FLOODPLAIN MANAGEMENT STUDY
ELK RIVER
PRICE COUNTY, WISCONSIN

Prepared by:
United States Department of Agriculture
Soil Conservation Service
Madison, Wisconsin

In cooperation with:
Price County, Wisconsin
and the
Wisconsin Department of Natural Resources

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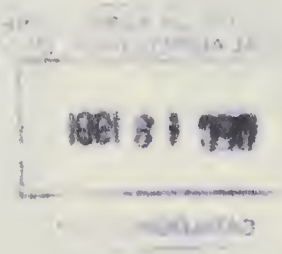


Price County Floodplain Management Study
Elk River

Introduction

The purpose of this study is to define the flood characteristics of seventeen miles of the Elk River. The study limits are the confluence with the South Fork of the Flambeau River, Section 10, T. 37 N., R. 2 W., upstream to Musser Dam northeast of the city of Phillips, Section 31, T. 38 N., R. 2 E. Squaw creek from Lake Duroy to Solberg Dam is also included.

This report is prepared for use by the county in planning the use and regulation of the floodplain of Squaw Creek and the Elk River.

The 100-year floodplain is delineated on the photomaps. The high water elevations and floodplain delineations are based on the 5-year projected land use of the watershed, stream, floodplain, and existing road crossings.

The Soil Conservation Service carries out floodplain management studies in accordance with Federal Level Recommendation 3 of "A Unified National Program for Floodplain Management," and Section 6 of Public Law 83-566. The principles contained in Executive Order 11988, Floodplain Management, are addressed in this part.

In Wisconsin, the Soil Conservation Service coordinates floodplain management studies with the Wisconsin Department of Natural Resources (DNR), through a joint coordination agreement entered into in October 1978. The Wisconsin Water Resources Act (Chapter 614, Laws of Wisconsin, 1965) authorizes the DNR, Division of Enforcement, to establish and upgrade minimum standards for floodplain regulations.

Study Area Description

The Elk River is located in central Price County. Price County is located in north central Wisconsin. The study area consists of the floodplain adjacent to 17 miles of the Elk River and 4 miles of Squaw Creek.

The downstream study limit is the confluence with the South Fork of the Flambeau River (north central Sec. 10, T. 37 N., R. 2 W.). The upstream study limit is immediately downstream of Musser Dam (near the corner of section 25, 30, 31, 36, T. 38 N., R. 2 E.) a distance of 17 miles. Squaw Creek was studied from it's confluence with Duroy Lake (quarter corner of section 7 and 8, T. 37 N., R. 1 E.) to Solberg Lake Dam (sec 29, T. 38 N., R. 1 E.) a distance of 4 miles.

The drainage area is as follows:

Elk River upstream Study Limit (Musser Dam)	83. square miles
Elk River at State Highway 13	174. square miles
Elk River at Jobes Dam	196. square miles
Elk River at Weimer Dam	255. square miles
Elk River at mouth	257. square miles
Squaw Creek at Solberg Dam	21. square miles
Squaw Creek at County Highway H	24. square miles

Elk River is in Hydrologic Unit 07050003-020.

The Elk River lies entirely within the Northern Highland physiographic province of Wisconsin. The topography has an irregular glaciated landscape. Pitted outwash plains predominate, with many swamps and lakes having poorly developed drainage patterns. Price county has less than 14 per cent of the county in farmland. The Elk River watershed is predominantly wooded with many marsh and swamp areas throughout. Scattered homes are located along the main roads and adjacent to the floodplains. The Musser Lake and Solberg Lake watersheds are 95 percent woods and marsh covered. Both watersheds head in the Chequamegan National Forest. The Little Elk, which drains into Duroy Lake immediately upstream of the city of Phillips, has the most open area. The Little Elk has approximately 40 percent of the drainage area in open land consisting of farms and private homes. The remainder of Elk River watershed has a ratio 80 percent woods to 20 percent open land.

The climate is typically continental. January temperatures average 13 degrees F. July, the warmest month, has an average temperature of 68 degrees F. The average maximum for July is 80 degrees F with the average minimum at 54 degrees F. Precipitation averages 34 inches per year (7).

The soils of the watershed consist of the Kennan-Hatley association, in the northeast portion of the Musser Lake Watershed. The majority of the Little Elk Watershed consists of the Renova-Vlasity-Seaton association. The central portion of the Elk River watershed, between Phillips and Soo Lake, consist of the Fenwood-Rietbrock-Rozellville association, with areas of Fordum-Kickapoo-Abscota association occurring above the city of Phillips. The majority of the upper reaches of Carpenter Creek consist of the Seelyville-Markey association.

Natural and Beneficial Floodplain Values

The undeveloped flood plain in the study area consists primarily of bottomland tree and shrub species, primarily willow, aspen, red maple, tamarack, white birch, black ash, and tag alder. There are also scattered open sedge areas.

The flood plain is habitat for a large number of wildlife species including white-tailed deer, squirrels, racoon, beaver, bob cat, mink, muskrat, fox, black bear, coyote, timber wolf, and otter. Bird species include numerous songbirds, woodpeckers, hawks, owls, ruffed grouse, and woodduck. Bald eagles, which are on the endangered species list, have been known to use the area.

As well as providing important wildlife habitat, the flood plain also provides a natural storage area for large amounts of floodwater during peak flows. The natural flood plain also plays an important role in trapping sediment and keeping river banks stable.

The Elk River and its flowages in the study area is a walleye and muskellunge fishery. Other game fish include northern pike, smallmouth and largemouth bass. Perch and crappie are common panfish.

There is no prime farmland in the study area. There are no sites on the National Register of Historic Places, or sites with important historical or cultural values. A majority of the floodplains are wetlands and will remain wetlands under current state policy.

Flooding Problems

No significant flash flooding occurs on the river system. Spring flooding occurs annually with highest water recorded in 1981, 1982, and 1986. The highest flooding caused by a summer storm event occurred on June 13, 1981 as a result of 6 to 8 inches of rainfall in 12 hours. The spring runoffs of 1982 and 1986 were very close to the same elevations as the June storm. The June storm was in excess of a 100-year rainfall but did not produce a "100-year flood". The amount of flooding is related to the spillway operation of Musser, Jobes, and Weimer dams. When a storm sufficient to cause runoff occurs on the watershed, the spillways are opened in anticipation of the flood water. If the spillways are opened too far the lake will fall below the desired level. The spillways are adjusted to maintain the desired lake level. The result being varying discharges and high water marks. For future operation planning it is important the gate settings be recorded as well as the condition of the watershed prior to the flood.

No flood damage was apparent during the floods of record. No residential properties are flooded.

Existing Floodplain Management

Price County does not have a floodplain ordinance in effect. Price County is in the emergency phase of the National Flood Insurance Program.

Alternatives for Mitigating Flood Damages to Existing and Future Development

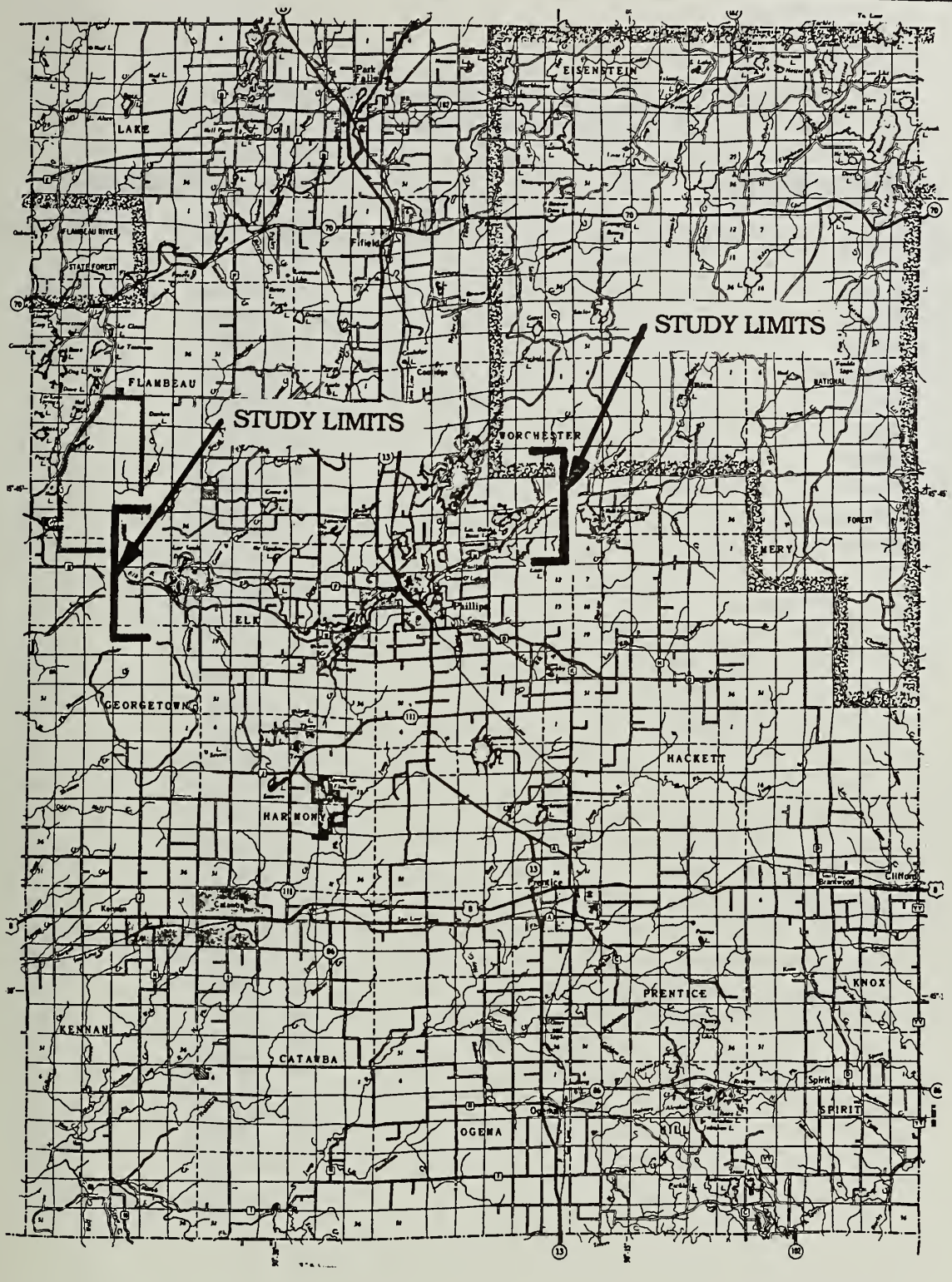
Floodplain management consists of the implementation, operation, and maintenance of nonstructural and structural measures to reduce or mitigate potential flood damages. Nonstructural measures include (1) administrative actions such as zoning, building codes or flood insurance; (2) relocation (repositioning) of existing floodplain properties to flood free areas, (3) floodplain acquisition, (4) flood warning systems, and (5) floodproofing. Structural measures include such things as dams, dikes, diversions, floodways, and manmade or modified channels.

Specific recommendations for Price County are:

A. Incorporate the floodplain maps from this study into a floodplain ordinance and provide administration in accord with Wisconsin Administrative Code NR116.

B. Apply existing standards set forth in the county's subdivision control ordinance to regulate development in nonsuitable areas and minimize erosion and diffused surface water runoff within the watershed.

C. Ensure the operations (water management) plan for Musser, Jobes, Weimer, and Solberg dams is enforced, followed and kept current. A copy of a proposed operations plan is included as Appendix F.



Location in Wisconsin

PRICE COUNTY WISCONSIN

Elk River Floodplain Management Study

LOCATION MAP

Listing of cross section locations
by map sheet number

ELK RIVER

CROSS SECTION	MAP NUMBER
A	SHEET 1
B	SHEET 2
C	SHEET 2
D	SHEET 2
E	SHEET 2
F	SHEET 7
G	SHEET 7
H	SHEET 8
I	SHEET 9
J	SHEET 10
K	SHEET 11
L	SHEET 11
M	SHEET 11
N	SHEET 11
O	SHEET 12
P	SHEET 13
Q	SHEET 13
R	SHEET 15
S	SHEET 15
T	SHEET 15
U	SHEET 15
V	SHEET 16
W	SHEET 16
X	SHEET 18
Y	SHEET 21
Z	SHEET 22
AA	SHEET 22
AB	SHEET 22
AC	SHEET 23
AD	SHEET 23
AE	SHEET 25
AF	SHEET 25
AG	SHEET 25
AH	SHEET 25

SQUAW CREEK

CROSS SECTION	MAP NUMBER
A	SHEET 18
B	SHEET 18
C	SHEET 18
D	SHEET 18
E	SHEET 17
F	SHEET 26
G	SHEET 26
H	SHEET 26
I	SHEET 26
J	SHEET 27

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

LEGEND

- SHEET COVERAGE
- STUDY LIMIT
- SECTION CORNER
- MERIDIAN LINE
- CITY LIMITS

VICINITY MAP

PHOTO INDEX MAP

ELK RIVER
FLOOD PLAIN MANAGEMENT STUDY

PRICE COUNTY, WISCONSIN

0 1 2 3 4 5
MILES

0 1 2 3 4 5
KILOMETERS

SOURCE:
BASE COMPILED FROM U.S.G.S.
QUADRANGLES AND WISCONSIN
GENERAL HIGHWAY MAP.
POLYCONIC PROJECTION.

JUNE 1989 1004570

USDA-SCS NATIONAL CARTOGRAPHIC CENTER, FT. WORTH, TX. 1989

USDA SCS-NATIONAL CARTOGRAPHIC CENTER, FT. WORTH, TX. 1983

LEGEND

- 100 Year Frequency Flood
- RM 6 X Reference Bench Marks
- Stream Channel
- Valley Section Location
- (1398.2) Flood Elevation

SCALE 0 400 800 FEET; 0 100 200 METERS APPROXIMATE

1981 Photography

SHEET 1 OF 30

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ELK RIVER
FLOOD PLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

FLOOD HAZARD MAPS

ELK RIVER

AUGUST 1981 1004569

LEGEND

- 100 Year Frequency Flood
- RM 6 X — Reference Bench Marks
- Stream Channel
- Valley Section Location
- (1398.2) — Flood Elevation

SCALE 0 400 800 FEET; 0 100 200 METERS APPROXIMATE

1981 Photography

SHEET 2 OF 30

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FLOOD HAZARD MAPS

ELK RIVER

AUGUST 1989 100-4569

1024 SCS NATIONAL CARTOGRAPHIC CENTER FT WORTH, TX. 1983

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

SHEET 3 OF 30

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FLOOD HAZARD MAPS

ELK RIVER

AUGUST 1989 1004569

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

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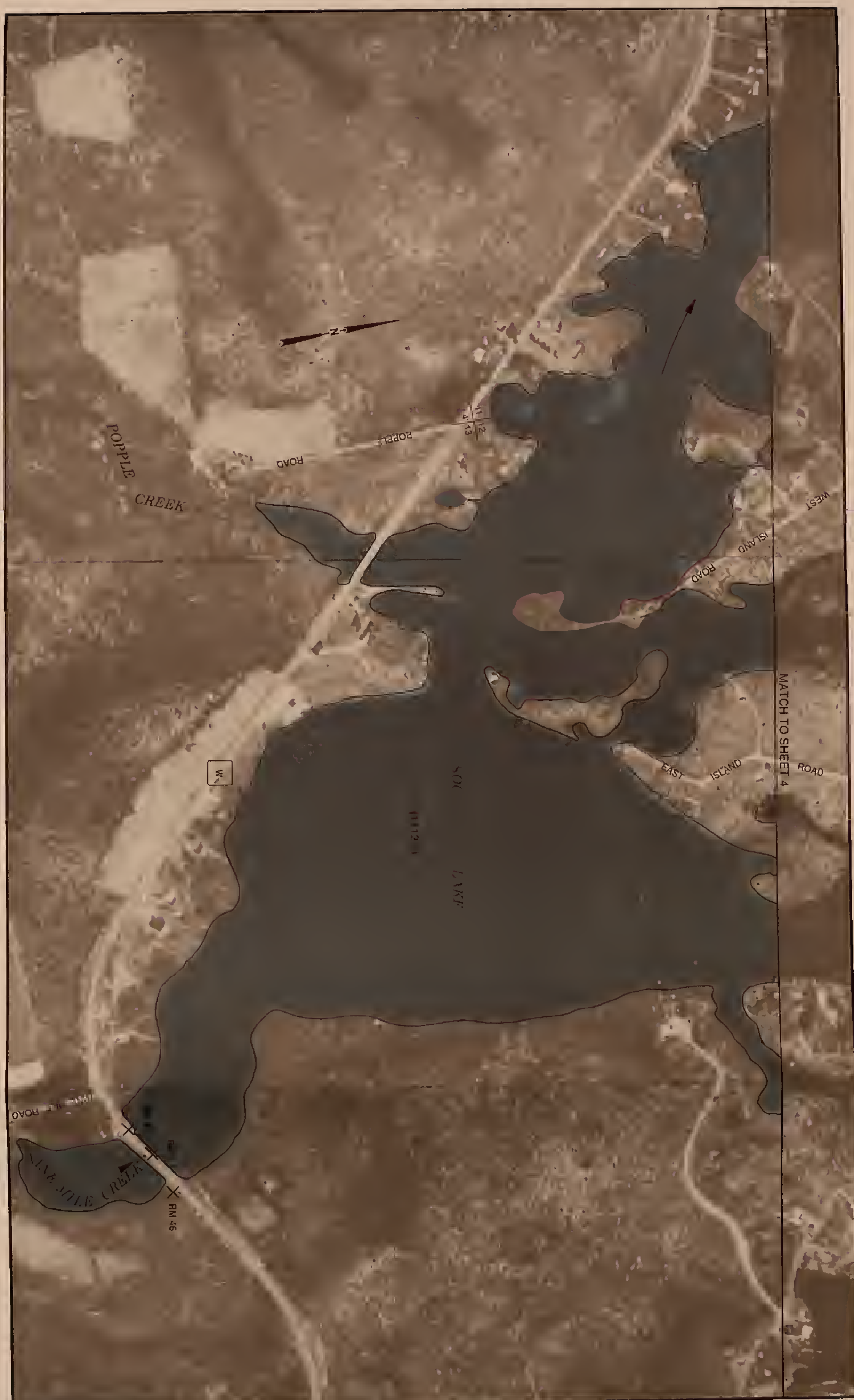
SHEET 4 OF 30

FLOOD HAZARD MAPS

SOO LAKE, ELK RIVER

AUGUST 1989 1004568

11



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SHEET 5 OF 30

FLOOD HAZARD MAPS

ELK RIVER

AUGUST 1989 1003569

SHEET 6 OF 30

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FLOOD HAZARD MAPS

SOO LAKE

AUGUST 1989 100-5569

LEGEND

- 100 Year Frequency Flood
- RM 6 X Reference Bench Marks
- Stream Channel
- Valley Section Location
- (1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

SHEET 7 OF 30

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PRICE COUNTY, WISCONSIN

FLOOD HAZARD MAPS

SOO LAKE

AUGUST 1989 L004569

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

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FLOOD PLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

SHEET 8 OF 30

FLOOD HAZARD MAPS

ELK RIVER

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

SHEET 9 OF 30

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PRICE COUNTY, WISCONSIN

FLOOD HAZARD MAPS

ELK RIVER

USDA SCS-NATIONAL CARTOGRAPHIC CENTER FT. WORTH, TX. 1979

AUGUST 1989 100-4569

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

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PRICE COUNTY, WISCONSIN

SHEET 10 OF 30

FLOOD HAZARD MAPS

ELK RIVER

AUGUST 1989 100456

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

SHEET 11 OF 30

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PRICE COUNTY, WISCONSIN

FLOOD HAZARD MAPS

ELK RIVER

AUGUST 1989 1004569

SHEET 12 OF 30

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PRICE COUNTY, WISCONSIN

FLOOD HAZARD MAPS

ELK RIVER

AUGUST 1969 1004569

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ELK RIVER
FLOOD PLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

SHEET 13 OF 30

FLOOD HAZARD MAPS

LONG LAKE (ELK RIVER)

USDA SCS NATIONAL CARTOGRAPHIC CENTER, FT. WORTH, TX 1989

LEGEND

- 100 Year Frequency Flood
- RM 6 X Reference Bench Marks
- Stream Channel
- Valley Section Location
- (1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

SHEET 14 OF 30

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PRICE COUNTY, WISCONSIN

FLOOD HAZARD MAPS

LONG LAKE (ELK RIVER)

AUGUST 1989 100456

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PRICE COUNTY, WISCONSIN

SHEET 15 OF 30

FLOOD HAZARD MAPS

LONG LAKE (ELK RIVER)

AUGUST 1989 1003569

LEGEND

- 100 Year Frequency Flood
- RM 6 X Reference Bench Marks
- Stream Channel
- Valley Section Location
- (1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

SHEET 16 OF 30

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PRICE COUNTY, WISCONSIN

FLOOD HAZARD MAPS

ELK LAKE (ELK RIVER)

AUGUST 1989 L004569

LEGEND

- 100 Year Frequency Flood
- RM 6 X — Reference Bench Marks
- Stream Channel
- Valley Section Location
- (1398.2) — Flood Elevation

SCALE 0 400 800 FEET; 0 100 200 METERS; APPROXIMATE

1981 Photography

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PRICE COUNTY, WISCONSIN

SHEET 17 OF 30

FLOOD HAZARD MAPS

ELK RIVER AND SQUAW CREEK

AUGUST 1989 100-4569

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

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PRICE COUNTY, WISCONSIN

SHEET 18 OF 30

FLOOD HAZARD MAPS

DUROY LAKE, ELK RIVER AND SQUAW CREEK

AUGUST 1989 100-4565

SHEET 19 OF 30

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FLOOD PLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

FLOOD HAZARD MAPS

DUROY LAKE, ELK RIVER

USDA SCS NATIONAL CARTOGRAPHIC CENTER FT WORTH, TX 1989
AUGUST 1989 1003569

SHEET 20 OF 30

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PRICE COUNTY, WISCONSIN

FLOOD HAZARD MAPS

DUROY LAKE

AUGUST 1999 100-3569

MATCH TO SHEET 17

RM 32

SOLBERG LAKE ROAD

ELK

V

(1450.1)

