FLOOD

Hazard Profile

Floods generally result from excessive precipitation and the severity of a flood event is typically determined by a combination of several major factors, including: stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions, and the degree of vegetative clearing and impervious surface. Generally floods are long-term events that may last for several days. The primary types of general flooding are inland and coastal flooding. Inland flooding is profiled in this section since coastal flooding is not applicable to the study area.

Inland or riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. It is natural and inevitable as it is the overbank flooding of rivers and streams, typically resulting from large-scale weather systems that generate prolonged rainfall over a wide geographic area. Some river floods occur seasonally when winter or spring rainfalls fill river basins with too much water, too quickly. Torrential rains from decaying hurricanes or tropical systems can also produce river flooding.

Location

Location of flood zones in the CVCOG Region is illustrated in Figures 5-1 to 5-17. No DFIRM or Q3 digital flood maps were available for any of the counties in the CVCOG. However, other digital flood map sources were available for four counties in entirety and partially available for four counties and the cities within those four counties. The source for the flood maps was First American Flood Data Service. No flood maps were available for the City of Big Lake. All flood zones mapped are the 100 year event probabilities or the base flood.

Figure 5-1. Estimated Flood Zones in the CVCOG Region

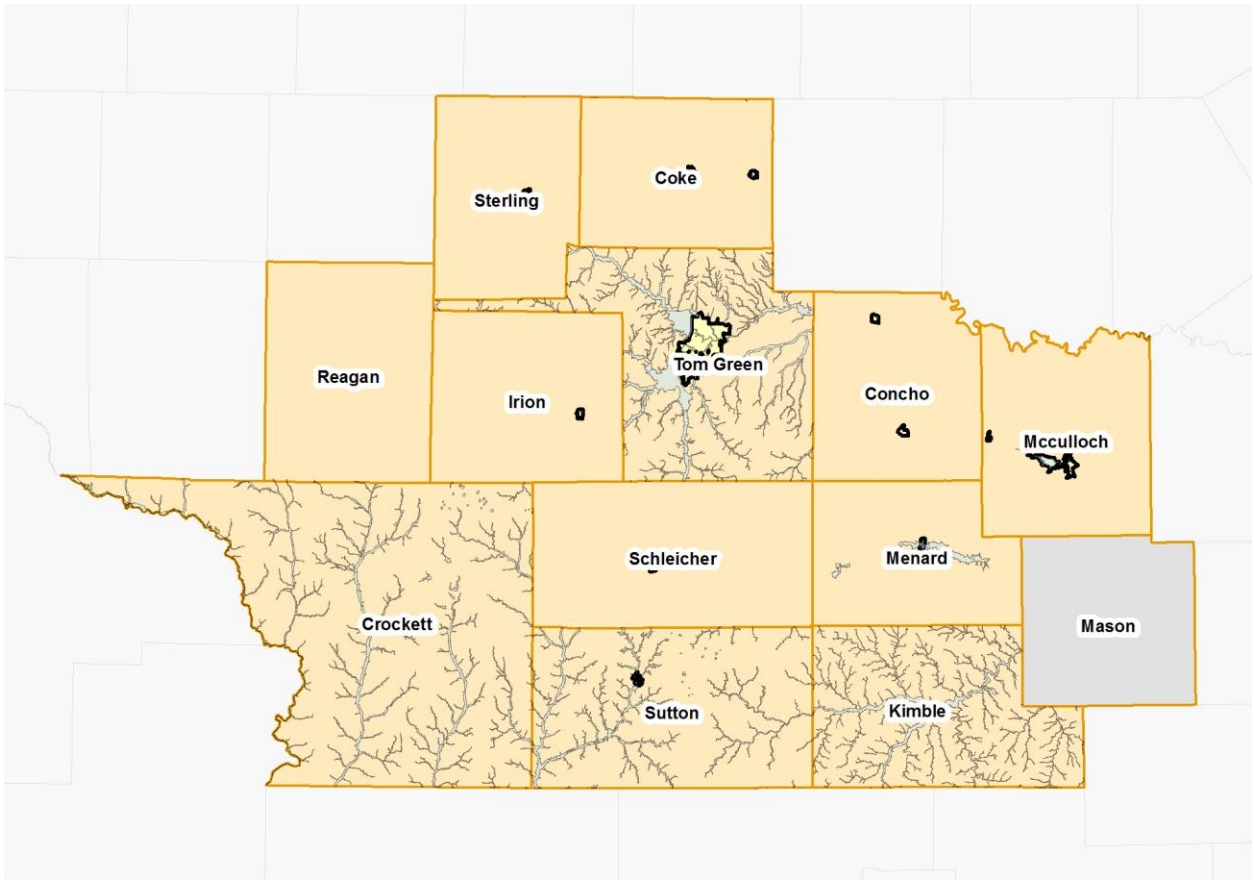

Figure 5-2. Estimated Flood Zones in the Town of Bronte (Coke County)

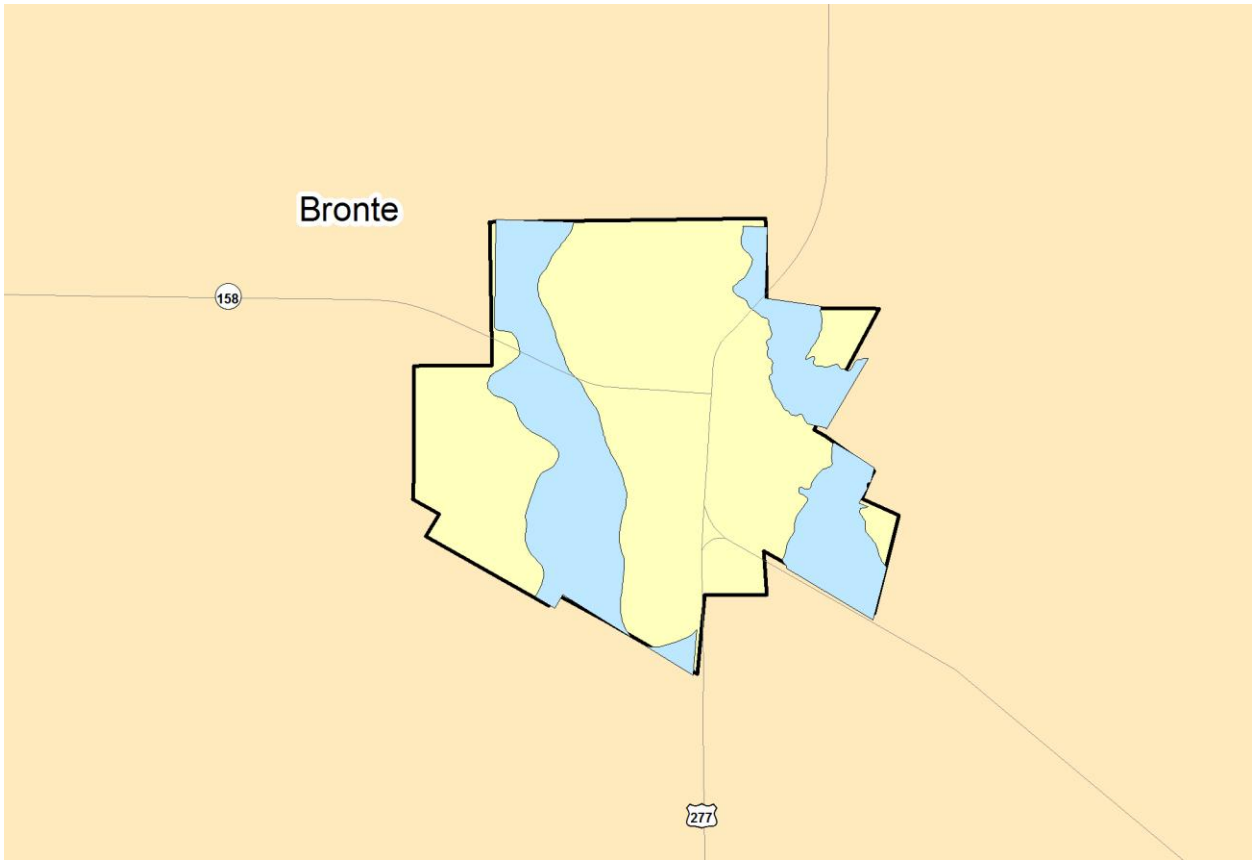

Figure 5-3. Estimated Flood Zones in the City of Robert Lee (Coke County)

