

FLOOD INSURANCE STUDY



OZAUKEE COUNTY, WISCONSIN AND INCORPORATED AREAS VOLUME 1 OF 2

Community Name	Community Number
BAYSIDE, VILLAGE OF	550270
BELGIUM, VILLAGE OF	550311
CEDARBURG, CITY OF	550312
FREDONIA, VILLAGE OF	550313
GRAFTON, VILLAGE OF	550314
MEQUON, CITY OF	555564
NEWBERG, VILLAGE OF	550056
OZAUKEE COUNTY (UNINCORPORATED AREAS)	550310
PORT WASHINGTON, CITY OF	550316
SAUKVILLE, VILLAGE OF	550317
THEINSVILLE, VILLAGE OF	550318



Ozaukee County

Revised December 4, 2007



Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
55089CV001A

**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.

Effective Date: December 4, 2007

Revised Dates:

TABLE OF CONTENTS

1.0	INTRODUCTION	3
1.1	Purpose of Study	3
1.2	Authority and Acknowledgments	3
1.3	Coordination	3
2.0	AREA STUDIED	4
2.1	Scope of Study	4
2.2	Community Description.....	4
2.3	Principal Flood Problems.....	5
2.4	Flood Protection Measures	8
3.0	ENGINEERING METHODS	8
3.1	Hydrologic Analyses.....	8
3.2	Hydraulic Analyses.....	12
3.3	Vertical Datum.....	18
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	19
4.1	Floodplain Boundaries.....	20
4.2	Floodways.....	20
5.0	INSURANCE APPLICATIONS	74
6.0	FLOOD INSURANCE RATE MAP	74
7.0	OTHER STUDIES	75
8.0	LOCATION OF DATA	75
9.0	BIBLIOGRAPHY AND REFERENCES	77

FIGURES

Figure 1 – Transect Location Map.....	14
Figure 2 – Floodway Schematic	22

TABLES

Table 1 – Summary of Discharges.....	10-11
Table 2a – Summary of Stillwater Elevations	11
Table 2b – Transect Descriptions and Data	13
Table 3 – Manning’s “n” Roughness Coefficients.....	16-17
Table 4 – Floodway Data Tables	23-73
Table 5 – Community Map History	76

EXHIBITS

Exhibit 1 - Flood Profiles	
Canyon Creek	Panels 01-03P
Cedar Creek	Panels 04-11P
Fredonia Creek	Panels 12-15P
Milwaukee River	Panels 16-34P
Mineral Springs	Panels 35-38P
Mole Creek	Panels 39-42P
North Branch Milwaukee River	Panel 43P
Pigeon Creek	Panels 44-47P
Sauk Creek	Panels 48-61P
Ulaio Creek	Panels 62-70P
Unnamed Tributary No. 1 to the Belgium-Holland Drainage Ditch	Panels 71-72P
Unnamed Tributary No. 1 to the Belgium-Holland Drainage Ditch Overflow #1	Panel 73P
Unnamed Tributary No. 1 to the Belgium-Holland Drainage Ditch Overflow #2	Panel 74P
Unnamed Tributary No. 1 to the Milwaukee River	Panels 75-76P
Unnamed Tributary No. 1 to Ulaio Creek	Panels 77-78P
Unnamed Tributary to Unnamed Tributary No. 1 to Ulaio Creek	Panels 79-80P
Unnamed Tributary No. 2 to Pigeon Creek	Panels 81-83P
Unnamed Tributary No. 3 to the Milwaukee River	Panel 84P
Exhibit 2 - Flood Insurance Rate Map Index	
Flood Insurance Rate Map	

**FLOOD INSURANCE STUDY
OZAUKEE COUNTY, WISCONSIN, 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 Ozaukee County, including the Cities of Cedarburg, Mequon, and Port Washington; the Villages of Bayside, Belgium, Fredonia, Grafton, Newberg, Saukville, and Theinsville; and the unincorporated areas of Ozaukee County (referred to collectively herein as Ozaukee 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.

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.

The hydrologic and hydraulic analyses for this study were performed by Wisconsin Department of Natural Resources and its contractor(s), for the Federal Emergency Management Agency (FEMA), under Cooperating Technical Partner Agreement (CTP) Grants EMC-2003-GR-0023 (FY03) and EMC-2004-GR-0212 (FY04). This work was completed in October 2005.

The hydraulic and wave runup analysis for Lake Michigan were performed by Dewberry and Davis, and was completed in June 1996 for the December 6, 1999 Ozaukee County Flood Insurance Study (Reference 3)

1.3 Coordination

The initial Consultation Coordination Office (CCO) meeting was held on December 18, 2003, and attended by representatives of Ozaukee County, Wisconsin Department of Natural Resources (WDNR), the Southeastern Wisconsin Regional Planning Commission (SEWRPC), Belgium Township, City of Cedarburg, Cedarburg Township, Village of Fredonia, Fredonia Township, Village of Grafton, City of Mequon, City of Port Washington, Port Washington Township, Village of Saukville, and the Village of Theinsville. The purpose of an initial Consultation Coordination Officer (CCO) meeting is to

discuss the scope of the FIS. The results of the final scoping were reviewed and agreed upon at the second Consultation Coordination Officer [CCO] meeting held on April 27, 2004.

The results of the study were reviewed at the final CCO meeting held on April 27, 2006, and attended by representatives of Federal Emergency Management Agency (FEMA); SEWRPC; the Cities of Cedarburg, Mequon, and Port Washington; the Villages of Belgium, Fredonia, Grafton, Newberg, Saukville, and Theinsville; and WDNR. 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 Ozaukee 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 through April 2005.

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, Ozaukee County, the Wisconsin Department of Natural Resources, and Southeastern Wisconsin Regional Planning Commission.

2.2 Community Description

Ozaukee County is located in southeastern Wisconsin and is bordered on the east by Lake Michigan; on the south by the Villages of River Hills, Brown Deer, and Bayside; on the west by Washington County and the Village of Germantown; and on the north by Sheboygan County. Ozaukee County has a land area of 235 square miles. The county seat is the City of Port Washington, which is located 24 miles north of the City of Milwaukee. The 2000 population of Ozaukee County was 82,317 (Reference 1).

Ozaukee County is on a glacial drift plain of moderate relief depressed eastward toward Lake Michigan. Topography ranges from relatively flat in the south to undulating in the north. Bluffs as high as 100 feet exist along Lake Michigan shoreline in the southern half of the county, but diminish to steep banks less than 10 feet high in the northern half. A pattern of alternating parallel north-south belts of ground moraine and end moraine extends within the county. Most of the county is between 100 and 200 feet above the mean level of Lake Michigan. The soils in Ozaukee County are of glacial origin and are almost entirely silty loams of various associations. They are well drained to somewhat poorly drained and have a subsoil of silty clay loam and silty clay.

