

4.6 Flood Hazard Profile

A flood is a general and temporary condition of partial or complete inundation of normally dry land areas from: (1) the overflow of stream banks, (2) the unusual and rapid accumulation of runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land. Flooding results when the flow of water is greater than the normal carrying capacity of the stream channel. Rate of rise, magnitude (or peak discharge), duration, and frequency of floods are a function of specific physiographic characteristics. Generally, the rise in water surface elevation is quite rapid on small (and steep gradient) streams and slow in large (and flat sloped) streams. (Colorado Flood Mitigation Plan Update, 2013)



4.6.1 Regulatory Oversight

4.6.1.1 National Flood Insurance Program (NFIP)

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. For most participating communities, FEMA has prepared a detailed Flood Insurance Study (FIS). The study presents water surface elevations for floods of various magnitudes, including the 1-percent annual chance flood (the 100-YR flood) and the 0.2-percent annual chance flood (the 500-YR flood). Base flood elevations and the boundaries of the 100- and 500-YR floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principle tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under their floodplain management program.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-YR flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

La Plata County entered the NFIP on June 3rd, 1977. Structures permitted or built in the County before then are called “pre-FIRM” structures, and structures built afterwards are called “post-FIRM.” The insurance rate is different for the two types of structures. The effective date for the current countywide FIRM is August 19th, 2010. This map is a digital flood insurance rate map (DFIRM).

All three incorporated cities/ towns in La Plata County participate in the NFIP. The County and cities are currently in good standing with the provisions of the NFIP. Compliance is monitored by FEMA regional staff and the Colorado Water Conservation Board. Maintaining compliance under the NFIP is an important component of flood risk reduction. All planning partners that participate in the NFIP have identified initiatives to maintain their compliance and good standing. Jurisdictions will incorporate and reference DFIRM maps in regulations as new floodplains are mapped. Audits of regulations will ensure compliance with NFIP in all program areas.



Properties constructed after a FIRM has been adopted are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Properties built before a FIRM is adopted are more vulnerable to flooding because they do not meet code or are located in hazardous areas. The first FIRMs in La Plata County were published on December 15th, 1981. They were converted into a countywide digital FIRM (DFIRM) on August 19th, 2010.

Table 4-18 lists NFIP statistics for the County. The statistics show 19 flood insurance claims paid as of May 31st, 2017 for a total of \$454,557.

Table 4-18: Flood Insurance Statistics for La Plata County

NFIP Status & Information	
La Plata County (Unincorporated)	
NFIP Status	Participating since 06/03/1977
CRS Class	N/A
Policies in Force	624
Policies in SFHA	411
Policies in non-SFHA	213
Total Claims Paid	19
Paid Losses	\$ 453,113
Repetitive Loss Properties	0
Severe Repetitive Loss Properties	0
Repetitive Loss Payment by NFIP on Building	0
Repetitive Loss Payment by NFIP on Contents	0

The Privacy Act of 1974 (5 U.S.C. 522a) restricts the release of certain types of data to the public. Flood insurance policy and claims data are included in the list of restricted information. FEMA can only release such data to state and local governments, and only if the data are used for floodplain management, mitigation, or research purposes. Therefore, this plan does not identify the repetitive loss properties or include claims data for any individual property.

4.6.1.2 CWCB Adopted Floodplain Rules and Regulations

The Colorado Water Conservation Board (CWCB) has promulgated new floodplain rules and regulations that became effective on January 14, 2011. The rules provide for increased public safety and reduced flood losses across the state.

The purpose of these Rules is to provide uniform standards for regulatory floodplains (or floodplains) in Colorado, to provide standards for activities that may impact regulatory floodplains in Colorado, and to stipulate the process by which floodplains will be designated and approved by the CWCB. Rules for Regulatory Floodplains are of statewide concern to the State of Colorado and the Colorado Water Conservation Board in order to prevent flooding and the negative impacts of floods, as well as to assure public health, safety, welfare and property by limiting development in floodplains. These Rules will also assist the CWCB and communities in Colorado to develop sound floodplain management practices and implement the National Flood Insurance Program (NFIP). The floodplain rules and regulations can be read at the CWCB website here:

http://cwcb.state.co.us/Documents/FloodplainRulesRegsUpdate/CWCB_Adptd_FP_Rules_BasisPurp_%2011172010.pdf

4.6.1.3 La Plata County Code Chapter 78: Floods

Article II, Division 3 of La Plata County Code Chapter 78 sets the standards for flood hazard reduction in the County. It states that no floodplain development permit shall be issued for any building or structure, including a manufactured home, which is proposed to be located within an area of special flood hazard without the full compliance with the terms of this chapter. No subdivision which contains at least five acres or 50 lots, or other development proposed for any designated floodplain area shall be granted final approval without full compliance with the provisions of this chapter.

Chapter 78 also contains general and specific standards for special flood hazard areas (SFHA), restrictions for increasing surface elevation of the base flood level, provisions for areas of shallow flooding, safety provisions for floodways, standards for proposed developments that alter a watercourse within a SFHA, criteria for building new structures on a property removed from the floodplain based on fill, and standards for critical facilities in floodplains.

The complete chapter can be viewed here:

<http://online.encodeplus.com/regs/la-plata-co/doc-viewer.aspx#secid-1248>

4.6.1.4 2002 Flood Plain Regulations- Crawlspace

These standards created new optional regulations regarding below-grade residential crawlspace construction and types of foundation used.

The new regulations can be read in full here:

http://lpcds.org/UserFiles/Servers/Server_1323669/File/Government/Departments/floodplain.pdf

4.6.1.5 2017 La Plata County Comprehensive Plan

The Public Safety Element establishes the following policies pertaining to flood hazards:

Policy 8.1.B1: Continue to develop floodway mapping for all major drainages in La Plata County.

4.6.2 Measuring Floods and Floodplains

The frequency and severity of flooding are measured using a discharge probability, which is a statistical tool used to define the probability that a certain river discharge (flow) level will be equaled or exceeded within a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-YR discharge has a 1-percent chance of being equaled or exceeded in any given year. The "annual flood" is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-YR or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-YR flood) is used as the regulatory boundary by many agencies. Also referred to as the special flood hazard area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.



4.6.2.1 Floodplain Definitions

100-YR Floodplain

The boundaries of the floodplain coincide with an annual risk of 1% and are a FEMA study product consisting of both floodway and flood fringe.

500-YR Floodplain

The boundaries of the floodplain coincide with an annual risk of 0.2% and are a FEMA study product. The 500-YR floodplain includes the 100-YR.

Floodway

This includes the channel of the tributary and the land adjacent to it. This zone needs to remain free from obstruction so the 100-YR floodplain can be conveyed downstream.

Flood Fringe

This is the remaining portion of the 100-YR floodplain (sans Floodway). This zone can be obstructed or developed if criteria are met.

