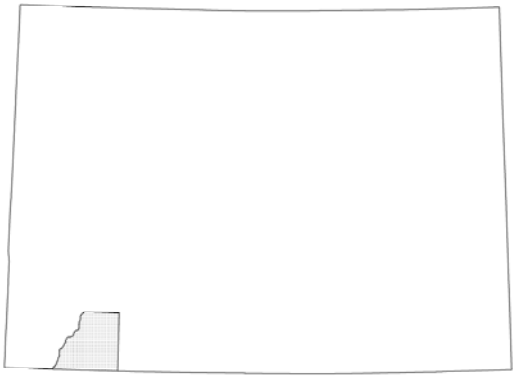
FLOOD INSURANCE STUDY

LA PLATA COUNTY COLORADO, AND INCORPORATED AREAS

VOLUME 1 OF 2



COMMUNITY NAME	COMMUNNITY NUMBER
BAYFIELD, TOWN OF	080098
DURANGO, CITY OF	080099
IGNACIO, TOWN OF*	080268
LA PLATA COUNTY (UNINCORPORATED AREAS)	080097

* N0N FLOOD PRONE COMMUNITY

August 19, 2010

Federal Emergency Management Agency

08067CV001A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Countywide FIS Effective Date: August 19, 2010

Revised Countywide FIS Dates:

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FLOOD INSURANCE STUDY
LA PLATA COUNTY, COLORADO, AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates previous FISs/Flood Insurance Rate Maps (FIRMs) for the geographic area of La Plata County, Colorado, including: the City of Durango, the Towns of Bayfield and Ignacio; the Southern Ute and the Ute Mountain Indian Reservations and the unincorporated areas of La Plata County (hereinafter referred to as La Plata County). The Town of Ignacio is a non flood prone community.

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the county that will be used to establish actuarial flood insurance rates. This information will also be used by La Plata County and the incorporated communities to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal regulations at 44 CFR, 60.3.

This countywide FIS was prepared by compiling pertinent information for the flood hazard areas in both the incorporated and unincorporated areas of La Plata County, Colorado, from existing technical and/or scientific data. This existing data was reviewed by the Federal Emergency Management Agency (FEMA) prior to its use in the development of this Flood Insurance Study to ensure compliance with NFIP regulations.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this countywide FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The original hydrologic and hydraulic analyses for the Town of Bayfield, City of Durango, and La Plata County studies were performed by Camp, Dresser & McKee, Inc., for the Federal Insurance Administration, under Contract No. H-4014. This work, the majority of which was completed in December 1977, covered all significant flooding sources affecting the unincorporated areas of La

Plata County, Colorado. A portion of the work concerning the Los Pinos River in the vicinity of the Town of Bayfield was completed in September 1977.

Within the City of Durango, the study was revised to show the effects of the new U.S. Highway 160/550 By-Pass Bridge and fill along the Animas River on the Base Flood Elevations (BFEs), the floodplain boundaries, and the floodway boundaries. Computations for the revised hydraulic analysis, through the use of the U.S. Army Corps of Engineers (COE) HEC-2 step backwater computer program, were performed by Goff Engineering & Surveying, Inc. and the findings were presented in the report entitled "Floodway and Flood Elevation Modifications, MP 63.000 to MP 63.251, Durango,Colorado," (Goff, 1988). The BFEs, the floodplain and the floodway boundaries were revised to reflect these data from a point approximately 2,430 feet upstream of the new La Posta Road Bridge to a point approximately 1,850 feet upstream of the old U.S. Highway 160 Bridge. This study was completed in April 1988.

As part of the countywide Digital Flood Insurance Rate Map (DFIRM) conversion project for La Plata County, the Los Pinos River (Anderson Consulting Engineers, Inc., 2007), Junction Creek in unincorporated La Plata County (Anderson Consulting Engineers, Inc., 2008) and Vallecito Creek, Grimes Creeks, and various split flow path in the Vallecito Valley (Anderson Consulting Engineers, Inc., 2007) were studied using detailed methods. The DFIRM conversion contractor, Anderson Consulting Engineers, Inc., under contract to the La Plata County Public Works Department and the Colorado water Conservation Board (CWCB), performed these analyses in 2007.

Approximate floodplain analyses on the Florida, La Plata, and Animas Rivers were performed in 2008 by Michael Baker, Jr. Inc., FEMA's National Service Provider (NSP) for the Federal Emergency Management Agency (FEMA), under Contract No. HSFEHQ- 04-J-0025, Task Order HSFE08-05-J-0003. This work was completed in February 2008.

Except as noted below, the vector base map for the county was provided by La Plata County and the City of Durango. Specifically, the La Plata County data was provided in 2006 by the La Plata County GIS Department located at 1060 E. 2nd Ave., Durango, CO 81301, phone (970) 382-6226. The City of Durango data was supplied by the City of Durango GIS Department located at 949 E. 2nd Ave, Durango, CO 81301, phone (970) 375-5076. The base map data consists of a series of shape files based on the NAD83 horizontal datum, using the UTM Zone 13 projection and includes the following:

(a) Transportation coverage – Included in this information is the road centerline and airport information within the county. Road centerline information was obtained from the La Plata County and City of Durango GIS Departments. Airports were digitized from the 2005 NAIP aerial photo of the county, which was obtained from the United States Geological Survey (USGS);

(b) Political boundaries – These data include all incorporated community, military and Federal facility, National Forest, and State Park boundaries. These data were obtained from the La Plata County GIS Department and were aligned to the Public Land Survey System (PLSS) lines for the County;

(c) Public Land Survey System - These data were obtained from the Bureau of Land Management and includes all section, township, and range information for the County;

(d) Hydrography - These data were initially obtained from the La Plata County GIS Department; then corrected by Anderson Consulting Engineers, Inc. to coincide with the stream centerlines visible on the 2005 NAIP aerial photograph. For areas where new studies were conducted for the DFIRM conversion project the stream centerline was replaced with the profile baseline utilized in the respective hydraulic study;

(e) National Geodetic Survey (NGS) benchmarks – The NGS benchmarks were downloaded from the National Geodetic Survey/National Oceanic and Atmospheric Administration website;

(f) USGS Quad map index – These data were obtained from the USGS and includes the outline of all quad maps encompassed by the County boundary; and

(g) New FIRM panel boundaries – This data set was created by Anderson Consulting Engineers, Inc., and displays the outlines of the new DFIRM panels for the county.

