

**Fort Bend County – Interim Atlas 14
Drainage Criteria Manual and
Minimum Slab Elevation Criteria
December 2019
Revised September 2021**

*(Note: September 2021 revisions in bold print and
underlined)*

1. Definitions

- a. Minimum Slab Elevation – (abbreviation = MSE) minimum slab elevation of a structure built or substantially improved in Fort Bend County.
- b. Atlas-14 Study – a drainage study using Section 6, Design Rainfall Depth, and the Drainage Criteria Manual to compute the 100-year water surface elevations and water surface ponding elevations for drainage infrastructure and drainage ways.
- c. Base Flood Elevation – (abbreviation = BFE) the 100-year base flood plain elevation established in accordance with the FEMA Flood Insurance Rate Maps and the Flood Insurance Study for Fort Bend County, other drainage study approved by Fort Bend County or Atlas-14 Study.
- d. Existing BFE – the flood plain or water surface elevation approved by Fort Bend County, prior to October 2018.
- e. New BFE – the updated water surface elevation (BFE or subdivision ponding level) established by an Atlas- 14 Study.
- f. Elevation – Elevation means height above mean sea level. The North American Vertical Datum (NAVD) of 1988 shall be used. If a datum other than NAVD 88 is used, a conversion to NAVD 88 must be provided and both the NAVD 88 and alternate datum must be documented within all elevation analyses. (plats, drainage reports, elevation certificates, etc....)

2. Minimum Slab Elevation (MSE)

- g. **Structures on property located within recorded subdivisions**

approved in accordance with FBC Subdivision Regulations. MSE

will be the greater of the following:

- i. 2.0 feet above the existing (Pre-Atlas 14) 500-year water surface elevation for the receiving stream or in the absence of an existing (Pre-Atlas 14) 500-year water surface elevation, 4.0 feet above the Existing (Pre-Atlas 14) BFE*
 - * 2.0' above existing (Pre-Atlas 14) Brazos River BFE will be allowed
- ii. 2.5 feet above the existing (Pre-Atlas 14) 100-year water surface elevation or maximum ponding elevation based on an existing detention facility designed prior to the adoption of these rules;
- iii. 2.0 feet above the lowest top of curb elevation within, or adjacent to, each lot or reserve; or, in the absence of a curb, 2.0 feet above the highest natural ground along perimeter of building foundation and 1.0 foot above any down gradient roadway or any down gradient drainage restraint, whichever is higher.
- iv. In lieu of 2.a.i-ii, 2.0 feet above the New (Atlas 14) BFE, and no lower than the new (Atlas 14) 500- year water surface elevation.

h. Structures on property not located within a recorded subdivision. MSE will
the greater of the following:

- i. 2.0 feet above the existing (Pre-Atlas 14) 500-year water surface elevation for the receiving stream or in the absence of an existing (Pre-Atlas 14) 500-year water surface elevation, 4.0 feet above the Existing (Pre-Atlas 14) BFE*
 - * 2.0' above existing (Pre-Atlas 14) Brazos River BFE will be allowed
- ii. 2.5 feet above the existing (Pre-Atlas 14) 100-year water surface elevation or maximum ponding elevation based on an existing detention facility designed prior to the adoption of these rules;
- iii. 2.0 feet above the lowest top of curb elevation within, or adjacent to, each lot or reserve; or, in the absence of a curb, 2.0 feet above the highest natural ground along perimeter of building foundation and 1.0 foot above any down gradient roadway or any down gradient drainage restraint, whichever is higher.
- iv. In lieu of 2.b.i-ii, 2.0 feet above the New (Atlas 14) BFE, and no lower than the new (Atlas 14) 500- year water surface elevation.

i. Structures located within Zone A. MSE will the greater of the following:

- i. 4.0 feet above the estimated Existing (Pre-Atlas 14) BFE;

- ii. In lieu of 2.c.i, 2.0 feet above the New (Atlas 14) BFE, and no lower than the new (Atlas 14) 500- year water surface elevation.

3. Drainage Master Plans and Impact Analysis

- a. Existing development drainage master plans, at the option of the developer, may be the basis for approval of new sections within a development through January 1, 2020.
- b. New developments, without an approved drainage master plan shall be based on an Atlas-14 Study.
- c. After January 1, 2020, minimum slab elevations and drainage infrastructure for all development shall be based on an Atlas-14 Study.

