

3 Briefing Document FLOOD REGULATIONS

Regulations in Floodplains

Every community has the authority to enact floodplain regulations to protect the health and safety of its residents under its jurisdiction. In addition, any community that participates in the National Flood Insurance Program (NFIP) has to meet minimum standards set by the NFIP. These minimum standards apply to every new development, substantially improved, or substantially damaged buildings in a community; structures that were built before floodplain regulations were adopted in a community do not need to be retrofitted to meet new NFIP standards.

Flood regulations are enforced by cities, counties, or third party flood control authorities. Different jurisdictions adopt different regulations and sometimes implement stricter standards than the NFIP. Regulations are not only enforced by several different jurisdictional authorities, they are enforced by several different departments within those authorities. The process of complying and acquiring permitting is often difficult to navigate. Refer to the diagram on the right for a general overview of the process in the City of Houston. This process varies by jurisdiction and type or scale of project.

Floodplain regulations set by the NFIP and participating jurisdictions are aimed at protecting the structures and neighboring properties. Jurisdictions will also regulate water drainage and storage at each site.

Mechanics of Development Regulations in Floodplains

There are several layers to flood regulations geared toward three main goals, protecting structures, storing water, and conveying water. Balancing these is tricky because while water must be drained away from structures quickly, it must also be drained slowly enough to keep from overloading drainage channels.

By **Protecting a Structure**, regulations try to ensure habitable spaces within buildings are safe from flooding. This is often achieved by requirements to raise the **Finish Floor** of structure a certain amount above the base flood elevation (BFE), or to floodproof the building below that BFE, designated by FEMA. For more information on how floodplains and BFEs are determined, refer to Fact Sheet 4: *How are floodplains designated?*

By **Storing Water**, regulations try to hold water on site to prevent channels from overflowing due to the impact from development. Channels can overflow if the rate of inflow of water exceeds their capacity to drain into a larger body of water. Loss of vegetation or large amounts of impervious surfaces increases rate of stormwater flow into channels. Using **Detention** ponds to hold water away from the channels helps to maintain the rate of flow to match the capacity of a channel, which can mitigate flooding. Refer to Fact Sheet 3: *What is a Detention Basin?* Additionally, if part of a site is elevated through adding soil, the developer must **Balance Fill** by removing soil from other parts of the site.

By **Conveying Water**, regulations address development of altered drainage paths. A structure in a floodway or floodplain can displace water or block the flow of water in a flood event, increasing flooding elsewhere. To avoid this, **Foundations** and structures below the lowest floor of buildings should be designed to allow water to flow. Additionally, **Site Drainage** should be designed in such a way that new development does not alter the flow of water onto a neighboring property and increase their chance of flooding.