The hydraulic structure layer, including bridges and culverts within the extents of the effective hydraulic models, along with dams, weirs, and levees that are present within the county were obtained from the respective hydraulic studies. Dams, weirs, and levees along with the bridges and culverts in the effective hydraulic models that were visible on the 2005 aerial photo were digitized by Anderson Consulting Engineers, Inc.

The coordinate system used for the production of the digital FIRM is Universe Transverse Mercator referenced to the North American Datum of 1983 and the GRS 80 spheroid, Western Hemisphere.

1.3 Coordination

An initial coordination meeting was held on July 21, 1976, and was attended by representatives of La Plata County; the Federal Insurance Administration, the State Coordination Agency, the CWCB, the City of Durango, the Town of Bayfield, and Camp Dresser & McKee, Inc., the study contractor. The purpose of

this meeting was to discuss the nature and purpose of the study, the scope, and limits of work, and flood information currently available concerning the community.

During the course of the work done by the study contractor, the U.S. Army Corps of Engineers - Sacramento District, the USGS; the U.S. Soil Conservation Service (SCS), and the CWCB reviewed the results of the hydrologic analyses. Flood elevations, flood boundaries, and floodway delineations were reviewed with community officials.

The results of the work done by the study contractor within the Town of Bayfield were reviewed at a final community coordination meeting held on October 26, 1977, and attended by representatives of the Federal Insurance Administration, the CWCB, the Town of Bayfield, La Plata County, and the study contractor. No objections were made concerning this portion of the FIS.

On March 7, 1978, the results of the study within La Plata County and the City of Durango were reviewed at a final community coordination meeting attended by county officials and personnel of the Federal Insurance Administration, the CWCB, and the study contractor. No major problems were encountered with the study results.

A pre-scoping meeting for the La Plata Countywide DFIRM conversion project was conducted in December 2005 at the La Plata County Fairgrounds in Durango.

On March 30, 2009 the results of the countywide La Plata DFIRM Conversion project were presented and reviewed at a final community coordination meeting attended by representatives of FEMA, the CWCB, La Plata County, the City of Durango, and the Towns of Bayfield and Ignacio. All concerns raised during this meeting have been resolved.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the unincorporated areas of La Plata County, Colorado including the incorporated communities of Durango, Bayfield, and Ignacio. This FIS includes flood hazard information located within the Southern Ute Indian Reservation, although the Reservation is not a participant in the NFIP. The Ute Mountain Indian reservation is not included in this FIS.

As part of the 1978 studies for the communities of La Plata County, the City of Durango, and the Town of Bayfield, detailed hydraulic analyses were performed on portions of the Animas River, Hermosa Creek in the vicinity of Hermosa, Junction Creek, Dry Gulch Creek, Lightner Creek, Los Pinos River at Bayfield, Los Pinos River at Ignacio, Vallecito Creek, and Grimes Creek. Because Los

Pinos River at Ignacio is located within the Southern Ute Indian Reservation, the information concerning the stream was not included in the 1978 study.

Portions of the Animas River, Hermosa Creek, Florida River, Los Pinos River, Spring Creek, Wilson Gulch, Wildcat Canyon, and Coal Gulch were studied by approximate methods because no significant development existed at the time or was expected for the next 5 years.

For the 1978 FIS studies, those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1982.

As part of the countywide DFIRM Conversion project in 2008, the following streams were studied by detailed methods:

- Los Pinos River from the Southern Ute Indian Reservation Boundary north to the Vallecito Reservoir, a distance of approximately 15.6 miles (Anderson Consulting Engineers, Inc., July 2007);

- Vallecito Creek from Vallecito Reservoir upstream to the Vallecito Campground, a reach of approximately 3.3 miles. Grimes Creek and Middle Creek (1.9 miles and 1.1 miles respectively) and several smaller spilt flow paths were also analyzed as part of this study (Anderson Consulting Engineers, Inc., July 2007); and

- Junction Creek from the City of Durango corporate boundary upstream to the boundary of the San Juan National Forest, a reach of approximately 2.7 miles (Anderson Consulting Engineers, Inc., February 2008).

Approximate flood hazard information was mapped along the Florida River from the confluence with the Animas River to a point approximately 1 mile upstream of the Lemon Reservoir, along the La Plata River from the Colorado/New Mexico border to approximately 2 miles upstream of Mayday, and along the Animas River from the Colorado/New Mexico border to a point approximately 2.3 miles downstream of U.S. Highway 160.

Water-surface elevations for the 100-year Zone A floodplain on the Florida, La Plata, and Animas Rivers were computed using the Hydraulic Engineering Center - River Analysis System (HEC-RAS), Version 3.1.2 and 3.1.3 (U.S. Army Corps of Engineers, April 2004 and May 2005).

For the Florida River, topographic maps with 2-foot contour intervals (City of Durango, April 2001) were acquired from the City of Durango, in GIS shapefile format. These maps were generated from photogrammetric DTM and aerial LIDAR flow in April 2001. In addition, for the Florida River, topographic maps with 5-foot contour intervals (La Plata County, April 2003) were acquired from

La Plata County in GIS shapefile format. These maps were generated from photogrammetric DTM and aerial LIDAR flow in April 2003. For the La Plata River, 10 meter Digital Elevation Models, dated 2001, (U.S. Geological Survey, 2001) were acquired from the U.S. Geological Survey (USGS), in the form of raster digital data. For the Animas River all of the aforementioned 10-meter, 2-foot, and 5-foot topographic data sources were used. These data were modified from their original formats (re-projected, clipped, and converted to TIN file formats) so that they could be used as input for the HEC-RAS models for all three rivers. Approximate structure surveys were conducted at all stream crossings for the Florida and La Plata Rivers, and that data was used to supplement the aforementioned topographic data.

