FLOOD INSURANCE STUDY

LA CROSSE COUNTY, WISCONSIN
AND INCORPORATED AREAS

Community Name	Community Number
BANGOR, VILLAGE OF	550218
HOLMEN, VILLAGE OF	550219
LA CROSSE, CITY OF	555562
LA CROSSE COUNTY	
(UNINCORPORATED AREAS)	550217
ONALASKA, CITY OF	550221
ROCKLAND, VILLAGE OF	550222
WEST SALEM, VILLAGE OF	550560

January 6, 2012

Federal Emergency Management Agency
FLOOD INSURANCE STUDY NUMBER
55063CV001B

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) report may not contain all data available within the Community Map Repository. Please contact the Community Map Repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current FIS report components.

Initial Countywide FIS Effective Date: April 2, 2008
Revised Countywide FIS Dates: January 6, 2012

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FLOOD INSURANCE STUDY
LA CROSSE COUNTY [AND INCORPORATED AREAS]

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of La Crosse County, including the Cities of La Crosse and Onalaska; the Villages of Bangor, Holmen, Rockland, and West Salem; and the unincorporated areas of La Crosse County (referred to collectively herein as La Crosse County), 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 to 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.

The Digital Flood Insurance Rate Map (DFIRM) and FIS report for this countywide study have been produced in digital format. Flood hazard information was converted to meet the Federal Emergency Management Agency (FEMA) DFIRM database specifications and Geographic Information System (GIS) format requirements. The flood hazard information was created and is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community.

1.2 Authority and Acknowledgments

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

This FIS was prepared to include the unincorporated areas of, and incorporated communities within, La Crosse County in a countywide format. Information on the authority and acknowledgments for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, is shown below.

Bangor, Village of:	The hydrologic and hydraulic analyses for the FIS report dated July 1980 were prepared by Carl C. Crane, Inc., for the Federal Insurance Administration (FIA), under Contract No. H-4785. That work was completed in April 1979.
La Crosse, City of:	The hydrologic and hydraulic analyses for the FIS report dated November 15, 1984, were prepared by the U.S. Army Corps of Engineers (USACE), St. Paul District, for the Federal Emergency Management Agency (FEMA), under Inter- Agency Agreement No. IAA-H- 10-77, Project Order No. 25. That work was completed in July 1980.
La Crosse County (Unincorporated Areas):	The hydrologic and hydraulic analyses for the FIS report dated September 15, 1983, were prepared by Owen Ayres and Associates, Inc., for FEMA, under Contract No. H-3600. That work was completed in February 1975. The study covers the flooding sources affecting the unincorporated areas of La Crosse County, except for the La Crosse River reach (from the mouth at the Mississippi River to the downstream end of Lake Neshonoc) which was studied by the Wisconsin Department of Natural Resources (WDNR) in September 1981.
Onalaska, City of:	The hydrologic and hydraulic analyses for the FIS report dated March 16, 1981, were prepared by Carl C. Crane, Inc., for the FIA, under Contract No. H-4785. That work was completed in June 1979.
West Salem, Village of:	The hydrologic and hydraulic analyses for the FIS report dated June 15, 1982, were prepared by Carl C. Crane, Inc., for FEMA, under Contract No. H-4785. That work was completed in January 1979.

The authority and acknowledgments for the Villages of Holmen and Rockland are not available because no FIS report was ever published for those communities.

For the previous countywide FIS dated April 2, 2008, revised hydrologic and hydraulic analyses were prepared for FEMA by the USACE, St. Paul District, under Inter-Agency Agreement No. EMW-95-E-4766, with work completed in July 1999; the U.S. Geological Survey (USGS), under Inter-Agency Agreement No. EMW-99-IA-0235, with work completed in September 2000 and Wisconsin

DNR under Inter-Agency Agreement No. EMC-2004-GR-0211 with work completed in September 2006.

The projection used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 15 North. The horizontal datum was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM. Also, the vertical datum was converted from the National Geodetic Vertical Datum of 1929 (NGVD) to the North American Vertical Datum of 1988 (NAVD).

1.3 Coordination

The initial Consultation Coordination Office (CCO) meetings for the previously printed FIS reports were held on the dates below. The purpose of an initial Consultation Coordination Officer (CCO) meeting is to discuss the scope of the FIS.

The dates of the initial and final CCO meetings for the previously printed FIS reports compiled for this countywide FIS are shown in the following tabulation.

Community	Initial CCO Date	Final CCO Date
Bangor, Village of	April 20, 1978	September 25, 1979
La Crosse, City of	August 26, 1976	May 13, 1982
La Crosse County (Unincorporated Areas)	*	June 1, 1982
La Crosse County and Incorporated Areas	November 11, 2004	November 21, 2006
Onalaska, City of	April 19, 1978	October 9, 1980
West Salem, Village of	April 19, 1978	October 9, 1980

*Data not available

The Villages of Holmen and Rockland are not shown in the above tabulation because no FIS report was ever published for those communities.

For this countywide study, the initial scoping meeting was held on November 19, 2009, and attended by representatives of La Crosse County; Cities of La Crosse and Onalaska; Towns of Onalaska, Shelby, and Washington; Mississippi River Regional Planning Commission (MRRPC); and the Wisconsin Department of Natural Resources. The results of the study were reviewed at the final CCO meeting held on September 21, 2010, and attended by representatives of La Crosse County; Cities of La Crosse and Onalaska. All problems raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of La Crosse County, Wisconsin, including the incorporated communities listed in Section 1.1. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction.

All or portions of the flooding sources listed in Table 1, "Flooding Sources Studied by Detailed Methods," were studied by detailed methods. Additionally each flooding source was re-delineated on a countywide LiDAR dataset acquired in June 2007. Limits of detailed study are indicated on the Flood Profiles and on the FIRM.

Table 1 – Flooding Sources Studied by Detailed Methods

Black River – La Crosse	Mississippi River
Bostwick Creek	Mormon Creek
Dutch Creek	
Ebner Coulee Southeast Bank	Pammel Creek
Ebner Coulee Ponds No. 1-7 and Unnumbered Pond	Sand Lake Coulee
Fleming Creek	Sand Lake Coulee Right Overbank - Midway
Green Coulee	Smith Valley Creek
Johns Coulee Creek	State Road Coulee
La Crosse River	Tributary A
La Crosse River Right Overbank 1	Tributary B
La Crosse River Right Overbank 2	Upper Boma Coulee
La Crosse River Railroad Ditch	

Approximate analyses were used to study those areas having low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by FEMA and Wisconsin DNR. The approximate streams and lakes that were newly studied are shown in Table 2.

Table 2 - Newly Studied Streams by Approximate Methods

Black River	Halfway Creek
Black River - Overflow	La Crosse River
Burns Creek	Sand Lake Coulee – South of Highway S
Fleming Creek	

This countywide FIS also incorporates the determination of letters issued by FEMA resulting in map changes (Letters of Map Change, or LOMCs) as shown in

Table 3. All letters of Map Revision (LOMRs) and Letters of Map Amendment (LOMAs) incorporated in this study are summarized in the Summary of Map Actions (SOMA) included in the Technical Support Data Notebook (TSDN) associated with this FIS update. Copies of the SOMA may be obtained from the Community Map Repository. Copies of the TSDN may be obtained from FEMA.

Table 3 – Letters of Map Change

Community Identifier	Flooding Source	Case Number	Project ID	Date Issued	Type
La Crosse, City of	La Crosse River	10-05-2342P	The Landings	05/06/2010	LOMR
La Crosse, City of	Pammel Creek	07-05-2077P[1]	Pammel Creek Addition	06/29/2007	LOMR
La Crosse, City of	Pammel Creek	94-05-081P[1]	Pammel Creek & State Road Coulee	06/22/1994	102

[1] Denotes Letters of Map Change (LOMC) that were previously incorporated in the April 2, 2008 FIS

2.2 Community Description

La Crosse County is totally surrounded by the following unincorporated communities: Monroe County, Wisconsin, to the east; Jackson County, Wisconsin, to the northeast; Trempealeau County, Wisconsin, to the northwest; Winona County, Minnesota, to the west; Houston County, Minnesota, to the southwest; and Vernon County, Wisconsin, to the south. The population of La Crosse County was reported to be 107,120 in 2000 (U.S. Department of Commerce, 2000). A slow but steady growth is expected for the county.

The climate in La Crosse County is characterized by wide variations in temperature, the monthly mean temperature varying from 83 degrees Fahrenheit (°F) in July to 7°F in January. The average annual precipitation is approximately 30 inches (U.S. Department of Agriculture, 1980).

The terrain within the county consists of deep valleys cut into what was a fairly level plateau. South of the La Crosse River, the bedrock is sandstone capped with dolomite. Soils in this area are of the Fayette-Dubuque series. North of the La Crosse River, the bedrock is mostly sandstone of the Upper Cambrian age. Soils in this area consist of the Gale and Fayette series on narrow ridgetops and steep upper slopes, and sandy Hixton soils on lower convex slopes. Along the Mississippi River Valley, soils are mainly of the Plainfield and Sparta series (U.S. Department of Agriculture, 1980).

The Mississippi River forms the entire western border of La Crosse County. The Black River, which is a tributary of the Mississippi River, forms a part of the northern border. Other tributaries flowing into the Mississippi River which are located within La Crosse County are the La Crosse River, Halfway Creek, Pammel Creek, and Mormon Creek.

The total land area of La Crosse County is 300,160 acres, of which approximately 250,000 acres are committed to agriculture. Of these 250,000 acres, 46 percent is cropland, 36 percent is woodland, and 18 percent is committed to other uses. Most of the floodplains are residential and farm areas. As the incorporated areas grow, there is a great tendency to build in the floodplain areas due to a lack of other suitable sites

2.3 Principal Flood Problems

Mississippi River:

The Mississippi River flows in a generally north-south direction in the study area. The main channel has numerous side channels that meander around islands and through slough areas. The Black River – La Crosse segment within the study area is not a true river; rather, it is a major side-channel to the Mississippi River and enters the Mississippi River north of the City of La Crosse and parallels it.

Floods on the Mississippi River occur primarily in the spring. Most of the larger floods result from snowmelt. However, intense thunderstorms have resulted in major floods on the Mississippi River and its tributaries with steep topography. Table 4 presents data for major floods on the river.

The greatest flood known to have occurred on the Mississippi River in La Crosse County was on April 20, 1965, with an estimated 170-year recurrence interval. The largest recorded discharge for the La Crosse River occurred on August 8, 1935; however, the stage was lower than the 1965 flood (USACE, 1970).

Table 4 – Summary of Major Floods on the Mississippi River at La Crosse, Wisconsin[1]

Date	Approximate Discharge (cubic feet per second, cfs)	Gage Height	Frequency (years)
April 20, 1965	273,000	17.90	170
April 20, 1969	190,000 (estimated)	15.70	20
April 20, 1952	220,000	15.30	50
April 18, 2001	210,000	16.41	40
June 19, 1880	196,000	16.50	25
April 19, 1951	184,000	14.90	20
June 27, 1993	182,000	14.10	20
April 7, 1967	180,000	14.60	20
May 7, 1954	166,000	14.30	10

'Drainage area at confluence of Mississippi and La Crosse Rivers = 62,840 square miles.

Table 5 – Summary of Flood Impacts at Various Gage Heights on the Mississippi River at La Crosse, Wisconsin

Gage Height	Flood Impact
20.7	Water reaches the top of the dike on the Minnesota side of the river.
18.0	The road to the La Crosse airport may experience flooding.
17.9	Water reaches the record flood level set in 1965.
16.5	Most of Riverside Park is now flooded...With water up state street in the park one block. Rose Street and Clinton Street may need to be closed.
16.0	Water is within one foot of Rose Street near Interstate 90 and the eastbound exit is closed. La Fond Street on French Island is closed. East and westbound lanes on Clinton Street between La Crosse and French Island are reduced to two lanes with one lane closed in each direction. The shelter and ballparks in Copeland Park may be flooded.
15.4	Lock and Dam No. 7 becomes inoperative.
15.0	Flooding begins to impact the Viterbo sports complex.
14.5	Lock and Dam No. 8 becomes inoperative and Goose Island Park begins to flood.
14.0	Flooding begins to threaten homes in the Shore Acres area. Water begins to impact homes and businesses along La Fond Avenue and Bainbridge Street on French Island. Water begins to go over the road at Copeland Park with some water into the ballparks. Water is near the bottom of the Pettibone Beach house shelter and water is nearly over the road at Houska Park near the wastewater treatment plant. Water also begins to spread into Riverside Park.
13.0	Road access to the north end of the Shore Acres development is impacted by flooding.
12.0	Pettibone campground and RV park is flooded. Some lowland flooding occurs in areas near the river.
10.0	No wake rules for boating are in effect, and recreational trails on the north end of the marsh area will closed due to high water.

The following are summaries of these some of these events:

April 1965 –

Record snowmelt floods affected much of the upper Midwest in March and again in April.

Several factors contributed to this record flood:

- An early freeze in the fall of 1964 which lowered the frost depth deeper than usual.
- Significant snowfall in March across the region (300% above normal in east and east central Minnesota).
- Below normal temperatures for the last half of March and start of April, preventing the gradual melting and runoff of the snowpack.

- Heavy rainfalls in early to mid April, falling upon the snowpack and frozen grounds. With nowhere to go due to the frozen ground, the rain and melted snow quickly found their way into the Mississippi River and its tributaries. This runoff would create the record flood.

The Mississippi River established many crest records. This includes at LaCrosse, WI (17.9 ft. on April 21) and McGregor, IA (25.4 ft. on April 24).

