1%-annual chance flood (commonly called the 100-year flood). A "5-year frequency storm: has a 20% probability of occurring in any given year and a"10-year frequency storm" has a 10% probability of occurring in any given year. A "100-year flood" has a 1% probability of occurring in any given year. Some key concepts in stormwater management and floodplain management are described in Appendix A.

DD7 implements its authority to manage drainage in order to protect lives and property from the adverse effects of uncontrolled drainage and flooding. The District was created primarily to provide drainage of overflow lands, including the construction and maintenance of drains, ditches and levees, and other improvements of the District.

In September 2019, DD7 adopted a *Hazard Mitigation Plan* that was prepared according to the planning process outlined by the Federal Emergency Management Agency. Prior to adoption of that plan, DD7 was a named participant in the Jefferson, Hardin and Orange Multi-County Plan that was approved in 2005. As part of the process of development of the current plan, the District formulated four mitigation goals:

1. To protect public health, safety, and welfare;
2. To reduce losses due to hazards by identifying hazards, minimizing exposure of citizens and property to hazards, and increasing public awareness and involvement;
3. To facilitate the development review and approval process to accommodate growth in a practical way that recognizes existing stormwater and floodplain problems while avoiding creating new problems or worsening existing problems; and
4. To seek solutions to existing problems.

The *Hazard Mitigation Plan (2019)* also sets forth an action agenda. One of the high priority actions is:

> Action # 3. Develop and adopt a master drainage plan [plan related to drainage and flood damage reduction] in order for DD7 to exercise the authority granted to drainage districts under Chapter 49.211 of the Texas Water Code.
>
> Chapter 49.211 requires districts to adopt master drainage plans before adopting rules relating to the review and approval of proposed development drainage plans.

Currently, coordinating reviews of drainage improvements with DD7 is part of the subdivision review process undertaken by Jefferson County and the cities of Port Arthur, Port Neches, Groves, and Nederland. Although the District does not have formal rules, the regulations adopted by the County and Cities do contain provisions that link approval of subdivisions to the District's review.

This Plan is prepared and adopted in order to allow DD7 to develop, adopt and implement rules, independent from City and County rules, relating to that review and to formalize the process of approval of proposed drainage plans submitted by property developers so that there are defined requirements and an orderly review and approval process.

3. Jefferson County Drainage District No. 7

The area covered by the Jefferson County Drainage District No. 7 is located in southeast Texas (Figure 3-1). Jefferson County is bounded on the north by the Neches River and Pine Island Bayou, which form the border with Hardin and Orange Counties; on the east by Sabine Lake, which forms the border with Cameron Parish, Louisiana; on the South by the Gulf of Mexico; and on the west by Liberty and Chambers Counties. The City of Beaumont is the County seat and the largest city in Jefferson County. Beaumont is situated approximately 85 miles east of Houston, approximately 70 miles northeast of Galveston, and 275 miles southeast of Dallas.

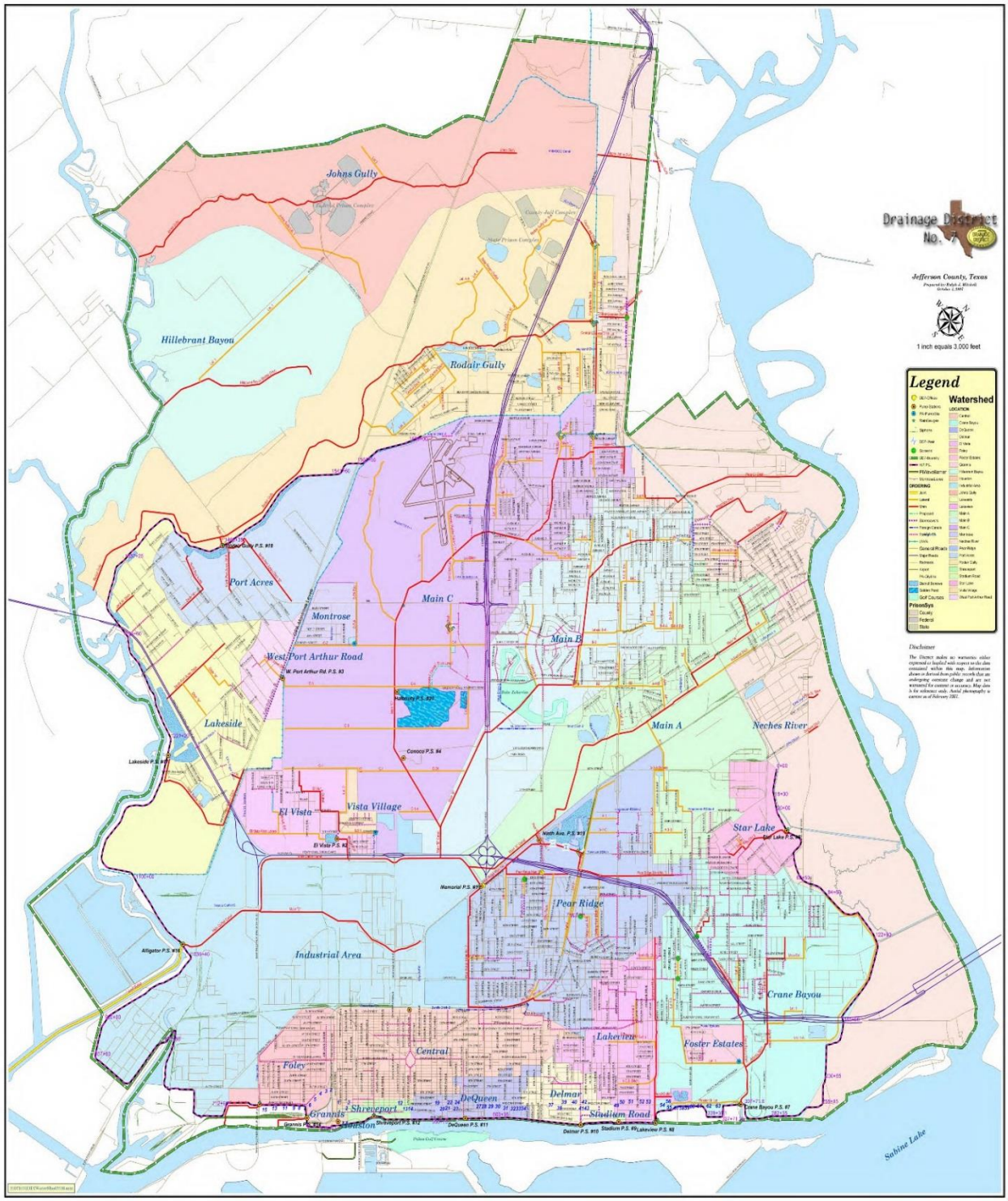
The District implements and maintains drainage projects throughout the District's 108 square mile area of responsibility which lies wholly within Jefferson County and includes the cities of Port Arthur, Port Neches, Groves, Nederland, and part of Jefferson County. Figure 3-1 also delineates the major watersheds that are within or flow through the District.

Among its other duties, DD7 works with the other jurisdictions to identify flood-prone areas, to encourage inclusion of flood-damage avoidance measures in land development, and to implement cost-effective flood mitigation projects. Chapter 6 includes additional information regarding flood hazards,

Southeast Texas is characterized by gently sloping or nearly flat topography. Ground surface elevations across the District vary from 20 feet to 0 feet above mean sea level. The geologic structure is nearly flat strata, with bedrock types comprised of deltaic sands and muds. Data from the Bureau of Economic Geology at the University of Texas at Austin identifies the land as "expansive clay and mud – locally silty, locally calcareous, flat to low; hilly prairie; commonly tilled".

The climate of the region is humid subtropical, with warm summers and moderate winters. Rainfall is abundant and, on average, is fairly evenly distributed throughout the year. The heaviest rains usually occur during the hurricane season, which extends from June through October. Average annual precipitation is approximately 56 inches and the average annual temperature is about 69° F.

Figure 3-1
Jefferson County Drainage District No. 7 Boundaries and Major Watersheds



Jefferson County, including the incorporated municipalities, has a total population of 252,273 (2010 Census). The population density per square mile is 288 (statewide average is 79.6 persons per square mile). The population of unincorporated Jefferson County totals 30,701; Table 3-1 shows the population distribution of the remaining 221,250 people. According to the State Demographer, the population estimate for Jefferson County for 2017 is 256,299 (1.6% increase). As indicated by this 2017 population estimate, growth within the District is relatively stagnant.

Table 3-1. Population (2010 Census)
Within DD7 Jurisdiction

Jurisdiction	**Population**
Groves	16,144
Nederland	17,547
Port Arthur	53,818
Port Neches	13,040
Total for cities	100,549
Unincorporated County (estimated)	24,000
Total	124,549

4. The Planning Process

4.1 Advisory Committee

To guide the development of this Plan, DD7 created an Advisory Committee and identified and invited municipal entities served by DD7 in addition to Jefferson County and several engineers which represent both the municipal and private development communities to participate. Table 4-1 lists the Advisory Committee membership.

Table 4-1. Advisory Committee Members

Name	Organization
Phil Kelley	Drainage District No. 7
Ronnie Hollier	Drainage District No. 7
Brady Girouard	Drainage District No. 7
Allen Sims, PE	Engineering Consultant, DD7
Kim Carroll, PE	Engineering Consultant, DD7
Don Rao	Jefferson County
Troy Foxworth	City of Groves
Robert Woods, PE	City of Nederland
Alberto Elefano, PE	City of Port Arthur
Taylor Shelton, PE	City of Port Neches
Tommy McDonald	Water Control & Improvement District 10
Joe Wilson, PE	Developer-Engineering Consultant
Gerald Condon	Developer

4.2 Planning Process

DD7 followed a well-established planning process to develop this Plan. The Advisory Committee met four times (meeting agendas and minutes are on file with DD7). The following summarize the sessions:

- **April 9, 2019.** DD7 and its consultants met with the City of Port Neches Public Works Department and presented the planning process, this Plan, the drainage regulations, and the Drainage Criteria Manual. Taylor Shelton is the current Public Works Director for the City and was named an advisory member acting as the lead representative for the City of Port Neches. It was established that there would need to be a strong coordination between the City and DD7 during the review/permitting process of development plat submittals. Mr. Shelton and his team were asked to review the documents and make comments on any concerns that the City may have that would need to be addressed before DD7 finalized and adopted this Plan.

- **April 16, 2019**. DD7 and its consultants held a meeting with the City of Port Arthur, the City's acting consultants, and members of the public. DD7 presented a summary of the Draft plan outline, the draft regulations outline, and the subdivision review and approval process that DD7 would adhere to once the Plan was adopted. Alberto Elefano is the current Public Works Director for the City and was named an advisory member acting as the lead representative for the City of Port Arthur. Engineering and development consultants for the area attended this meeting and Joe Wilson with Arceneaux Wilson and Cole was named an advisory member as prominent consultant in the southeast Texas area. After the summarized the outlines of all the documents, Mr. Elefano, Mr. Wilson, their respected teams, and the members of the public in attendance were asked to review the documents and make comments on any concerns that the City, local Engineers, and the public may have that would need to be addressed before DD7 finalized and adopted this Plan.

- **April 23, 2019**. DD7 and its consultants held two separate meetings with the City of Nederland and Jefferson County Engineering department. In both meetings, DD7 presented a summary of the Draft plan outline, the draft regulations outline, and the subdivision review and approval process that DD7 would adhere to once the Plan was adopted. Robert Woods is the current Public Works Director for the City and was named an advisory member acting as the lead representative for the City of Nederland. Don Rao is the current Engineering Director for Jefferson county and was named an advisory member acting as the lead representative for the County. The review/permitting process of development plat submittals and which ordinances/rules would take priority were key discussions in both meetings. Mr. Woods' and Mr. Rao's teams were asked to review the documents and make comments on any concerns that the City and County that would need to be addressed before DD7 finalized and adopted this plan.

- **April 30, 2019.** DD7 and its consultants met with the City of Groves Public Works Department and presented the planning process, this Plan, the drainage regulations, and the Drainage Criteria Manual. Troy Foxworth is the current Public Works Director for the City and

was named an advisory member acting as the lead representative for the City of Groves. Key concepts regarding detention system requirements were discussed as well as the City's review/permitting process and what coordination would be necessary between the City and DD7 once this Plan, regulations, and criteria are implemented. Mr. Foxworth and his team were asked to review the documents and make comments on any concerns that the City may have that would need to be addressed before DD7 finalized and adopted this Plan.

- **May 9, 2019.** DD7 and its consultants met with the Jefferson County Water Control and Improvement District No. 10 to bring to the District's attention to DD7's plans for implementing this Plan, the drainage regulations, and the Drainage Criteria Manual. Tommy McDonald is the General Manager for the District and was named an advisory member acting as the lead representative for Water Control and Improvement District No. 10. Mr. McDonald and his team were asked to review the documents and make comments on any concerns that the District may have that would need to be addressed before DD7 finalized and adopted this Plan. This meeting wrapped up all of the municipalities that would be impacted by DD7's Master Drainage Plan, Drainage Regulations, and the Drainage Criteria Manual.

- August 6, 2019. Summarized the presentation from the individual meetings with the municipalities that are within the Drainage District's jurisdictional boundaries. Comments that were submitted from the Cities, County, Engineering Consultants, and general public during the review/comment period were reviewed and actions needed to address them were discussed. An extensive review was given to each entity's subdivision review/permit process and the rules and ordinances that govern each. This review would determine the best path forward for the District's own review/permitting process for development submittals.

- **September 11, 2019**. A final internal review was given to all of the actions called for, including progress on drafting drainage regulations and the Drainage Criteria Manual. The Plan will be presented to the Board of Directors for adoption.

5. How Development is Managed

In general, a number of factors have varying influence over where development occurs. With the area's population increasing at what appears to be less than 2 percent since 2010, the pressure for development is not driving rapid construction and subdivision of land. The most likely factors taken into consideration by developers are land price, school zoning, convenience of existing amenities (shopping and recreation), and proximity to employment opportunities.