Approximate methods of analysis were used to study all the remaining areas having a potential flood hazard that did not have available detailed scientific or technical data.

The 1978 study was revised on March 16, 1995, to reflect the effects of more detailed topography and intermittent channelization along the Animas River in the vicinity of the James Ranch property. As a result of these changes, the floodplain and floodway were redefined for a reach of the Animas River from milepost 78.940 to milepost 81.419. The hydrologic analysis for this revision was based on the information found in the Flood Insurance Study report for La Plata County, Colorado (U.S. Army Corps of Engineers, Sacramento District, 1974 and Unknown, 1977). The revised hydraulic analysis for this reach, which was developed by Goff Engineering and Surveying, Inc., and presented in their technical report, entitled "Floodway and Flood Elevations Modifications, Animas River, MP 78.940 to 81.419, La Plata County, Colorado," dated November 10, 1992 (Golf Engineering and Surveying, Inc., November 10, 1992), utilized the U.S. Army Corps of Engineers (USACE) HEC-2 computer program (U.S. Army Corps of Engineers, May 1991). Known starting water-surface elevations and Manning's roughness coefficients were taken from the effective FIS report. Cross-section information was taken from aerial work maps. The floodway presented in this revision was computed on the basis of equal conveyance reduction from each side of the floodplain and on user-defined encroachment locations. As a result of this study, the base (100-year) flood elevations both decreased and increased throughout the revised reach, and the 100- and 500-year floodplains and 100-year floodway were revised. Topographic maps at a scale of 1"=200' with a contour interval of 2 feet, produced by Goff Engineering and Surveying, Inc., dated November 10, 1992 (Golf Engineering and Surveying, Inc., November 10, 1992), were utilized to produce the revised flood boundaries associated with this study.

The study was also revised on May 21, 2001, to incorporate detailed flood hazard information along the Animas River from approximately 2.09 miles downstream of U.S. Highway 155/160 to approximately 0.39 mile upstream of La Posta Road and from approximately 0.58 mile upstream of 32nd Street to approximately 3.56 miles upstream of 32nd Street, and along Lightner Creek from the confluence

with the Animas River to approximately 3,525 feet upstream of U.S. Highway 160.

The hydraulic analyses for this restudy were performed by Foothill Engineering Consultants, Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-93-C-4150. This work was completed in May 1998.

The floodway determination and boundary delineations for Lightner Creek and the upper portion of the Animas River from approximately 0.58 mile upstream of 32nd Street to approximately 3.56 miles upstream of 32nd Street were completed by Michael Baker Jr., Inc., for FEMA, in February 1999.

The peak discharge-frequency relationships for the studied streams were taken from previous Flood Insurance Studies for the City of Durango, Colorado (Federal Emergency Management Agency, December 5, 1989), and La Plata County, Colorado (Federal Emergency Management Agency, March 16, 1995).

Water surface elevations for the 10-, 50-, 100-, and 500-year flood events were computed using the BOSS River Modeling System (RMS) (Boss International, Inc., 1997). BOSS RMS is an AutoCAD®-based program designed to simplify the input processing of the USACE HEC-2 computer program (U.S. Army Corps of Engineers, September 1990).

Topographic maps with 2-foot contour intervals were acquired from the City of Durango, in the form of AutoCAD® drawing files. These maps were created from aerial photography flown April 4, 1994. Bridge inspection and construction drawings were available for the bridges over the Animas River. These drawings were used as input data for the HEC-2 models. A limited number of surveyed cross sections of the Animas River were provided by the City of Durango. These sections were used to supplement the AutoCAD® map and bridge data.

Field investigations were conducted to visually confirm the topographic mapping, verify culvert and bridge geometry, and estimate roughness coefficients (Manning's "n" values) for the studied streams. Roughness coefficients for the main channel depended on channel condition and obstructions, while roughness coefficients for the floodplain depended on vegetation, irregularity, obstructions, and meandering (U.S. Department of the Interior, 1985). The ranges of Manning's "n" values used for each stream are shown in Table 2 in Section 3.2 of this FIS.

The starting water-surface elevations were calculated using normal depth or critical depth as appropriate.

Using BOSS RMS, the cross sections were located to effectively represent changes in flow, conveyance, surface characteristics, and structures.

For the studied streams, the boundaries of the 100-year flood were delineated using the flood elevations plotted along surveyed cross sections. The flood boundaries between cross sections were interpolated using topographic mapping from the City of Durango.

Table 4 "Floodway Data," and Exhibit 1, "Flood Profiles," were also revised to reflect changes as a result of this restudy.

2.2 Community Description

La Plata County

La Plata County is located in southwest Colorado, and had a population of 47,936 in 2006, which is an increase of 48% over the 1990 population of 32,284 (U.S. Census Bureau, 2006). La Plata County is bordered by Montezuma County to the west; the Southern Ute Indian Reservation and San Juan County, New Mexico to the south; Archuleta and Hinsdale Counties to the east; and San Juan County to the north. The 2000 population of the Southern Ute Indian Reservation is 11,159, with the 2000 population of the Ute Mountain Indian Reservation being 1,687.

The detailed study areas for unincorporated La Plata County include the Animas River and Hermosa Creek, Junction Creek, Dry Gulch Creek, and Lightner Creek, the Los Pinos River near Bayfield, and Vallecito Creek and Grimes Creeks along with several split flow paths in the Vallecito valley. The study areas, which include the adjoining unincorporated areas of Durango and Bayfield, are located in the southwestern part of Colorado's San Juan mountain region, in La Plata County.