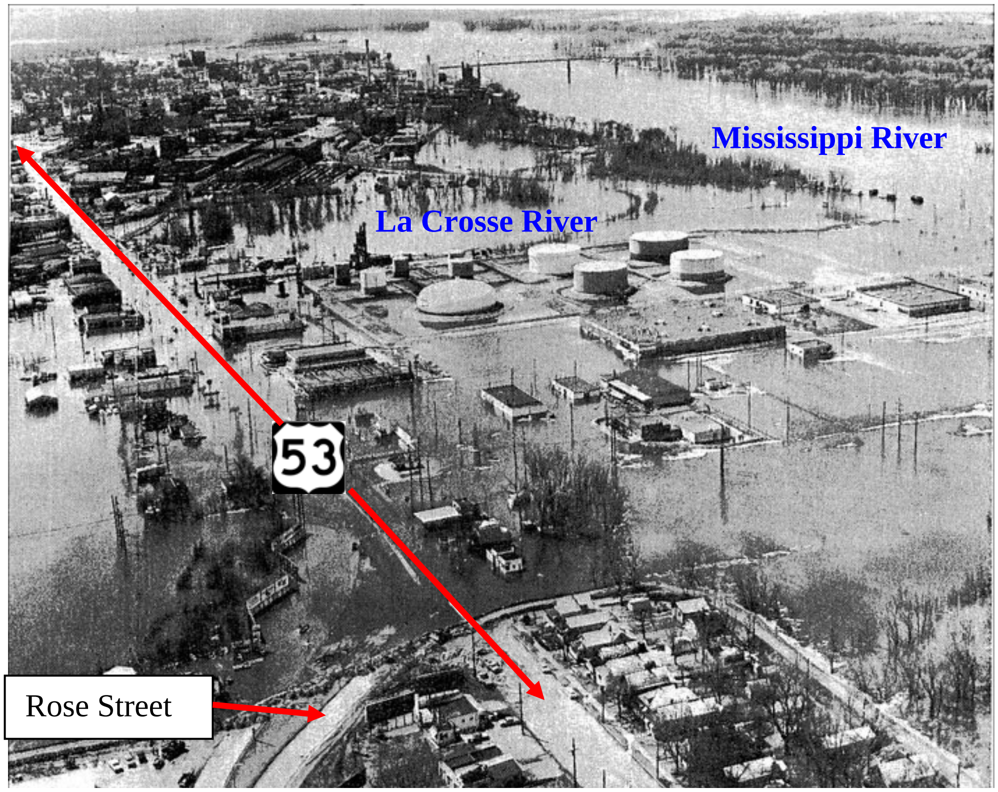

Figure 1:
Flooding looking southwest at the confluence of La Crosse and Mississippi Rivers - City of La Crosse
April 17, 1965
(Edward M. Huebner - La Crosse Tribune)

April 10, 2001 – May 1, 2001 –

March storms brought significant snows to parts of Minnesota and Wisconsin. Cold temperatures in the north helped limit the amount of melting of the snow pack, although locations such as La Crosse, WI, Winona, MN and points south lost their snow cover by the end of March. On April 5th and 6th, and then again on the 11th, showers and thunderstorms brought heavy rains to the Upper Mississippi River Valley. These rains, in excess of several inches in some locations, caused a rapid snow melt. Snow melt and rain funneled into area streams, creeks and rivers causing rapid rises and flooding. Eventually, most of this water flowed into the Mississippi River.

Most locations the water reached levels second only to the all-time flood of record, which occurred in April 1965. Hardest hit was the Prairie du Chien area and points southward, where flood waters did considerable damage to businesses and homes. Overall damage due to the high water was estimated around 6 million dollars. This resulted in Buffalo, Trempealeau, La Crosse, Crawford, Vernon and Grant counties receiving federal and state disaster relief funds. Water levels began dropping during the latter part of the month, but remained above flood stage through early May.

Figure 2: City of La Crosse - Copeland Park Pavilion (April 2001)

Figure 3: City of La Crosse – Riverside Park (April 2001)

La Crosse River:

The USGS has maintained a recording gage on the La Crosse River approximately two miles west of West Salem since 1938 (Gage No. 05383000). A non-recording gage was in operation from 1914 to 1938, 30 feet downstream of the present site.

Table 6 – Summary of Major Floods on the La Crosse River (Gage No. 05383000) at West Salem, Wisconsin

Date	Discharge (cubic feet per second, cfs)	Gage Height
August 6, 1935	8200	12.20
July 2, 1978	7600	12.82
February 8, 1966	5940	11.29
April 3, 1956	5720	10.42
September 15, 1928	5160	10.20

Mormon Creek:

The highest flow of record on Mormon Creek was 6,600 cfs in 1978. This is based on gaging records since 1961.

Table 7 – Summary of Major Floods on the Mormon Creek (Gage No. 05386300) near La Crosse, Wisconsin

Date	Discharge (cubic feet per second, cfs)	Gage Height
July 2, 1978	6,600	20.60
July 11, 1981	5,120	18.98
June 29, 1990	4,200	18.02
June 17, 1993	3,770	17.47
September 8, 1980	2,740	16.05

All Other Streams:

Flood damage occurred in August 1959 from Pammel Creek and State Road Coulee overflows and, on several occasions since 1955, from flooding of Ebner Coulee.

Green Coulee is a smaller basin and, therefore, more responsive to locally heavy rains. There are no stream gages on Bostwick Creek or Fleming Creek. From contacts with local residents, it was found that floodwaters have reached potentially hazardous heights on these streams in the past. No specific flood frequency could be associated with this data.

Dutch Creek is a smaller basin and is, therefore, quite responsive to locally heavy rains. Floods can occur on this creek during any of the warmer months of the year. There are no gage records available for Dutch Creek.

2.4 Flood Protection Measures

Emergency levees have been constructed along the northern bank of the La Crosse River and on both sides on the Black River throughout most of the north side of the City of La Crosse. However, due to the emergency nature of these levees, they cannot be relied upon to provide flood protection. A reach of agricultural levees is located in the right overbank of the La Crosse River, starting at a point approximately 0.75 miles south of County Highway B, crossing the river, and ending at the U.S. Highway 16 embankment. The levees have been modeled as overtopping but not completely failing (structurally).

Dams affecting the watercourses within La Crosse include Lock and Dam No. 7 on the Mississippi River, Lake Onalaska Dam on the Black River, dam at the mouth of Lake Neshonoc, and West Salem Dam on the La Crosse River. None of these dams were designed to provide flood control.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that 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 that equals or exceeds the 1-percent-annual-chance (100-year) flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

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

The following analyses have not changed from the previous countywide FIS. Study summaries have been compiled by waterway below:

Bostwick Creek and Fleming Creek –

Discharges on Fleming Creek were developed at the mouth using empirical methods. Drainage basin comparisons were made to gaged watersheds in the vicinity. The drainage area relationships were then used to project discharges upstream. Similarly, drainage-area relationships were used in obtaining discharges for Bostwick Creek.

Dutch Creek and Green Coulee –

The hydrologic analysis was investigated, utilizing the methodology outlined in the U.S. Department of Agriculture, Soil Conservation Service (SCS), National Engineering Handbook (U.S. Department of Agriculture, 1972). Using this procedure, the time of concentration and time of peak were computed for the basin and a unit hydrograph was developed. The expected 6-hour rainfall for the desired frequency event was obtained from Technical Paper 40 (U.S. Department of Commerce, 1963) and distributed into 30-minute amounts as described in the SCS criteria for design storms. A 6-hour duration storm was chosen since it was determined to be the "effective duration" for areas having an average annual precipitation of approximately 30 inches. Rainfall excess was computed from accumulated rainfall, using an SCS runoff equation which equates runoff as a function of soil type, antecedent moisture condition, and land use. Utilizing these precipitation data and the derived unit hydrograph, an outflow hydrograph was computed for the basin.

The State's Multiple Regression Equations with drainage area, main channel slope, percent lakes and marsh, areal factor, and mean snowfall as the independent variables were also investigated and compared with the results of the SCS method (Conger, 1971). The derivation of these equations is described in detail in Estimating Magnitude and Frequency of Floods in Wisconsin by Duane H. Conger (Conger, 1971).

The results of these studies of peak discharges were also compared with data obtained from similar gaged basins. These discharges reflect the present land use within the basin. Increased development without regard to changes in the runoff characteristics of the basin could substantially increase these flows.

<u>Ebner Coulee Main Channel/Ebner Coulee Southeast Bank/Ebner Coulee Ponds No. 1-7, Unnumbered Pond –</u>

Ebner Coulee flows westward out of the bluffs into a leveed channel that runs through several residential neighborhoods. Once out of the bluffs, approximately 900 feet upstream of 29th Street, the channel has levees on both sides and runs east to west to approximately 500 feet downstream of 29th Street where it turns southward along the Burlington Northern Railroad tracks. It then flows approximately 2,500 feet south to Farnam Street where it drains into an 8-foot by 10-foot reinforced box culvert (RCB) that is connected in several locations to a parallel 72-inch reinforced concrete pipe (RCP) trunk storm sewer line. Approximately 4,400 feet downstream of Farnam Street, the reinforced box culvert size increases to a 10-foot by 12-foot RCB. Both continue to follow the tracks southward along the railroad tracks and drain into Pammel Creek.

In 1998, the City of La Crosse contracted Mead & Hunt, Inc. to develop revised hydrologic and hydraulic models to better reflect actual conditions of the urbanized watershed.

<u>Inflows to Ebner Coulee Main Channel/Ebner Coulee Southeast Bank</u> –

Inflow hydrographs to the upstream channel and laterals were determined using a HEC- 1 rainfall-runoff model (USACE, 1991).

The previous study completed by the USACE for Ebner Coulee determined that the 100-year, 3-hour design storm is the critical event. An alternating block rainfall was used as the temporal distribution.

Based on the La Crosse County Soil Survey, the majority of the urbanized sub-basins consist of silty loams (Hydrologic Soil Group B) modeled having an average constant loss rate of 0.3 inches/hour. An average impervious area of 40 percent was assumed for most sub-basins. The exceptions to the above include the Blackhawk Subdivision sub-basin (area between Cliffwood Ln and Farnam Street) where the basin was further divided to account for silts, sands, and impervious areas; and the Farnam East sub-basin where there is less impervious area and a value of 20 percent was used.

Based on the La Crosse County Soil Survey,) was divided to account for silts, sands, and impervious areas. For the remaining sub-basins, the soils are silty loams (Hydrologic Soil Group B)

<u>Ebner Coulee Ponds No. 1-7, Unnumbered Pond</u> –

Flows in and out of the channel reach are controlled by the levees on each side. Similarly flows into the reinforced box culvert/reinforced circular culvert reaches are controlled by incoming storm sewer laterals. Due to the nature of this system the inflows to the channel and laterals were routed using the unsteady hydraulic UNET model (Barkau, 1996).

Capacities of the channel and laterals are not large enough to handle the entire inflow hydrographs determined in HEC-1 (USACE, 1991).

When flow capacity of the channel is exceeded, spill occurs in two locations:

- Flow over the levee occurs on both sides of the channel upstream of 29th street. The water leaving the channel to the north is assumed to flow through the area near La Crosse Floral to Pond 1 (near intersection of 28th Street and Floral Lane). Water leaving to the south flows to the pavement on Cliffwood Lane. Eventually the water flows along 28th Street and ponds at the inlet to the Farnam Street reinforced box culvert.
- Flow over the right levee occurs along the portion of the Ebner Coulee channel that parallels the Burlington Northern Railroad tracks.

When flow capacities of the laterals are exceeded, water ponds at their inlets:

- The locations where this occurs were designated Ponds No. 1-7. To account for this, stage-storage curves for each of the sub-basins/ponds were determined by one of two methods. In areas where adequate two-foot contour mapping was available, the surface area for each contour was electronically digitized. Where topographic data was limited, an approximate method was used. A representative street elevation was used as the base elevation of the stage-storage curve. It was assumed that 15% of the sub-basin was at this level, 30% was 0.5 feet higher than street level, 50% was 1.0 foot above street level, and the remaining area was 2.0 feet above street level.

In some instances, the volume capacities of the ponds were also exceeded. Flows out of the ponds were routed to adjacent sub-basins by calculating rating curves at low points using the standard broad-crested weir equation.

La Crosse River –

The La Crosse River was analyzed using 57 years of record covering the La Crosse River near West Salem gage (No. 05383000). Application of these data to the La Crosse area was done using a drainage area ratio transfer. Discharge information was also obtained from the USACE "Interim Survey Flood Control Report" (USACE, 1973). These analyses followed the standard log-Pearson Type III method as outlined by U.S. Water Resources Council Bulletin No. 17 (U.S. Water Resources Council, 1976).

Mormon Creek –

The 10-, 50-, and 100-year flood discharges for Mormon Creek were determined by a scaling technique demonstrated in "Techniques for Estimating Magnitude and Frequency of Floods for Wisconsin Streams" (USGS, 1981). Using this technique, the appropriate frequency discharges determined by log-Pearson Type III analyses for USGS crest gage 05386300 (at Breidel Coulee Road) were scaled to other locations in the Mormon Creek watershed based on area. The exponent used for this scaling was equal to that determined for the 'AREA' component of the appropriate regression equation as found in "Flood-Frequency Characteristics of Wisconsin Streams" (USGS, 1992). The l0-, 50-, and 100-year flood discharges for Johns Coulee were determined by using the regression equations in this report. The 500-year discharge for both Mormon Creek and Johns Coulee were determined by extrapolation.

Mississippi River/Black River –La Crosse –

The Mississippi River and Black River hydrology was determined through an investigation of flood frequency distribution estimation methods and resulted in a recommendation by the Technical and Interagency Advisory Groups (TAG and IAG) to use the basic methodology described in Bulletin 17B for obtaining at-site estimates of flood distributions for the Upper Mississippi Basin Flood Frequency Study. The Bulletin recommends the log-Pearson III distribution with method of moments to estimate flood quantiles (e.g., the 1% chance annual peak flow). The TAG and IAG also recommended regionalization of the flood statistics to obtain consistent flood quantile estimates. Regional shape estimation also involves estimating average skew values for statistically homogenous regions and substituting this average value for the at-site value when estimating the flood-frequency distribution.