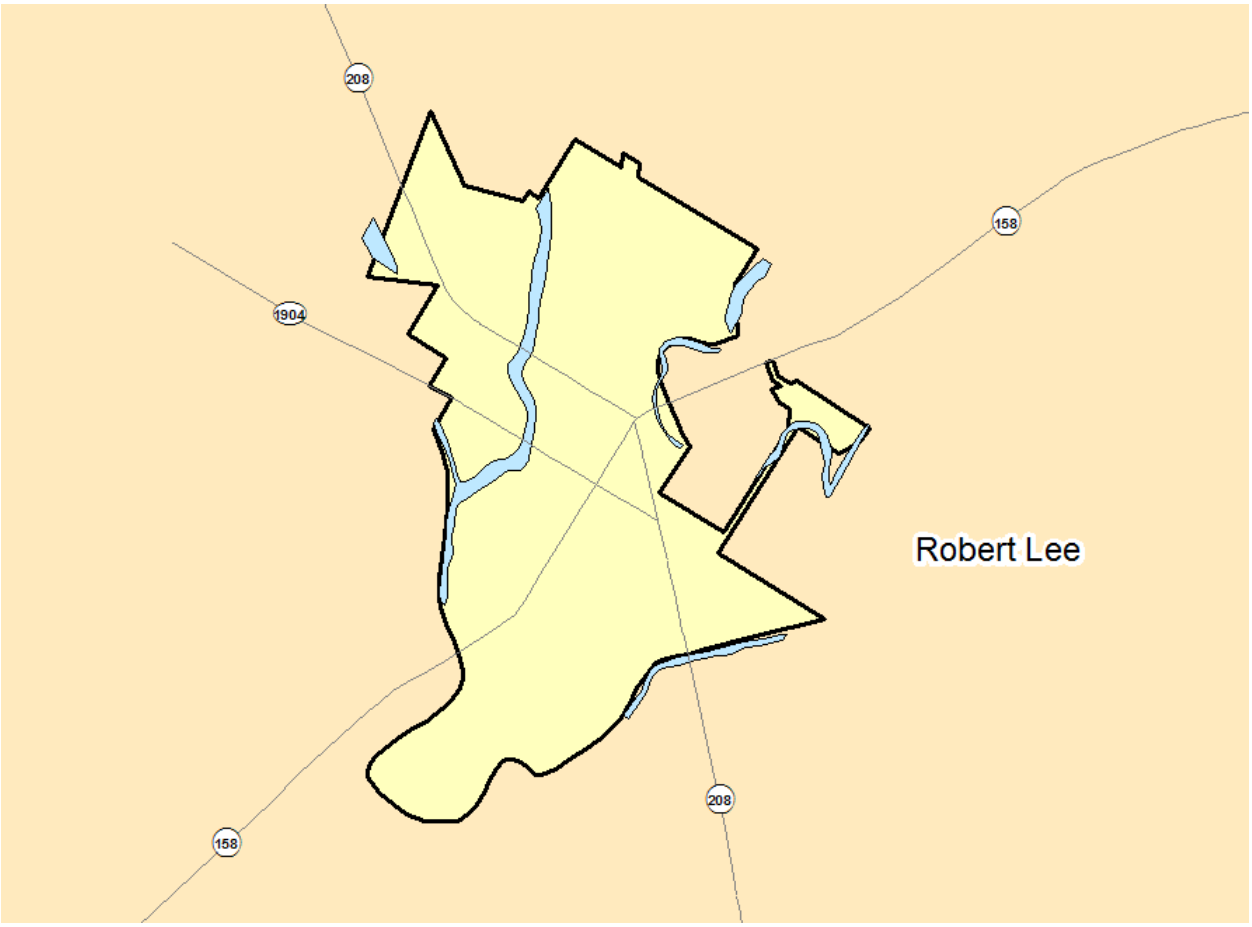

Figure 5-4. Estimated Flood Zones in the City of Eden (Concho County)

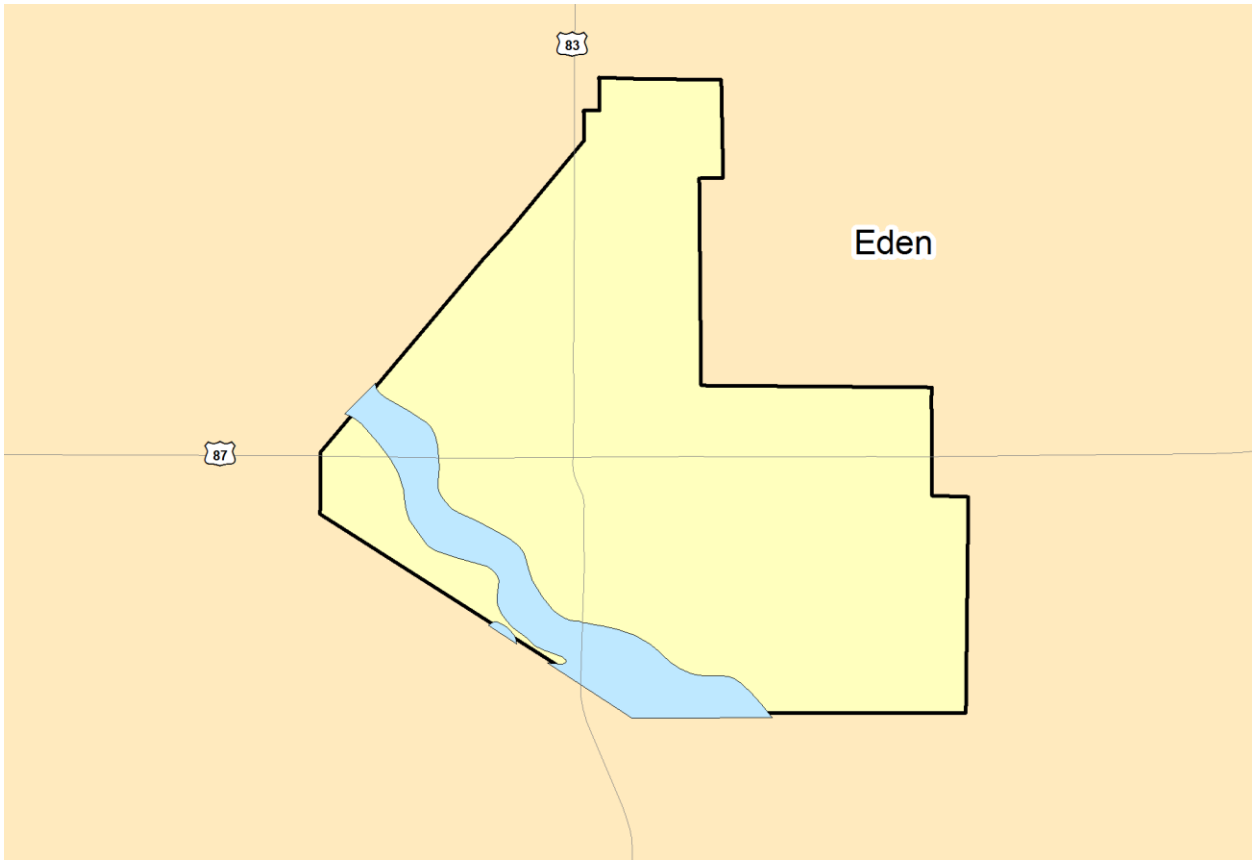

Figure 5-5. Estimated Flood Zones in the Town of Paint Rock (Concho County)