RM 19

H

RIVER

RM 31

SANDY LANE

MATCH TO SHEET 22

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1396.2) Flood Elevation

SCALE 0 400 800 FEET

0 100 200 METERS

APPROXIMATE

1981 Photography

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FLOOD PLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

SHEET 21 OF 30

FLOOD HAZARD MAPS

ELK RIVER

AUGUST 1989 100-56-

MATCH TO SHEET 21

RM 20

Z

(1460.1)

BIG ELK RIVER ROAD

WORCESTER RD

(1461.8)

(1462.1)

RM 21

H

AA

AB

ELK RIVER

Z

BASS LAKE ROAD

RIVER VIEW ROA

MATCH TO SHEET 23

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET

0 100 200 METERS

APPROXIMATE

1981 Photography

SHEET 22 OF 30

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FLOOD PLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

FLOOD HAZARD MAPS

ELK RIVER

AUGUST 1989 1004569

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

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PRICE COUNTY, WISCONSIN

SHEET 23 OF 30

FLOOD HAZARD MAPS

ELK RIVER

AUGUST 1989 100456

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

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ELK RIVER
FLOOD PLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

SHEET 24 OF 30

FLOOD HAZARD MAPS

ELK RIVER

AUGUST 1989 100-4569

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

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PRICE COUNTY, WISCONSIN

SHEET 25 OF 30

FLOOD HAZARD MAPS

ELK RIVER

AUGUST 1989 1004569

USDA SCS NATIONAL CARTOGRAPHIC CENTER FT WORTH, TX 1981

MATCH TO SHEET 17

FOREST ROAD

RM 36

(1449.1)

F

G

(1405.9)

US 1

CLERK

SQUAW CREEK ROAD

31 | 32 | 6 | 5

H

I

(1458.7)

(1459.1)

RM 33

MATCH TO SHEET 27

N

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET

0 100 200 METERS

APPROXIMATE

1981 Photography

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FLOOD PLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

SHEET 26 OF 30

FLOOD HAZARD MAPS

SQUAW CREEK

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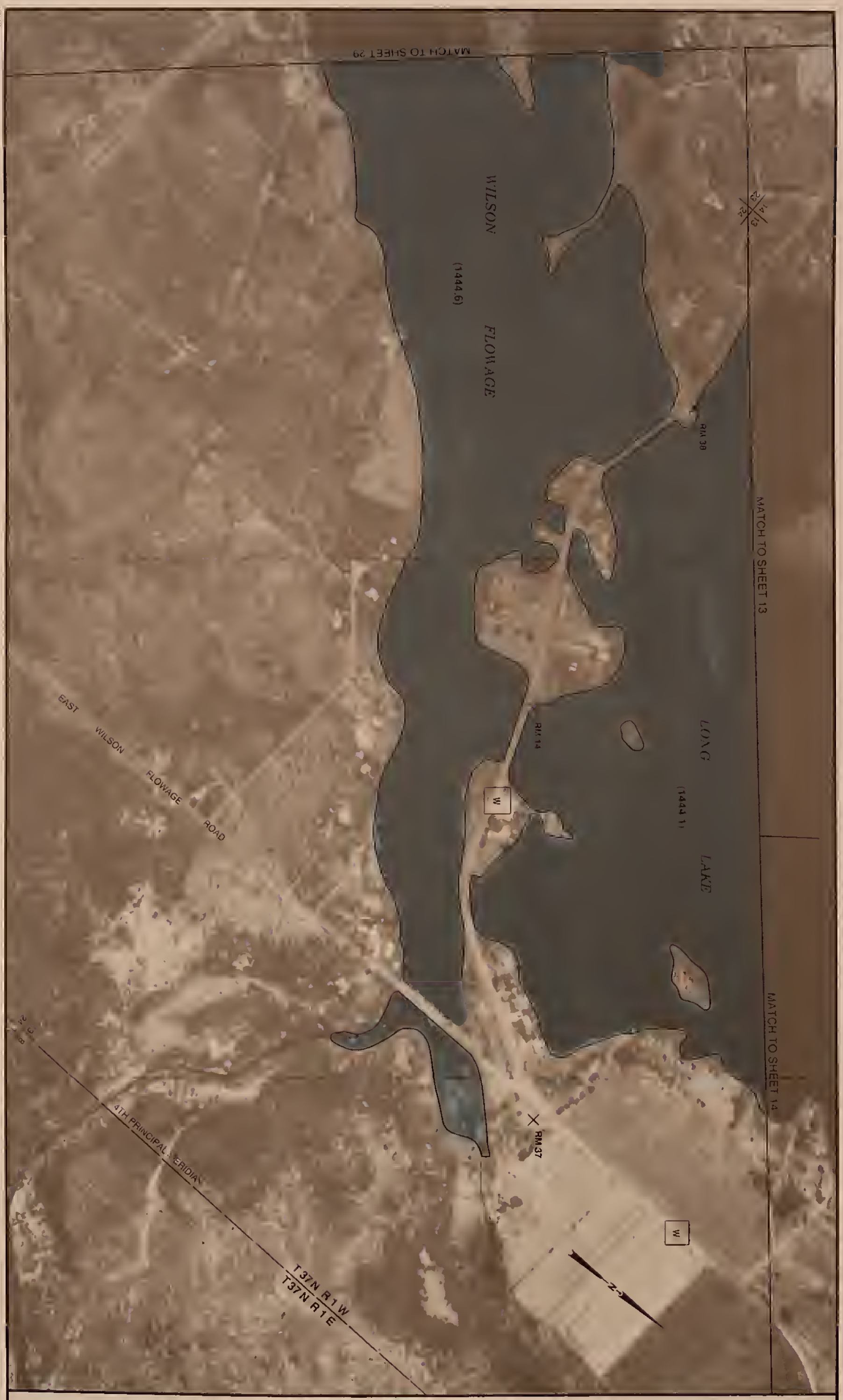
FLOOD HAZARD MAPS

SQUAW CREEK

AUGUST 1989 1004569



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PRICE COUNTY, WISCONSIN

SHEET 28 OF 30

FLOOD HAZARD MAPS

WILSON FLOWAGE

AUGUST 1989 100-5569

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

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ELK RIVER
FLOOD PLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

SHEET 29 OF 30

FLOOD HAZARD MAPS

WILSON FLOWAGE

AUGUST 1989 100-9569

LEGEND

100 Year Frequency Flood

RM 6 X Reference Bench Marks

Stream Channel

Valley Section Location

(1398.2) Flood Elevation

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1981 Photography

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PRICE COUNTY, WISCONSIN

SHEET 30 OF 30

FLOOD HAZARD MAPS

WILSON FLOWAGE

GLOSSARY AND BIBLIOGRAPHY

GLOSSARY

CHAPTER NR. 116, WISCONSIN'S FLOODPLAIN MANAGEMENT PROGRAM
NR. 116.03 DEFINITIONS

Channel. A channel is a natural or artificial watercourse with definite bed and banks to confine and conduct the normal flow of water.

Department. Department refers to the State of Wisconsin Department of Natural Resources.

Encroachment. An encroachment is any fill, structure, building, use, accessory use, or development in the floodway.

Encroachment/Floodway Lines. Encroachment/floodway lines are limits of obstruction to floodflows. These lines are on both sides of and generally parallel to the river or stream. The lines are established by assuming that the area landward (outside) of the encroachment/floodway lines will be ultimately developed in such a way that it will not be available to convey floodflows.

Flood. A general and temporary condition of partial or complete inundation of normally dry land areas caused by the overflow or rise of rivers, streams, or lakes.

Flood Frequency. The term flood frequency is a means of expressing the probability of flood occurrences and is generally determined from statistical analyses. The frequency of a particular floodflow is usually expressed as occurring, on the average, once in a specified number of years. Any particular floodflow could, however, occur more frequently than once in any given year.

Flood Fringe. The flood fringe is that portion of the floodplain outside of the floodway, which is covered by floodwaters during the regional flood; it is generally associated with standing water rather than rapidly flowing water.

Floodplain. The floodplain is the land which has been or may be hereafter covered by floodwater during the regional flood. The floodplain includes the floodway and the flood fringe.

Floodplain Management. Floodplain management involves the full range of public policy and action for insuring wise use of floodplains. It includes everything from the collection and dissemination of flood control information to actual acquisition of floodplain lands; and the enactment and administration of codes, ordinances, and statutes for land use in the floodplain.

Flood Proofing. Flood proofing involves any combination of structural provisions, changes, or adjustments to properties and structures subject to flooding, primarily for the purpose of reducing or eliminating flood damage to properties, water and sanitary facilities, structures and contents of buildings in flood hazard areas.

Flood Protection Elevation. The flood protection elevation shall correspond to a point 2 feet of freeboard above the water surface profile associated with the regional flood and the official floodway lines. Also see: Freeboard.

Floodway. The floodway is the channel of a river or stream and those portions of the floodplain adjoining the channel required to carry and discharge the floodwater or floodflows associated with the regional flood.

Freeboard. Freeboard is a factor of safety usually expressed in terms of a certain amount of feet above a calculated flood level. Freeboard compensates for the many unknown factors that contribute to flood heights greater than the height calculated. These unknown factors include, but are not limited to, ice jams, debris accumulation, wave action, obstruction of bridge openings and floodways, the effects of urbanization on the hydrology of the watershed, loss of flood storage areas due to development and aggradation of the river or streambed.

High Flood Damage Potential. High flood damage potential is associated with any danger to life or health and any significant economic loss to a structure or building or its contents.

Hydraulic Floodway Lines. Hydraulic floodway lines shall delineate the channel of the river or stream and those portions of the adjoining floodplains which are reasonably required to carry and discharge the regional floodflow without any measurable increase in flood heights.

Hydraulic Reach. A hydraulic reach along a river or stream is that portion of the river or stream extending from one significant change in the hydraulic character of the river or stream to the next significant change. These changes are usually associated with breaks in the slope of the water surface profile, and may be caused by bridges, dams, expansion and contraction of the waterflow, and changes in streambed slope or vegetation.

Levee. A levee is a continuous dike or embankment of earth constructed parallel to a river or stream to prevent flooding of certain areas of land.

Official Floodway Lines. Official floodway lines are those lines which have been adopted by the county, city, or village, approved by the department, and which are shown on the official floodplain zoning maps and used for regulatory purposes.

Regional Flood. The regional flood is a flood determined to be representative of large floods known to have generally occurred in Wisconsin and which may be expected to occur on a particular stream because of like physical characteristics. The regional flood is based upon a statistical analysis of streamflow records available for the watershed and/or an analysis of rainfall and runoff characteristics in the general watershed region. The flood frequency of the regional flood is once in every 100 years; this means that in any given year there is a 1 percent chance that the regional flood may occur. During a typical 30-year mortgage period, the regional flood has a 26 percent chance of occurring.

Structure. A structure is any manmade object with form, shape, and utility, either permanently or temporarily attached to or placed upon the ground, riverbed, streambed, or lakebed.

Watershed. A watershed is a region or area contributing ultimately to the water supply of a particular watercourse or body of water.

Water Surface Profile. The water surface profile is a graphical representation of the height of the water surface throughout a county, city, or village based upon a certain flow passing through the river or stream. A water surface profile based upon flows occurring during a regional flood is used in regulating the floodplain areas.

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8. U.S. Department of Commerce, NOAA National Weather Service, DAMBRK, The Dam-Break Flood Forecasting Model, Office of Hydrology, National Weather Service (NWS), Silver Spring, Maryland, 20910 July 18, 1984.

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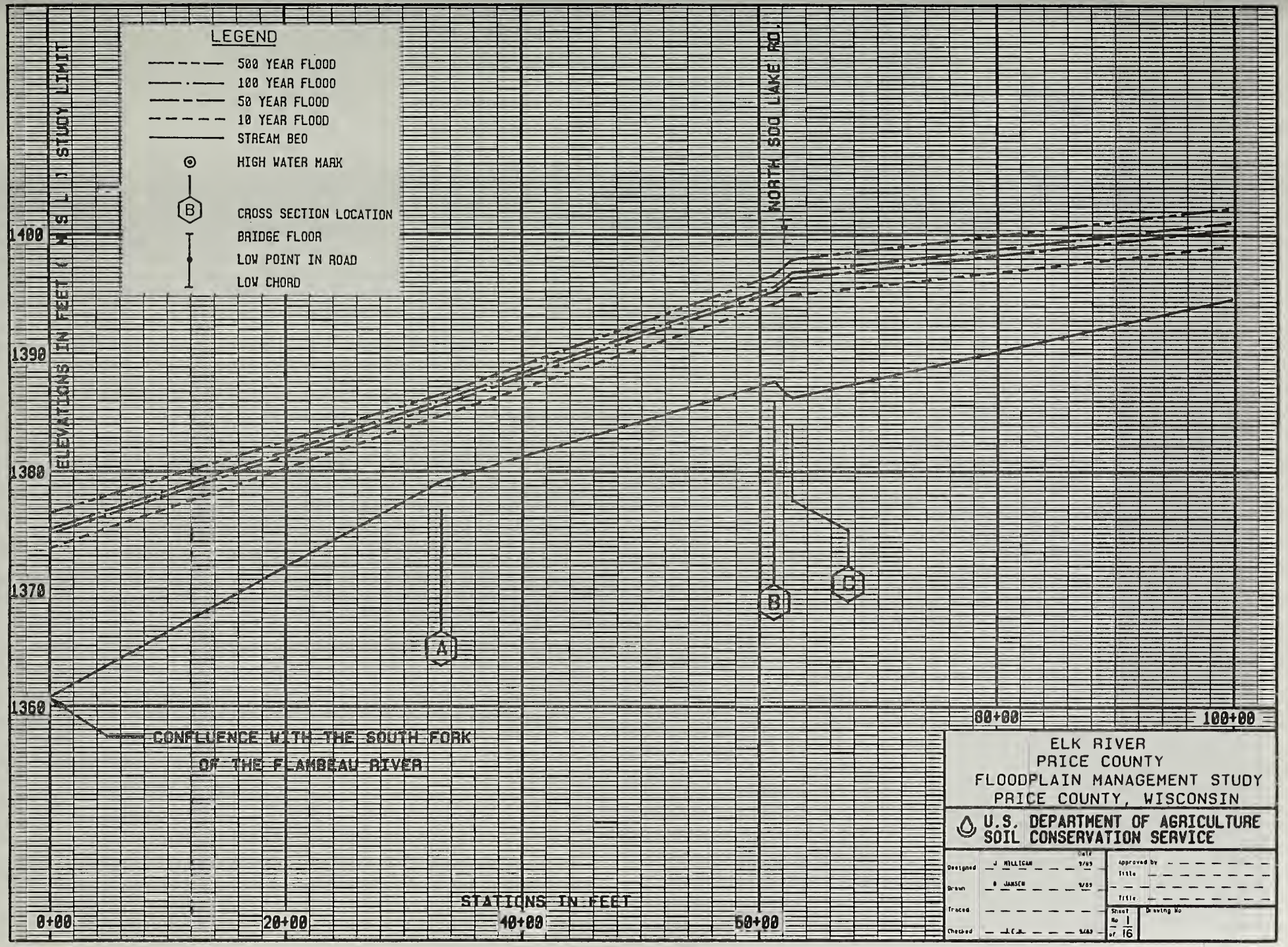
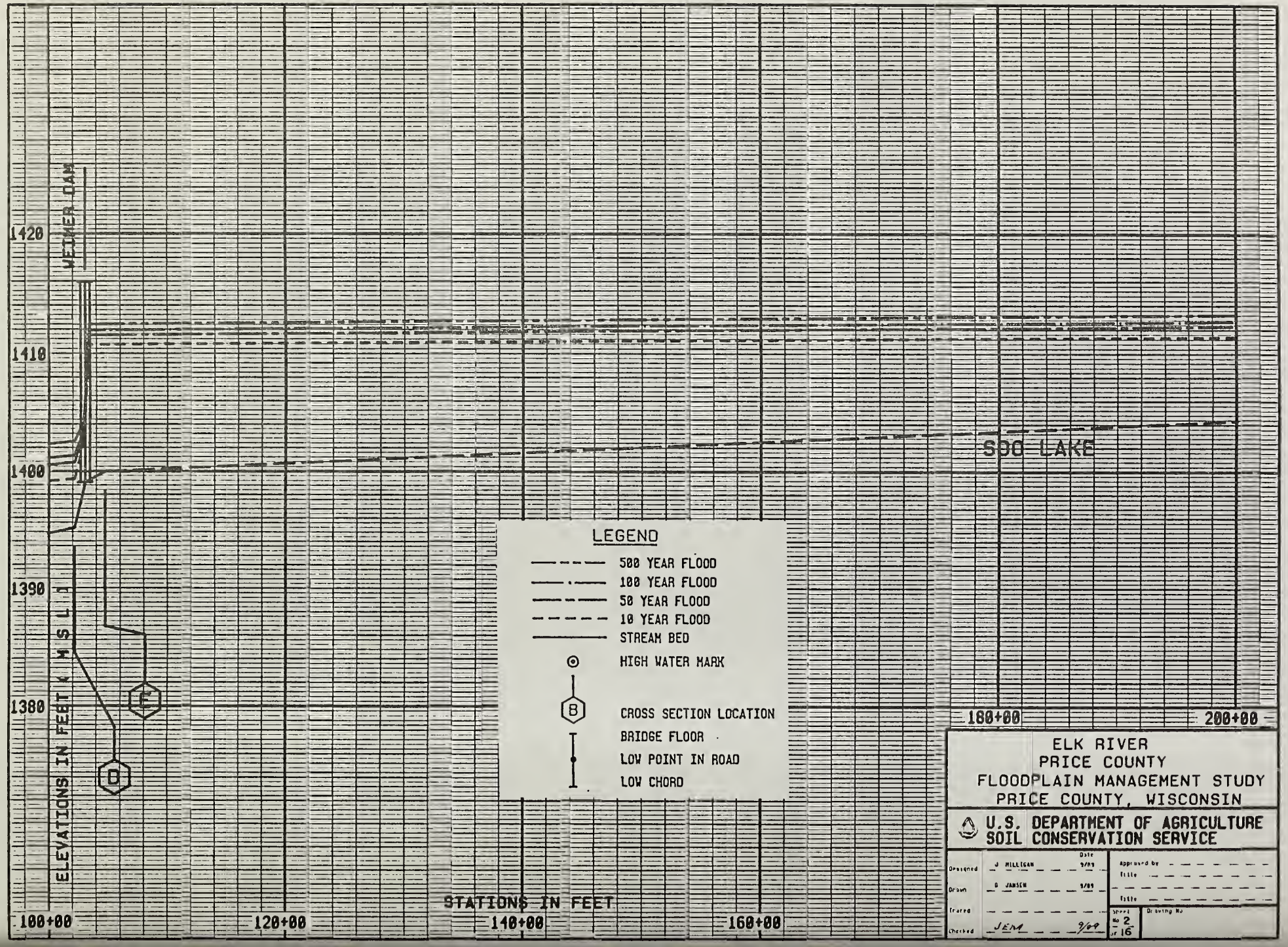
10. U.S. Army Corp of Engineers. Water Surface Profiles, HEC-2, August 1985, Hydrologic Engineering Center, Davis, California.