4. Atlas 14 Analysis Requirements after January 1, 2020

a. New developments without an approved drainage master plan or impact analysis: Evaluate using Section 6, Design Rainfall Depths, to determine pre-development discharges and size detention facilities to not exceed pre-development discharges for the Atlas 14 10-yr, , and 100-yr events. Evaluation of the 500- year event will be required in special circumstances (E.g. changing outfall location along a stream, diverting flows to a different channel, a natural overflow occurs along tract or drainage channel in the 100-year event). **All proposed development shall evaluate pre-development drainage patterns of adjacent off-site, upstream property and provide accommodations to ensure no adverse impact post-development. This evaluation should specifically include, but is not limited to, an analysis of pre-development 100-year sheet flow conditions across the proposed development and the design of necessary drainage infrastructure to sufficiently intercept and convey these flows around/through the new development.**

- b. **A new upstream development, or drainage system modifications within an existing development, draining into a downstream development with facilities sized for a release rate based on the previous (pre-Atlas 14) drainage criteria:** Follow guidelines from 4.a and incorporate an additional scenario with a 12.5" rainfall event (previous criteria), verifying that the outfall structure of the new upstream development does not result in discharges above the allowable release rate (from previously approved drainage report) into the downstream development.

- c. **Expansion of an existing development to incorporate development of off-site areas (areas that in the original drainage report were off site and not a part of the original development) draining through the existing development:** Follow guidelines from 4.a and include an additional scenario with a 12.5" rainfall event, verifying that the outfall structure for the new facilities does not result in discharges above the allowable release rate (from previously approved drainage report) from the off-site area. In addition, the resulting discharges from the existing development and developed off-site areas should not exceed the off-site predevelopment discharges for the Atlas 14 100-yr rainfall event.
- d. **Developments, less than 50 Acres, utilizing the simplified method for detention volume calculations:** no change.
- e. **For developments not described in 4.a-d:** coordinate with FBCDD to establish drainage master plan / impact study evaluation criteria.
- f. **Within an existing development where no modification of the existing outfall is proposed:** detention basins or drainage system facilities constructed prior to or following the implementation of these rules will be allowed to construct additional detention storage, utilize existing detention basin freeboard and allow for ponding in streets to a depth no greater than 1-foot below the lowest slab to accommodate the increase in storage volume resulting from the Atlas 14 100-year rainfall event. Reference the certification requirements in Section 9.

5. Detention Ponds

Detention ponds will be required to have at least 50% of their storage volume drain by way of gravity outfall. Pumped detention shall be routed to a junction box prior to reaching the outfall channel/ditch and the restriction should be achieved by an appropriately sized restrictor pipe draining the junction box. Should road ditch pro-rata share calculations produce a design release rate less than 0.125 cfs/acre, an additional assessment of the detention pond storage capacity must be provided to ensure adequate volume is provided within the detention pond to fully accommodate the 100-year event.

6. Bridge Crossings

For all new or modified bridge crossings, the low chord should be set at lowest at 12" above current 500- year WSE or 12" above the Atlas-14 100-year WSE.

7. Design Rainfall Depths

Table 1 summarizes the rainfall depths to be used within Fort Bend County for all drainage facilities. These values are based on Atlas 14, Volume 11 at latitude 29.5427°, longitude 95.5013°. Values for the 3-year event were interpolated from values for the 2-year, 5-year, and 10-year events. All values correspond to a Partial Duration series.

Table 1. Rainfall Depths

Duration	Rainfall Depths (in)								
	2 yr	3 yr	5 yr	10 yr	25 yr	50 yr	100 yr	500 yr	12.5" Event
5 min	0.59	0.65	0.73	0.84	1.00	1.13	1.26	1.57	0.90
10 min	0.94	1.04	1.16	1.34	1.60	1.80	2.01	2.47	
15 min	1.19	1.31	1.46	1.69	2.00	2.25	2.50	3.11	2.01
30 min	1.70	1.87	2.08	2.39	2.83	3.16	3.50	4.40	3.70
1 hr	2.26	2.49	2.78	3.22	3.83	4.30	4.80	6.20	4.55
2 hr	2.83	3.15	3.53	4.19	5.16	5.99	6.91	9.45	6.05
3 hr	3.17	3.55	4.00	4.82	6.08	7.19	8.47	12.00	6.85
6 hr	3.77	4.27	4.86	5.97	7.72	9.33	11.20	16.30	8.40
12 hr	4.40	5.04	5.79	7.20	9.41	11.40	13.80	20.50	10.45
24 hr	5.09	5.89	6.82	8.55	11.20	13.70	16.50	24.50	12.50

Table 2 summarizes e, b, d coefficients to be used within Fort Bend County. Note that these values are based on a regression analysis optimized (and only valid) for durations **between 10 minutes and up to two-hours**. The rainfall amounts generated using these coefficients do not supersede the rainfall amount in Table 1.