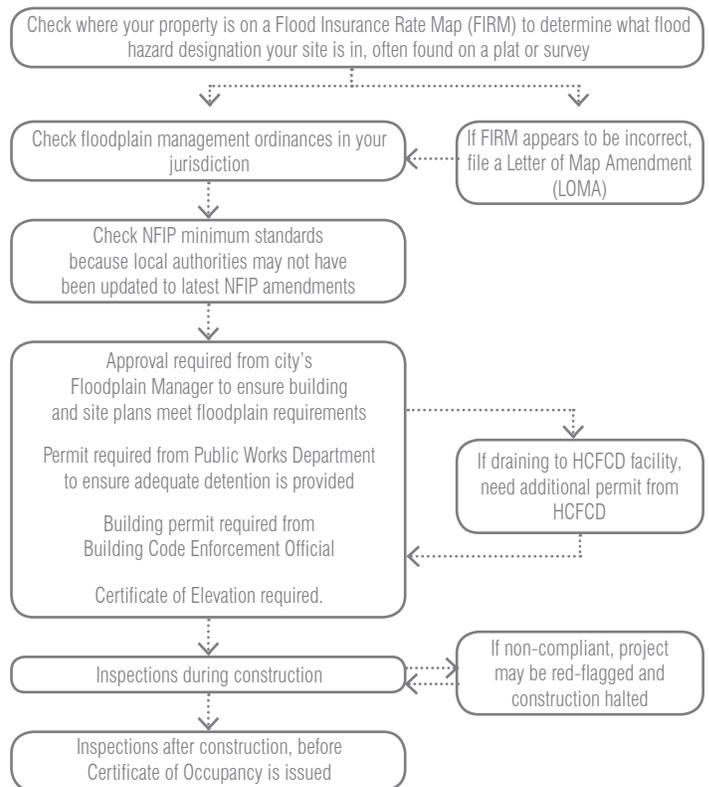


Figure 1 Permitting Process for New Development in Houston

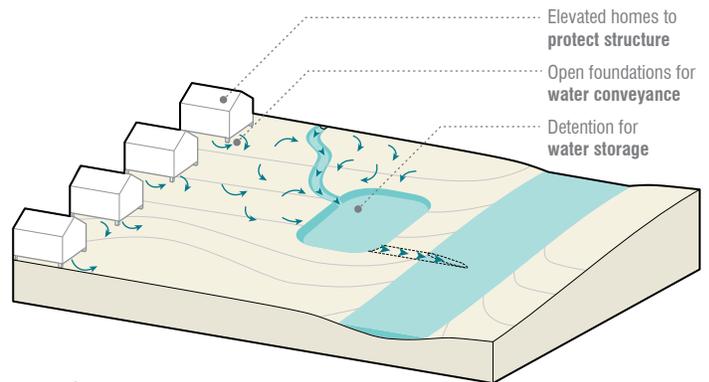


Figure 2 Mechanics of Flood Regulations

Key Terms

Finish Floor

Refers to the height of the top of a floor inside a building.

Detention

Is holding water and releasing it slowly into a channel.

Cut and Fill

Is the process of depressing and elevating the ground on parts of a site.

Foundation

Refers to the structural system beneath a building.

Site Drainage

Refers to the movement of water through a site.

ROLE OF FEDERAL EMERGENCY MANAGEMENT AGENCY

Mechanics of Insurance Regulations

The **National Flood Insurance Program (NFIP)** was established by Congress through the National Flood Insurance Act of 1968. If a community, city, or other governing entity chooses to participate in the NFIP, property owners in those communities have the option to purchase flood insurance, administered by the federal government. Participating communities agree to adopt and enforce a floodplain management ordinance that aims to reduce future flood risks in Special Hazard Flood Areas (SHFA).

All mortgages and loans for new construction, substantial improvements to existing buildings, and manufactured homes require flood insurance. The rate of flood insurance is based on where the property is located on a **Flood Insurance Rate Map (FIRM)**. If the property is located in an area of high flood risk, premiums are higher.

When floodplain maps change, the **Grandfathering Rule** allows a lower-cost insurance premium for buildings that already own flood insurance, or buildings that were built in compliance with the FIRM in effect at the time of construction.

If a building has been substantially damaged or improved, it is not eligible to be grandfathered. FEMA's definition of **Substantial Damage or Improvement** is that the cost of repairs or improvement of the structure due to a disaster is 50% or more of the structure's market value before the disaster occurs.

Letters of Map Amendment (LOMAs) and **Letters of Map Revision (LOTRs)** may be used by a property owner to remove their flood insurance requirement. The property owner must show that the property is incorrectly mapped or has been raised by fill out of the SFHA floodplain.

Community Rating System (CRS) is an incentive program to reward and encourage communities who take substantive steps to limit flood risk by providing discounted insurance rates. The CRS program benefits local and state governments as well as homeowners. If measures are implemented in accordance with CRS, floods damage fewer insurable properties, homeowners file fewer claims, and the NFIP pool remains stable. The CRS passes savings on to property owners in the form of lower premiums, all while encouraging more comprehensive approaches to mitigating flood hazard.

FEMA reviews each community against 19 criteria and gives each community a class rating from 1 to 10. Class 1 communities earn a 45% discount on NFIP premiums, while class 7, 8, and 9 earn 15, 10, and 5% discounts, respectively. Harris County, class 7, has earned residents in the SHFA outside cities a 15% discount. Houston, a class 5 community, passes on 25% savings to residents.