Agriculture and the lumber industry have continued to play important roles in the economy of the study areas near Durango since the first settlement. New factors affecting the economic base of the study area include tourism, the recreation industry, natural gas production, and mountain homesites. Tourism has increased its importance in the areas economy in recent years. The area upstream from Vallecito Reservoir has become popular for mountain homesites as second homes since the construction of Vallecito Reservoir.

From the San Juan Mountains, the Animas River flows southerly through steep, narrow canyons into the nearly 1-mile wide Animas Valley, which extends for approximately 15 miles to Durango. Elevations in the Animas River drainage basin vary from more than 14,000 feet along the western slopes of the San Juan Mountains to approximately 6500 feet at Durango. The Animas Valley north of Durango is wide, gently sloping, and shallow. The flood-carrying capacity of the Animas River channel in this area is relatively small. The drainage area of the Animas River at the northeast corporate limits of the City of Durango is 649 square miles.

The Animas River's upper drainage basin (near Hermosa) is bounded by the Dolores and San Miguel River basins on the west; by the Uncompahgre and Gunnison River basins on the north; and by the Rio Grande, Los Tinos, and Florida River basins on the east. Elevations range from approximately 6,700 feet in the Hermosa area to over 14,000 feet in the highest headwater areas of the Animas River and 11,000 feet in the Hermosa Creek basin.

The study area of the Animas River and Hermosa Creek in the vicinity of Hermosa extends along the Animas River from near the end of the river's canyon reach upstream to near the southern boundary of the San Juan National Forest, and along the lower 2.8 miles of Hermosa Creek. Hermosa Creek joins the Animas River from the west in the Animas Valley, southeasterly of Hermosa. The Animas Valley is on the southern slopes of the San Juan Mountains in the southwest corner of Colorado. The Hermosa area is on the western side of the valley, approximately 10 miles north of Durango.

The Lightner and Junction Creek watersheds, which are tributaries of the Animas River at Durango, cover approximately 66 and 39 square miles, respectively. Lightner and Junction Creeks rise in the La Plata Mountains to the northwest of Durango at elevations greater than 12,000 feet. The watersheds consist of high, mountainous terrain with steep to moderately steep slopes. Within the study areas, both Lightner and Junction Creeks have well-defined channels and sufficient channel capacities to pass minor floodflows without significant property damage.

The drainage basin of Dry Gulch Creek, which covers approximately 4 square miles, is situated between the lower portions of the basins of Lightner and Junction Creeks. The headwater elevation is in excess of 8000 feet and it joins Junction Creek approximately 0.5 mile upstream from the Animas River.

The Los Pinos River flows through typical glaciated mountains from the Needle Mountains at approximately 14,000 feet. Vallecito Creek joins the Los Pinos River at Vallecito Reservoir at an elevation of approximately 7,670 feet. In general, bed slopes on Vallecito Creek are steep upstream from the reservoir. Stream gradients of 100 to 300 feet per mile are common. The drainage area above Vallecito Dam is approximately 270 square miles. Downstream from the Vallecito Reservoir, the Los Pinos River watershed consists of high mountainous terrain with steep to moderately steep slopes. The drainage area of the Los Pinos River is 349 square miles at Bayfield.

Vallecito Creek and Grimes Creek are located upstream from the Vallecito Reservoir in a wide valley. This valley also contains several smaller split flow channels that occur in storm events on Grimes and Vallecito Creeks greater than the 10-year event. Both of these watersheds drain into the Vallecito Reservoir, at the southern end of the Vallecito valley. The drainage areas for these creeks are 90 and 5 square miles, respectively.

Soils of the study area are mostly Rock Outcrop-Cryumbrepts association according to the U.S. Soil Conservation Service's classifications. These soils are shallow and well to poorly drained; therefore, they have slow infiltration rates when thoroughly wetted and a slow rate of water transmission. Most of the watersheds are covered with trees and bushes, which tend to reduce the runoff potential.

The climate of the study area is arid to semi-arid except in the high headwaters, where precipitation is moderately heavy. The annual precipitation ranges from greater than 50 inches in the headwater regions to the Durango area, which has a mean annual precipitation of approximately 18 inches, with 8 inches falling from May to September. The areas at Bayfield and Ignacio have a mean annual precipitation of approximately 14 inches, with 6 inches observed from May to September. The Vallecito Reservoir area receives 25 inches mean annual precipitation, with 10 inches of this in May through September. The mean annual temperature in the study area is approximately 45°F, which varies from 66°F in July to 21°F in January. The humidity is generally quite low, which allows rapid evaporation in all the study areas.

City of Durango

The City of Durango is located in central La Plata County, in the mountainous region of southwest Colorado. The city had a population of approximately 15,614 in 2006, which is an increase of 25% over the 1990 population of 12,430 (U.S. Census Bureau, 2006).

Agriculture, retail trade, and the lumber industry have continued to play important roles in the economy of the city since it became a trading and manufacturing center for the nearby mines, ranches, and farms during the early years. New factors affecting the economic base of the community include Ft. Lewis College, natural gas production, tourism, and the recreation industry.

Although much of Durango has been developed, the majority of the 100-year floodplain lies in undeveloped areas.

Town of Bayfield

The Town of Bayfield is located in eastern La Plata County, and had a population of 1,792 in 2006, an increase in population of 64% when compared to the 1990 population of 1,090 (U.S. Census Bureau, 2006). The town is completely surrounded by unincorporated areas of La Plata County. The economy of this area depends primarily on agricultural activities and tourism. The flood plain development within the town is mostly comprised of residential development and relatively little commercial development. The Los Pinos River flows from the north from Vallecito Reservoir, through the southwest part of the town before entering the Southern Ute Indian Reservation.

2.3 Principal Flood Problems

Generally, severe floods are caused by rainfall in the study area. 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 the 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.