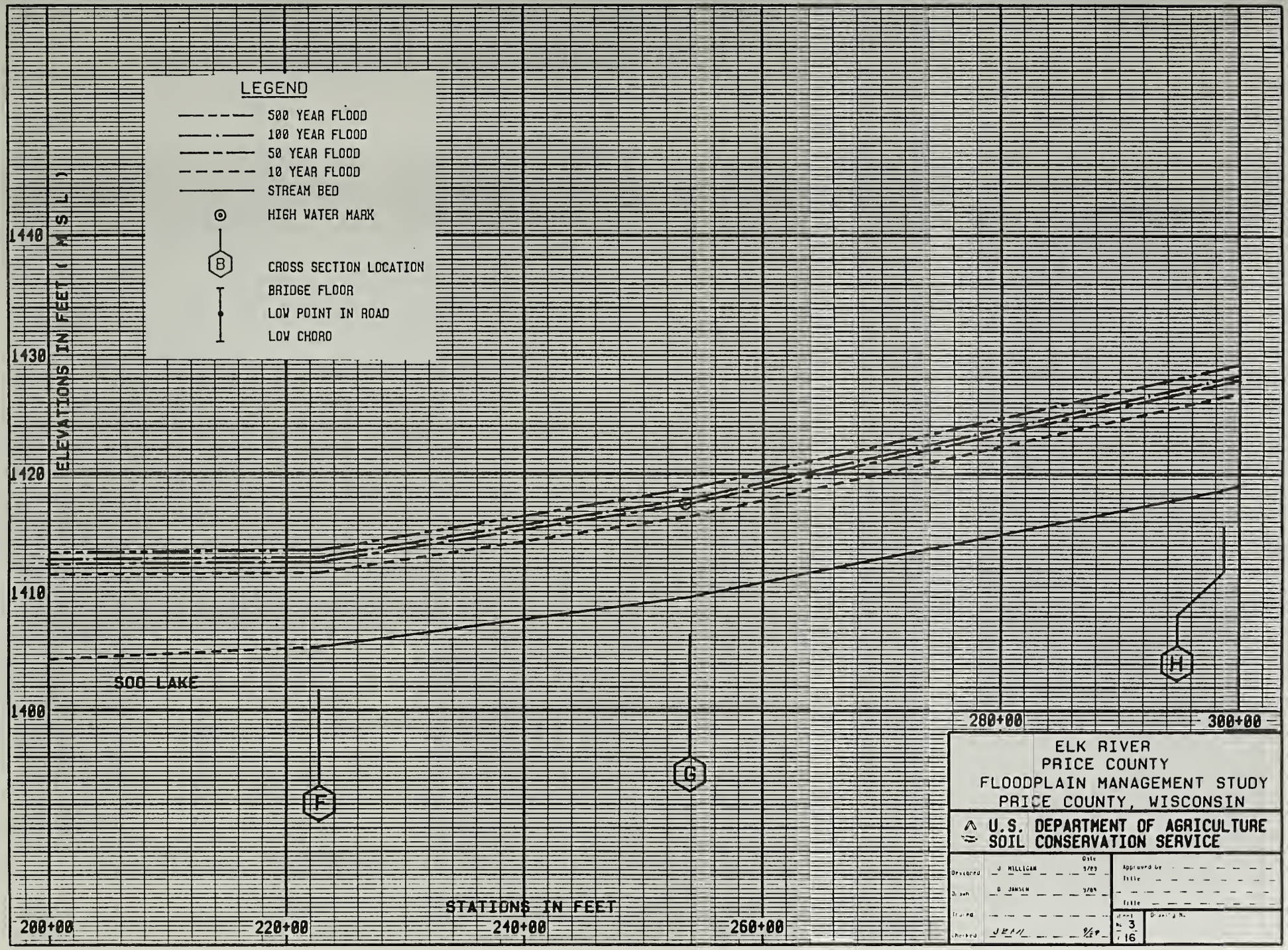
Appendix A

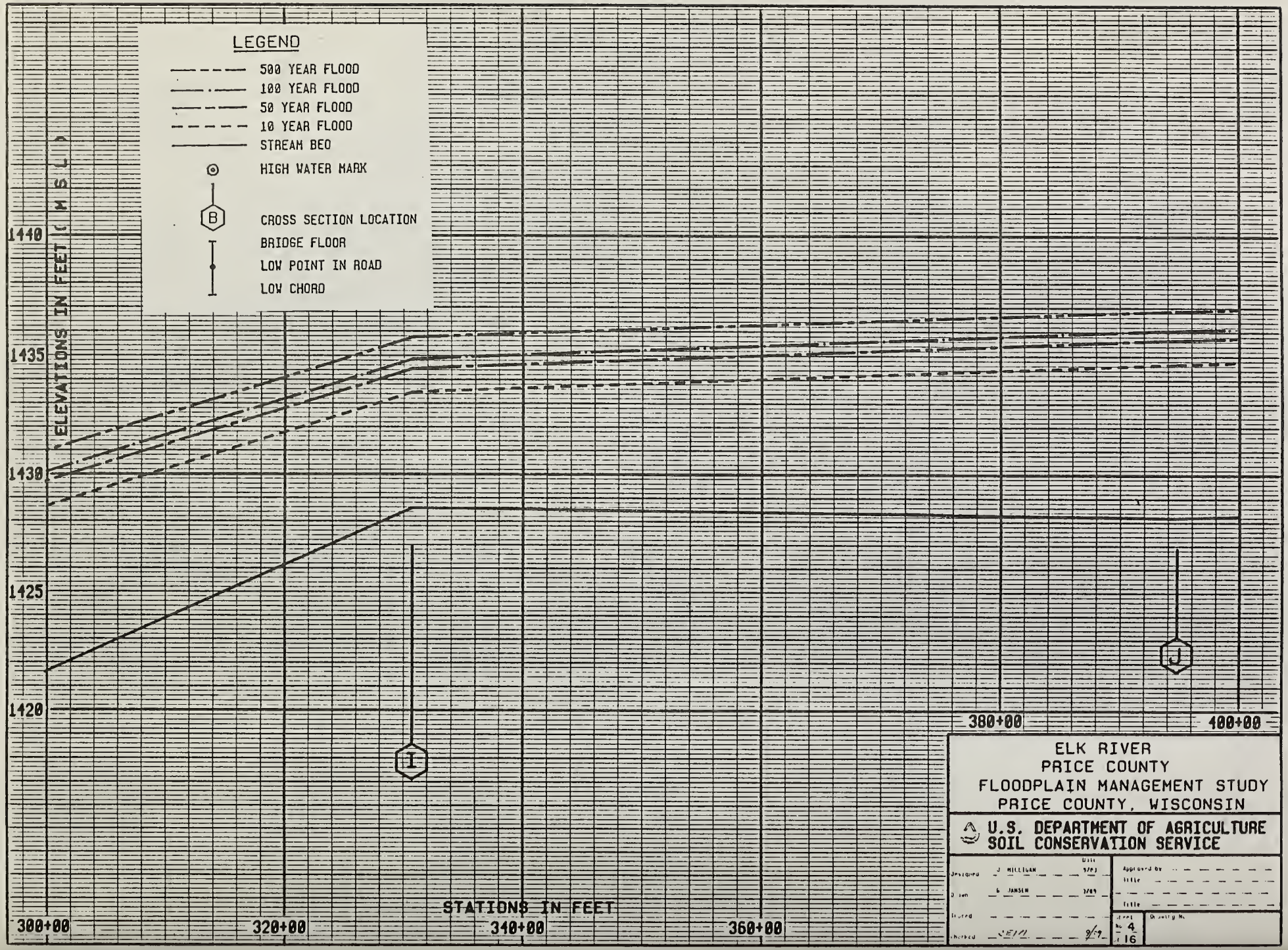
FLOOD PROFILES


LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
ELEVATIONS IN FEET (M S L) STUDY LIMIT
1400
1390
1380
1370
1360
NORTH SOO LAKE RD.
A
B
C
CONFLUENCE WITH THE SOUTH FORK
OF THE FLAMBEAU RIVER
0+00
20+00
40+00
60+00
80+00
100+00
STATIONS IN FEET
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed J MILLIGAN 9/83
Drawn B JANSCH 9/83
Traced
Checked J.C.M. 9/83
Approved by
Title
Title
Sheet No 1 of 16
Drawing No

A-1


VEIKER DAM
1420
1410
1400
1390
1380
ELEVATIONS IN FEET, M S L D
SOO LAKE
E
D
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
100+00
120+00
140+00
160+00
180+00
200+00
STATIONS IN FEET
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed J MILLIGAN 9/89
Drawn B JANSEN 9/89
Traced
Checked JEM 9/89
Approved by
Title
Title
Sheet No 2 of 16
Drawing No


LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
ELEVATIONS IN FEET (M S L)
1440
1430
1420
1410
1400
SOO LAKE
B
F
G
H
200+00
220+00
240+00
260+00
280+00
300+00
STATIONS IN FEET
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
J HILLIGAN
9/83
Drawn
D JANSEN
9/83
Checked
JEAH
9/83
Approved by
Title
Title
Sheet No. 3 of 16
Drawing No.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500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BEO
HIGH WATER MARK
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
ELEVATIONS IN FEET (M S L D
1440
1435
1430
1425
1420
I
J
380+00
400+00
STATIONS IN FEET
300+00
320+00
340+00
360+00
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
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Sheet No. 4 of 16
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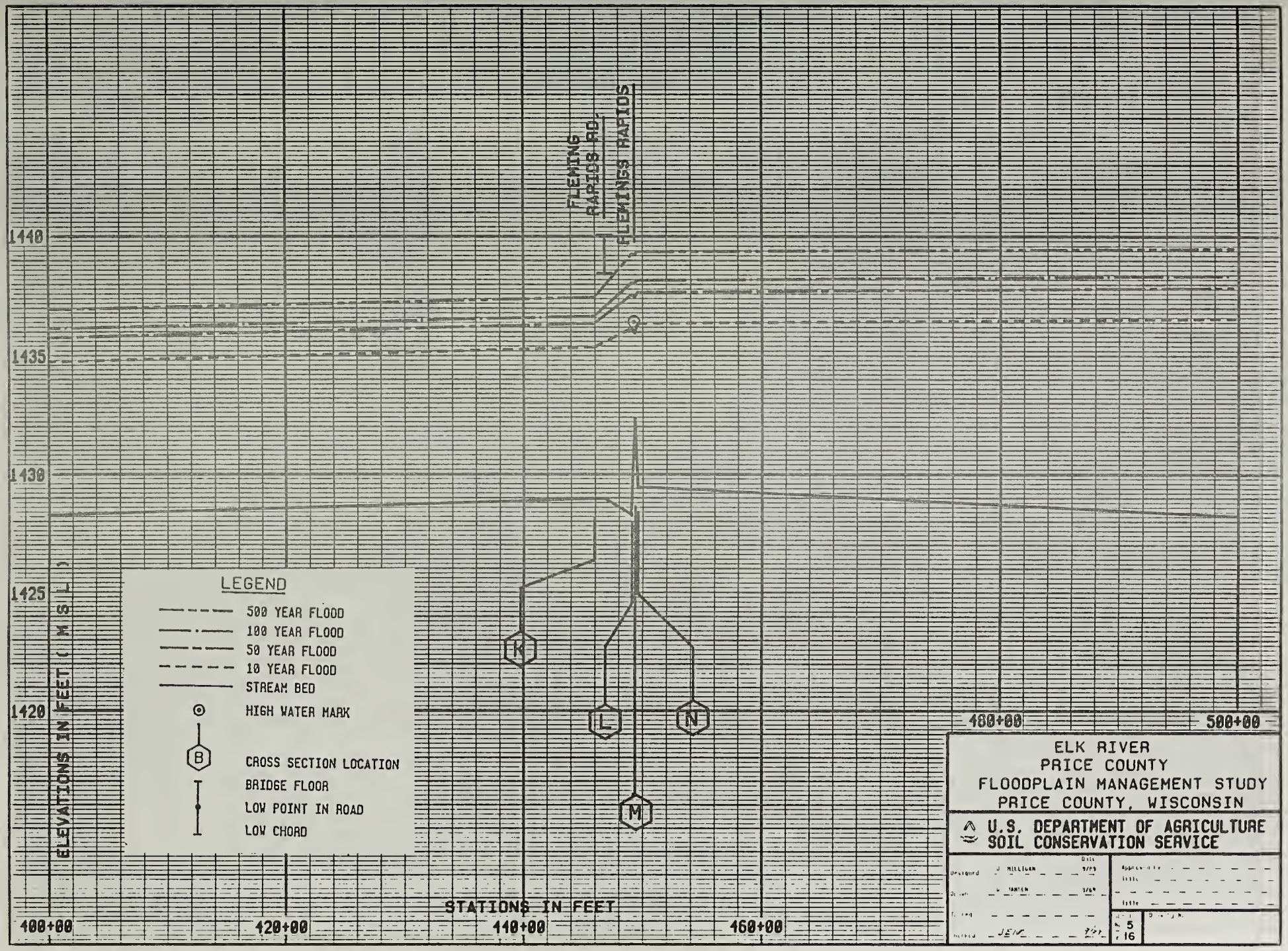
FLEMING RAPIDS RD.
FLEMINGS RAPIDS
1440
1435
1430
1425
1420
ELEVATIONS IN FEET (M S L)
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
K
L
M
N
400+00
420+00
440+00
460+00
480+00
500+00
STATIONS IN FEET
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed J. MILLIGAN 9/69
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Approved
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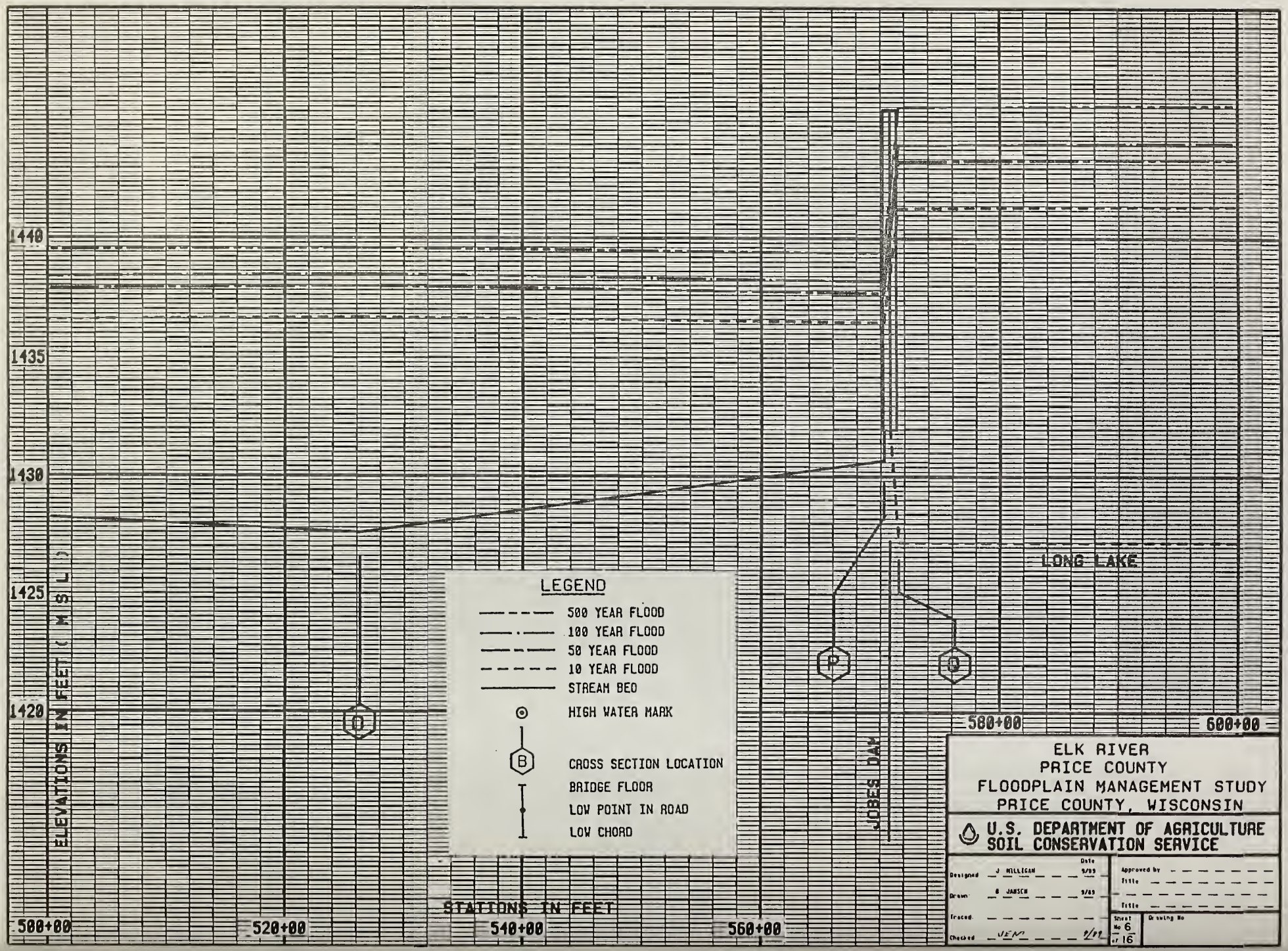
of 16