The unincorporated areas of Ozaukee County are predominately rural with much of the land devoted to agriculture. The incorporated areas of the southern half of the county are increasingly being developed commercially and residentially.

The climate in southeastern Wisconsin is characteristically continental with cold, snowy winters and short, mild summers.

2.3 Principal Flood Problems

Most flood damage within the study area has been caused by high stages on the Milwaukee River and Cedar Creek. North of Port Washington, where the bluffs are as far as 500 feet from the water's edge, flooding is possible from high lake stages and wave action. Numerous cottages are located between the bluffs and the lake. In October 1986, a record stage of 583.55 feet from the National Geodetic Datum of 1929 (NGVD) was established on Lake Michigan. This daily mean value was only 0.15 feet below the predicted 100-year instantaneous level of 583.55 feet NGVD29 at the time of the March 18, 1991 FIS (Reference 2). Flood damage and erosion during the winter of 1986 north of Port Washington was extensive due to the high lake levels. The danger of flooding from Lake Michigan south of Port Washington is negligible, because there is little or no level land between the bluffs and the lake.

General:

Floods on both the Milwaukee River and Cedar Creek usually occur during March and early April because of snowmelt. If there are also large amounts of rain, the floods can be of much greater magnitude, as was the case in 1959 and 1975. Large floods can also result from summer thunderstorms.

Milwaukee River:

Historical flooding has occurred along the Milwaukee River in 1918, 1924, 1929, 1959, 1973, 1975, and 1986 (Reference 3).

- 08/06/1924: The 1924 flood is the largest flood of record for the Milwaukee River. It equaled the peak discharge of 15,100 cubic feet per second (cfs) that occurred in March 1918. The 1924 flood was particularly devastating, because it washed out dams in both the villages of Newberg and Saukville Wisconsin.
- 1975: The flood had an estimated recurrence interval of 50 years at Waubeka based on 14 years of record at the gage there. This flood was a snowmelt event that was enhanced by a large amount of rainfall. The highwater peak was also influenced heavily by large amounts of ice on the river.
- 09/1986: The flood resulted from a summer thunderstorm. On Tuesday, September 9, rain began to fall in Ozaukee County, and the National Weather Service issued a flood warning for the county. The UW-Milwaukee

field station recorded a total of 7.13 inches in the Village of Saukville, while the City of Port Washington received 6.86 inches. The largest total rainfall from the storm was 7.94 inches at Holy Hill in Washington County, with 6.92 inches of the rain recorded in a 24-hour period. A peak discharge of 10,180 cfs, which corresponds to a 20-year flood discharge, was reported at Milwaukee River gage No. 4087000, located in the City of Milwaukee. The damage in downtown Saukville was caused by water backing up in public sewers and stormwater drainage systems. Two miles north of the Village of Saukville, railroad tracks were washed out on the bridge over the Milwaukee River causing five cars to derail along the Soo Line.

More recent large-scale flooding events have occurred 06/18/1996-06/20/1996, 06/21/1997, 06/2004 (Reference 4).

- 06/18/1996-06/20/1996: A series of thunderstorms "trained" N/NW into Ozaukee county and dumped heavy rains from 2 inches to over 7 inches on June 18th. Total rainfalls for the 3-day period of the 16th, 17th, and 18th ranged from 5 to over 13 inches (see Port Washington flash flood report for 06/18/96). There were many reports of flooding of basements, businesses, farmland, and low lands along rivers, streams, and creeks. Some roads were blocked for extended periods of time in Mequon, Cedarburg, Saukville, and Thiensville. Trash dumpsters were carried away by water 3 feet deep in Thiensville. Farmland sustained soil erosion and crop damage. The Milwaukee River on the eastside of Cedarburg crested at 12.66 feet at 1815CST on the 18th, or 1.66 feet above flood stage.
- 06/21/1997: Flash flooding occurred in southern Ozaukee county as a result of heavy rainfall amounts in excess of 8 inches over a 30 hour period ending about 1200CST. This flash flooding was greater than a "100 year rainfall" based on rainfall frequency maps. No one was injured or killed. Besides public sector damage in county/city parks, there were widespread private home and business damages. The hardest hit areas were the cities of Mequon and Thiensville, a small area about 2 miles southwest of Fredonia, and east of Cedarburg. By mid-morning much of downtown Thiensville was essentially a functional lake. On July 7th, Ozaukee County was officially declared a Federal Disaster Area, making county residents and business owners eligible for Federal disaster aid. Areas along and near the Milwaukee River experienced moderate to major damage to homes and businesses. Hundreds of homes and businesses in southern Ozaukee County had significant damage to basements and personal property. Over a dozen homes in Mequon had collapsed basement walls. Hundreds of customers lost electrical power, natural gas, or telephone service. Many people were forced from their homes until repairs or cleanups could be completed. Some car dealerships and repair shops suffered damage to new and used vehicles. The loss of electrical service prevented the use of sump pumps in many homes, which compounded the flooding problems. Many roads and underpasses across the southern part of the county were flooded with several feet of water, resulting in road closures.

Some drivers had to be rescued after their vehicles were swept away by deep, fast water currents over roads. Several roads in the southern part of the county had sections of asphalt washed away. Rainfall totals for the 30-hour period ending 1200CST were about 8.50 inches in the extreme southern part of the county along the county line. Other totals included 6.25 inches near the Mequon city hall, 3.09 inches at Cedarburg, 3.08 inches in Waubeka, and 2.26 inches in Port Washington, which experienced a disastrous 100 year flood 1 year ago when over 11 inches of rain fell in a 3 day period.

- 06/2004: The Milwaukee River at Cedarburg rose above flood stage of 11 feet on June 11th at 1900 CST, crested at 12.97 feet on June 13th at 1730 CST, 1.97 feet above flood stage (minor flooding). The river remained above flood stage until June 16th at 2300 CST. One-hundred and nine houses reported basement flooding, with 1 house reporting major flooding and 8 houses being inaccessible.

Cedar Creek:

Large floods have occurred along Cedar Creek in 1952, 1959, 1960, and 1975. The largest flood of record is March 1960 (Reference 3).

