7-16-1987

Flood Insurance Study

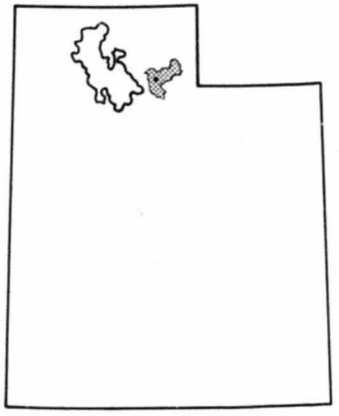
City of Morgan City, Utah, Morgan County

MAY 5 1987

COMPLETED

ORIGINAL

FLOOD INSURANCE STUDY



CITY OF MORGAN CITY, UTAH

MORGAN COUNTY

JULY 16, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 490093

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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FLOOD INSURANCE STUDY
CITY OF MORGAN CITY, MORGAN COUNTY, UTAH

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in Morgan City, Morgan County, Utah and 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 community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

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 Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Simons, Li and Associates, Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-84-C-1629. This study was completed in February 1986.

1.3 Coordination

Streams requiring detailed study were identified at an initial Consultation and Coordination Officer (CCO) meeting attended by representatives of the Utah Division of Comprehensive Emergency Management, the City of Morgan City, FEMA, and the study contractor on April 17, 1984.

Results of the hydrologic analyses were coordinated with the U.S. Army Corps of Engineers (COE), and Weber River Water Users Association.

The results of the study were reviewed at an intermediate CCO meeting attended by representatives of the community, FEMA and the study contractor on January 30, 1986. The study was acceptable to the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Morgan City, Morgan County, Utah. The area of study is shown on the Vicinity Map (Figure 1).

Weber River and East Canyon Creek were studied by detailed methods for their entire length within the community. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through February 1991.

2.2 Community Description

Morgan City is located in central Morgan County, in northern Utah. It is also the Morgan County Seat. The total land area contained within the corporate limits is approximately three square miles. It is situated approximately 50 miles north of Salt Lake City, Utah. According to U.S. Census Bureau figures, the population increased from 1,586 in 1970 to 1,900 in 1984 (Reference 1).

The Weber River flows in a westerly direction through the center of the study area for a distance of 2.8 miles. Its drainage area encompasses 1,215 square miles. East Canyon Creek, a major tributary, forms a two mile section of the southwest boundary of Morgan City as it flows in a northwesterly direction towards the Weber River, and has a drainage area of approximately 150 square miles.

Approximately 50 percent of the city has been developed, with the remainder of land being vacant or farmed. Within the floodplains studied, development is limited to residential homes and business. The majority of development is located in the central part of the city. Interstate Highway 80 and State Highway 66 serve the residents of Morgan.

The climate in the Morgan area is characteristically semiarid continental. The mean annual temperature is about 45 degrees F., and the average annual precipitation is about 20 inches (Reference 2).

2.3 Principal Flood Problems

Historically, the maximum floods of record have occurred during the April through June snowmelt period and have resulted in prolonged periods of high flows varying from a few days to more than a month. Cloudburst type floods and floods resulting from combined general rain storms and melting snow are also not uncommon. Principal floods of record on Weber River are shown in the Table 1.