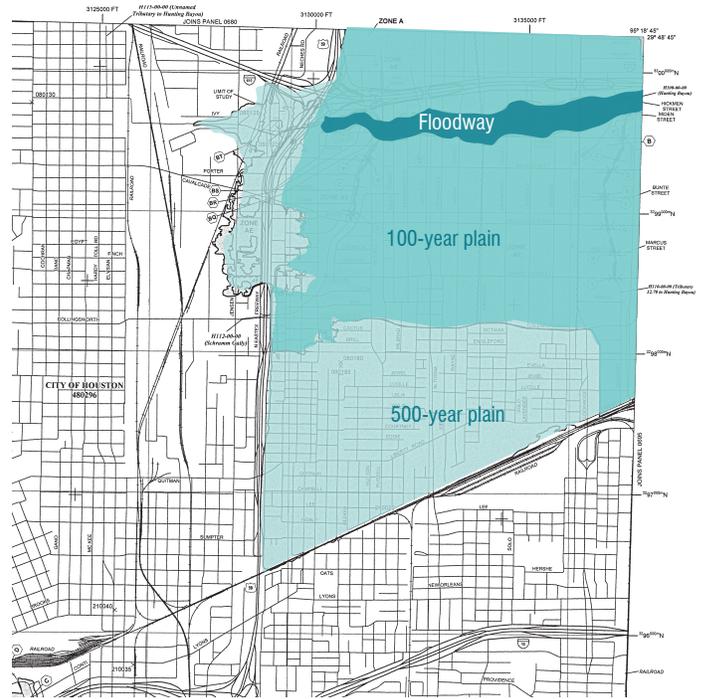


Figure 2 Typical Flood Insurance Rate Map (FIRM) overlaid with floodplain colors

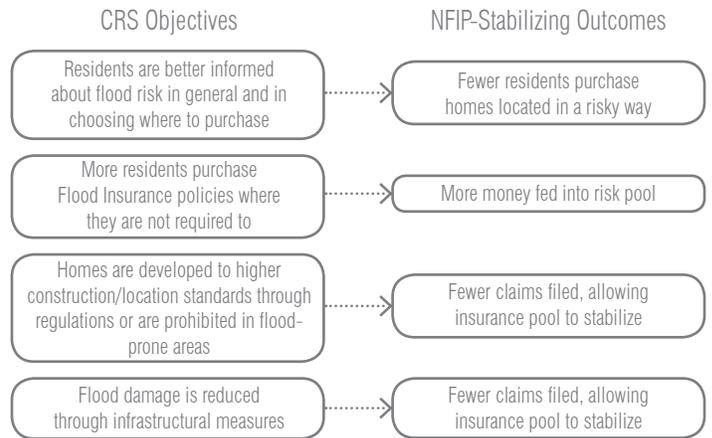


Figure 3 Objectives vs Outcomes

Key Policy Questions

What information should sellers be required to disclose transparently to property buyers?

Are we regulating the correct aspects of development?

Are there ways to retrofit buildings built before current regulations for greater flood mitigation?

Would it be useful to implement regulations across watersheds rather than political jurisdictions?

How can we balance implementing stricter regulations for flood mitigation with economic development and affordability?

For More Information Visit

National Weather Service
Weather.gov

NOAA National Hurricane Center Info
NHC.NOAA.gov/Surge

Greater Houston Flood Mitigation Consortium
HoustonConsortium.com

ROLE OF JURISDICTIONAL AUTHORITIES

Which Authorities Do You Need Approvals from at Each Site?

Jurisdictions implement and enforce a variety of different regulations that pertain to flooding. Some of these regulations are enforced by the jurisdiction whose political boundaries the site is located within. This is complicated by the establishment of Zones of Extraterritorial Jurisdiction (ETJs), which give cities some power outside their city limits. Other regulations are not set by political boundaries at all; the governing authority for detention and runoff is determined by the facility into which a development drains. Storm drains under local streets may be owned by the city or county, and those may feed into a drainage pipe owned and maintained by Harris County Flood Control District (HCFCD) or Texas Department of Transportation (TxDOT). The properties that connect directly to the HCFCD or TxDOT drainage facility must comply with their respective regulations.