1440
1435
1430
1425
1420
ELEVATIONS IN FEET (M S L)
LONG LAKE
JOBES DAM
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
500+00
520+00
540+00
560+00
580+00
600+00
STATIONS IN FEET
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed J MILLIGAN 9/89
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Title
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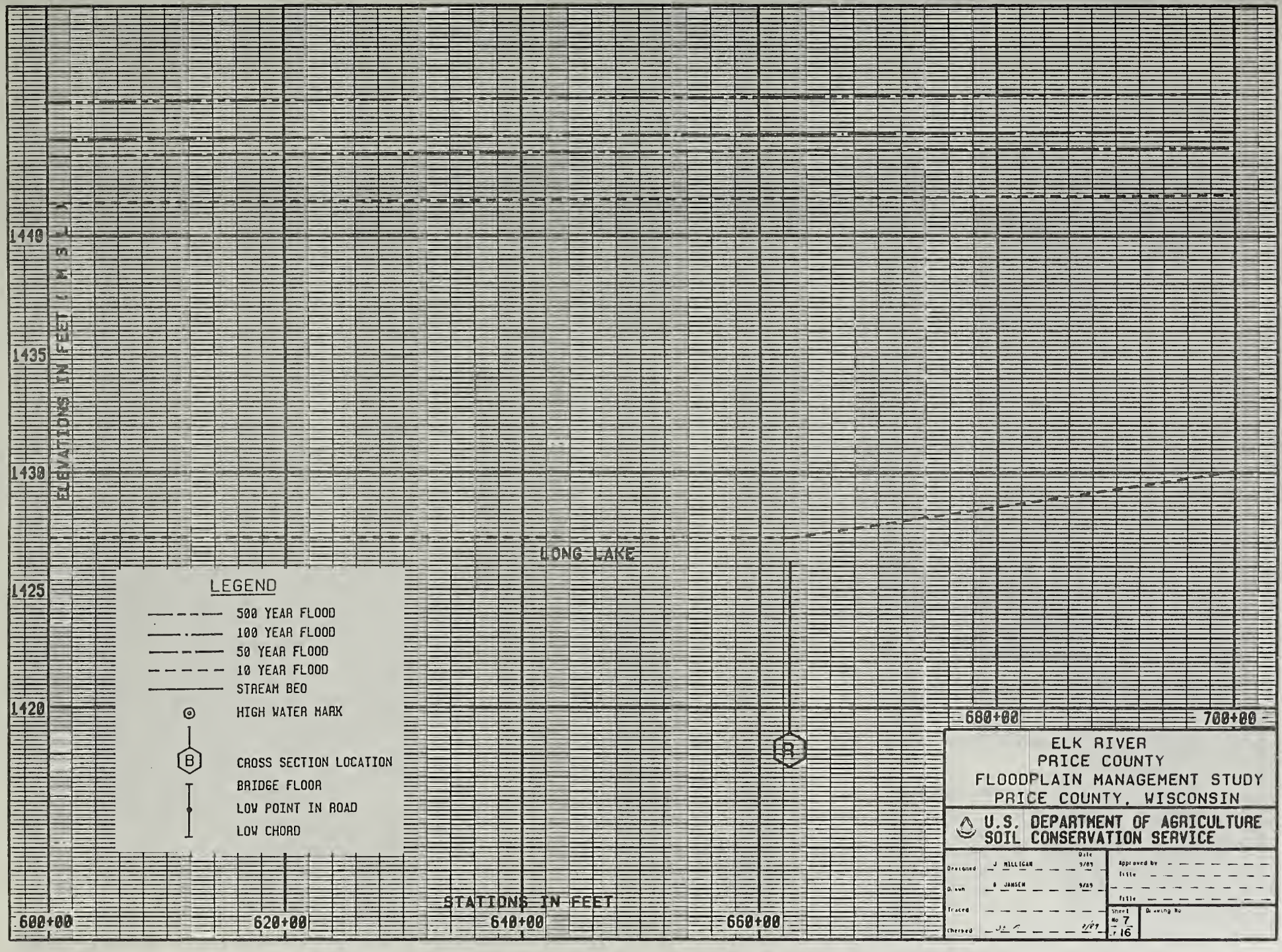
Drawing No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1440
1435
1430
1425
1420
LONG LAKE
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
R
600+00
620+00
640+00
660+00
680+00
700+00
STATIONS IN FEET
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
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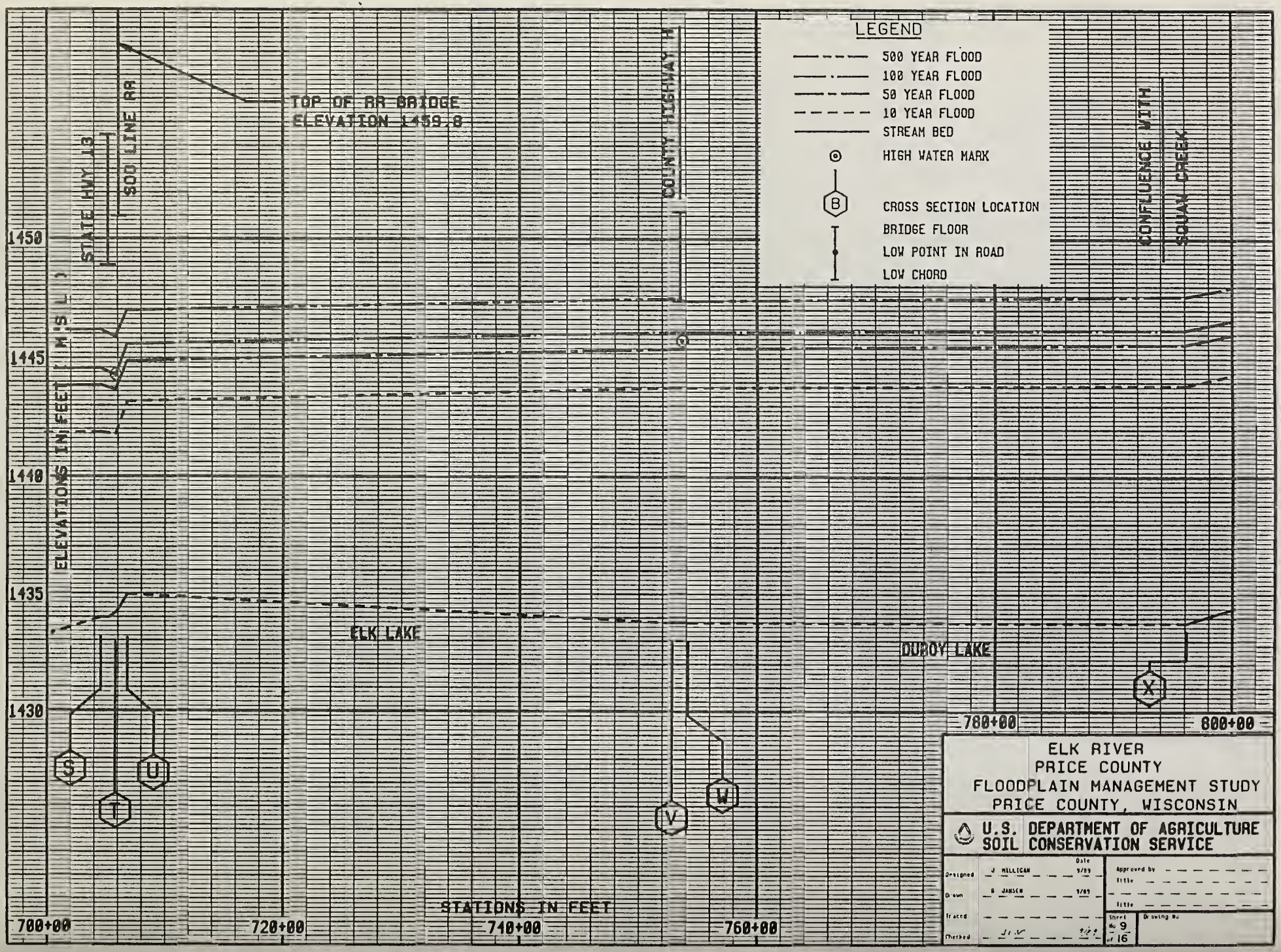
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
TOP OF RR BRIDGE
ELEVATION 1459.8
500 LINE RR
STATE HWY 13
COUNTY HIGHWAY H
CONFLUENCE WITH
SQUAW CREEK
ELEVATIONS IN FEET (M.S.L.)
1450
1445
1440
1435
1430
ELK LAKE
DUBOY LAKE
S
T
U
V
W
X
700+00
720+00
740+00
760+00
780+00
800+00
STATIONS IN FEET
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed J. MILLIGAN 9/89
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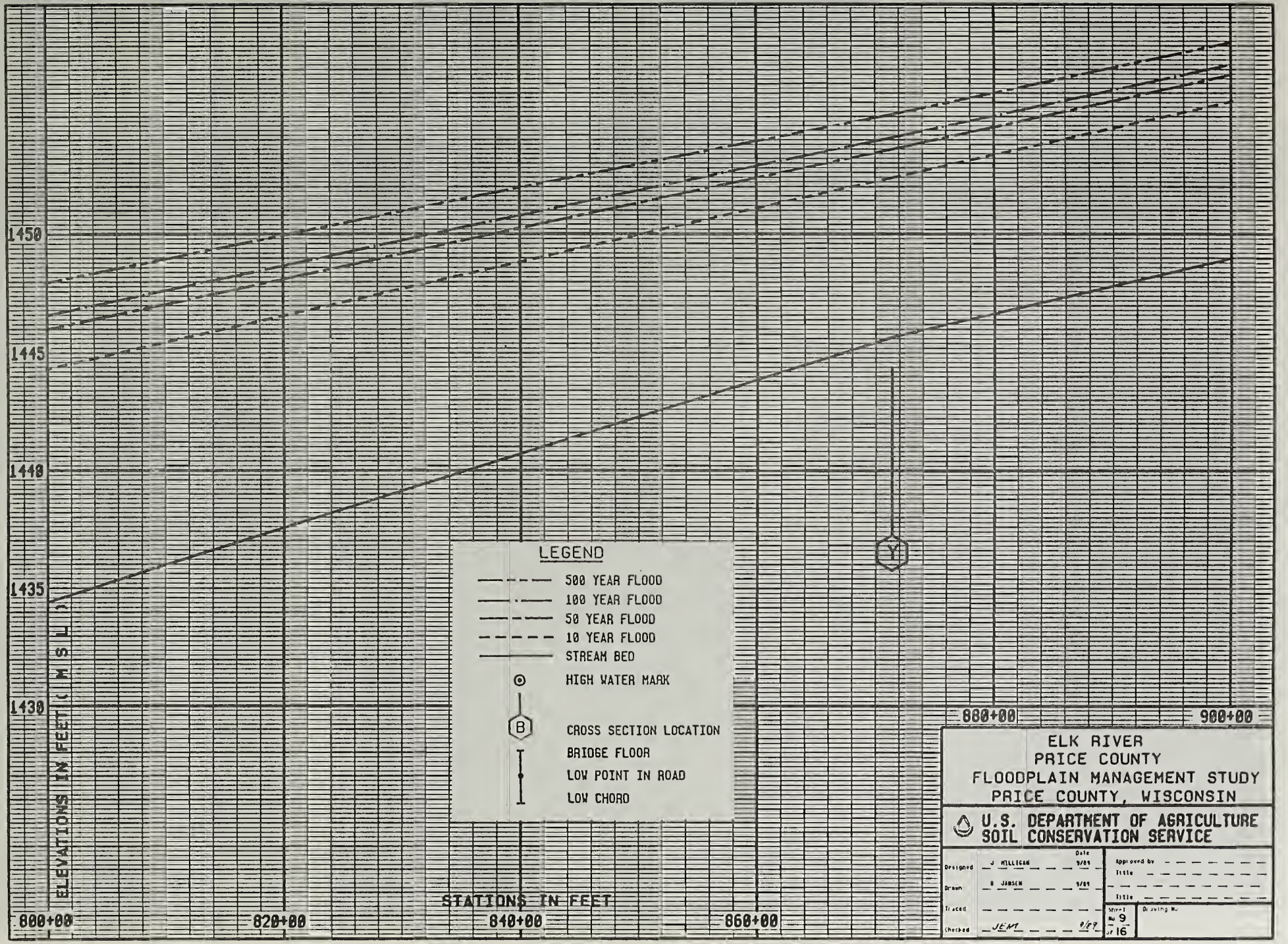
1450
1445
1440
1435
1430
ELEVATIONS IN FEET (M S L)
800+00
820+00
840+00
860+00
880+00
900+00
STATIONS IN FEET
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
Y
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
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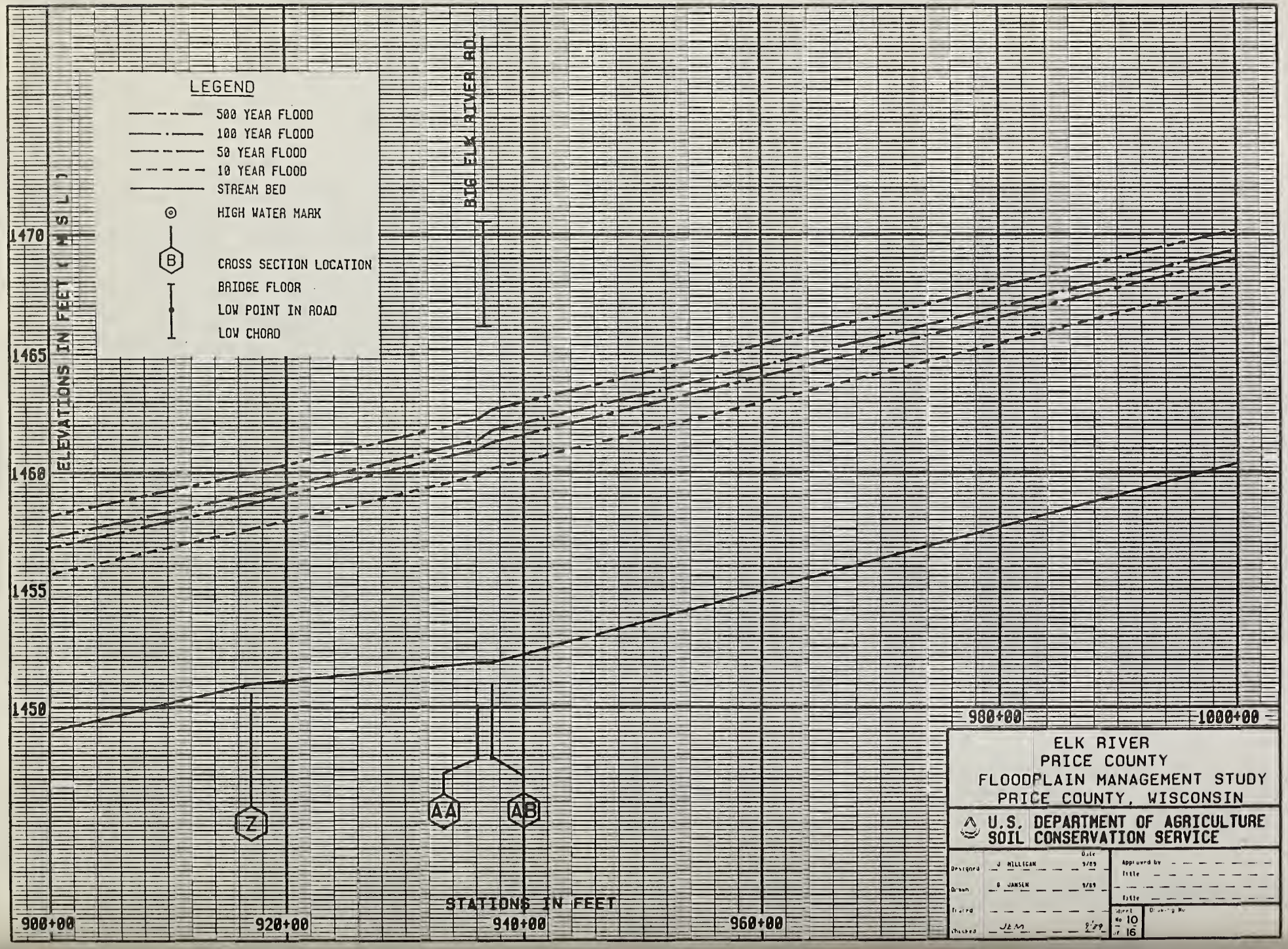
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
BIG ELK RIVER RD.
ELEVATIONS IN FEET (MSL)
1470
1465
1460
1455
1450
980+00
1000+00
Z
AA
AB
STATIONS IN FEET
900+00
920+00
940+00
960+00
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
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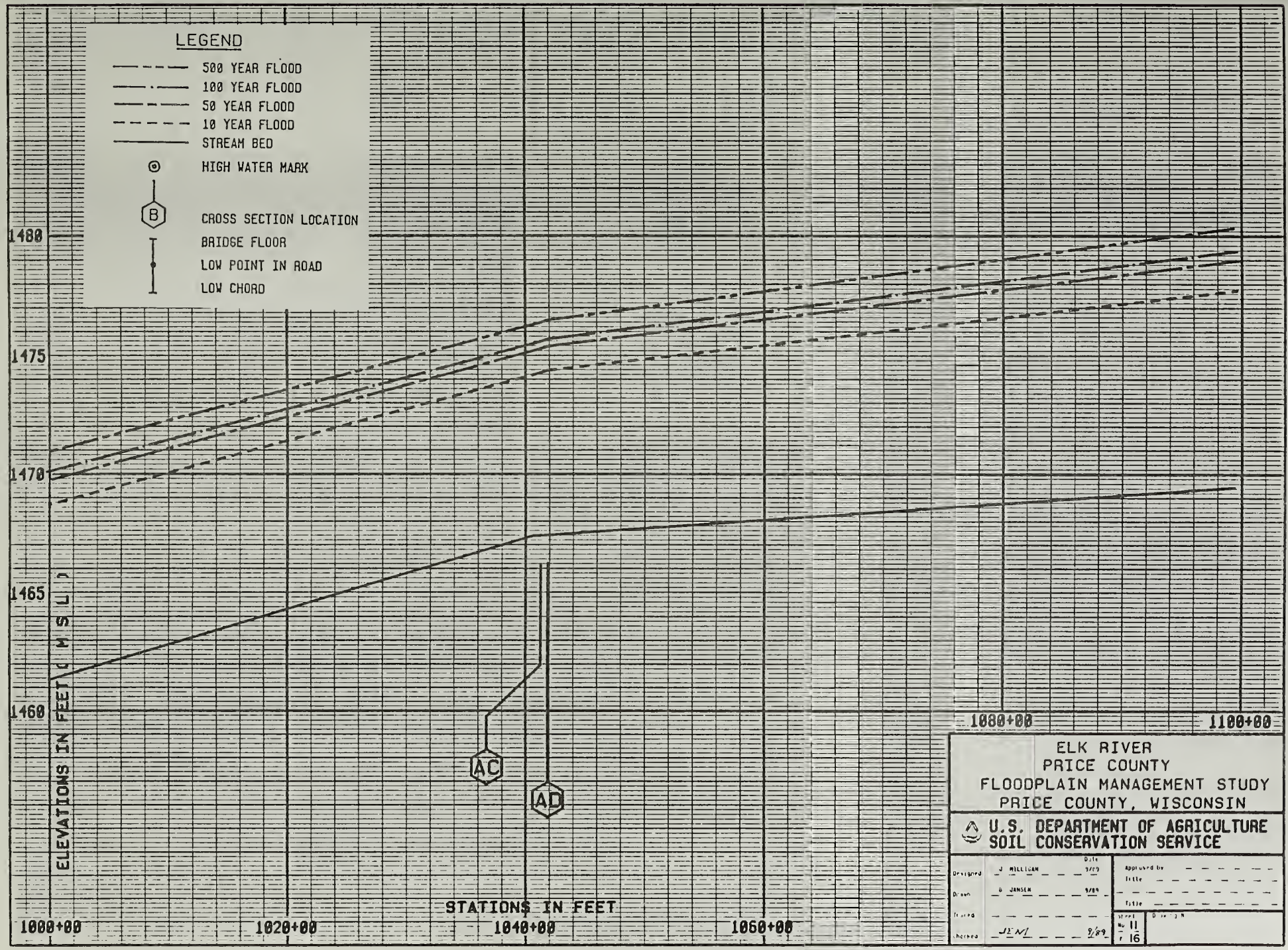
Drawing No


LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
1480
1475
1470
1465
1460
ELEVATIONS IN FEET (M S L D)
AC
AD
1000+00
1020+00
1040+00
1060+00
1080+00
1100+00
STATIONS IN FEET
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
J. MILLIGAN
9/89
Drawn
B. JANSEN
9/89
Traced
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JEM
9/89
Approved by
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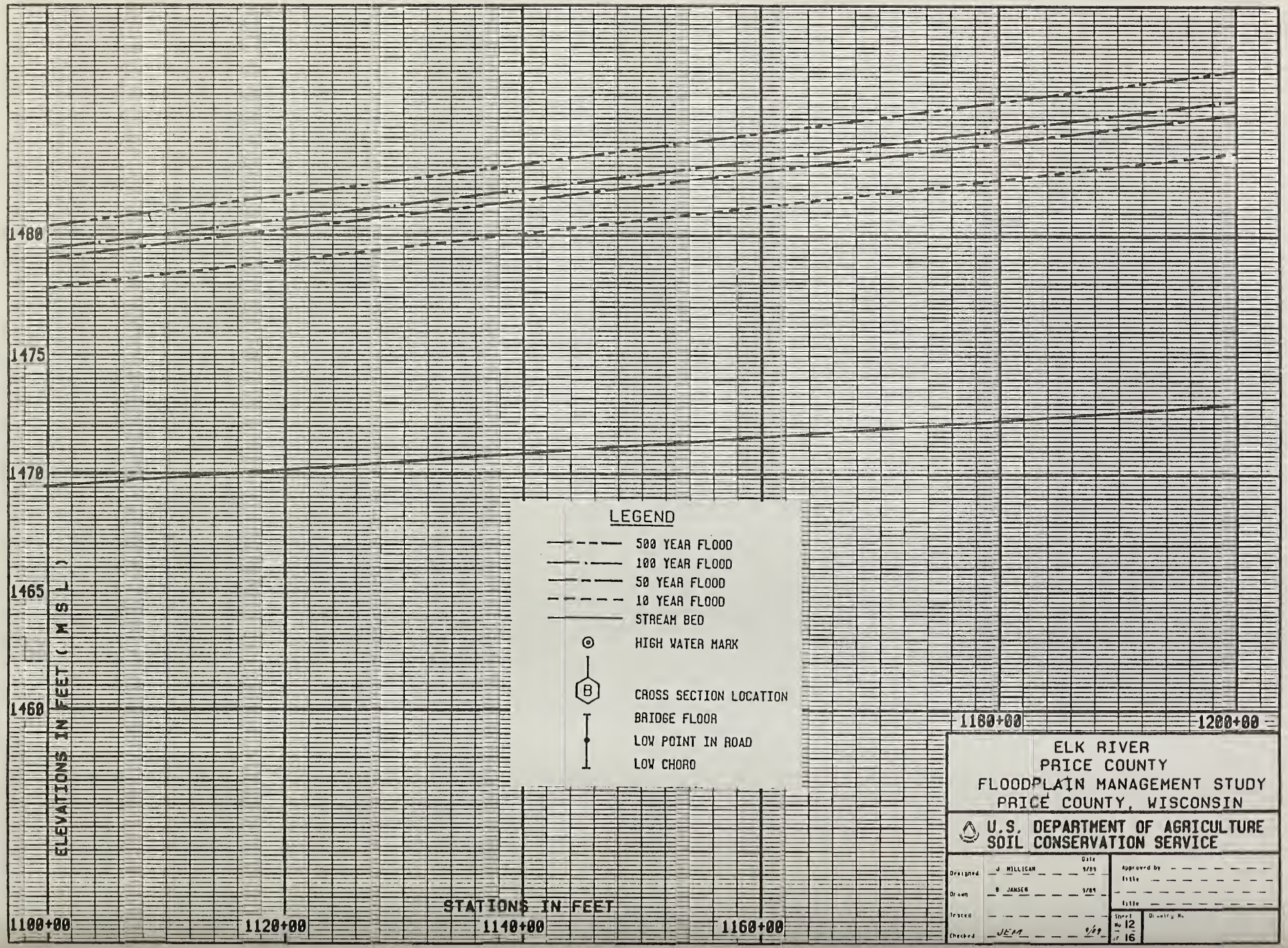
Title
Sheet No. 11 of 16
Drawing No.


1480
1475
1470
1465
1460
ELEVATIONS IN FEET (M S L)
1100+00
1120+00
1140+00
1160+00
1180+00
1200+00
STATIONS IN FEET
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
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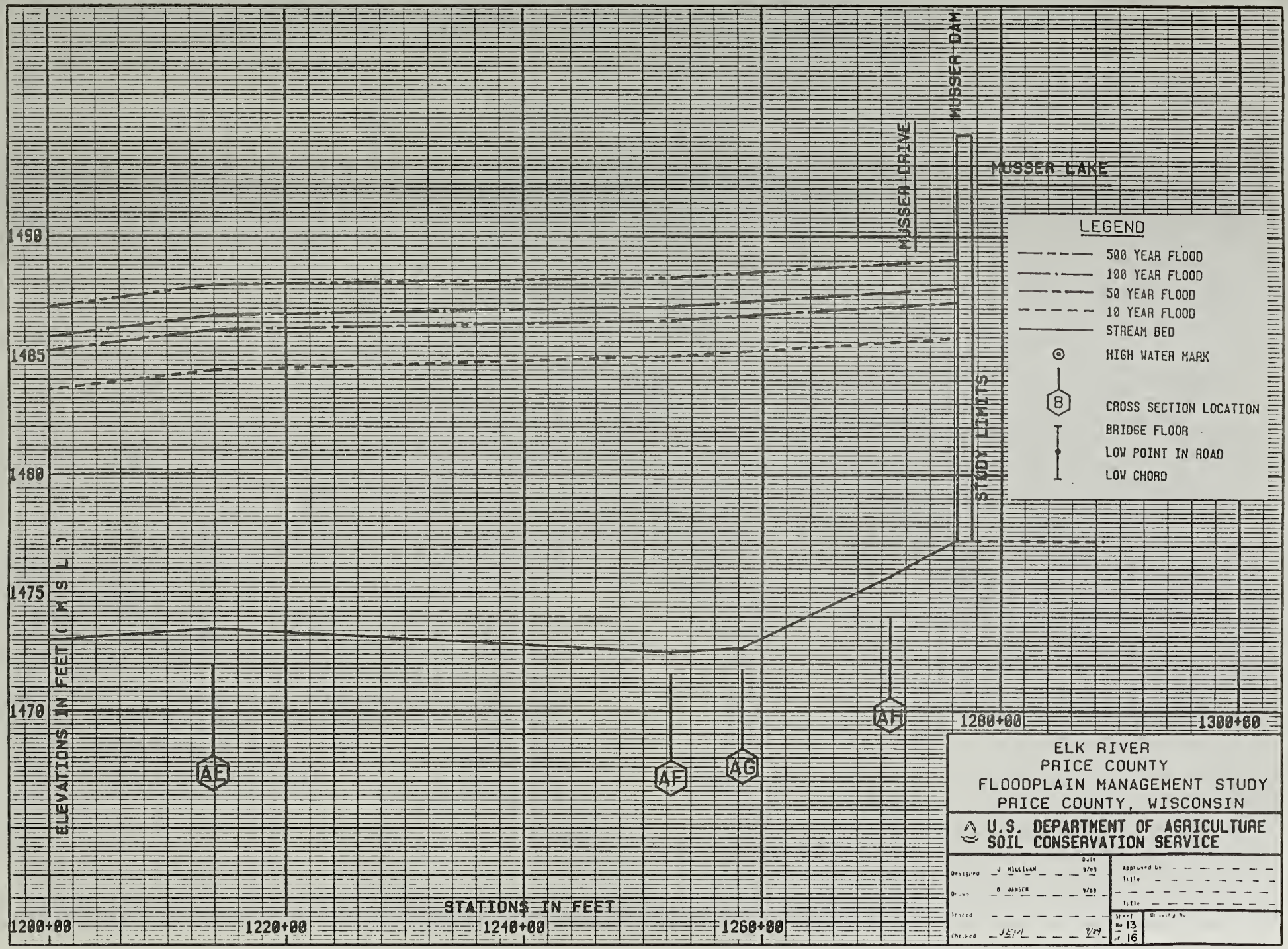
Title
Sheet No 12 of 16
Drawing No.