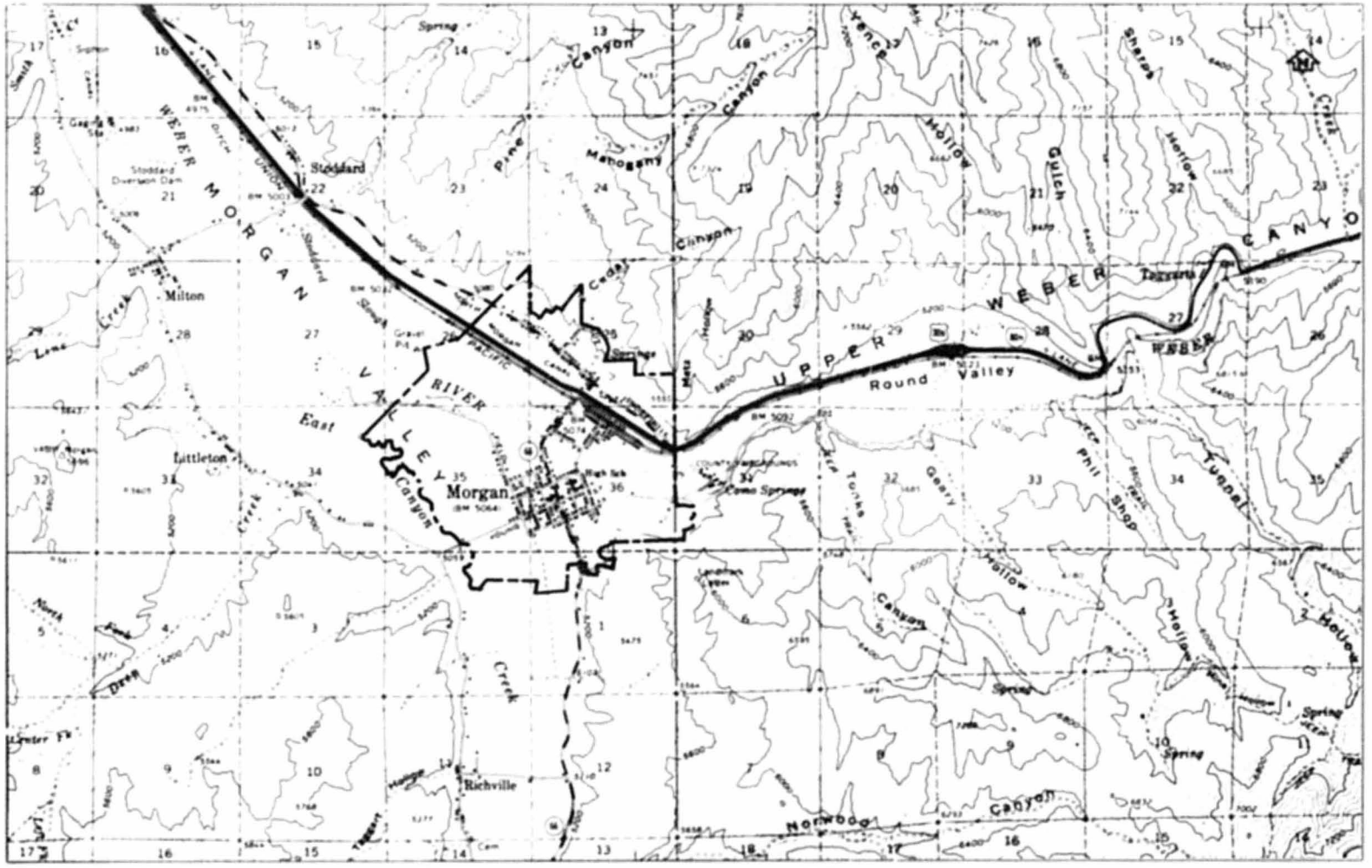

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MORGAN CITY, UT
(MORGAN COUNTY)

APPROXIMATE SCALE
1 0 1 2 3 MILES

VICINITY MAP

TABLE 1. PRINCIPAL FLOODS

Year	Peak Flows (cubic feet per second) Weber River at Devils Slide	Weber River at Gateway
1893	--[1]	7,280
1896	--[1]	7,980
1907	4,620	6,750
1909	5,120	7,480
1917	4,120	5,680
1920	5,500	7,240
1921	3,810	5,400
1922	4,140	6,570
1936	2,180	4,180
1950	3,450	4,730
1952	4,700	7,390
1983	--[1]	5,970
1984	--[1]	5,080

[1] Not available

In recent history, reservoir operation has reduced the flood damage below the reservoirs to a minimum, with the exception of the 1983 flood (Reference 3). The 1983 flood flows are not published at this time, but are estimated to be about the same or higher as compared to the 1952 flood (Reference 4). It was estimated that the 1952 flood flows from Weber River at Morgan is approximately 6,000 cubic feet per second (cfs) and from East Canyon Creek at Morgan is approximately 900 cfs. It was also estimated that the 1952 flood was approximately a 50-year event (Reference 4). Main flood problems that occurred due to the 1983 flood were basement flooding, damage to sewer systems, and threats to the electric substations. Total estimated damage was $300,000 plus $50,000 for privately owned dikes and volunteer time.

2.4 Flood Protection Measures

Four dams and reservoirs within the Weber River Basin upstream of Morgan provide significant regulation of flow on the Weber River and its tributaries above the study area. Existing dams and reservoirs include Wanship, on Weber River (capacity of 60,860 acre-feet); Echo, on Weber River (capacity of 74,000 acre-feet); Lost Creek, on Lost Creek (capacity of 20,000 acre-feet); East Canyon, on East Canyon Creek (capacity of 52,000 acre-feet) (Reference 5).

The U.S. Army COE studied the area approximately 20 years ago and was considering constructing dikes through most of the city along the Weber River (Reference 6). These dikes were not constructed.

Temporary dikes have been constructed by private interests along Weber River during past floods. These temporary dikes have no significant effects on the 100- and 500-year floods.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail 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), 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 study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

For the Weber River at Gateway gaging station (approximately ten miles downstream from Morgan), gaging records for the 1967 through 1984 period were analyzed by using regression analysis to determine the 10-year peak flow. The upper portion of the frequency curve was derived using the natural flow curve from historical record to determine the flow at the 500-year recurrence interval. The publication Methods for Estimating Peak Discharge and Flood Boundaries of Streams in Utah was utilized to predict the flows at the desired ungaged point at Morgan (Reference 7).