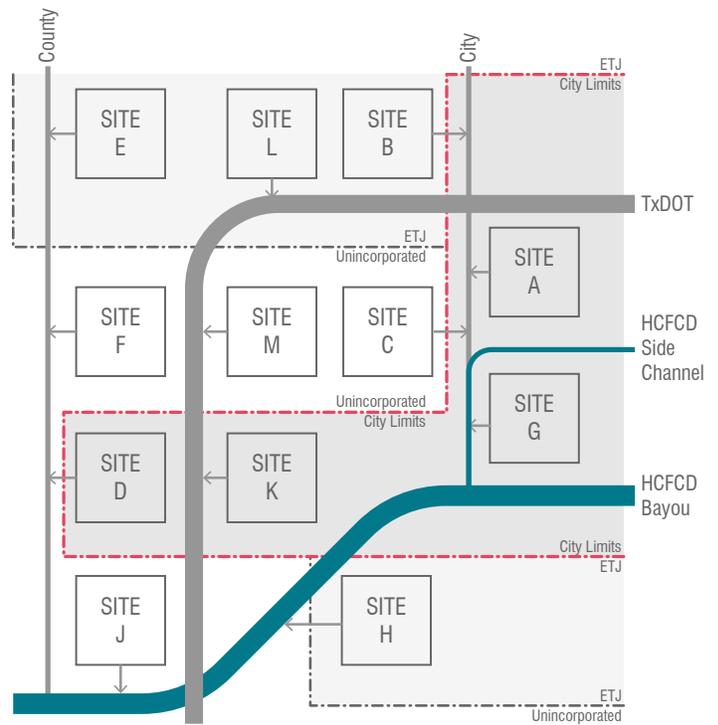


Figure 4 Jurisdiction boundaries and drainage facilities

DRAINS TO FACILITY OPERATED BY	REGULATION TYPE	SITE LOCATED IN		
		Houston City Limits	Extraterritorial Jurisdiction	Unincorporated Harris County
City of Houston		A	B	C
	Detention & Outflow	City of Houston	Harris County	Harris County
	All Other Flood Regulations	City of Houston	Harris County	Harris County
	Platting, Code & Other Permits	City of Houston	City of Houston	Harris County
Harris County		D	E	F
	Detention & Outflow	Harris County	Harris County	Harris County
	All Other Flood Regulations	City of Houston	Harris County	Harris County
	Platting, Code & Other Permits	City of Houston	City of Houston	Harris County
HCFCD		G	H	J
	Detention & Outflow	HCFCD	HCFCD	HCFCD
	All Other Flood Regulations	City of Houston	Harris County	Harris County
	Platting, Code & Other Permits	City of Houston	City of Houston	Harris County
TxDOT		K	L	M
	Detention & Outflow	TxDOT	TxDOT	TxDOT
	All Other Flood Regulations	City of Houston	Harris County	Harris County
	Platting, Code & Other Permits	City of Houston	City of Houston	Harris County

Table 1 Who enforces various regulations at each site

WHAT TOOLS ARE USED FOR FLOODPLAIN REGULATIONS?

Protect Structure

Finish Floor Elevation

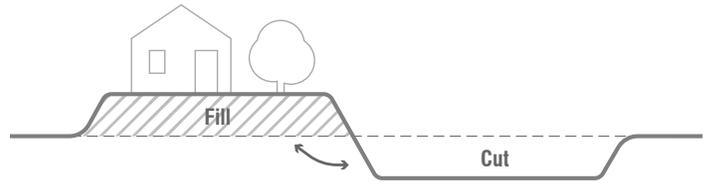
The purpose of this is to ensure that habitable spaces in buildings are high enough to not be in danger of flooding. Several regulations require structures and/or utilities to be elevated relative to a Base Flood Elevation (BFE). The BFE is set by Flood Insurance Rate Maps (FIRMs). There are BFEs for both 1% (100-year) and 0.2% (500-year) events; the 0.2% BFE is always higher than the 1%, but the difference between the two can vary from inches to feet. Other regulations affecting the elevation of a structure are based on the closest sanitary sewer manhole and crowns of adjacent roads. Elevating the lowest floor of a structure attempts to mitigate water damage inside enclosed spaces.