MUSSER DAM
MUSSER DRIVE
MUSSER LAKE
STUDY LIMITS
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
8
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
1490
1485
1480
1475
1470
ELEVATIONS IN FEET (M S L)
AE
AF
AG
AH
1200+00
1220+00
1240+00
1260+00
1280+00
1300+00
STATIONS IN FEET
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed J MILLIGAN
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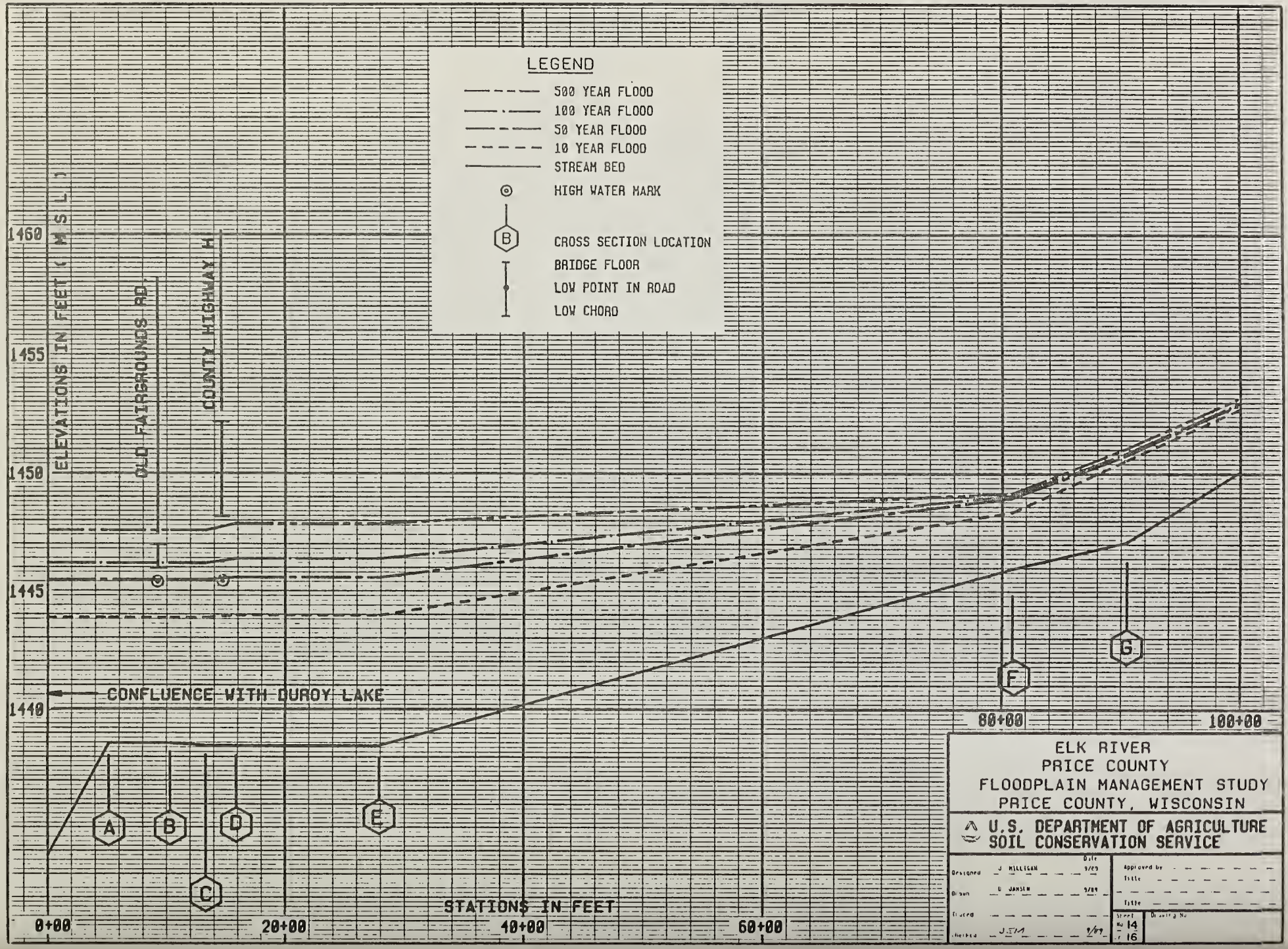
Date 9/89
Approved by
Title
Sheet No 13 of 16

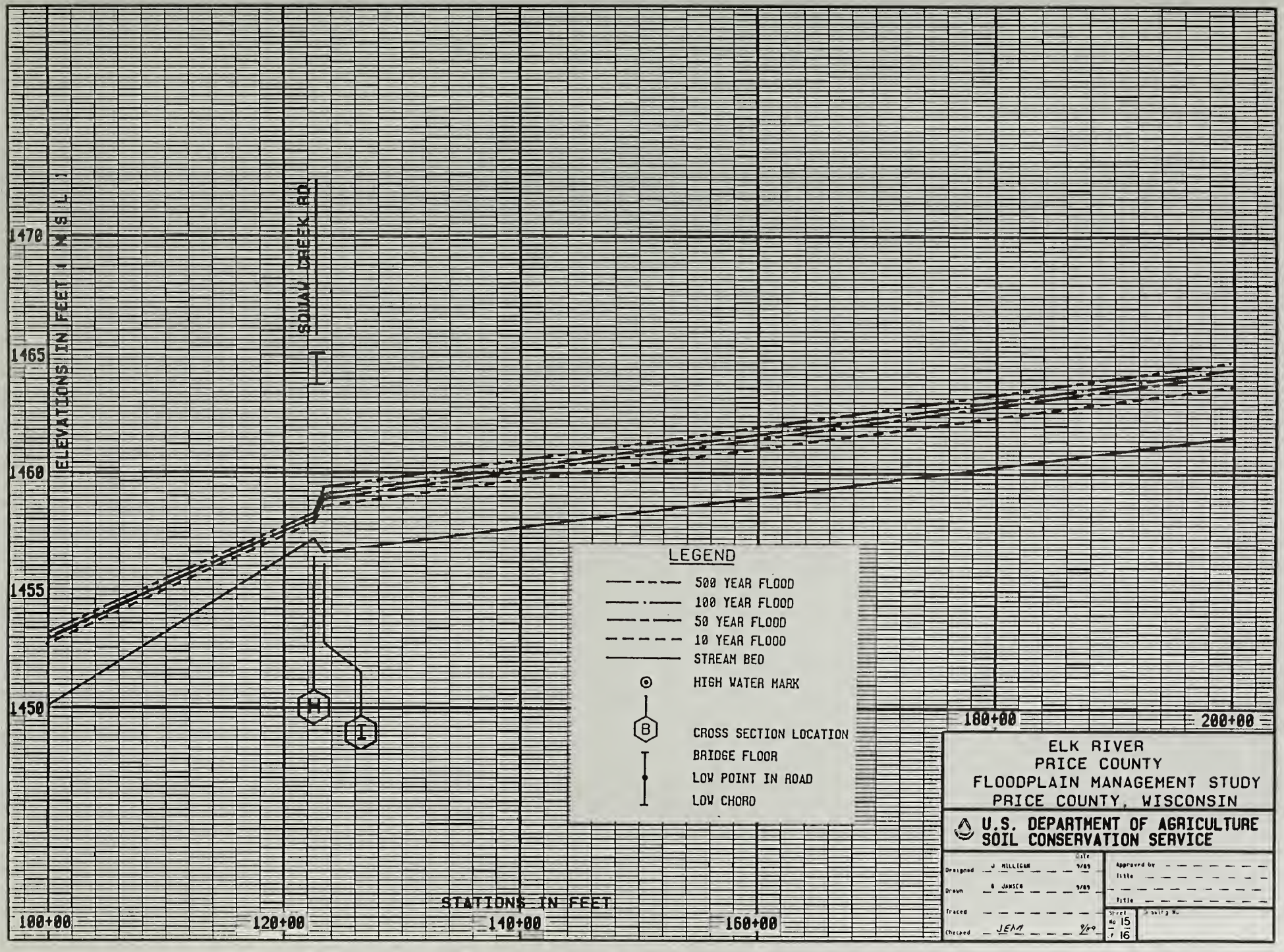


ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date
Designed	J. KILLIGAN	1/89
Drawn	D. JANSEN	1/89
Traced		
Checked	J.S.M.	1/89

Approved by
Title
Title
Sheet No. 14 of 16
Drawing No.


ELEVATIONS IN FEET (M S L)
1470
1465
1460
1455
1450
SQUAW CREEK RD.
H
I
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
100+00
120+00
140+00
160+00
180+00
200+00
STATIONS IN FEET
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed J. MILLIGAN 9/89
Drawn G. JANSEN 9/89
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Checked JEM 9/89
Approved by
Title
Title
Sheet No 15 of 16
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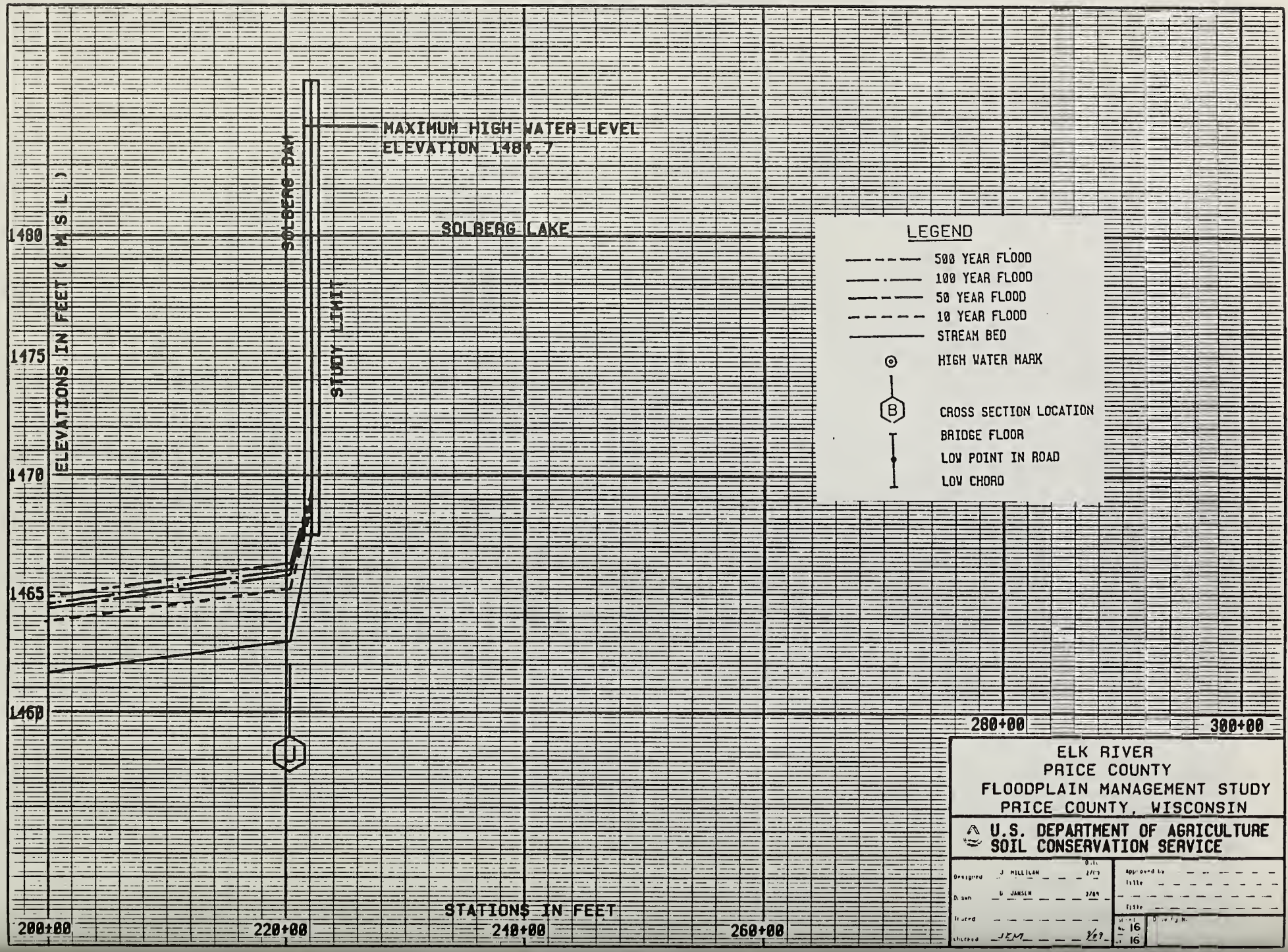

MAXIMUM HIGH WATER LEVEL
ELEVATION 1484.7
SOLBERG DAM
SOLBERG LAKE
STUDY LIMIT
ELEVATIONS IN FEET (M S L)
1480
1475
1470
1465
1460
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
HIGH WATER MARK
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
200+00
220+00
240+00
260+00
280+00
300+00
STATIONS IN FEET
ELK RIVER
PRICE COUNTY
FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed J. MILLIGAN 2/69
Drawn D. JANSEN 2/69
Traced
Checked JEM 2/69
Approved by
Title
Title
Sheet No. 16 of 16 Sheets
Drawing No.

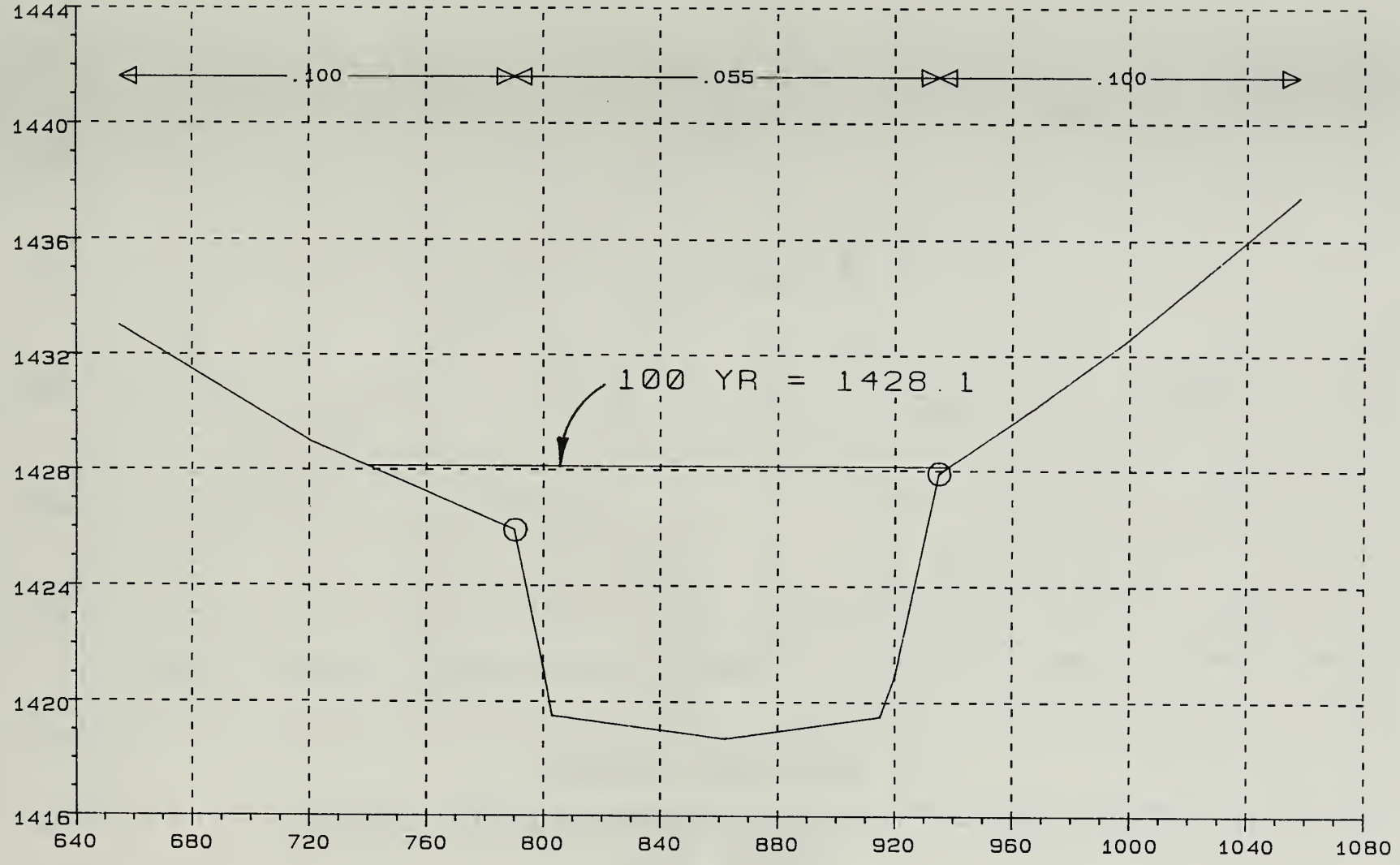
Appendix B

TYPICAL SECTIONS

ELK RIVER

PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY

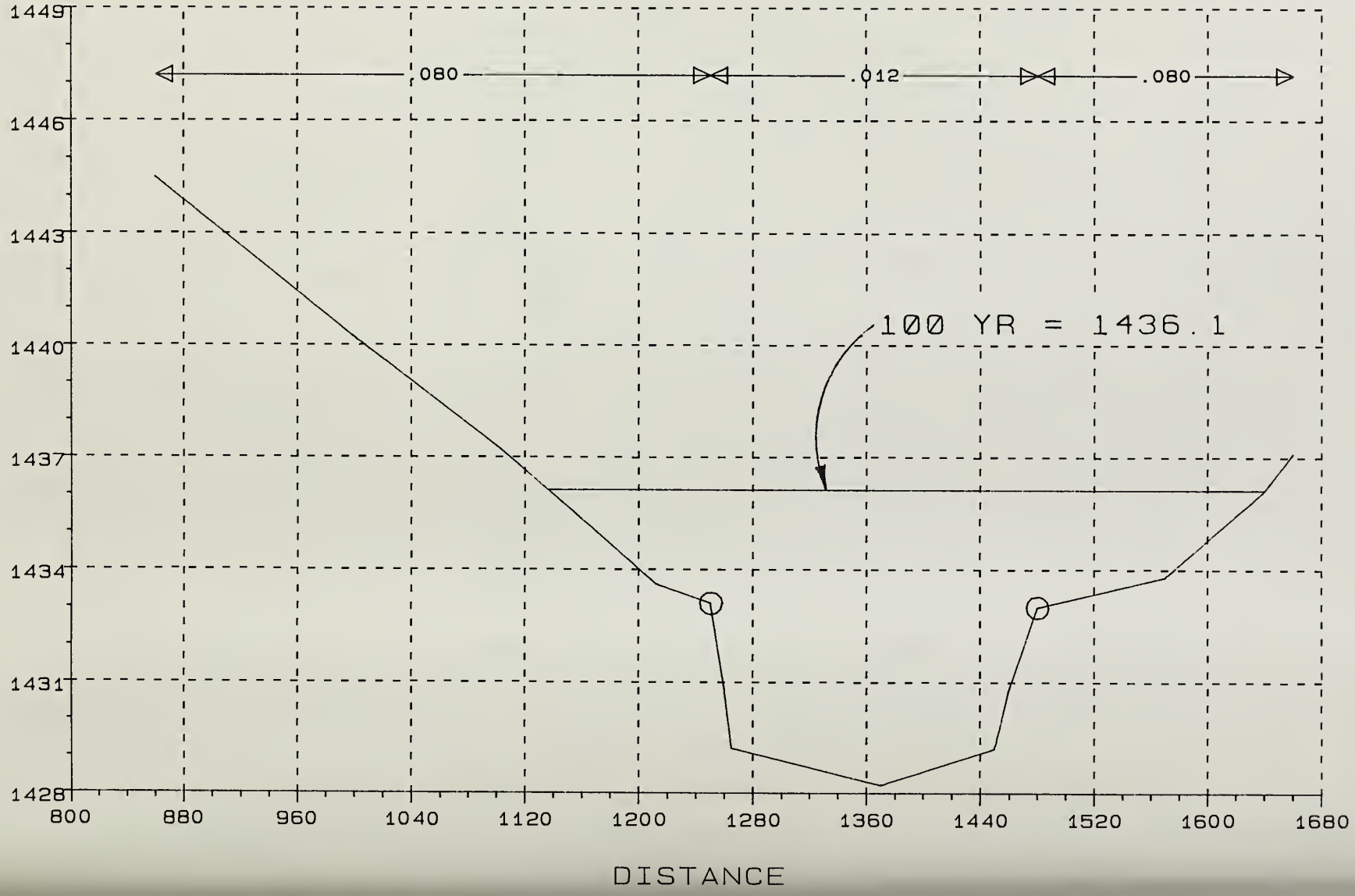
CROSS SECTION "H"



ELK RIVER

PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY

CROSS SECTION "J"



ELK RIVER
PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY
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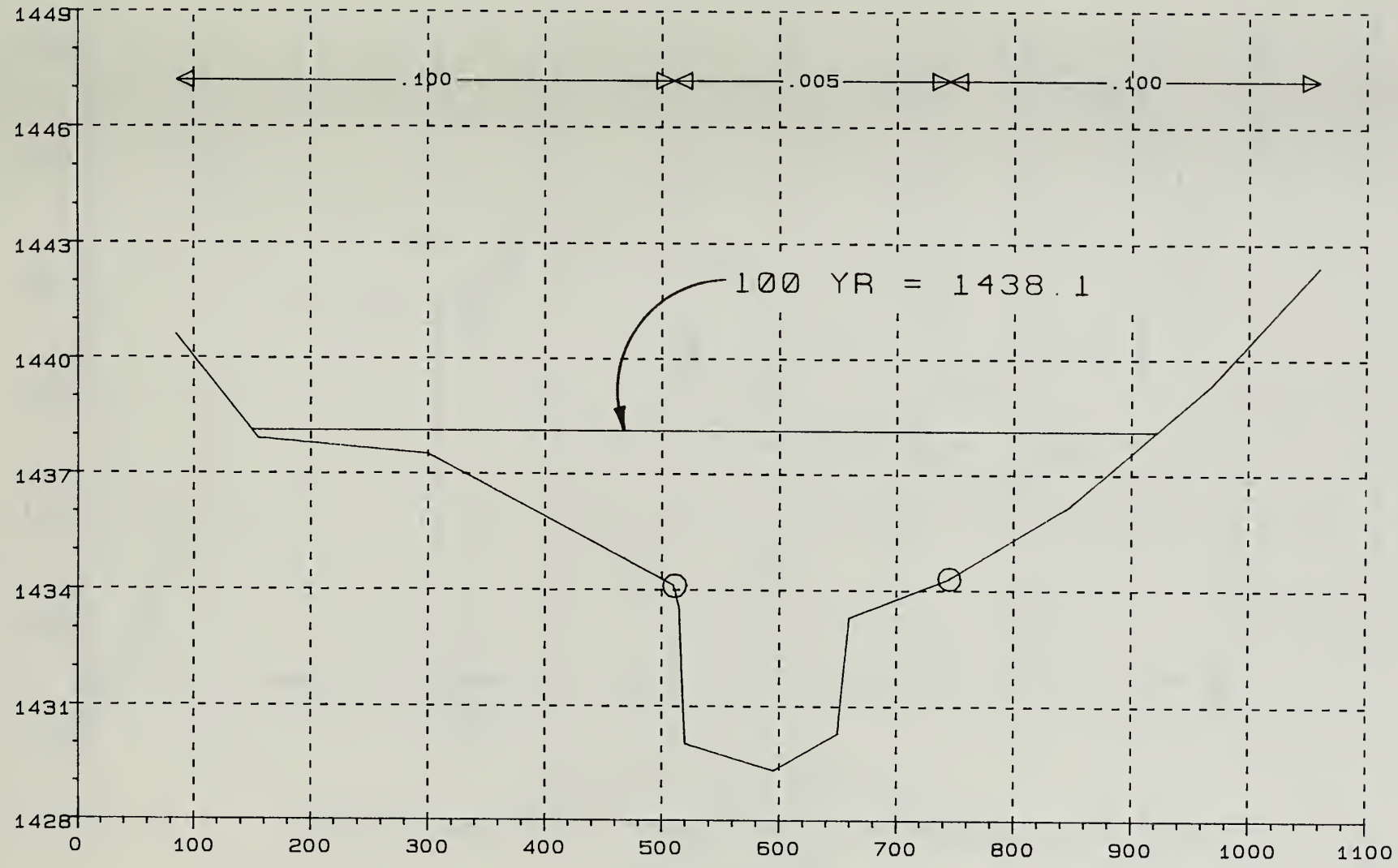