Although no analysis was performed, DD7 staff reports that the presence of mapped floodplain areas on a parcel of land does not appear to significantly influence decisions to purchase or to develop. The exceptions to this are most likely to occur in areas that have flooded frequently or recently (even if such areas are not shown on official maps) and areas where flooding is predicted to be deep (which affects construction costs).

5.1 Jefferson County

Jefferson County, Texas, has land use and permit authority over the unincorporated land within its boundaries and exercises this authority through issuance of permits and approvals for certain types of development proposals. The County's requirements for drainage within subdivisions are set forth in the Jefferson County Subdivision and Development Regulations which were adopted by Court Order in October, 2010. The County shares jurisdiction for subdivisions that are proposed in the Extraterritorial Jurisdiction (ETJ) areas of the cities. To minimize the effects of flooding and to make federal flood insurance available to its citizens, the County administers a floodplain management ordinance within mapped special flood hazard areas. The ordinance and the County's administrative procedures are in compliance with the requirements of the National Flood Insurance Program.

The County Engineer is empowered to approve subdivision proposals that conform to the requirements. Developers are required to obtain DD7 approval of drainage plans, although this process is managed by the County. The County sends submitted reports and materials to DD7 for review at two times during the approval process. The Commissioner's Court approves the construction plans and final plat prior to construction.

The County requires that at least one-year elapse between completion of the subdivision streets and drainage and submission of the "as-built" plans prior to acceptance (or rejection) by the Commissioner's Court.

5.2 City of Port Arthur

The City of Port Arthur regulates development within its corporate boundaries through administration of various ordinances (land use, building code, subdivision). The City and Jefferson County share jurisdiction and issue joint subdivision approvals in the City's ETJ, which extends five miles into the County from the City boundary.

Notes on selected provisions of Port Arthur's Subdivision Regulations that pertain to flood hazard areas and storm drainage are found in Appendix B-4. The Subdivision Regulations do not identify specific design criteria.

- The developer is notified when the Planning & Zoning Commission has approved the preliminary plat which is followed by submission of construction plans and drainage calculations (among other materials).
- DD7 is provided material for review and returns written comments. The City conveys the comments to the developer.
- Upon approval of the construction plans, the developer proceeds with construction and the City performs periodic inspections.
- When construction is complete, the City performs a final inspection and the developer applies for approval of the final plat and as-builts and requests the City's acceptance of the infrastructure.

The City processes proposals for subdivisions in the ETJ through the same phased approval process previously described. Once approved, the City submits the applicant's submittal to the County for review and approval, after which the City issues the final approval.

5.3 Cities of Nederland, Port Neches and Groves

DD7 maintains drainage channels in the cities of Nederland, Port Neches, and Groves. Unlike Port Arthur and Jefferson County, little development occurs within these communities. However, DD7 is available to review and advise the cities should proposals for subdivisions and large single lot developments be received.

5.4 Jefferson County Drainage District No. 7

The District is organized in three departments:

- Administration – personnel, finance, and general management of the District,
- Operations – general maintenance of District equipment, facilities, and infrastructure, and construction of new infrastructure
- Permits and engineering – permitting for pipeline and other crossings or entries into DD7 rights-of-way, flood studies of problem areas, identification and engineering of mitigation alternatives, review of development proposals, and coordination with

maintenance and new construction.

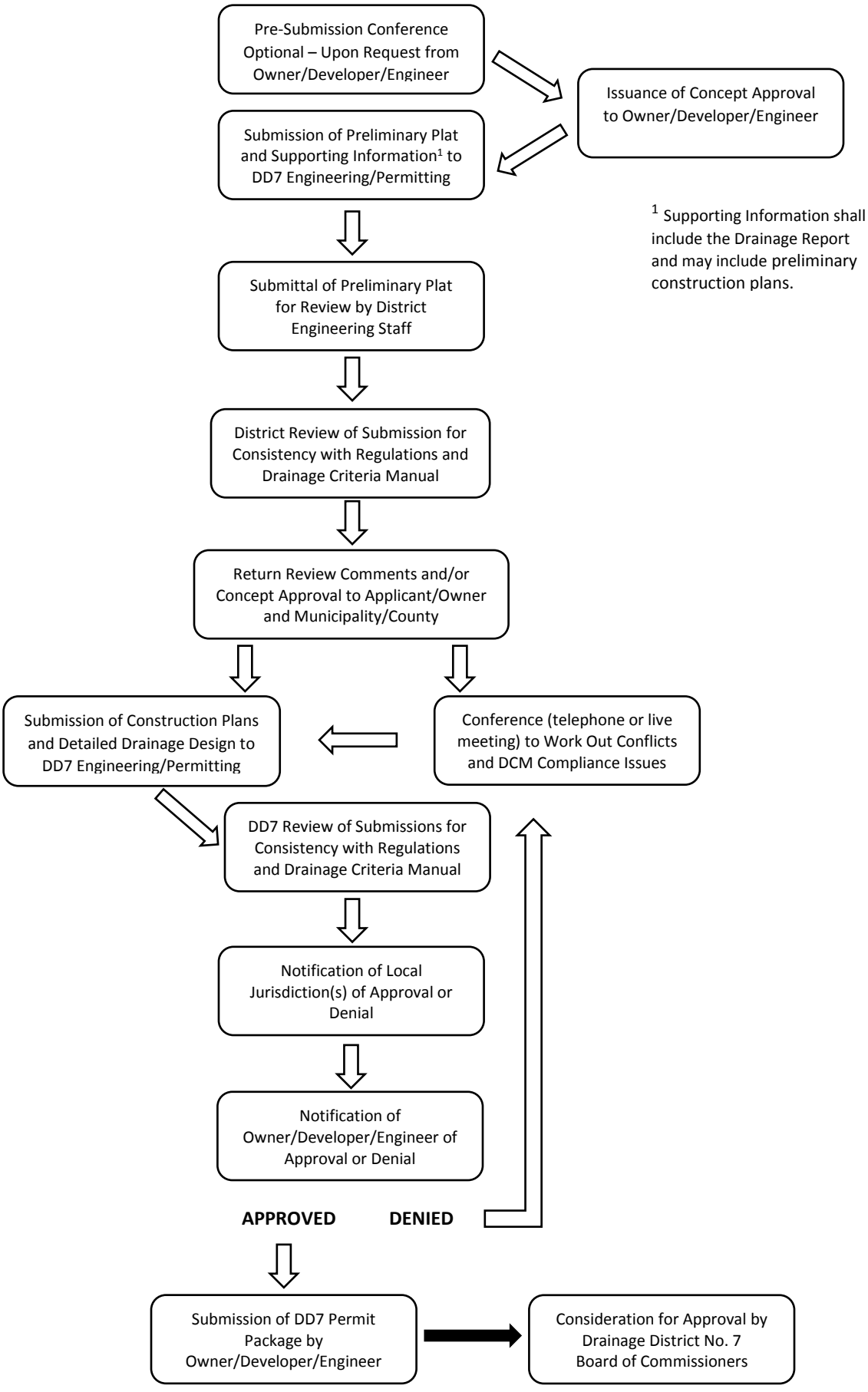
The District participates in the development review processes of Jefferson County and the cities of Groves, Nederland, Port Arthur, and Port Neches through review of subdivision drainage plans and some single-lot development proposals (typically those over one-acre in size). Figure 5-3 outlines the review steps performed by DD7 Engineering. The County and cities provide copies of subdivision proposals (preliminary plats in the City) and drainage plans to DD7 for review. In addition to development proposal reviews:

- The County requests DD7 comments on all applications for building permits in flood-prone areas.
- Groves, Nederland, Port Arthur, and Port Neches requests DD7 comments on proposals for lots that are one-acre or larger in size and on proposals for lots that are adjacent to DD7 ditches.

DD7's concerns are largely focused the impacts of receiving additional runoff into its existing drainage system, the availability of adequate easements for maintenance access, the areas affected when subdivision drainage system capacity is exceeded, and on downstream flooding impacts, especially in areas already known to flood frequently. The District's interest in management of development in flood-prone areas is directly related to the demand for drainage improvement and investments in flood control and flood mitigation projects.

The process for submittal and review of development proposals, including drainage reports, preliminary drainage plans, preliminary plat, construction plans, details, and specifications, and associated documentation is illustrated below in Figure 5-1. The process which has been in operation in recent years is essentially the same. The main distinction is the legal requirement to submit and acquire approval directly from Jefferson County Drainage District No. 7 pursuant to the Texas Water Code and this Master Drainage Plan.

Figure 5-1
DD7 Review of Development Plats and Plans



DD7 Permits and Engineering prepares written comments to document its review, especially if drainage from a proposed subdivision drains directly to a DD7 facility. In general, DD7 Engineering does not confirm the computations of the volume of discharge proposed to flow into a DD7 ditch but conducts reviews of the data submitted for general conformity with the Drainage Criteria Manual. The likely path of overland flow is checked to see where water will flow when the designed drainage capacity is exceeded. If the proposal is adjacent to a DD7 facility, the District's comments address the need for sediment and erosion control during construction and any maintenance right-of-way, including the adequacy of existing rights-of-way.

It is common for DD7 Engineering to meet with developers and engineers to discuss drainage needs and to negotiate mutually beneficial alternatives. Alternatives have included redirecting runoff, increased easement widths, and joint stormwater management or drainage improvement projects, such as increasing the hydraulic capacity of drainage structures, installing detention structures, and others.

The District also provides information about past flooding and drainage limitations and problems in the vicinity of proposed developments, with particular attention to downstream impacts on DD7 drainage facilities. Any impact which increases flows and water surface elevations will have some adverse impact on those downstream areas which drain into the DD7 facilities.

DD7 reinforces the importance of floodplain management requirements (especially elevation above the Base Flood Elevation or height above grade where BFEs are not available) and recommends floor heights above grade in areas prone to flooding that are not shown on the Flood Insurance Rate Maps.

The District's review comments and recommendation to approve or disapprove proposals are returned to the County or City and copied to the developer's engineer. An explanation is provided if disapproval is recommended.

To keep the DD7 Board informed of development activity, DD7 Engineering provides an overview of proposed subdivisions and its technical comments during the Board's work sessions. Because of their familiarity with the area, Board members often provide insight or additional comments. These presentations are informational only and do not involve approval by the Board.

DD7 is not involved in inspection of private construction sites; Jefferson County and the cities are responsible for determining whether construction conforms to the approved plans.

6. Flood and Drainage Conditions

DD7 was a partner in the 2005 Jefferson County Hazard Mitigation Plan group. In September 2019, DD7 adopted their own Hazard Mitigation Plan which includes an overview of past flood events and the nature of flood damage sustained in the area. Since 1965, twelve major Federal disaster declarations have been declared due to storms and flooding in the area.
Flooding that does not prompt a disaster declaration occurs more frequently in some areas.

As described in Chapter 2, DD7 implements its authority to manage drainage in order to protect lives and property from the adverse effects of uncontrolled drainage and flooding. This chapter briefly describes the different flood and drainage conditions that occur in the area and that can be exacerbated by increases in impervious area in some watersheds.

Rainfall amounts associated with storms that are expected to occur with given frequencies are used for design of drainage works and flood control/mitigation projects, and for evaluation of the impacts of proposed development. For the region of Texas that includes Jefferson County Drainage District No. 7, the event level (frequency) and rainfall amounts used are shown in Table 6-1. The rainfall depths are derived from NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES which is found online at nws.noaa.gov.

Table 6-1. Rainfall Frequency

24 hour rainfall/event	
Event Level	Inches of Rain
2-year	5.63"
5-year	7.56"
10-year	9.48"
25-year	12.5"
100-year	18.2"

6.1 Available Data

Flood and drainage problems are generally categorized in two ways: (1) flooding along waterways (ditches and streams), and (2) inadequate drainage (ponding in low areas and street flooding). DD7 has a number of sources of information that identify problem areas and examine potential projects, including some engineering studies and reports prepared in the past 40+ years. The value of information in these sources varies considerably, in part because of age, the level of detail, and subsequent analyses.

The District reserves the right to provide data from the following sources based on its determination of the quality and usefulness of the data for specific uses:

- 1981 Alligator Bayou Watershed Study
- 1990 Alligator Bayou Ponding Study
- 1998 Drainage Analysis of the Upper Main "B" Channel
- 1999 Drainage Analysis of the Upper Main "C" Channel
- 2002 Comprehensive Study and Drainage Plan
- 2012 408 Summary Report – Alligator Bayou Pump Station
- 2014 Port Arthur and Vicinity Hurricane Flood Protection Levee - FEMA Accreditation Report
- Various studies and analyses of smaller areas

The Flood Insurance Studies and Flood Insurance Rate Maps (FIRMs) prepared by the National Flood Insurance Program (NFIP) for Jefferson County and the cities show some areas that have been determined to be subject to flooding by the 1%-annual chance flood (commonly called the 100-year flood). The maps show some flood-prone areas that were not determined using current detailed engineering methodologies (called ‘unnumbered A Zones’) and some FIRM panels are more than 25 years old.

The District operates an automated system to collect rainfall and stream data as part of the information collected at the Control Center located at pump station no. 1. The data collection system stores historic data which are used in a number of ways to support DD7 functions. One notable use is to identify areas that flood but that are not shown on FEMA flood maps. In these areas, the District regularly recommends that buildings be elevated above grade in order to minimize the likelihood of future flood damage.

Together these sources of information may prove useful for DD7, the cities, landowners, and developers to plan projects and to evaluate alternatives to reduce problems.

6.2 Ditch and Creek Flooding

Many DD7 ditches are sized to carry floodwaters, but many ditches pre- date current design considerations. In those areas, flooding of drainage ditches and creeks is characterized by floodwaters that exceed the capacity of the waterways. When capacity is exceeded, adjacent lands are affected. Some of these flood-prone adjacent lands are shown on the FIRMs. It is known, however, and confirmed by recent experience, that the FIRMs do not show all flood-prone areas along ditches and waterways.