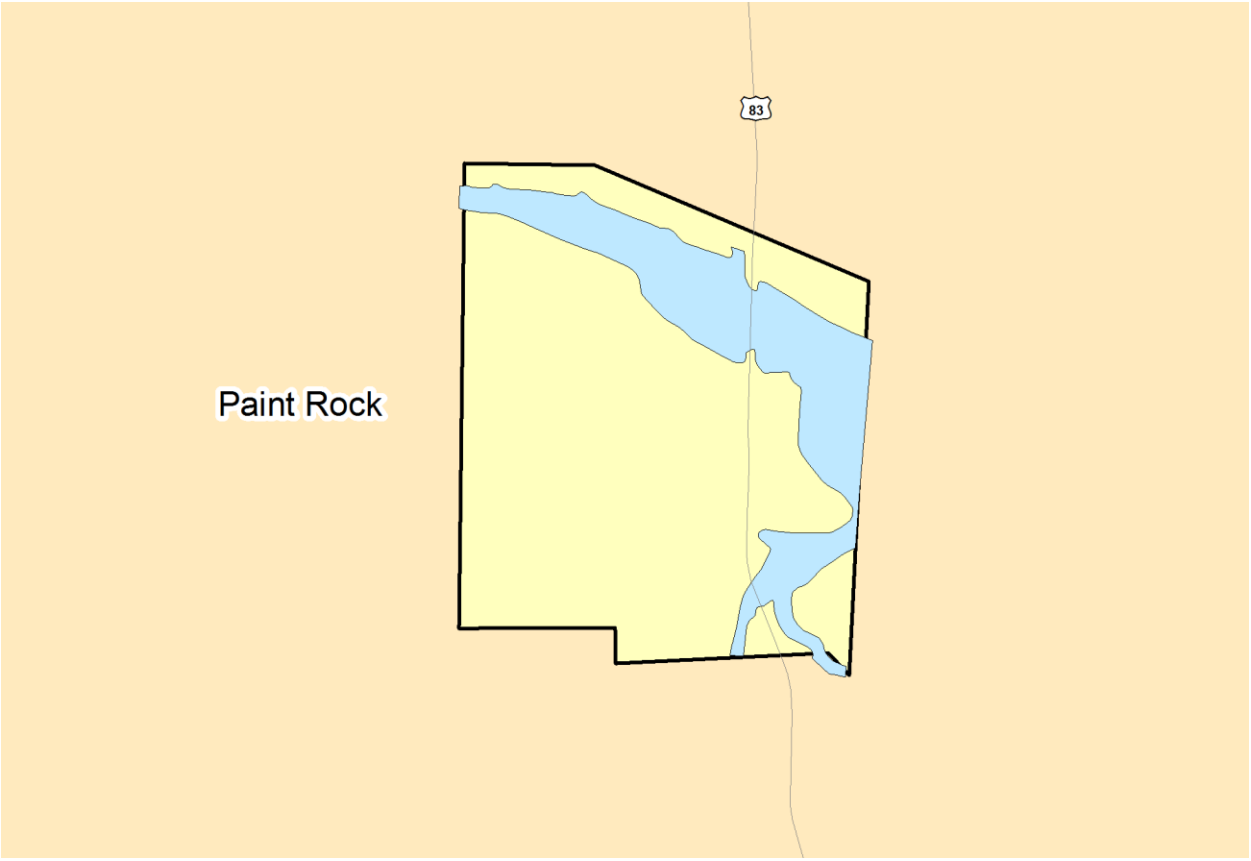

Figure 5-6. Estimated Flood Zones in Crockett County

Figure 5-7. Estimated Flood Zones in the City of Mertzon (Irion County)

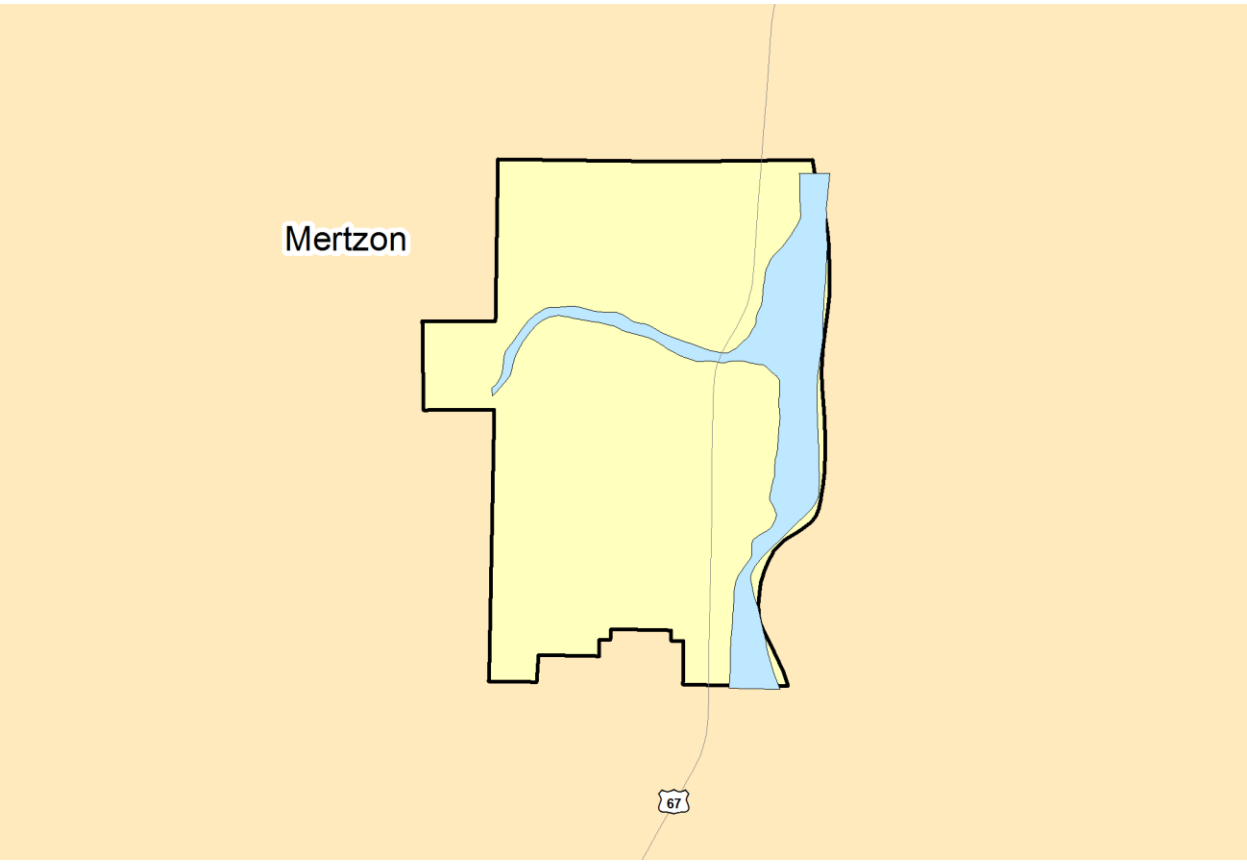

Figure 5-8. Estimated Flood Zones in Kimble County

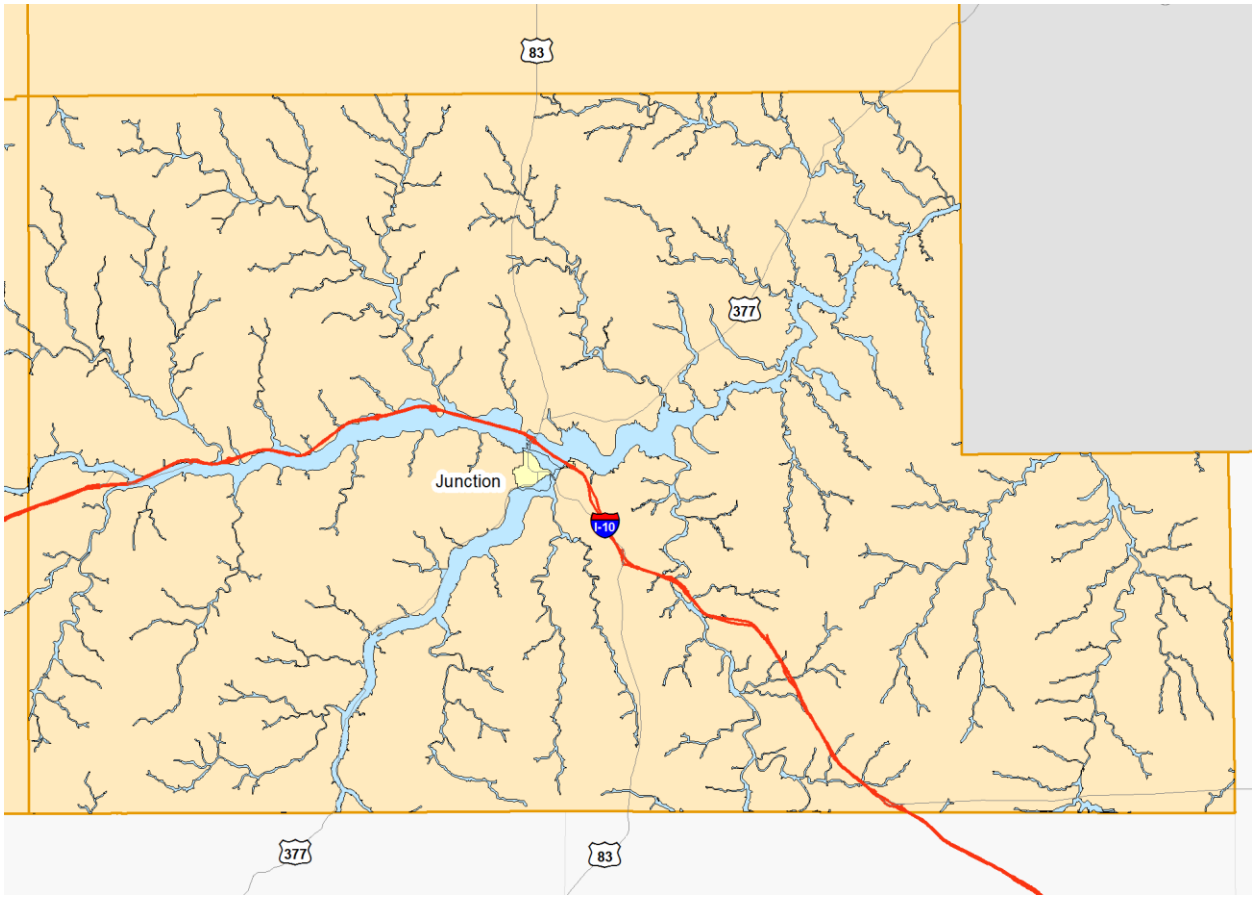

Figure 5-9. Estimated Flood Zones in the City of Junction (Kimble County)