For the East Canyon Creek at Gage No. 1345, the 10-year flow was first calculated using a regression analysis of the 1967 through 1984 flows. Since none of the gaging records at the East Canyon Creek gage were unregulated, the natural flow curve was derived using the peak flow-drainage area relationsips. Values for peak flows were transferred from the East Canyon Creek gage to Morgan using the peak flow-drainage area relationsips (Reference 5).

$$GEM = QEM \frac{(AEM)^X}{(AEG)^X}$$

Where QEM = Peak flow at Morgan (cfs)
QEG = Peak flow at East Canyon gage (cfs)
AEM = Drainage area at Morgan (square miles) = 240 square miles
AEG = Drainage area at East Canyon gage (square miles) = 150 square miles
X = Regression coefficient

Peak discharge-drainage area relationships for Weber River and East Canyon Creek are shown in Table 2.

TABLE 2. SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (square miles)	Peak Discharge (cubic feet per second) 10-year	50-year	100-year	500-year
Weber River at Morgan City	1,215	3,700	5,295	6,370	10,205
East Canyon Creek at Morgan City	150	620	1,095	1,415	2,545

3.2 Hydraulic Analyses

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

Cross sections for the backwater analyses of Weber River and East Canyon Creek were obtained from aerial mappings, flown in November, 1984 (Reference 8). The below-water sections were obtained by field measurement. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

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 was computed (Section 4.2), selected cross section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the U.S. Army COE HEC-2 step-backwater computer program (Reference 9).

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and floodplain areas. Roughness values for the main channel of the Weber River ranged from 0.025 to 0.04 while floodplain roughness values ranged from 0.035 to 0.14 for all floods. Roughness values for the main channel of East Canyon Creek ranged from 0.05 to 0.075, while floodplain roughness values ranged from 0.04 to 0.065 for all floods.

Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Weber River and East Canyon Creek were calculated using the slope-area method.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Shallow flooding with average depth of 1 foot was determined along the right overbank of Weber River adjacent to 200 East Street.

All elevations are referenced to the National Geodetic Vertical Datum (NGVD) of 1929. Elevation reference marks used in this study are shown on the maps; the description of the marks are presented in Elevation Reference Marks (Exhibit 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- and 500-year floodplain boundaries and 100-year floodway 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 each stream studied in detail, 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 scale of 1:4,800, with a contour interval of 2 feet (Reference 8).

The 100- and 500-year floodplain boundaries are 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 (Zones AE and AO); and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary 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.

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 100-year 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 100-year 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 floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated at selected cross sections (Table 3). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year 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 100-year 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 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
Weber River								
A	850	285/265[2]	1,217	5.2	5033.9	5033.9	5034.5	0.6
B	1,350	265	985	6.5	5035.4	5035.4	5036.4	1.0
C	1,900	240	906	7.0	5037.8	5037.8	5038.6	0.8
D	2,425	382	1,021	6.2	5040.6	5040.6	5041.1	0.5
E	3,000	445	1,239	5.1	5043.1	5043.1	5044.1	1.0
F	3,750	260	976	6.5	5046.0	5046.0	5046.8	0.8
G	4,310	390	967	6.6	5048.4	5048.4	5049.1	0.7
H	5,020	395	1,191	5.3	5051.4	5051.4	5052.4	1.0
I	5,560	240	1,077	5.9	5053.3	5053.3	5054.0	0.7
J	5,890	175	703	9.1	5054.0	5054.0	5055.0	1.0
K	5,985	64	562	11.3	5055.2	5055.2	5055.2	0.0
L	6,005	64	569	11.2	5055.3	5055.3	5055.3	0.0
M	6,500	144	886	7.2	5057.3	5057.3	5057.5	0.2
N	6,850	125	925	6.9	5058.3	5058.3	5058.7	0.4
O	7,330	112	786	8.1	5059.5	5059.5	5060.1	0.6
P	7,665	67	596	10.7	5060.1	5060.1	5060.6	0.5
Q	7,685	67	601	10.6	5060.2	5060.2	5060.7	0.5
R	8,070	95	629	10.1	5062.4	5062.4	5062.5	0.1
S	8,600	181	1,180	5.4	5064.2	5064.2	5065.0	0.8
T	9,030	268	1,004	6.3	5065.1	5065.1	5065.9	0.8
U	9,660	329	838	7.6	5068.5	5068.5	5068.8	0.3
V	10,270	330	1,255	5.1	5070.3	5070.3	5071.3	1.0
W	11,100	339	968	6.6	5073.0	5073.0	5073.4	0.4
X	11,600	564	1,567	4.1	5074.8	5074.8	5075.4	0.6
Y	12,900	875[3]	1,830	3.5	5078.2	5078.2	5078.4	0.2

[1] Feet from downstream corporate limits.
[2] Width/Width within corporate limits.
[3] Lies entirely outside corporate limits.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MORGAN CITY, UT
(MORGAN CO.)

