



Flood Infrastructure Classification Guidance

to Support Statewide and Regional Flood Planning



Agenda

- Texas Water Development Board Flood Planning Initiative
- Findings from the 1st Statewide Flood Plan
- Project Overview
- Flood Infrastructure Classification Guidance
- Questions

Texas State Flood Plan

- Statewide
- Watershed based
- Bottom-up approach
- The state flood plan integrates information from 15 regional flood plans
- 10 tasks

15 Regional
Flood Plans



State
Flood Plan



over
61,000 pages



condensed into
285 pages

Texas State Flood Plan

Existing Flood Risk

(in 1 percent [100-year] and 0.2 percent [500-year] annual chance flood hazard areas)



5,219,900
Population



1,664,200
Buildings



12,654,000
Agricultural area (acres)



63,900
Roadway miles





1,295,700
Residential buildings



6,258
Hospitals, emergency medical services, fire stations, police stations, and schools

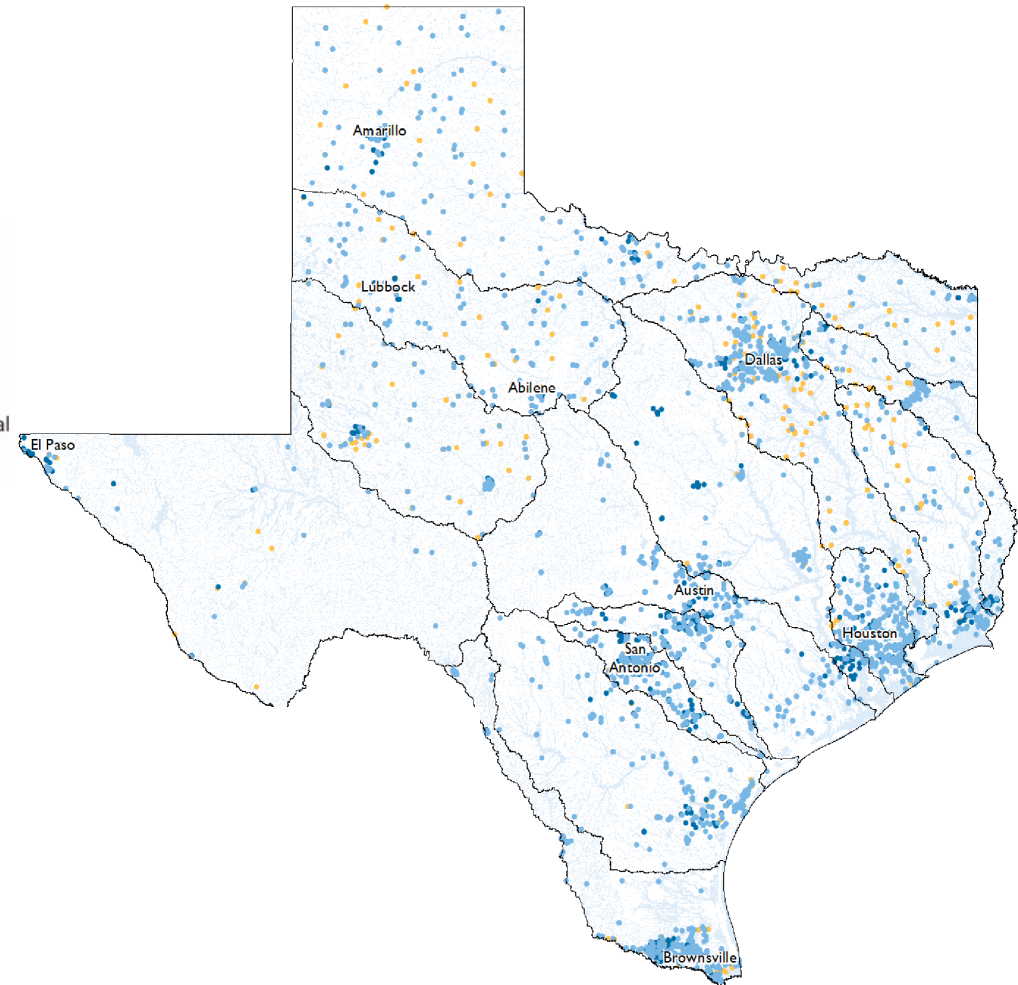
Recommended Studies, Projects and Strategies