ELK RIVER

PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY

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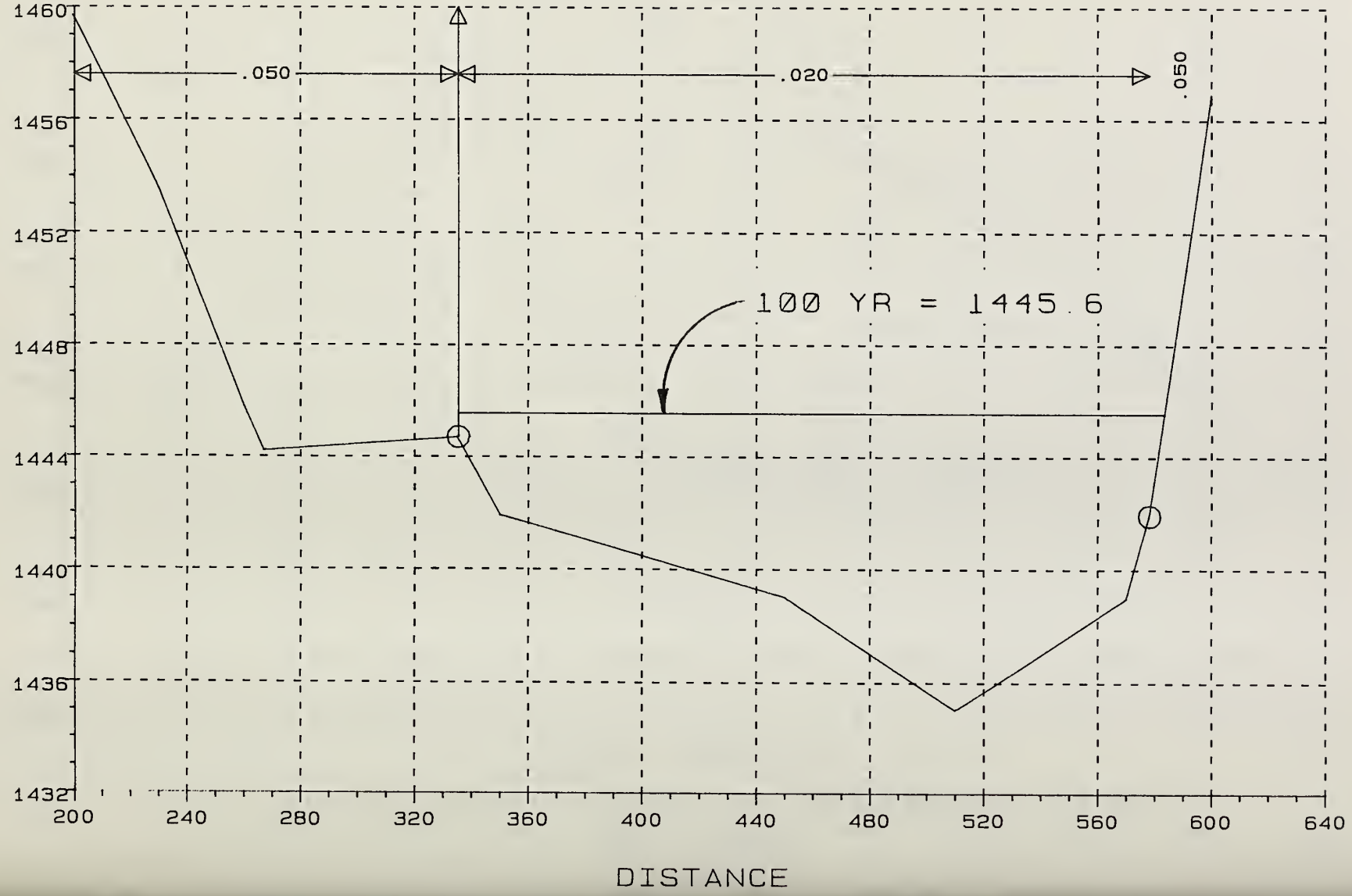

ELK RIVER

PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY

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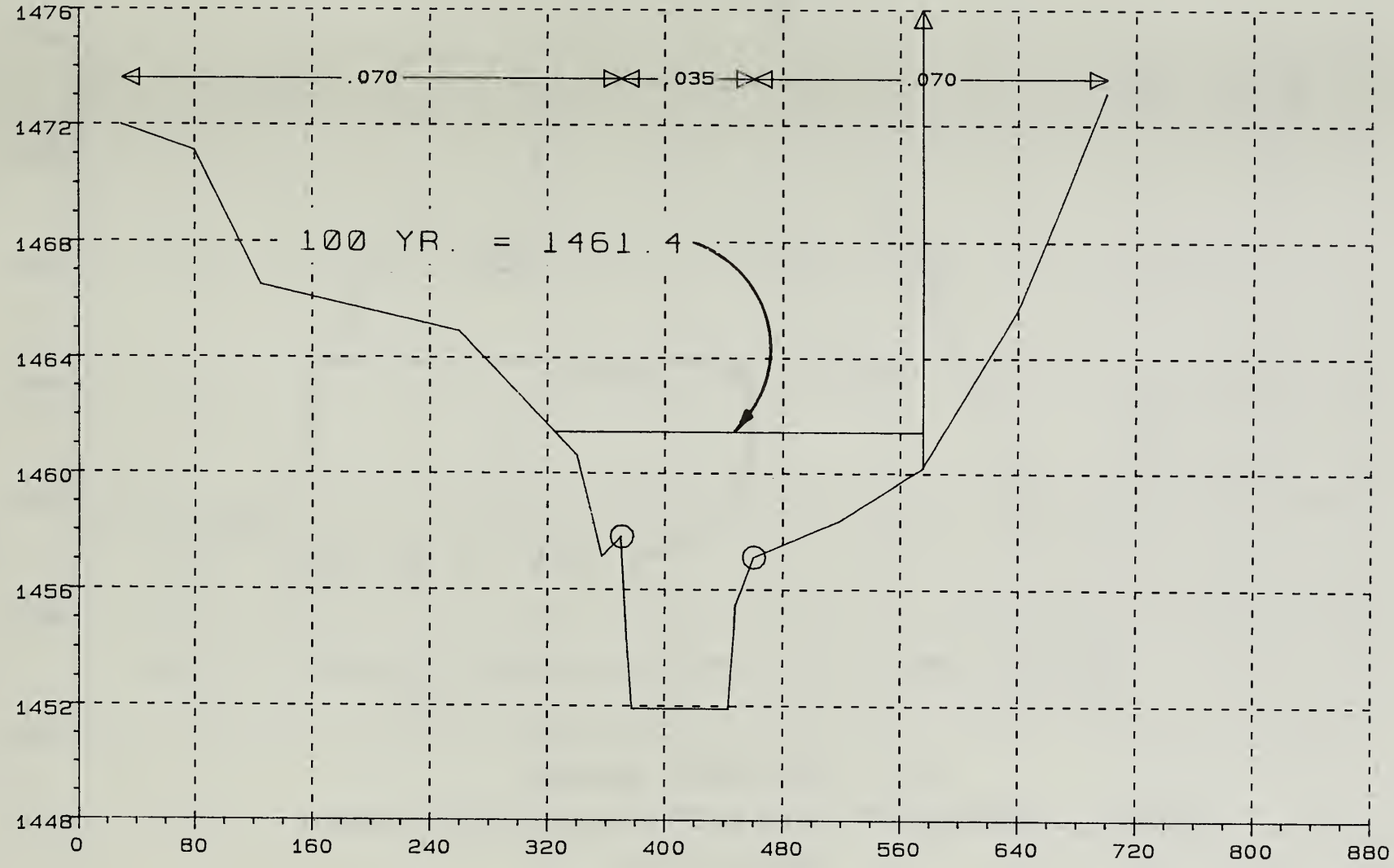
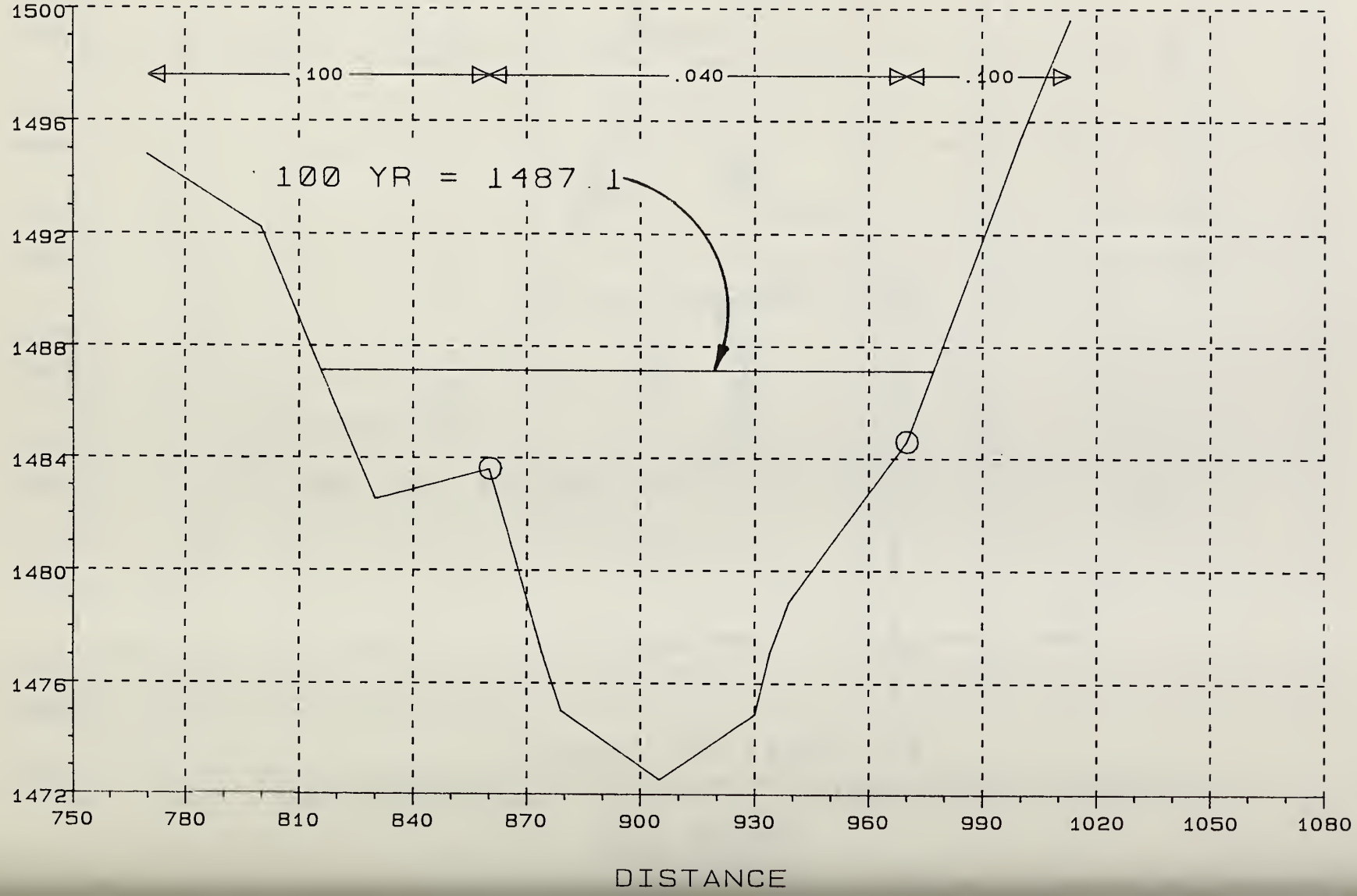


B-5

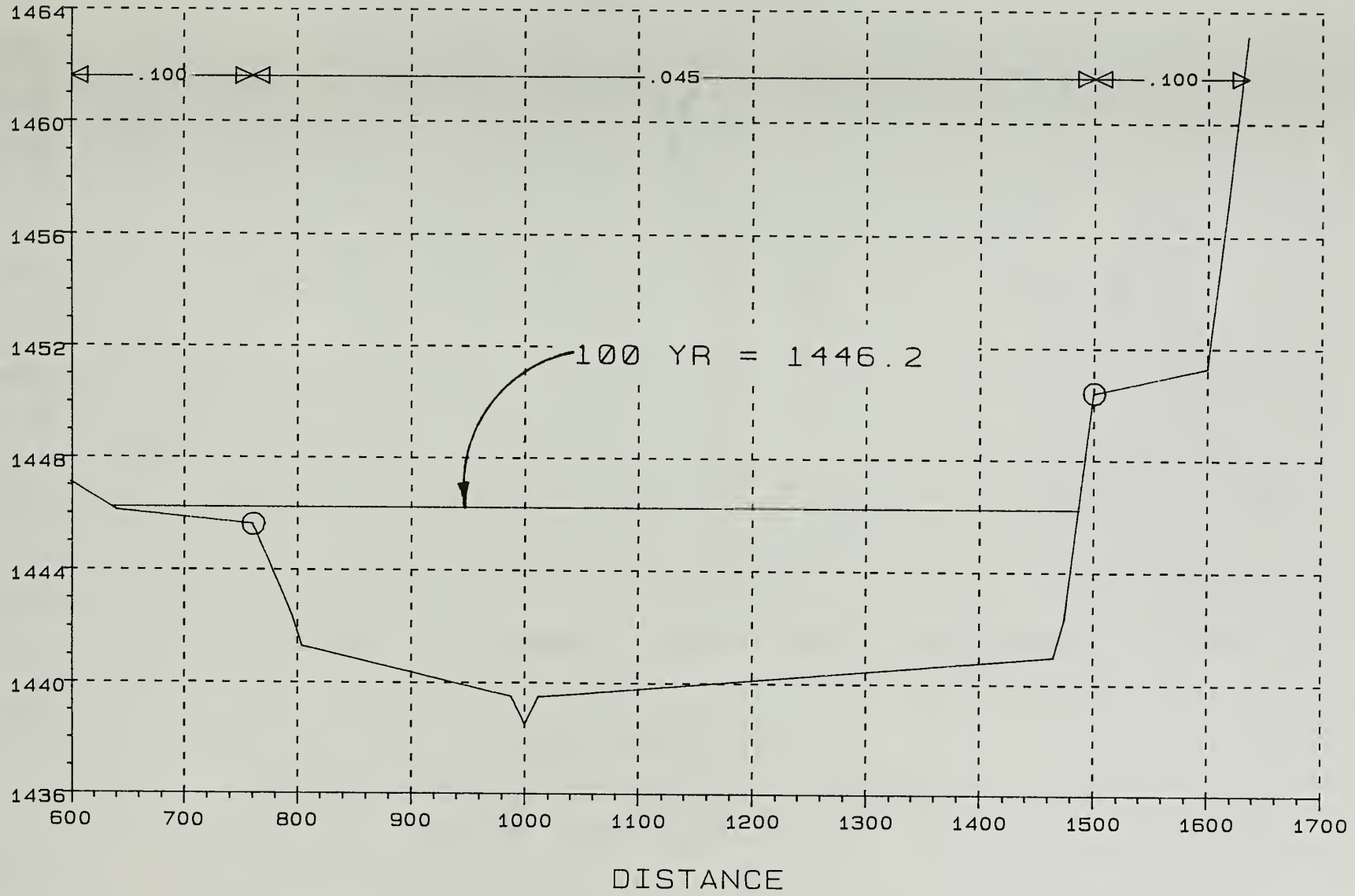
ELK RIVER
PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY
CROSS SECTION "AF"



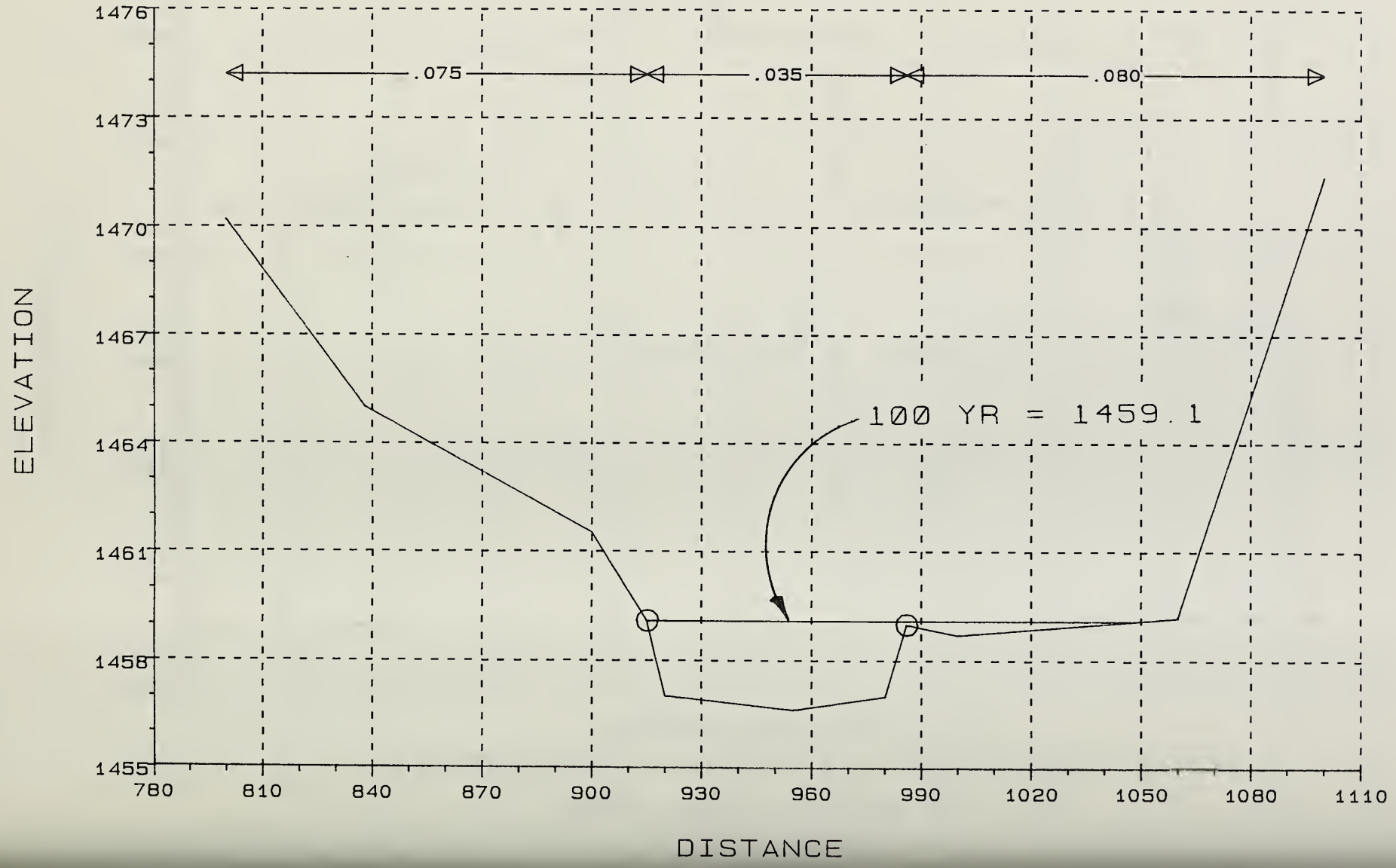
SQUAW CREEK, PRICE CO. WI

PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY

CROSS SECTION "C"



SQUAW CREEK, PRICE CO. WI
PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY
CROSS SECTION "I"



Appendix C

ELEVATION REFERENCE MARKS

ELEVATION REFERENCE MARKS

Reference Mark	Elev. (MSL)	
1	1416.45	TBM-2. Top of orange painted nut in the south-east leg of power line tower No. 207.
2	1416.48	TBM. A spike in power pole. 400 feet south of bridge on east side of North Soo Lake Road.
3	1415.67	BM-528-E. Tablet marked Public Service Commission of Wisconsin. Set in top of east end of south abutment of Weimer Dam.
4	1415.65	TBM. CTH W and Nine Mile Creek. Top of north end of 13-foot culvert.
5	1413.14	TBM. North Soo Lake Road and Crane Creek culvert. Orange "X" painted on the north end of road culvert.
6	1429.48	TBM. A spike in power pole at the end of Elk River Road at "T" intersection of private drive from the east.
7	1423.50	TBM. A spike in base of power pole with transformer at end of private driveway, 10 feet west of big metal shed.
8	1430.00	Ref. Point. Top of rock at end of private road turn-a-round. 30 feet north of river.
9	1437.00	Ref. Point. Top of 2nd row of block foundation on N.E. corner of trailer house.
10	1433.74	TBM. A nail in base of 3-inch red oak. 50 feet north of river in private yard .
11	1437.68	TBM. Top of 2 spikes in 10-inch black ash tree. 400 feet south of bridge, 22 feet east of center line of Flemming Rapids Road. Set by D.O.T.
12	1450.20	TBM. A spike in base of power pole at end of Muskie Bay Road, west side of road.
13	1447.00	BM-785-E. There is a 2-inch square cut in left abutment of Jobes Dam and in line with catwalk over dam.
14	1449.51	TBM-2. CTH W road culvert between Long and Wilson Lake. The top of first nut at north end of 10-foot diameter culvert.