City of Port Washington:

- 06/18/1996-06/20/1996: Torrential rainfalls due to "training" thunderstorms moving N/NW into Port Washington resulted in probably the worst flash flooding ever experienced by that city. Within about 2 hours the city picked up 6 to over 7 inches of rain on top of 5 to 6.5 inches that fell in the previous two days. Water reached 3 to 4 feet deep on some roads, while most manhole covers were swept away. City officials declared a State of Emergency at 0800CST, with the height of the storm occurring at 0830 to 0900CST. Mudslides were reported on several of the city's hills. Whole sections of some city streets were washed away. A rampaging Sauk Creek severely damaged the Wisconsin Street Bridge. A railroad embankment on Grand Ave. was washed away, and a section of tracks was washed out. Lake Michigan bluffs also sustained severe damage in the form of mudslides that extended down to the water's edge. The mudslides destroyed the public beach and a bike trail through Lake Park. Knocked down poles resulted in the loss electricity to about 1300 homes. About 1000 homes had a varying amount of flood damage... or 1/3 of the city's homes. About 100 businesses sustained flood damage to their property. Several automobiles were also washed away on the city's roads. Maximum rainfall in Port Washington was 7.68 inches for June 18th, on top of 5.84 inches on the previous two days. The 3-day total was 13.52 inches. By the end of June a grand total of 18.27 inches dropped out of the sky. There were no reports of injuries or deaths (Reference 4).

2.4 Flood Protection Measures

Although there are several dams along the Milwaukee River and Cedar Creek in Ozaukee County, they do not provide significant flood protection from major events such as the 100-year flood.

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 approx. 40 percent (4 in 10); for any 90-year period, the risk increases to approx. 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.

Little Menomonee River and Little Menomonee Creek (Ozaukee Co. March 18, 1991 FIS/Milwaukee Co. November 19, 1987 FIS):

The discharges on the Little Menomonee River and Little Menomonee Creek were computed using the Hydrocomp Inc. continuous simulation model (Reference 27). This model makes use of several meteorological factors and land characteristics to determine the volume and temporal distribution of flow from the land to the stream system. Flows are routed through the stream system and are calibrated with computed discharges for storms where streamflow data are available at gaging stations. Discharges for these two streams were not included in the Floodway Data Tables, because they are currently being re-studied by the Southeastern Wisconsin Regional Planning Commission, but were unavailable at the time of this report.

Milwaukee River and Cedar Creek (March 18, 1991 FIS):

Floodflow frequencies on the Milwaukee River and Cedar Creek were based on a statistical analysis of USGS gages 4087000 (Milwaukee River) and 4086500 (Cedar Creek). These were analyzed in accordance with the criteria outlined in Bulliten 17B (Interagency Advisory Committee on Water Data, 1982, Reference 5). Discharges upstream and downstream of each gage were adjusted based on the difference in area between the gage and the area of interest.

Lake Michigan (December 6, 1999 FIS):

The hydrologic analysis for Lake Michigan was carried out to establish the peak elevation-frequency relationship. The stillwater elevations for the 100-year and 500-year floods have been determined from the United States Army Corps of Engineers report entitled Phase I, Revised Report on Great Lakes Open-Coast Flood Levels (Reference 6). The lacustrine analysis reported in this FIS reflect the stillwater elevations due to wind set-up effects, and include the contributions of wave action. The effects of wave action were also considered in the determination of the flood hazard areas. Deepwater wave heights and their associated wave periods can be found in the United States Army Corps of Engineers report titled Hindcast Wave Information for the Great Lakes: Lake Michigan (Reference 7). The wave run-up component was determined using the procedures developed in the Federal Emergency Management Agency (FEMA) report entitled Guidelines and Specifications for Wave Elevation Determination and V-Zone Mapping – Great Lakes (Reference 8). The 100-year and 500-year stillwater elevations for Lake Michigan can be found in Table 2a.

This Revision

Other Study Streams:

Gaged flow data is not available for any of the remaining study streams within the county. Therefore, rainfall-runoff models were developed for all of the remaining study streams using the Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS Version 2.2.2, Reference 9).

Rainfall depths for the 10-year, 50-year, and 100-year rainfall events in Ozaukee County were determined from scanned and geo-referenced rainfall atlas maps from Technical Paper 40 (TP40, Reference 10). A 500-year rainfall depth was estimated by plotting the 10-year, 50-year, and 100-year and then generating a trendline. Recent evaluation of the Soil Conservation Service (SCS) Type II rainfall distribution by the Wisconsin Department of Natural Resources, which had previously been the standard in Wisconsin for use in synthetic hydrologic models, has indicated that this type of distribution produces unreasonably high flood flow peaks. A revised distribution for this flood insurance study was

developed based on two inch and larger storms recorded at National Weather Service gage 473269 (WBAN No. 14898) located at Austin Straubel Airport in Green Bay, Wisconsin.

Physical characteristics of the watersheds were developed within GIS (geographical information systems) using the ESRI Arcview (Version 3.3) extension Geo-HMS (V1.1). Datasets used include the Ozaukee County digital 2' contours/spot elevations (Reference 11), Wisconsin Wetland Inventory (WWI), and 2000 orthophotos from SEWRPC (Reference 12). Rainfall abstractions were determined using the SCS method (Reference 13). Curve numbers were developed county-wide using the Southeastern Wisconsin Regional Planning Commission (SEWRPC) 2000 landuse and the National Conservation Service (NRCS) Soil Survey Geographic (SSURGO, Reference 14) database soils. Transformation of rainfall depths to flood flows utilizes the SCS method (Reference 13). Flood flows were routed using Muskingum 8-point cross-sections extracted from the digital terrain. Routing cross-sections represented the estimated extent of the flood conveyence area. In general, flood storage was modeled only for large lakes and impoundments.

As per Wisconsin Administrative Code NR116.07 (Reference 15), a second hydrology method was used to confirm the reasonableness of modeled flows. In general, the HEC-HMS modeled flows were compared to flows from similar basins that were adjusted based on the area ratio of the modeled and gaged watersheds.

Peak discharge-drainage area relationships for Ozaukee County are shown in Table 1.

Table 1 - Summary of Discharges

<u>Flooding Source and Location</u>	Peak Discharges (cubic feet per second)				
	<u>Drainage Area (square miles)</u>	<u>10-Percent- Annual-Chance</u>	<u>2-Percent- Annual-Chance</u>	<u>1-Percent- Annual-Chance</u>	<u>0.2-Percent- Annual-Chance</u>
Canyon Creek at I-43	1.2	143	210	250	318
Canyon Creek at outlet	2.5	313	457	543	689
Cedar Creek at CTH I	108.0	2535	4579	5609	6600
Cedar Creek at USGS Gage 4086500	117.4	2666	4815	5898	6940
Cedar Creek at outlet	123.0	2741	4951	6065	7136
Fredonia Creek at Belgium-Kohler Rd	1.9	218	325	391	501
Fredonia Creek at Willow Valley Rd	4.7	527	796	957	1230
Fredonia Creek at outlet	6.5	689	1051	1274	1645
Milwaukee River – upstream of the North Branch Milwaukee River	269.0	4770	7050	7930	9900
Milwaukee River – upstream of Cedar Creek	466.4	7845	11370	12560	15420
Milwaukee River – downstream of Cedar Creek	592.2	8790	12550	14210	17900
Mineral Springs at Maritime Dr	0.9	101	152	184	238