Water Storage

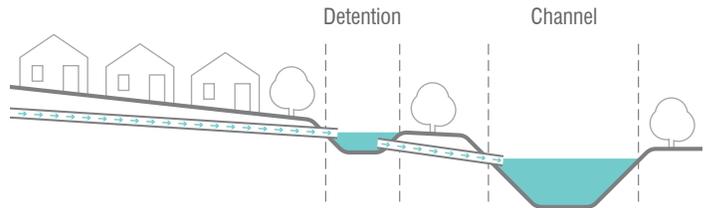
Balancing Fill

The purpose of balancing fill on a site is to ensure that the capacity of drainage systems and bayous are not reduced. While elevating a structure to meet the finish floor elevation requirement, or while grading a site, developers will often “fill” soil to raise part of the property. One flood mitigation strategy is to require developers to balance the “fill” with an equal amount of “cut” so the average elevation within the property remains the same and the developer is not inadvertently flooding neighboring properties. The “cut” creates room for water storage on-site.



Detention

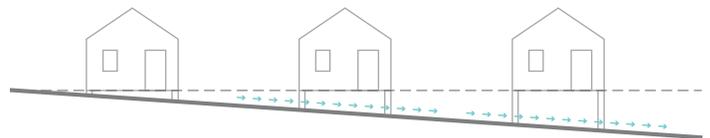
On-site or regional detention may be required to mitigate potential additional runoff from a new development and ensure drainage channels are not overloaded. Detention basins allow a large volume and rate of water to flow in, and a smaller volume and rate to flow out, reducing the chance of the channel overflowing. For more information on detention ponds, refer to *Fact Sheet 3: What is a Detention Basin?*



Water Conveyance

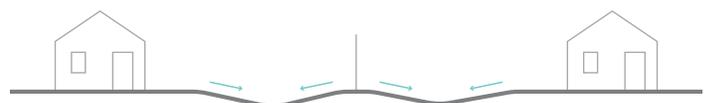
Foundation Types

Enclosures below the lowest floor and foundation types may be specified to ensure the path of water is not impeded. Flood regulations may require a structure to be elevated on a pier and beam foundation system. This lifts the structures off the ground, allowing water to flow beneath them. A pier and beam system is sometimes confused with a structural slab on piles, which does not mitigate flooding. A structural slab sits on-grade; so while the soils do not carry any loads, there is still no room for water to flow. Pier and beam systems ensure the flow of water is not impeded.



Site Drainage

Site drainage requirements are geared toward directing the flow of water within property limits to the proper drainage facility without altering drainage patterns and volumes on neighboring sites. This may require on-site swales or otherwise sloping the ground around a structure.



PROTECT STRUCTURE

Finish Floor Elevation

Minimum finish floor elevations vary significantly by jurisdiction. Everyone requires it to be at least as high as the 1% Base Flood Elevation, but most jurisdictions add to this. Most floodways restrict development in floodways unless they demonstrate that the development will not increase flood levels. In this case, developments in floodways must match those in the SFHA. In the AO/AH zones where the FIRM provides a depth number, finish floors must be at least that high. Where there is no depth number, finish floors must be a specified elevation higher than adjacent grade. The International Building Code (IBC) requires finish floors to be built at 12 inches higher than the closest sanitary sewer or 4 inches higher than the crown of the street, whichever is stricter.