15	1456.22	Ref. Point. Bottom of siding at N.E. corner of red house that is half log house, 1 1/2 feet above ground.
16	1459.00	BM-4 Along main street P and Soo Line R.R. one rail north of mile post 359, at a bridge, and in the S.W. corner of the concrete backwall of the south abutment; a Wisconsin Water Power and R.R. commission standard disk stamped "4".
17	1452.36	BM-UE-4A. 350 feet S.W. of CTH H bridge between Elk and Duroy Lake, 23 feet S.E. of and 0.9 feet lower than center of grade crossing of CTH H and Soo Line R.R., 9.5 feet S.W. of S.W. rail, in top of the S.E. end of a 20-inch circular metal culvert; punched hole.
18	1448.46	BM-UE-4B. CTH H and Squaw Creek Road culvert at north end of Duroy Lake, top of the most N.W. bolt end on N.W. end of a 15-foot circular metal culvert; chiseled cross on bolt-end.
19	1471.87	TBM. A spike in south side of 24-inch pine stump, highest one of 4 stumps on north side of hill by river bend.
20	1479.46	TBM. Top of old well casing about 100 feet south of CTH H off on old trail running down along hill side.
21	1470.19	BM. D.O.T. brass cap in S.E. corner of Big Elk road bridge.
22	1490.01	Ref. Point. Notch in base of 30-inch white pine near end of X-Section 37, tree is between a field and the west bank of the river.
23	1496.93	TBM. Nail in west side of power pole, 10-inch S.W. of trailer house.
24	1504.61	TBM. Top of 2-inch diameter corner pipe in west edge of Musser Drive and private woods road.
25	1485.14	TBM. A cross on concrete culvert abutment by south metal upright by west railing.
26	1494.64	BM-801-B. A tablet marked Public Service Commission of Wisconsin, set in top of N.E. wing wall of Musser Dam.
27	1501.82	BM-801-A. A tablet marked Public Service Commission of Wisconsin set in concrete post located 147 feet north of north end of Musser Dam.

28	1530.48	BM.UE-VRBA. Head of R.R. spike in south side of 24-inch white pine, 126.8-feet east of intersection CTH H and Musser Drive.
29	1481.31	BM-UE-1A. CTH H and Hoffman Creek twin culverts; in top of the south end of most easterly one of two 60-inch circular metal culverts; punched hole.
30	1496.71	Ref. Mark for BM "1 FDR 1966 1492" standard tablet; at above 200 feet south east of CTH H and private drive in the WNW side of the most southern one of two 40-inch white pine trees; head of rail spike.
31	1496.62	Ref. Mark to BM "TT 76 @ 1940 1493" standard table; a 12-inch popple tree 58 feet NNW of intersection CTH H and Sandy Lane; head of rail spike.
32	1487.93	BM-UE-4C. At intersection of CTH H and Solberg Lake Road; A power pole 32 feet S.E.; a spike in the WNW side of pole.
33	1485.94	TBM. A spike in base of power pole west side 1-foot above ground; 50-feet S.E. of cross roads of Solberg Lake Road, Squaw Creek Road and Rudy Road.
34	1465.54	TBM. X marks on top middle of N.W. wingwall abutment of Squaw Creek Road Bridge.
35	1486.60	BM-906-B There is a tablet marked Public Service Commission of Wisconsin set in top of S.W. wingwall abutment of dam on top of upstream end of left abutment of Solberg Dam.
36	1458.60	TBM. Top of 4-inch septic field vent cap about 50 feet SSE of trailer house.
37	1458.84	TBM-3. 30 feet east of Junction CTH W and Wilson Flowage Road, a spike in base of power pole.
38	1453.96	TBM-1. A spike in base of power pole with transformer, 10 feet north of CTH W and across from Wilson Flowage Bait Shop.
39	1455.20	BM.785-F. There is a tablet marked Public Service Commission of Wisconsin set in concrete post 200 feet left of left edge of Jobes Dam and 65 feet upstream from extended line of the handrail.

40	1481.14	TBM. A nail in north post of Rest Haven Resort sign, 1 inch above ground north of the Junction of CTH W and west Wilson Lake Road.
41	1458.18	BM-UEH-FDRA. Head of rail spike in the south side of the western most one of three 12-inch elm trees, 20 feet north west of the cross roads of CTH W, Danish settlement and Arbutus Hill Road.
42	1444.34	BM-4-FDR-1966-1444. Above 110 feet south west of Junction CTH W and Flemming Rapids Road; top of standard tablet in concrete post projecting 3 inches above ground.
43	1432.87	BM-UE-3-FDR-B. 1.8 mile west on North Soo Lake Road from Junction of CTH F. 250 feet west of west end of curve in the road; on north end of east most of two corrugated steel culverts; a punched hole.
44	1456.00	BM-32-SAN-1970. Top of hill on North Soo Lake Road and Junction of Private Woods Road about 50 feet south west of junction is a white witness sign, set on the top of copper coated steel rod driven 10 feet; a standard tablet on 3-inch pipe.
45	1427.00	TBM. Top of R.R. spike in 12-inch elm stump about 30 feet north west of junction and bend of North Soo Lake Road, Elk River Road and private driveway.
46	1416.89	TBM. From D.O.T., from Junction of CTH W and Nine Mile Creek culvert, 340 feet east of culvert. About 40 feet south. A spike in base of 8-inch maple.
47	1412.91	TBM. From D.O.T., from Junction of CTH W and Nine Mile Creek culvert, 220 feet west of culvert and 65 feet north side of road is a spike in base of white birch.
48	1408.68	T.P. R.R. spike in west side of North Soo Lake Road and junction of private drive, 94 feet south of bridge.
49	1401.77	TBM. Chisel square on N.E. curb of North Soo Lake Road bridge.
50	1417.97	TBM. Junction of power lines and CTH W; a metal tower high line No. 206; top of painted orange nut on south most tower leg brace.
51	1488.65	Top of center west guard rail; widest upright brace on Musser Drive old bridge.

Appendix D

WATER SURFACE ELEVATION DISCHARGE AND FLOODWAY TABLES

TABLE 1
ELEVATION- DISCHARGE DATA

FLOODING SOURCE		FREQUENCY-DISCHARGE-ELEVATION DATA							
CROSS SECTION	DISTANCE 1/	10 YEAR		50 YEAR		100 YEAR		500 YEAR	
		Q CFS	ELEV MSL	Q CFS	ELEV MSL	Q CFS	ELEV MSL	Q CFS	ELEV MSL
ELK RIVER	0	CONFLUENCE WITH THE SOUTH FORK OF THE FLAMBEAU RIVER							
A	3320	4230	1384.8	5580	1385.7	6220	1386.1	7630	1386.6
B	6128	4230	1394.3	5580	1395.3	6220	1395.7	7630	1396.7
	6215	NORTH SOO LAKE ROAD							
C	6278	4230	1395.2	5580	1396.4	6220	1396.9	7630	1398.0
D	10218	4230	1399.4	5580	1400.8	6220	1401.4	7630	1402.6
	10308	WEIMER DAM, SOO LAKE OUTLET							
E	10474	4230	1410.8	5700	1411.6	6300	1412.0	7600	1412.5
F	22274	4046	1411.6	5430	1412.5	6000	1412.9	7310	1413.5
G	25389	3925	1416.4	5260	1417.5	5830	1417.9	7082	1418.8
H	29869	3925	1426.6	5260	1427.7	5830	1428.1	7082	1429.0
I	33074	3925	1433.5	5260	1434.5	5830	1434.9	7082	1435.8
J	39474	3925	1434.7	5260	1435.7	5830	1436.1	7082	1436.9
K	44594	3925	1435.4	5260	1436.4	5830	1436.7	7082	1437.5
	44682	FLEMINGS RAPIDS ROAD							
L	44909	3925	1436.2	5260	1437.6	5830	1438.1	7082	1439.3
M	44934	3925	1436.0	5260	1437.5	5830	1438.1	7082	1439.3
N	44959	3925	1436.4	5260	1437.7	5830	1438.2	7082	1439.4
O	52629	3676	1436.7	4925	1438.0	5424	1438.5	6590	1439.6
P	57029	3676	1436.5	4925	1437.7	5424	1438.2	6590	1439.4
	57079	JOBES DAM, LONG LAKE OUTLET							
Q	57154	3800	1441.3	5140	1443.3	5700	1444.0	6940	1445.6
R	66254	3800	1441.6	5140	1443.6	5700	1444.3	6940	1445.9
S	70454	3800	1441.9	5140	1443.9	5700	1444.6	6940	1446.2
	70520	STATE HIGHWAY 13							
T	70581	3800	1441.8	5140	1443.7	5700	1444.3	6940	1445.9
	70611	SOO LINE RAILROAD							
U	70681	3800	1443.2	5140	1444.9	5700	1445.6	6940	1447.0
V	75281	3800	1443.8	5140	1445.4	5700	1446.1	6940	1447.5
	75352	COUNTY HIGHWAY H							
W	75414	3800	1443.8	5140	1445.4	5700	1446.1	6940	1447.4
X	79614	2480	1443.9	3340	1445.6	3700	1446.2	4500	1447.6
Y	87134	2480	1452.4	3340	1453.6	3700	1454.1	4500	1455.1
Z	91704	2480	1457.6	3340	1458.7	3700	1459.1	4500	1460.0
AA	93614	2480	1459.9	3340	1461.0	3700	1461.4	4500	1462.3
	93672	BIG ELK RIVER ROAD							

1/ DISTANCES ARE MEASURED FROM THE DOWNSTREAM STUDY LIMITS.

PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

ELK RIVER

TABLE 1
ELEVATION-DISCHARGE DATA

FLOODING SOURCE		FREQUENCY-DISCHARGE-ELEVATION DATA							
CROSS SECTION	DISTANCE 1/	10 YEAR		50 YEAR		100 YEAR		500 YEAR	
		Q CFS	ELEV MSL	Q CFS	ELEV MSL	Q CFS	ELEV MSL	Q CFS	ELEV MSL
AB	93734	2480	1460.2	3340	1461.3	3700	1461.8	4500	1462.7
AC	104134	2480	1474.3	3340	1475.3	3700	1475.6	4500	1476.4
AD	104194	2480	1474.4	3340	1475.4	3700	1475.7	4500	1476.5
AE	121394	2260	1484.4	3038	1486.1	3370	1486.7	4107	1488.0
AF	125244	2260	1485.0	3038	1486.5	3370	1487.1	4107	1488.3
AG	125844	2260	1485.2	3038	1486.7	3370	1487.3	4107	1488.5
AH	127084	2260	1485.6	3038	1487.1	3370	1487.7	4107	1488.9
TOWN ROAD	127400								
MUSSER DAM	127700								
SQUAW CREEK	0	CONFLUENCE WITH DUROY LAKE							
A	520	209	1443.9	300	1445.5	344	1446.2	440	1447.6
	928	OLD FAIRGROUND ROAD							
B	1036	209	1443.9	300	1445.5	344	1446.2	440	1447.6
C	1336	209	1443.9	300	1445.5	344	1446.2	440	1447.6
	1465	COUNTY HIGHWAY H							
D	1594	209	1444.0	300	1445.6	344	1446.4	440	1447.9
E	2794	209	1444.0	300	1445.6	344	1446.4	440	1447.9
F	8094	209	1448.4	300	1449.0	344	1449.1	440	1449.2
G	9054	209	1450.6	300	1450.8	344	1450.9	440	1451.1
H	12254	209	1457.9	300	1458.1	344	1458.1	440	1458.3
	12278	SQUAW CREEK ROAD							
I	12340	209	1458.6	300	1458.9	344	1459.1	440	1459.4
J	22036	209	1465.2	300	1465.8	344	1466.0	440	1466.3
SOLBERG DAM	22186								

1/ DISTANCES ARE MEASURED FROM THE DOWNSTREAM STUDY LIMITS.

PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

ELK RIVER
AND SQUAW CREEK

TABLE 1
FLOODWAY DATA

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION	
CROSS SECTION	DISTANCE 1/	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	STREAM BED ELEVATION	100 YEAR FLOOD ELEVATION
A	3320	148	843	7.49	1379.1	1386.1
B	6128	166	918	6.93	1387.7	1395.7
	6215	SOO LAKE ROAD				
C	6278	195	1637	3.80	1386.3	1396.9
D	10218	192	844	7.37	1395.2	1401.4
	10308	WEIMER DAM, SOO LAKE OUTLET				
E	10474	630	4127	1.54	1400.0	1412.0
F	22274	206	1149	5.46	1405.4	1412.9
G	25389	155	1036	5.63	1409.6	1417.9
H	29869	198	1231	4.93	1418.7	1428.1
I	33074	486	1825	3.62	1428.6	1434.9
J	39474	504	2114	3.59	1428.2	1436.1
K	44594	169	1006	6.41	1429.0	1436.7
	44682	FLEMINGS ROAD BRIDGE				
L	44909	772	2492	3.65	1429.3	1438.1
M	44934	769	1927	4.22	1432.4	1438.1
N	44959	777	2416	3.24	1429.5	1438.2
O	52629	482	3944	1.38	1427.6	1438.5
P	57029	192	1000	5.47	1432.6	1438.2
	57079	JORES DAM, LONG LAKE OUTLET				
Q	57154	426	3570	1.54	1427.2	1444.0
R	66254	427	3848	1.48	1427.2	1444.3
S	70454	267	2080	2.74	1434.0	1444.6
	70520	STATE HIGHWAY 13				
T	70581	99	666	8.56	1434.2	1444.3
	70611	SOO LINE RAILROAD				
U	70681	248	1620	3.60	1435.0	1445.6

1/ DISTANCE IN FEET FROM CONFLUENCE WITH THE SOUTH FORK FLAMBEAU RIVER

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY
PRICE COUNTY, WISCONSIN

FLOODWAY DATA

ELK RIVER

TABLE 2
FLOODWAY DATA

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION	
CROSS SECTION	DISTANCE 1/	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	STREAM BED ELEVATION	100 YEAR FLOOD ELEVATION
V	75281	471	2576	2.40	1433.8	1446.1
	75352	COUNTY HIGHWAY H				
W	75414	454	3050	1.99	1433.8	1446.1
X	79614	1068	6982	0.57	1433.8	1446.2
Y	87134	83	899	4.20	1444.1	1454.1
Z	91704	121	597	6.22	1451.0	1459.1
AA	93614	257	1213	4.17	1451.9	1461.4
	93672	BIG ELK RIVER ROAD				
AB	93734	279	1656	3.58	1451.9	1461.8
AC	104134	114	595	7.05	1467.4	1475.6
AD	104194	115	609	6.92	1467.4	1475.7
AE	121394	891	5561	1.47	1473.5	1486.7
AF	125244	161	1252	3.00	1472.5	1487.1
AG	125844	161	1250	3.01	1472.7	1487.3
AH	127084	460	3248	1.81	1475.7	1487.7
	127400	MUSSER LAKE ROAD				
	127700	MUSSER DAM				

1/ DISTANCE IN FEET FROM STUDY LIMIT

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY PRICE COUNTY, WISCONSIN	FLOODWAY DATA ELK RIVER

TABLE 3
FLOODWAY DATA

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION	
CROSS SECTION	DISTANCE 1/	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	STREAM BED ELEVATION	100 YEAR FLOOD ELEVATION
SQUAW CREEK	0	CONFLUENCE WITH DUROY LAKE				
A	520	432	424	.94	1438.6	1446.2
	928	OLD FAIRGROUNDS ROAD				
B	1036	402	1804	.20	1438.6	1446.2
C	1336	851	4172	.08	1438.5	1446.2
	1465	COUNTY HIGHWAY H				
D	1594	478	2300	.15	1438.5	1446.4
E	2794	478	2301	.15	1438.5	1446.4
F	8094	362	167	4.86	1446.0	1449.1
G	9054	389	436	2.10	1447.1	1450.9
H	12254	77	65	5.27	1457.2	1458.1
	12278	SQUAW CREEK ROAD				
I	12340	132	162	2.29	1456.6	1459.1
J	22036	80	200	1.72	1463.0	1466.0
SOLBERG DAM	22186	OUTLET OF SOLBERG LAKE			1467.5	

1/ DISTANCE IN FEET FROM STUDY LIMIT

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE PRICE COUNTY FLOODPLAIN MANAGEMENT STUDY PRICE COUNTY, WISCONSIN	FLOODWAY DATA ELK RIVER

Appendix E

INVESTIGATION AND ANALYSIS

Investigation and Analysis

The Elk River watershed is relatively flat with many swamps and lakes. The soils are of medium texture and permeability. Due to the nature of the watershed a single storm event model based on rainfall would not produce a significant floodflow. For example it took 6 to 8 inches of rainfall in 12 hours in 1981 to equal the spring snowmelt runoff. The 100-year March snowpack has fifteen inches of water equivalent (6). Should the snowpack melt rapidly a major flood could result. The spring snowmelt runoff has caused the highest floods of record, therefore the runoff approach as outlined in NEH-4 Hydrology was chosen for the study hydrology. The expected 100-year, 24 hour runoff based on gage data for the area is 3.12 inches (7). Distributing this amount of runoff over a 5-day period and routing through the spillways of the three dams based on an estimated operation procedure for the gates, produced a flood event that matched the recorded floods within reason. Some adjusting of the operation sequence was necessary to fine tune the model to match the known flood flows experienced on the river. The results are produced in the appendices of this report. The gate operation tables are included in this section for reference. Solberg lake drainage area was not included in the model. The drainage area above the lake has three manually operated flowages, two of which are on national forest land. The flowages control the discharge into Solberg lake such that all of the runoff can be contained during the flood event. Should the flowages be abandoned or breached, Solberg lake has sufficient storage to contain the runoff from the entire watershed rising only 2.3 feet above normal lake level. The snowmelt runoff was used to obtain the discharge rates for the Squaw Creek floodplain deliniations. The following assumptions were used in determining the discharges:

1. The upstream flowages had been abandoned.
2. The stoplogs in Solberg dam were in place.

The resultant flows used in the study are listed for each cross section and frequency in Appendix D.

The flows and surveyed cross sections data were modeled in a step backwater computer program HEC-2 (10). The resultant water surface elevations for each cross section are listed in Appendix D and the profiles are shown in Appendix A.

The floodplain and cross section locations are shown on flood hazard maps.

The following tables are the discharges used for the routing through the dams assuming a proposed operation procedure.

Weimer Dam, Soo Lake

The spillway system consists of two sluice gates and a 85.5 foot long weir notch with stoplogs. The sluice gates are located near each end of the dam. The weir notch is located in the center portion of the dam. The stoplogs can be removed to a depth of two feet.
Note: It is assumed the gates will be operated before the stoplogs are removed.

The formula used to derive the following discharge table are:

Discharge through sluice gates.

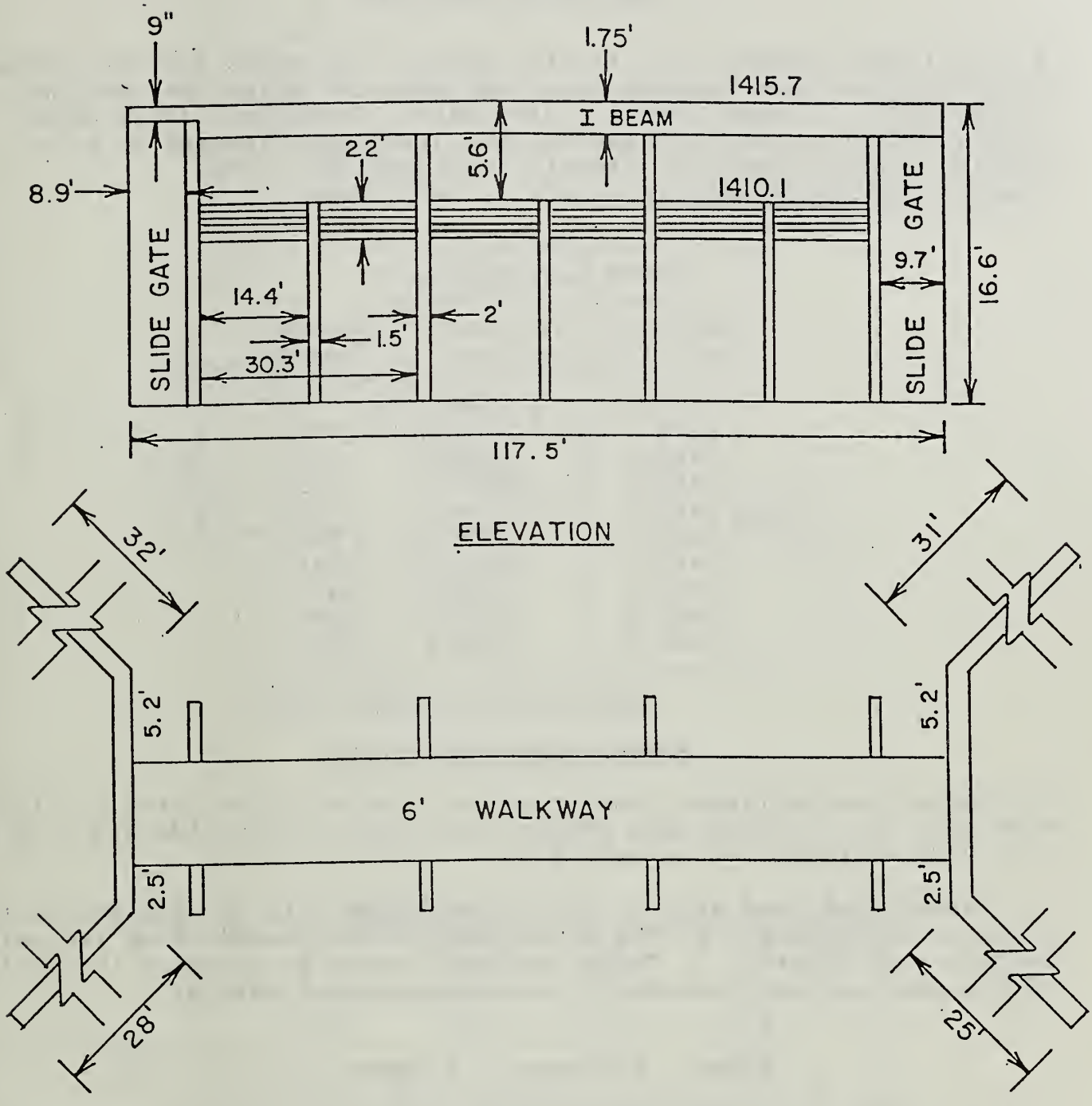
$Q = A\,[2gH / K]^{0.5}$ $K = 1.5625$
$L = 9.5 \times 2 = 19'$ $A = 19 \times$ gate opening

Weir flow sections.