FLOODWAY DATA

WEBER RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
East Canyon Creek								
A	-1,265	426[2]	688	2.1	5036.3	5036.3	5036.9	0.6
B	-415	1340/760[3]	556	2.5	5038.7	5038.7	5039.1	0.4
C	1,485	1748/1220[3]	859	1.6	5040.6	5040.6	5041.6	1.0
D	2,835	1149/1110[3]	819	1.7	5041.8	5041.8	5042.7	0.9
E	3,285	343/320[3]	480	3.0	5044.3	5044.3	5044.9	0.6
F	3,685	215/165[3]	405	3.5	5046.0	5046.0	5046.6	0.6
G	4,375	200	523	2.7	5047.4	5047.4	5048.1	0.7
H	4,985	200[3]	302	4.7	5049.4	5049.4	5049.9	0.5
I	5,565	190/170[3]	494	2.9	5052.1	5052.1	5052.3	0.2
J	6,145	188[2]	475	3.0	5053.2	5053.2	5053.5	0.3
K	6,865	46/35[3]	207	6.8	5055.7	5055.7	5056.0	0.3
L	6,885	46/20[3]	218	6.5	5056.1	5056.1	5056.3	0.2
M	7,585	80	364	3.9	5058.8	5058.8	5059.4	0.6
N	7,925	75/65[3]	378	3.7	5059.4	5059.4	5060.1	0.7
O	8,545	88/60[3]	380	3.7	5060.9	5060.9	5061.5	0.6
P	9,125	255	667	2.1	5061.6	5061.6	5062.3	0.7

1 Feet from downstream corporate limits.
2 Lies entirely outside corporate limits.
3 Width/Width within corporate limits.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MORGAN CITY, UT
(MORGAN CO.)

FLOODWAY DATA

EAST CANYON CREEK

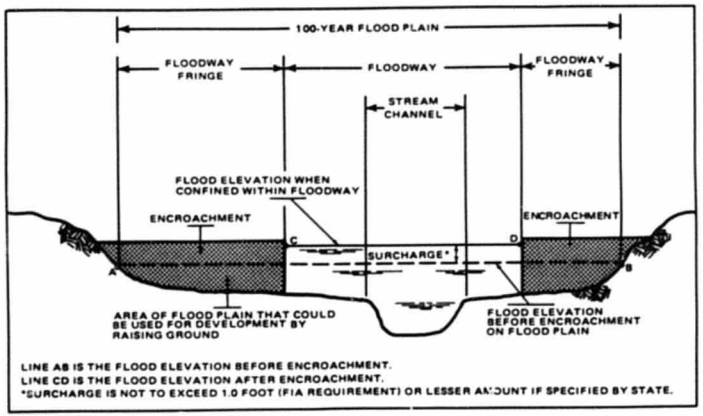

Figure 2. Floodway Schematic

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 AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations 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 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.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths 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.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

Weber River Hydrology, Davis and Weber Counties, Utah was prepared in 1979 by Gingery Assoociates, Inc. (Reference 10). The flood frequency information in this report was considered to be the best analysis of flow on the Weber River since the last phase of reservoir regulation was completed in 1967 on Lost Creek Reservoir. Analysis was based on a frequency distribution for regulated flow from 1967 through 1977 and unregulated flow prior to 1930 at the Gateway and Plain City gages.

The U.S. Army COE prepared a 1961 report, Design Memorandum No.1, Weber River, Utah - Channel Improvement Morgan to Ogden which developed peak flows for the Weber River for the 10-year, 50-year, and 100-year recurrence intervals at Echo, Morgan, Gateway, and Plain City (Reference 6). The report does not adequately reflect recent flow conditions and in particular, recent reservoir operation, which regulates flow in the Weber River within the Morgan City study.

The U.S. Army COE published a 1971 Report on Reservoir Regulation for Flood Control-Weber Basin Reservoirs (Reference 11). This report gives general design information, reservoir capacities, spillway capacities, and general operation guidelines for the major reservoirs which regulate flow on both the Weber River and East Canyon Creek. The operational information is applicable to flood frequency analysis for the Morgan City study.

Wasatch Front and Central Utah Flood Control Study was prepared by Vaughn Hansen Associates for the U.S. Army COE (Reference 3). This report was a reconnaissance level flood control study and, therefore, did not contain detailed background information on hydrology. Values for the 50-year and 100-year recurrence interval discharges at Morgan were given as 4,900 cfs and 6,000 cfs, respectively.

The Bureau of Reclamation published Dam Failure Inundation Study, Echo Dam, Weber River Project, Utah in 1984 (Reference 12). Echo Dam is located approximately 16 miles upstream of Morgan City. Regional hydrology was used to determine the inflow design flood. The results were used only for comparison, due to the general nature of the hydrology analysis.

FEMA published Flood Hazard Boundary Maps for Morgan City and the unincorporated areas of Morgan County, Utah (References 13 and 14, respectively). Because of the more detailed and current nature of this hydrologic analysis, this Flood Insurance Study supersedes the data presented on the Flood Hazard Boundary Maps on Weber River and East Canyon Creek.