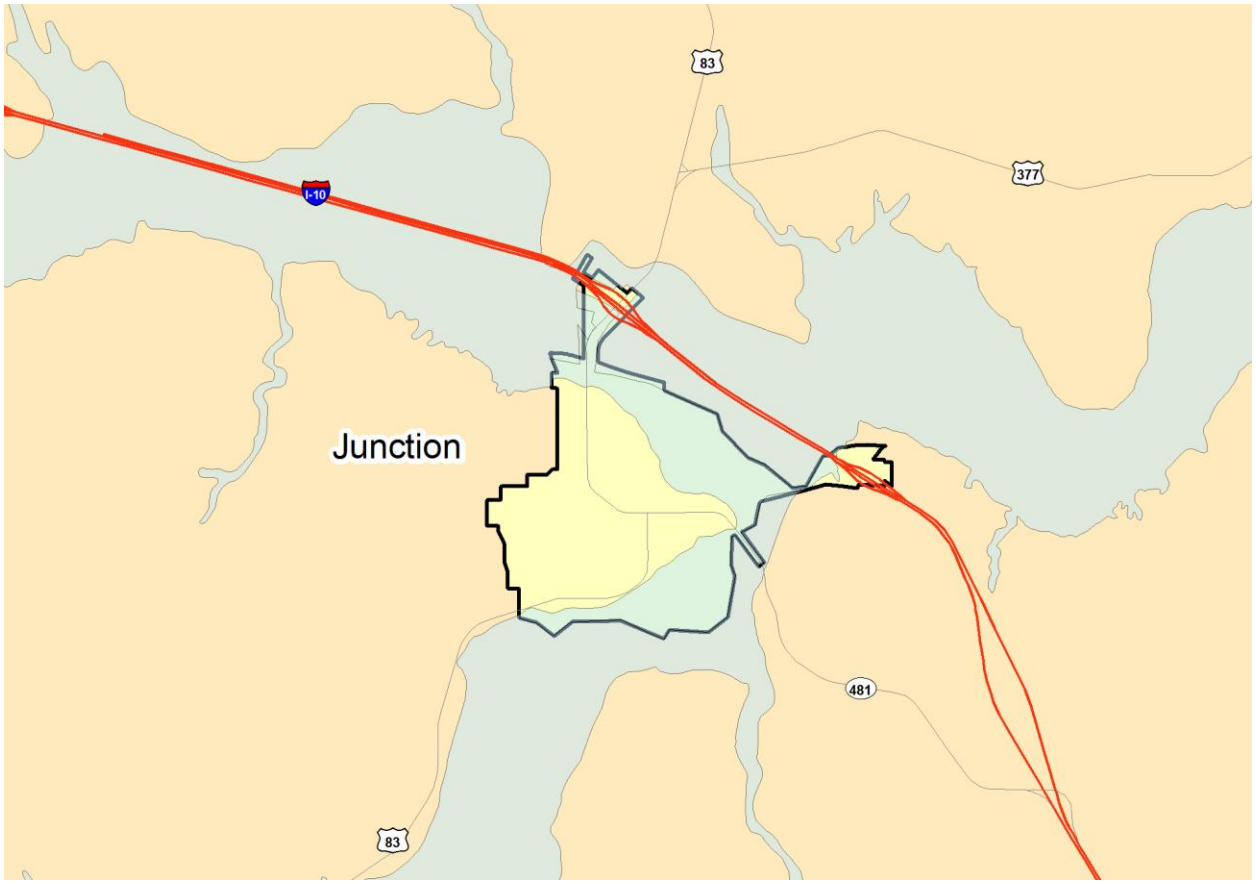

Figure 5-10. Estimated Flood Zones in the Town of Melvin (McCulloch County)

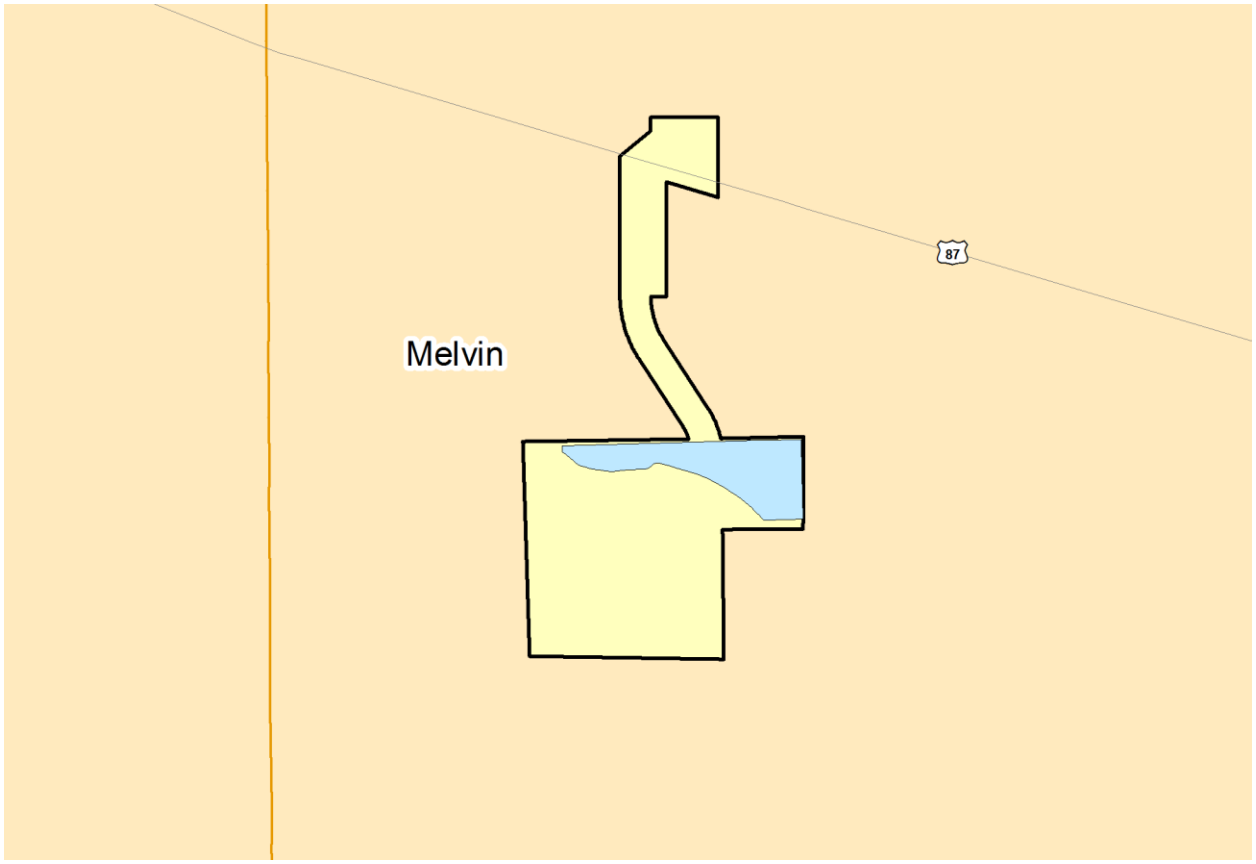

Figure 5-11. Estimated Flood Zones in the City of Menard (Menard County)