 Flood management evaluations (3,097)
\$2.6 billion+

 Flood mitigation projects (615)
\$49 billion+

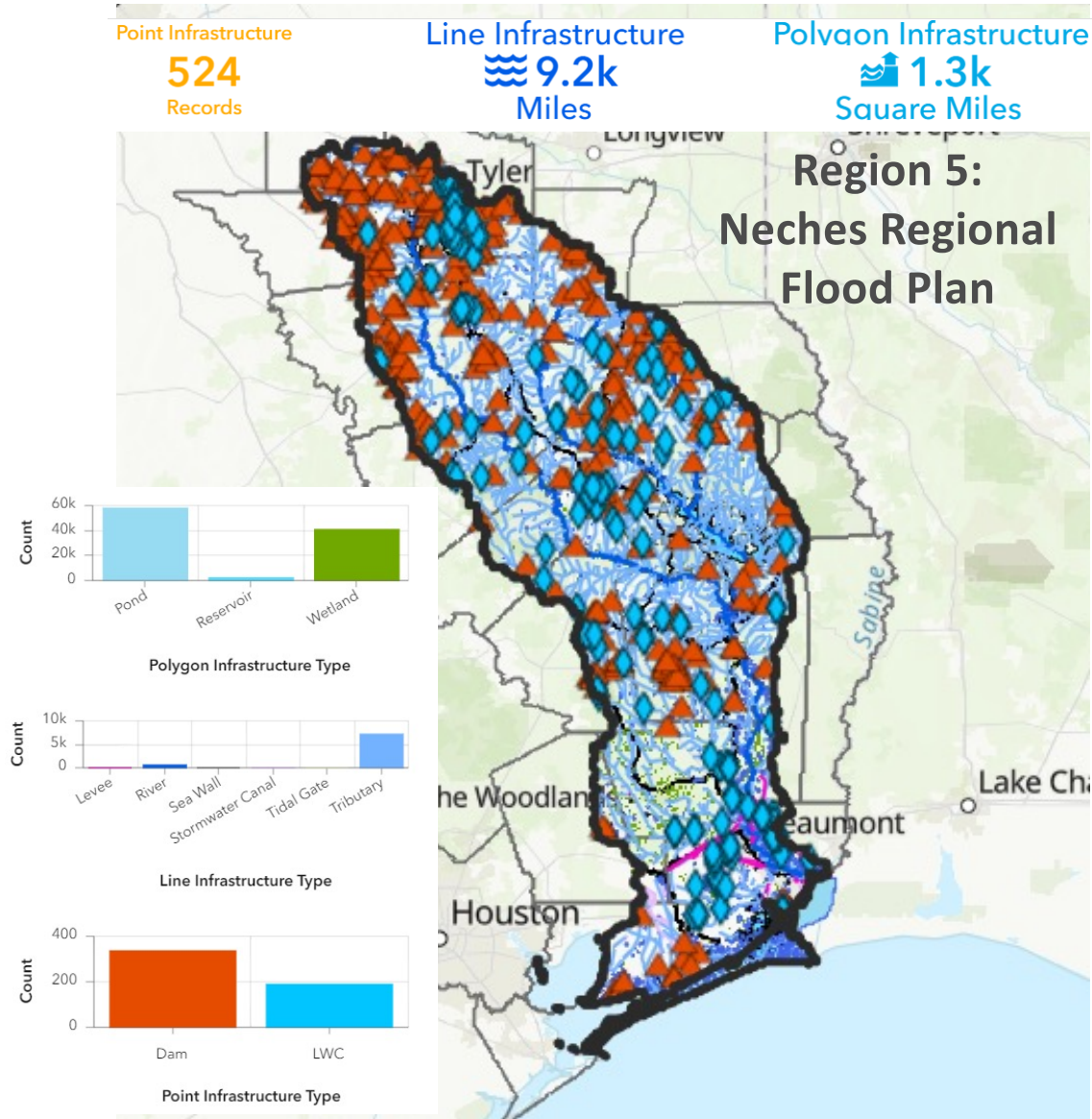
 Flood management strategies (897)
\$2.8 billion+

Total \$54.5 billion+



Task 1: Flood Planning Area Description Infrastructure Assessment

- Texas Administrative Code requires a general description of the location, condition, adequacy, and functionality of major flood related infrastructure
 - natural features (i.e., rivers, wetlands, playa lakes, natural coastal features, etc.)
 - constructed flood infrastructure (dams, levees, low water crossing, bridges, stormwater management systems, detention and retention ponds, coastal infrastructure, etc.)