4.6.2.2 Floodplain Ecosystems

Floodplains can support ecosystems that are rich in quantity and diversity of plant and animal species. A floodplain can contain 100 or even 1000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive and larger species enter a rapid breeding cycle. Opportunistic feeders (particularly birds) move in to take advantage. The production of nutrients peaks and falls away quickly; however, the surge of new growth endures for some time. This makes floodplains particularly valuable for agriculture. Species growing in floodplains are markedly different from those that grow outside floodplains. For instance, riparian trees (trees that grow in floodplains) tend to be very tolerant of root disturbance and very quick-growing compared to non-riparian trees.

4.6.2.3 Effects of Human Activities

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available, land is fertile and suitable for farming, transportation by water is easily accessible, and land is flatter and easier to develop. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream's capacity to contain flows, and it increases flow rates or velocities downstream during all stages of a flood event. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

4.6.3 Principal Flood Problems

Flooding as a natural hazard is a long-recognized problem for La Plata County; a concentrated downpour over the extreme terrain has the potential to be highly destructive and life-threatening. Seasonal flooding, often more moderate, occurs in the county during the spring when the mountain snowpack starts its melting process and heavy rainfall sometimes combines with the runoff and causes some rivers and streams to swell out of their banks. (La Plata County Hazard Mitigation Plan, 2013)

Generally, severe floods in La Plata County are caused by rainfall. General rainstorms usually occur during the period from July through October. This type of flood results from prolonged heavy rainfall over the watershed and is characterized by peak flows of moderate volume and duration. Flooding is more severe when antecedent rainfall has saturated the soils in the watershed.

Flood potential also exists from the rapid melting of heavy snow cover in late spring. Flood flows resulting from snowmelt are characterized by moderate peaks, large volumes, and long durations. This type of flood is usually not as damaging as those resulting from general rainstorms.

Cloudburst storms generally cause flooding on the streams having small tributary areas. These high-intensity, short-duration type rainstorms usually occur during the summer. Floodflows resulting from cloudburst storms are characterized by high peak flow, short duration of flow, and small volume of runoff.

Cloudbursts have caused numerous floods in the unincorporated areas near Durango from Junction and Lightner Creeks. The largest flood on Lightner and Junction Creeks occurred on October 20, 1972, with peak flows of 2830 and 1780 cfs, respectively (approximate return period of 50 years). Historic Dry Gulch Creek flood flows are not available.

Past floods have disrupted highway and railroad traffic and communication services; drowned livestock; and damaged and destroyed agricultural lands, roads, bridges, buildings, the sewage disposal plant, and the State Fish Hatchery. Several persons have drowned, and many others were injured.

In July 1957, heavy rains in the mountains to the north filled the Vallecito Reservoir to its ultimate capacity. The three flood gates all opened at once releasing a surge of water at approximately 13,000 cfs. The river stage at Bayfield reached the top of the U.S. Highway 160 Bridge. The high water caused basement flooding and agricultural loss.

The greatest rain flood of record on the Animas River in the vicinity of Hermosa occurred in October 1911. A severe flood also occurred on Hermosa Creek at that time, but no record or estimate of flow is available. These floods resulted from continuous heavy rain that totaled more than 4 inches in 3 days at one station in the upper watershed of the river.

The largest snowmelt flood of record, on Hermosa Creek occurred in May 1941, and the second largest occurred in 1920. Little definitive data on these floods are available.

The flood of September 1970 at Upper Vallecito Creek was caused by an extremely heavy rainfall of 4.5 inches in a 6- to 12-hour period. Many vehicles, homes, and trailers were damaged or destroyed. The total cost of the flood loss exceeded \$60,000.

In October 2006, a flood occurred on Vallecito Creek that was caused by a rain on snow event within the upper drainage basin of the creek. A pedestrian bridge, outbuildings and recreational vehicles were severely damaged or destroyed by the event which was measured to be in the vicinity of 4,000 cfs, corresponding to a 4% annual chance of recurrence (25-year



return period) event. The flood also caused severe bank erosion along the length of the creek above Vallecito reservoir, which resulted in bank retreats of 20 to 30 feet in some locations. The flood was also characterized by the transport and deposition of hundreds of large coniferous trees, which had been felled the previous year by an avalanche in the upper part of the basin. (Flood Insurance Study- La Plata County Colorado, and Incorporated Areas, 2010)

4.6.4 Past Events

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Table 4-19 lists the flood events in La Plata County since 2002. In recent years, flash floods have been extremely destructive throughout the County. In 2002 and 2006, damages from flash flood events were reported to be \$1,000,000 or greater per event. In the 2002 event, flash flooding was widespread along the east side of the Animas Valley. Very large debris flows accompanied the flash floods. Two large houses in the path of the flows incurred extensive damage and two mobile homes were knocked off their foundations. Some sheds were heavily damaged or destroyed. Mud, large trees, and boulders the size of cars covered many sections of county roads and residential properties up to 10 feet deep. A six-mile section of irrigation canal was completely filled with debris. 750 people were evacuated from the Bar D Chuckwagon restaurant after being trapped for nearly three hours. (Information, 2017)

In the 2006 flash flood event, a persistent fetch of subtropical moisture brought heavy rainfall to La Plata County for two consecutive days, October 5th and 6th. The two-day rainfall amounts in the areas of heaviest flooding ranged from 1.99 to 3.51 inches. The first reports of flooding and flash flooding occurred along County Road 250 north of Durango and also near Vallecito Reservoir. In the community of North Vallecito, a 44 foot self contained RV, a cabin, and a shed were carried by the flood waters down Vallecito Creek and totally destroyed, with pieces ending up in Vallecito Reservoir. Part of a garage and two snowmobiles were swept away by flood waters and an unattended SUV was swept into the current but later pulled to high ground. Vallecito Creek carved out a new 4 to 5 foot channel in North Vallecito in the backyards of residences, with the new channel adjacent to the back decks of some homes. An enormous amount of landscape was destroyed in Vallecito and North Vallecito. Dikes and levees built in 1970 around Vallecito Creek were initially breached at several points and were subsequently destroyed. Flood waters came up to the foundation of houses, and left at least 18 houses surrounded by water. Law enforcement and other emergency service providers evacuated residents of Vallecito and North Vallecito, mostly prior to the dike and levee failures. An underground telephone cable in North Vallecito became exposed and severed by logs in the flood waters, eliminating phone service to homes and businesses around Vallecito Reservoir. Flooding also occurred along Bolteus Creek. Roads were flooded at various locations in La Plata County with fast moving water generally 6 to 18 inches deep. Several landslides were also reported, some of which closed down the Durango-Silverton Narrow Gauge Railroad due to debris on the tracks. (Information, 2017)

Most recently, flooding and mudslides have occurred on and below drainages in the mountains that burned in the 416 Fire, shown in Figure 4-13. Wildfires of this intensity damage soil and prevent it from absorbing water, increasing the chance of flooding, mudslides and debris flow, especially after rainstorms. (For more information regarding the 416 Fire, see Section 4.9.4 Past Events in the Wildfire Hazard Profile.)