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

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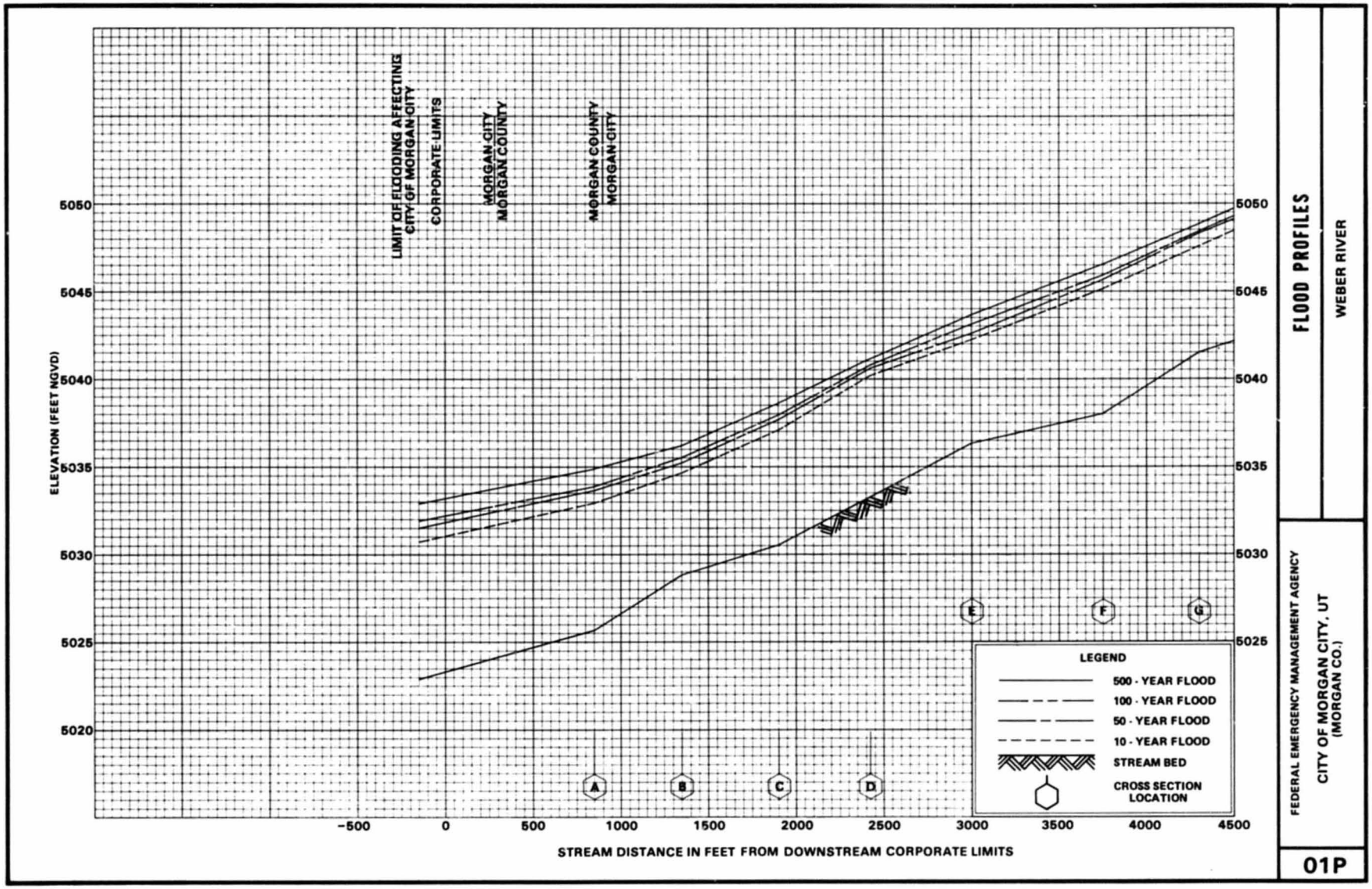