Findings from the 1st Statewide Flood Plan

- Collected over a million flood infrastructure assets statewide

Natural Flood Infrastructure

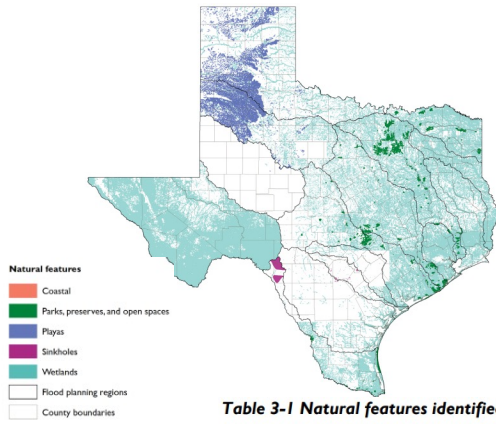


Table 3-1 Natural features identified by the regional flood planning groups*

Region	Rivers/tributaries (mile)	Wetland (acre)	Playa (acre)	Playa (count)	Sinkhole	Open space (acre) ^a	Coastal ^b	Other ^c
1	13,152	193,012	204,563	9,302				
2	7,233	432,919				180,055		
3	0.3	447,706			16	317,932		
4	6,267	333,034						
5	8,872	237,147						
6	2,505	188,756						
7	6,854	36,896	147,260	10,109				
8		246,462			3	106,861	63	
9	19,898	132	38	3				26
10	6	275,570			7	131,981	42	
11	4,214	46,405						
12	8,246	58,081			78			
13	29,050	182,377			29			
14	83,579	346,202						
15		355,455			5	44,208	27	
Total	189,875	3,380,155	351,861	19,414	138	781,037	132	26

Constructed Flood Infrastructure

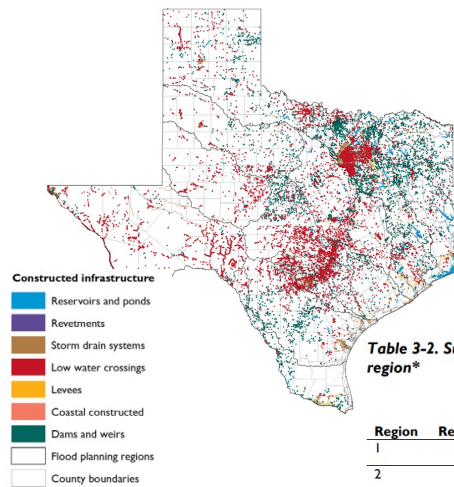


Table 3-2. Summary of major constructed flood infrastructure types by flood planning region*

Region	Reservoirs	Dams	Levees (mile)	Low water crossings	Ponds	Storm drain system (mile) ^a	Coastal	Gauges ^b	Other ^c
1	22	624	14	1,249	25,132	329		35	5
2	29	487	100	133	115				1
3		1,845	402	2,298	531	3,599		1,545	115,443
4	15	341	64	132	58,591	235			0
5	1,159	338	205	186	57,780	79	160		20
6	17	180	152	239	22,738	178	59	312	0
7	12	240	0	300	37,617	184			0
8	67	485	255	1,168	281		40	1,942	53
9	76	120	5	538	27,968				0
10	2	700	110	1,354	2,030		454	157	4
11	6	221	28	815	30,502	517			0
12	28	162	13	496	424	806		49	2,714
13	10	501	25	576	1,483	1,102	6	65	2,707
14		218	249	1,782	674	774			4,197
15		269	261	129	199	128	217		5
Total	1,443	6,731	1,884	11,395	266,065	7,931	936	4,105	5,876

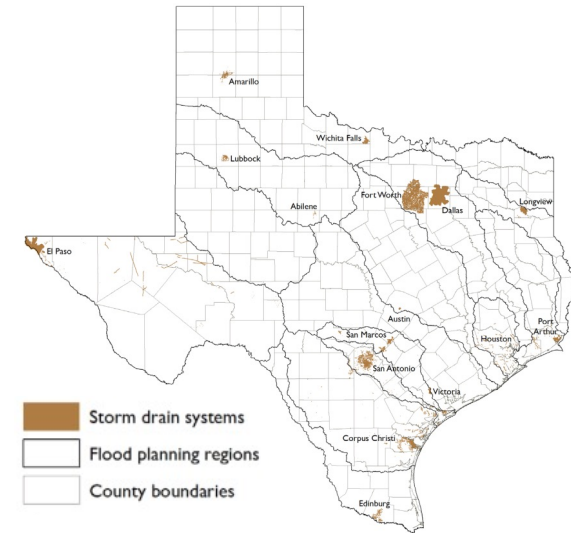
Findings from the 1st Statewide Flood Plan