Figure 4-13: Flooding and debris around a home along U.S. Highway 550

Source: Jerry McBride/ Durango Herald

In late July 2018, nearly 2 months after the 416 Fire started, about 6 feet of boulders, rock and mud blocked Highway 550 near Honeyville, and near the Animas Village Apartments, 1 foot of debris covered the highway. According to the Durango Herald, water a foot deep flowed around the Country Sunshine Bed & Breakfast and mud caused significant damage to the interior of one family’s home. Irrigation ditches overflowed near homes and about 800 passengers with the Durango & Silverton Narrow Gauge Railroad had their train ride cut short at Rockwood. Despite the havoc that hit properties, no injuries were reported from debris flows that closed Highway 550 as well as County Road 250, County Road 250C and County Road 203. (Report, 2018)

The County is working with the Natural Resources Conservation Service (NRCS) to provide resources to private property owners. For example, The NRCS Emergency Watershed Protection Program can help with erosion, flood mitigation and repair work on private property. (Simonovich, 2018) The program has identified projects on 162 properties in the 416 Fire burn scar and will fund 75% of the cost of these projects. Property owners would be responsible for the remaining 25%. All permitting, design and construction work would be performed through a local sponsor.

Table 4-19: Flood Events in La Plata County Since 2000

Date	Description	Injuries	Fatalities	Property Damage	Crop Damage	Source
07/22/2002	Flooding			\$2,000	\$ 2,000	SHELDUS
07/23/2002	Flooding			\$400,000		SHELDUS
08/03/2002	Flooding			\$400,000		SHELDUS
08/08/2002	Flooding			\$40,000		SHELDUS
08/29/2002	Flooding			\$20,000		SHELDUS
09/07/2002	Flash flood	1		\$1,500,000		Colorado NHMP 2011; SHELDUS
09/11/2002	Flooding			\$100,000		Colorado NHMP 2011; SHELDUS
07/26/2003	Flooding			\$10,000		SHELDUS
07/30/2003	Flooding			\$5,000		SHELDUS
08/17/2003	Flooding			\$10,000		SHELDUS
08/30/2003	Flooding			\$10,000		SHELDUS



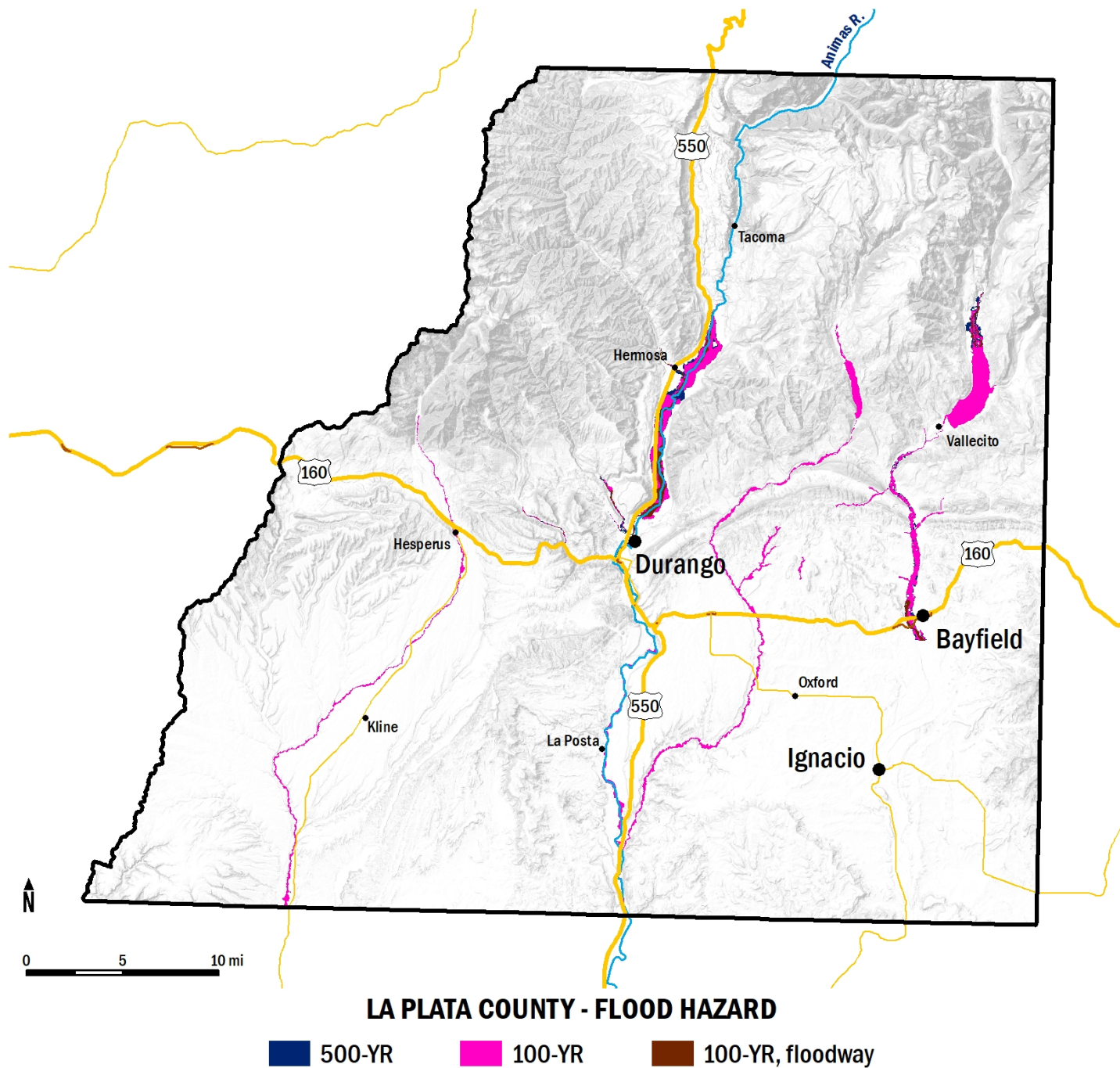
Date	Description	Injuries	Fatalities	Property Damage	Crop Damage	Source
04/15-04/20/2005	Flash flood			\$30,000		SHELDUS
05/20-05/30/2005	Flooding			\$34,000		NCDC; SHELDUS
10/06-10/07/2006	Flash flood			\$1,000,000		NCDC; SHELDUS
08/28/2011	Flash flood, Haflin Creek/CR 250					NCDC
09/18/2013	Flash flood, Vallecito			\$30,000		NCDC
09/18/2013	Flash flood, Durango			\$50,000		NCDC
09/18/2013	Flash flood, Trimble					NCDC
09/22/2013	Flash flood, Durango					NCDC
09/22/2013	Flash flood, Trimble			\$30,000		NCDC
07/12/2014	Flash flood, Rockwood					NCDC
07/28/2014	Flash flood, Hermosa					NCDC
07/28/2014	Flash Flood, Durango					NCDC
09/21/2014	Flash flood, Durango					NCDC
7/24/2018	Flood, mud and debris flow in 416 Fire burn area			TBD		Durango Herald
Total		1	0	\$1,171,000	\$2,000	

4.6.5 Location

Four rivers begin in the high mountains in the northern half of the county, flow south through mountain valleys, and continue into New Mexico. Development along the rivers and tributaries are at risk during flooding events. In particular, the Vallecito Creek drainage system poses a threat to hundreds of homes.