Mineral Springs at Park St, upstream of by-pass weir	2.4	264	397	477	614
Mineral Springs at outlet, just downstream of by-pass weir ¹	2.5	110	130	142	159
Mole Creek at STH 33	1.5	164	248	299	388
Mole Creek at E Sauk Rd	4.7	458	686	844	1112
Mole Creek at Pleasant Valley Rd	6.8	503	792	967	1302
Mole Creek - at outlet	8.8	596	964	1191	1632
North Branch Milwaukee River – just upstream of the Milwaukee River	146.5	3910	5875	6590	8190
Pigeon Creek at Highland Rd	0.7	81	121	141	185
Pigeon Creek at Highland Rd	10.1	1117	1685	1976	2621
Pigeon Creek at Freistadt Rd	11.1	1142	1739	2046	2731
Pigeon Creek at outlet	12.6	1268	1933	2284	3055
Sauk Creek at Kay-K Rd	0.9	104	155	186	239
Sauk Creek at Sixmile Rd	17.9	1515	2380	2896	3781
Sauk Creek at CTH A	20.6	1689	2672	3261	4285
Sauk Creek at I-43	26.5	1920	3070	3790	5040
Sauk Creek at STH 33	29.0	1996	3203	3958	5307
Sauk Creek at outlet	31.5	2100	3384	4202	5653
Ulaos Creek at STH 32	0.6	78	114	136	173
Ulaos Creek at STH 60/CTH Q	5.9	511	780	957	1288
Ulaos Creek at Lakefield Rd	8.3	669	1051	1304	1756
Ulaos Creek at outlet	13.5	944	1485	1838	2464
Unnamed Tributary No. 1 to the Belgium-Holland Drainage Ditch at Silver Beach Rd	2.0	163	284	296	382
Unnamed Tributary No. 1 to the Belgium-Holland Drainage at countyline, CTH KK	4.5	299	521	592	785
Unnamed Tributary No. 1 to the Milwaukee River at Progress Dr	0.7	86	132	154	198
Unnamed Tributary No. 1 to the Milwaukee River at outlet, CTH O	1.4	167	252	297	380
Unnamed Tributary No. 1 to Ulaos Creek at outlet	2.0	236	348	415	532
Unnamed Tributary to Unnamed Tributary No. 1 to Ulaos Creek at outlet	0.9	110	164	198	254
Unnamed Tributary No. 2 to Pigeon Creek at Hawthorne Rd	6.8	776	1159	1355	1792
Unnamed Tributary No. 3 to the Milwaukee River at outlet	1.0	124	179	212	268

¹ Flow leaves Mineral Springs over a weir and into a by-pass channel leading to Lake Michigan

Stillwater elevations for Ozaukee County are shown in Table 2a.

Table 2a - Summary of Stillwater Elevations

Flooding Source	Water Surface Elevations (Feet NGVD29)			
	10-Percent- Annual-Chance	2-Percent- Annual-Chance	1-Percent- Annual-Chance	0.2-Percent- Annual-Chance
Lake Michigan ¹	N/A	N/A	584.3	587.3

¹ National Geodetic Vertical Datum of 1929

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.

Little Menomonee River and Little Menomonee Creek (Ozaukee Co. March 18, 1991 FIS/Milwaukee Co. November 19, 1987 FIS):

Hydraulic modeling was completed with the HEC-2 hydraulic modeling package. Cross-sections for the backwater analysis were obtained by various means. Large-scale topographic maps at a scale of 1:1200 with a contour interval of two feet were used for the Little Menomonee River. Bridges, dams, and culverts were field surveyed to obtain elevation and structural geometry. Channel cross-sections were principally obtained by field surveying, but in some cases by estimating the channel shape between known points and by use of channel improvement contract drawings. The resulting profile is somewhat suspect when compared to the current two-foot contours, therefore the flood profiles were not included in the previous December 6, 1999 FIS or this current revision. The Little Menomonee River and Little Menomonee Creek are in the process of being updated by the Southeastern Wisconsin Regional Planning Commission, but were unavailable at the time of this report.

Lake Michigan (March 18, 1991 FIS):

The stage-frequency relationship for Lake Michigan along the coastline of Ozaukee County was obtained from the Report on Great Lakes Open-Coast Flood Levels (Reference 2). The reported stages are stillwater elevations, including the tilting of the entire lake surface caused by winds (wave setup), but not including the height of waves or the heights that the waves might reach when they meet the shore (wave run-up). In the southern portion of Ozaukee County, any highwater on Lake Michigan was at an elevation of 580.0 feet NGVD (Reference 16). The October 1986 maximum lake level was 583.55 feet NGVD.

The computed wave run-up elevation is 589.6 feet NGVD. This is the 100-year stillwater elevation (instantaneous water level) of 583.7 feet NGVD plus the 5.9 feet of wave runup. Ozaukee County had previously experienced a wave runup of 5 feet or greater during a storm in early April 1973. This correlates well with the 5.9 feet of runup determined by the model.

Lake Michigan (December 6, 1999 FIS):