Table 3-3. Summary of the functionality of identified major flood infrastructure

Region	Total infrastructure	Functional	Non-functional	Functionality unknown
1	66,637			66,637
2	40,656	40,572	20	64
3	237,849	708	76	237,065
4	102,649	32	31	102,586
5	108,066	31	26	108,009
6	73,934			73,934
7	69,365			69,365
8	52,272	100	115	52,057
9	62,434	69	1	62,364
10	54,296			54,296
11	74,446			74,446
12	52,034	2,745	13	49,276
13	98,801	2,867	15	95,919
14	235,891	435	136	235,320
15	32,313			32,313
Total	1,361,643	47,559	433	1,313,651

Note: Blank cells signify that the functionality of identified major flood infrastructure is not categorized and should not be interpreted as definitive statements of operational status; they merely reflect that the regional flood planning group(s) did not supply information regarding functionality

Figure 3-17. Locations of stormwater management systems as reported by the regional flood planning groups*



* Map reflects stormwater management systems as reported by the regional flood planning groups. This information is displayed with the acknowledgement that much of the state's stormwater infrastructure may not have been identified by the regional flood planning groups due to constraints in the availability of infrastructure data across the state. The TWDB is currently funding and guiding a research project to develop infrastructure assessment guidance and a toolkit to help local communities identify and determine functionality of their existing stormwater infrastructure.

- 96% of identified assets classified as “Functionality Unknown”
- 98% of identified assets classified as “Condition Unknown”
- Potential data availability challenges

Findings from the 1st Statewide Flood Plan

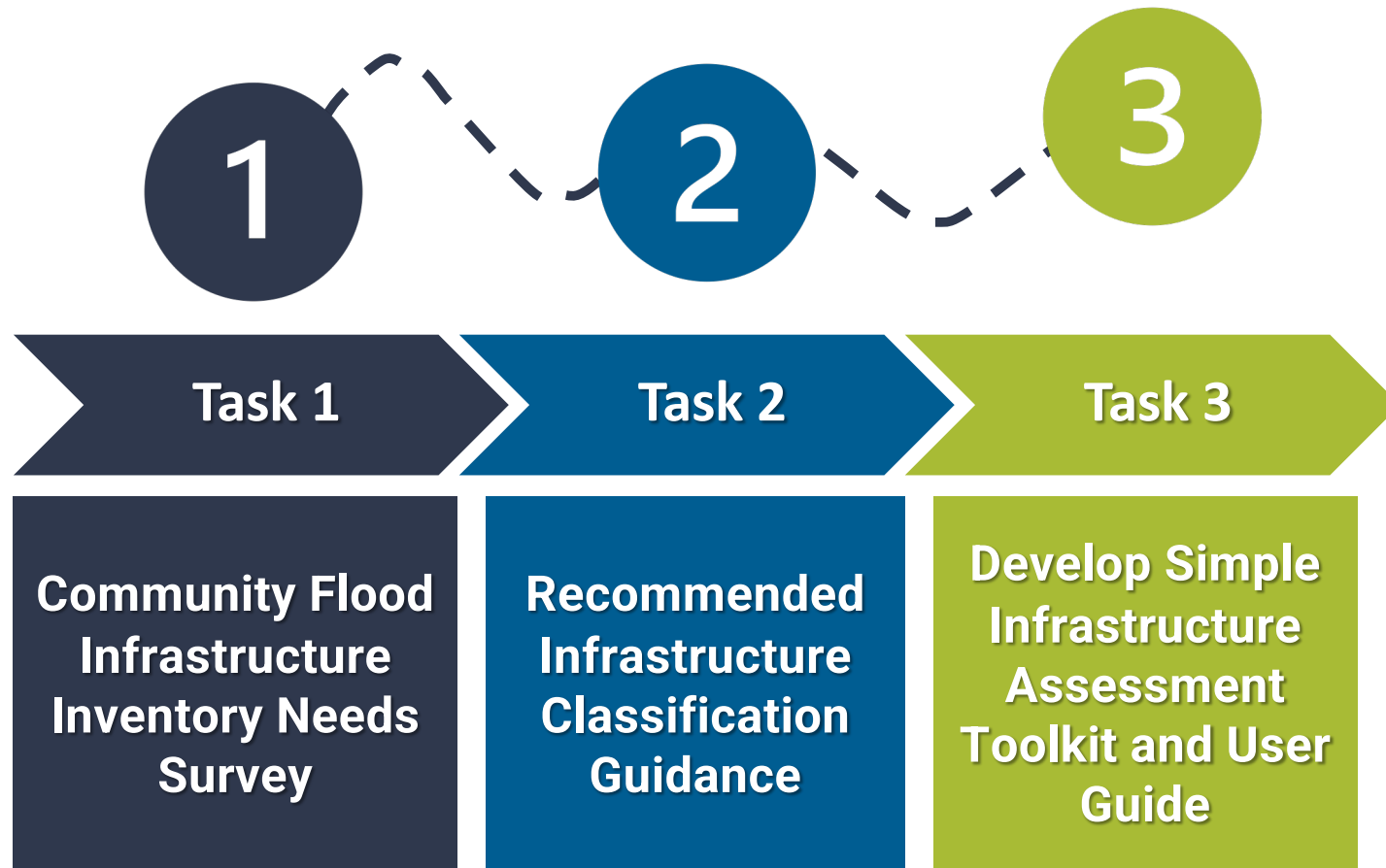
Two Flood Infrastructure Inventory Challenges