The 90-square mile drainage basin ranges in elevation from nearly 14,000 feet to 7,000 feet at the Vallecito Reservoir. The drainage is lined with highly erodible soils and there is a concentrated residential area with 700 lots at the base of the gorge and on the valley floor. The Vallecito Creek geography has been likened to Big Thompson Canyon, the site of Colorado’s most deadly and damaging flood in 1976. (La Plata County Hazard Mitigation Plan, 2013)

The FEMA National Flood Hazard Layer for La Plata County Colorado, and Incorporated Areas is the sole source of data used in this risk assessment to map the extent and location of the flood hazard. Figure 4-12 shows the location of flood hazard zones in La Plata County.



Data Source: FEMA National Flood Hazard Layer

Figure 4-14: Location of Flood Hazard Zones in La Plata County

*Note: The 500-YR floodplain includes the 100-YR floodplain.



4.6.6 Frequency/ Probability of Future Events

Severe flooding in the planning area is generally caused by rainfall. Heavy rainfall is most likely to occur between July and October.

Flooding can also be caused by snowmelt in the spring. In a year of near-normal snow accumulations in the mountains and normal spring temperatures, river stages become high, but there is no general flooding. In years when snow cover is heavy, or when there is widespread lower elevation snow accumulation and a sudden warming in the spring, there may be extensive flooding.

The greatest threat of flooding in Colorado is not snowmelt, however. It is flash flooding from localized intense thunderstorms. The most flash-flood prone regions of Colorado are found along the base of the lower foothills east of the mountains. Flash floods occur on the western slopes as well, but with somewhat lower frequency and intensity due to a reduced supply of low level moisture to fuel such storms. (Center, 2017)

For the purposes of this plan, flooding events have been broken out into two distinct categories: moderate floods that are typical of the area, flooding streets, overtopping curbs, and causing minimal damages; and severe flooding defined by an event that causes significant damages to properties, involves streams overflowing their banks, and can include the 100- and 500-YR flood interval. The probability of the two categories is as follows:

Moderate Flood (less than 100-YR flood)

LIKELY: Ten to 100 percent chance of occurrence next year or it has a recurrence interval of 10 years or less.

Based on historical data for previous occurrences in La Plata County, there were 34 damaging flooding events that occurred within a 115-year period. This equates to a probability of about 30 percent that a damaging flood will occur in any given year, or that a damaging flood will occur approximately once every three to four years.

Severe Flood (100-YR or greater flood)

OCCASIONAL: One to ten percent chance of occurrence in the next year or it has a recurrence interval of 11 to 100 years.

When taken literally, the 500-YR flood event should occur once every 500 years, or have a 0.2 percent chance of occurring in any given year. The 100-YR flood event should occur once every 100 years, or have a one percent chance of occurring in any given year. The likelihood of a lesser significant flood such as a 50- or 100-YR flood, is greater than a 500-YR flood but far less than the typical flood. (La Plata County Hazard Mitigation Plan, 2013)

4.6.7 Severity

The main factors affecting flood damage are water depth and velocity. Deeper and faster flood flows can cause more damage. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high velocity flows and transporting debris and sediment. In La Plata County, the likelihood of flash flooding is increased in hilly areas which have experienced fires, such as the Missionary Ridge Fire and the 416 Fire. The 416 Fire has already caused damage to US 550 and major damage to the Durango and Silverton Railroad. Flood severity is often evaluated by examining peak discharges; Table 4-20 lists peak flows used by FEMA to map the floodplains of La Plata County.



Table 4-20: Summary of Peak Discharges in La Plata County

Source/Location	Drainage sq. Miles Area	Discharge (cubic feet/second)			
		10-YR	50-YR	100-YR	500-YR
500-YR Split Flow					
Split from Vallecito Creek	—	—	—	—	—
Animas River					
At Durango Northern Corporate Limits	649	9,800	17,500	22,500	38,000
At La Posta Road	765	10,200	18,500	23,500	40,000
D Creek					
Split from Vallecito Creek	—	—	2,953	5,293	16,138
Dry Gulch Creek					
At Mouth	4.3	150	650	1,200	3,000
Grimes Creek					
Upstream of West Grimes Creek Road	—	631	2,157	2,443	4,106
	—	301	2,368	2,933	6,522
	—	301	3,230	4,231	10,106
	—	301	3,240	4,317	11,370
	—	301	3,703	4,957	13,640
At Vallecito Reservoir	—	301	3,703	6,043	18,138
Grimes East					
Split from Grimes Creek	—	168	2,450	3,148	5,317
	—	168	2,553	3,353	5,993
	—	168	2,625	3,530	6,604
Confluence with Grimes Creek	—	168	2,694	3,789	7,588
Grimes to Vallecito					
Split from Vallecito Creek	—	—	—	495	2,528
Grimes West					
Split from Grimes Creek	—	—	272	334	815
Hermosa Creek					
At Confluence with Bucks Creek		2,200	3,600	4,400	6,300
Junction Creek					
National Forest Boundary	—	1,500	3,000	4,000	7,100



Source/Location	Drainage sq. Miles Area	Discharge (cubic feet/second)			
		10-YR	50-YR	100-YR	500-YR
Junction Creek – Lower Split Flow					
Spill from Junction Creek	—	0	260	590	2,217
Junction Creek – Upper Split Flow					
Spill From Junction Creek	—	0	100	192	654
Lightner Creek					
At Fish Hatchery	27	900	1,650	2,050	3,200
At Confluence with Coal Gulch	53	1,550	2,670	3,530	5,530
At Mouth	66	1,800	3,100	4,200	9,100
Los Pinos River					
At Vallecito Reservoir Outlet	—	3,100*	3,100*	3,100*	3,100*
At Red Creek	—	3,700	4,500	5,000	6,700
Near Columbus, CO	—	4,600	6,500	7,800	11,700
At Bear Creek	—	5,400	8,300	10,200	16,100
At Bayfield, CO	—	5,800	9,200	11,500	18,600
Lower Berri Creek					
Confluence with Vallecito Creek	—	—	—	1,928	9,529
Middle Creek					
Split from Vallecito Creek	—	284	305	317	511
	—	614	1,112	1,246	1,912
	—	860	1,841	2,515	6,007
At Vallecito Reservoir	—	1,246	1,797	3,079	7,821
Middle East					
Confluence with Middle Creek	—	56	201	538	2,397
South Bear Creek					
Split from Vallecito Creek	—	239	658	1,103	1,959
Upper Berri Creek					
Confluence with Vallecito Creek	—	—	—	73	512
	—	—	—	68	1,366
Vallecito Creek					
At National Forest Boundary	—	2,372	4,524	7,175	20,772
	—	2,088	4,219	6,859	20,261
	—	1,841	2,744	4,502	11,058
	—	1,739	2,480	3,866	9,815
	—	1,454	1,914	2,483	4,876