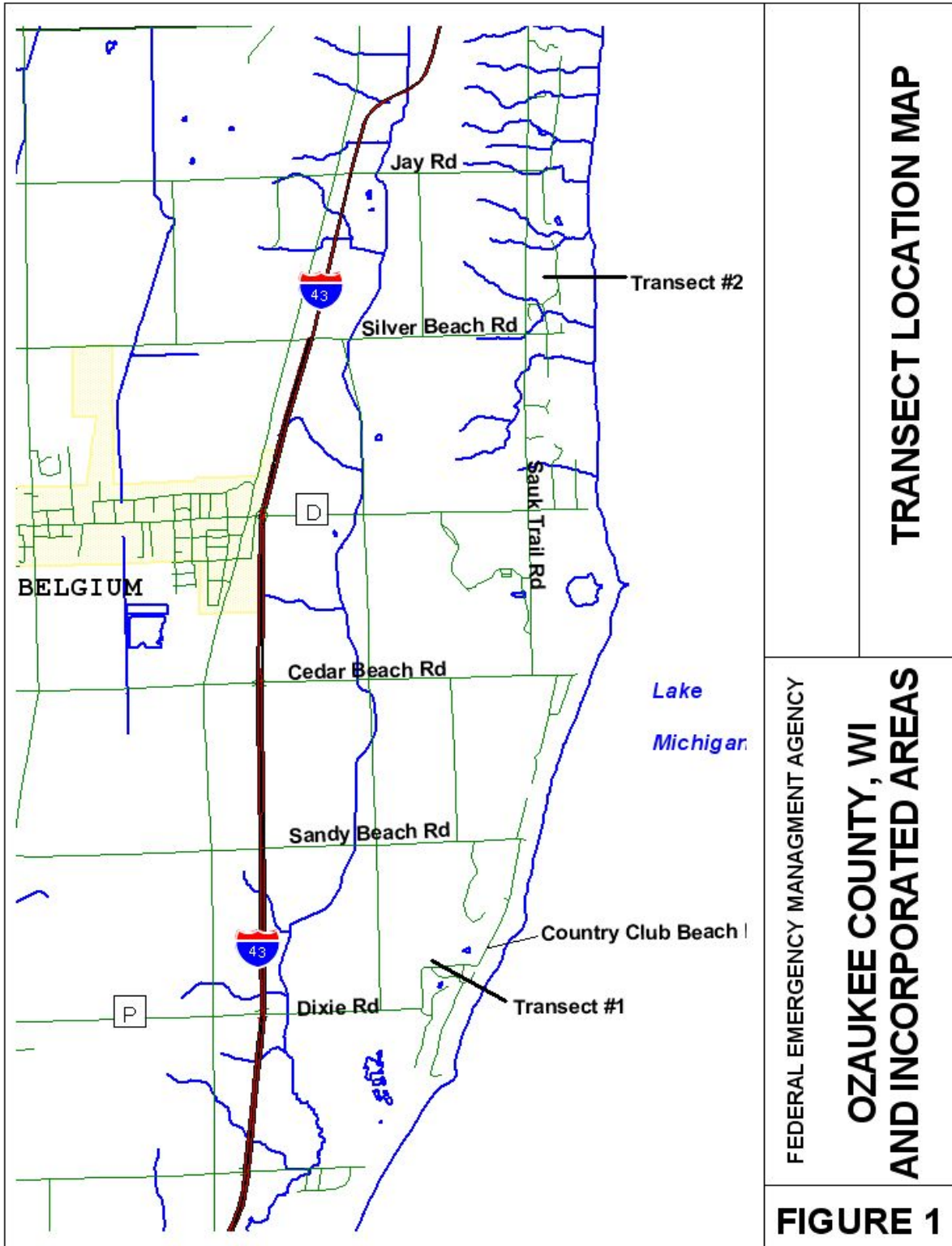
Coastal analyses for Lake Michigan were conducted to estimate the wave runup above the 100-year flood elevation for the study area from north of Lake Drive to the northern county boundary. The wave runup components and maximum wave runup elevations for individual sites located along the Ozaukee County shoreline were determined using methodologies established by the United States Army Corps of Engineers in conjunction with the aforementioned FEMA report (References 8 and 17). In October 1994, field surveys were conducted to determine profile ground elevations along transects. Wave heights and wave runup were computed along transects perpendicular to the shoreline, with consideration given to the physical and cultural characteristics of the land. Figure 1, “Transect Location Map” shows the location of transects for the county.

Along each transect, the maximum wave runup elevations were computed considering the combined effects of changes in ground elevation, vegetation, and other physical features. Between transects, elevations were interpolated using topographic maps, land-use, land-cover data, and engineering judgment to determine the aerial extent of flooding. Transect field investigations by Dewberry & Davis and FEMA were conducted on August 7 and 8, 1996 and May 21, 1998. The results of these analyses for Lake Michigan are summarized in Table 2b, “Transect Descriptions and Data”.

Table 2b – Transect Descriptions and Data

Transect	Location	Water Surface Elevations (Feet NGVD29)			
		100-year Stillwater	Computed Runup	100-year Wave Runup	500-year Wave Runup
1	From approx. 2,500 feet south of Dixie Road to Harrington Beach State Park	584.3	3.0	587.3	585.2
2	From Harrington Beach State Park to the northern county boundary	584.3	3.9	588.2	585.2
N/A	From the southern county boundary to approx. 2,500 feet south of Dixie Road	584.3	5.9	589.6	585.2

¹ National Geodetic Vertical Datum of 1929



TRANSECT LOCATION MAP

FEDERAL EMERGENCY MANAGEMENT AGENCY
**OZAUKEE COUNTY, WI
 AND INCORPORATED AREAS**

FIGURE 1

Figure 1 – Transect Location Map

This Revision

Milwaukee River/Cedar Creek/North Branch Milwaukee River:

The Milwaukee River within Ozaukee County had previously been modeled using the HEC-2 (Reference 18) hydraulic modeling package. Models were split at the Theinsville Dam, Lime Kiln Dam, Chair Factory Dam, Grafton Dam, and Waubeka Dam. Rating curves based on each dam's geometry were used to determine the starting surface water elevation for the next upstream model. Since the release of the 1999 FIS, the Chair Factory Dam and Waubeka Dam have been removed.

Similarly, Cedar Creek within Ozaukee County had previously been modeled using the HEC-2 hydraulic modeling package. Models were split at the Hamilton Dam, Wire and Nail Factory Dam, Ruck Dam, and Woolen Mills Dam. Rating curves based on each dam's geometry were used to determine the starting surface water elevation for the next upstream model. Since the release of the 1999 FIS, the Hamilton Dam has been removed.

All models on the Milwaukee River downstream of its first crossing of the Ozaukee-Washington County boundary, Cedar Creek, and North Branch Milwaukee River were revised and re-modeled into a single hydraulic model using the Hydrologic Engineering Center River Analysis System (HEC-RAS Version 3.1.1, Reference 19). Cross-section geometry was updated by extracting elevations from Ozaukee County two-foot topography and orthophotography (References 11 and 12) at the locations of those in the previous model. The surveyed channel from the previous model was merged with the extracted overbank points from GIS. Dams were added based on Wisconsin Department of Natural Resource field file surveys and bridges were updated based on available Wisconsin Department of Transportation plans. Contraction/expansion coefficients, Manning's roughness values, and flows were not changed.

Hydraulic modeling on the Milwaukee River upstream of its first crossing of the Ozaukee-Washington County boundary through the Village of Newberg remains unchanged. Cross-sections covered by the revised HEC-RAS model downstream were removed and the HEC-2 model was re-run to confirm existing FIS elevations.

All other Detailed Study Streams:

- Canyon Creek
- Cedar Creek
- Fredonia Creek
- Milwaukee River

- Mineral Springs
- Mole Creek
- North Branch Milwaukee River
- Pigeon Creek
- Sauk Creek
- Ulao Creek
- Unnamed Tributary No. 1 to the Belgium-Holland Drainage Ditch
- Unnamed Tributary No. 1 to the Milwaukee River
- Unnamed Tributary No. 1 to Ulao Creek
- Unnamed Tributary to Unnamed Tributary No. 1 to Ulao Creek
- Unnamed Tributary No. 2 to Pigeon Creek
- Unnamed Tributary No. 3 to the Milwaukee River

The Southeast Wisconsin Regional Planning Commission and Ozaukee County generated a detailed structure inventory for those streams scoped to be modeled in detail. Each structure was identified as having adequate (those having been included in a previous model and have not been replaced, or those having WisDOT plans available) or inadequate data available for hydraulic modeling. Structures that had inadequate data were surveyed by Ayres and Associates, Village of Theinsville, City of Mequon, and Village of Grafton in December 2004 and January 2005. An ESRI shapefile was created identifying the source of all modeled structures and where their supporting data was generated.