Flood regions may be defined by the confluence of major rivers (e.g., Kansas and Missouri, Illinois and Mississippi, Mississippi and Missouri), a change in climatology or some other feature that is manifested in the observed flow series. A statistical approach was proposed by the Technical Advisory Group (TAG) to obtain regional boundaries (see Hydrologic Engineering Center, 2000). The approach taken was to identify boundaries based on channel characteristics, statistical variation of flood characteristics, and climate across the study area.

Once regions with statistically similar flood characteristics were defined, a regional skew coefficient (a regional shape parameter) was obtained as an average of the at-site gage estimates within the region. The flood frequency distribution is computed from the at-site mean and standard deviation combined with the regional skew coefficient used as the adopted skew coefficient. Flood distributions in between gages are obtained by a linear smoothing relationship of the mean flow and the standard deviation with drainage area.

Sand Lake Coulee –

The l0-, 50-, and 100-year flood discharges for Sand Lake Coulee were determined by creating a HEC- 1 rainfall-runoff model (USACE, 1990). The Sand Lake Coulee watershed was split into 12 separate sub-watersheds based on the drainage network. Land use was determined for each of these areas using 1"=660' aerial photos, and subsequent curve numbers were determined using TR-55 (U.S. Department of Agriculture, 1986). Lag times were also determined by using TR-55. SCS Type II rainfall distribution was used, and 24-hour rainfall depths were determined from TP 40 (U.S. Department of Commerce, 1961). Slopes, distances and areas were determined from USGS 7.5-minute quad maps.

The Sand Lake Coulee watershed is unique in that it is leveed in two places: near two subdivisions (Thunderbird Hills and Beverly Hills) and a nearby golf course, and in the Town of Midway.

Golf Course/Thunderbird and Beverly Hills Subdivision Levee –

Years ago, a golf course was constructed on some low-lying agricultural land adjacent to the stream approximately halfway up the watershed. In order to prevent this area from flooding frequently, a levee was built along the entire distance (approximately one mile) of the golf course, continuing downstream past two housing subdivisions.

There are three ways in which runoff can enter the golf course during floods: levee overtopping, direct runoff from local contributing areas, and flows from upstream.

The levee creates a hydrologic situation where overland runoff from these areas - which would normally have run off into the stream - is now retained on the golf course by the levee and will not contribute to flood peaks. Additionally, the levee creates a main channel discharge capacity that is significantly lower than what is expected during flood conditions and overtopping onto the golf course is likely. Peak flood flows downstream from this area will be greatly attenuated.

For these reasons, the discharge from the original HEC-1 model at a location just upstream from the golf course was diverted past the golf course and routed downstream. Runoff contributed from the golf course sub-watersheds was not allowed into the main channel flow calculations. The amount of flow to be routed past the golf course was determined from "split flow" runs using the step-backwater program HEC-2 using surveyed levee data (USACE, 1990). The maximum channel capacity for the golf course levee was determined to be 230 cfs.

Overflow discharges for the right overbank in the golf course were determined by combining several model outputs for each flow scenario. First, as described above, the main channel levee overflow into the golf course was determined using the split flow HEC-2 model for the golf course. The maximum discharge that would not cause water to top the levee at the upstream end of the golf course was assumed to enter the channel (650 cfs for all frequencies). Based on the outputs from this split flow model, it was determined that a peak discharge of 55 cfs would overtop the levee at the southern half of the golf course, and 15 cfs would overtop the levee at the northern half of the golf course. Some additional overflow is expected to cross Hwy SN at the southern edge of the golf course and enter the low-lying areas to the southwest (an elevation for this flooding was not determined). Next, HEC-1 models were created for the two subwatersheds which contribute flow to the golf course. The dividing line between these two areas is Golf Course Road. The calculated 100-year peak flow for the sub-watershed to the south of Golf Course Road was 180 cfs, and the 100-year peak flow for the sub-watershed to the north of Golf Course Road was 95 cfs. Another HEC-2 model was created for the right overbank area in the golf course using these discharges. The final way for water to enter the golf course is by direct flow from upstream. To help determine this flow, a constant "balancing discharge" was added to the existing discharges at all of the cross sections in the HEC-2 model for the right overbank in the golf course. This balancing discharge was then adjusted and the model was iteratively run until there was a good energy grade balance between the right overbank model and the main channel model at cross section AB at the upstream end of the golf course. The balancing discharge for the 100-year event was determined to be 400 cfs; therefore, the starting discharge for the HEC-2 model at the northern edge of the golf course is (400+15+95+55 +180) 745 cfs. All water in the golf course, as well as the area ponded to the north of the intersection of Hwy SN and S should be considered flood storage because peak flows downstream are greatly attenuated.

Town of Midway –

The Town of Midway is leveed as well, with a low-level berm constructed for approximately 1,000 feet along the right bank. It too will be overtopped by the 100-year flood, and flooding is anticipated within the town.

A similar technique to that described above was used to determine the capacity of the channel in the Town of Midway with a separate split flow HEC-2 model. The resulting maximum capacity of the main channel in Midway was determined to be 210 cfs. The resulting discharges from the split flow analyses and the HEC-1 model results were hard-coded into the final HEC-2 hydraulic model.

Overflow discharges in the Town of Midway (right overbank) were determined by subtracting the maximum channel capacity (210 cfs) from the peak discharge determined in the final routed HEC-1 model.

Smith Valley Creek –

There were no existing discharge-frequency curves for Smith Valley Creek and there are no USGS stream gages in the Smith Valley Creek basin. A discharge frequency curve at the mouth of Smith Valley Creek was derived by using the current USGS regression equation study in effect for Wisconsin (USGS, 1992). The equations used were as follows:

$$Q_2 = 158A^{0.720}\ INTENS^{2.95}\ S^{0.185}$$
$$Q_5 = 186A^{0.778}\ INTENS^{3.34}\ S^{0.337}$$
$$Q_{10} = 226A^{0.798}\ INTENS^{3.58}\ S^{0.396}$$
$$Q_{25} = 282A^{0.818}\ INTENS^{3.82}\ S^{0.447}$$
$$Q_{50} = 317A^{0.833}\ INTENS^{3.96}\ S^{0.480}$$
$$Q_{100} = 342A^{0.848}\ INTENS^{4.06}\ S^{0.512}$$

where Q is the flow for a given recurrence interval, A is the drainage area in square miles, INTENS is the 2-year 24-hour precipitation minus 2.3 in inches, and S is the main channel slope in feet per mile. The values of A, INTENS, and S are 7.04 square miles, 0.6 inch, and 63 feet per mile, respectively. The drainage area and main channel slope were derived from the 7.5-minute USGS quadrangle map for this area (USGS, 1993). The 500-year discharge was extrapolated from a graphical plot of the other discharge-frequency values on logarithmic probability paper.

The discharge-frequency curve was also estimated by a regional analysis method that showed the results from the regression equations were satisfactory. This method involved computing discharge-frequency relationships for 11 hydrologically similar streams in the same USGS region used to define the regression equations (USGS, 1992). The Hydrologic Engineering Center Flood

Frequency Analysis (FFA) computer program (USACE, 1995) was used to compute the 11 analytical discharge-frequency curves from annual instantaneous peak flows obtained from USGS records. The mean log of discharge, standard deviation and skew for each of the 11 gages were plotted versus drainage area. These statistics were then estimated from the plots for Smith Valley Creek. The FFA program was used with the three estimated statistics as input data to compute a discharge-frequency curve. This curve matched the regression equation results closely in magnitude, skew (curvature) and slope. Therefore, the discharge-frequency relationship for the mouth of Smith Valley Creek derived from the regression equations was adopted.

The discharge-frequency relationship adopted at the mouth of Smith Valley Creek was transferred upstream to other locations on the main stem of the creek by drainage area ratio using the following equation:

$$Q_{UPSTREAM} = Q_{MOUTH} \ (A_{UPSTREAM}/A_{MOUTH})^{N}$$

where Q_{MOUTH} values are the adopted discharges at the mouth of Smith Valley Creek, A_{STREAM} are drainage areas at locations on the main stem upstream from the mouth, A_{MOUTH}, is the drainage area at the mouth of Smith Valley Creek (7.04 square miles) and N are the drainage area exponents for the return intervals of the USGS regression equations shown above. The 500-year discharges were extrapolated from graphical plots of the other discharge-frequency values on logarithmic probability paper.

Pammel Creek –

Unit hydrographs using Clark's Method were synthesized from hydrologic data supplied by the USACE, St. Paul District (USACE, 1967). The unit hydrographs were then used to compute frequency-discharge relationships for the stream. Gilmore Creek at Winona was used to assist in establishing parameters, such as drainage area, time of concentration and the time to peak. Point rainfall was obtained from National Weather Service Technical Paper No. 40 (U.S. Department of Commerce, 1963). A basin area transfer was then performed using 0.7 as the power of the drainage area ratio. All data used in formulation of the hydrology for Pammel Creek was taken from the Phase I General Design Memorandum (USACE, 1976). Peak discharges for Pammel Creek are reduced proceeding downstream due to unsteady flow conditions and large storage volumes.

State Road Coulee, Tributary A, Tributary B, and Upper Boma Coulee –

Peak discharges were obtained from the SCS "Flood Hazard Study, State Road Coulee" (U.S. Department of Agriculture, 1980). Discharges for the selected recurrence interval floods were computed using the SCS generalized TR-20 rainfall-runoff computer model (U.S. Department of Agriculture, 1965). TR-20 is a hydrologic model which computes surface runoff resulting from selected rainstorms, taking into account conditions having a bearing on runoff, such as drainage area, slope, soil composition, vegetation and land use.

Peak discharge-drainage area relationships for La Crosse County are shown in Table 8.

Table 8 - Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
BLACK RIVER					
At County Highway V	2,020	40,500	60,000	67,500	89,500
BLACK RIVER – LA CROSSE					
At confluence with Mississippi	2,200	24,825	34,000	38,000	47,000
BOSTWICK CREEK					
At confluence with La Crosse River	48.4	3,870	7,160	8,880	14,130
At County Highway B	41.3	3,540	6,560	8,130	12,930
At confluence of Garbers Coulee	36.1	2,900	5,380	6,660	10,600
At St. Joseph Coulee	20.3	2,120	3,920	4,880	7,760
DUTCH CREEK					
At mouth	21.1	1,800	3,100	4,100	6,100
EBNER COULEE MAIN CHANNEL					
Upstream of Overflow to Ebner Coulee Southeast Bank	0.9	N/A	N/A	1,430	N/A
Upstream of South 29th Street	0.9	N/A	N/A	301	N/A
Approximately 1240 feet Upstream of Farnam Street	0.9	N/A	N/A	247	N/A
EBNER COULEE SOUTHEAST BANK					
Upstream of South 29th Street	0.9	N/A	N/A	820	N/A
Approximately 1260 feet Upstream of Farnam Street	0.9	N/A	N/A	836	N/A
FLEMING CREEK					
At confluence with Black River	49.7	4,250	7,000	8,450	12,100
At confluence of Gavin Coulee	36.1	3,250	5,380	6,480	9,280
At confluence of Wet Coulee	19.4	2,050	3,390	4,060	5,830
At confluence of Helen Coulee	7.0	1,180	1,940	2,330	3,340
GREEN COULEE					
Upstream of Interstate Route 90	2.13	250	475	625	1,000

Table 8 - Summary of Discharges (*continued*)

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
JOHNS COULEE CREEK					
At mouth	3.4	620	1,120	1,360	2,100
At Tributary	2.1	420	750	900	1,350
At Tributary	1.7	350	610	730	1,100
LA CROSSE RIVER					
At La Crosse city limits (La Crosse gage)	480	5,300	8,150	9,500	13,000
Upstream of confluence with Bostwick Creek (West Salem gage)	398	4,750	7,350	8,600	12,000
LA CROSSE RIVER RIGHT OVERBANK 1					
At confluence with La Crosse River	480	956	1,767	4,021	4,586
LA CROSSE RIVER RIGHT OVERBANK 2					
At confluence with La Crosse River	480	3,162	3,769	5,103	5,569
LA CROSSE RIVER RAILROAD DITCH					
At confluence with La Crosse River	480	N/A	N/A	538	N/A
MISSISSIPPI RIVER					
At Root River (mile 693.7)	63,740	164,500	223,000	248,000	306,500
At La Crosse River (mile 698.4)	62,080	161,000	220,000	245,000	304,000
At Black River (mile 709.1)	61,600	160,000	219,000	244,000	303,000
At Lock and Dam No. 6	59,350	156,000	215,000	240,000	300,000
MORMON CREEK					
At mouth	35.9	4,220	9,110	11,780	20,500
At Old Town Road	34.9	4,130	8,900	11,510	20,050
At County Route MM	33.6	4,000	8,620	11,140	19,500
At Justin Road	32.9	3,940	8,480	10,950	19,050
At Park	31.8	3,830	8,220	10,610	18,250
At Bloomer Mill Road	29.9	3,650	7,820	10,090	17,200
At Subdivision	28.7	3,530	7,550	9,730	16,500
At Tributary (Breidel Coulee)	27.9	3,450	7,380	9,510	16,150
At Breidel Road (gage)	25.3	3,190	6,800	8,760	15,000
At Tributary (Johns Coulee)	24.7	3,130	6,670	8,580	14,700
At County Route YY	21.3	2,780	5,890	7,560	13,000
At Tributary	21.0	2,650	5,590	7,170	12,200
At Schmaltz Road	18.7	2,510	5,290	6,780	11,500
At Roesler Road	15.6	2,170	4,550	5,820	9,700
PAMMEL CREEK					
At downstream limit	7.67	1,020	1,040	1,050	1,050
Approximately 1,000 feet upstream of Drive-in Road	4.54	2,440	4,080	5,000	7,200

Table 8 - Summary of Discharges (*continued*)

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
SAND LAKE COULEE					
At Basin Outlet	6.27	340	620	820	1,260
At downstream face County Route OT	6.27	210	210	210	210
At Section D	6.27	340	620	815	1,155
At Section E	6.27	340	620	820	1,260
Downstream face Highway SN	4.49	235	240	245	250
Approach to County Route SN	4.35	230	230	230	230
At Section T	4.35	245	245	245	245
At Section W	4.35	285	295	295	295
At Section Y	4.35	310	380	415	470
Downstream face Golf Course Bridge	4.35	650	650	650	650
Upstream from Golf Course Levee	4.35	685	1,385	1,950	3,275
At Tributary confluence	2.81	480	1,010	1,415	2,330
At Tributary confluence	1.11	190	390	550	895
At Private Drive Culvert	0.64	110	225	315	515
SAND LAKE COULEE RIGHT OVERBANK - MIDWAY					
Approach to Bike Bridge	N/A	340	620	820	1,260
Section A	N/A	130	410	610	1,050
Section H	N/A	105	315	470	835
Section E (Common Upstream – Full Flow)	N/A	340	620	820	1,260
SMITH VALLEY CREEK					
At mouth	7.04	890	1,560	1,880	2,650
At confluence of Keil Coulee	5.78	760	1,320	1,590	2,230
At southeast corner of Section 26	2.50	390	660	780	1,080
At campground northwest corner of Section 36	1.34	240	390	460	620
STATE ROAD COULEE					
Upstream of Hagen Road	4.42	2,038	3,336	4,201	6,178
Upstream of Stry Drive	3.94	1,855	3,035	3,822	5,620
Upstream of Hass Farm Drive	2.86	1,378	2,255	2,840	4,177
Upstream of State Route 33	1.17	666	1,089	1,372	2,017
TRIBUTARY A					
Upstream of State Route 33	0.78	464	759	956	1,406
Upstream of Boma Road	0.76	417	682	860	1,264
TRIBUTARY B					
At By-Pass at State Route 33	0.01	7.2	36	73	144
UPPER BOMA COULEE					
Stream at confluence with State Road Coulee	0.79	396	648	828	1,200

Stillwater elevations have been determined for the 10-, 50-, 100-, and 500-year floods for the flooding sources studied by detailed methods and are shown in Table 9.