To provide optimum drainage function, DD7 performs routine maintenance of the drainage ditch and pump station systems. Maintenance of drainage ditches involves mowing rights-of-way, cutting vegetation on ditch side slopes, removing excessive accumulations of sediment, repairing erosion and slumps, and repair of areas eroded during high water events. Erosion control measures include application of concrete, rock, timber bulkheads, installing pipe outfalls, and vegetative measures (sod or grass seeding).

6.3 Localized Ponding and Street Flooding

Areas where water collects or flows slowly that are not directly associated with a waterway are described as subject to 'localized' ponding or flooding. These areas may simply be flat or shallow depressions with limited or poor drainage in which rainfall-runoff collects faster than it can drain away or infiltrate into the ground. Local drainage problems contribute to the frequency of flooding, increase ditch maintenance costs, and are perceived to adversely affect property values and the quality of life in some neighborhoods.

In areas where streets are constructed with curbs and flat local topography limits drainage options, rainfall-runoff collects in streets and may become too deep for vehicle access. Many areas of local ponding and street flooding are not shown on the Flood Insurance Rate Maps and thus are not regulated as flood hazard areas. Damage to buildings is evident due to the large number of NFIP flood insurance claims in areas that are not shown on the FIRMs (see Section 6.5). Although DD7 maintains some records of areas subject to localized ponding and street flooding, a comprehensive map is not available.

6.4 Storm Drainage

Drainage is an important component of subdivision and site design. As described in Appendix A, storm drainage networks generally are designed for more frequent storms (e.g., the 5-year or 10-year rainfall) and, therefore, are not expected to convey significant intense or prolonged storms. Sections 5.1 through 5.3 describe requirements administered by Jefferson County and the cities of Groves, Nederland, Port Arthur, and Port Neches.

Many older developments were built prior to adoption of the current minimum requirements. Local storm drainage flooding causes problems in some of those subdivisions, even during frequent rainstorms. This type of flooding occurs when elements of the drainage network are undersized, when they are overwhelmed by increased runoff from new impervious surfaces, or if they are compromised by lack of maintenance by property owners or homeowners' associations. Elements of the drainage network include swales, subsurface storm drains, inlets, pipes, culverts, and basins.

6.5 Flood-Prone Buildings

In many locations throughout the area buildings are subject to flooding, regardless of whether the source of water is ditch or creek flooding or localized ponding and street flooding. The County and cities require that new buildings and certain improvements to existing buildings comply with ordinances that contain the minimum flood-damage resistant provisions outlined by the National Flood Insurance Program.

As part of the Jefferson County Drainage District No. 7 Hazard Mitigation Plan (2019), an estimate was prepared of the number of flood- prone buildings located in the District (Table 6-2). Using Geographic Information System (GIS) capabilities at the County and historical knowledge, it is estimated that about 2,300 residential buildings and nearly 2,500 non-residential structures are located in the flood-prone areas of the District. Therefore, approximately 12% of all buildings in the District are prone to some degree of flooding. It should be noted that, due to limited GIS capabilities, a more precise identification of flood-prone structures within the FEMA-mapped floodplain is not feasible.

Table 6-2
Flood Prone Properties Located Within
Jefferson County DD7

	Residential	Non-Residential
Total number of buildings	37,376	3,511
Number of est. flood prone buildings (Note 1) (as % of total bldgs)	2,342 (6.3%)	2,559 (72.8%)

Note 1: Estimate of flood prone buildings is derived from actual historical building claims plus an estimate of number of buildings experiencing prior non-insured losses

The most telling evidence of flood-prone buildings is found in the records of the National Flood Insurance Program. Table 6-3 summarizes the program's recent flood insurance policy and claims data for the area. For the most part, two factors prompt people to purchase flood insurance – when mortgage lenders require it because a building is located in a mapped floodplain and when actual flood damage makes it clear that buildings are, indeed, located in flood-prone areas. Thus, the number and distribution of flood insurance policies is one way to characterize flood- prone areas throughout the District.

Table 6-3.

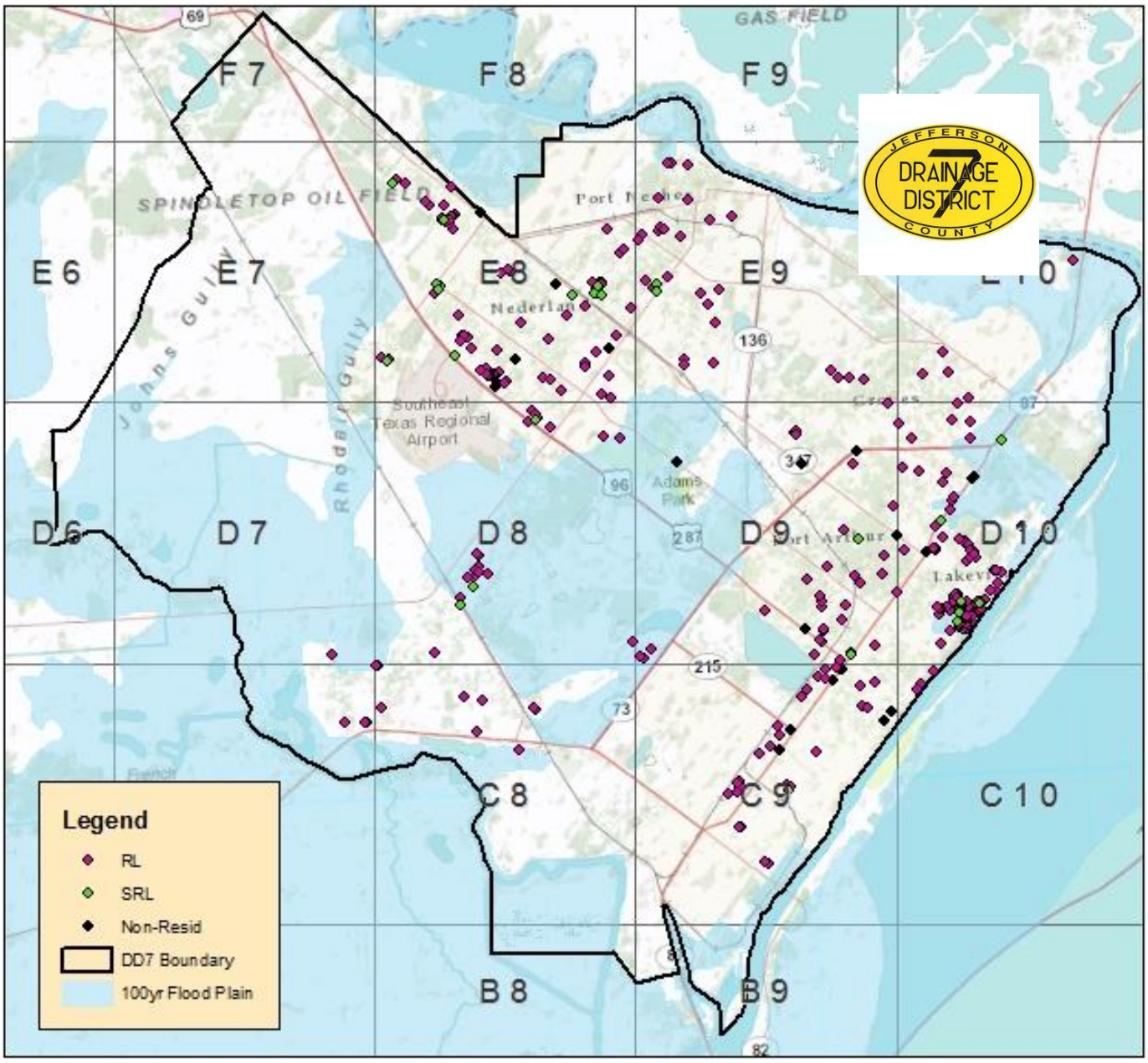
NFIP Claims Statistics for Jurisdictions in DD7 and Unincorporated Jefferson County

(Source: FEMA NFIP query December, 2009, FEMA. NFIP - Flood Insurance Statistics)

COMMUNITY NAME	POLICIES IN FORCE	CLAIMS	CLAIMS PAYMENTS
GROVES, CITY OF	2,982	657	$5,836,686
NEDERLAND, CITY OF	2,961	839	$11,507,679
PORT ARTHUR, CITY OF	6,583	3,216	$51,478,104
PORT NECHES, CITY OF	2,468	404	$3,940,359
UNINCORPORATED JEFFERSON COUNTY (DD7)	2,891	1,193	$43,031,454
TOTALS	17,885	6,309	$115,794,282

Past claims for flood damage can be used to identify areas where buildings are affected by flooding, especially in areas that are not shown on the NFIP's maps. Figure 6-1 shows the locations of properties identified as having received multiple flood insurance claims: 373 properties have received payments totaling over $20 million (includes payments for building damage and contents damage). Mitigation projects undertaken by the District in recent years are focused specifically on these repetitive loss structures. When these projects are completed, many of the repetitive loss properties will be protected from future damage associated with the 1%-annual chance flood (100-year).

Figure 6-1
Map of Repetitive Loss Properties and Severe Repetitive Loss Properties in Jefferson County DD7
(Sources: FEMA/NFIP, JSWA - GIS)



7. Factors Influencing Future Problems

A brief overview of the types of flood and drainage conditions is described in Section 6, highlighting that problems may be associated with:

- Flooding when runoff exceeds the capacity of existing ditches and creeks,
- Localized ponding and flooding of streets,
- Exceeding the capacity of existing storm drains, swales, ponds and inlets, and
- Flooding that impacts buildings.

This section briefly describes factors that contribute to those problems and that may exacerbate existing problems or that may lead to future problems. These factors are considered to be the more significant influences, but other factors may come into play in different areas of the District's jurisdiction. The factors described include:

- Pattern of development as indicated by where permits have been issued in the past few years,
- The impact of new development on runoff and flooding,
- New development in areas that are known to experience periodic flooding, and
- The District's program for drainage improvements and on-going maintenance.

7.1 New Development and Runoff

New development that changes the surface of the land alters existing drainage by changing how much water runs off the land and by changing the timing of that runoff. New development increases runoff because impervious areas are increased by the construction of buildings, roads, and parking lots.

Whether increases in runoff due to new development create drainage problems and downstream flooding problems is a function of where in the watershed the development takes place, the capacity of existing ditches conditions, the planned drainage work, the potential future drainage work, and whether downstream flooding will be made worse. Combinations of these factors will vary from location to location.

To determine how new developments can alter runoff patterns and rates, drainage reports can be prepared for proposed new subdivisions and large single lot developments. As described in Section 5, the cities of Groves, Nederland, Port Arthur, and Port Neches, and Jefferson County largely focus on the adequacy of drainage that is interior to a proposed subdivision. Although it is not explicit in their regulations, their interests are to assure that the drainage system provided by a developer will handle frequent rainfall-runoff events, generally the 5-year storm (see Table 6-1).

For DD7, the focus of a review of proposed drainage system designs is two-fold:

(1) adequacy of the flow path when the provided drainageways are exceeded so that improved properties are not adversely impacted; and

(2) the impact of the additional drainage to the District's overall system and how it impacts downstream flooding. Drainage reports should include:

- Computations of runoff for the site before development,
- Computations of how runoff will change if the site is developed,
- Flow path when the capacity of the proposed drainage system is exceeded,
- Determinations of the adequacy of downstream drainage channels and the impact of the additional runoff,
- Determination of whether, and to what degree, downstream flooding is affected, and
- Preliminary assessment of alternatives to address the increased runoff.

7.2 New Development in Flood Hazard Areas

In the DD7 jurisdictional area, flooding that impacts homes and businesses occurs with considerable frequency. Table 7-1 shows the extent of parcels in the flood plain as shown on the Flood Insurance Rate Maps prepared by FEMA. The table relates land use categories to number of parcels in flood plain areas.

Table 7-1
Number of Parcels in DD7 by Land Use Category and the Number of Parcels in the Floodplain, ordered by Number of Parcels in the Floodplain
(Source: JCAD, JSWA - GIS)

Land Use Category	Description	Count	Percent of Parcels	# in Floodplain	Percent in Floodplain
Residential	Single Family Residence	36,353	70.27%	2,293	6.31%
Other	Other Vacant and improved parcels (county property, vacant lots, municipality owned, etc.)	10,702	20.69%	2,169	20.27%
Commercial	Commercial Property	2,337	4.52%	198	8.47%
Commercial	Commercial Or Industrial Vacant Lots	958	1.85%	71	7.41%
Commercial	Religious And Charitable Organizations	402	0.78%	28	6.97%
Residential	Duplex	380	0.73%	8	2.11%
Mobile Home	Mobile Homes	246	0.48%	41	16.67%
Commercial	Industrial Property	213	0.41%	78	36.62%
Commercial	Apartments	144	0.28%	15	10.42%
Totals		51,735	100.00%	4,901	9.47%

Development in flood hazard areas that are shown on the FIRMs is regulated by ordinances adopted by the County and the cities. The most notable requirement is that the lowest floor must be elevated above the Base Flood Elevation (which is the elevation of the 1%-annual chance flood, commonly called the "100-year" flood). It is important to emphasize that floodplain management requirements are imposed in areas shown on the FIRMs as special flood hazard areas. Regardless of actual flood experience, areas not mapped as special flood hazard areas are not subject to the minimum flood-damage reduction requirements established by the NFIP, unless a community adopts a specific requirement to that effect.

The requirement that new buildings be elevated above the Base Flood Elevation does not address the impacts of the development on the flow of water during flooding conditions. Earthen fill that is used to elevate buildings reduces available floodwater storage and can alter local drainage patterns. Developments that increase runoff due to added impervious area can contribute to downstream flooding either by making existing flooding worse (deeper and/or more frequent) or by creating flood problems where none existed.