- Majority of the identified flood infrastructure was assigned an Unknown Functionality or Condition
- Potential gaps in the statewide flood infrastructure inventory

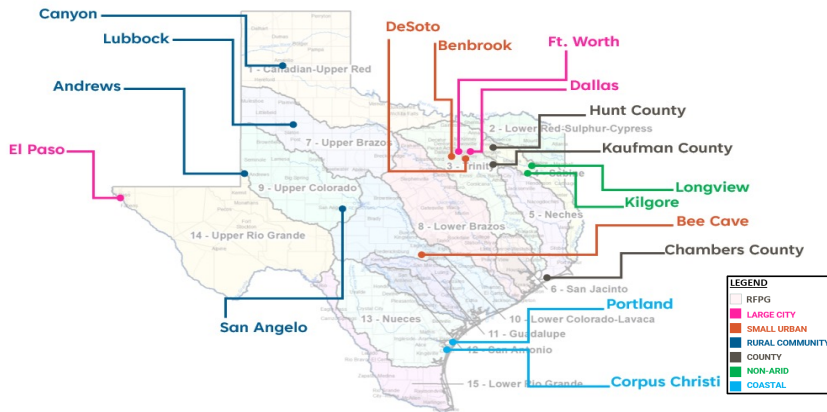
Potential Root Causes

- Inventory does not exist due to lack of resources at local level
- Inventory does not exist due to lack of GIS capability
- Inventory exists but communities have limited incentive to provide to RFPG
- Lack of guidance and data to classify flood infrastructure provided by communities

Project Overview



Community Survey



Goal: align technical guidance and toolkit with community needs to enhance the Statewide Flood Infrastructure Inventory

Survey Findings



Limited In-house Resources and Expertise



Need for Terminology Standardization and Guidance



Need for a Simple Data Collection and Management Tool

Flood Infrastructure Classification Guidance

Table 3-3. Summary of the functionality of identified major flood infrastructure

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CONDITION

- **Deficient:** The infrastructure or natural feature is in poor structural or non-structural condition and needs replacement, restoration, or rehabilitation.
- **Non-Deficient:** The infrastructure or natural feature is in good structural or non-structural condition and does not require replacement, restoration, or rehabilitation.
- **Unknown:** The condition of infrastructure or natural feature is unknown.