Table 9 - Summary of Stillwater Elevations

	Water Surface Elevations (Feet NAVD[1])			
Flooding Source	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
LAKE NESHONOC				
At shoreline	699.1	701.0	701.9	703.6
EBNER COULEE POND 1				
Between 29th Street and Burlington Northern Railway (storage area 30*)	N/A	N/A	662.8	N/A
EBNER COULEE POND 2				
Between Farnam Street and State Road (storage area 6*)	N/A	N/A	655.8	N/A
EBNER COULEE POND 3				
From approximately 200 feet north of Crestline Place to State Road (storage area 7*)	N/A	N/A	654.7	N/A
EBNER COULEE POND 4				
On 28 St-Ct. from 150 feet north to 500 feet south of Evergreen Street (storage area 10*)	N/A	N/A	652.4	N/A
EBNER COULEE POND 5				
From State Road to Paul Place (storage area 11*)	N/A	N/A	652.7	N/A
From Paul Place to Ray Place (storage area 12*)	N/A	N/A	653.2	N/A
From Ray Place to approximately 1200 feet south of Ray Place (storage area 13 & 14*)	N/A	N/A	652.2	N/A
From approximately 1200 feet south of Ray Place to 50 feet south of Glendale Ave. (storage area 16*)	N/A	N/A	651.8	N/A
From 50 south of Glendale Avenue to Ward Avenue (storage area 20*)	N/A	N/A	651.7	N/A
EBNER COULEE POND 6				
From approximately 600 feet north of West Fairchild Street to 600 feet south of East Fairchild Street (storage area 15*)	N/A	N/A	653.5	N/A
EBNER COULEE POND 7				
From approximately 125 feet south of Jackson Street to Farnam Street (storage area 4*)	N/A	N/A	658.4	N/A
EBNER COULEE UNNUMBERED POND				
29th Street (storage area 19*)	N/A	N/A	653.4	N/A

[1] North American Vertical Datum 1988

* Storage area numbers reference Mead & Hunt December 1998 Ebner Coulee Study

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. Users should be aware that flood elevations shown on the Flood Insurance Rate Map (FIRM) represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data Table in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

Cross sections for other waterways were determined from topographic maps and field surveys. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry. All topographic mapping used to determine cross sections are referenced in Section 4.1.

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 FIRM (Exhibit 2).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Qualifying bench marks within a given jurisdiction that are cataloged by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B, or C are shown and labeled on the FIRM with their ***6***-character NSRS Permanent Identifier.

Bench marks cataloged by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation well (e.g., mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation well (e.g., concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)

- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

In addition to NSRS bench marks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

To obtain current elevation, description, and/or location information for bench marks shown on the FIRM for this jurisdiction, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their Web site at www.ngs.noaa.gov.

It is important to note that temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with this FIS and FIRM. Interested individuals may contact FEMA to access this data.

The following analyses have not changed from the previous countywide FIS. Study summaries have been compiled by waterway below:

Bostwick Creek and Fleming Creek –

Cross sections for the backwater analyses were field surveyed and located at close intervals above and below bridges in order to compute the effects of these structures. Starting water-surface elevations for Fleming Creek were developed using normal depth analysis. Starting water surface Water-surface elevations of floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program (USACE, 1990).

Dutch Creek and Green Coulee –

Cross sections and bridge elevation data and structural geometry for the backwater analyses of Green Coulee and Dutch Creek were obtained by field surveys by the study contractor. Channel soundings were also obtained by field measurement.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program (USACE, 1990).

Starting water-surface elevations for each flood frequency studied for Green Coulee and Dutch Creek were computed using the Computer Program Hydraulics of Bridge Waterways (Wisconsin Department of Natural Resources, 1978).

Ebner Coulee Main Channel/Ebner Coulee Southeast Bank –

Water leaves the main channel of Ebner Coulee over the south levee upstream of 29th Street. The overflow (also defined as the "spill" reach) follows Cliffwood Lane west and then 28th Street southward where it ponds at the inlet to the Farnam Street reinforced box culvert, which is designated as Pond 7.

Based on the UNET (Barkau, 1996) Pond 7 extends northward from Farnam Street to 120 feet south of Jackson Street, where the water surface profile begins to increase. Water surface profiles north of this area were calculated using the HEC-RAS hydraulic model (USACE, 1998).Starting water surface elevations are based on Pond 7. All cross-sections representing the street were taken from the previous study and supplemented with additional survey. Manning's "n" values were increased from typical pavement values to account for road obstructions, debris, and sediment transport.

Johns Coulee Creek –

The investigated reach for Johns Coulee Creek begins at the confluence with Mormon Creek and continues upstream for approximately 2.1 miles. Survey data collected for the entire reach included 10 channel cross sections, geometry and road profiles for 3 hydraulic structures, and approach and exit cross sections for each structure. The starting water-surface elevations for Johns Coulee Creek were determined from the water-surface elevations for Mormon Creek at the exit to the County Route YY Bridge. The 10-year elevation for Mormon Creek was used for the 50- and 100- year floods on Johns Coulee Creek. The 10- and 500-year floods on Johns Coulee assumed normal water and the 100-year elevations of Mormon Creek, respectively.

La Crosse River (Mississippi River to 1.7 miles upstream of State Highway 16) La Crosse River Right Overbank 1, La Crosse River Right Overbank 2, and La Crosse River Railroad Ditch –

The hydraulic analysis within this reach is complicated by an agricultural levee located in the right overbank (looking downstream) of the main channel starting at a point approximately 0.75 miles south of the County Route B crossing of the river and ending at the State Route 16 embankment (a total of two miles of levees). The levee has a significant impact on flood elevations in this portion of the river as indicated by recorded high water marks of the July 2, 1978, flood event. The discharge in the La Crosse River splits in three locations. These split flows create the need for additional waterways, listed as La Crosse River Right Overbank 1, La Crosse River Right Overbank 2 and La Crosse River Railroad

Ditch. Lateral weir analyses was included for portions of these split flows in the HEC-RAS model.

This reach of stream was originally modeled using the USACE HEC-2 computer program (USACE, July 1979) to approximate realistic conditions for levees that overtop but do not fail (structurally) completely. A “split flow” option analyzed the amount of flow leaving the main channel (by overtopping) while computing a profile using the remaining flow in the channel.

Computed flood profiles were compared to known historical profiles and measured stages at gaging stations on the La Crosse River. Records of high water marks were obtained from the USACE, USGS, and local residents. The model was successfully calibrated using recorded high water marks from the 1978 flood (this information is available from the WDNR). The recorded discharge for the 1978 flood is only slightly lower than the estimated 100-year discharge. A computer model (100-year) is, therefore, an accurate representation of actual flooding conditions on the La Crosse River.

In 2005, Mead & Hunt revised this study reach within the corporate limits of the City of La Crosse. This was done by integrating two HEC-2 models into one HEC-RAS model and updating bridges and lateral weirs where necessary. Manning’s roughness coefficients, bank stations, and starting water surface elevations were not modified in the new HEC-RAS model.

Flooding between the Chicago and North Western Railroad tracks and Interstate Route 90 near the confluence of Bostwick Creek and the La Crosse River is caused by backwater from the La Crosse River.

La Crosse River Overflow to the Black River-La Crosse –

Based on the 2007 LiDAR data provided by the County, there were four locations along the north side of the La Crosse River where water calculated water surface elevations indicated possible overflow into a low lying area south of the Black River-La Crosse.

1) Intersection of Railroad and Valley Drive
2) Intersection of Railroad and Gateway Road
3) Over St. James Street
4) Over high point just east of Lang Drive

Each location was modeled as a lateral structure based on the County 2007 LiDAR data to determine the peak flow leaving the La Crosse River. Additionally, the low elevations based on the terrain (elevation where overflow begins) were compared to the 1978 storm event calibrated HEC-1 model to estimate the duration where overflow occurs. Assuming a triangular hydrograph for the overflow, the total volume leaving the La Crosse River was calculated.

Finally, the volume for 0.1 foot intervals within the low-lying area were calculated and compared to the outflow volume to determine the mapped floodplain elevation.

La Crosse River (1.7 miles upstream of State Highway 16 to the Lake Neshonoc) Dam/Lake Neshonoc –

Cross sections and bridge elevation data and structural geometry for the backwater analyses of the La Crosse River were obtained by field surveys by the study contractor. Starting water-surface elevations for each flood frequency studied were determined from the downstream effective model. Water-surface elevations for floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program (USACE, 1990).

La Crosse River (Village of Bangor) –

Cross sections and bridge elevation data and structural geometry for the backwater analyses of the La Crosse River were obtained by field surveys by the study contractor. Starting water-surface elevations for each flood frequency studied were computed using the Computer Program Hydraulics of Bridge Waterways (Wisconsin Department of Natural Resources, 1978). Water-surface elevations for floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program (USACE, 1990).

Mississippi River –

The St. Paul District of the U.S. Army Corps of Engineers performed hydraulic modeling along the Mississippi and Black River – La Crosse. This hydraulic model was created in the computer software UNET. This UNET model was then converted to a HEC-RAS model for the 0.1% chance flood hazard only.

The hydraulic modeling starts at Anoka, Minnesota, at river mile (RM) 864.8, and continues downstream to Dubuque, Iowa, at RM 579.3. Even though the model extends to Dubuque, it is intended to provide results only for the reach at and upstream of Guttenberg, Iowa, at Lock and Dam No. 10. Guttenberg corresponds with the St. Paul District boundary with the Rock Island District. The extension of the model to Dubuque allows for a convergence reach taking care of any mathematical instability or errors introduced from the downstream boundary condition. The modeling effort for the Flow Frequency Study developed water surface profiles for the reach from the mouth of the St. Croix River near Hastings, Minnesota (River Mile 811.4) to the headwater of Lock and Dam No. 10 at Guttenberg, Iowa (River Mile 615.2).

The levee areas along the Mississippi-Missouri River systems are substantial. Breaching of levees, as shown in Fig. 1, results directly in flooding of areas meant to be protected by the levees. The water that floods those areas is stored for later return to the river. The modeling of this exchange and storage of water resulting from levee breaches is an important aspect of UNET. This feature is included in HEC-UNET Ver. 4.0.

A major effort was undertaken to provide the ability to simulate lock and dam operations with the UNET system (Barkau, 1996). The capability to use operating rule curves at navigation dams as internal boundary conditions was developed and implemented. Preparation of the input data necessary to describe these rule curves was accomplished by the District offices.

Aerial photography, airborne global positioning system (GPS) control, ground survey control, and aero triangulation were used in development of a digital terrain model (DTM) and digital elevation model (DEM) of the project area for the St. Paul District (Mississippi River from Anoka, Minnesota, to Lock and Dam No. 10 at Guttenberg, Iowa, RM 864.8 to 615.1). The aerial photography for the DTM was taken in April and May 1999 under the direction of the Scientific Assessment Study Team (SAST). The DTM data is composed of mass points and break lines that adequately define elevated roads, railroads, levees (features that would impede flow) and other major topographic changes required for accurate DEM development. The aerial mapping is based on surveyed ground control points. These surveyed ground control points are very accurate, but the aerial mapping of well-defined features between the ground control points can vary by as much as 0.67 foot 67 percent of the time in accordance with the ASPRS Class I mapping standards. Ground surface elevations developed by the aerial mapping will be accurate to within 1.33 feet. This level of accuracy is much better than that used for previous hydraulic models along these rivers and is considered very good for the purposes of hydraulic modeling.

Data below water surface elevation for the UNET model cross-sections are from various sources including xyz data obtained from Construction-Operations. Construction-Operations Division obtains sounding data for maintenance of the Navigation Channel for the Mississippi River. In areas that soundings were not available in the Navigation Channel, data from the Brown Surveys was utilized. The Brown Surveys are surveys taken in the early 1930’s across the Navigation Channel at approximately ½ mile increments. The Surveys were acquired from the St. Paul District map file archives. In the Overbank areas data was obtained from the Upper Midwest Environmental Sciences Center (UMESC formerly the EMTC). In areas that the UMESC data was not available flowage surveys were utilized. The flowage surveys were taken in the early 1930’s prior to placement of the lock and dams. The Flowage Surveys were acquired from the St. Paul district map file archives. In areas that new geometry was not available previously developed geometry data was utilized from the Mississippi River UNET model.