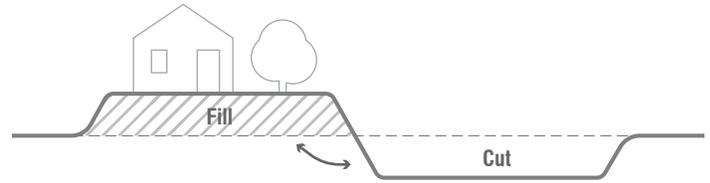
	Floodway	1% Floodplain (SFHA)		0.2% Floodplain	Everywhere
		Zones A1-30, A99	Zones AO / AH (shallow flooding)		
City of Houston	If demonstrated no increase in flood levels, 1% BFE + 1.5 ft	1% BFE + 1 ft	Depth Number + 1 ft Adjacent Grade + 3 ft	Critical Buildings = 0.2% BFE + 12 in	Nearest Sanitary Sewer + 12 in or Crown of Street + 4 in
City of Pasadena	Prohibited	1% BFE + 2 ft No Critical Facilities	Depth Number + 1 ft Adjacent Grade + 2 ft		Nearest Sanitary Sewer + 12 in or Crown of Street + 4 in
City of Baytown	If demonstrated no increase in flood levels, 1% BFE + 2 ft	1% BFE + 2 ft	Depth Number + 1 ft Adjacent Grade + 2 ft		Nearest Sanitary Sewer + 12 in or Crown of Street + 4 in
City of Conroe	If demonstrated no increase in flood levels, 1% BFE + 1 ft	1% BFE + 1 ft	Depth Number + 0 ft Adjacent Grade + 2 ft		Nearest Sanitary Sewer + 12 in or Crown of Street + 4 in
City of Sugar Land	If demonstrated no increase in flood levels, 1% BFE + 1 ft	1% BFE + 1 ft	Depth Number + 0 ft Adjacent Grade + 2 ft		Nearest Sanitary Sewer + 12 in or Crown of Street + 4 in
Missouri City	If demonstrated no increase in flood levels, 1% BFE + 1 ft	1% BFE + 1 ft	Depth Number + 1 ft Adjacent Grade + 3 ft	Adjacent Grade + 1.5 ft 1% BFE @ Nearest Drain + 1 ft	Nearest Sanitary Sewer + 12 in or Crown of Street + 4 in
League City	If demonstrated no increase in flood levels, 1% BFE + 1.5 ft	1% BFE + 1.5 ft	1% BFE + 8 in Adjacent Grade + 2 ft		Crown of Street or Adjacent Grade + 1.5 ft
Harris County (new)	Prohibited unless no increase in base levels, 0.2% BFE + 2 ft	0.2% BFE + 2 ft	Depth Number + 3 ft Adjacent Grade + 6 ft	Res. = adjacent grade + 1 ft* Non-Res. = adj. grade + 6 in*	Res. = adjacent grade + 1 ft* Non-Res. = adj. grade + 6 in*
Fort Bend County	If demonstrated no increase in flood levels, 1% BFE + 1.5 ft	Natural Ground + 2 ft 1% BFE + 1.5 ft	Depth number + 1 ft Adjacent grade + 2 ft		
Montgomery County	If demonstrated no increase in flood levels, 1% BFE + 1 ft	1% BFE + 1 ft	Depth Number + 1 ft Adjacent Grade + 3 ft		
San Jacinto County	If demonstrated no increase in flood levels, 1% BFE + 1 ft	1% BFE + 1 ft	Consider establishing a minimum finish floor		
Liberty County	If demonstrated no increase in flood levels, 1% BFE + 1 ft	1% BFE + 1 ft	Depth Number + 0 ft Adjacent Grade + 2 ft		
Galveston County	If demonstrated no increase in flood levels, 1% BFE + 0 ft	1% BFE + 0 ft or Natural Ground + 1.5 ft	Depth Number + 0 ft Adjacent Grade + 2 ft		
Brazoria County	If demonstrated no increase in flood levels, 1% BFE or natural ground + 2 ft	1% BFE or Natural Ground + 2 ft	Depth Number + 0 ft Adjacent Grade + 2 ft		
Grimes County	If demonstrated no increase in flood levels, 1% BFE + 0 ft	1% BFE + 0 ft	1% BFE + 0 ft Adjacent Grade + 2 ft		
Waller County	If demonstrated no increase in flood levels, 1% BFE + 1.5 ft	1% BFE + 1.5 ft	1% BFE + 0 ft Adjacent Grade + 2 ft		
Walker County	If demonstrated no increase in flood levels, 1% BFE + 1 ft	1% BFE + 1 ft			

* Harris County does not apply these regulations to conforming subdivisions.

WATER STORAGE

Balancing Fill

Fill on a site can impede or redirect water flow. To prevent this, most jurisdictions do not allow any fill in the floodway, unless the developer can demonstrate that flood levels will not increase. In the 1% floodplain, fill may be allowed but often jurisdictions will require fill to be balanced with a “cut” within the site or some small distance away from the site so no water storage capacity in the floodplain is lost.