Using the Hydrologic Engineering Center HEC-GeoRAS (Version 3.1.1) Arcview (v 3.3) extension, new cross-sections were extracted based on the Ozaukee County digital terrain. Structure and channel information from surveys and existing models was combined with the GIS data. In general, the below normal water level channel at intermediate cross-sections (those between structures where a channel survey was not completed) were modeled as a “v” shape. Channel inverts were estimated based on the average difference between the surveyed channel bottom and the digital terrain, the slope of the terrain, and/or the slope of the upstream and downstream surveyed channel. The 2000 SEWRPC landuse dataset was used to generate Manning’s “n” roughness values. Each detailed landuse classification was assigned a roughness value, which was then automatically extracted for each cross-section.

Table 3 - Manning’s “n” Roughness Coefficients

Stream	Channel “n”	Overbank “n”
Canyon Creek	0.03-0.05	0.013-0.1
Cedar Creek	0.035-0.05	0.035-0.2
Fredonia Creek	0.03-0.05	0.013-0.1
Milwaukee River	0.035-0.045	0.04-0.06
Mineral Springs	0.04-0.15	0.013-0.15
Mole Creek	0.035-0.1	0.03-0.1
North Branch Milwaukee	0.042-0.06	0.08-0.1

River		
Pigeon Creek	0.02-0.15	0.013-0.15
Sauk Creek	0.03-0.1	0.013-0.1
Ulaio Creek	0.03-0.1	0.013-0.1
Unnamed Tributary No. 1 to the Belgium-Holland Drainage Ditch	0.03-0.1	0.013-0.15
Unnamed Tributary No. 1 to the Milwaukee River	0.03-0.1	0.013-0.1
Unnamed Tributary No. 1 to Ulaio Creek	0.035-0.05	0.013-0.1
Unnamed Tributary to Unnamed Tributary No. 1 to Ulaio Creek	0.035-0.05	0.013-0.1
Unnamed Tributary No. 2 to Pigeon Creek	0.025-0.05	0.013-0.15
Unnamed Tributary No. 3 to the Milwaukee River	0.035-0.05	0.1-0.15

Model runs were completed by the Wisconsin Department of Natural Resources and Hey & Associates using the Hydrologic Engineering Center's HEC-RAS hydraulic modeling package (Version 3.1.1).

Mineral Springs:

Mineral Springs empties into Sauk Creek just upstream of Sauk Creek's outlet to Lake Michigan. Flooding at the WE Energies power plant due to Mineral Springs prompted the design and construction of a by-pass weir that diverts excess flood flows from Mineral Springs directly to Lake Michigan.

Limited Detailed Study Streams:

URS CORP. gathered structure and channel information on Limited Detail Study Streams in the Spring of 2005. The 2000 SEWRPC landuse dataset was used to generate Manning's "n" roughness values. Structure and hydraulic parameters were inventoried in the Water Information System (WISE, Version 2.0.9) and extracted to HEC-RAS (V 3.1.1). The following streams were studied in limited detail, (floodway data tables and profiles were not included in this FIS):

- Belgium-Holland Drainage Ditch, Unnamed Tributaries No. 2 and No. 3 to the Belgium-Holland Drainage Ditch
- Cedarburg Creek
- Lac du Cours Tributary
- Mud Lake Creek

- Ozaukee County Unnamed Tributaries No. 1 No. 2 to the Menomonee River
- Riveredge Creek
- Sandhill Creek
- Silver Creek
- Sucker Creek
- Trinity Creek
- Unnamed Tributary No. 1 and Unnamed Tributary to Unnamed Tributary No. 2 to Pigeon Creek
- Unnamed Tributary No. 1 to Cedar Creek
- Unnamed Tributaries No.1 and No. 2 to Little Menomonee Creek
- Unnamed Tributary No. 1 to the Little Menomonee River
- Unnamed Tributaries No.1, No. 2, No. 3, and No. 4 to Mole Creek
- Unnamed Tributary No. 1 to Nor-x-way
- Unnamed Tributaries No.1, No. 2, and No. 3 to Sauk Creek
- Unnamed Tributary No. 4 to the North Branch of the Milwaukee River
- Unnamed Tributaries No. 6, No. 7, No. 8, No. 9 to the Milwaukee River

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.

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 the National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of the North American Vertical Datum of 1988 (NAVD88), many FIS reports and FIRMs are being prepared using NAVD88 as the referenced vertical datum.

Discussion between local communities, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) and the Wisconsin Department of Resources identified that the standard in southeastern Wisconsin is NGVD29. Therefore, all flood elevations shown in this FIS report and on the FIRM are referenced to NGVD29. Structure and ground elevations in the community must, therefore, be referenced to NGVD29.

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

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.

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-percent-annual-chance 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 topographic maps at a scale of 1:800, with a contour interval of 2 feet (Reference 11).

For the Lake Michigan shoreline, the flood boundaries were delineated using wave runup elevations determined at each transect. Between transects, the boundaries were interpolated using topographic maps at a scale of 1:800, with a contour interval of 2 feet (Reference 11).

The 1-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 (Zone[s] [A, AE, and VE). 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 limited detail and approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this FIS report and on the FIRM were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations have been tabulated for selected cross sections (Table 4). 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. Where reasonable, encroachments were modeled to maintain the existing floodway as per Wisconsin Administrative Code NR116.11 sub.(4) (Reference 15), which allows communities to keep the existing floodway boundaries:

(4) EXCEPTION TO CRITERIA FOR REDELINEATING OR REZONING FLOODPLAIN DISTRICTS. If, as a result of improved data generated by a revised study approved by the department, and not as a result of changes due to encroachments in the floodplain, the hydraulic floodway line is revised landward of the official floodway lines, the municipality may continue to regulate on the basis of the official floodway lines provided the municipality meets all of the requirements of sub. (3), except the requirement of sub. (3) (a) 4.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water surface elevation of the 1-percent-annual-chance flood 0.01' at any point with the exception of those situations where Wisconsin Administrative Code NR116.11 applies (see above). Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