Source/Location	Drainage sq. Miles Area	Discharge (cubic feet/second)			
		10-YR	50-YR	100-YR	500-YR
	—	2,700	3,711	5,562	12,697
	—	2,700	3,467	4,994	11,290
	—	2,459	2,589	2,804	5,603
	—	2,461	5,542	8,097	21,741
At Vallecito Reservoir	—	2,700	6,200	9,200	23,700

**Discharges controlled by Vallecito Reservoir Dam
 Source: Table 1 Summary of Discharges from FEMA FIS Text, 2010*

4.6.8 Warning Time

In general, warning times for floods can be a few hours to days. Flash flooding can be less predictable, often with no warning time as the County has poor radar and river gauges are poorly placed for sudden changes. Potential hazard areas can be warned in advanced of potential flooding danger through the CodeRed alert system. Through October 2018, the County; in partnership with the Colorado Division of Homeland Security and Emergency Management, Colorado Water Conservation Board and University of Oklahoma at Norman OK, placed a temporary radar on top of Missionary Ridge for the 2018 Monsoon Season. The radar was critical for public warning due to the inherent deficiencies in the NWS Doppler coverage of the region.

4.6.9 Secondary Hazards

The most problematic secondary hazard for flooding is bank erosion, which in some cases can be more harmful than actual flooding. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail. Hazardous materials spills are a secondary hazard of flooding if storage tanks rupture and spill into streams or storm sewers. Septic systems could also be impacted if they are in the path of floods.

It is also recognized that wildland fires within a watershed can exacerbate the flood hazard by virtue of increased rate and volume of runoff and attendant erosion and sediment discharge.

4.6.10 Climate Change Impacts

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Going forward, model calibration or statistical relation development must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted. Climate change is already impacting water resources, and resource managers have observed the following:

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management and ecosystem functions.



- Extreme climatic events will become more frequent, necessitating improvement in flood protection, drought preparedness and emergency response.

The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain area to contribute to peak storm runoff. High frequency flood events (e.g. 10-YR floods) in particular will likely increase with a changing climate. Along with reductions in the amount of the snowpack and accelerated snowmelt, scientists project greater storm intensity, resulting in more direct runoff and flooding. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

As hydrology changes, what is currently considered a 100-YR flood may strike more often, leaving many communities at greater risk. Planners will need to factor a new level of safety into the design, operation, and regulation of flood protection facilities such as dams, floodways, bypass channels and levees, as well as the design of local sewers and storm drains.

4.6.11 Flood Vulnerability Analysis

This section describes vulnerabilities to flooding in terms of population, property and infrastructure. Two methods of analysis were performed for flood exposure assessment. The Level 2 Hazus protocol was used to assess the exposure to flooding in the planning area, these results are not included in the snapshots. An intersect analysis with FEMA flood zones and the Preliminary 100-YR flood study was also completed, the results of which are included in the snapshots. Both methods used property value and building characteristics at the parcel/building level, FEMA floodplain data, and (Hazus) National Elevation Dataset topography to estimate potential flooding impacts.

Flood exposure snapshot results for the County were generated using FEMA 100-YR and 500-YR flood zones and the following data sources: Population: Census TIGER Data (2016); Parcel Value: La Plata County Assessor, La Plata County GIS; Critical Infrastructure: La Plata County GIS, Colorado Health Facilities and Emergency Medical Services Division of the Colorado Department of Public Health and Environment, Colorado Department of Human Services, US Department of Transportation National Bridge Inventory, FEMA, USACE. County assessor data does not include tax exempt structures, such as federal and local government buildings except where market values were provided for such holdings. Table 4-21 provides a snapshot of vulnerability data to flooding. All data sources have a level of accuracy acceptable for planning purposes. Details for each snapshot can be found in this section.

Table 4-21: Flood Vulnerability Analysis Snapshot (Unincorporated La Plata County)

Exposed Population	Exposed Market Value (\$)	Exposed Content Value (\$)	Exposed Critical Facilities	Exposed Miles of Lifeline
2,786	\$ 416,735,030	\$ 214,841,295	974	107
11.3% <i>total pop.</i>	9.4% <i>total value</i>	9.3% <i>total value</i>	6.4% <i>total count</i>	4.3% <i>total mileage</i>



4.6.11.1 Population

Population counts of those living in the floodplain were generated by analyzing County assessor and parcel data that intersect with the 100-YR and 500-YR floodplains identified on FIRMs. Using GIS, U.S. Census Bureau information was used to intersect the floodplain and an estimate of population was calculated by weighting the population within each census block and track with the percentage of flood risk area. Using this approach, it was estimated that the total exposed population is 2,615 within the 100-YR floodplain and 2,786 within the 500-YR floodplain, as shown in Figure 4-15 and Table 4-22.

Figure 4-15: Population Exposure to Flood (Unincorporated La Plata County)

Population Exposure

Population Count in the 100-YR and 500-YR Floodplains

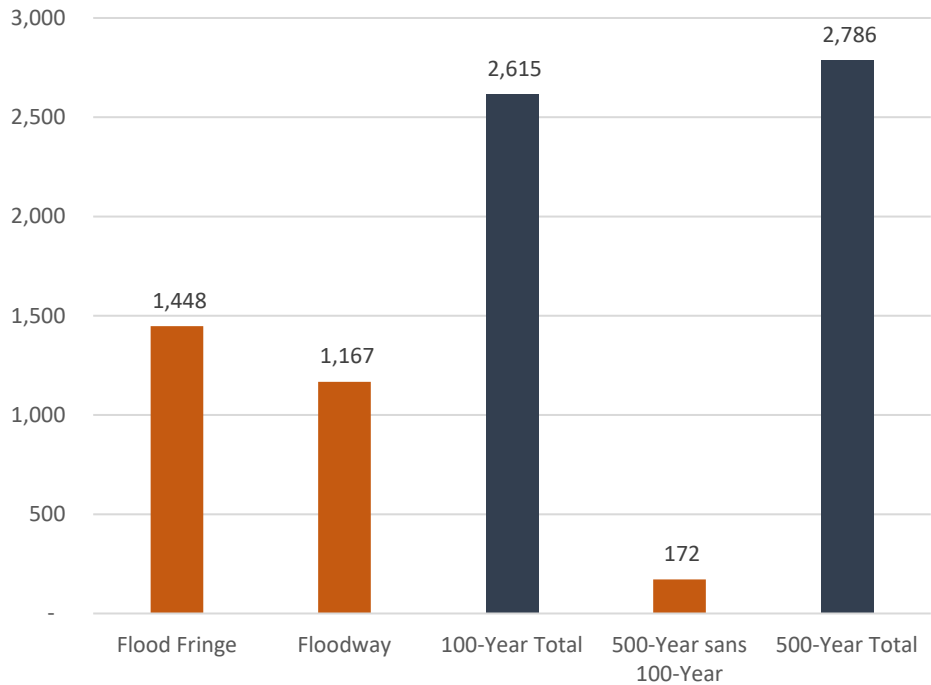


Table 4-22: Summary of Population Exposure to Flood (Unincorporated La Plata County)