Geometry data from the varying sources described above was imported into the GIS program Arcview 3.2. All geometry data was converted to horizontal UTM

Coordinates, NAD 83, Zone 15 North, Feet and vertical NGVD 1929, US Survey Feet. Cross-sections, reach lengths, and overbank line shapefiles were created in Arcview 3.2. Each geometry data source was combined with the cross-sections shapefile and cross-sections were cut using an extension in Arcview 3.2 called Geo-RAS. By the use of Geo-RAS the cross-sections, reach lengths and overbank geometric data was imported into HEC-RAS 3.0 as a geometry file. A separate geometry file was created for each geometry data source. The geometry files were then combined in HEC-RAS 3.0 and a final geometry data file was created. The final geometry data file contains data from the DEM/DTM above WSEL and soundings data, UMESC data, Brown Surveys data, Flowage Surveys Data, and Old UNET data (listed in decreasing control) below WSEL. The channel roughness coefficients were assigned by use of UMESC supplied land use data. The land use data was imported into Arcview 3.2 and each landuse was assigned a roughness coefficient. The data was then imported into HEC-RAS 3.0 by use of the Geo-RAS extension.

The geometry data was completed in HEC-RAS with the addition of effective flow limits, bridges, control structures (locks and dams), and levees. Steady flow discharges were acquired from the hydrologic study. Calibration was then completed by the use of High Water Marks for the 1965, 1969, 1993, 1997 and 2001 floods. Rating curves were used for calibration at each Lock and Dam, at each control point between the Lock and Dams, and at the gaging stations at Anoka, St. Paul, Winona and McGregor. The geometry for the Calibrated steady flow HEC-RAS model was then imported into UNET for an unsteady flow calibration.

Mormon Creek –

The investigated reach for Mormon Creek begins at the confluence with the Mississippi River and continues upstream for approximately 11.9 miles to the County Route M Bridge. Survey data collected for the entire reach included 32 channel cross sections, geometry and road profiles for 10 hydraulic structures, and approach and exit cross sections for each structure. Manning's "n" roughness values were determined using engineering judgment based on field observations, photos, and a technique described in "Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains" (U.S. Department of Transportation, 1984). Starting water-surface elevations were obtained from the 1983 FIS for the unincorporated areas of La Crosse County (Mississippi River) at the confluence with Mormon Creek (at approximately river mile 692). The 10-year elevation for the Mississippi River was used for the 50- and 100-year floods on Mormon Creek. The 10- and 500-year floods on Mormon Creek assumed normal water and the 100-year elevations of the Mississippi River, respectively.

The Wisconsin Department of Natural Resources had previously created a HEC-2 model for the flooding at the downstream end of Mormon Creek. This model evaluated the complex hydraulic scheme near the Highway 35 Bridge, which includes road overflow south of the Highway 35 Bridge for the 100-year flood. This model was spliced into the newly created HEC-2 model, with minor modifications to include newly surveyed bridge geometry for the Highway 35 Bridge. The new mapping for this area was unchanged from the original DNR study.

Pammel Creek and Pammel Creek AH/AO Zones -

Pammel Creek within the study limit is a leveed channel. In 1994 the Federal Emergency Management Agency (FEMA) approved LOMR 94-05-081P which covered substantial improvements made to the area by the United States Army Corps of Engineers (USACE) as part of the Pammel Creek Flood Control Project (also known as the State Road Coulee Project). These improvements eliminated flooding over the right levee (known previously as Pammel Creek West Bank and Pammel Creek Northeast Bank) and minimized impacts in the left overbanks (known previously as Pammel Creek East Bank). Major project components included:

- Channelization of the stream from a point approximately 950 feet downstream of the Burlington Northern Railroad to a point 150 feet upstream of the Hagen Road Bridge.
- Excavation of an overflow area downstream of the concrete channel
- Replacement of several bridges crossing Pammel Creek
- Construction and/or modification of drainage facilities along the east bank of the stream to allow drainage of several ponding areas

Two sets of hydraulic analysis were completed:

- Interior drainage computations for the ponding and shallow flooding areas along the east bank were based on the Interior Drainage Flood Routing Program.
- Cross-sections and structure geometry for the main channel was taken from "as-built" plans of Stages I, II, and III of the flood control project as well as supplemental field survey. Water-surface elevations of floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program (USACE, 1990). Starting water-surface elevations for Fleming Creek were developed using normal depth analysis. Starting water surface

Since riverine flooding was contained within the channel, the floodway was eliminated downstream of Hagen Road.

Sand Lake Coulee –

The investigated reach for Sand Lake Coulee begins at the confluence with the Mississippi River and continues upstream for approximately 4.8 miles. Survey data collected for the entire reach included 26 cross sections, geometry and road profiles for 12 hydraulic structures, and approach and exit cross sections for each structure. Survey data were also collected for the levees near the golf course and Thunderbird Hills and Beverly Hills Subdivisions, and in the Town of Midway. Starting water-surface elevations were obtained from the 1983 FIS for the unincorporated areas of La Crosse County (Mississippi River) at the confluence with Sand Lake Coulee (at approximately river mile 705). The 10-year elevation for the Mississippi River was used for the 50- and 100-year floods on Sand Lake Coulee. The 10- and 500-year floods on Sand Lake Coulee assumed normal water and the 100-year elevations of the Mississippi River, respectively.

A tributary run to the main Sand Lake Coulee HEC-2 model was created to best approximate the floodway through the Town of Midway. For this analysis, 15 cross sections were added to the overbank areas in Midway to approximate an assumed logical flow path based on survey elevations and historic flood photos (1985 and 1992).

State Road Coulee, Tributary A, Tributary B, and Upper Boma Coulee –

Cross sections for the backwater analyses were field surveyed and located at close intervals above and below bridges in order to compute the effects of these structures. Profiles for the upper reach of State Road Coulee, Upper Boma Coulee, and Tributaries A and B were obtained from the SCS Flood Hazard Study (U.S. Department of Agriculture, 1980) and were computed using the WSP-2 computer program, Technical Release No. 61 (U.S. Department of Agriculture, 1976).

Smith Valley Creek –

Water-surface profiles for the 10-, 50-, l00-, and 500-year floods were developed for Smith Valley Creek. Profiles for Smith Valley Creek were computed using the USACE HEC-RAS (River Analysis System) computer program (USACE, 1998). Starting water-surface elevations were obtained from the profiles in the existing unincorporated areas of La Crosse County FIS (FEMA, 1983). The starting water surface elevation used for all profiles was the 10-year elevation (approximately 656) for the La Crosse River, which is at the mouth of Smith Valley Creek. A sensitivity analysis was performed with the 50-, l00-, and 500-year elevations at the La Crosse River. There was no impact of different starting water-surface elevations upstream of the first bridge at the downstream end of the model.

Roughness factors (Manning's “n”) used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. Roughness factors for all streams studied by detailed methods are shown in Table 10, "Manning's “n” Values."

Table 10 – Manning’s “n” Values for Detailed Study Streams

Stream	Left Overbank “n”	Channel “n”	Right Overbank “n”
Black River – La Crosse	0.10-0.12	0.03-0.035	0.11-0.12
Bostwick Creek	0.05-0.09	0.033-0.038	0.05-0.10
Dutch Creek	0.05-0.08	0.045	0.085
Ebner Coulee Southeast Bank	0.06-0.10	0.02-0.03	0.06-0.07
Fleming Creek	0.05-0.10	0.032-0.042	0.05-0.11
Green Coulee	0.055-0.06	0.045-0.055	0.055-0.09
Johns Coulee Creek	0.04-0.09	0.035-0.075	0.04-0.09
La Crosse River	0.05-0.15	0.03-0.045	0.05-0.15
La Crosse River Right Overbank 1	0.04-0.08	0.04-0.07	0.04-0.08
La Crosse River Right Overbank 2	0.04-0.05	0.04-0.05	0.04-0.05
La Crosse River Railroad Ditch	0.04	0.04	0.04
Mississippi River	0.03-0.12	0.03-0.12	0.03-0.12
Mormon Creek	0.075-0.10	0.025-0.075	0.04-0.10
Pammel Creek	0.06	0.04	0.06
Sand Lake Coulee	0.04-0.10	0.02-0.06	0.04-0.10
Sand Lake Coulee Right Overbank - Midway	0.06-0.09	0.025-0.055	0.06-0.09
Smith Valley Creek	0.08-0.10	0.05-0.08	0.08-0.10
State Road Coulee	0.04-0.10	0.04	0.03-0.10
Tributary A	*	*	*
Tributary B	*	*	*
Upper Boma Coulee	*	*	*

* Data not available

Approximate Study Streams –

For all streams studied, HEC-RAS version 3.1.3 hydraulic models were created using the HEC-GeoRAS extension for ArcMap (V9.1). Cross-section information in the model was derived by cutting cross-sections from the 1-meter cell grids generated from LiDAR data provided by La Crosse County (June 2007, +/-, 0.35 foot vertical accuracy at 95-percent confidence level). Structures (bridges, culverts, dams) were modeled based on WiDOT or WDNR as-built plans when available. If bridge/culvert plans were not available, they were modeled by estimating bridge deck width and openings based on the La Crosse County Orthoimagery, top of road elevations were estimated based on the La Crosse County LiDAR data. If dam plans were unavailable, they were modeled by estimating crest length from the La Crosse County Orthoimagery, crest elevations were estimated based on the La Crosse County LiDAR data.

A statewide polygon shapefile layer was developed for estimating approximate study Manning's"n" values. This layer is derived from a vector representation of the Wiscland land cover grid, which categorizes land cover types based on LANDSAT TM satellite imagery acquired in 1991 through 1993.

For approximate modeling purposes, the WDNR assigned conservative Manning's "n" values to each of the major land cover categories as described below:

Table 11 - Manning's "n" Values for Approximate Streams

Land Cover Value	Description	Manning's N
101	High Intensity Urban	0.025
104	Low Intensity Urban	0.05
105	Golf Course	0.04
110	Agriculture	0.06
112	Row Crops	0.06
124	Forage Crops	0.04
148	Cranberry Bog	0.045
150	Grassland	0.06
161	Upland Forest	0.1
200	Open Water	0.045
211	NonForested Wetland	0.06
223	Forested Wetland	0.1
240	Barren	0.04
250	Shrubland	0.08
255	Cloud Cover	0.06

3.3 Vertical Datum

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

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities may be referenced to NGVD88. This may result in differences in Base Flood Elevations (BFEs) across the corporate limits between the communities. Some of the data used in this study were taken from the prior effective FIS reports and adjusted to NAVD88. The average conversion factor that was used to convert the data in this FIS report to NAVD88 was calculated using the National Geodetic Survey's (NGS) VERTCON online utility. The data points used to determine the conversion are listed in Table 12.

Vertical Datum Conversion: NGVD + 0.0 = NAVD

Table 12 - Vertical Datum Conversion

Quad Name	Corner	Latitude	Longitude	Conversion from NGVD to NAVD (feet)
Trempealeau	SE	44.000	-91.375	0.07
Stevenstown	SE	44.000	-91.125	0.00
Galesville	SE	44.000	-91.250	0.01
Four Corners	SE	44.000	-90.875	0.13
North Bend	SE	44.000	-91.000	0.01
Holmen	SE	43.875	-91.250	0.07
Onalaska	SE	43.875	-91.125	0.04
West Salem	SE	43.875	-91.000	0.02
Bangor	SE	43.875	-90.875	0.01
Pickwick	SE	43.875	-91.375	0.04
La Crescent	SE	43.750	-91.250	0.08
Middle Ridge	SE	43.750	-90.875	-0.01
La Crosse	SE	43.750	-91.125	0.01
St. Joseph	SE	43.750	-91.000	-0.01
			Average:	0.03

For additional information regarding conversion between NGVD and NAVD, visit the NGS website at www.ngs.noaa.gov, or contact the NGS at the following address:

Vertical Network Branch, N/CG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides 1-percent-annual-chance (100-year) flood elevations and delineations of the 1- and 0.2-percent-annual-chance (500-year) floodplain boundaries and 1-percent-annual-chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data Table, and Summary of Stillwater Elevations Table. Users should reference the data presented in the FIS report as well as additional information that may be available at the local map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community.

For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using a 1-meter cell size grid created from a countywide LiDAR dataset acquired by La Crosse County in June 2007.

For each lake studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using a 1-meter cell size grid created from a countywide LiDAR dataset acquired by La Crosse County in June 2007.
.
The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, and AH), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance 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.

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (Exhibit 2). Floodplain boundaries have been delineated using a 1-meter cell size grid created from a countywide LiDAR dataset acquired by La Crosse County in June 2007. Source data meets FEMA Appendix A and NSSDA vertical accuracy standards for LIDAR Flood Plain Surveys with vertical accuracy of +/- 0.35 feet.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards Zones A, AE, AH, AO, and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance 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 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 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. However, the WDNR has established a policy that requires a 0.0 foot surcharge except for the waterways which were redelineated, where the surcharge from the effective study remains valid (WDNR, 1986).

The floodways presented in this FIS report and on the FIRM were computed at representative cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations have been tabulated for selected cross sections (Table 13). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

In the redelineation efforts, the floodways were not recalculated. As a result, there were areas where the previous floodway did not fit within the boundaries of the redelineated 1-percent-annual chance floodplain. In these areas, the floodway was reduced to coincide with the 1-percent-annual chance floodplain. Water surface elevations, with and without a floodway, the mean velocity in the floodway, and the location and area at each surveyed cross section as determined by the hydraulic methods can be seen in Table 16. The width of the floodway depicted by the FIRM panels and the amount of reduction to fit the floodway inside the 1-percent annual chance floodplain, if necessary, is also listed.

