1995

Flood Insurance Study, Town of Joseph, Utah, Sevier County

Federal Emergency Management Agency

FLOOD INSURANCE STUDY

TOWN OF JOSEPH, UTAH
SEVIER COUNTY

REVISED: JUNE 2, 1995

Federal Emergency Management Agency

COMMUNITY NUMBER - 490127

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 may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and updates a previous Flood Insurance Rate Map for the Town of Joseph, Utah. This information will be used by the Town to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP). The information will also be used by local and regional planners to further promote sound land use and floodplain development.

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 hydrologic and hydraulic analyses for this study were prepared by the Bureau of Reclamation (Reclamation), the study contractor for the Federal Emergency Management Agency (FEMA), under Interagency Agreement EMW-89-E-2993.

1.3 Coordination

On July 27, 1979, the Federal Insurance Administration informed the town officials of Joseph that there was no need for a detailed study for the Town and that it was being converted to the Regular Program. This included converting the earlier Flood Hazard Boundary Map (Reference 1), to a Flood Insurance Rate Map, which resulted in a redesignation of insurance rate zones (Reference 2).

A meeting was held on June 20, 1989, between representatives of FEMA and the Town of Joseph. As a result of the meeting and inspection of areas prone to flooding, the FEMA representative recommended that a flood study be done to correctly evaluate the current flooding hazard in the Town of Joseph.

The study scope was determined during meetings held in June and July 1989 between representatives of FEMA and Reclamation.

The Utah Department of Transportation provided most of the information used in the study. This consisted of the following:

a. Photographs of the Interstate Highway 70 (I-70) borrow area, I-70, and Joseph Connection (Connection) Crossing. (The Connection is a road connecting I-70 and Joseph, and is the same as Utah State Highway 118).

b. Hydraulic and geometric data for culverts in I-70 along Indian Creek, and plan and profile maps for the I-70 area.

c. Hydraulic and hydrologic information for the Cottonwood Creek drainage near Richfield, Utah.

Field surveys were done during October 1990 by the Reclamation Project Office, Provo, Utah. The surveys consisted of the following:

a. Elevations on most streets and highways in the Joseph vicinity.

b. Culvert elevations and measurements for I-70 and the Connection.

c. Elevations and distances defining the I-70 borrow area and gravel pits in Joseph.

d. Cross sections for Indian Creek.

The results of the study were reviewed at the final CCO meeting held on July 11, 1994, and attended by representatives of the Town of Joseph, FEMA, and the U.S. Department of the Interior, Reclamation. All problems raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the Town of Joseph, Sevier County, Utah.

Task Assignment letter (Reference 3) dated September 26, 1989, states the limits of the study reach of Indian Creek to be 1.5 miles from the I-70 crossing downstream to the Town boundary. (The actual distance as measured along the surveyed thalweg is approximately 1.1 miles.) The only defined channel in the study reach, which is small and partly manmade, is located between I-70 and the Canal. The remainder of the reach is characterized by a low depression through yards and streets of Joseph. The entire reach of Indian Creek was studied in detail.

2.2 Community Description

The Town of Joseph, in Sevier County and South Central Utah, is located approximately 116 miles south of Provo, Utah, and approximately 71 miles north of Bryce Canyon National Park. It is also located approximately 12.5 miles southwest of Richfield. The 1990 Census for Joseph indicates a population of 198 (Reference 4).

The Town of Joseph is served by three highways: U.S. Highway 89 passes through Joseph in a north-south direction, Utah State Highway 118 in an east-west direction, and newly constructed I-70 in a northeast-southwest direction. I-70 passes through the northwest part of the Town but is located north and west of all streets. The streets of Joseph are primarily located in the eastern half of the incorporated area. I-70 intercepts the several streams that flow from the high areas west of Joseph. Some of the discharges collect in a large borrow area which is emptied by three culverts and the Connection underpass; other discharges flow through other culverts. The high embankment of the Connection diverts some water in an easterly direction.

The Canal flows through Joseph in a northerly direction and is located immediately west of the streets. The Canal intercepts discharges coming from the I-70 culverts; the discharge will either be contained in the Canal or overtop it, depending on the magnitude of the flood.

For nearby Richfield, the average January and July temperatures are 28.0 degrees Fahrenheit (°F) and 70.8 °F, respectively, and the average annual precipitation is 7.8 inches (Reference 5). It is assumed that these values should approximate those for Joseph.

Vegetation in Joseph ranges from barren, thick grasses, and sagebrush in much of the undeveloped area west of the Canal to shrubs, lawns, and shade trees in the urban area. Vegetation along the Canal and Joseph Canal (smaller canal running parallel to and east of the larger canal) is very dense along most of the banks with thick grass, shrubs, and some trees.