$Q = 3.9\,(85.5)h^{1.5}$

WEIMER DAM OPERATION TABLE

GATES					WEIR FLOW		TOTAL
ELEV. HEADWATER	ELEV. TAILWATER	GATE OPENING	H	Q cfs	h	FLOW cfs	Q cfs
1410.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1410.1	1400.4	2.6	10.0	1002	0.1	8.9	1011.0
1410.2	1401.8	4.0	9.4	1496	0.2	30.0	1526.0
1410.3	1401.2	5.3	9.1	1949	0.3	55.0	2004.0
1410.4	1401.5	7.0	8.9	2547	0.4	84.0	2631.0
1410.5	1402.2	9.1	8.3	3196	0.5	118.	3314.0
1410.6	1402.3	9.2	8.3	3233	1.5	612.6	3846.0
1410.7	1402.7	9.3	8.0	3206	2.5	1318.	4524.0
1410.8	1402.8	9.4	8.0	3243	2.8	1582.	4825.0
1410.9	1402.9	9.5	8.0	3275	2.9	1647.	4922.0
1411.0	1402.95	9.5	8.05	3320	3.0	1733.	5053.0
1411.1	1403.0	9.7	8.1	3365	3.1	1820.	5185.0
1411.2	1403.05	9.8	8.15	3413	3.2	1909.	5322.0
1411.3	1403.1	9.9	8.2	3456	3.3	1999.	5455.0
1411.4	1403.2	10.0	8.2	3490	3.4	2090.	5580.0
1411.5	1403.3	10.1	8.2	3525	3.5	2183.	5708.0
1411.6	1403.35	10.15	8.2	3543	3.6	2278.	5821.0
1411.7	1403.4	10.3	8.3	3617	3.7	2373.	5990.0
1411.8	1403.5	10.4	8.3	3652	3.9	2470.	6122.0
1412.0	1403.8	10.6	9.2	3919	4.2	2870.	6789.0



OUTLET FOR SOO LAKE

WEIMER DAM

Jobes Dam, Long Lake

The spillways consist of 5 tainter gates. The gates are non-standard with the pivot pins located such that when the gates are open the configuration is more like a sluice gate. Therefore, these gates were analyzed as sluice gates and the gates were assumed to all operate simultaneously to simplify computations. The elevation-discharge-storage table is as follows:

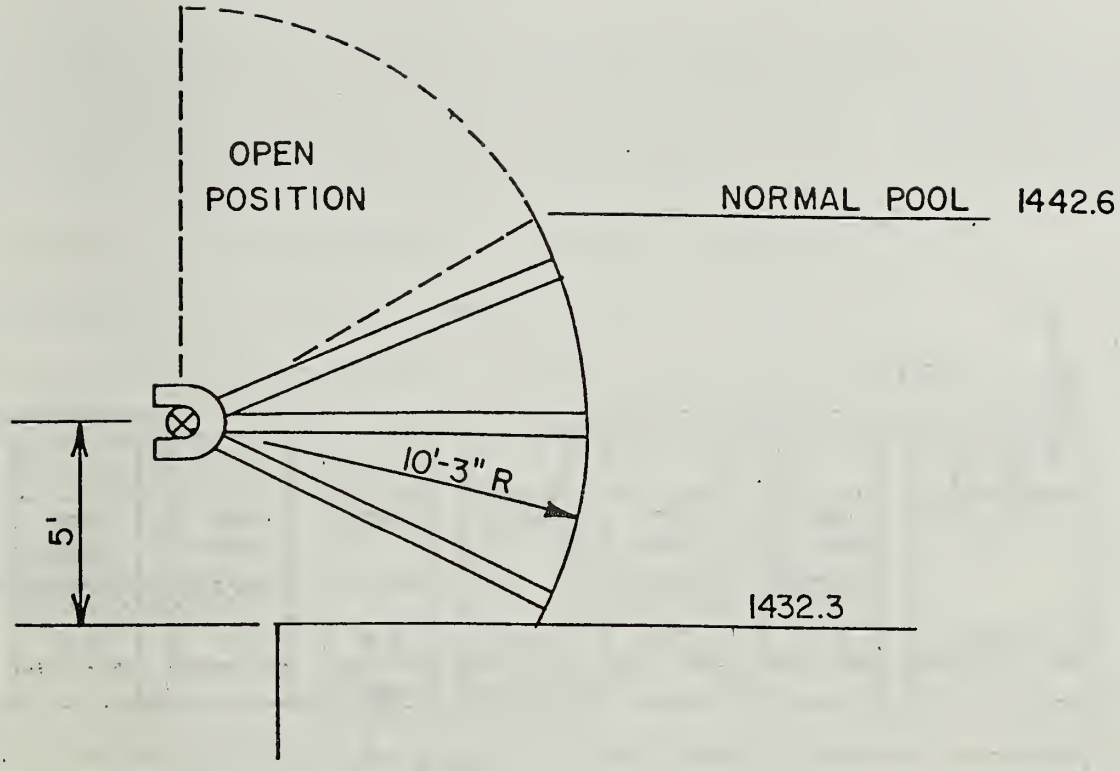
Jobes Dam, Long Lake		
Elevation (m.s.l.)	Discharge c.f.s.	Storage ac-ft
1442.6	0.0	0.
1442.7	672.0	150.
1442.8	1298.0	330.
1442.9	1912.0	535.
1443.0	2410.0	760.
1443.1	2955.0	986.
1443.2	3475.0	1215.
1443.3	3975.0	1455.
1443.4	4450.0	1680.
1444.0	5980.0	2583.

Musser Dam, Musser Lake

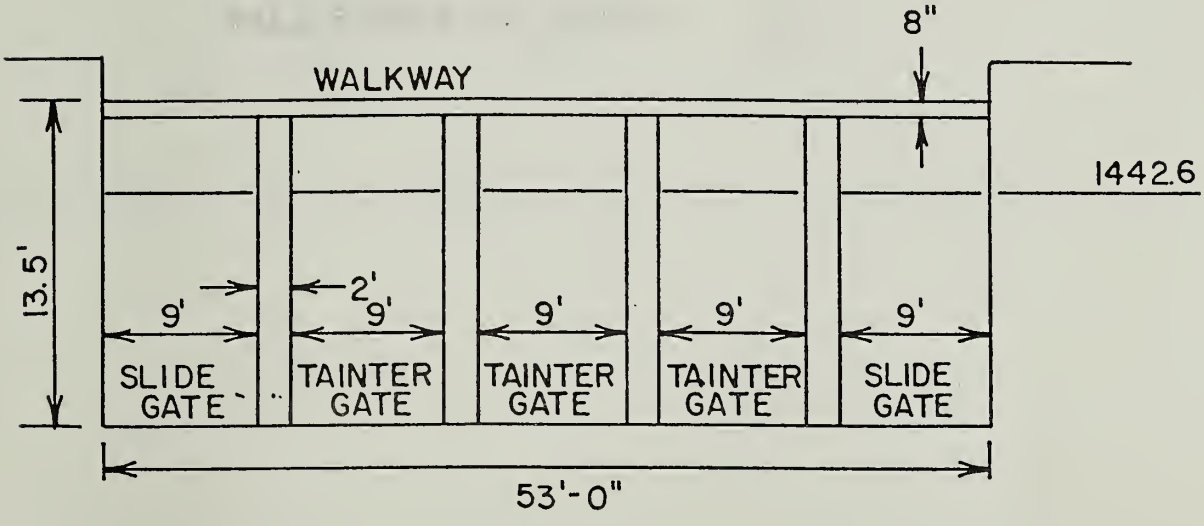
The Musser Dam spillways consist of two center sluice gates 6.4 feet wide with two 7.3 feet wide stoplog sections on each side and a 10.6 feet wide weir section on each end.

The assumptions used are: 1. The center gates will be used before the stoplogs are pulled. 2. The gates will not be opened above the water surface in the lake. 3. Three stoplogs remain in place at the bottom of the gate openings making the bottom elevation 1478.5.

STAGE - DISCHARGE - STORAGE						
Elevation	Discharge in cfs					Storage
m.s.l.	Sluice Gates	End Weir 1	End Weir 8	Weirs 2,3,6,7	Total	acre feet
1490.0	0.	0.	0.	0.	0.0	0.
1490.5	0.	12.4	0.	0.	12.4	261.05
1491.0	2316.	35.0	12.4	0.	2363.0	534.2
1492.0	2618.	98.9	64.3	0.	2781.0	1116.8
1493.0	2954.	157.4	138.3	2180.	5430.0	1747.8
1494.0	3302.	279.8	229.1	2601.	6412.0	2427.2



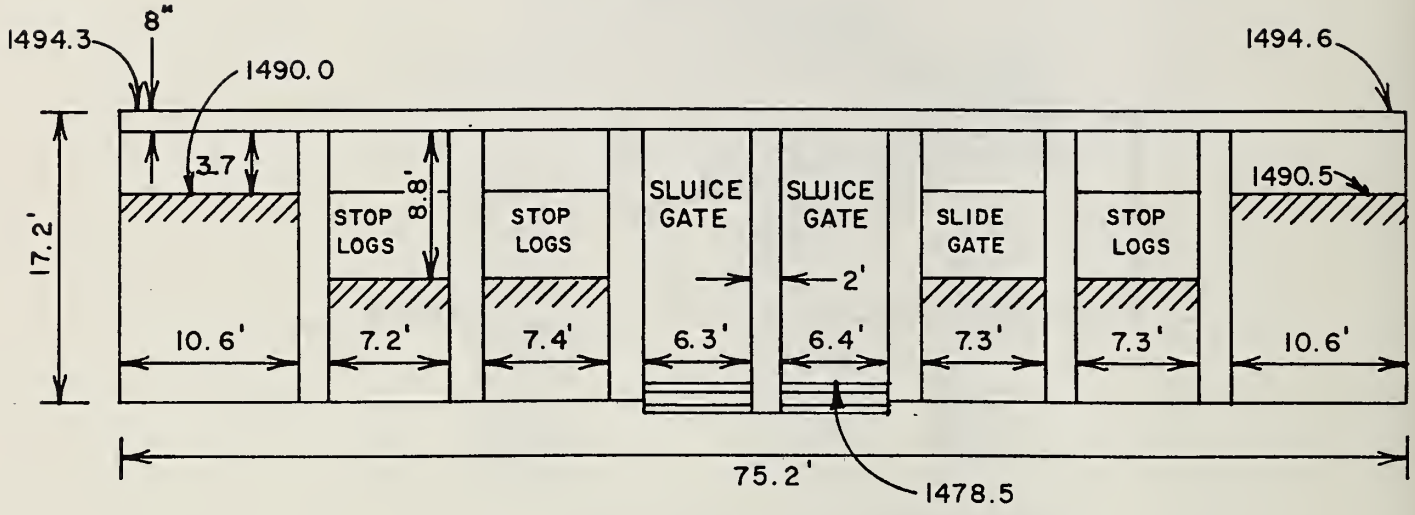
PLAN VIEW- TAINTER GATE



ELEVATION

JOBES DAM

OUTLET TO LONG LAKE



ELEVATION

OUTLET TO MUSSER LAKE

MUSSER DAM

Solberg Dam, Solberg Lake

Solberg lake has a large surface area in comparison to the discharge capacity of the dam and the drainage area. The runoff volume can be contained with only a minimal rise in the lake level. This feature was used to determine the flows used for Squaw Creek. The following assumptions were used to derive the discharges:

1. The flowages in the watershed have been abandoned.

2. The stoplogs have not been removed from the dam.

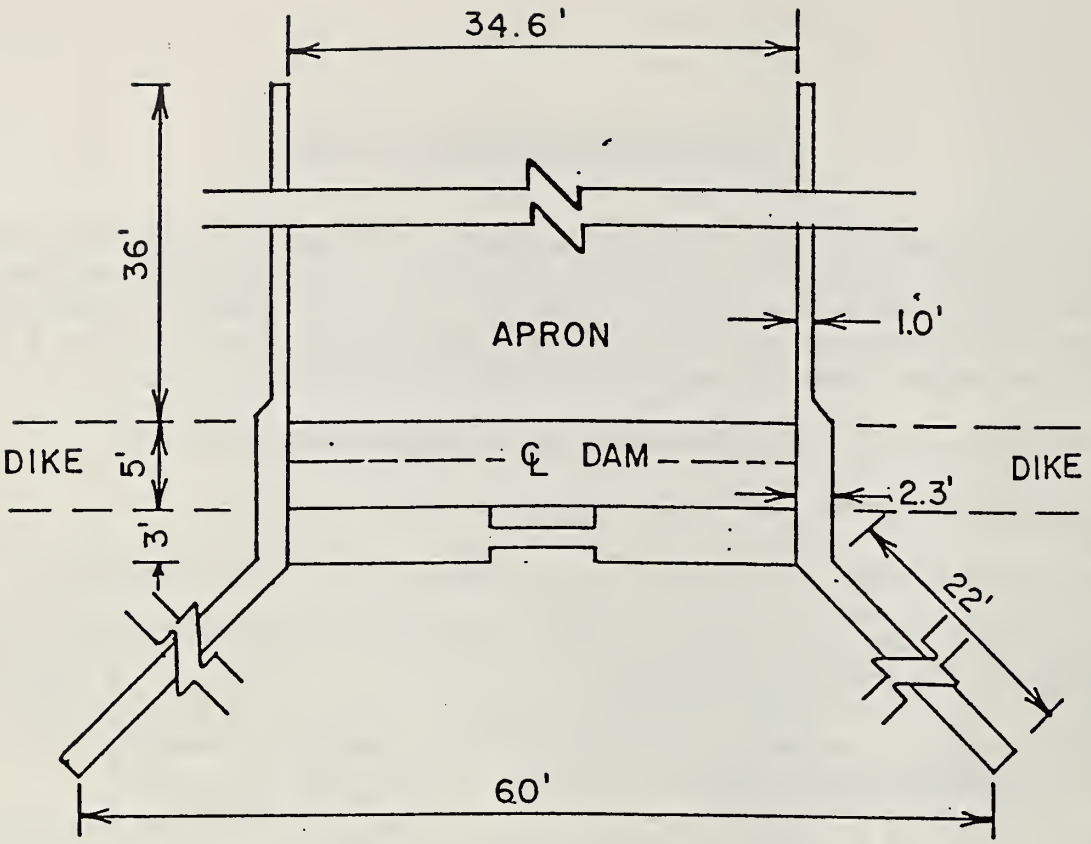
The following formula was used to compute the discharges for the dam.

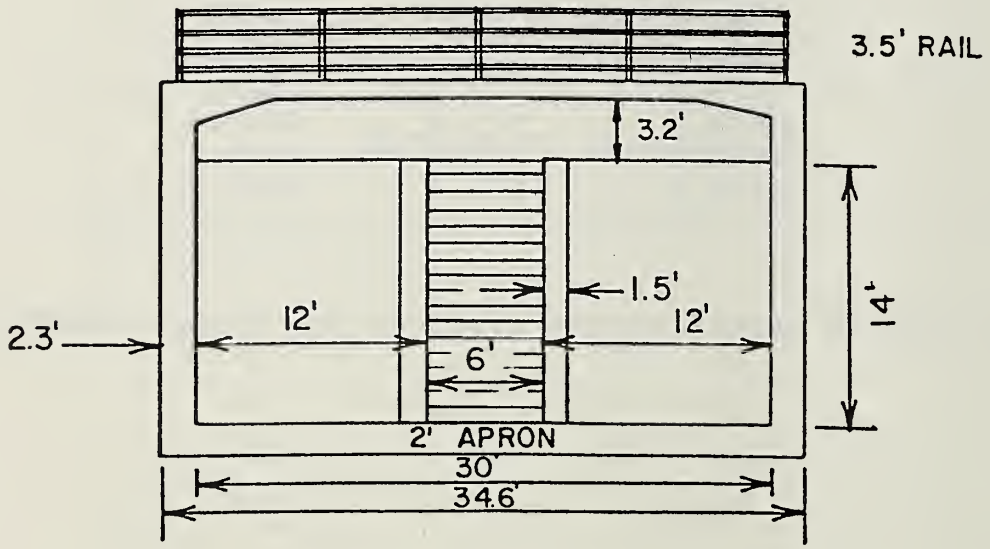
$Q = 3.3LH^{3/2}$ Where L = 29.8 the total weir length and H = lake height above the spillway crest.

The following is the elevation-discharge-storage table used to route the runoff through the lake:

Solberg Dam		
Elevation (m.s.l.)	Discharge c.f.s.	Storage ac-ft
1481.5	0.0	0.
1482.0	34.8	458.
1482.5	98.3	922.5
1483.5	278.1	1870.
1484.5	511.0	2842.5
1485.5	786.7	3840.
1486.5	1099.5	4862.5

Routing the spring runoff events produced the flows listed in appendix B.





ELEVATION

OUTLET TO SOLBERG LAKE

SOLBERG DAM

Appendix F

DRAFT DAM OPERATION AND MAINTENANCE PLAN

DRAFT

PRICE COUNTY DAM OPERATION AND MAINTENANCE PLAN

I. Watershed Monitoring

Inspect the dams daily. Adjust the spillways as necessary to maintain the pools at their required levels. Inspect the entire embankment once a week for vandalism, signs of seepage and burrowing animal holes.

Monitor the watershed as to the moisture condition. Has it been dry for weeks or is it wet with a majority of the swamps and low areas full of water? This will have a direct effect on operation of the spillway should a storm occur. If the watershed is wetter than normal the chances of a flood are greater. Any rainfall that occurs during a wet condition will drain off the top, reach the dams quicker and be of a greater volume than normal. If the watershed is drier than normal it will take more rainfall to fill the low areas before runoff will occur and the spillway gates require operation.

II. Spillway Operation

A. After a storm event

1. Wet conditions in watershed.

The gates will require operation for rainfalls of 2 inches or more and require monitoring at least twice daily. A rainfall of 2-2 1/2 inches on a very wet watershed could cause as great a flood as 5 to 6 inches of rain on a normal to dry watershed. It takes up to 8 hours for the runoff water to reach the lake in large enough amounts that the gates in Musser Dam have to be opened, an additional 12 hours before Jobes has to be operated and another 12 hours for Weimer Dam. The dams should be checked twice daily until the waters recede, then once daily adjusting the gates accordingly. The gates should be used until they will no longer pass the floodflow, then pull the stoplogs. The bottom of the gates should be below the water surface; a minimum of one foot is suggested.

Solberg Lake should be checked along with the other dams but can be allowed to contain the storm water until the other dams have passed their peak. The Solberg Dam can then be opened and allowed to be drained back to normal level. An arrangement with the Forest Service and private flowage owners/operators should be worked out so you will be notified when upstream floodwaters are released.

2. Dry watershed conditions

The drier the conditions, the more rainfall required to produce a flood. Therefore, storms producing up to 3 inches

of rainfall may not cause concern; however the dams should be checked and gates adjusted as needed. Storms producing rainfall in excess of 3 inches would undoubtedly require operation of the gates.

B. Winter Operation

The dams should be checked daily for ice build-up that could impair the operation of the gates. Heavy snow on ice will cause the water level to rise, requiring the spillway gates to be adjusted.

Before the snow melts in the spring, the lakes should be drawn down 6 to 8 inches to store the initial runoff and provide more flexibility for gate operation. The drawdown can be performed after the lakes start to open up upstream from the spillways. The spring snowmelt runoff can be estimated more accurately by watching the snow cover. When the snow is melting and settling and the bottom layer is almost water or slush, it is approaching runoff conditions and preparation should be made to open the gates. A critical time would be a rainfall when the snow is in this wet condition.

III. Staff gages of some type should be maintained at each dam to aid in the monitoring of the water surface. The gages should be upstream from the dams at least 30 feet. The gages will then be upstream of the drawdown effect of the gates/stoplog spillways.

Operation Outline

A. Check dams daily and adjust spillway gates if necessary.

B. Keep a daily diary. A hard cover bound book is suggested.
   1. Record time and date of each visit.
   2. Record condition of dam and any out of the ordinary observation.
   3. Record rainfall and estimated watershed condition.
   4. Record gate/stoplog opening.
   5. Sign entry log.

C. During storm conditions.
   1. Operate dams as necessary to pass the storm runoff water. Utilize the mechanical gates before removing stoplogs.
   2. Visit the dams at least twice daily.
   3. Check embankment and spillway abutments for seepage.
   4. Record finding in diary.
      a. rainfall amount and time.
      b. gate openings.
      c. condition of dams.

Maintenance

Repair any defect detected during the daily operation inspections and weekly embankment inspections. Minor items noted in the diary can be scheduled and repaired periodically. Major items such as concrete repair, gate replacement, etc. may have to be inspected and a repair plan developed by a registered engineer.

Embankments should be mowed during the summer months. Burrowing animals should be removed and their holes plugged. All trees and brush should be removed from embankments yearly as necessary. The daily diary can be used as a guide for scheduling repairs beyond the capabilities of the dam operator.