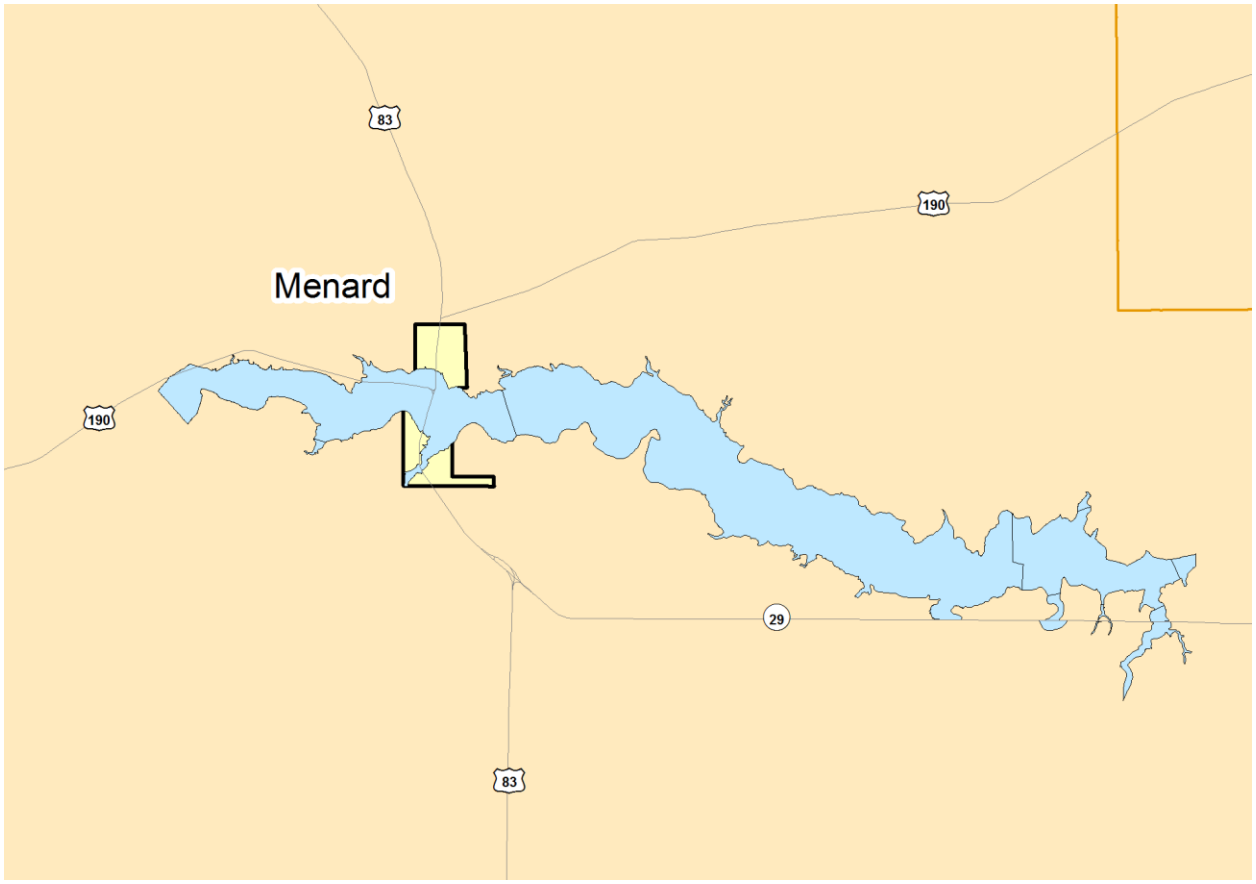

Figure 5-12. Estimated Flood Zones in the City of Eldorado (Schleicher County)

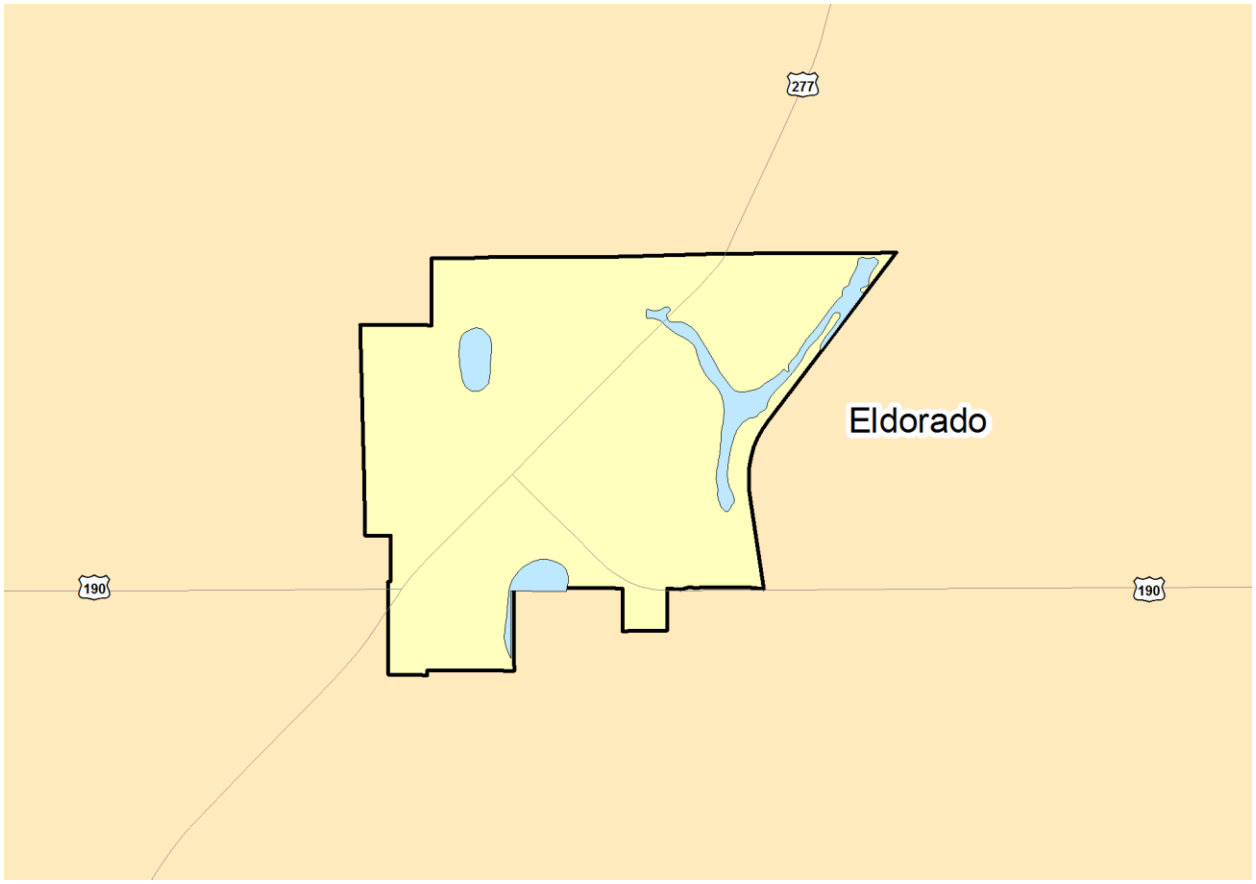

Figure 5-13. Estimated Flood Zones in the City of Sterling City (Sterling County)