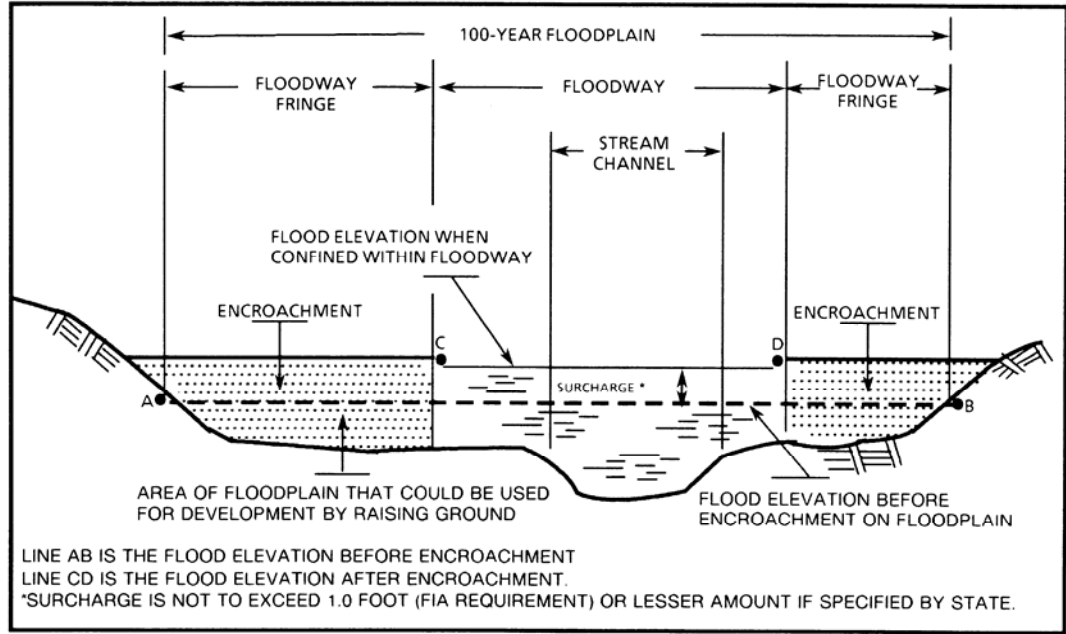


Figure 2 - Floodway Schematic

No floodways were computed for limited detail studies.

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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
CANYON CREEK								
A	40	39	50	10.8	589.6 ²	582.6	582.6	0.0
B	633	40	144	3.6	592.0	592.0	592.0	0.0
C	895	25	63	8.3	592.9	592.9	592.9	0.0
D	1334	22	49	10.6	596.6	596.6	596.6	0.0
E	1708	28	68	7.6	602.7	602.7	602.7	0.0
F	2265	108	147	3.5	609.8	609.8	609.8	0.0
G	2527	68	107	4.3	611.9	611.9	611.9	0.0
H	2880	59	107	4.3	615.0	615.0	615.0	0.0
I	3349	45	80	5.7	623.7	623.7	623.7	0.0
J	3776	52	96	4.8	628.5	628.5	628.5	0.0
K	4256	68	172	2.7	634.8	634.8	634.8	0.0
L	4614	39	120	3.8	640.3	640.3	640.3	0.0
M	4801	8	20	19.3	641.9	641.9	641.9	0.0
N	5033	66	331	1.2	651.4	651.4	651.4	0.0
O	5566	57	82	4.6	653.7	653.7	653.7	0.0
P	5939	77	87	4.4	663.3	663.3	663.3	0.0
Q	6399	30	87	4.4	671.1	671.1	671.1	0.0
R	6542	87	282	1.4	676.7	676.7	676.7	0.0
S	6945	89	257	1.5	676.8	676.8	676.8	0.0

¹ Feet above Lake Michigan

² Regulatory Backwater Elevation from Lake Michigan

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

CANYON 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
CANYON CREEK								
T	7470	147	210	1.8	678.1	678.1	678.1	0.0
U	7941	182	181	2.1	680.8	680.8	680.8	0.0
V	8521	91	138	1.8	683.6	683.6	683.6	0.0
W	8971	125	83	3.0	684.7	684.7	684.7	0.0
X	9303	156	84	3.0	686.6	686.6	686.6	0.0
Y	9908	299	277	0.9	689.0	689.0	689.0	0.0
Z	10248	133	68	3.7	689.4	689.4	689.4	0.0
AA	10687	251	184	1.4	691.1	691.1	691.1	0.0
AB	11074	147	69	3.6	692.6	692.6	692.6	0.0
AC	11396	183	152	1.6	694.9	694.9	694.9	0.0
AD	11633	71	60	4.1	696.7	696.7	696.7	0.0
AE	11798	25	97	2.6	701.3	701.3	701.3	0.0

¹ Feet above Lake Michigan

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

CANYON 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
CEDAR CREEK								
A	735	431	1685	3.6	679.6	679.6	679.6	0.0
B	2207	390	1413	4.3	683.2	683.2	683.2	0.0
C	3992	352	1150	5.3	688.0	688.0	688.0	0.0
D	5261	939	3312	1.8	690.4	690.4	690.4	0.0
E	5943	410	1168	5.2	691.5	691.5	691.5	0.0
F	6551	412	1506	4.0	696.9	696.9	696.9	0.0
G	7140	158	686	8.8	698.8	698.8	698.8	0.0
H	7202	107	749	8.1	700.2	700.2	700.2	0.0
I	7254	99	957	6.3	702.6	702.6	702.6	0.0
J	8580	216	1349	4.5	709.1	709.1	709.1	0.0
K	9721	166	1300	4.7	710.2	710.2	710.2	0.0
L	10699	549	3181	1.9	711.4	711.4	711.4	0.0
M	11775	326	1474	4.1	712.5	712.5	712.5	0.0
N	12009	412	2345	2.6	712.8	712.8	712.8	0.0
O	13616	418	1813	3.4	714.2	714.2	714.2	0.0
P	15954	830	4178	1.5	717.2	717.2	717.2	0.0
Q	16839	688	2630	2.3	717.9	717.9	717.9	0.0
R	17296	623	1463	4.2	719.8	719.8	719.8	0.0
S	17678	210	815	7.4	723.6	723.6	723.6	0.0

¹ Feet above confluence with the Milwaukee River

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

CEDAR 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
CEDAR CREEK								
T	18028	121	590	10.3	726.5	726.5	726.5	0.0
U	18360	95	747	8.1	730.2	730.2	730.2	0.0
V	18572	106	731	8.3	731.1	731.1	731.1	0.0
W	18808	63	466	13.0	732.6	732.6	732.6	0.0
X	19068	127	990	6.1	738.1	738.1	738.1	0.0
Y	19337	91	887	6.8	738.8	738.8	738.8	0.0
Z	19705	161	1306	4.6	762.1	762.1	762.1	0.0
AA	20975	186	1531	3.9	765.2	765.2	765.2	0.0
AB	21314	109	1500	4.0	775.0	775.0	775.0	0.0
AC	21877	220	2434	2.5	775.4	775.4	775.4	0.0
AD	23288	618	4992	1.2	775.6	775.6	775.6	0.0
AE	24631	215	865	6.9	776.6	776.6	776.6	0.0
AF	25009	103	610	9.9	777.7	777.7	777.7	0.0
AG	25099	211	1521	3.9	789.4	789.4	789.4	0.0
AH	25676	138	1309	4.6	789.8	789.8	789.8	0.0
AI	25805	141	1277	4.7	789.9	789.9	789.9	0.0
AJ	26488	97	708	8.4	790.6	790.6	790.6	0.0
AK	26559	108	904	6.6	791.4	791.4	791.4	0.0
AL	26732	137	1150	5.2	792.8	792.8	792.8	0.0