	Total Population
La Plata Unincorporated	24,711

Flood Hazard Zone	Population Count	% of Total
Flood Fringe	1,448	5.86%
Floodway	1,167	4.72%
100-Year Total	2,615	10.58%
500-Year sans 100-Year	172	0.69%
500-Year Total	2,786	11.27%



4.6.11.2 Structures and Parcel Value

Figure 4-23 summarizes the number of parcels in the floodplain. GIS models determined that there are 1,280 parcels within the 100-YR floodplain, 216 in the 100-YR floodway and 1,064 additional parcels within the 500-YR floodplain. This methodology also estimated \$471.1 million worth of building-and-contents exposure to the 100-YR flood, representing 7.0 percent of the total assessed value of the planning area, and \$160.3 million worth of building-and-contents exposure to the 500-YR flood, representing 2.4 percent of the total assessed value.

Table 4-23: Parcels Exposed to NFIP Flood Zones (Unincorporated La Plata County)

	Total Parcels		Total Market Value (\$)	Total Content Value (\$)	Total Value (\$)	
La Plata Unincorporated	23,417		\$ 4,444,920,130	\$ 2,321,780,140	\$ 6,766,700,270	

Flood Hazard Zone	Parcel Count	% of Total	Market Value Exposure (\$)	Content Value Exposure (\$)	Total Exposure (\$)	% of Total
Flood Fringe	1,064	4.5%	\$ 272,299,520	\$ 138,603,315	\$ 410,902,835	6.1%
Floodway	216	0.9%	\$ 39,729,410	\$ 20,550,010	\$ 60,279,420	0.9%
100-Year Total	1,280	5.5%	\$ 312,028,930	\$ 159,153,325	\$ 471,182,255	7.0%
500-Year sans 100-Year	473	2.0%	\$ 104,706,100	\$ 55,687,970	\$ 160,394,070	2.4%
500-Year Total	1,753	7.5%	\$ 416,735,030	\$ 214,841,295	\$ 631,576,325	9.3%

The table above does not display loss estimation results; the table exhibits total value at risk based upon the hazard overlay and La Plata County building value data.

4.6.11.3 Damage Estimation

HAZUS-MH calculates losses to structures from flooding by analyzing the depth of flooding and type of structure. Using historical flood insurance claim data, HAZUS-MH estimates the percentage of damage to structures and their contents by applying established damage functions to an inventory. For this analysis, all non-vacant parcels with current market values were used instead of the default inventory data provided with HAZUS-MH. The analysis is summarized in Table 4-24 for the 100-YR and 500-YR flood events. It is estimated that there could be up to \$43.4 million of flood loss from a 100-YR flood event in the planning area and \$54 million of flood loss from a 500-YR flood event. This represents 0.64% of the total value exposed to the 100-YR flood and 0.80% of the total value exposed to the 500-YR event. Table 4-25 and Figure 4-16 shows the 100-YR flood loss estimation (based on depth) in NFIP flood zones by occupancy type. Table 4-25 and Figure 4-17 shows the 500-YR flood loss estimation (based on depth) in NFIP flood zones by occupancy type.



Table 4-24: Flood Loss Estimation (Based on Depth) in NFIP Flood Zones (Unincorporated La Plata County)

Flood Hazard Zone	Building Damage (\$)	Building Damage (% of total)	Content Damage (\$)	Content Damage (% of total)	Total Estimated Damage (\$)	Total Estimated Damage (% of Total Value)
100-YR	\$27,315,837	0.40%	\$16,153,402	0.24%	\$43,469,239	0.64%
500-YR	\$33,794,627	0.50%	\$20,234,933	0.30%	\$54,029,559	0.80%

Table 4-25: 100-YR Flood Loss Estimation (Based on Depth) in NFIP Flood Zones by Occupancy Type

Building Type	Building Damage (\$)	Building Damage (% of total damage)	Content Damage (\$)	Content Damage (% of total damage)	Total Damage (\$)	Proportion of Loss (%)
Agricultural	\$ 26,250	0.0%	\$ 83,897	0.2%	\$ 110,147	0%
Commercial	\$ 308,649	0.6%	\$ 1,006,293	1.9%	\$ 1,314,942	3%
Residential	\$ 26,980,937	49.9%	\$ 15,063,213	27.9%	\$ 42,044,150	97%
Total	\$ 27,315,837	63%	\$ 16,153,402	37%	\$ 43,469,239	