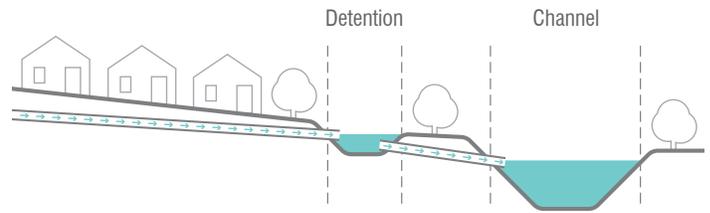


City/County	Floodway	1% Floodplain (SFHA)		0.2% Floodplain
		Zones A1-30, A99	Zones AO / AH (shallow flooding)	
City of Houston	Fill conveyance offset volume requirement	Fill mitigation required		
City of Pasadena	Prohibited unless no increase in flood levels	Mitigated so no loss of flood storage capacity		
City of Baytown	Prohibited unless no increase in flood levels			
City of Conroe	Prohibited unless no increase in flood levels			
City of Sugar Land	Prohibited unless no increase in flood levels	Compensate capacity reduction		
Missouri City	Prohibited unless no increase in flood levels			
League City	Prohibited unless no increase in flood levels	Storage volume equal to amount of encroachment		
Harris County (new)	Prohibited	No fill allowed Offset capacity reduction		
Fort Bend County	Prohibited unless no increase in flood levels	Compacted fill if more than 40 loads per acre		Mitigate alteration of natural flow
Montgomery County	Prohibited unless no increase in flood levels	Compensate capacity reduction		
San Jacinto County	Prohibited			
Liberty County	Prohibited unless no increase in flood levels			
Galveston County	Prohibited unless no increase in flood levels	Compensate capacity reduction	Permitted if increase in BFE is less than 1 ft	
Brazoria County	Offset capacity reduction	Mitigate alteration of natural flow	Mitigate alteration of natural flow	Mitigate alteration of natural flow if >20 loads
Grimes County			Permitted if increase in BFE is less than 1 ft	
Waller County	Prohibited unless no increase in flood levels	If increase in BFE is more than 1 ft, comply with FEMA 44 CFR 65.12	Permitted if increase in BFE is less than 1 ft	
Walker County	Prohibited unless no increase in flood levels	Compensate capacity reduction	Permitted if increase in BFE is less than 1 ft	

WATER STORAGE

Detention

Detention requirements are governed by the authority that owns and maintains the outfall from each site, so these regulations do not vary by floodplain, but are based on the design capacity of the drainage facility. Design capacities and formulae for calculating runoff and drainage vary significantly across jurisdictions. The capacity of a drainage facility may be based on the estimated rainfall amount in a given storm at a specified duration of time.



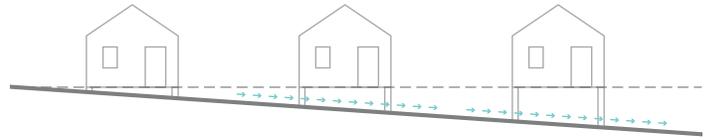
Requirements

City of Houston	Design rainfall duration for area less than 200 acres of drainage area must be greater than 3 hours. Design rainfall duration for area greater than 200 acres must be greater than 6 hours.
City of Pasadena	Runoff rates computed by Director of Public Works. All runoff rates computed on the basis of ultimate development of entire watershed contributing runoff to proposed subdivision.
City of Baytown	Design storm based on rainfall intensity-frequency data used by county flood district.
City of Conroe	
City of Sugar Land	
Missouri City	Design storm runoff will be calculated in accordance with Fort Bend County or Harris County, as applicable.
League City	Stormwater runoff calculated based on whether or not stormwater management techniques have been utilized. For non-platted land, calculated as if land was developed according to existing zoning and as if stormwater management techniques have been utilized.
Harris County (new)	Maximum discharge rate based on capacity of receiving storm sewer or pro-rata share of existing capacity of roadside ditch.
Fort Bend County	Runoff based on analysis of rural areas.
Montgomery County	Flow rates calculated case-by-case, working closely with County Drainage Administrator.
San Jacinto County	Calculations based on fully developed upstream conditions.
Liberty County	
Galveston County	Peak outflow rate at undeveloped conditions.
Brazoria County	Design for 24-hour storm duration. Assume average 40% impervious cover on average for developed areas.
Grimes County	Outfall ditches sized to 100-year rainfall frequency.
Waller County	Runoff to match pre-development flows for 100-year, 25-year, and 10-year at a 24-hour storm duration.
Walker County	
HCFC	Design for 1% and 10% chance rain events at a 24-hour duration, and not exceeding pre-development outfall amounts.