Information on flooding in the Durango study area prior to the turn of the century is practically nonexistent. Detailed information on the earlier historical floods is very limited because streamflow records were not made, newspaper accounts were very vague, and eyewitness accounts are not available. Large floods occurred in the County in 1896, 1909, 1911, 1927, 1937, 1941, 1946, 1949, 1970, and 1972.

The October 5, 1911 flood is considered the most severe known in the Durango area. During that flood, a peak flow of 25,000 cubic feet per second (cfs), which was estimated to be a flood of 100-year frequency, was recorded on the Animas River. The October 5 event was accompanied by high flows on both Junction and Lightner Creeks. Major snowmelt floods have occurred on the Animas River in May 1941 and June 1949. A rainstorm falling on melting snow in June 1927 produced flows of 20,000 cfs.

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.

The potential flooding hazard at Bayfield from the Los Pinos River is controlled by the discharge from Vallecito Reservoir, 15 river miles upstream of Bayfield.

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. Other major flooding in the Bayfield area occurred in October 1911 and July 1927. In 1911, the Los Pinos River inundated the land along the river at Bayfield for nearly 1 week. One house was washed away, while the water reached a depth of 3.5 to 4 feet at the fairgrounds. Residents reported that the 1927 flood stage was about equal to the 1911 flood. In September 1901, flooding was reported in the San Juan River drainage basin; however, the Los Pinos River did not overflow its banks.

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.

2.4 Flood Protection Measures

No specific flood protection works have been undertaken in La Plata County, the City of Durango, or the Town of Bayfield. However, some flood protection measures are provided in the City and Town Ordinances and La Plata County Flood Hazard Regulations for areas within the 100-year floodplains.

The Town of Bayfield Ordinance No. 99 provides land use and control measures with effective enforcement provisions consistent with the criteria set forth in Section 1910 of the National Flood Insurance Program Regulations.

The City of Durango City Resolution No. 292 requires that any proposed construction, or substantial improvement in a location having a flood hazard, be designed (or modified) and anchored to prevent flotation, collapse, or lateral movement of the structure; all construction materials and utility equipment that are used be resistant to flood damage; and, all construction methods and practices that are used will minimize flood damage. Proposed subdivisions and new developments shall be reviewed to assure that all public utilities and facilities are located, elevated, and constructed to minimize or eliminate flood damage, and adequate drainage must be provided to reduce exposure of flood hazards.

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. City Resolution No. 293 provides land use and control measures with effective enforcement provisions, which are consistent with the NFIP criteria set forth in Code of Federal regulations at 44 CFR, 60.3.

Within the Vallecito area of La Plata County, the Vallecito Reservoir can regulate flow along Los Pinos River, although it was designed solely for irrigation purposes. It does provide some protection from minor flooding. However, some flood protection measures are provided in La Plata County Flood Hazard Regulations for areas within the 100-year flood plains.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this FIS. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, or 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or event within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood, which equals or exceeds the 100-year flood (1 percent chance of annual exceedance) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this FIS. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each stream studied in detail in the county.

Discharge-frequency analyses for the Animas River, Hermosa Creek, Lighter Creek (downstream of Wildcat Canyon), Junction Creek, Dry Gulch Creek, Vallecito Creek, and Grimes Creek were prepared by the U.S. Army Corps of Engineers (U.S. Army Corps of Engineers, Sacramento District, 1974; Unknown, 1977; and Unknown, April 1976) and were reviewed by the 1978 study contractor. The discharges on Vallecito Creek and Grimes Creek were further refined in 2007 to reflect several split flow paths to and from both creeks as flows move south toward the Vallecito Reservoir (Anderson Consulting Engineers, Inc., 2007).

Methods employed in the U.S. Army Corps of Engineers discharge-frequency analyses included streamflow record analysis and the Synthetic Hydrograph method. Discharge-frequency analyses for the Animas River and Lightner Creek (downstream of Wildcat Canyon) were based on streamflow records of rain and snowmelt floods and on data based on streamflow records of rain and snowmelt floods and on data from historic storms. Discharge-frequency analyses for Junction Creek were based on streamflow records and on data developed from similar stream basins in the region. Discharge-frequency analyses for Dry Gulch Creek were based on the Synthetic Hydrograph method because historic floodflow and precipitation data were not available. For Grimes and Vallecito Creeks, discharge-frequency analyses were based on records from the U.S. Geological Survey gaging station near Bayfield on Vallecito Creek and several long-term stream gages in the vicinity having similar basin characteristics.

Discharge-frequency analyses for Lightner Creek (upstream of Wildcat Canyon) were prepared by the 1978 study contractor and were based on regional peak discharge-frequency relationships. Ten gaging stations in the Animas River basin were selected to establish the regional curves. For each selected gaging station, rain and snowmelt events are fitted separately with log-Pearson Type III distribution (U.S. Water Resources Council, March 1976) and then combined statistically into one frequency curve. Regional relationships of basin area to peak discharge for the 10-, 50-, 100-, and 500-year floods were developed through regression analysis.

Discharges previously developed by the COE for the 10-percent, 2-percent, 1-percent, and 0.2-percent annual chance recurrence storms were utilized by Anderson Consulting Engineers, Inc. for the Los Pinos River study reach from Bayfield north to the Vallecito reservoir (Anderson Consulting Engineers, Inc., 2007). The hydrologic analysis and results documented in this report were reviewed and approved by FEMA in November 2006.

Discharge-frequency values for the Animas River and Hermosa Creek in the Vicinity of Hermosa were taken directly from the U.S. Army Corps of Engineers, Sacramento District, and based on streamflow records of rain and snowmelt floods (Unknown, October 1977).