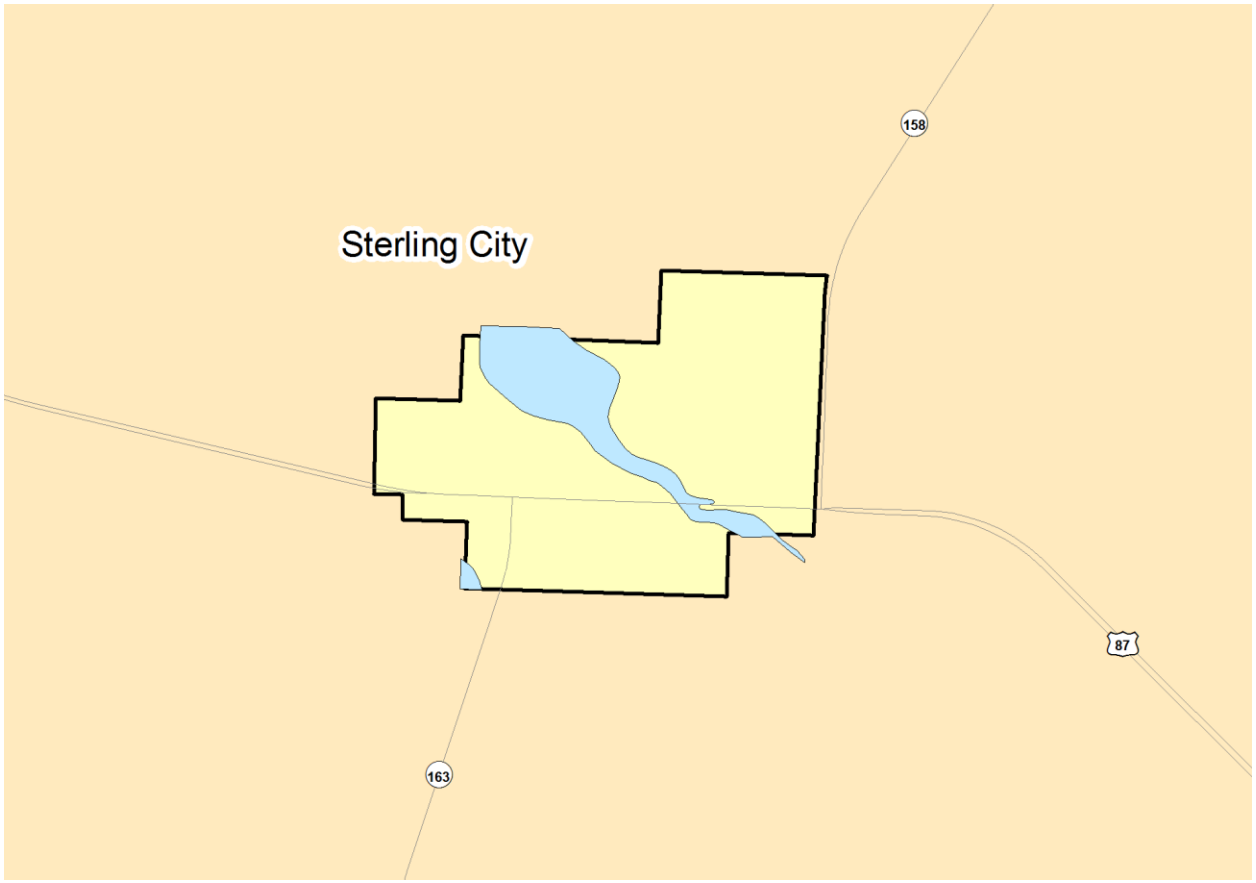

Figure 5-14. Estimated Flood Zones in Sutton County

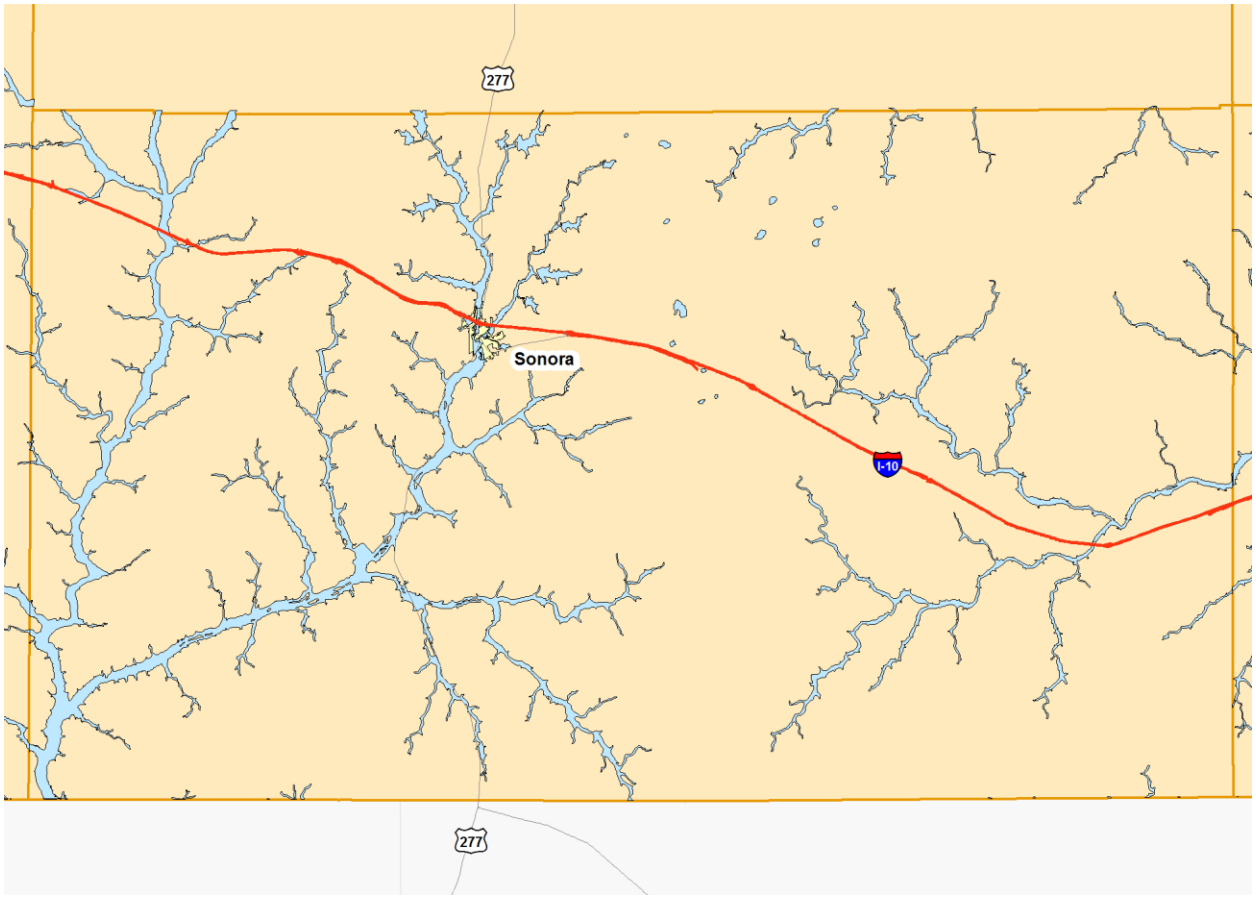

Figure 5-15. Estimated Flood Zones in the City of Sonora (Sutton County)