Table 2. Updated e, b, d Coefficients

	50%	33%	20%	10%	4%	2%	1%	0.20%
	(2-year)	(3-year)	(5-year)	(10-year)	(25-year)	(50-year)	(100-year)	(500-year)
E	0.7122	0.7063	0.7033	0.6771	0.6222	0.5782	0.5274	0.4782
b (in.)	45.19	48.73	53.74	55.66	51.65	47.69	42.99	45.22
d (min)	8.51	8.37	8.30	7.43	5.09	3.04	1.08	0.20

8. Impervious Values for Residential areas

For residential areas, use the impervious values outlined in Table 3. If the streets within the subdivision are delineated separately from the lots, use the values under the “without/street” column, otherwise use the impervious values that account for streets. Undeveloped areas within a residential subdivision, such as parks, pipeline corridors, or maintenance berms can be delineated separately and assigned a separate impervious value. For other types of development, refer to table 2-2 of the 2011 Drainage Criteria Manual.

Table 3. Typical Average Values for Impervious Cover

Lot size (ac)		% Impervious	
		without/street	w/street
1/4	0.2500	49	53
1/5	0.2000	50	55
1/6	0.1667	54	58
1/7	0.1429	58	62
1/8	0.1250	62	66
1/9	0.1111	63	66

9. Floodplain Storage Mitigation for conditions where Atlas 14 100-year BFEs are not defined

Any reduction in floodplain storage within the existing 500-year (Pre-Atlas 14) floodplain must be offset with a hydraulically equivalent (one-to-one) volume of mitigation sufficient to offset the reduction. The reduction may result from development or placement of fill within the 500-year (Pre-Atlas 14) floodplain. Such mitigation shall be within the same watershed and shall be provided on the same property within the same hydrologic sub-watershed or at an alternate site meeting the approval of the County Engineer. A full hydrological and hydraulic analysis must be submitted to support a request for mitigation outside the boundaries of the property being developed.

An analysis of the pre-development floodplain storage within a project site,

and the need for sufficient mitigation to ensure no adverse impact post-development, should be conducted for all proposed projects regardless of the FEMA Flood Insurance Rate Maps zone designation at the project site. Additional resources for consideration in this analysis include FBCDD Atlas 14 Master Drainage Plan Studies of local watersheds, areas shown with 100-year ponding greater than 2.0' on the Fort Bend - Countywide Ponding Map, and areas with documented historical flooding.

10. Drainage Report Review Cost

If the drainage report for a proposed development is of a significant technical nature and the Drainage District Engineer determines that it should be reviewed by a technical consultant; the Drainage District will be responsible for the technical consultant's review fee up to and including the first 2 reviews of the drainage report. Any cost associated with the technical consultant's review and/or meetings, pertaining to the development drainage report, in excess of the first 2 will be the responsibility of the development engineer.

11. Certification Memorandum for a Pre-Atlas 14 Development

The purpose of the "certification statement" below is to allow a MUD/LID/ Development Engineer of a development (with a pre-Atlas 14 approved report), to submit a memorandum, with the below statement, to FBCDD which will detail the pre-Atlas 14 100-yr WSEL and post-Atlas 14 100-yr WSEL for the drainage system. This memorandum will confirm conformance with section 4(f) of Interim Guidelines and documenting the 1-foot of freeboard from lowest slab elevation to the Atlas 14 100-yr WSEL. This memo will be prepared for each detention basin service area within a pre-Atlas existing development and will be in lieu of a new formal, Atlas 14 drainage report for said development. This memo is only applicable for conditions where:

- a. Ultimate outfall size/configuration, including the extreme event outfall does not change from previously approved (pre-Atlas 14) analysis/design
- b. Original service area defined by previously approved drainage report (pre-Atlas 14) has not changed (such as land area or land use density)
- c. The intent of section is to promulgate a policy which provides for continued development without modification or increase of the size of the existing outfall structure.

Certification Statement

The design of this project, as shown on these signed and sealed construction plans, has been analyzed in accordance with the Fort Bend County Drainage Criteria Manual and the Interim Atlas 14 Drainage Criteria Manual and Minimum Slab Elevation Criteria effective January 1, 2020 and it has been found that for storms utilizing Atlas 14 rainfall up to and including the one percent annual exceedance probability event: (1) floodwater will not inundate any existing structures, and (2) proposed finished floor elevations of new structures will comply with Fort Bend County Floodplain Regulations.