When homes and businesses are damaged by floods, and when traffic circulation is impaired due to street flooding, there is increased demand for DD7 to improve drainage, to manage runoff, to construct flood control projects, and to undertake other flood mitigation projects.

7.3 DD7 Improvements and Maintenance

Jefferson County Drainage District No. 7 has a long history of improving the drainage system and, importantly, a history of maintaining the improved system.

Drainage Improvements. Relieving and reducing known flooding of residential areas is given the highest priority in the District's capital improvement project planning. Priorities are identified by examining several sources of information, including reports from citizens, questionnaires distributed by the District, location of NFIP flood insurance claims, and the personal experiences of the DD7 staff and board. When a priority area is identified, the cause of flooding is analyzed, considering how the drainage in the area relates to a DD7 outfall, lack of an outfall, or the inadequacies of an existing outfall. Some cooperative projects are undertaken within the DD7 area to make improvements where the problems include street flooding, inadequate inlets from the streets, and inadequate outfall pipes.

When new development is proposed, the impact of the increased runoff on downstream flows is considered. If the increased runoff occurs in areas with known flooding and drainage problems, improvements at culverts and bridges, or channel improvements, may provide enough capacity to handle the increases.

Examining the cost effectiveness of an improvement is part of the District's process to identify where improvements will be made. Existing watershed and floodplain studies are examined to determine if sufficient information is available to both identify the problem and evaluate alternatives. In general, channel improvements are more economical than detention and, unless there are specific environmental concerns, the channel improvements are undertaken. Some known problem areas require study to ascertain feasible solutions in order to determine costs and benefits. As of the end of 2005, the District's project list includes work that may take 10 years to complete, and the list continues to grow.

Detention Improvements. Detention is a relatively less expensive approach than channel

and ditch improvements when addressing downstream flooding problems. However, it involves relatively large tracts of land for implementation. The District initially examines other approaches before considering detention, especially in areas where some reaches of the downstream ditch system have sufficient capacity to handle added runoff from anticipated development which suggests that additional ditch improvement may be feasible. If the downstream capacity is inadequate, detention is considered when an appropriate site that is available at reasonable cost also meets the hydrologic requirements for the detention capacity.

The concept of detention is to hold water in a constructed ponding area while, below the pond (or basin), the existing drainage infrastructure moves the water which flows directly to it. The detention basin handles the runoff from the drainage area above it which would otherwise increase the flows through the downstream drainage system. The District carefully balances detention outflows with the downstream channel capacities.

Within DD7, the majority of storm runoff is channeled through its system of pump stations. Stormwater detention provides an effective strategy for reducing the amount of peak flow which must be pumped out of the system.

Maintenance of the Drainage System. The District recognizes that periodic maintenance of its 281miles of drainage channels and 21 pump stations is required in order to maintain its performance. Additionally, 36 miles of earthen levee and floodwall is constantly monitored and maintained to insure the integrity and operational capability of the system. The superintendent and general field supervisor are responsible for scheduling the approximately 75 employees that perform maintenance work on a daily basis. The District also constructs many capital improvement projects. Some maintenance work and some capital work is contracted with the private sector. Most ditches are mowed twice each year, although some problem areas are addressed on an as-needed basis.

The District's area of jurisdiction is toured and examined routinely by the division managers and the general field supervisors; other District personnel report concerns noted as they travel the area. Property owners in the area also are a source of information about problem areas; their phone calls and visits are logged and are given significant weight when determining maintenance priorities. When a citizen reports a concern, a DD7 representative is dispatched to assess the area and to evaluate the priority for work. Problems that are deemed more important, such as a major blockage of a culvert or major build-up of debris under a bridge, are addressed as soon as possible, usually within a couple of days. Minor problems are addressed sequentially.

Before and during heavy rain events, DD7 crews are assigned to pump stations and specific bridges or culverts to perform debris removal operations. The crews remove debris as it is accumulated by trash rakes or catches at crossings in order to keep pump stations and channels open and free-flowing and to minimize blockage which can exacerbate flooding.

8. Meeting the Goals: Actions

With the guidance of the Advisory Committee DD7 has determined that the actions identified in Table 8-1 and described in the following subsections will meet the goal described in Section 2 and set forth in the *Hazard Mitigation Plan (2019)*. Specifically, these actions will "facilitate the development review and approval process to accommodate growth in a practical way that recognizes existing stormwater and floodplain problems while avoiding creating new problems or worsening existing problems."

Table 8-1. Summary of Actions

A. Develop and Implement Drainage Regulations
B. Identify Watershed Study Needs
C. Coordinate Flood Map Revisions
D. Document Flood Conditions
E. Continue development of GIS Capabilities
F. Develop Drainage Design Criteria Manual

8.1 Coordinate Regulations & Development Reviews

As authorized in Section 49.211 of the Texas Water Code, a master drainage plan may include rules relating to the planning and design criteria for drainage channels, facilities, and flood control improvements. These regulations will form the basis of DD7's review and approval of the drainage reports for proposed development that occurs within its jurisdiction in Jefferson County, and the cities of Port Arthur, Port Neches, Nederland, and Groves.

ACTION A: Develop and Implement Drainage Regulations. DD7 will develop regulations to implement the authority to review and approve drainage reports for proposed developments. The regulations will be subject to public review prior to adoption and are expected to address:

- The types of developments and construction activities that are subject to the requirements set forth in regulations, as well as those activities that are exempt.
- The District's review process and coordination with the County and cities.
- A requirement for pre-design meetings and encouragement for

negotiations with the District to address site-specific, ditch-specific and watershed-specific needs.

- The contents of drainage reports and drainage plans.
- Availability of engineering studies and data; conditions under which new studies or contributions to studies may be required.
- The performance requirements for adequacy of post-development drainage and alternatives that may be considered to address runoff and flooding.
- Standards for drainage and flood hazard reduction to address runoff and flooding, including but not limited to: cooperative projects with DD7; land or other contributions for new DD7 ditches or regional detention facilities; new or increased easements along drainage ditches to be maintained by DD7; design for replacement, upgraded, or new drainage pipes and culverts that carry drainage to DD7 ditches; design for upgraded or new erosion protection at outfalls; and on-site detention of increases in runoff.
- Procedures to enforce rules adopted by the District.

DD7 will develop application forms and a formal approval instrument. To implement the regulations in a manner that meets the stated goal, DD7 will work with Jefferson County and the cities to coordinate development processes and timelines, and to improve regulatory consistency. DD7 may suggest modifications to the regulations and procedures of the County and the cities.

To facilitate compliance and understanding by the development community, DD7 will prepare a review checklist.

8.2 Watershed Studies & Revised Flood Hazard Maps

DD7 has a number of engineering studies and reports that were prepared for the entire district as well as portions of some watersheds that are within its jurisdiction (see Section 6.1). The District has determined that some of the information in these available sources may be useful and makes it available to others. However, some information is not of sufficient quality to meet today's standards. In addition, older reports do not reflect subsequent projects and improvements, nor do they cover all areas where development is occurring.

The Flood Insurance Rate Maps prepared by the National Flood Insurance Program delineate special flood hazard areas within which floodplain management regulations apply. As described in Section 6, these maps do not delineate all areas that experience drainage problems and flooding. In recognition of the fact that many FIRMs are out-of-date, the Federal Emergency Management Agency (FEMA), which administers the NFIP, has

embarked on a multi-year effort to modernize and revise the maps. As of June 2005, Jefferson County is projected to have the map revision process initiated in Federal Fiscal Year 2006 with completion some time in FFY2008. The initial planning meeting took place in early 2006. Preliminary FIRMs were released in 2012. As of 2019, the map revision process has not been completed.

During the map revision cycle FEMA actively encourages partnerships with local entities such as DD7. Local contributions may take a number of forms, such as providing digital base mapping, watershed studies that show current areas subject to flooding by the 1%-annual chance flood, records that demonstrate areas prone to flooding that are not shown on the FIRMs, and funding.

DD7 has collected many records of high water from past flooding events, including flooding in areas not shown on the **FIRMs**. Some data are recorded in survey field books and some have been noted on maps. The rainfall and stream data collection system for the ALERT flood warning system stores historic data. These are used in a number of ways to support DD7 functions. One notable use is, in areas not shown on FEMA flood maps, to recommend that buildings be elevated above grade in order to minimize the likelihood of future flood damage.

ACTION B: Identify Watershed Study Needs. DD7 will develop a prioritized list of watersheds and sub-watersheds for which new engineering studies are needed in the next 5 to 10 years to help guide the District's consideration of capital projects and the review of development proposals.

ACTION C: Coordinate Flood Map Revisions. DD7 will coordinate the participation and contributions of the County and cities in FEMA's Map Modernization effort to revise and update the Flood Insurance Rate Maps for that portion of Jefferson County that is within its jurisdiction.

ACTION D: Document Flood Conditions. DD7 will continue to survey and collect high water data, especially in areas that are not shown as mapped floodplain on the FIRMs. Data collection tools should be standardized, and data should be collected, displayed on a map, and stored so that information can be retrieved readily to support recommendations for development in areas susceptible to flooding and drainage problems.

8.3 Geographic Information System Capabilities

Geographic Information Systems (GIS) is a computer system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data related to positions on the Earth's surface. Typically, a GIS is used for handling maps and other data that can be displayed spatially. These might be represented as several different layers where each layer

holds data about a particular kind of feature. Each feature is linked to a position on the graphical image on a map and a record in an attribute table. GIS can relate otherwise disparate data based on common geography, revealing hidden patterns, relationships, and trends that are not readily apparent in spreadsheets or statistical packages, often creating new information from existing data resources. With GIS, spatial elements of data can be displayed, such as flood-prone areas, drainage ditch locations, drainage structure locations, easements, etc.

At present, DD7 owns and operates an ESRI GIS and utilizes it for an increasing array of data management and mapping tasks. The software is updated at regular intervals, and staff receives training on an as-needed basis. The following is a list of data warehoused and managed in the GIS database.

- DD7 boundary and watershed mapping data
- Channel locations and inventory
- Channel right-of-way data
- Pump station location and inventory
- Hurricane Flood Protection Levee system location and inventory
- HFPL structure location and inventory
- HFPL USACE periodic inspection data
- HFPL maintenance records
- Lidar Contour Lines
- Local Municipal Drainage Assets
- On-line ArcGIS Application for public displaying City, County and Drainage District Drainage Assets

DD7 proposes to enhance it's current GIS capabilities by:

- Providing additional training opportunities for staff
- Identify additional data management needs of the District and develop an implementation strategy for data acquisition and management
- Incorporating additional maintenance data and real time information

Section 8.2 (Action C) calls for DD7 to take a leadership role to coordinate with FEMA for revision of the Flood Insurance Rate Maps for the area. Because FEMA's initiative is entirely GIS-based, the District will be better prepared to fulfill this action with in-house GIS capabilities.

ACTION E: Continue Development of GIS Capabilities. DD7 will continue development and enhancement of current GIS capabilities. This action will include the continued upgrade of GIS software, including more on-line map content, additional training for staff, the development of additional layers of data, and utilization of the system on a regular basis.

Additional data expected to be developed or converted: channel maintenance data; drainage structure inventory (type, size, capacity, etc.); statistics on homes in flood-damage areas (addresses, building characteristics, property values; historical flood losses (flood insurance claims and uninsured losses); prior flood depths and H & H model information.

8.4 Prepare a Drainage Design Criteria Manual

With the adoption of regulations for drainage reports and DD7's review of development proposals, it will be helpful for the development community to have a manual that outlines the appropriate design criteria. The manual will address drainage and flooding conditions experienced in the area, including ditch and creek flooding, localized ponding and street flooding, storm drainage, and development in flood-prone areas.

ACTION F: Develop Drainage Design Criteria Manual. DD7 will develop a Drainage Design Criteria Manual. The manual will be based on manuals from other jurisdictions but tailored to the conditions of the area and DD7. The manual is expected to include design methods and criteria that are specific to DD7 and that have been successfully applied in the region. The manual will be subject to public review and comment.

8.5 Capital Projects: Drainage & Flood Mitigation

DD7 implements its authority to manage drainage in order to protect lives and property from the adverse effects of uncontrolled drainage and flooding. The District was created primarily to provide drainage of overflow lands, including the construction and maintenance of drains, ditches and levees, and other improvements of the District.

ACTION G: Drainage & Flood Mitigation Projects. DD7 will continue to identify effective drainage improvement projects and flood mitigation measures and will continue to pursue state and federal grant funding for those projects that are eligible and cost-effective.

Appendix A
Key Concepts in Stormwater and Floodplain Management

When property owners are affected by water, it usually is not important to them whether the water is considered "stormwater" or "floodwater." Although the problems are both related to water, the approaches taken to deal with the problems are different. To understand those differences, a few key concepts are important.

What is a Watershed?

A watershed is the area of land that drains runoff to a point on a waterway, sometimes it is called the drainage basin. Figure A-1 shows a simple watershed. The size and shape of a watershed depends on the shape of the land. Every river, creek, stream and ditch has a watershed. Many small watersheds, or subwatersheds, combine to make large watersheds. The Mississippi River watershed covers almost 1.25 million square miles.