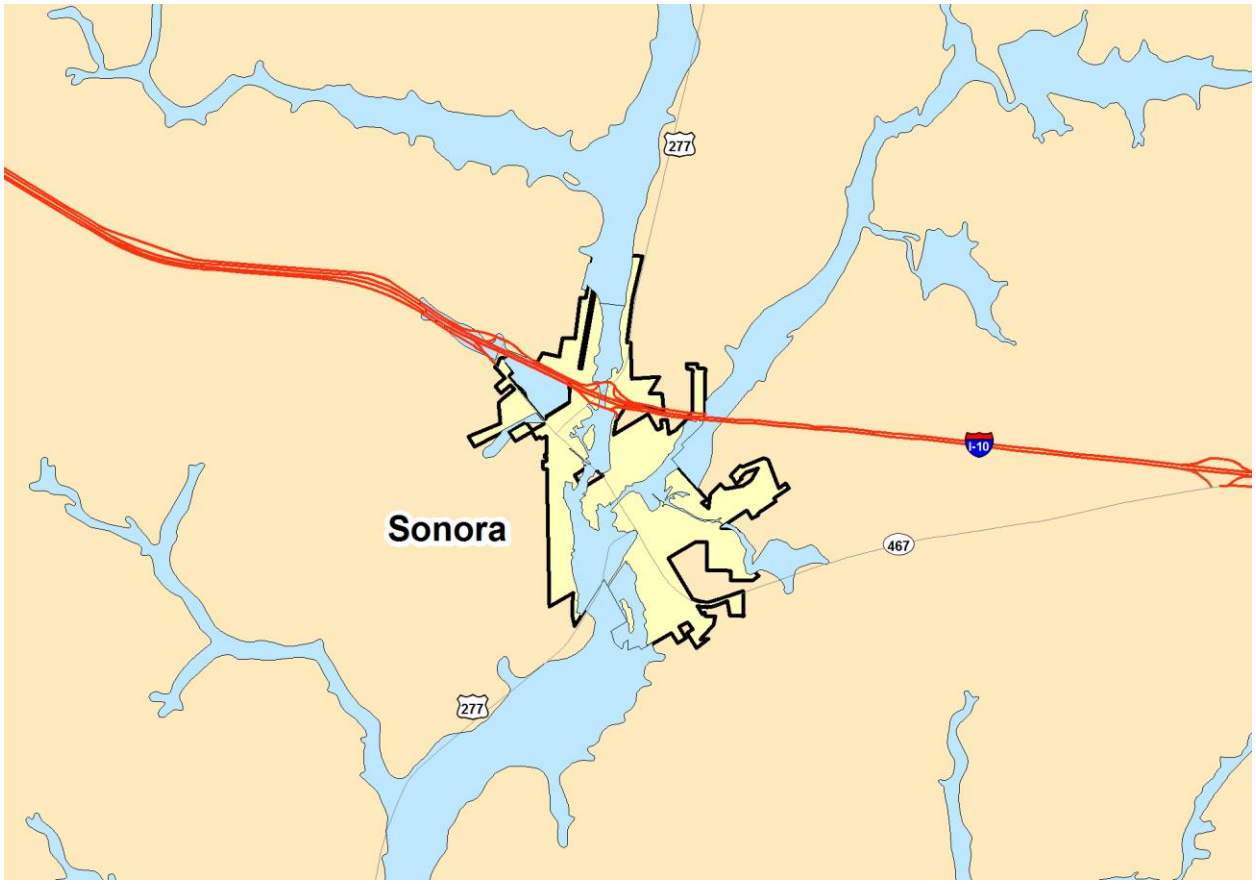

Figure 5-16. Estimated Flood Zones in Tom Green County

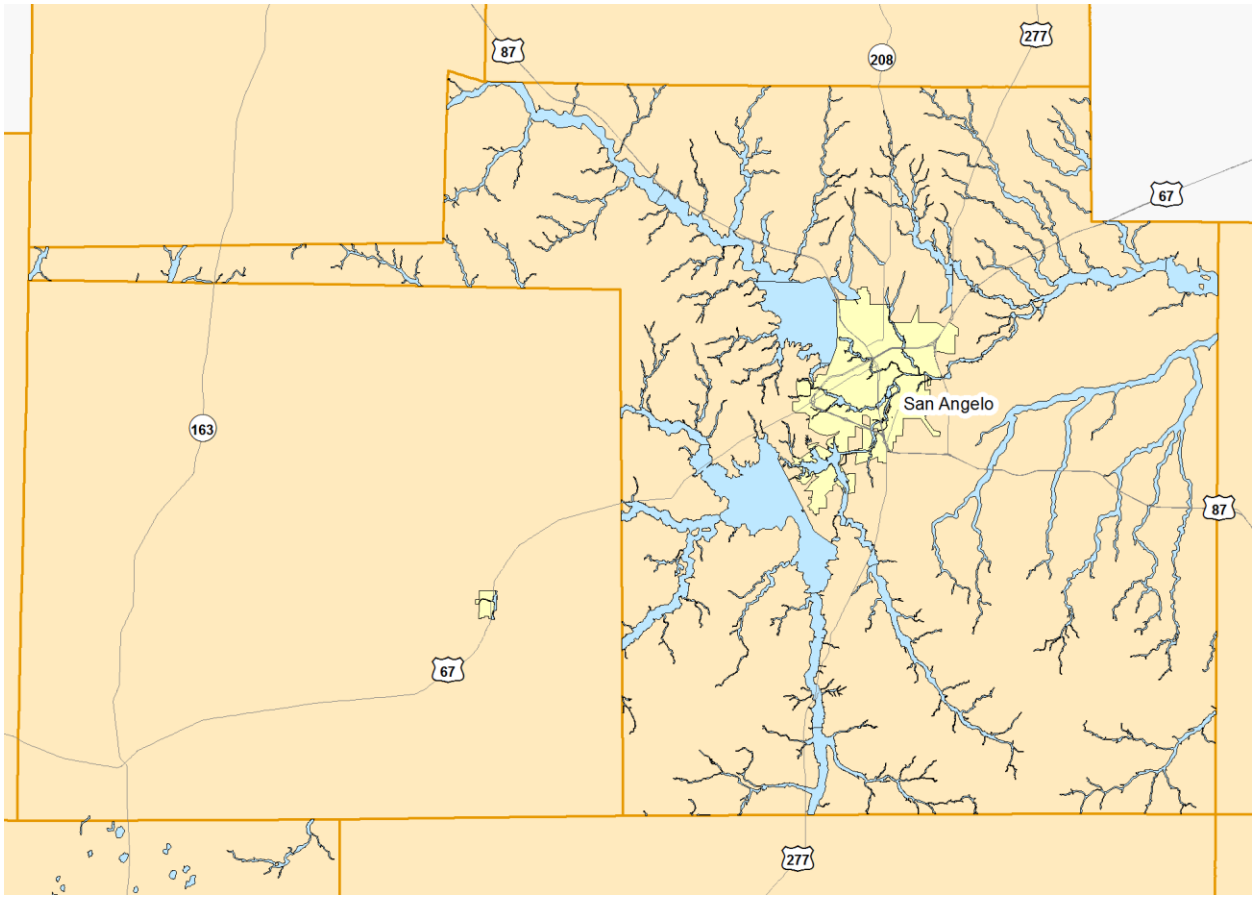

Figure 5-17. Estimated Flood Zones in the City of San Angelo (Tom Green County)

Extent

The severity of a flood event is typically determined by a combination of several factors including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. Generally floods are long-term events that may last for several days.

Determining the intensity and magnitude of a flood event is dependent upon the flood zone and location of the flood hazard area. Extent of flood damages can be expected to be more damaging in the areas that will convey a base flood. FEMA categorizes areas on the terrain according to how the area will convey flood water. Flood zones are the categories that are mapped on Flood Insurance Rate Maps. Table 5-1 provides a description of FEMA flood zones, though Flood Zone A is the only hazard area mapped in the region.

Table 5-1. Flood Zones

INTENSITY	ZONE	DESCRIPTION
HIGH	ZONE A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.
	ZONE A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
	ZONE AE	The base floodplain where base flood elevations are provided. AE Zones are now used on the new format FIRMs instead of A1-A30 Zones.
	ZONE AO	River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
	ZONE AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
	ZONE A99	Areas with a 1% annual chance of flooding that will be protected by a federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.
	ZONE AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
MODERATE to LOW	ZONE X 500	An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from 100-year flooding.

Zone A is interchangeably referred to as the 100-year flood, the one-percent-annual chance flood, or the Special Flood Hazard Area (SFHA), or more commonly, the base flood. By any name, it is the area that will convey the base flood. This area constitutes a threat to the planning area and it is the only threat; no other flood zones have been mapped in the CVCOG Region according to available flood maps.

Structures built in the SFHA are subject to damage by rising waters and floating debris. Moving flood water exerts pressure on everything in its path and causes erosion of soil and solid objects. Utility systems, such as heating, ventilation, air conditioning, fuel, electrical systems, sewage maintenance systems and water systems, if not elevated above base flood elevation, may also be damaged.

Many people do not understand the risk of living in a floodplain. There is a 26 percent chance that a home in the floodplain at or below the base flood elevation will be damaged during a 30-year mortgage. The chance that a major fire will occur during the same period is only one percent. Table 5-2 below, provides samples of the extent of flood events within the region, as well as associated damage definitions where available, and damages and estimates of structures destroyed are included. Detailed descriptions are found in the section on historical occurrences that follows.

Table 5-2. Extent of Large-Scale Flood Events in the CVCOG Region

DATE	JURISDICTION	EXTENT
June 21, 1997	Kimble County (near Segovia)	A major flood event due to 4-10 inches of rainfall in a 32 hour period. Roads and highways were closed; water was 5 feet deep in certain areas. No fatalities but damages to roads and bridges were estimated at $5 million and crop damages were $2 million from this one event.
October 7, 2002	Sutton County	A stalled cold front produced a major flood event from 4-7 inches of rain overnight. Streams overflowed their banks and 3 people were rescued by helicopter before their vehicle was swept away on a flooded road. Property damage was estimated at $5 million.

DATE	JURISDICTION	EXTENT
November 3-5, 2000	Menard County	Heavy rain across McCulloch, Menard, and San Saba (not in the CVCOG) counties caused a major flood event with the San Saba river cresting at 5.7 feet above flood stage. Damage to infrastructure, homes, businesses, and agriculture in Menard County was considered substantial. Property damages totaled $160,000. No crop loss was reported.
August 14, 2005	Coke, Fisher, Haskell, Jones, Shackelford, Sterling, Throckmorton, Tom Green counties	A major flood event resulted from rainfall amounts up to 10 inches in less than 48 hours, resulted in up to 5 feet of standing water in many places. Nearly 200 homes were substantially damaged. No fatalities were reported but property loss was estimated at $930,000.

Historical Occurrences

Historical evidence shows that areas within the region are susceptible to flooding, especially in the form of flash flooding. It is important to note that only flood events that have been reported have been factored into this risk assessment, and in most cases NCDC data is limited to flood events that have occurred since 1994. It is likely that additional flood occurrences have gone unreported before and during this recording period. In some instances, historical flood information, as provided by NCDC, shows flood activity across a multi-county forecast area for a particular event. In such instances, an appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each participating county impacted by the event. Table 5-3 shows historical incident information by county.