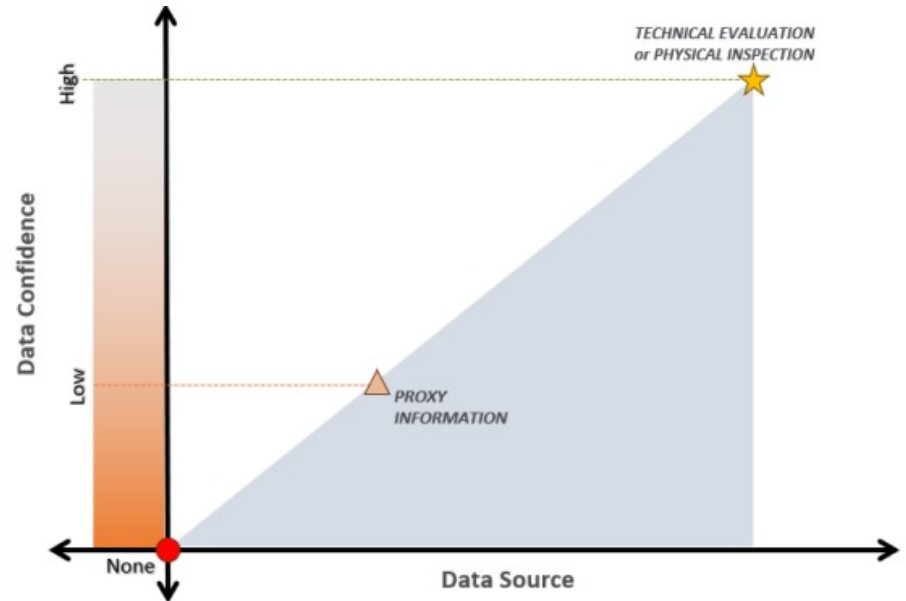
FUNCTIONALITY

- **Functional:** The infrastructure is serving its intended design level of service.
- **Non-Functional:** The infrastructure is not serving its intended or design level of service.
- **Unknown:** The functionality or capacity for infrastructure is unknown.

- Establish guidance on assigning condition and functionality to flood infrastructure where possible
- Identify potential data sources that can be leveraged in the absence of report or study findings
- Develop a data confidence system to communicate the basis of the classification

Classification Data Confidence

- New fields for all existing infrastructure feature classes:
 - Functionality Data Confidence
 - Condition Data Confidence
- Simple rating system:
 - High = Study/Report
 - Low = Proxy Information
 - None = No Data
- Allows users to assign data confidence to the results of the classification



This figure illustrates the three-tier classification (high, low, or none) used to rate the reliability of data sources in flood infrastructure assessments. High-confidence sources (e.g., recent H&H studies and field inspections) are preferred, while lower-confidence or proxy information can still be utilized when technical evaluations and empirical data are not available.

Flood Infrastructure Classification Guidance

- Able to develop guidance for functionality and condition of constructed flood infrastructure
- Due to the nature of natural flood infrastructure, only condition classification guidance was developed

Flood Infrastructure Type	Functionality	Condition
Dams, Reservoirs, and Weirs	Y	Y
Levees	Y	Y
Roadway Stream Crossings, Culverts, and Bridges	Y	Y
Low Water Crossings	Y	Y
Storm Drain Systems, Inlets, Channels, Tunnels, and Ponds	Y	Y
Revetments and Coastal Constructed (Sea Barriers, Sea Walls, and Tidal Barriers)	Y	Y
Rivers and Tributaries	N	Y
Wetlands and Estuaries	N	Y
Playas	N	Y
Dunes	N	Y
Fans	N	N
Parks or Open Spaces	N	N
Coastal Natural	N	N
Sinkholes	N	N
Gauges	N	N

Constructed Flood Infrastructure Classification Guidance Example

Table 2-5: Roadway Stream Crossings, Culverts, and Bridges Condition Classification Guidance

	DEFICIENT	NON-DEFICIENT
HIGH	Documented as deficient in a report or study performed in the last 10 years	Documented as non-deficient in a report or study performed in the last 10 years
LOW*	<ul style="list-style-type: none"> Age is greater than 50 years OR Institutional knowledge of structural deficiency OR There is limited O&M budget relative to the amount of infrastructure managed by the asset owner 	<ul style="list-style-type: none"> Age is less than 50 years AND No institutional knowledge of deficiency

*Use engineering judgment to assess whether the characteristics can inform, with a low confidence level, the condition classification.

Table 2-6: Roadway Stream Crossings, Culverts, and Bridges Functionality Classification Guidance

	FUNCTIONAL	NON-FUNCTIONAL
HIGH	Documented as functional in a report or study performed since 2018 (NOAA Atlas 14 publication date)	Documented as non-functional in a report or study performed since 2018 (NOAA Atlas 14 publication date)
LOW*	<ul style="list-style-type: none"> Based on <i>Task 2 Existing Flood Risk Exposure</i>, there appears to be capacity to pass the 100-year event OR No institutional knowledge of capacity concerns 	Institutional knowledge of capacity concerns

*Use engineering judgment to assess whether the characteristics can inform, with a low confidence level, the functionality classification.