Notable exceptions are identified below:

La Crosse River (within the Village of West Salem) –

The floodway within West Salem was developed to reflect the existing effective flow limits, and was determined administratively by the WDNR.

Pammel Creek –

Since riverine flooding was contained within the channel, the floodway was eliminated downstream of Hagen Road.

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BLACK RIVER								
A	36.70	929/4,745	45,997	1.5	695.2	695.2	695.2	0.0
B	37.29	1,608/5,466	63,757	1.1	696.1	696.1	696.1	0.0
C	38.02	179/4,767	54,758	1.2	696.9	696.9	696.9	0.0
D	38.56	0[3]/5,667	73,017	0.9	697.4	697.4	697.4	0.0
E	39.57	0[3]/5,278	66,110	1.0	697.9	697.9	697.9	0.0
F	40.48	0[3]/6,590	40,007	1.7	699.5	699.5	699.5	0.0
G	42.02	0[3]/4,941	42,801	1.6	701.5	701.5	701.5	0.0
H	42.70	797/4,863	36,915	1.8	704.0	704.0	704.0	0.0

[1]Miles above outlet to the Mississippi River
[2]Width within La Crosse County/Total Width
[3]Cross-sections lie entirely outside of La Crosse County

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

BLACK RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BLACK RIVER – LA CROSSE								
A	0.24	949	22,354	1.8	643.4	643.4	643.4	0.0
B	0.60	619	15,781	2.5	643.4	643.4	643.4	0.0
C	0.80	695	12,371	3.2	643.5	643.5	643.5	0.0
D	0.96	864	17,664	2.2	643.6	643.6	643.6	0.0
E	1.00	870	16,725	2.4	643.6	643.6	643.6	0.0
F	1.45	2,055	48,147	0.8	643.7	643.7	643.7	0.0
G	1.71	1,138	20,668	1.9	643.7	643.7	643.7	0.0
H	1.77	1,245	22,829	1.7	643.7	643.7	643.7	0.0
I	2.07	2,040	39,631	1.0	643.8	643.8	643.8	0.0
J	2.67	1,988	36,848	1.1	643.8	643.8	643.8	0.0
K	3.11	2,528	47,155	0.8	643.8	643.8	643.8	0.0
L	3.24	1,462	25,989	1.5	643.8	643.8	643.8	0.0
M	3.30	734	14,753	2.7	643.8	643.8	643.8	0.0
N	3.37	688	13,646	2.9	643.8	643.8	643.8	0.0
O	3.52	2,357	30,220	1.3	644.0	644.0	644.0	0.0
P	4.03	1,031	16,324	2.4	644.1	644.1	644.1	0.0
Q	4.79	1,244	18,264	2.2	644.6	644.6	644.6	0.0
R	4.87	817	12,422	3.2	644.6	644.6	644.6	0.0

[1]Miles above outlet to the Mississippi River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

BLACK RIVER – LA CROSSE

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BLACK RIVER – LA CROSSE (CONTINUED)								
S	4.92	751	10,118	3.9	646.1	646.1	646.1	0.0
T	4.98	1,063	17,187	2.3	646.3	646.3	646.3	0.0
U	5.01	1,134	17,836	2.2	646.4	646.4	646.4	0.0
V	5.04	1,221	19,320	2.0	646.4	646.4	646.4	0.0
W	5.37	1,798	25,170	1.6	646.5	646.5	646.5	0.0
X	5.86	3,253	47,857	0.8	646.6	646.6	646.6	0.0
Y	6.47	6,649	79,035	0.5	646.6	646.6	646.6	0.0
Z	7.06	6,152	76,438	0.5	646.6	646.6	646.6	0.0
AA	7.58	5,971	81,729	0.5	646.6	646.6	646.6	0.0

[1] Miles above outlet to the Mississippi River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

BLACK RIVER – LA CROSSE

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOSTWICK CREEK									
A	1,996	714	6,662	1.3	0	676.3	676.3	676.3	0.0
B	5,078	719	5,997	1.5	654	681.6	681.6	681.6	0.0
C	7,825	552	3,030	2.7	0	682.9	682.9	682.9	0.0
D	10,718	77	780	10.5	166	685.7	685.7	685.7	0.0
E	10,818	154	1,830	4.4	258	687.2	687.2	687.2	0.0
F	11,991	511	2,353	3.4	0	689.8	689.8	689.8	0.0
G	15,630	175	1,147	7.1	43	694.2	694.2	694.2	0.0
H	18,818	126	782	10.4	0	701.7	701.7	701.7	0.0
I	21,977	620	3,765	1.8	29	707.4	707.4	707.4	0.0
J	25,370	252	1,062	6.3	0	713.7	713.7	713.7	0.0
K	26,196	338	5,352	1.2	317	716.3	716.3	716.3	0.0
L	30,586	441	1,002	6.6	54	720.1	720.1	720.1	0.0
M	34,255	378	2,197	3.0	0	728.7	728.7	728.7	0.0
N	37,324	279	949	7.0	0	733.3	733.3	733.3	0.0
O	39,842	95	904	7.4	0	740.1	740.1	740.1	0.0
P	44,366	569	995	4.9	0	751.8	751.8	751.8	0.0
Q	46,324	464	1,588	3.1	286	757.3	757.3	757.3	0.0
R	49,486	759	1,214	4.0	38	768.0	768.0	768.0	0.0

[1]Feet above outlet to the La Crosse River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

BOSTWICK CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOSTWICK CREEK (CONTINUED)									
S	52,164	73	497	9.8	0	779.5	779.5	779.5	0.0

[1]Feet above outlet to the La Crosse River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

BOSTWICK CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
DUTCH CREEK									
A	1,561	605	1,647	2.5	0	716.3	715.9[2]	715.9[2]	0.0
B	2,004	375	1,534	2.7	0	717.3	717.3	717.3	0.0
C	2,498	264	1,229	3.3	60	718.5	718.5	718.5	0.0
D	2,978	71	564	7.3	0	720.2	720.2	720.2	0.0
E	3,542	38	403	10.2	0	722.0	722.0	722.0	0.0
F	4,608	38	334	12.3	0	726.2	726.2	726.2	0.0
G	6,354	131	523	7.8	0	732.0	732.0	732.0	0.0
H	8,140	84	1,013	4.1	0	737.0	737.0	737.0	0.0
I	9,669	236	1,655	2.5	114	739.9	739.9	739.9	0.0

[1]Feet above outlet to the La Crosse River
[2]Elevation computed without consideration of backwater effects from La Crosse River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

DUTCH CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
EBNER COULEE MAIN CHANNEL								
A	1,238	20	58	4.2	658.7	658.7	658.7	0.0
B	2,547	12	34	8.4	664.6	664.6	664.6	0.0
C	3,022	20	66	4.6	668.5	668.5	668.5	0.0
D	3,138	33	122	2.5	670.7	670.7	670.7	0.0
E	3,259	31	81	6.8	670.6	670.6	670.6	0.0
F	3,537	29	70	8.4	673.7	673.7	673.7	0.0
G	3,655	25	86	9.8	676.4	676.4	676.4	0.0
H	3,737	26	110	10.0	678.3	678.3	678.3	0.0

[1]Feet above Farnam Street

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

EBNER COULEE MAIN CHANNEL

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
EBNER COULEE SOUTHEAST BANK								
A	1,260	160	493	1.7	659.6	659.6	659.6	0.0
B	1,568	93	149	5.6	659.7	659.7	659.7	0.0
C	1,797	83	151	5.5	660.5	660.5	660.5	0.0
D	2,073	88	175	4.8	661.6	661.6	661.6	0.0
E	2,243	80	141	5.9	662.4	662.4	662.4	0.0
F	2,702	90	163	5.0	664.7	664.7	664.7	0.0
G	3,010	92/185[2]	104	5.3	665.9	665.9	665.9	0.0
H	3,191	154/282[2]	136	4.0	667.9	667.9	667.9	0.0
I	3,251	144/277[2]	125	4.3	669.7	669.7	669.7	0.0
J	3,358	142/154[2]	100	2.8	671.0	671.0	671.0	0.0
K	3,457	51/67[2]	15	1.4	673.2	673.2	673.2	0.0

[1]Feet above Farnam Street
[2]Includes portion of floodway due to overflow from Ebner Coulee Main Channel

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

EBNER COULEE SOUTHEAST BANK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
FLEMING CREEK									
A	5,473	322	929	9.1	0	696.9	696.9	696.9	0.0
B	12,674	830	3,597	2.4	0	705.3	705.3	705.3	0.0
C	18,808	811	2,632	3.2	79	712.3	712.3	712.3	0.0
D	19,517	112	691	12.2	0	715.2	715.2	715.2	0.0
E	22,745	582	3,712	2.3	49	723.2	723.2	723.2	0.0
F	28,487	278	1,011	8.4	0	729.2	729.2	729.2	0.0
G	32,033	429	2,543	3.3	0	739.8	739.8	739.8	0.0
H	34,278	133	1,654	3.9	258	743.7	743.7	743.7	0.0
I	35,004	438	2,412	2.7	0	744.6	744.6	744.6	0.0
J	38,802	297	914	7.1	0	751.0	751.0	751.0	0.0
K	48,185	71	759	8.5	0	773.2	773.2	773.2	0.0
L	60,592	883	2,269	2.9	0	799.0	799.0	799.0	0.0
M	64,914	757	1,209	3.4	0	808.1	808.1	808.1	0.0
N	71,451	41	334	12.2	0	830.1	830.1	830.1	0.0
O	73,069	413	1,295	3.1	0	838.0	838.0	838.0	0.0
P	77,046	624	529	4.4	0	856.8	856.8	856.8	0.0
Q	85,780	48	210	11.1	0	915.7	915.7	915.7	0.0
R	89,219	33	226	10.3	35	952.7	952.7	952.7	0.0

[1]Feet above outlet to the Black River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

FLEMING CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
GREEN COULEE									
A	6,891	318	2,109	0.3	58	710.9	710.9	710.9	0.0
B	7,326	216	1,744	0.4	118	710.9	710.9	710.9	0.0
C	7,653	103	415	1.5	33	711.0	711.0	711.0	0.0
D	9,011	29	180	3.5	0	714.3	714.3	714.3	0.0

[1]Feet above outlet to the La Crosse River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

GREEN COULEE

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
JOHNS COULEE									
A	121	140	556	2.5	0	725.0	721.0[2]	721.0[2]	0.0
B	1,092	215	905	1.5	0	725.0	723.1[2]	723.1[2]	0.0
C	1,785	57	215	6.3	0	728.6	728.6	728.6	0.0
D	2,754	83	327	4.2	0	738.0	738.0	738.0	0.0
E	3,533	67	226	6.0	0	744.4	744.4	744.4	0.0
F	3,791	61	161	8.4	0	747.5	747.5	747.5	0.0
G	4,723	73	212	6.4	0	755.5	755.5	755.5	0.0
H	5,859	313	328	2.7	0	769.2	769.2	769.2	0.0
I	7,030	210	279	3.2	58	783.0	783.0	783.0	0.0
J	7,715	135	187	4.8	0	793.7	793.7	793.7	0.0
K	8,852	114	180	5.0	0	810.2	810.2	810.2	0.0
L	9,680	74	136	6.6	0	826.9	826.9	826.9	0.0

[1]Feet above outlet to Mormon Creek
[2]Elevation computed without consideration of backwater effects from Mormon Creek

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

JOHNS COULEE CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LA CROSSE RIVER									
A	2,513	278	2,866	3.3	0	643.6	643.6	643.6	0.0
B	2,721	201	2,549	3.7	0	643.9	643.9	643.9	0.0
C	3,061	263	3,111	3.1	36	644.0	644.0	644.0	0.0
D	3,399	316	3,205	3.0	44	644.1	644.1	644.1	0.0
E	3,890	503	4,740	2.0	27	644.4	644.4	644.4	0.0
F	4,793	805	6,162	1.4	0	644.6	644.6	644.6	0.0
G	6,471	812	6,391	1.3	0	645.0	645.0	645.0	0.0
H	7,235	710	5,433	1.6	0	645.3	645.3	645.3	0.0
I	8,452	630	4,684	1.8	0	645.5	645.5	645.5	0.0
J	8,845	192	2,809	3.0	0	645.8	645.8	645.8	0.0
K	9,451	660	7,109	1.2	0	646.0	646.0	646.0	0.0
L	9,942	1,326	14,083	0.7	0	646.1	646.1	646.1	0.0
M	10,842	2,326	23,892	0.4	0	646.1	646.1	646.1	0.0
N	12,186	3,423	32,814	0.3	0	646.1	646.1	646.1	0.0
O	14,482	2,645	20,995	0.5	0	646.1	646.1	646.1	0.0
P	15,619	2,403	11,990	0.8	0	646.2	646.2	646.2	0.0
Q	16,068	856	5,239	1.8	0	646.2	646.2	646.2	0.0
R	16,224	1,271	6,382	1.5	0	646.6	646.6	646.6	0.0

[1]Feet above outlet to the Mississippi River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

LA CROSSE RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LA CROSSE RIVER (CONTINUED)									
S	16,668	3,735	25,003	0.4	0	646.8	646.8	646.8	0.0
T	17,330	3,617	27,358	0.4	33	646.8	646.8	646.8	0.0
U	19,052	2,735	19,633	0.5	0	646.8	646.8	646.8	0.0
V	20,057	2,340	16,680	0.6	0	646.8	646.8	646.8	0.0
W	21,366	770	3,498	1.3	0	646.9	646.9	646.9	0.0
X	22,593	146	1,492	3.0	72	647.2	647.2	647.2	0.0
Y	22,809	250	1,267	3.5	0	647.5	647.5	647.5	0.0
Z	23,191	1,648	9,623	1.0	0	648.2	648.2	648.2	0.0
AA	23,911	551	9,579	1.0	0	648.3	648.3	648.3	0.0
AB	25,027	395	1,910	2.9	0	648.8	648.8	648.8	0.0
AC	25,676	405	1,665	3.3	0	649.4	649.4	649.4	0.0
AD	26,246	270	1,416	3.5	0	650.2	650.2	650.2	0.0
AE	26,864	657	2,133	2.3	0	650.7	650.7	650.7	0.0
AF	27,361	372	2,006	2.5	0	650.8	650.8	650.8	0.0
AG	27,795	489	2,264	2.2	0	651.1	651.1	651.1	0.0
AH	28,475	200	1,041	4.8	0	651.2	651.2	651.2	0.0
AI	28,889	125	909	5.4	0	651.8	651.8	651.8	0.0
AJ	29,301	123	971	5.1	0	652.5	652.5	652.5	0.0