The topography west of Joseph is very steep, that around I-70 is moderately steep, and that in the urban area ranges from moderately to mildly steep. The down gradient through Joseph is toward the north and east. The floodplains of Indian Creek are flat and wide. Landforming, resulting from constructing small yard-irrigation concrete canals and street embankments, has changed the natural topography in Joseph. These features, together with low borrow areas, have a tendency to disrupt the uniformity of the flowing discharge.

The floodplains of the urban reach of Indian Creek consist of commercial and residential development and public utilities. Streets and highways cross the floodplains. Future economic development within the study area is expected to be slow.

2.3 Principal Flood Problems

Precipitation in the Joseph area originates from two major sources. Moisture-laden Pacific air entering the area from the West during the winter produces large general storms, which most often result in heavy snowfall in the upper elevations and either snowfall or moderate-intensity rainfall in the lower elevations.

The second major source of precipitation in the area arises from tropical airmasses entering from the Gulf of Mexico and Pacific Ocean from the South and Southwest during the summer. These airmasses cause high-intensity convective or cloudburst storms, which are augmented by the orographic lifting that occurs as the airmasses pass over the mountains.

Flooding in the Joseph area can result from either heavy spring snowmelt or from summer cloudburst storms. Infrequent cloudburst floods have the greatest potential for damage. Floodwaters carry a large amount of mud, rocks, and debris (all from the slopes to the west), which plug canals and cause flood damage in the lower valley.

Historical data indicate that the Sevier Valley Canal contributes to flooding. Floods deposit debris and sediment in the canal, causing the canal to overtop and breach. The Canal has overflowed several times in the past in the vicinity of the Connection Crossing, although this is not caused by the bridge at that location (Reference 6).

The Sevier River Valley has a long history of flooding, dating back to the earliest settling of the region. Available records do not indicate any large floods in the immediate area of Joseph; however, records for Richfield, Monroe, Elsinore, and localities around Joseph indicate that heavy rains produced floods that caused loss of both life and livestock and destruction of property. The largest flood recorded for Cottonwood Creek (two miles northwest of Richfield) occurred on August 6, 1967, and had an estimated peak discharge of 5,180 cubic feet per second (cfs). This flood, from a drainage area of 19 square miles, had a unit rate of runoff of 273 cfs. The estimated return period is 250 years (References 7 and 8).

2.4 Flood Protection Measures

I-70, located between the urban part of Joseph and the mountains to the west, intercepts discharge originating in the mountains. This discharge is temporarily stored in a borrow area and empties through three I-70 culverts and the Connection underpass toward the urban area of Joseph. A large gravel pit, located east of I-70, intercepts and temporarily stores discharge coming from the I-70 culverts. The Canal will intercept only a small amount of discharge since it is assumed to be full during flooding conditions. All three of the previously described features were not originally planned to provide flood prevention; therefore, they can give only minimal prevention.

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 study. 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-, and 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 even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10); 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 study. 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 each flooding source studied in detail affecting the community. Discharges were computed by Reclamation for the Indian Creek drainage upstream from I-70. A Soil Conservation Service rainfall-runoff program (TR-55) was used to generate the discharge peaks and hydrographs. The program model begins with a rainfall amount uniformly imposed on the watershed over a specified time distribution. Mass rainfall is converted to mass runoff by using a runoff curve number (CN). The CN is based on soils, plant cover, amount of impervious areas, interception, and surface storage. Runoff is then transformed into a hydrograph by using unit hydrograph theory and routing procedures that depend on runoff travel time through segments of the watershed (Reference 9).

Artificial features, downstream from and including I-70, cause the discharges to split, combine, and flow in different areas. Due to this, the original discharges were changed at two locations downstream of I-70. Peak discharge-drainage area relationships for Indian Creek are summarized in Table 1.

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Year	50-Year	100-Year	500-Year
Indian Creek					
At upstream side of I-70	5.74	208	880	1,288	2,226
Immediately downstream of I-70 culverts	--[1]	198	726	967	1,844
Immediately east of south gravel pit and canal	--[1]	173	694	917	1,815

--[1]Data Not Available

3.2 Hydraulic Analysis

Analyses of the hydraulic characteristics of the Indian Creek flow path (including artificial features) were carried out to provide estimates of depths of the 100-year flood. The discharge hydrographs were routed through the I-70 borrow-area, three I-70 culverts, and Joseph Connection underpass. Input data consisted of storage relationships for the borrow area, discharge ratings for the culverts and the underpass.

Some of the discharge from the I-70 culverts is diverted by the Connection high embankment in an easterly direction. The remaining discharge passes through three culverts located in the Connection. The discharge from the culverts combines with that from the overpass and eventually flows toward and into the south gravel pit.