Note: *from Table 4-5 Hazus Census Block Input Values

1- Building Replacement Costs = \$4,443,561,759

2- Content Replacement Cost = \$2,321,083,227

3- Total Value = \$6,764,644,986

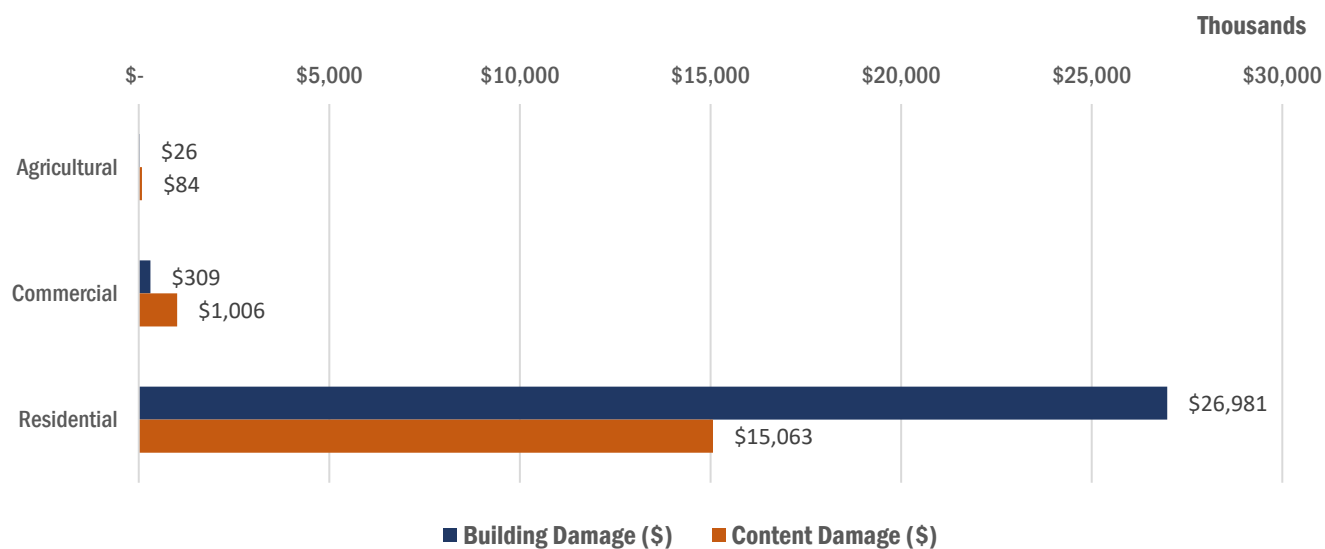


Figure 4-16: 100-YR Flood Loss Estimation by Occupancy



Table 4-26: 500-Year Flood Loss Estimation (Based on Depth) in NFIP Flood Zones by Occupancy Type

Building Type	Building Damage (\$)	Building Damage (% of total damage)	Content Damage (\$)	Content Damage (% of total damage)	Total Damage (\$)	Proportion of Loss (%)
Agricultural	\$ 27,515	0.1%	\$ 85,377	0.2%	\$ 112,891	0%
Commercial	\$ 476,157	0.9%	\$ 1,491,169	2.8%	\$ 1,967,326	4%
Residential	\$ 33,290,955	61.6%	\$ 18,658,387	34.5%	\$ 51,949,342	96%
Total	\$ 33,794,627	63%	\$ 20,234,933	37%	\$ 54,029,559	

Note: *from Table Hazus Census Block Input Values
 1- Building Replacement Costs = \$4,443,561,759
 2- Content Replacement Cost = \$2,321,083,227
 3- Total Value = \$6,764,644,986

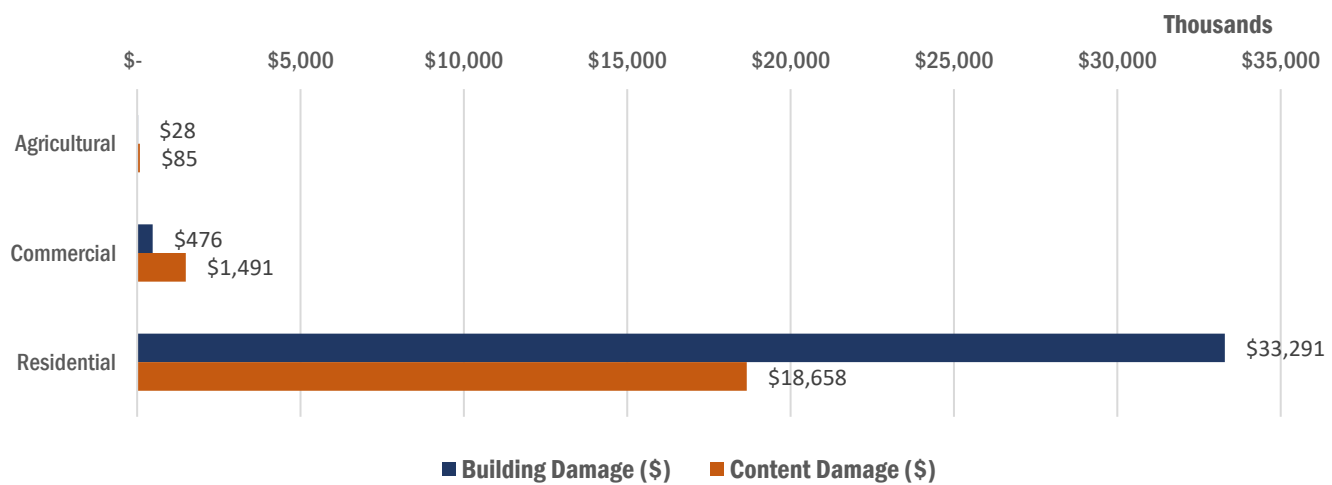


Figure 4-17: 500-YR Loss Estimation by Occupancy

4.6.11.4 Critical Facilities and Infrastructure

Table 4-27 summarizes the critical facilities and infrastructure in the 100-YR, 100-YR floodway and 500-YR floodplains of La Plata County. Details are provided in the following sections.

Table 4-27: Critical Facility Points in the Floodplain in Unincorporated La Plata County

Infrastructure Type	Flood Fringe	Floodway	100 Year Total	500-Year sans 100-Year	500 Year Total	Total Feature Count
Essential Facility	2	0	2	0	2	2
Police Station	0	0	0	0	0	0
Fire Station	1	0	1	0	1	1
Hospital	0	0	0	0	0	0
Medical Facility	0	0	0	0	0	0
County-Owned	0	0	0	0	0	0
City-Owned	1	0	1	0	1	1

Infrastructure Type	Flood Fringe	Floodway	100 Year Total	500-Year sans 100-Year	500 Year Total	Total Feature Count
School	0	0	0	0	0	0
High Potential Loss	29	1	30	2	32	32
Child Care, Licensed	0	0	0	0	0	0
Health Facility, Licensed	0	0	0	0	0	0
Other Government	0	0	0	0	0	0
Shopping Center	0	0	0	0	0	0
Churches	0	0	0	0	0	0
Archeological	0	0	0	0	0	0
Historical Site	6	0	6	1	7	7
Natural Gas Station	0	0	0	0	0	0
Natural Gas Well	23	1	24	1	25	25
Transportation and Lifeline Points	610	177	787	153	940	940
Airport	0	0	0	0	0	0
Bridge	19	6	25	1	26	26
Communication Tower	0	0	0	0	0	0
Power Plant	0	0	0	0	0	0
Primary Substation	0	0	0	0	0	0
Substation	0	0	0	0	0	0
Natural Gas Facility	8	0	8	0	8	8
Waste Water Facility	0	0	0	0	0	0
Water Dock	0	0	0	0	0	0
Water Well	583	171	754	152	906	906
Grand Total	641	178	819	155	974	974

4.6.11.5 Linear Utilities

It is important to determine who may be at risk if infrastructure is damaged by flooding. Roads that are blocked or damaged can isolate residents and can prevent access throughout the county, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Water and sewer systems can be flooded or backed up, causing health problems. Underground utilities can be damaged. Levees can fail or be overtopped, inundating the land that they protect. Table 4-28 shows critical facilities (linear) in the floodplain.