[1]Feet above outlet to the Mississippi River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

LA CROSSE RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LA CROSSE RIVER (CONTINUED)									
AK	29,435	146	1,077	4.6	0	653.0	653.0	653.0	0.0
AL	29,524	147	1,027	4.8	0	653.0	653.0	653.0	0.0
AM	30,026	415	2,062	4.4	0	654.1	654.1	654.1	0.0
AN	30,742	490	3,070	3.0	0	655.0	655.0	655.0	0.0
AO	30,987	398	2,545	3.7	218	655.4	655.4	655.4	0.0
AP	32,380	563	3,763	2.5	131	657.0	657.0	657.0	0.0
AQ	37,320	1,681	9,781	1.0	0	657.9	657.9	657.9	0.0
AR	40,029	2,741	14,108	0.7	0	658.3	658.3	658.3	0.0
AS	49,528	2,167	7,751	1.2	0	663.4	663.4	663.4	0.0
AT	56,728	1,171	7,258	1.3	0	666.5	666.5	666.5	0.0
AU	58,235	1,470	8,976	1.1	0	667.3	667.3	667.3	0.0
AV	63,969	829	5,655	1.5	0	672.7	672.7	672.7	0.0
AW	69,892	2,485	8,848	1.0	0	675.5	675.5	675.5	0.0
AX	76,587	149	1,570	5.5	103	680.4	680.4	680.4	0.0
AY	81,228	222	2,058	4.2	0	686.1	686.1	686.1	0.0
AZ	89,394	193	2,182	3.9	0	691.9	691.9	691.9	0.0
BA	92,752	554	4,892	1.8	0	693.5	693.5	693.5	0.0
BB	125,273	2,598	7,679	1.1	58	711.8	711.8	711.8	0.0

[1]Feet above outlet to the Mississippi River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

LA CROSSE RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LA CROSSE RIVER (CONTINUED)									
BC	128,194	1,200	4,790	1.8	0	714.7	714.7	714.7	0.0
BD	129,898	600	3,796	2.3	0	716.3	716.3	716.3	0.0
BE	131,683	1,787	12,616	0.7	1,018	717.0	717.0	717.0	0.0
BF	135,130	2,579	9,394	0.9	0	718.1	718.1	718.1	0.0

[1]Feet above outlet to the Mississippi River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

LA CROSSE RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LA CROSSE RIVER RIGHT OVERBANK 1								
A	15	1,550	6,862	0.6	648.3	648.3	648.3	0.0
B	485	819	2,771	1.5	648.3	648.3	648.3	0.0
C	787	1,328	4,096	1.0	649.0	649.0	649.0	0.0
D	2,082	1,000	4,237	1.0	649.2	649.2	649.2	0.0
E	3,083	1,090	3,934	1.0	649.3	649.3	649.3	0.0
F	3,821	1,175	4,068	1.0	649.5	649.5	649.5	0.0
G	4,839	618	1,604	2.5	649.8	649.8	649.8	0.0
H	5,438	234	852	4.7	650.8	650.8	650.8	0.0
I	5,659	217	1,342	3.0	652.4	652.4	652.4	0.0
J	6,848	840	4,501	0.9	652.9	652.9	652.9	0.0
K	7,520	910	4,202	1.0	653.1	653.1	653.1	0.0
L	8,099	695	2,758	1.5	653.3	653.3	653.3	0.0

[1]Feet above confluence with the La Crosse River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

LA CROSSE RIVER RIGHT OVERBANK 1

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LA CROSSE RIVER RIGHT OVERBANK 2								
A	649	770	5,089	1.0	646.9	646.9	646.9	0.0
B	1,421	151	1,279	4.0	647.0	647.0	647.0	0.0
C	1,661	270	2,198	2.3	648.1	648.1	648.1	0.0
LA CROSSE RIVER RAILROAD DITCH								
A	1,210	72	229	2.4	651.9	651.9	651.9	0.0
B	1,363	75	194	2.8	652.8	652.8	652.8	0.0

[1]Feet above confluence with the La Crosse River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

LA CROSSE RIVER RIGHT OVERBANK 2 - LA CROSSE RIVER RAILROAD DITCH

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MISSISSIPPI RIVER								
A	691.30	11,967/18,176	160,421	1.5	639.0	639.0	639.0	0.0
B	691.42	13,781/17,995	159,178	1.6	639.1	639.1	639.1	0.0
C	691.81	14,052/18,526	167,813	1.5	639.3	639.3	639.3	0.0
D	692.22	13,776/18,808	169,841	1.5	639.4	639.4	639.4	0.0
E	692.64	13,874/20,382	183,287	1.4	639.6	639.6	639.6	0.0
F	692.96	12,909/20,038	186,554	1.3	639.7	639.7	639.7	0.0
G	693.24	11,928/19,486	179,784	1.4	639.8	639.8	639.8	0.0
H	693.53	10,782/18,766	163,368	1.5	640.0	640.0	640.0	0.0
I	693.99	8,412/18,633	153,899	1.6	640.3	640.3	640.3	0.0
J	694.32	6,522/18,316	157,847	1.6	640.5	640.5	640.5	0.0
K	694.74	4,720/16,837	145,503	1.7	640.8	640.8	640.8	0.0
L	695.12	3,141/14,995	142,214	1.7	640.9	640.9	640.9	0.0
M	695.61	1,800/13,173	132,957	1.8	641.2	641.2	641.2	0.0
N	696.03	692/11,713	119,900	2.0	641.5	641.5	641.5	0.0
O	696.20	723/10,038	112,562	2.2	641.6	641.6	641.6	0.0
P	696.34	873/9,875	120,590	2.0	641.8	641.8	641.8	0.0
Q	696.56	1,248/9,866	124,548	2.0	642.0	642.0	642.0	0.0
R	696.75	1,249/9,401	123,728	2.0	642.2	642.2	642.2	0.0

[1]Miles above confluence with the Ohio River
[2]Width within La Crosse County/Total Width

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MISSISSIPPI RIVER (CONTINUED)								
S	696.94	1,735/9,059	125,236	2.0	642.3	642.3	642.3	0.0
T	697.22	2,706/8,898	123,908	2.0	642.5	642.5	642.5	0.0
U	697.38	2,670/7,374	102,073	2.4	642.6	642.6	642.6	0.0
V	697.42	3,141/4,490	66,132	3.7	642.7	642.7	642.7	0.0
W	697.47	1,972/2,334	51,890	4.7	642.8	642.8	642.8	0.0
X	697.52	1,865/2,233	46,206	5.3	642.8	642.8	642.8	0.0
Y	698.37	4,175/4,578	62,116	3.3	643.6	643.6	643.6	0.0
Z	699.06	4,735/5,132	61,623	3.3	644.2	644.2	644.2	0.0
AA	699.36	3,942/4,722	83,513	2.5	644.5	644.5	644.5	0.0
AB	699.74	1,720/3,048	64,843	3.2	644.5	644.5	644.5	0.0
AC	699.80	1,499/2,783	58,690	3.5	644.6	644.6	644.6	0.0
AD	700.06	3,164/5,582	85,064	2.4	644.8	644.8	644.8	0.0
AE	700.17	3,461/6,028	92,548	2.2	644.8	644.8	644.8	0.0
AF	700.22	3,681/6,321	95,707	2.1	644.8	644.8	644.8	0.0
AG	700.37	4,574/7,451	109,626	1.9	645.0	645.0	645.0	0.0
AH	700.85	4,755/7,766	115,242	1.8	645.1	645.1	645.1	0.0
AI	701.28	5,390/6,205	102,288	2.0	645.3	645.3	645.3	0.0

[1]Miles above confluence with the Ohio River
[2]Width within La Crosse County/Total Width

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MISSISSIPPI RIVER (CONTINUED)								
AJ	701.66	7,067/8,358	97,187	2.1	645.4	645.4	645.4	0.0
AK	701.76	6,956/7,697	67,784	3.0	645.3	645.3	645.3	0.0
AL	701.82	7,211/7,737	66,015	3.1	645.3	645.3	645.3	0.0
AM	701.93	7,477/8,128	124,784	1.6	645.5	645.5	645.5	0.0
AN	702.17	7,408/7,685	120,711	1.7	645.5	645.5	645.5	0.0
AO	702.32	6,999/8,345	90,565	2.3	645.6	645.6	645.6	0.0
AP	702.47	6,056/7,048	45,364	4.5	645.5	645.5	645.5	0.0
AQ	702.51	6,105/7,018	42,709	4.8	645.8	645.8	645.8	0.0
AR	702.57	6,511/7,255	79,622	2.6	646.2	646.2	646.2	0.0
AS	702.61	6,990/7,755	122,040	1.7	646.3	646.3	646.3	0.0
AT	702.97	8,905/10,222	143,206	1.4	646.4	646.4	646.4	0.0
AU	703.25	10,740/12,769	177,320	1.2	646.5	646.5	646.5	0.0
AV	703.54	11,588/14,149	182,479	1.1	646.5	646.5	646.5	0.0
AW	703.73	12,764/15,599	201,582	1.0	646.6	646.6	646.6	0.0
AX	703.82	12,712/15,738	202,884	1.0	646.6	646.6	646.6	0.0
AY	703.92	12,089/15,321	192,938	1.1	646.6	646.6	646.6	0.0
AZ	704.03	14,769/18,135	225,922	1.1	646.6	646.6	646.6	0.0

[1]Miles above confluence with the Ohio River
[2]Width within La Crosse County/Total Width

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MISSISSIPPI RIVER (CONTINUED)								
BA	704.56	14,641/18,058	220,694	1.1	646.7	646.7	646.7	0.0
BB	705.09	14,537/16,612	198,058	1.2	646.8	646.8	646.8	0.0
BC	705.73	14,024/14,754	171,621	1.4	646.9	646.9	646.9	0.0
BD	706.22	12,925/14,408	182,118	1.3	647.1	647.1	647.1	0.0
BE	706.64	12,318/14,012	165,180	1.5	647.2	647.2	647.2	0.0
BF	707.13	12,666/13,340	147,568	1.7	647.4	647.4	647.4	0.0
BG	707.23	12,457/12,973	146,954	1.7	647.4	647.4	647.4	0.0
BH	708.00	11,242/11,751	133,894	1.8	647.7	647.7	647.7	0.0
BI	708.70	9,585/11,010	117,012	2.1	648.0	648.0	648.0	0.0
BJ	709.08	9,773/11,226	111,420	2.2	648.2	648.2	648.2	0.0
BK	709.58	9,610/11,054	120,087	2.0	648.6	648.6	648.6	0.0
BL	710.15	9,102/10,411	124,206	1.9	648.9	648.9	648.9	0.0
BM	710.81	9,517/10,065	114,391	2.1	649.3	649.3	649.3	0.0
BN	711.30	9,994/10,641	128,216	1.9	649.7	649.7	649.7	0.0
BO	711.72	7,581/10,344	125,664	1.9	649.9	649.9	649.9	0.0
BP	712.26	4,155/8,720	111,027	2.2	650.2	650.2	650.2	0.0
BQ	712.75	1,612/7,393	93,186	2.6	650.5	650.5	650.5	0.0

[1]Miles above confluence with the Ohio River
[2]Width within La Crosse County/Total Width

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MORMON CREEK									
A	5,431	994	3,825	3.1	93	647.8	647.8	647.8	0.0
B	6,977	605	2,289	5.2	0	651.9	651.9	651.9	0.0
C	8,098	484	2,139	5.5	0	655.0	655.0	655.0	0.0
D	9,393	370	2,261	5.2	0	657.3	657.3	657.3	0.0
E	11,137	447	2,692	4.3	0	660.8	660.8	660.8	0.0
F	12,412	500	3,061	3.8	0	662.2	662.2	662.2	0.0
G	14,941	426	2,705	4.1	0	672.3	672.3	672.3	0.0
H	16,090	385	2,205	5.1	0	673.3	673.3	673.3	0.0
I	17,005	423	2,220	4.9	0	674.3	674.3	674.3	0.0
J	18,892	460	2,159	5.1	0	678.8	678.8	678.8	0.0
K	20,459	258	1,774	6.2	0	681.4	681.4	681.4	0.0
L	21,765	402	2,543	4.3	0	683.1	683.1	683.1	0.0
M	23,358	387	1,848	5.9	0	685.5	685.5	685.5	0.0
N	24,527	393	2,355	4.7	0	688.4	688.4	688.4	0.0
O	25,812	427	2,480	4.3	0	691.0	691.0	691.0	0.0
P	27,296	400	2,201	4.8	0	693.3	693.3	693.3	0.0
Q	29,084	495	3,009	3.5	0	696.5	696.5	696.5	0.0
R	31,515	685	4,100	2.5	0	703.6	703.6	703.6	0.0

[1]Feet above outlet to the Mississippi River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