WATER CONVEYANCE

Foundation Types

Enclosures and foundation structures below the lowest floor of a building are regulated so that water is able to flow in its intended path. Most new homes in the Houston area are slab-on-grade on top of fill. This blocks water flow. Pier and beam foundations or perimeter walls with openings, on the other hand, permit water conveyance minimizing negative impact. To achieve this in the floodway, City of Houston and Harris County require open foundation systems with a minimum elevation for the lowest structural member. However, note that foundations are also subject to balancing fill regulations. For most jurisdictions, this means whatever the foundation type is, the development must demonstrate no increase in flood levels. Within the 1% floodplain, a majority of jurisdictions require some percentage of any enclosure below the lowest floor to have a minimum amount of openings.

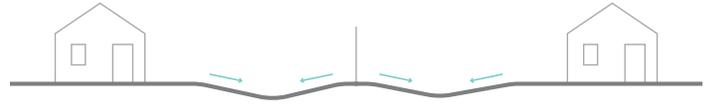


	Floodway	1% Floodplain (SFHA)		0.2% Floodplain
		Zones A1-30, A99	Zones AO / AH (shallow flooding)	
City of Houston	Pier and beam structural members = 1% BFE + 18 in	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		
City of Pasadena	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		
City of Baytown	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		
City of Conroe	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		
City of Sugar Land	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		
Missouri City	Enclosures prohibited below 1% BFE	Enclosures prohibited below 1% BFE		
League City	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		
Harris County (new)	Lowest structural member = 0.2% BFE + 3 ft.	Open foundations No basement in residential	No basement in residential	
Fort Bend County	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		Watertight structure below BFE or flood depth number
Montgomery County	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		Watertight structure below BFE or flood depth number
San Jacinto County	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		
Liberty County	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		
Galveston County	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		
Brazoria County	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		
Grimes County	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		
Waller County	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		
Walker County	Prohibited unless no increase in flood levels - then follow SFHA requirements	If enclosed below lowest floor with 2 openings 1' above grade at 1 in ² / 1 ft ²		

WATER CONVEYANCE

Site Drainage

Site drainage requirements are very generic but where regulated, they have three common underlying goals: to drain away from structures, minimally affect drainage patterns over the site, and cause absolutely no change in drainage patterns on adjacent sites. This can be controlled by sloping away from structures and creating swales on-site to direct water.



1% Floodplain (SFHA)

Zones A1-30, A99

Zones AO / AH
(shallow flooding)

Everywhere

	Zones A1-30, A99	Zones AO / AH (shallow flooding)	Everywhere
City of Houston	Floodway Conveyance Offset Volume at rate by City Engineer		No sheet flow from developed property to adjacent property
City of Pasadena			
City of Baytown		Adequate drainage paths to guide floodwaters away from structures	
City of Conroe			
City of Sugar Land			
Missouri City		Adequate drainage paths to guide floodwaters away from structures	Adequate drainage paths away from structures No alteration of flow on adjacent sites
League City		Adequate drainage paths to guide floodwaters away from structures	
Harris County (new)			Drainage swales permitted for off-site sheetflow only
Fort Bend County			Drainage swales permitted along lot line
Montgomery County			
San Jacinto County			
Liberty County		Adequate drainage paths to guide floodwaters away from structures	
Galveston County			Adequate drainage paths to guide floodwaters away from structures
Brazoria County			Drainage swales permitted along lot line
Grimes County			
Waller County			
Walker County			Adequate drainage paths to direct floodwaters to streets or drainage

Strictest Regulation

No Regulation