*If Task 2 Analysis indicates less than 100-year capacity for the crossing, but the design level of service is unknown, the functionality should be classified as unknown with Low data confidence.

Natural Flood Infrastructure Classification Guidance Example

Table 3-1: Rivers and Tributaries Condition Classification Guidance

	DEFICIENT	NON-DEFICIENT
HIGH	Documented as deficient in a report or study performed in the last 10 years	Documented as non-deficient in a report or study performed in the last 10 years
LOW*	<ul style="list-style-type: none"> Urban reaches only: Institutional knowledge of severe bank erosion, including trees falling into the waterway due to bank undercutting, exposed tree roots, or other visible deficiencies <u>OR</u> A reach with unstable slopes (steeper than 2:1) 	<ul style="list-style-type: none"> Any reach located in a rural area <u>OR</u> An urban reach with no institutional knowledge of deficiency <u>OR</u> An urban reach with stable slopes (flatter than 2:1)

*Use engineering judgment to assess whether the characteristics can inform, with a low confidence level, the condition classification.

Flood Infrastructure Classification Toolkit Goals

1. Be a resource for communities without GIS to submit their inventory to the Regional Flood Planning Consultants
2. Be a starting point to help communities with limited resources apply asset management principles to their flood infrastructure
3. Apply the flood infrastructure classification guidance as assets are added to the toolkit

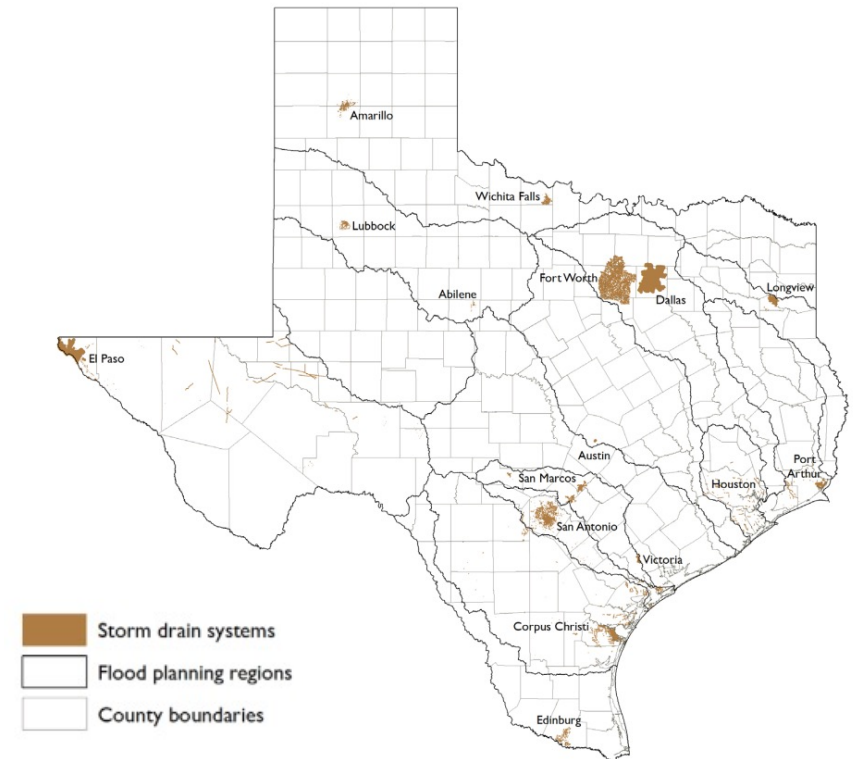


Figure 3-17. Locations of stormwater management systems as reported by the regional flood planning groups*