MORMON CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MORMON CREEK (CONTINUED)									
S	32,838	391	1,551	6.5	0	704.4	704.4	704.4	0.0
T	34,144	440	2,436	4.1	0	708.5	708.5	708.5	0.0
U	35,606	446	2,012	4.8	0	711.0	711.0	711.0	0.0
V	36,658	218	1,966	5.0	91	713.5	713.5	713.5	0.0
W	38,505	366	3,148	3.0	0	716.9	716.9	716.9	0.0
X	40,494	231	2,337	3.8	70	720.2	720.2	720.2	0.0
Y	41,583	329	3,048	2.9	68	721.1	721.1	721.1	0.0
Z	43,039	327	2,163	4.0	0	722.6	722.6	722.6	0.0
AA	44,789	107	945	8.0	0	725.9	725.9	725.9	0.0
AB	46,219	153	1,387	5.5	35	728.9	728.9	728.9	0.0
AC	48,028	100	984	7.7	26	732.3	732.3	732.3	0.0
AD	49,452	263	2,074	3.6	0	734.7	734.7	734.7	0.0
AE	50,656	177	1,148	6.6	0	736.5	736.5	736.5	0.0
AF	52,046	102	862	8.3	0	740.2	740.2	740.2	0.0
AG	53,791	98	949	7.6	0	744.1	744.1	744.1	0.0
AH	54,902	129	1,327	5.1	0	745.8	745.8	745.8	0.0
AI	56,491	90	896	7.6	0	750.9	750.9	750.9	0.0

[1]Feet above outlet to the Mississippi River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

MORMON CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MORMON CREEK (CONTINUED)									
AJ	57,352	86	865	7.8	0	752.9	752.9	752.9	0.0
AK	58,998	112	1,117	6.1	0	756.3	756.3	756.3	0.0
AL	60,374	76	515	11.3	0	760.5	760.5	760.5	0.0

[1]Feet above outlet to the Mississippi River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

MORMON CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SAND LAKE COULEE									
A	2,798	29	128	1.6	0	652.1	652.1	652.1	0.0
B	3,341	41	70	3.0	0	654.2	654.2	654.2	0.0
C	3,723	37	68	3.1	0	656.4	656.4	656.4	0.0
D	4,347	75	163	5.0	0	662.8	662.8	662.8	0.0
E	4,885	73	236	3.5	0	667.5	667.5	667.5	0.0
F	5,335	41	134	6.1	0	670.5	670.5	670.5	0.0
G	5,695	66	250	3.3	0	673.0	673.0	673.0	0.0
H	6,594	148	181	4.5	0	678.2	678.2	678.2	0.0
I	7,692	132	298	2.8	44	686.6	686.6	686.6	0.0
J	8,658	72	272	3.0	0	692.3	692.3	692.3	0.0
K	9,274	46	123	6.7	0	696.1	696.1	696.1	0.0
L	10,129	29	104	2.2	0	700.8	700.8	700.8	0.0
M	10,474	31	92	2.5	0	701.5	701.5	701.5	0.0
N	11,064	46	111	2.1	0	702.1	702.1	702.1	0.0
O	11,315	40	78	2.9	0	702.3	702.3	702.3	0.0
P	11,827	44	111	2.1	0	703.7	703.7	703.7	0.0
Q	12,325	21	60	3.8	0	705.1	705.1	705.1	0.0
R	12,907	30	100	2.3	0	707.2	707.2	707.2	0.0

[1]Feet above outlet to Halfway Creek

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

SAND LAKE COULEE

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SAND LAKE COULEE (CONTINUED)									
S	13,317	42	137	1.7	0	707.8	707.8	707.8	0.0
T	14,045	29	96	2.6	0	709.0	709.0	709.0	0.0
U	14,252	36	140	1.8	0	709.5	709.5	709.5	0.0
V	14,989	30	90	2.7	0	710.7	710.7	710.7	0.0
W	15,619	36	114	2.6	0	712.4	712.4	712.4	0.0
X	16,391	25	108	2.7	0	714.3	714.3	714.3	0.0
Y	17,192	37	140	3.7	0	717.0	717.0	717.0	0.0
Z	17,693	245	712	0.9	0	718.9	718.9	718.9	0.0
AA	18,236	269	736	2.7	0	719.0	719.0	719.0	0.0
AB	18,373	447	2,937	0.7	382	721.0	721.0	721.0	0.0
AC	19,076	412	939	2.1	0	721.0	721.0	721.0	0.0
AD	19,722	305	504	3.9	0	723.0	723.0	723.0	0.0
AE	20,645	185	383	3.7	0	728.3	728.3	728.3	0.0
AF	21,158	79	225	6.3	0	731.0	731.0	731.0	0.0
AG	21,312	426	1,772	0.8	0	736.0	736.0	736.0	0.0
AH	21,773	399	1,032	1.4	0	736.1	736.1	736.1	0.0
AI	22,307	135	365	3.9	0	736.6	736.6	736.6	0.0

[1]Feet above outlet to Halfway Creek

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

SAND LAKE COULEE

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SAND LAKE COULEE (CONTINUED)									
AJ	22,833	118	441	3.2	0	738.8	738.8	738.8	0.0
AK	23,354	38	118	4.7	0	739.8	739.8	739.8	0.0
AL	24,054	76	881	0.4	415	752.2	752.2	752.2	0.0
AM	24,857	54	79	4.0	0	757.2	757.2	757.2	0.0
AN	25,601	7	57	5.6	43	770.2	770.2	770.2	0.0

[1]Feet above outlet to Halfway Creek

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

SAND LAKE COULEE

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SAND LAKE COULEE RIGHT OVERBANK - MIDWAY									
A	246	120	253	2.4	0	651.6	651.6	651.6	0.0
B	426	125	240	2.5	0	652.2	652.2	652.2	0.0
C	652	125	246	2.5	0	652.5	652.5	652.5	0.0
D	724	105	139	4.4	0	652.5	652.5	652.5	0.0
E	811	112	153	4.0	0	653.3	653.3	653.3	0.0
F	1,032	119	227	2.7	27	655.3	655.3	655.3	0.0
G	1,188	111	149	4.1	31	656.7	656.7	656.7	0.0
H	1,495	142	307	2.0	0	659.2	659.2	659.2	0.0

[1]Feet above confluence with Sand Lake Coulee

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

SAND LAKE COULEE RIGHT OVERBANK - MIDWAY

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SMITH VALLEY CREEK									
A	1,304	91	474	4.0	0	663.0	663.0	663.0	0.0
B	2,884	341	870	2.2	0	668.5	668.5	668.5	0.0
C	3,938	79	582	3.2	0	674.6	674.6	674.6	0.0
D	4,625	193	498	3.7	0	675.5	675.5	675.5	0.0
E	5,866	48	614	2.7	0	678.6	678.6	678.6	0.0
F	7,013	238	558	3.0	0	683.7	683.7	683.7	0.0
G	7,559	277	513	3.2	0	686.1	686.1	686.1	0.0
H	8,909	172	442	3.6	66	691.1	691.1	691.1	0.0
I	9,580	84	345	4.6	0	693.6	693.6	693.6	0.0
J	11,127	175	443	2.1	0	699.0	699.0	699.0	0.0
K	12,035	80	167	5.7	0	703.6	703.6	703.6	0.0
L	13,520	116	353	2.6	76	713.5	713.5	713.5	0.0
M	15,315	71	333	2.6	102	726.2	726.2	726.2	0.0
N	16,361	111	356	2.3	125	736.5	736.5	736.5	0.0
O	17,427	40	178	4.4	0	751.0	751.0	751.0	0.0
P	17,621	48	192	4.1	0	753.2	753.2	753.2	0.0
Q	18,706	31	114	5.3	0	768.8	768.8	768.8	0.0
R	19,428	51	296	1.8	0	780.0	780.0	780.0	0.0

[1]Feet above outlet to the La Crosse River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

SMITH VALLEY CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SMITH VALLEY CREEK (CONTINUED)									
S	20,289	34	97	4.7	0	787.3	787.3	787.3	0.0
T	21,628	138	155	3.0	0	814.0	814.0	814.0	0.0

[1]Feet above outlet to the La Crosse River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

SMITH VALLEY CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
STATE ROAD COULEE									
A	17,859	110	1,083	3.9	52	686.5	686.5	686.5	0.0
B	18,809	134	572	6.5	0	694.7	694.7	694.7	0.0
C	20,551	104	724	5.2	0	701.0	701.0	701.0	0.0
D	22,002	36	245	11.6	0	713.7	713.7	713.7	0.0
E	23,839	75	261	10.9	43	723.3	723.3	723.3	0.0
F	24,854	139	1,233	2.3	172	741.7	741.7	741.7	0.0
G	25,573	279	533	2.4	0	750.2	750.2	750.2	0.0
H	26,271	228	329	4.2	0	758.2	758.2	758.2	0.0
I	27,446	97	187	7.1	0	777.4	777.4	777.4	0.0
J	29,203	34	50	7.3	0	813.2	813.2	813.2	0.0
K	30,018	21	44	6.3	0	850.4	850.4	850.4	0.0

[1]Feet above outlet to the Mississippi River

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

STATE ROAD COULEE

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
TRIBUTARY A									
A	375[1]	49	136	7.0	0	744.4	744.4	744.4	0.0
B	556[1]	103	275	3.5	50	753.0	753.0	753.0	0.0
C	803[1]	55	227	3.8	0	757.7	757.7	757.7	0.0
D	1,276[1]	74	110	7.4	0	765.5	765.5	765.5	0.0
TRIBUTARY B									
A	207[2]	117	203	0.3	119	753.6	753.6	753.6	0.0
B	563[2]	225	172	0.4	291	755.0	755.0	755.0	0.0
UPPER BOMA COULEE									
A	402[1]	253	194	4.3	0	801.2	801.2	801.2	0.0
B	1,085[1]	125	101	8.2	0	820.1	820.1	820.1	0.0

[1]Feet above outlet to State Road Coulee
[2]Feet above outlet to Tributary A

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI AND INCORPORATED AREAS

FLOODWAY DATA

TRIBUTARY A – TRIBUTARY B UPPER BOMA COULEE

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the WSEL of the 1-percent-annual-chance flood. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

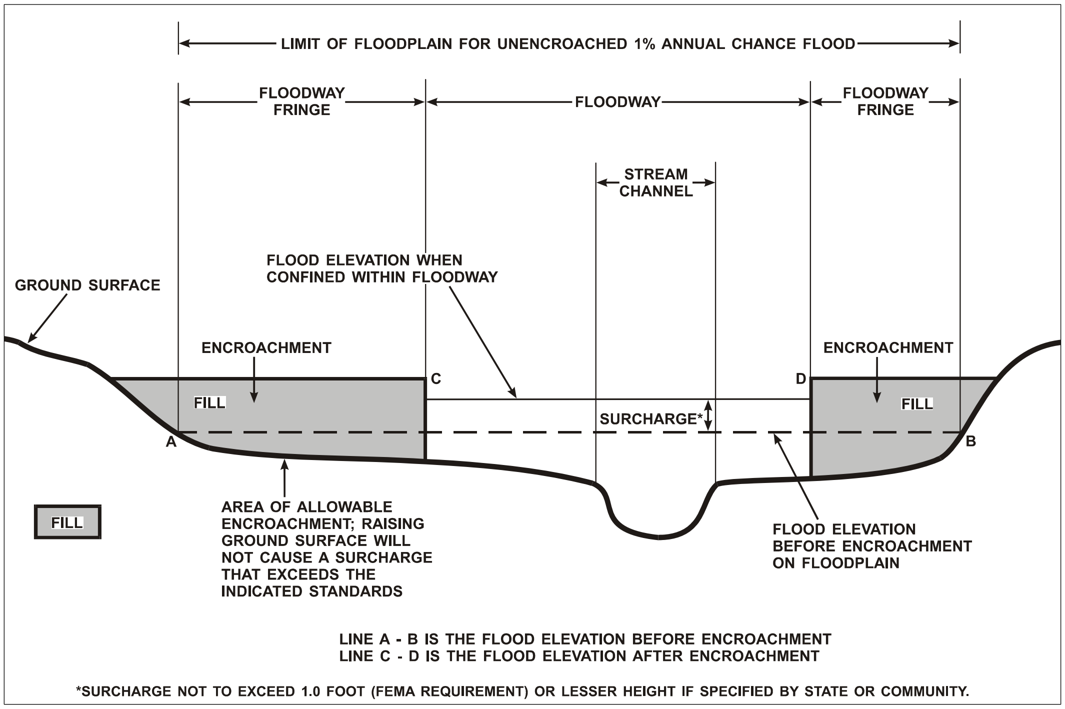

Figure 4 - Floodway Schematic

5.0 INSURANCE APPLICATIONS

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

Zone A

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

Zone AE

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

Zone AH

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

Zone AO

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

Zone X

Zone X is the flood insurance risk zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by levees. No BFEs or base flood depths are shown within this zone.

Zone X (Future Base Flood)

Zone X (Future Base Flood) is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined based on future-conditions hydrology. No BFEs or base flood depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

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

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

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	FIRM EFFECTIVE DATE	FIRM REVISION DATE
Bangor, Village of	January 16, 1974	July 30, 1976	January 2, 1981	None
Holmen, Village of	May 17, 1974	May 14, 1976	April 20, 1979	None
La Crosse, City of	January 15, 1971	July 1, 1974	May 14, 1976	None
La Crosse County (Unincorporated Areas)	March 15, 1984	None	March 15, 1984	None
Onalaska, City of	December 28, 1973	May 28, 1976	September 16, 1981	None
Rockland, Village of	April 2, 2008	None	April 2, 2008	None
West Salem, Village of	April 3, 1981	None	December 15, 1982	None

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

LA CROSSE COUNTY, WI
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The countywide FIRM presents flooding information for the entire geographic area of La Crosse County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 8, "Community Map History."

7.0 OTHER STUDIES

FISs have been prepared for the following counties in Wisconsin: Vernon (FEMA, 1990), Monroe (FEMA, 2010), Trempealeau (U.S. Department of Housing and Urban Development, Flood Insurance Rate Map, Trempealeau County), and Jackson (FEMA, 1994). FISs have also been prepared for Houston (FEMA, 2001) and Winona counties (FEMA, 1983) in Minnesota.

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

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Federal Insurance and Mitigation Division, 536 South Clark Street, Sixth Floor, Chicago, Illinois 60605.

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