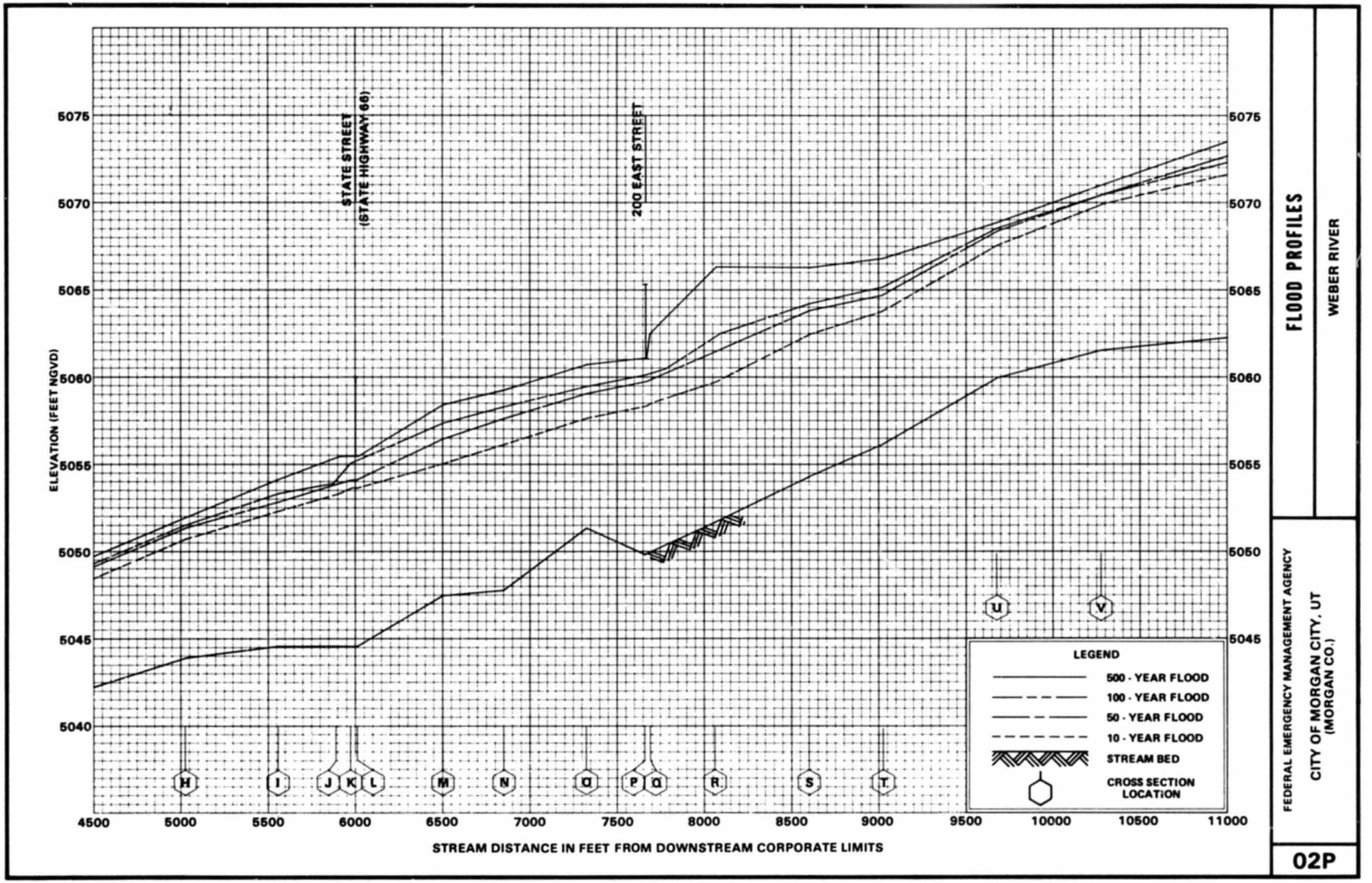
FLOOD PROFILES

WEBER RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MORGAN CITY, UT
(MORGAN CO.)

01P



FLOOD PROFILES

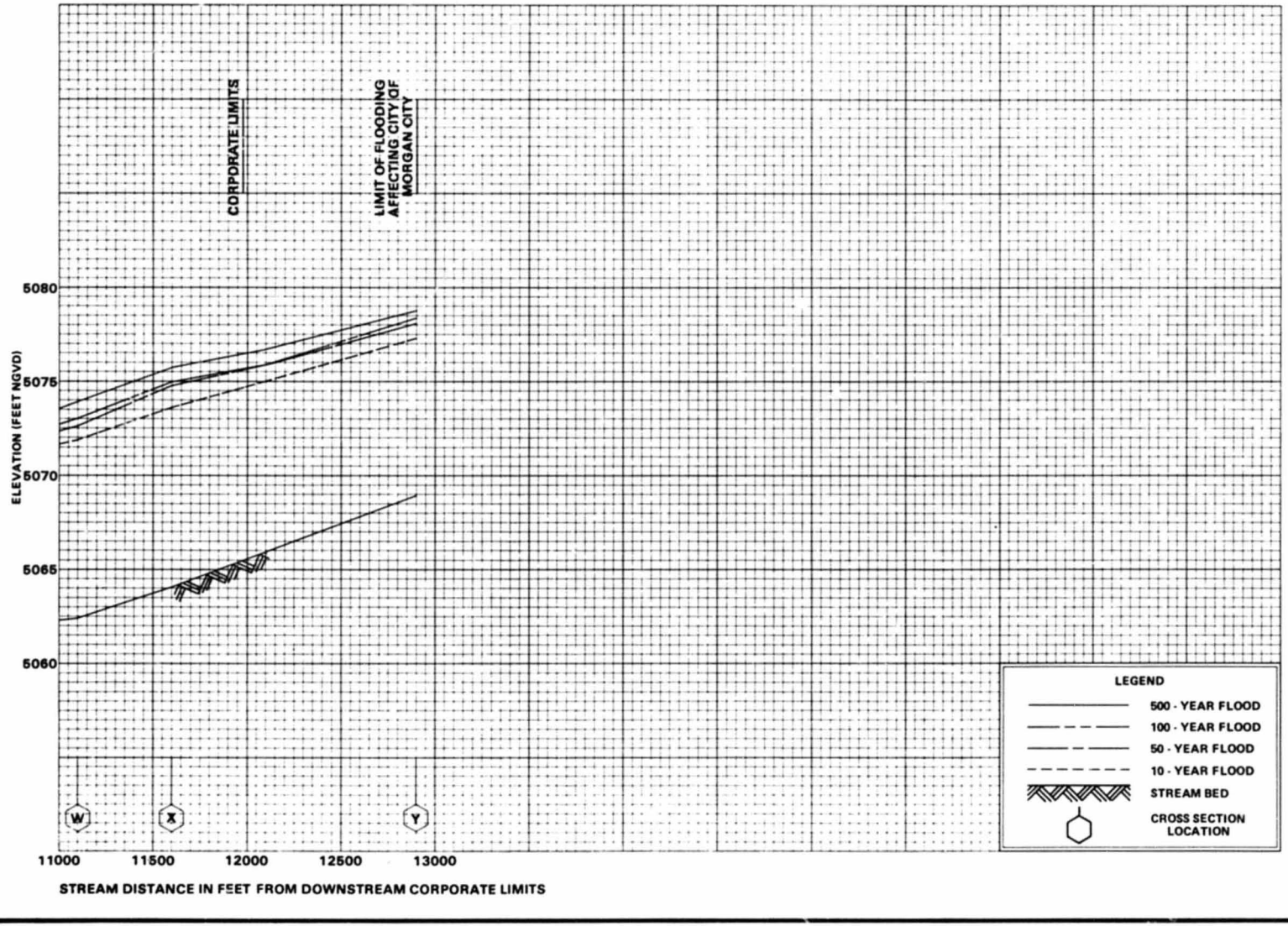
WEBER RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MORGAN CITY, UT
(MORGAN CO.)