The peak discharge-frequency relationships for the 2008 Zone A restudy of the La Plata and Florida Rivers were determined using the guidelines for regression equation, gage analysis, and drainage area transfer provided in the United States Geological Survey publication WRIR 99- 4190 (U.S. Geological Survey, 2000). The peak discharge-frequency relationships for the Zone A restudy of the Animas River was determined from a flood frequency analysis of three gages along the Animas River (at Farmington (09364500), near Cedar Hill (09363500), and at Durango (093612500)).

Peak discharge-drainage area relationships for all creeks studied in detail are shown in Table 1.

Table 1 – Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Percent Annual Chance (10-year event)	2-Percent Annual Chance (50-year event)	1-Percent Annual Chance (100-year event)	0.2-Percent Annual Chance (500-year event)
500-Year Split Flow					
Split from Vallecito Creek	--	--	--	--	482
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	3,484	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

Table 1 – Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Percent Annual Chance (10-year event)	2-Percent Annual Chance (50-year event)	1-Percent Annual Chance (100-year event)	0.2-Percent Annual Chance (500-year event)
	--	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
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					
	--	--	--	1,928	9,529
Confluence with Valecito Creek	--	--	--	65	3,551

Table 1 – Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Percent Annual Chance (10-year event)	2-Percent Annual Chance (50-year event)	1-Percent Annual Chance (100-year event)	0.2-Percent Annual Chance (500-year event)
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					
	--	--	--	73	512
Confluence with Vallecito Creek	--	--	--	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
	--	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

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the riverine sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the FIRM (Exhibit 2).

La Plata County

Water-surface profiles of the selected recurrence intervals for the Animas River, Hermosa Creek, Junction Creek in the City of Durango, Dry Gulch Creek, and Lightner Creek, were developed using the U.S. Army Corps of Engineers HEC-2 step-backwater computer model (Unknown, October 1973). Water-surface profiles of the selected recurrence intervals for Los Pinos River, Vallecito Creek, Grimes Creek, and Junction Creek outside of Durango were developed using the U.S. Army Corps of Engineers HEC-RAS step-backwater computer model (USACE, 2004).

Cross section data for Junction Creek within Durango, Dry Gulch Creek, and Lightner Creek were obtained from aerial photographs (Bell Mapping Company, October 1976); the below-water sections were obtained by field measurement. Cross section data for the Animas River and Hermosa Creek near Hermosa were taken directly from the U.S. Army Corps of Engineers Flood Hazard Information report (Unknown, October 1977). The below-water sections for these streams were obtained by field measurement. Cross section data for Vallecito Creek, and Grimes Creek, were obtained from 1- and 2-foot contour topography generated in 2006 (Anderson Consulting Engineers, Inc., 2007). Cross-section data for Junction Creek in unincorporated La Plata County was obtained from 2-foot contour topography generated by the City of Durango in conjunction with surveyed below water data at each cross section (Anderson Consulting Engineers, Inc., April 10). Cross section data for the Los Pinos River was obtained form 2-foot contour data generated by the U.S. Army Corps of Engineers (Anderson Consulting Engineers, Inc., 2007). All bridges and culverts were field measured to obtain elevation data and structural geometry. The hydraulic analyses for the reach of the Animas River from MP 63.000 to MP 63.251 were conducted by Goff Engineering & Surveying, Inc., (Goff Engineering & Surveying, Inc., April 1988) and reviewed by the study contractor.

Roughness coefficients (Manning's “n”) for the Animas River, Hermosa Creek, Dry Gulch Creek, and Lightner Creek were estimated by field inspection at each cross section and checked for reasonableness against a recognized standard text (Ven Te Chow, 1959). In the case of the Vallecito Creek, Grimes Creek, Los Pinos River, and Junction Creek studies, Manning’s *n* values were determined through a combination of field reconnaissance efforts and the application of Cowan’s Method (Ven Te Chow, 1959).

Field investigations were conducted for the Zone A analyses on the Florida, La Plata, and Animas Rivers to determine culvert and bridge geometry and estimate roughness coefficients (Manning’s “n” values) for the studied streams. The starting water-surface elevations were calculated using normal depth. Using the Watershed Information System (WISE) (Watershed Concepts, 2006) geographic information system interface, cross sections were located to effectively represent changes in flow, conveyance, hydraulic structure data, meandering or other

surface characteristics. The cross-sectional data points were then extracted from the topography detailed in Section 2.1 of this FIS, by the WISE computer program at all cross-section locations.

Roughness factors for all streams studied by detailed methods are shown in Table 2.

Table 2 – Manning's "*n*" Values

Stream	Channel "*n*"	Overbank "*n*"
500-Year Split Flow	0.040-0.078	0.020-0.10
Animas River	0.034-0.050	0.050-0.080
D Creek	0.040-0.078	0.020-0.10
Dry Gulch Creek	0.024-0.040	0.05
Grimes Creek	0.040-0.078	0.020-0.10
Grimes East	0.040-0.078	0.020-0.10
Grimes to Vallecito	0.040-0.078	0.020-0.10
Hermosa Creek	0.035	0.06
Junction Creek	0.025-0.070	0.030-0.120
Lightner Creek	0.040-0.100	0.040-0.150
Los Pinos River	0.043-0.073	0.020-0.10
Los Pinos River Divided Flow Path	0.043-0.073	0.020-0.10
Lower Berri Creek	0.040-0.078	0.020-0.10
Middle Creek	0.040-0.078	0.020-0.10
Middle East	0.040-0.078	0.020-0.10
South Berri Creek	0.040-0.078	0.020-0.10
Upper Berri Creek	0.040-0.078	0.020-0.10
Vallecito Creek	0.040-0.078	0.020-0.10

Starting water-surface elevations for the Animas River, Junction Creek in Durango, and Dry Gulch were taken from the Flood Hazard Information report (Unknown, 1977). Hermosa Creek starting water-surface elevations were taken from the Animas River at their confluence. Starting water surface elevations for the study of Junction Creek within unincorporated La Plata County were obtained from the effective water surface elevations in the 2001 FIS for the City of Durango. All other starting water-surface elevations were determined by the slope-area method.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

The flood profiles shown in this report are based on the effects of flow through unobstructed hydraulic structures and are, thus, considered valid only if these structures remain unobstructed and do not fail.