Flood Infrastructure Classification Toolkit

Asset Record Entry Form		Detailed Asset Inventory													Asset Condition and Capacity Assessment									
<input type="button" value="SUBMIT RECORD TO TABLE"/> <input type="button" value="CLEAR ENTRY FORM"/>		Unit of Measure	Asset Category	Asset Type	Subcategory (optional)	Name	Description	County	Notes	Starting Address or (X,Y) Coordinate	Ending Address or (X,Y) Coordinate	Year Constructed	Material	Diameter (ft)	Length (ft)	Width (ft)	Height (ft)	Official Study or Report Available?	Report for Deficiency, Functionality, or Both?	Report Year After 2018?	Report/Study Deficiency (Condition) Rating	Report/Study Functionality (Capacity) Rating	Decision Tree Deficiency (Condition) Rating	Decision Tree Functionality (Capacity) Rating
Detailed Asset Info		Count	CONSTRUCTED	LEVEE				BEE										Yes	Both	Yes	Non-Deficient	Functional		
Asset Category: CONSTRUCTED		Count	CONSTRUCTED	DAM		FNI	QWERTY	ARCHER										Yes	Both	Yes	Non-Deficient	Functional		
Asset Type: DAM		Count	CONSTRUCTED	DAM		FNI	QWERTY	ARCHER										Yes	Both	Yes	Non-Deficient	Functional		
Subcategory:		Count	CONSTRUCTED	LEVEE	South St Levee 1			BRAZORIA			2000							Yes	Both	Yes	Non-Deficient	Functional		
Asset Name:		Count	CONSTRUCTED	DAM														Yes	Functionality	No		Functional	Non-Deficient	
Asset Description:																								
County:																								
Notes:																								
Starting Address or (X,Y) Coordinate:																								
Ending Address or (X,Y) Coordinate:																								
Year Constructed:																								
Material:																								
Diameter (ft):																								
Length (ft):																								
Width (ft):																								
Height (ft):																								
Condition and Capacity Assessment																								
Study or Report available?																								
Is Report for Deficiency, Functionality, or Both?																								
Report Year After 2018?																								
Report/Study Deficiency (Condition) Rating:																								
Report/Study Functionality (Capacity) Rating:																								
Institutional Deficiency (Condition) Rating:																								
Institutional Functionality (Capacity) Rating:																								
Deficiency (Condition) Description:																								
Functionality (Capacity) Description:																								

1. User enters asset attributes into the Entry Form and selects "Submit Record to Table"

2. Asset data is copied into the Detailed Asset Inventory Table

3. Assets are classified automatically based on the provided data



Flood Infrastructure Classification Guidance and Toolkit Documentation

- Envisioned as living documents to be revised over time
- The Guidance and the Toolkit are available at the TWDB Flood Planning Website
- 2028 Regional Flood Plan Working Documents

[2028 Regional Flood Plan Working Documents \(2024-2028\) | Texas Water Development Board](#)

Supporting Studies & Materials

1. [Flood Planning Geodatabase Templates](#) The TWDB generated template GIS geodatabases with multiple feature classes and tables for the RFPGs. Each planning group must fill the template geodatabase with relevant regional flood planning data. The template geodatabases are populated with feature classes and fields to match the specifications in Exhibit D: Data Submittal Guidelines. The geodatabase templates are being provided with the guidelines. (01/08/2025)
2. [Flood Planning Data Hub](#): To support the Regional Flood Planning Groups (RFPGs), the TWDB has assembled a wide array of flood-related data. The data, all of which come from publicly available sources, has been centralized into a single, easy-to-use [Data Hub](#). (01/08/2025)
3. [Benefit-Cost Analysis \(BCA\) Input Tool](#) and [Instructions](#): The TWDB funded and guided the development of a user-friendly benefit cost analysis (BCA) input interface in the form of a spreadsheet document. This is being provided alongside the guidelines. [Summary of updates \(01/26/2024\)](#)
4. **Infrastructure Assessment Toolkit**: The TWDB funded and guided the development of an Infrastructure Assessment Toolkit to assist with the assessment of the condition and functionality of major constructed flood infrastructure in Texas.
[Infrastructure Assessment Classification Guidance](#): This document provides guidance on classifying the condition, functionality and data confidence rating of constructed and natural flood infrastructure. (2/19/2025)
[Infrastructure Assessment Toolkit](#): This is a spreadsheet-based resource designed for communities without a GIS-based inventory. (2/19/2025)
5. [Draft Floodplain Quilt](#): The floodplain quilt consists of multiple layers of data from various sources available throughout the state to 'quilt' together a single flood hazard dataset. The Quilt is only the starting point of flood hazard data for the RFPGs. RFPGs will need to review and potentially re-prioritize the quilt data as appropriate by location and incorporate additional information available in their respective regions. (1/27/2025)



Reem J. Zoun, PE, CFM

Assistant Deputy Executive
Administrator

Reem.Zoun@twdb.Texas.gov

512 475 1546

Scott Hubley, PE

Vice President, Freese and
Nichols, Inc.

Scott.Hubley@freese.com

817 343 9194

Trey Shanks, PE

Vice President, Freese and
Nichols, Inc.

Trey.Shanks@freese.com

817 455 8739

Questions