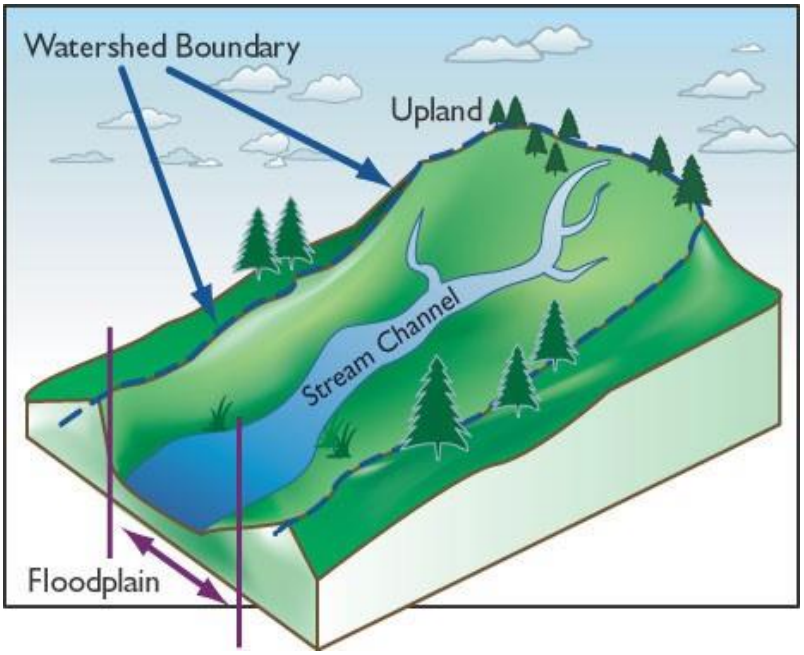


Figure A-1. Simple watershed

What is Hydrology?

Hydrology is the study of water and how it moves through the hydrologic cycle (Figure A-2). Hydrology involves understanding what influences the distribution and circulation of water, including surface water (runoff) and groundwater.

When it rains, many things affect how much water runs off the land and how quickly it collects in streams and drainage channels.

How people use the land is a significant factor in runoff. Figure A-3 shows how "discharge" or the volume of water running off the land, changes with time for different amounts of development.

Heavily developed areas, with large areas covered by buildings, parking lots, and roads, have the most runoff which usually collects very quickly because of drainage ditches. Forested areas absorb a lot of rainfall and so less water collects in the rivers and streams. Detailed engineering studies are done to understand the runoff from each watershed and to estimate how much water will collect during different types of rain storms.

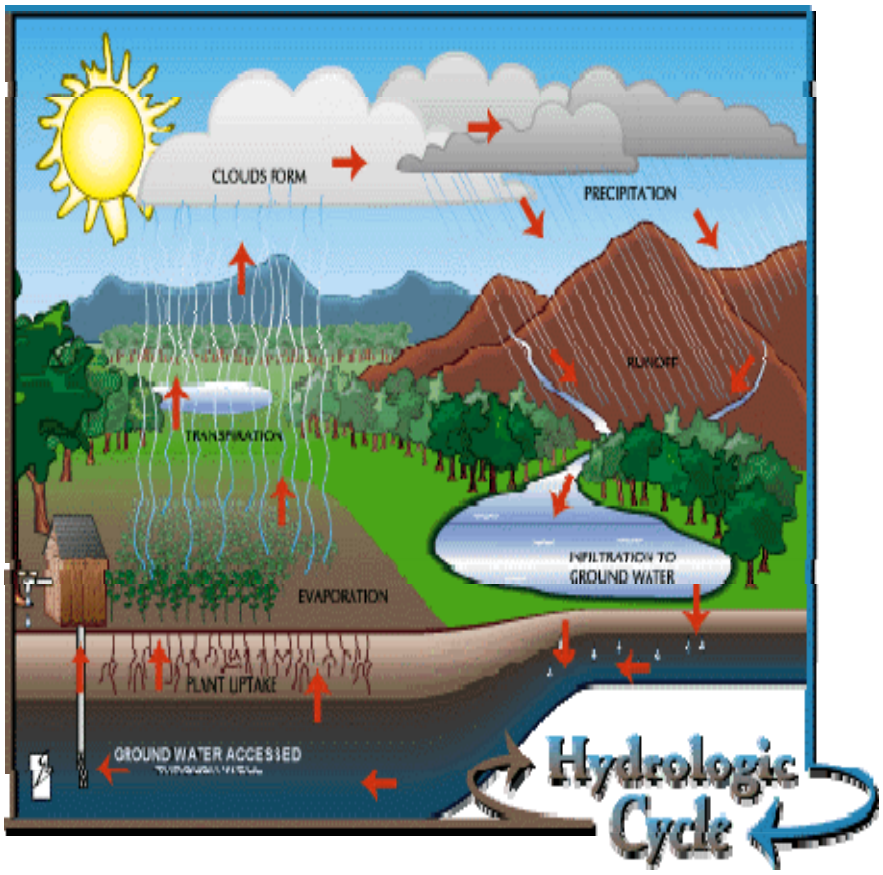


Figure A-2. Hydrologic cycle

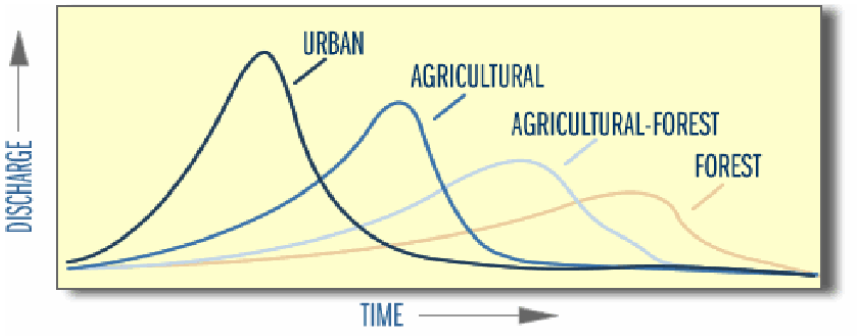


Figure A-3. How land use changes discharge (runoff)

What is Hydraulics?

Hydraulics is the study of how the water that runs off the land flows through the river, stream or ditch. Engineering studies are done to understand how fast the water will flow and how high it will rise. Many factors come into play, including the flatness of the landscape, the shape of the stream valleys, whether there are bridges and culverts that block flow, the size and shape of drainage channels, and others. A common product of these studies is a floodplain map, shown below.

What is Stormwater Management?

Rainfall runs off of all land. But when land is developed with buildings and pavement, more water runs of the than before it was developed. Stormwater management refers to measures that control – or manage – the increases in runoff. Usually developers are required to estimate how much more water will runoff during different storms or different amounts of rainfall. The amount of rainfall for different storms is determined by long-term studies by the U.S. Geological Survey and the Natural Resources Conservation Service.

For southeast Texas, NOAA Atlas 14 indicates that:

- The 2-year, 24-hours storm (that has a 50% chance of occurring in any year) will drop 5.6 inches of rain
- The 10-year storm, 24-hour storm, will drop 9.5 inches of rain
- The 100-year storm, 24-hour storm, will drop 18.3 inches of rain

When stormwater management is required for a proposed development project, engineers first estimate how much water will run off of the project site assuming no development occurs. Then the changes to the land are taken into consideration and new estimates are made. The difference between the two estimates is the amount of increased runoff that the developer must manage.

Increases in stormwater runoff can increase downstream flooding and cause more erosion of streams and drainageways. Therefore, developers are required to account for the increases that their projects create. Management options include building small ponds as part of the development to capture the increased runoff. Sometimes drainage channels can be improved or enlarged to handle the additional water. And sometimes a “regional” approach is found to be best. In a regional approach, a larger pond or detention facility is built and developers contribute funding or land.

In Jefferson DD7, the Halbouty Detention Basin is a regional detention pond. It is designed to capture and manage increased runoff due to upstream development and to mitigate the impacts of flood flows on downstream areas and the Alligator Bayou Pump Station. It is not designed to prevent all downstream flooding.

What is Floodplain Management?

Floodplain management is an overall program of corrective and preventive measures taken to reduce flood damage. Such measures generally are of two types:

- Preventive measures include managing areas that are prone to flooding to guide development away from problem areas or to require construction in ways that reduce damage; and
- Corrective measures such as flood control projects to help reduce flooding of areas that are already developed.

The basis for floodplain management is a map that shows areas that are predicted to flood during what is commonly called the "100-year flood." A more precise term is the "1% annual chance flood." It is the flood that has only 1 chance in 100 of occurring in any given year. While that may seem like a low probability, it has been shown that a home in the 100-year floodplain is 5 times more likely to be damaged by a flood than to sustain damage from a major fire.

Jefferson County and the cities of Port Arthur, Port Neches, Groves, and Nederland all have adopted floodplain management regulations and participate in the National Flood Insurance Program. By administering these regulations they help protect people and property, while also making federal flood insurance available to all citizens. These entities maintain flood maps that were prepared by the National Flood Insurance Program through FEMA. Many of those map panels do not show all areas that are known to be prone to flooding. In addition, because many of the map panels are more than 20 years old they do not take into account increases in runoff due to more recent land development.

FEMA's published schedule for revising and modernizing the maps anticipates that new maps for Jefferson County and its incorporated municipalities has been pushed back numerous times. As of September 2019, Effective Maps have not been published.

Figure A-4 shows a cross-section across a natural floodplain, where the water is deepest in the channel and gets shallower toward the edge as the land rises up from the stream. (Drainage channels that are built and maintained generally are intended to confine within the channel the waters of most flow conditions, often up to and including the 1% annual chance flood.) Figure A-5 is a sample of what a flood map looks like. It shows many streets, roads and streams, and the area shaded gray is the mapped flood hazard area. Development in the shaded gray areas must comply with the floodplain management regulations.

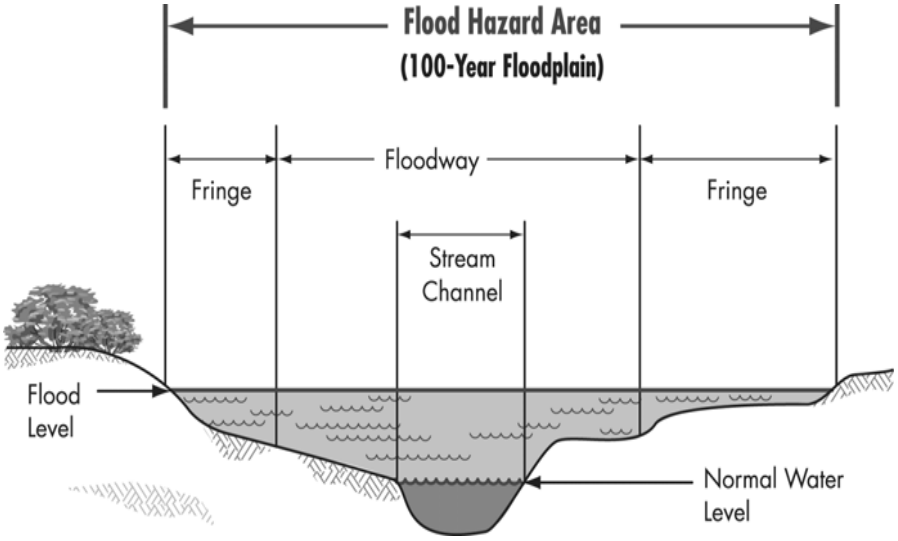


Figure A-4. Floodplain Cross-Section

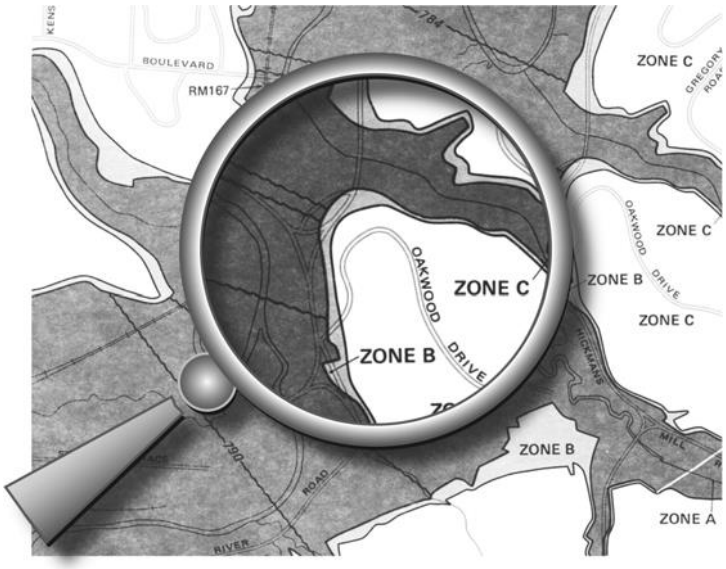


Figure A-5. Close up of Flood Insurance Rate Map

Appendix B
Notes on Drainage Requirements – Subdivision Rules & Ordinances

B-1. Jefferson County

RULES, REGULATIONS AND REQUIREMENTS RELATING TO THE APPROVAL AND ACCEPTANCE OF IMPROVEMENTS IN SUBDIVISIONS OR RE-SUBDIVISIONS. Revised March 28, 1994

Article 1(b): Approval and acceptance of streets, roads, storm sewers, drainage ditches and drainage easements, fresh water supply and sanitary sewage disposal and setback lines of a subdivision or re-subdivision is contingent upon compliance.

Article 1(b): Compliance is required in the extraterritorial jurisdiction of any incorporated city, town or village; in the case of conflict, the regulations of the city, town or village shall prevail. The width of the ETJ varies as a function of the population of the municipality.

Article 1(k): Developer required to submit elevations of each lot.

Article 1(n): Developer required to obtain approval of drainage plan from applicable Drainage District and shall submit approval with plat, said plan must comply with the Jefferson County Floodplain Order.

Article 1(q): Requires compliance with State requirements for on-site sewage facilities; planning materials that must be submitted include the "100-year floodplain map." As part of this requirement, states that "A comprehensive drainage and 100-year floodplain impact plan must also be included in this planning material.

Article 3.0, Section A(9) notes that drainage improvements are to meet minimum standards to be accepted by the County for maintenance, including "ditches must have a discharge factor of 1.3 cfs per acre and may not have substantial ponding."

Article 3.0, Section D, outlines requirements for subdivision layout, including drainage easements which "shall be dedicated as required by Jefferson County Drainage Districts, or the County Engineer if the subdivision is outside a Drainage

District, for major drainage channels and ditches, and of sufficient width to provide for maintenance and ample room for spoil banks and berm, if spoil is left in place after excavation. In addition, 40 feet, 20 feet on each side of centerline of drainage way, shall be dedicated for all minor drainage ways."