For all streams studied by approximate methods, the slope-area method was employed to obtain flood elevations.

3.3 Vertical Datum

All FISs and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FISs and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of the North American Vertical Datum of 1988 (NAVD88), many FIS reports, and FIRMs are being prepared using NAVD88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities may be referenced to NGVD29. This may result in differences in base flood elevations across the corporate limits between the communities.

As noted above, the elevations shown in the FIS report and on the FIRM for La Plata County and Incorporated Areas are referenced to NAVD88. Ground, structure, and flood elevations may be compared and/or referenced to NGVD29 by applying a standard conversion factor.

The conversion factor from NGVD29 to NAVD88 varies for the detailed study streams in this county. The elevations shown in the FIS report and on the FIRM were, therefore, converted to NAVD88 using a stream network approach. In this method, a single average conversion was established for each flooding source network and applied accordingly. The conversion factor for each flooding source in the community may be found in the following table, as well as on the FIRM.

The vertical datum offset values used for this countywide study are included in Table 3 "Vertical Datum Conversion Factor Table."

Table 3 – Vertical Datum Conversion Factor Table

Flooding Source	Vertical Datum Offset (ft)
Animas River	4.2
Dry Gulch Creek	4.0
Hermosa Creek	4.2
Junction Creek	4.1
Lightner Creek	4.1

Example: To convert Animas River elevations to NAVD 88, 4.2 feet were added to the NGVD 29 elevations.

The BFEs shown on the FIRM represent whole-foot rounded values. For example, a BFE of 5,920.4 will appear as 5,920 on the FIRM and 5,920.6 will appear as 5,921. Therefore, users that wish to convert the elevations in this countywide study to NGVD29 should apply the stated conversion factor(s) to

elevations shown on the Flood Profiles in the FIS report, which are shown to the nearest 0.1-foot.

For more information on NAVD88, see Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication FIA-20/June 1992, or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration, Rockville, Maryland 20910 (Internet address http:/www.ngs.noaa.gov).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS provides 1-percent annual chance floodplain data, which may include a combination of the following: 10-percent, 2-percent, 1-percent, and 0.2-percent annual chance flood elevations; delineations of the 1-percent and 0.2-percent annual chance floodplains; and 1-percent annual chance floodway. This information is presented on the FIRM and in many components of the FIS, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1-percent and 0.2-percent annual chance floodplain boundaries have been delineated using the flood elevations determined at each cross section.

For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at scales of 1:1,200, with a contour interval of 2 feet; 1:2,400, with a contour interval of 2 feet; 1:4,800, with a contour interval of 20 feet (City of Durango, 1974; Kucera and Associates, May 1976; Colorado Department of Natural Resources Topo Maps; and U.S. Geological Survey Topo Maps 1963-1968). Areas studied by approximate methods were delineated using topographic maps at a scale of 1:24,000, with contour intervals of 20 and 40 feet (U.S. Geological Survey Topo Maps 1961-1968).

For each stream studied in detail in the City of Durango, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated

using topographic maps at *a* scaleof 1:1,200, with a contour interval of 2 feet (City of Durango, November 1974). For the revision to Animas River from MP 63.000 to MP 63.251, the boundaries were interpolated using topographic maps with contour interval of 1 foot (Goff Engineering & Surveying, Inc., April 14, 1988).

Prior to the 2007 restudy of the Los Pinos River, the boundaries of the 100- and 500-year floods on the Los Pinos River had been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps enlarged to a scale of 1:4800, with a contour interval of 20 feet (U.S. Geological Survey, 1968).

For the Vallecito Creek, Grimes Creek, Middle Creek, Junction Creek in unincorporated La Plata County, and the Los Pinos River studies, floodplain boundaries between cross sections were interpolated manually in conjunction with the U.S. Army Corps of Engineers HEC-GeoRAS geospatial data processor based on a Triangulated Irregular Network or TIN (U.S. Army Corps of Engineers, 2005).

Approximate flood boundaries in some portions of the study area were taken from the Federal Insurance Administration's Flood Hazard Boundary Map (U.S. Department of Housing and Urban Development, 1977).

The 1-percent and 0.2-percent annual chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, and D), and the 0.2-percent annual chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1-percent and 0.2-percent annual chance floodplain boundaries are close together, only the 1-percent annual chance floodplain has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent annual chance floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management.

Under this concept, the area of the 1-percent annual chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent annual chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The area between the floodway and 1-percent annual chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water surface elevation of the 1-percent annual chance flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