02P

16



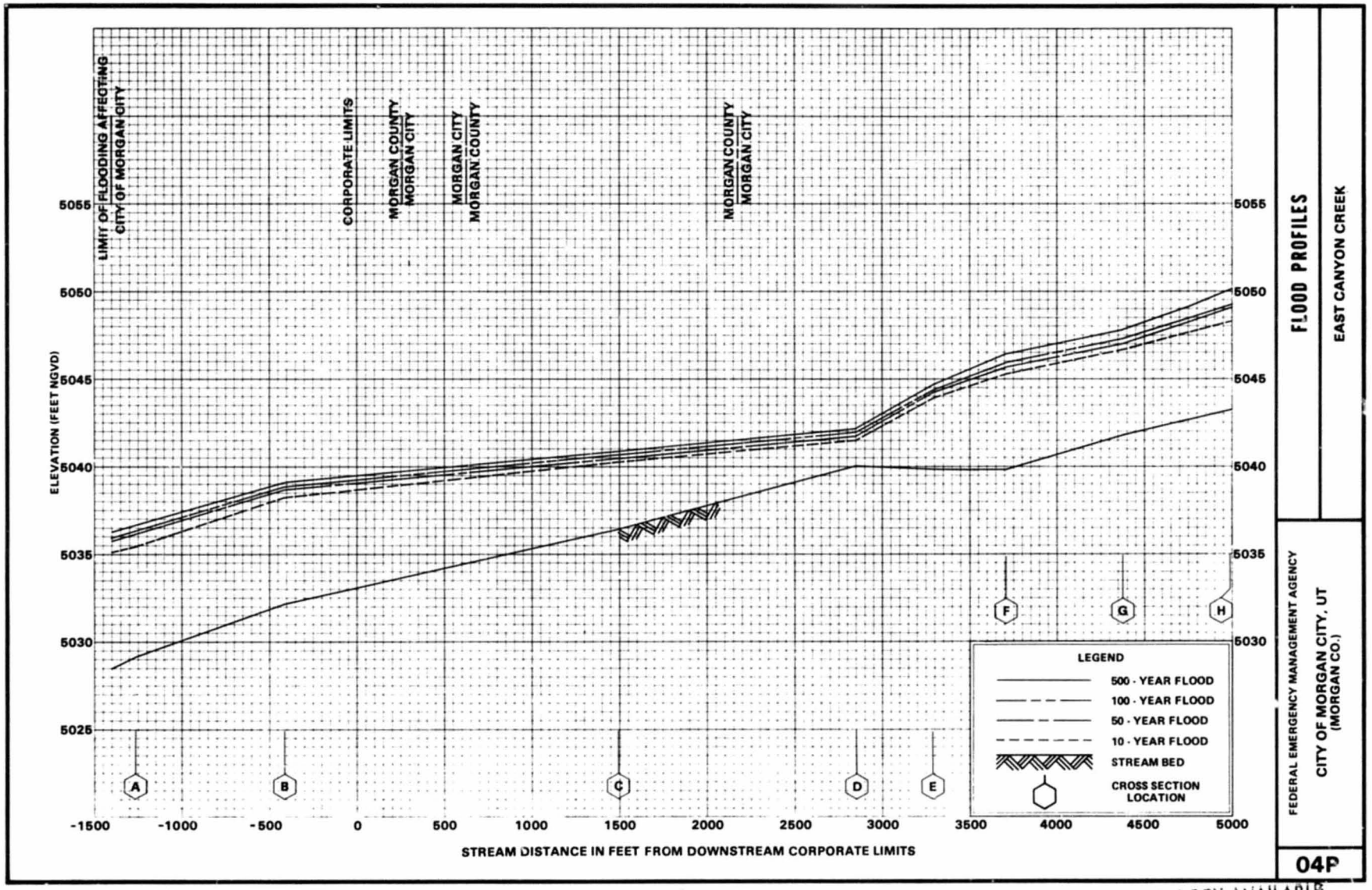
FLOOD PROFILES

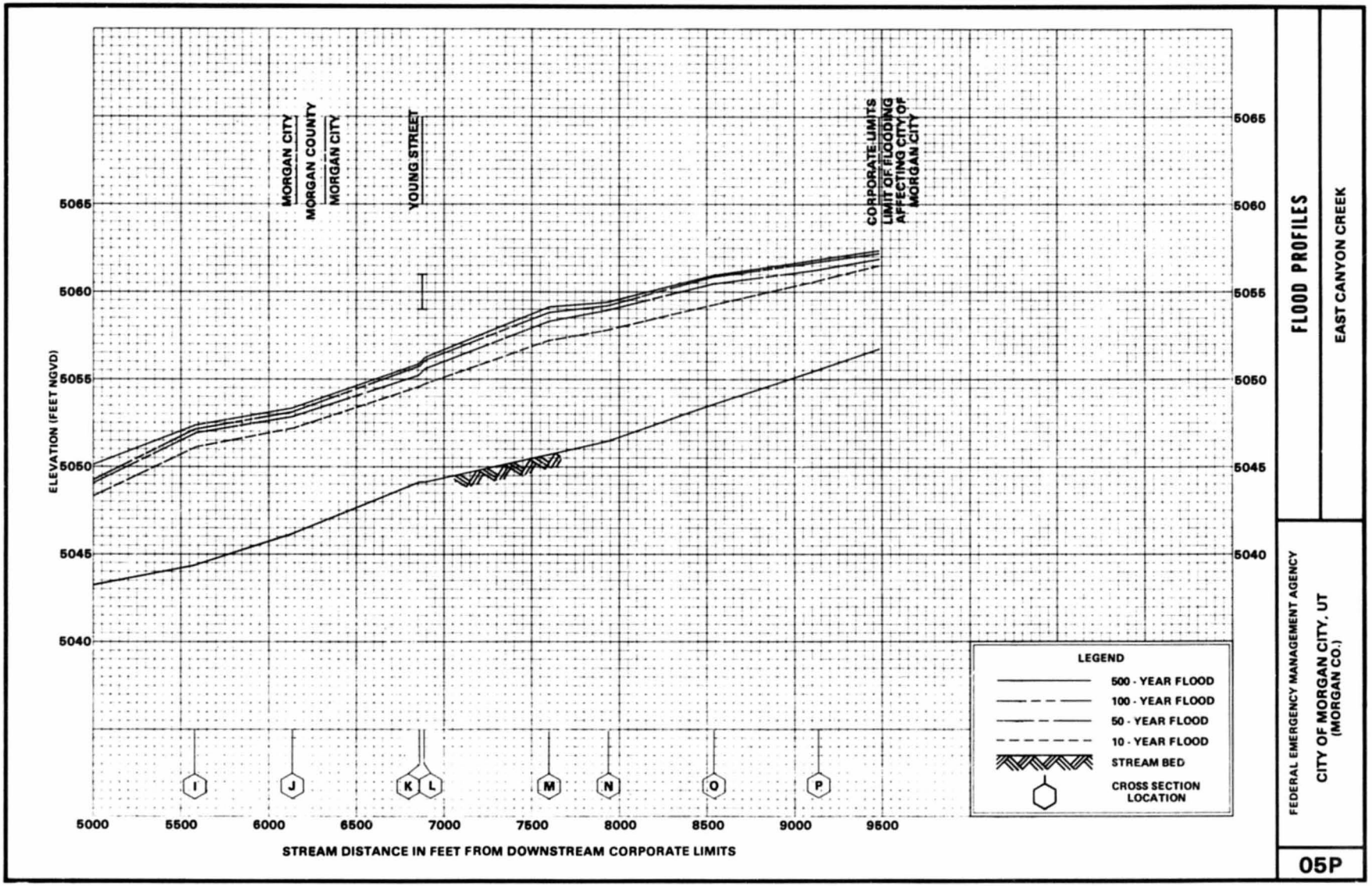
WEBER RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MORGAN CITY, UT
(MORGAN CO.)

03P





FLOOD PROFILES

EAST CANYON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MORGAN CITY, UT
(MORGAN CO.)

05P

EXHIBIT 3 - ELEVATION REFERENCE MARKS
CITY OF MORGAN CITY, MORGAN COUNTY, UTAH

Reference Mark	Elevation (feet NGVD)	Description of Location
RM 1	5063.51	USGS Bench Mark, brass cap located 100 feet west, southwest of intersection of State Street (State Highway 66) and Young Street, and 10 feet north, northwest of sidewalk.