Article 3.0, Section G, outlines requirements for storm drainage, including:

- For areas inside the subdivision a discharge factor of 1.3 cfs per acre shall be used.
- For discharge originating outside the subdivision, a discharge factor of 1.3 cfs per acre, or such factor of runoff as may be determined by study of the drainage area shall be used, discharge factor must be approved by Drainage District.
- Storm sewers shall be designed to carry the discharges from factors listed above, but must have a design velocity of not less than 3.0 feet per second.
- Outfalls from sewers and ditches into drainage ways or natural navigable waterways shall enter at the grade of the drainage channel. If necessary, rip-rap and/or drop type outfall structures shall be used to prevent erosion.

B-2. City of Port Neches

SUBDIVISON ORDINANCE **(Ordinance No. 2018-15; Chapter 102, September, 2018, as amended).**

Sec. 102-1. Applicability of Chapter: Applies to "every person owning any tract of land within the city limits who may hereafter divide the tract of land into two or more parts for the purpose of laying out any subdivision of any tract of land or any addition to the city, or for laying out suburban lots or building lots, or any lots, streets, alleys, parks or other portions intended for the public use, or the use of purchasers or owners of lots fronting thereon or adjacent thereto."

Sec. 102-4. Policy; Approval of Subdivisions Required: Outlines that any owner of land must obtain approval of the city council to "lay out, subdivide, plat or replat any land into lots, blocks and streets within the city." This section directs the subdivider to V.T.C.A., Property Code 12.022, which states, in part:

(a) "The county clerk or a deputy of the clerk with whom a plat or replat of a subdivision of real property is filed for recording shall determine whether the plat or replat is required by law to be approved by a county or municipal authority or both. The clerk or deputy may not record a plat or replat requiring approval

unless it is approved as provided by law by the appropriate authority and unless the plat or replat has attached to it the documents required by V.T.C.A., Local Government Code § 212.0105 or 232.0035, if applicable. If a plat or replat does not indicate whether l and covered by the plat or replat is in the extraterritorial jurisdiction of the municipality, the county clerk may require the person filing the plat or replat for recording to file with the clerk an affidavit stating that information."

(b) "A person may not file for record or have recorded in the county clerk's office a plat or replat of a subdivision of real property unless it is approved as provided by law by the appropriate authority and unless the plat or replat has attached to it the documents required by V.T.C.A., Local Government Code § 212.0105 or 232.0035, if applicable."

Sec. 102-5. General Requirements: Section goes through general requirements for subdivisions such as streets, minimum width of alley, and size of residential lots. This section proclaims that the sizing of residential lots, "in no case, shall contain less than 6,600 square feet, exclusive of drainage easements,"

Sec. 102-7. Minimum Improvements for Class A subdivisions: Regulations and requirements for approval are listed in this section. In this last part of this section, the City's drainage easement requirements are described. Water, sewer, and drainage utilities shall be designed to be placed in the street right-of-way. Gas utility mains shall be placed as far as practicable from the city's drainage utilities, with a minimum two-foot separation between the gas mains and city utilities. "Easements shall be provided which are at least 15 wide in the rear of lots."

Sec. 102-9. Procedure for Plat Approval: All subdividers and developers shall be directed to this section for information on the process for plat approval by the City. Highlighted for convenience below are the engineering and design criteria for drainage needed for approval. There are many more requirements needed for submission, and subdividers should extensively review this section for compliance.

Submission of Preliminary Plat:

(a): Twenty-one copies of a preliminary plat shall be submitted to the director of public works for review by the city staff and a registered professional engineer appointed by the city 21 days prior to the monthly deadline to be presented to the planning and zoning commission, with a copy of the preliminary plat, along with the recommendations of the city staff and engineer, going to each member of the planning and zoning commission.

(a)(2): The names of the owner and the engineer or surveyor responsible for the survey and design shall be indicated.

(a)(5): The physical features of the property shall be shown, including the location of water sources, culverts, bridges, proposed drainage ditches, including the total drainage area, showing inlets, and drainage calculations demonstrating that off-site downstream drainage facilities can accept increased runoff to DD7 facilities, present structures, easements, maintenance access easements with all necessary structural restrictions, streets and alleys, highways, etc., including widths and names. Streets, alleys, lot lines, etc., in adjacent subdivisions shall be shown dotted. All necessary data to reproduce the plat on the ground must be shown on the plat.

(a)(9): Profiles of streets and ditches may be called for.

Action on preliminary plat by council:

(b)(3): Approval of the preliminary plat does not constitute acceptance of the subdivision, but is merely authority to proceed with the preparation of the final or record plat. No work shall be done on the subdivision before the final plat is accepted. Approval of a preliminary plat expires at the end of 90 days unless a final or record plat has been submitted to the city council. If changes by the city council, city manager and director of public works require submission of another preliminary plat, the city shall notify the subdivider, outlining changes desired or required for requested approval.

Submission of Final or Record Plat:

(c): Twenty-one blue line, white print copies of the final or record plat, with a reproducible tracing of the final plat, shall be submitted to the city council after the preliminary plat has been approved by the city manager, the director of public works and a registered professional engineer selected by the city and all changes and alterations made. No final plat will be considered unless a preliminary plat has been submitted first.

(c)(7): Two sets of plans and specifications for water, sewers, paving, and drainage prepared by a registered engineer shall be submitted, which must be approved by the city council, and when appropriate by state or other agencies, prior to the beginning of any construction of the subdivision.

(c)(8): A letter from the appropriate drainage commission addressed to the city council stating that plans for drainage of the subdivision are approved by the drainage commission shall be submitted.

Sec. 102-10. Submission of As-Built Plans: The engineer representing the subdivider must present to the city council reproducible mylar complete as-built plans for all paving, drainage structures, water lines and sewer lines within 30 days after completion of each contract. No subdivision will be accepted by the city council until all as-built plans for the subdivision improvements have been filed with the city.

B-3. City of Nederland

SUBDIVISON ORDINANCE **(Ordinance No. 2017-05; Chapter 94, March, 2017, as amended).**

Sec. 94-26. Statutory Authority; Classes; Costs: This section states the authority that is granted to the City by the constitution and laws of the state, including particularly V.T.C.A Local Government Code ch. 212. The City subdivides each subdivision into two classes, class 1 and class 2. The following are brief descriptions of both classes, the applicable requirements, and costs (subdivider should reference this section for further information):

(b) The following specifications provide for two classes of subdivisions denoted as class 1 and class 2; specifications for the two classes differ principally in requirements for street surfacing: Class 1 subdivisions shall have concrete streets with curb and gutter sections and storm sewers; street surfacing in class 2 subdivisions may be either concrete or inverted penetration, and drainage shall be by open ditch, except by storm sewers with catch basins and inlets if larger than 24-inch-diameter culverts are required.

(d) No class 2 subdivision will be permitted adjacent to an existing class 1 subdivision, except where separated along the common boundary by a natural or manmade dividing border, such as a canal, railroad, or state highway.

(e) The subdivider shall pay all costs for providing the subdivision with streets, water, sanitary sewer, and drainage in accordance with the plans and specifications approved by the planning and zoning commission and the city council.

Sec. 94-27. Preliminary Plat: All subdividers and developers shall be directed to this section for information on the process for plat approval by the City. After the following preliminary plat initialization, there are many more requirements needed for submission, and subdividers should extensively review this section for complete compliance.

(a) A preliminary plat (six copies) for any proposed subdivision shall be submitted to the planning and zoning commission for approval before the preparation of the final plat for record. Such plat shall be submitted to the planning and zoning commission, through the office of the city engineer, at least seven days prior to the meeting at which approval is to be

asked.

(b)(8) Location, width, and purpose of all easements.

Sec. 94-28. Final Plat: Preliminary plats should be completed and approved first before a final or record plat is prepared for the City. Subdividers should refer to this section for the information that is required for complete compliance. The following are the requirements regarding drainage that is required upon submission:

(4) The location of building lines on front and side streets, and the location and purpose of all easements.

(10) A plat showing location of fire hydrants and the storm drainage system.

(11) Letters of approval from the utilities companies covering proposed utility installations and easements, and approval of Drainage District No. 7.

Sec. 94-29. Planned Development:

Any person wishing to develop a zero-lot line project shall comply with the requirements as set forth in this article and this section in preparing the plat, plans and specifications for the project. All other requirements pertaining to concrete paving, drainage systems, water lines, sanitary sewer lines and street lighting shall conform to the requirements as set forth in this article.

(g)(1) Utility easements and drainage easements shall be as required in section 94-47 (e) and (f).

Sec. 94-32. Conflict with Other Ordinances: States that whenever the standards and specifications in the City's article conflicts with other ordinances that apply to the subdivider, the most stringent or restrictive provision shall govern.

Sec. 94-47. Lots and Blocks:

(e) A minimum easement of ten feet for utilities is required, except easements shall be 15 feet, minimum, if both water and sewer are to be located therein.

(f) When Drainage easements are necessary, they shall be designated for drainage and utility easements.

Sec. 94-48. Improvements: As a condition to final approval of the plat and of the subdivision, the planning and zoning commission may require completion of street surfacing and utilities. In lieu of completion of such work, the planning and zoning commission may accept bond in the amount and with the security satisfactory to the city manager, providing and securing to the city the actual construction and installation of such improvements and utilities, including sanitary sewers, water lines, fire hydrants, drainage, etc., within a period of time to be specified by the planning and zoning commission.

Sec. 94-62. Streets with Curb and Gutter Sections: Under *Division 3 Minimum Street Requirements,* this section applies only to existing subdivisions where no new class 2 additions shall be permitted. Subdividers should review this section extensively for compliance. The following are drainage requirements listed for reference that subdividers must adhere to:

In a subdivision, curb and gutter sections shall be used with concrete pavement, only, and shall require the installation of storm sewers.

(d) Minimum gradient on gutters shall be 0.20 percent. Minimum fall around the curb return shall be 0.10 feet.

(e) Storm sewer inlets shall be installed in such a manner that stormwater is not carried more than 1,000 feet from the high point of the gutter to a storm sewer opening.

(d) Storm sewer inlets shall have an S-throat opening of not less than 1.5 square feet. Inlets of this size shall drain not more than 1,000 feet of gutter and shall have an outlet pipe not less than 18 inches in diameter.

(g) Minimum runoff used in calculating drainage structures shall be not less than one inch per hour

(h) Minimum storm sewer size is to be based on calculations for not less than one inch per hour total runoff.

(i) Drainage across streets by means of valley gutters shall be prohibited.

(j) Storm sewer and inlet leads having less than one-foot cover at street crossings shall be reinforced concrete pipe.

Sec. 94-63. - Roads without Curb and Gutter: Under *Division 3 Minimum Street Requirements*, this section applies only to existing subdivisions where no new class 2 additions shall be permitted. Subdividers should review this section extensively for compliance. The following are drainage requirements listed for reference that subdividers must adhere to:

(b) Open ditch drainage shall be provided; minimum 12-inch-diameter culverts, one-foot ditch; maximum 24-inch-diameter culverts, two-foot depth of ditch; continuous storm sewer with inlets required for larger than 24-inch culverts.

(c) Minimum road ditch gradient shall be 0.10 percent.

(d) Road ditches shall be designed for a runoff of one inch per hour total runoff.

(e) Culvert sizes shall be in accordance with design criteria for one inch per hour total runoff.

(f) Roadway widths shall be minimum of eight feet wider than the road surface, with a maximum slope of two to one from the edge of the roadway to the ditch bottom.

Sec. 94-113: Infrastructure Requirements: Under *Article IV Private Subdivison Development,*

this section states general requirements for infrastructure regrading private streets, ADA requirements, and utilities. Section (c) states that "storm sewer systems within a private subdivision shall not be maintained by the city but must be maintained by the subdivision association."

Sec. 94-114: Infrastructure Compliance: Under *Article IV Private Subdivison Development,* upon completion of construction and prior to approval by the director of public works, the director shall be provided with a written certification signed by a registered professional engineer certifying that all infrastructure was designed and installed as required by the provisions of this ordinance. The platting, review, approval and filing processes described in division II of the subdivision ordinance shall govern all plats of private subdivisions.

B-3. City of Groves

SUBDIVISON CONTROL ORDINANCE **(Ordinance No. 2017-Apendix B; Chapter 94, August, 2017, as amended).**

Sec. 1. – General Provisions: Applies this section to any person who wishes to create a subdivision of land within the corporate limits of the city must conform to the rules and regulations set forth in this ordinance including all plats and subdivisions of any land.

Sec. 3. – **Preliminary Plat:** A preliminary plat (six copies) for any proposed subdivision shall be submitted to the city plan commission for approval before the preparation of the final plat for record. Such plat shall be submitted to the plan commission, through the office of the director of public works, at least seven (7) days prior to the meeting at which approval is to be asked. Subdividers should extensively review this section for compliance with all the requirements needed for approval. Listed below for reference is information that is required to be provided at submission of a preliminary plat:

(h) Location, width, and purpose of all easements.

(i) Utilities on and adjacent to the tract. Sizes of existing sewer and water mains.

(j) Topography shown by contour lines on one-foot vertical interval, U.S.C. & G. Datum.

Sec. 4. – Final Plat: After the preliminary plat has been approved, a final or record plat with a duplicate original and ten (10) copies shall be prepared and submitted to the office of the public works department. Subdividers should extensively review this section for compliance with all the requirements needed for approval. Listed below

for reference is information that is required to be provided at submission of a final plat:

> (d) The location of building lines on front and side streets, and the location and purpose of all easements.
>
> (j) The final plat shall be accompanied by two (2) complete sets of engineering drawings and specifications for streets, drainage and utilities, prepared by a registered engineer.
>
> (k) The final plat shall be accompanied by letters of approval from the necessary state or other agencies, utility companies covering proposed utility installations and easements, and Drainage District No. 7 covering outfall drainage, if applicable.
>
> (l) After approval by the plan commission, the final plat shall be submitted to the city council for approval.
>
> (n) Upon final approval by the city council of all improvements, street pavement, sanitary sewer, water lines, fire hydrants and drainage, within the subdivision, the final plat and dedication deed, with restrictions, shall be recorded in the county clerk's office in Jefferson County, by the city clerk.