The gravel pit, similar to the borrow area, temporarily stores some of the discharge. By using the volume of the gravel pit and a discharge rating for the overflow from the pit, the discharge was routed through the pit and toward the low depression in Joseph.

The discharge from the gravel pit combines with that which was diverted by the Connection embankment. The combined discharge flows in the low depression and leaves the Town in the northeast part as it flows toward the Sevier River.

For the urban part of Joseph, there is no defined channel and the water flows through the Town as sheetflow. The 100-year floodplain widths in the urban part of Joseph were estimated using cross sections located at various points between the Canal and the east side of Joseph. The sections were generally located across the low depression where most of the water was expected to run. The HEC-2 hydraulic model (Reference 10) was used to estimate the flow widths. These widths were checked and adjusted based on field investigations.

The flow widths between I-70 and the Canal (west urban part of Joseph) were estimated in the following manner. At I-70, the flow width was taken to be the distance from the southernmost culvert (one of those draining the borrow area) and north to the Connection underpass. This flow path follows Indian Creek's small channel and progressively gets wider until it joins and blends with the flow path in the urban area.

Average flow depths for the sheetflow were estimated as follows:

a. Several depths were located along the inundated portions of the streets. An average depth was computed for four cross sections that followed streets. This average depth was then used to approximate the average depth for the area surrounding a street (a street neighborhood).

b. For the area between I-70 and the Canal (west end of urban area) no cross sections were used; rather, the estimated depths around the Joseph Connection and spoil bank were used to compute an average depth for the area. A field investigation verified these depths. Final average depths and street neighborhoods are shown in Table 2.

Table 2. Summary of Sheetflow Depths

Street Neighborhood, in upstream direction	Average depth in whole feet
East Joseph limit to past 200 Street East, including east end of 400 Street North	1
100 Street East	3
State Street	2
100 Street West	3
West of urban part to I-70	3

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100-year floodplain boundaries to assist communities in developing floodplain management measures.

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 Indian Creek studied by detailed methods, the 100-year floodplain boundary has been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 (enlarged to a scale of 1:2,400), with a contour interval of 40 feet (Reference 11).

The 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zone A0). 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.

4.2 Floodways

Only average flood depths were estimated for this study and no floodway was computed.

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 AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map 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 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

7.0 OTHER STUDIES

The only other studies available for the Town of Joseph are a Flood Hazard Boundary Map done in 1979 (Reference 1) and a Flood Insurance Rate Map done in 1986 (Reference 2). Both of these maps had limited use in the study.

A detailed study was done for the nearby City of Richfield in 1986. The types of useful information from that study included storm and flooding history and principal flood problems and damage.

8.0 LOCATION OF DATA

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

9.0 BIBLIOGRAPHY AND REFERENCES

1. Federal Insurance Administration, Flood Hazard Boundary Map, Town of Joseph, Sevier County, Utah, 1979

2. Federal Emergency Management Agency, Flood Insurance Rate Map, Town of Joseph, Sevier County, Utah, 1986

3. Federal Emergency Management Agency, Task Letter to Bureau of Reclamation, Denver, Colorado, September 26, 1989

4. Verbal Communications, Sevier County Utah, County Clerks Office, Richfield, Utah, March 8, 1991

5. U.S. Department of Commerce National Oceanic and Atmospheric Administration, Environmental Data and Information Service, Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1951-80, Utah: Climatography of the United States No. 81, 1982

6. Utah Department of Transportation, Plan Sheet for Joseph Connection: Sheet No. JC-4, Project No. RS 0317(2), Richfield, Utah, 1981

7. Butler, Elmer and Marsell, R.E., Developing a State Water plan-Cloudburst Floods in Utah, 1939-69: Geological Survey, Cooperative Investigations Report No. 11, 1972

8. Whitaker, G. L., Summary of Maximum Discharges in Utah Streams: Geological Survey, 1969

9. Soil Conservation Service, Urban Hydrology for Small Watersheds: Soil Conservation Service, Washington, DC, Technical Release, 55210-V1-TR-55-Second Edition, 1986

10. U.S. Department of the Army, Corps of Engineers, HEC-2 Water Surface Profiles Users Manual: Davis, California, 1982

11. U.S. Geological Survey, Topographic Maps (Antelope Range, Utah and Elsinore, Utah); Scale 1:24,000 (original), changed to 1:2,400, Contour Interval 40 feet, Denver, Colorado, 1980

    Bureau of Reclamation, Flood Hydrograph Determinations for FEMA Flood Insurance Studies, Indian Creek near Joseph, Utah: Bureau of Reclamation, Denver, Colorado, 1990