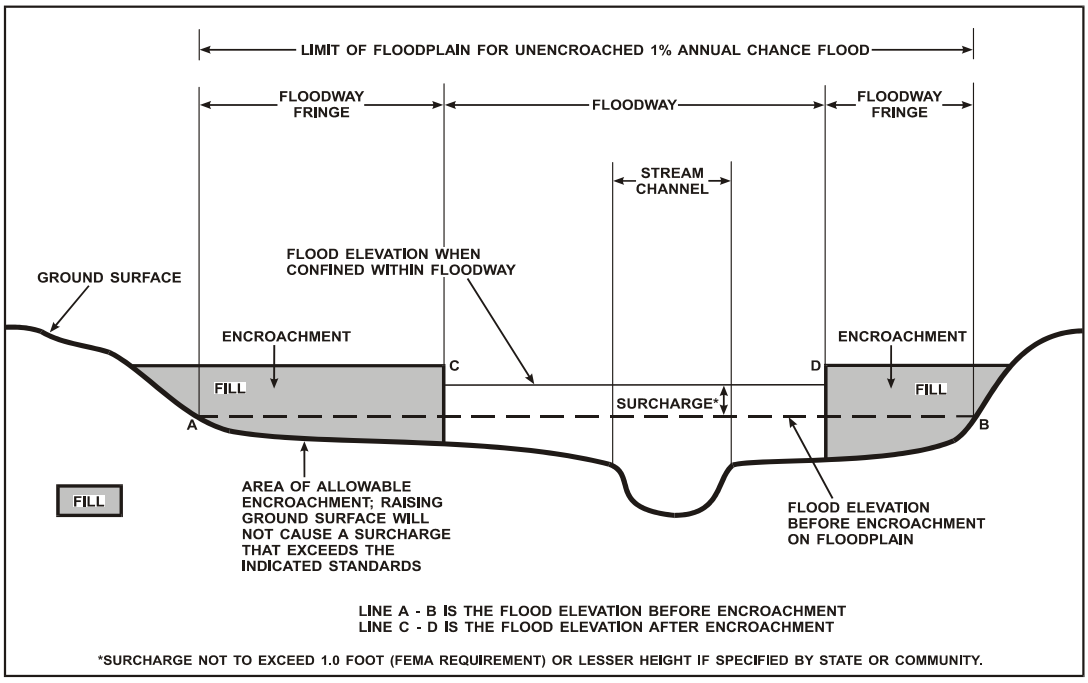

Figure 1 – Floodway Schematic

For this FIS, a floodway was not computed for Hermosa Creek. It was determined that a calculated floodway would not be appropriate because most of the flow is supercritical with high velocities. Encroachment of any kind within the 100-year flood plain is not recommended. Consequently, the 100-year boundary for this stream has been designated as the floodway boundary, except in areas of non-conveyance. No floodway was computed for Dry Gulch Creek because shallow overflow occurs in the reach from Delwood Avenue to the mouth due to inadequate channel capacity.

The floodways for the remaining streams in the study area were computed on the basis of equal-conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 4).

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent annual chance floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent annual chance floodplains that are determined in the FIS by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 1-percent annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Average whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 1-percent annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent annual chance floodplain, areas within the 0.2-percent annual chance floodplain, areas of 1-percent annual chance flooding where average depths are less than 1-foot, areas of 1-percent annual chance flooding where the contributing

drainage areas is less than 1 square mile, and areas protected from the 1-percent annual chance flood by levees. No BFEs or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent annual chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use the zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1-percent annual chance floodplain, and the location of selected cross sections used in the hydraulic analysis.

The current FIRM presents flooding information for the entire geographic area of La Plata County, Colorado. Previously, separate Flood Hazard Boundary Maps (FHBMs) and/or FIRMs were prepared for each identified flood prone incorporated community within the county. Historical data relating the maps prepared for each flood prone community, prior to this countywide FIS are presented in Table 5 “Community Map History”.

7.0 OTHER STUDIES

This FIS was prepared by compiling existing hydrologic and hydraulic technical and scientific data. The data was identified as the best available at the time of compilation of this FIS, and should depict the general conditions of the flooding sources with relative accuracy. FEMA performed a cursory review and accepted the data as valid for purposes of this FIS and the NFIP. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to FEMA, Mitigation Division, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267 for consideration of revision of this Flood Insurance Study.

La Plata County

The U.S. Army Corps of Engineers completed flood hazard studies for the Animas River, Junction Creek, and Dry Gulch Creek in the Durango area in May 1977 (Unknown, 1977). The studies included 10-, 50-, 100-, and 500-year flood profiles and flood plain

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Durango, City of	November 30, 1973	March 5, 1976	January 17, 1979	September 14, 1982 December 5, 1989 May 21, 2001
Ignacio, Town of*	N/A	N/A	N/A	N/A
Bayfield, Town of	October 18, 1974	N/A	September 29, 1978	N/A
La Plata County (Unincorporated Areas)	June 3, 1977	N/A	December 15, 1981	May 21, 2001

* Non Flood Prone Community

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA PLATA COUNTY, CO AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

delineations for 9 miles of the Animas River, 4 miles of Junction Creek, and 0.8 mile of Dry Gulch Creek. Results of the U.S. Army Corps of Engineers' studies were reviewed and adopted in this FIS, except for the portion of Junction Creek outside the Durango corporate limits, where the hydraulics were reanalyzed based on more recent topographic mapping. This reach of Junction Creek, outside of Durango, was subsequently re-studied in 2008 (Anderson Consulting Engineers, Inc., 2008), and the results of this study were incorporated into the 2008 DFIRM conversion project for the county. The reach of the Animas River between Main Avenue and the Denver and Rio Grande Western Railroad Bridge was also excluded from the FIS. The hydraulic analysis for this reach of the Animas was reanalyzed based on field inspection, with the assumption that the dike at the south bank of the Animas River would be unstable when overbank flow occurs.

The U.S. Army Corps of Engineers also conducted a Flood Hazard Information report of Vallecito and Grimes Creeks in 1976 (Unknown, 1976). The study included 10-, 50-, 100-, and 500-year flood profiles and flood plain delineations. The results of that study were reviewed and adopted in the 1978 study. These reaches of Vallecito and Grimes Creeks, including several smaller split flow paths, were re-studied in 2008 (Anderson Consulting Engineers, Inc., 2007), and the results of this study were incorporated into the 2008 DFIRM conversion project for the county.

Another study conducted by U.S. Army Corps of Engineers was done in 1977 on portions of Animas River and Hermosa Creek (Unknown, October 1977). The results of that study were reviewed and adopted in this study.

The Flood Hazard Boundary Map prepared by the Federal Insurance Administration for La Plata County (U.S. Department of Housing and Urban Development, 1977) is superseded by this study.

This Flood Insurance Study either supersedes or is compatible with all previous studies published on streams studied in this Flood Insurance Study and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Mitigation Division, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267.

9.0 BIBLIOGRAPHY AND REFERENCES

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