Section 5. – General Requirements and Design Standards: This section should be extensively review for compliance with the general requirements and the design criteria for subdividers that must be met to receive approval for plat submissions. Listed below are the general requirements that can be referenced for general drainage criteria:

> (b)(5) Utility easements. A minimum easement of ten (10) feet for utilities is required; except easements shall be twenty (20) feet, minimum, if more than one utility is to be located therein.
>
> (b)(6) Drainage easements. When drainage easements are necessary, they shall be designated for drainage and utility purposes.
>
> (d)(1) Conditions to final approval. As a condition to final approval of the plat and of the subdivision, the city council shall require completion of street construction and utilities. In lieu of completion of such work, the city council may accept bond in the amount and with the security satisfactory to the city manager, providing and securing to the city the actual construction and installation of such improvements and utilities, including sanitary sewers, water lines, fire hydrants, drainage, within a period of time to be specified by the city council.

Sec. 6. Minimum Street Requirements: Subdividers should review this section extensively for

compliance. The following are drainage requirements listed for reference that subdividers must adhere to:

Minimum gradient on gutters shall be 0.20%. Minimum fall around curb return shall be 0.10 feet.

Storm sewer inlets shall be installed in such a manner that storm water is not carried more than four hundred (400) feet from the high point of the gutter to a storm sewer opening.

(6) Storm sewer inlets shall have throat opening of not less than 1.5 square feet and shall be sized for contributing area.

(7) Minimum run-off used in calculating drainage structures shall be in accordance with city standards.

(8) Drainage across streets by means of "valley" gutters shall be prohibited.

(9) Storm sewer and inlet leads having less than 1.0 feet cover at street crossings shall be reinforced concrete pipe.

Sec. 9. - Planned Development Projects: Any person(s) wishing to develop a townhouse project or a zero-lot line project shall comply with the requirements in this section when preparing the play, plans, and specifications for the project. Listed below for reference are drainage requirements that must be met for a planned development project within the City:

(g)(3) When computing the required open space, the required front or side setbacks, streets, alleys or other public right-of-ways of any kind, vehicular drives, parking areas, drainage easements and utility easements shall not be included.

(i)(2) Utility easements and drainage easements shall be as required in subsections 5(B)(5) and 5(B)(6) of this ordinance.

(o) Any requirement not stated in this section for drainage systems shall conform to the requirements set forth in this ordinance.

Section 11. – Maintenance Bond: To insure that all improvements, streets, drainage, water, sewer, are constructed in accordance with specifications and to guarantee that they will be properly maintained by the subdivider for a period of one (1) year from the date of final completion of all of the subdivision improvements and subsequent formal acceptance by the city, the subdivider shall provide a bond, in an amount and with the security acceptable to the city manager, payable to the City of Groves.

B-4. City of Port Arthur,

SUBDIVISONS ORDINANCE **(Published 2001; Chapter 98, January 8, 2019, as amended).**

Sec. 98-3. – Scope and Application of Chapter: No person shall subdivide any tract of land which is located within the city or which is located entirely or in part within the area of extraterritorial jurisdiction of the city except in conformity with the provisions of this chapter; provided, however, that the requirements of article IV (Required Improvements) do not apply to the land owned by the city on Pleasure Island which is under the control of the Pleasure Island Commission. This chapter shall have application to the full extent provided under V.T.C.A., Local Government Code § 212.001 et seq., including, but not limited to, the area of extraterritorial jurisdiction of the city as has been heretofore or may be hereafter established, pursuant to the provisions of V.T.C.A., Local Government Code § 42.001 et seq.; provided, however, the penal conditions contained in this chapter shall not have application beyond the corporate limits of the city. No transfer of land in the nature of a subdivision shall be exempt from the provisions of this chapter even though the instrument or document of transfer may describe land so subdivided by metes and bounds. The filing of any plan, plat or replat without complying with the provisions of this chapter, or transfer of land without having first complied with the requirements of this chapter, shall be deemed a violation of this chapter.

Sec. 98-5. - Penalty for violation of chapter: Violation of any provision of this chapter shall constitute a misdemeanor and, upon conviction of such violation in the municipal court of the city, a fine shall be imposed, as provided in section 1-13 of this Code. If a corporation is the violator of any of the provisions of this chapter, each officer, agent and/or employee in any way responsible for such violation shall be individually liable for the penalties prescribed in this section.

Sec. 98-61. - Building permits required: No employee or official of the city shall issue building permits for any structure, located on a lot in any subdivision, the plat of which has been prepared after the date of the adoption of this chapter, unless such plat has been approved and recorded in accordance with the provisions contained in this division.

Sec. 98-62. – Acceptance: The approval of any plan, 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 actual appropriation of same by entry, use or improvement. If any such plan, plat or replat is disapproved by the commission, such disapproval shall be deemed as refusal by the city of the offered dedication shown thereon.

Sec. 98-63. – Service: Unless and until any such plans, plats or replats, specifications and required minimum improvements shall have been first completed and approved in the manner and by the authorities provided for in this chapter, it shall be unlawful within the area covered by such plans, plats or replats for any city official or employees to issue a certificate of occupancy or to permit such land or any part of such land to be served, for purposes of occupancy, with any public utility, such as water, sewer, lights, gas, etc., which may be owned, controlled, regulated or distributed by the city.

Sec. 98-64. - Construction on an unimproved street.

A building permit and/or a certificate of occupancy for a home or other structure may be issued when the city manager or his designee confirms:

(1) That a plan for improvement of the street is in place and a completion date has been established;

(2) Utilities are in place;

(3) Building plans have been approved;

(4) The construction of the building and structure is in substantial conformance with generally accepted planning procedures and city ordinances.

This section shall not apply to more than one structure or home at a time.

Sec. 98-94. - Application for variance fee: Each application or request, by a person or corporation having a proprietary interest in any property, to the planning and zoning commission for a variance shall be accompanied by a fee of $125.00 to cover publication and associated costs.

Sec. 98-121. - Right to appeal: Any subdivider contesting any disapproval and/or the interpretation and/or application of any rule, standard, regulation, determination, requirement or necessity set forth in this chapter, directly or by delegation of authority, shall have the right, after filing a written request with the commission, to have a hearing thereon before the commission within 21 days after the date of filing of such request. Any subdivider not satisfied with the ruling of the commission shall have the right to appeal such rulings or decisions to the city council by giving written notice to the city secretary within 15 days after the final hearing before the commission.

ARTICLE III. - PLATS
DIVISION 1. - GENERALLY

Sec. 98-151. - Preapplication procedure: At least 15 days prior to submitting a preliminary plat, the subdivider shall file, in writing, in the office of the director of planning, the following information:

(1) General subdivision information. General subdivision information shall describe or outline the existing conditions of the site and the proposed development as necessary to supplement the drawings required by subsections (2) and (3) of this section. This information shall include data on existing covenants, land characteristics and available community facilities and utilities; information describing the subdivision proposal such as the number of residential lots, typical lot width and depth, business areas, playgrounds; and park areas and other public areas, proposed protective covenants and proposed utilities and street improvements.

(2) Location map. A location map shall show the relationship of the proposed subdivision to existing community facilities which serve or influence it. A location

map shall include the subdivision name and location, main traffic arteries, public transportation lines, elementary and high schools, parks and playgrounds, title, scale, north arrow and date.

(3) Sketch plan. A sketch plan on topographic survey shall show in simple sketch the proposed layout of streets, lots and other features in relation to existing conditions. The sketch plan may be a freehand pencil sketch made directly on a print of the topographic survey.

Sec. 98-152. - Minor plat approval:

(a) Submittal. The original of the final plat (on the form furnished by the city) meeting all applicable requirements of articles III and IV of this chapter shall be submitted to the director of planning for filing with the commission, not less than seven days prior to any meeting of the commission at which the plat is to be considered.

(b) Approval. The commission shall render a decision within 30 days of receipt of the plat from the director of planning, together with his recommendation and in compliance with the applicable requirements of V.T.C.A., Local Government Code § 212.001 et seq. Such decision shall consist of approval or denial.

Sec. 98-153. – Replat:

(a) Submittal. The original of the final plat (on the form furnished by the city) meeting all applicable requirements of articles III and IV of this chapter shall be submitted to the director of planning for filing with the commission, not less than 20 days prior to any meeting of the commission at which the plat is to be considered.

(b) Approval. The commission shall render a decision within 30 days of receipt of the plat from the director of planning, together with his recommendation and in compliance with the applicable requirements of V.T.C.A., Local Government Code §§ 212.014—212.016. Such decision shall consist of approval or denial.

DIVISION 2. - PRELIMINARY PLATS

Sec. 98-181. – Submittal: All persons desiring to subdivide land within the area of jurisdiction of this chapter shall next prepare and submit to the director of planning for filing with the commission, not less than eight days prior to any meeting of the commission at which the plat is to be considered, the following information:

(1)One reproducible copy of a preliminary plat covering the land to be subdivided and a sufficient area adjacent thereto, which is owned or controlled by the subdivider, to indicate a suitable plan for coordinating the area to be subdivided with the surrounding area.

(1a**)** The preliminary plat shall be drawn at a scale of 200 feet to one inch or larger, and shall otherwise conform to the requirements of a final plat. It may contain map

information that is not permitted on a final plat.

(1b) The preliminary plat shall contain the following inscription in bold letters (one-fourth inch high): "PRELIMINARY PLAT: SUBJECT TO CHANGE," and further: "PLEASE REFER TO THE FINAL PLAT OR PLATS OF THIS SUBDIVISION FOR STREET LAYOUT, LOT ARRANGEMENT, ADJACENT AREAS, AND DETAILS OF THE EXACT AREA INCLUDED IN THE DEDICATION FOR DEVELOPMENT PURPOSES."

(2) Three prints of the preliminary schematic plans for the furnishing of water, the installation of sanitary sewer facilities, and provisions for storm sewers and general drainage facilities, widths of streets and alleys, and locations of bridges. (Topographic contours of not more than one-foot intervals referred to as U.S. Coast and Geodetic Survey or State Highway Benchmark may be required by the commission.)

(3) A completed application form. Such forms shall be as adopted by the commission and available from the city planning department.

(4) A written certificate or binder from a title company or title opinion from an attorney duly licensed to practice law in the state certifying to at least the following, concerning title to the land: a statement of records examined and date of examination; description of the property in question by metes and bounds; the fee owner as of the date of examination and the date, file number, and volume and page of the recording of the deed or other basis of title involved; the name of any lienholder together with the date of filing and volume and page of such lien; and a general description of any right-of-way, easements or reservations, along with the file number, date of filing, and volume and page of recording.

(5) In cases where public streets, alleys or easements are proposed to be platted across existing private easements, rights-of-way or fee strips, a copy of the instrument establishing such private easement, right-of-way or fee strip shall be submitted.

(6) A preliminary submittal shall be required for all replats of existing subdivisions containing major changes in the physical layout, as determined by the commission. However, the commission may, at its discretion, waive the various requirements of accompanying submittal information where the facts warrant.

Sec. 98-182. - Approval of preliminary plat:

(a) The commission shall render a decision within 30 days from the date the plat and other information was submitted to the commission by the director of planning. Such decision shall consist of approval or disapproval. All objections made to the preliminary plat shall be furnished the subdivider in writing.

(b) When a preliminary plat has been approved, the subdivider may thereafter file a final plat of sections of the proposed subdivision upon which approval of the preliminary plat has been obtained, and, upon the approval of a final plat covering a portion of such subdivision, the remainder of the preliminary plat shall be deemed as approved as in

subsection (a) of this section; provided, however, that such approval of the remainder of the preliminary plat shall be limited to a one-year period from the date of final approval of a section of such plat. The commission may, upon application and at its discretion, extend such period of validity not to exceed two years.

(b) When a preliminary plat has been approved, the subdivider may thereafter file a final plat of sections of the proposed subdivision upon which approval of the preliminary plat has been obtained, and, upon the approval of a final plat covering a portion of such subdivision, the remainder of the preliminary plat shall be deemed as approved as in subsection (a) of this section; provided, however, that such approval of the remainder of the preliminary plat shall be limited to a one-year period from the date of final approval of a section of such plat. The commission may, upon application and at its discretion, extend such period of validity not to exceed two years.

(c) When a preliminary plat has been approved and thereafter the subdivider fails to file a final plat of the subdivision or a section of such plat within a period of six months, the approval of the preliminary plat shall expire and have no further force or effect; except, however, the commission may, upon application and at its discretion, extend such period of validity not to exceed one year.

DIVISION 3. - FINAL PLAT

Sec. 98-203. - Requirements prior to plat approval: Before the final plat shall be signed and its recording permitted by the planning and zoning commission, compliance with the following requirements shall be made, where applicable:

(1) No more than one single-family detached dwelling shall be located on each lot in a single-family zoned district. A notation of this restriction shall be placed on the face of the final plat. This restriction shall be placed in all deeds and contracts for deeds for real estate sold within the subdivision. Proposals which include two-family or multifamily residential shall include adequate, detailed planning materials as required for determination of proper water and wastewater utility type and design. A subdivision with lots of five acres or less is presumed to be a residential development unless the land and/or the zoning is restricted to nonresidential use on the final plat and all deeds and contracts for deeds.