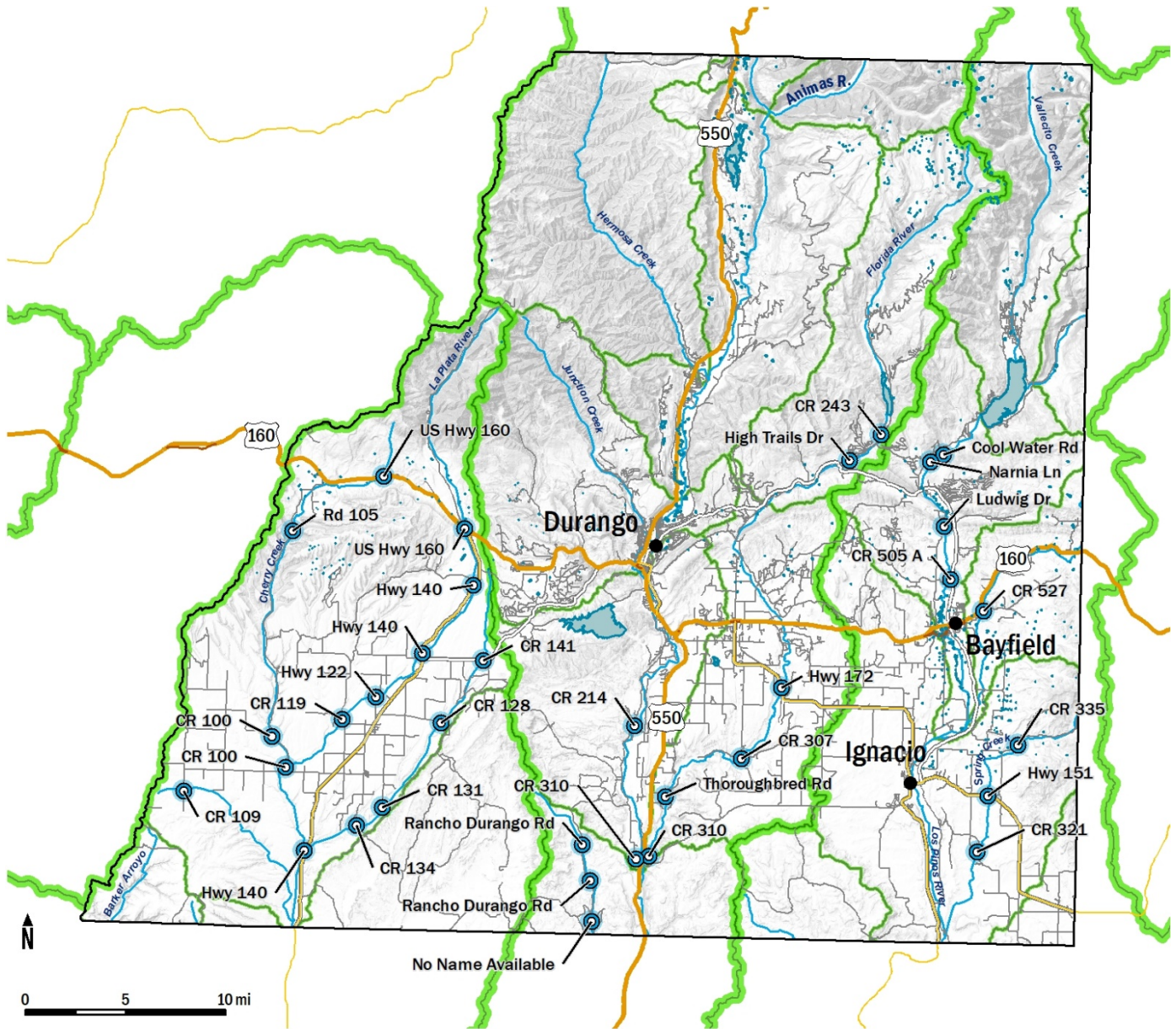
Table 4-28: Critical Facilities (Linear) in the Floodplain

Infrastructure Type (Linear)	Flood Fringe	Floodway	100 Year Total	500-Year sans 100-Year	500 Year Total	Total Mileage
High Potential Loss	4.76	0.03	4.79	1.01	5.81	5.81
Railroad	4.76	0.03	4.79	1.01	5.81	5.81
Transportation and Lifeline	70.65	6.65	77.31	23.62	100.93	100.93
Potable Water Pipeline	7.62	1.13	8.76	4.27	13.02	13.02
Sewer Line	11.13	1.47	12.60	4.61	17.21	17.21
Transmission Lines	16.77	1.23	18.00	3.02	21.02	21.02
Snow Routes	8.07	0.32	8.39	1.99	10.38	10.38
Street	27.07	2.50	29.57	9.73	39.30	39.30
Primary Highway	3.35	0.01	3.37	0.94	4.31	4.31
State/County Hwy	1.13	-	1.13	0.18	1.31	1.31
Ramp	-	-	-	-	-	-
Major Road	6.82	1.30	8.12	2.79	10.91	10.91
Local road	15.65	1.19	16.83	5.72	22.55	22.55
Traffic circle	-	-	-	-	-	-
Cul-de-sac	-	-	-	-	-	-
4wd Trail	-	-	-	-	-	-
Road, parking area	-	-	-	-	-	-
Driveway	0.12	-	0.12	0.10	0.22	0.22
Walkway	-	-	-	-	-	-
Grand Total	75.41	6.69	82.10	24.64	106.74	106.74

County Roads and Bridges

The following major roads in La Plata County pass through the 100-YR floodplain and thus are exposed to flooding:

- Highway 550
- Highway 160
- State Highway 172
- State Highway 140



At Risk Road Crossings along Drainages within Watersheds

- Sensitive Drainage Crossings
- ▭ Watersheds (HUC 8)
- ▭ Watersheds (HUC 10)

Data source: Sensitive drainage crossings are highlighted areas created manually during stakeholder interaction and observation of the geospatial data. HUC boundaries from NHD.

Figure 4-18: Sensitive Drainage Crossings



Water and Sewer Infrastructure

Water and sewer systems can be affected by flooding. Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers and streams.

4.6.12 Future Trends in Development

La Plata County, and its incorporated cities and towns, have floodplain policies regulating development in flood prone areas. Some flood protection measures are provided in the City and Town Ordinances and La Plata County Flood Hazard Regulations for areas within the 100-YR floodplains.

Most recently, La Plata County Resolution No. 2014-30 repealed and re-enacted the La Plata County Land Use Code, Chapter 78, Floods. La Plata County, the City of Durango, and the Town of Bayfield have all adopted the National Flood Insurance Act of 1968, which provides relief in the form of federally subsidized flood insurance.

Summary of Flood Issues

- Areas of known flood risk are not mapped by FEMA preliminary or regulatory flood hazard areas.
- Localized flashy creeks with no visibility (Gauged or otherwise).
- Many domestic water wells within flood risk area.
- Development in the FEMA preliminary 100-YR Floodplain and also within Geo Hazards may occur in Hermosa.
- Difficult and expensive to get flood insurance in A/E Zone.
- Loss of bridge for evacuation and emergency services at multiple locations are possible during flooding events. This includes CR 100 and 106 and others.
- CR 250 floods with mud and debris almost every year.
- General flood risk to county snow routes/prim. roads limiting access.