Table 5-3. Historical Flood Events by County, 1994-2011[1]

COUNTY	EVENTS	DEATHS	INJURIES
Coke	16	0	0
Concho	9	0	0
Crockett	26	0	0
Irion	16	0	1
Kimble	32	0	0

[1] Source: NCDC

COUNTY	EVENTS	DEATHS	INJURIES
McCulloch	36	0	0
Menard	20	0	0
Reagan	26	0	0
Schleicher	14	0	0
Sterling	12	0	0
Schleicher	29	0	0
Tom Green	60	0	3
TOTALS	296	0	4

Probability of Future Events

Based on historical occurrences and extent, flooding is highly likely meaning an event is probable within the next year.

Vulnerability and Impact

The building vulnerability assessment was conducted using a GIS mapping analysis process in which the available flood maps were overlaid with local parcel data to determine the number of parcels that intersect these hazard zones. In order to determine vulnerable population counts, buildings, and values, 2010 Census population, 2000 Census building data and 2006 building value data was used.

In making vulnerability determinations, it was decided that if any portion of a structure was confirmed to be located within the flood zone, then it was considered to be at risk to that flood hazard. While the GIS-based assessment does use specific attribute data tied to each individual property (i.e., year built and building value), it does not take into account certain unknown site-specific factors that may mitigate future flood losses on a building-by-building basis (such as finished floor elevations, surrounding topography, flood proofing measures, drainage, etc.). No further analysis on the potential vulnerability of structures to flooding was completed as part of this assessment.

Table 5-4 summarizes the vulnerability assessment which is an estimate of potential for exposure to the base flood. The results of the analysis place the following percentages at risk to flood: 5.21 percent of the population, 8.78 percent of housing units, and 5.28 percent of building value.

Table 5-4. Vulnerability to Flooding[2]

JURISDICTION	2010 POPULATION		BUILDING VALUE*		HOUSING UNITS	
	By Jurisdiction	Vulnerable to flood	By Jurisdiction	Vulnerable to flood	By Jurisdiction	Vulnerable to flood
Coke County	**3,320**		**$291.4**		**2,667**	
Bronte	999	82	$54.9	$6.6	473	44
Robert Lee	1,049	35	$70.8	$2.6	636	19
Concho County	**4,087**		**$187.2**		**1,637**	
Eden	2,766	53	$92.5	$3.3	581	25
Paint Rock	273	26	$11.3	$1.0	128	12
Crockett County	**3,719**	**1,139**	**$263.7**	**$58.4**	**1,866**	**559**
(No Incorporated Cities)						
Irion County	**1,599**		**$112.3**		**856**	
Mertzon	781	62	$38.6	$3.3	358	39
Kimble County	**4,607**	**652**	**$345.1**	**$51.9**	**3,371**	**506**
Junction	2,574	212	$152.9	$14.9	1,270	118
McCulloch County	**8,283**		**$459.6**		**4,302**	
Melvin	178	24	$8.9	$1.4	113	20
Menard County	**2,242**		**$148.4**		**1,702**	
Menard	1,471	580	$69.4	$31.7	828	302
Reagan County	3,367		$178.8		1,372	
Big Lake	2,936				1,089	
Schleicher County	**3,461**		**$163.7**		**1,489**	
Eldorado	1,951	27	$95.8	$1.3	838	10
Sterling County	**1,143**		**$89.1**		**615**	
Sterling	888	58	$65.8	$6.0	419	27
Sutton County	**4,128**	**886**	**$259.0**	**$40.4**	**2,031**	**366**
Sonora	3,027	735	$157.0	$34.0	1,323	299
Tom Green County	**110,224**	**5,145**	**$6,423.0**	**$320.2**	**46,571**	**2,360**
San Angelo	93,200	2,707	$5,600.0	$195.8	39,548	1,304
COUNTY TOTALS	**150,180**	**7,822**	**$8,921**	**$471**	**68,479**	**6,010**

[2] N/A is listed for dollar amounts less than $5,000 and populations less than 50.

* *values are in millions of dollars*

Based on the vulnerability assessment, a flooding event will have a limited impact on the area, which could result in the shutdown of critical facilities and services for 24 hours or less, with less than 10 percent of property destroyed or with major damage.

NFIP Participation

Flood insurance offered through the National Flood Insurance Program (NFIP) is the best way for home and business owners to protect themselves financially against the flood hazard. Of the 25 jurisdictions in the CVCOG Region, all participate in the NFIP with the exception of the Towns of Paint Rock (Concho County) and Melvin (McCulloch County). Table 5-5 below lists the communities that are not participating and provides a reason for non-participation.

Table 5-5. Communities Not Participating in the NFIP

COUNTY	JURISDICTION	REASON FOR NON-PARTICIPATION
Concho	Town of Paint Rock	Lack of funds
McCulloch	Town of Melvin	Lack of funds

As an additional indicator of floodplain management responsibility, communities may choose to participate in FEMA's Community Rating System (CRS). This is an incentive-based program that allows communities to undertake flood mitigation activities that go beyond NFIP requirements. Currently, no participating CVCOG communities participate in CRS.

NFIP Compliance and Maintenance

Jurisdictions in the CVCOG Region have also developed mitigation actions or analyzed previous actions that relate to either NFIP maintenance or compliance. Compliance and maintenance actions can be found in Section 17.

Flooding was identified by the majority of the counties as a moderate risk hazard during hazard ranking activities at the Risk Assessment Workshop. However, many of the mitigation actions, both for communities that participated in the 2005 Plan and those participating in the Plan Update, were developed with flood mitigation in mind. A majority of these flood actions address compliance with the NFIP and implementing flood awareness programs. Region-wide, communities recognize the need and are adopting higher NFIP regulatory standards to further minimize flood risk in their community. Smaller no-growth communities that typically do not have personnel or funds to implement more stringent NFIP compliance measures are focusing on NFIP public awareness activities. This includes

promoting the availability of flood insurance by placing NFIP brochures and flyers in public libraries or public meeting places.

The prioritization method for implementing actions was based on FEMA's STAPLE+E criteria and included social, technical, administrative, political, legal, economic and environmental considerations. As a result of this exercise, an overall priority was assigned to each mitigation action by each Team member. The overall priority of each action is reflected in the mitigation actions found in Section 17 for the local jurisdictions. In prioritizing actions a community must consider many factors. Of primary consideration is targeting specific mitigation actions for implementation following a major disaster. Other factors that determine prioritization are, in part, ease of implementation by the community, cost of the project vs. perceived benefit, timeframe for implementing the action, and available personnel to oversee and implement the project.

FEMA's Community Rating System (CRS) is an incentive-based program that allows communities to undertake flood mitigation activities that go beyond NFIP requirements. Currently, no participating CVCOG communities participate in CRS.

Repetitive Loss

The Severe Repetitive Loss (SRL) Grant Program under FEMA provides federal funding to assist states and communities in implementing mitigation measures to reduce or eliminate the long-term risk of flood damage to severe repetitive loss residential structures insured under the NFIP. The Texas Water Development Board (TWDB) administers the SRL grant program for the State of Texas.

Severe Repetitive Loss properties are defined as residential properties that are:

- covered under the NFIP and have at least four flood related damage claim payments (building and contents) over $5,000.00 each, and the cumulative amount of such claims payments exceed $20,000; or

- at least two separate claim payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

In either scenario, at least two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart.[3] Table 5-6 shows repetitive loss and severe repetitive loss properties for the Counties.

[3] Source: Texas Water Development Board

Table 5-6. Repetitive Loss and Severe Repetitive Loss Properties

COUNTY	JURISDICTION	PROPERTY #	INSURED?	BUILDING TYPE	LOSSES	TOTAL PAID	SRL INDICATOR[4]
Menard	Menard	0005599	No	Single family residence	2	$20,425.06	-
	Menard	0044991	No			$21,443.75	-
	Menard	0056784	No			$14,182.95	PU
	Ft. McKavett	0050177	Yes			$14,132.06	-
Tom Green	San Angelo	0123241	Yes			$4,585.53	-
	San Angelo	0118558	Yes			$17,191.72	-
	San Angelo	0043376	No			$30,413.84	-

[4] In this column: "V" stands for "Validated"; "VN" stands for "Validated Nonresidential"; "VU" stand for "Validated Uninsured"; "VNU" stands for "Validated Nonresidential Uninsured"; "P" stands for "Pending"; "PU" stands for "Pending Uninsured"; and "PN" stands for "Pending Nonresidential".