(2) Complete and detailed construction plans and written specifications (indicating the method of construction and the materials to be used and specifying all construction equal to or better than city standards, and certified to by a professional engineer registered by the state) shall be submitted for:

(2a). A detailed cost estimate for those unconstructed water and wastewater facilities necessary to serve each lot shall be attached to the final plat for approval;

(2b) A construction schedule for each significant element needed to provide adequate water or wastewater facilities shall be attached to the final plat for approval;

(3) Public water systems:

(3a) Subdividers who propose to supply drinking water by connecting to an existing public water system must provide a written agreement with the city in substantially the form as shown. The agreement must provide that the city water system has, or will have, the ability to supply the total flow anticipated from the ultimate development and occupancy of the proposed subdivision for a minimum of 30 years. The agreement must reflect that the subdivider has paid the cost of water meters and other necessary connection equipment, membership fees, water rights, acquisition costs, or other fees associated with connection to the public water system so that service is available to each lot upon completion of the water facilities described on the final plat. Before final plat approval, plans and specifications for the proposed water facilities shall have been approved by all entities having jurisdiction over the proposed project which may include in addition to the county, the planning and zoning commission and the county health department.

(3b) Transportation of potable water. The conveyance of potable water by transport truck or other mobile device to supply the domestic needs of the subdivision is not an acceptable method, except on an emergency basis. Absence of a water system meeting the standards of these rules due to the negligence of the subdivider does not constitute an emergency.

(c) Where there is no existing retail public utility to construct and maintain the proposed sewerage facilities; the subdivider shall establish a retail public utility and obtain a certificate of convenience and necessity (CCN) from the commission. Before final plat approval, a wastewater treatment permit authorizing the treatment of the wastewater for the ultimate build-out population of the subdivision shall have been obtained from the Texas Commission on Environmental Quality and plans and specifications for the proposed sewerage facilities shall have been approved by all entities having jurisdiction over the proposed project.

(d) On-site sewerage facilities. Where private on-site sewerage facilities are proposed, the final engineering report shall include planning materials required by 30 TAC 285.4(c), including the site evaluation described by 30 TAC 285.30 and all other information required by the county's OSSF order. The city may, at its option, require additional information necessary to determine the adequacy of proposed water and wastewater improvements as part of the plat approval process. Such information may include, but is not limited to:

1. Layout of proposed street and drainage work;
2. Legal description of the property;
3. Existing area features;
4. Topography;
5. Floodplains;
6. Description of existing easements;
7. Layout of other utilities;
8. Notation of deed restrictions;
9. Public use areas; or
10. Proposed area features.

(e) The sanitary sewer system showing by plan and profile the size, location and gradient of all existing and proposed sanitary trunk lines, laterals, manholes and services within the proposed subdivision and the location and method of connecting the proposed sewer system into the existing city sanitary sewer system.

(f) The stormwater drainage system showing by plan and profile the means and the methods of draining the proposed subdivision, showing in detail all existing and proposed drainage structures and the means and methods of connecting the proposed drainage system into the existing drainage system.

(g) All proposed bridges or culverts within the proposed subdivision, showing in detail, by plan and/or profile, the structural members, connectors, railing, approaches, reinforcing steel and deck.

(h) All existing and proposed streets, alleys and sidewalks within the proposed subdivision, showing by plans and profiles the width of the rights-of-way; the widths of the proposed roadways; the gradient of all curb lines; the location and size of all drainage inlets; and the type of pavement.

(All of the above-required plans and specifications must be reviewed by the director of planning and approved by the city engineer and water utilities manager before the chairman of the commission shall sign the plat and permit it to be recorded.)

(4) Except where the subdivision improvements have been previously completed in accordance with the city standards and plans and specifications, approved by the city engineer and water utilities manager, the developer shall either:

(4a) File a performance bond with the city executed by a corporate surety authorized to do business in the state, conditioned that the required improvements within the subdivision shall be completed in accordance with the approved plans and specifications. Such bond will be in an amount equal to the estimated cost of actual construction of such improvements plus engineering fees, less the amount of the actual cost that is to be borne by the city (or the county), if any, as specified by the city engineer. Such bond shall be payable to the city and shall guarantee completion of all required improvements within two years from the date of final approval of the plat. If any or all of the required improvements are not completed within the time specified in such bond, the city may let or relet the contract or contracts and the subdivider and surety shall be severally and jointly liable for the cost of such improvements. The bond may provide for extensions of time under conditions approved by the city council and for the termination of the bond upon vacation of the plat.

(4b) Deposit in escrow funds sufficient and for the purpose of the required improvements, with a bank or other institution suitable to the city as escrow agent. Such funds shall be paid out only as the required improvements are constructed and approved by the city, and such escrow agreement provides that on failure of the developer to complete the required improvements within two years of final plat approval, the city may proceed to construct such improvements by contract or otherwise and secure payment therefore from the escrow funds.

Sec. 98-204. – Approval:

(a) The planning and zoning commission shall render a decision thereon within 30 days from the date that the plat and other information were submitted to the planning and zoning commission by the director of planning. Such decision shall consist of approval or disapproval. Reasons for disapproval shall be furnished to the subdivider in writing.

(b) On approval of the plat, provided that such plat has been otherwise fully and properly endorsed and specifications for the subdivision as required in this chapter have been reviewed by the director of planning and construction plans approved by the city engineer and water utilities manager, the chairman of the commission shall sign the space provided.

(c) Final approval will expire one year after the commission action granting approval for any plat that has not been filed for record.

Sec. 98-207. - General principles of acceptability:

(a) The subdivision shall conform to the comprehensive plan and the major thoroughfare plan of the city and any separately adopted parts.

(b) The subdivision layout shall make reasonable provisions for development of adjacent land.

(c) Subdivisions shall fit and take advantage of topography and solar orientation to the end that good building sites are provided and utilities can be provided most economically.

(d) Subdivisions shall conform to all applicable zoning regulations. No subdivision shall be approved that requires a change in zoning after consideration of the subdivision plat.

(e) Subdivisions shall conform to all applicable provisions of chapter 42 (floods) of this Code; specifically including, but not limited to, section 42-94, standards for subdivision proposals.

Sec. 98-209. - Key map, boundaries and existing features.

(a) A vicinity or key map shall be included to show relation of proposed subdivision to major streets, railroads, watercourses and other important features in all directions to a reasonable distance.

(b) Boundaries and existing features shall be included as follows:

(b1) Ownership or outline of the tract the plat is proposed to subdivide shall be shown with very heavy, solid lines. The boundaries shall be described with complete and overall dimensions and bearings and be tied to an original corner of the original survey of which the proposed subdivision is a part.

(b2) The location, width and name of existing streets, subdivisions, and any blocks, lots, tract (to include numbers or other designations), alleys, easements, fee strips, pipelines, building lines, watercourses or other important features or significant information shall be shown within the plat boundary and on all sides for a distance of not less than 200 feet. Lines or indications outside the plat boundaries shall be dashed.

(b3) All flood zones and flood zone boundaries, as indicated on the applicable flood insurance rate map (FIRM), within the plat boundary shall be shown.

Sec. 98-212. - Engineering data.

(a) Generally. Accurate dimensions, both linear and angular, of all items on the plat at a scale of one inch equals 100 feet. The boundary of the site shall close within one in 10,000. Linear dimensions shall be expressed in feet and decimals of a foot; angular dimensions may be shown by bearing. (Preliminary plats may contain approximate data.)

(b) Streets and alleys. The following information shall be provided for streets and alleys:

(b1) Complete curve data (P.C., L.R., P.R.C., P.C.C., P.T., etc.) shown on each side of streets and alleys.

(b2) Length and bearings of all tangents.

(b3) Dimensions from all angle points and points of curve to an adjacent side lot line.

(b4) Actual width of all streets and alleys, measured at right angles or radially where curved.

(c) Lots. Complete bearings and dimensions for front, rear and side lot lines. The following note for side lot lines may be used when applicable in lieu of bearings: "All side lot lines are either perpendicular or radial to street frontage unless otherwise noted."

(d) Watercourses and easements.

(d1) The location, width and high-bank of watercourses, ravines and drainage easements shall be shown.

(d2) Distances shall 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.

(d3) Traverse line shall be provided along the edge of all large watercourses in a convenient location, preferably along a utility easement or paralleling the drainage easement or stream.

(4) 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, building setback lines shall be shown at a distance of ten feet and parallel to the centerline of the pipeline.

Sec. 98-215. - Easements.

(a) Drainage.

(a1) Where conditions warrant, the subdivider shall dedicate to the public such drainage easements and drainage rights-of-way as may be required to drain substantially the subdivider's property as determined by the commission. Where gullies, ravines, draws, sloughs or other substantial natural drainage courses are located within the area to be subdivided, the commission may require the subdivider to dedicate to the public a drainage easement sufficient to maintain the natural drainage.

(2) Where unusually large drainage easements and drainage rights-of-way are required to drain substantially large areas beyond those being developed by the subdivider, as determined by the city engineer, the commission may require the developer to allow the city or other appropriate public agency a reservation and option to purchase for a period of two years such drainage right-of-way which is determined by the city engineer to be in excess of the drainage easements and drainage rights-of-way required to substantially drain the subdivision. Where conditions require, there shall be provided a stormwater drainage easement or right-of-way adequate for the purpose, as determined by the city engineer.

(3) Where a drainage easement is adjacent to lots, tracts or reserves, the easement shall be noted on the face of the final plat as follows: "This easement shall be kept clear of obstructions to the operation and maintenance of the drainage facilities and abutting property shall not be permitted to drain into this easement except by means of an approved drainage structure."

ARTICLE IV. - REQUIRED IMPROVEMENTS

Sec. 98-251. - General requirements:

The subdivider shall be required to install at his own expense, all water, sanitary sewer and other utility lines; streets; alleys; sidewalks; storm sewer lines and drainage facilities and structures within the subdivision, including all engineering costs covering design, layout and construction, except as provided in this section. The commission may require excess improvements which it determines, on the advice of the planning director, city engineer, or water utilities manager, to be necessary to the city. Such excess improvements may include, but are not necessarily limited to, oversized storm drainage or utility lines to service areas beyond the proposed subdivision. In such cases, the city shall participate in the cost of such improvements to the extent of the difference in cost between the improvement required and that which is necessary for the proper development of the subdivision in accordance with city standards. 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 chapter, complete plans and specifications for such improvements shall have first been completely approved by the city engineer and water utilities manager as meeting the city standards in connection with the approval of a

final plat of the proposed subdivision by the commission. Construction of streets, alleys, sidewalks, storm drainage and utility service facilities shall be in conformance with city standards, and constructed in accordance with the Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges adopted by the Texas Department of Transportation - November 2014 or latest edition. Improvements shall be installed within all of the area of any subdivision or section thereof given final approval and filed or to be for record.

(b) The city may pay a portion of the construction cost of the extension of the city water, sanitary sewer and storm drainage system to serve the subdivision when funds are available for such extensions and the same is deemed expedient by the city. Any such participation by the city shall be only for the extension of services to the plat boundary and not within the subdivision proper, except as provided in subsection (a) of this section. The subdivider shall be responsible for providing any necessary off-site easements or rights-of-way. The commission may refuse to approve a plat whenever it is evident, based upon evidence submitted by the city engineer and/or water utilities manager, that adequate city utilities or storm drainage facilities cannot be supplied within a reasonable time or at a reasonable cost. Where the public water and sewer system is not reasonably accessible to the subdivision, the plat may be approved if the developer shall construct and install complete private water and sewer systems, meeting city standards and approved by the city health department and water utilities manager. This shall not be construed to permit individual wells or water supply or individual septic tank or sewage disposal. The approval of a final plat shall not commit or obligate the city to extend its water, sanitary sewer or storm drainage systems to serve the subdivision.

(c) The city engineer or his duly authorized representative shall, from time to time, inspect the construction of all required improvements during the course of construction to see that the improvements comply with the city standards governing them. In this regard, free access to the subdivision shall be accorded by the subdivider, his agents and employees. Inspection by the city engineer, or a failure of the city engineer to inspect construction as required in this section 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 therefor as approved by the city engineer and water utilities manager in accordance with the city standards. The subdivider shall hire a construction inspector to monitor all infrastructure during the course of construction. Compaction testing of all backfill and road subgrades and cylinder testing of concrete shall be conducted by an independent testing agency.

(d) After all improvements required by the city have been completed by the owner or subdivider of the subdivision, the city engineer will require one set of as-built drawings of all utilities, street improvements and sidewalks that have been constructed, to be filed within 30 days after completion of all required improvements.

Sec. 98-252. - Streets, alleys and sidewalks:

(a) Streets are to be of reinforced concrete with monolithic curb and gutter and catchbasins laid to grade to provide efficient drainage, and according to current city standards. Minimum radius of 15 feet, or one-half the width of the minor street at intersections, whichever is greater. Minimum width of street shall be 27 feet, back-to-

back of curbs in self-contained subdivisions, with minimum widths of other streets to be determined by the city engineer. In or adjacent to a previously platted and improved subdivision where the storm drainage is predominantly of open-ditch design, the commission may approve, upon the recommendation of the city engineer, a concrete street pavement width of 22 to 24 feet with open-ditch drainage.

(b) The developer or subdivider shall connect the proposed streets to the city's existing streets with approved connections at no cost to the city when deemed expedient by the city. Culverts, bridges or other structures to span existing or proposed ditches shall be built by the subdivider.

Sec. 98-255. - Storm drainage system:

(a)The subdivider shall construct a drainage system to drain the proposed subdivision and every lot therein. The developer's engineer shall conform to the recommendations of the city engineer in the design of the drainage system.

(b) Materials and installation shall be in accordance with the city standards for the same. In no case shall a smaller diameter pipe than 18 inches be used.

(c) Catchbasins shall be spaced no more than 300 feet apart and shall be of the type specified by the city engineer

(d) Minimum gutter grade shall be 0.20 percent. The city engineer may approve a lesser slope, but in no case less than 0.15 percent.

(e) Where a culvert runs under a proposed roadway or within two feet of such roadway, the subdivider shall backfill with cement stabilized sand and compact the trench to a uniform density equal to or greater than that of the undisturbed earth adjacent to the trench.

(f) The commission may refuse to approve a plat whenever it is evident, based upon evidence submitted by the city engineer or the inspections department that the development of the subdivision cannot reasonably be expected to meet the requirements of any ordinance or law governing the development of floodprone lands.