¹ Feet above confluence with the Milwaukee River

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

CEDAR 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
CEDAR CREEK								
AM	27079	212	1842	3.2	801.3	801.3	801.3	0.0
AN	28133	233	1986	3.0	801.8	801.8	801.8	0.0
AO	28688	401	2536	2.3	802.1	802.1	802.1	0.0
AP	29298	310	1904	3.1	802.5	802.5	802.5	0.0
AQ	29806	667	4358	1.4	802.9	802.9	802.9	0.0
AR	30432	300	1631	3.6	803.0	803.0	803.0	0.0
AS	31712	298	1628	3.6	804.9	804.9	804.9	0.0
AT	32808	253	1427	4.1	806.7	806.7	806.7	0.0
AU	34847	306	1789	3.3	808.8	808.8	808.8	0.0
AV	35552	268	2146	2.8	809.5	809.5	809.5	0.0
AW	35844	286	1888	3.1	810.8	810.8	810.8	0.0
AX	37940	277	1715	3.4	811.6	811.6	811.6	0.0
AY	38725	313	1737	3.4	812.6	812.6	812.6	0.0
AZ	41404	387	2135	2.7	814.7	814.7	814.7	0.0
BA	41969	347	3284	1.8	817.0	817.0	817.0	0.0
BB	46036	182	1820	3.2	818.1	818.1	818.1	0.0
BC	46421	216	2196	2.7	819.7	819.7	819.7	0.0
BD	50061	336	2957	2.0	821.1	821.1	821.1	0.0
BE	51836	431	2591	2.3	822.1	822.1	822.1	0.0

¹ Feet above confluence with the Milwaukee River

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

CEDAR 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
CEDAR CREEK								
BF	53386	768	5463	1.1	822.9	822.9	822.9	0.0
BG	53487	715	3605	1.6	823.0	823.0	823.0	0.0
BH	55324	617	3947	1.5	823.8	823.8	823.8	0.0
BI	56638	690	3395	1.7	824.2	824.2	824.2	0.0
BJ	58710	354	1978	2.9	825.8	825.8	825.8	0.0
BK	61238	333	1905	3.0	827.4	827.4	827.4	0.0
BL	64364	772	4421	1.3	829.1	829.1	829.1	0.0
BM	66623	212	1418	4.0	830.3	830.3	830.3	0.0
BN	66826	106	665	8.5	830.0	830.0	830.0	0.0
BO	71787	1587	5324	1.1	833.8	833.8	833.8	0.0
BP	73806	290	2079	2.7	834.8	834.8	834.8	0.0
BQ	73943	184	1337	4.2	834.7	834.7	834.7	0.0
BR	77517	1481	11200	0.5	836.1	836.1	836.1	0.0
BS	80494	825	4590	1.2	836.4	836.4	836.4	0.0

¹ Feet above confluence with the Milwaukee River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

CEDAR 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
FREDONIA CREEK								
A	610	155	570	2.2	780.5 ²	779.0	779.0	0.0
B	1258	100	454	2.8	780.8	780.8	780.8	0.0
C	1836	195	676	1.9	782.1	782.1	782.1	0.0
D	2333	100	441	2.9	782.8	782.8	782.8	0.0
E	3511	150	595	2.1	785.0	785.0	785.0	0.0
F	3913	220	675	1.9	785.8	785.8	785.8	0.0
G	4566	400	1189	1.1	786.7	786.7	786.7	0.0
H	5259	128	477	2.6	788.8	788.8	788.8	0.0
I	6072	114	171	6.2	791.7	791.7	791.7	0.0
J	6323	51	128	8.2	793.8	793.8	793.8	0.0
K	6531	129	450	2.3	796.9	796.9	796.9	0.0
L	7253	330	820	1.3	797.3	797.3	797.3	0.0
M	7427	330	436	2.3	797.4	797.4	797.4	0.0
N	8103	41	161	6.4	802.6	802.6	802.6	0.0
O	8199	145	716	1.4	804.7	804.7	804.7	0.0
P	9034	503	1459	0.7	805.3	805.3	805.3	0.0
Q	9673	403	1220	0.8	805.5	805.5	805.5	0.0
R	10152	278	677	1.5	805.9	805.9	805.9	0.0
S	10863	337	1764	0.5	811.2	811.2	811.2	0.0

¹ Feet above confluence with the Milwaukee River

² Regulatory Backwater Elevation from the Milwaukee River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

FREDONIA 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
FREDONIA CREEK								
T	11686	462	1503	0.6	811.3	811.3	811.3	0.0
U	12255	358	1616	0.6	811.3	811.3	811.3	0.0
V	12822	566	1811	0.5	811.3	811.3	811.3	0.0
W	13121	454	784	1.2	811.4	811.4	811.4	0.0
X	13289	547	1958	0.4	812.1	812.1	812.1	0.0
Y	13832	387	675	1.3	812.2	812.2	812.2	0.0
Z	14591	961	1411	0.5	812.7	812.7	812.7	0.0
AA	15222	1220	2363	0.3	812.8	812.8	812.8	0.0
AB	15941	1204	2553	0.3	812.9	812.9	812.9	0.0
AC	16952	1028	1003	0.6	813.1	813.1	813.1	0.0
AD	17872	1182	1069	0.4	814.8	814.8	814.8	0.0
AE	18464	594	244	1.6	815.9	815.9	815.9	0.0
AF	19437	120	114	3.4	817.9	817.9	817.9	0.0
AG	19531	261	340	1.0	820.3	820.3	820.3	0.0
AH	20007	157	160	2.0	820.5	820.5	820.5	0.0
AI	20902	112	224	1.4	822.2	822.2	822.2	0.0
AJ	21931	238	324	1.0	823.4	823.4	823.4	0.0
AK	22717	106	105	2.6	828.7	828.7	828.7	0.0
AL	23152	121	214	1.3	830.8	830.8	830.8	0.0

¹ Feet above confluence with the Milwaukee River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

FREDONIA 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
FREDONIA CREEK								
AM	23547	647	1117	0.3	830.9	830.9	830.9	0.0
AN	23810	1077	2326	0.1	830.9	830.9	830.9	0.0

¹ Feet above confluence with the Milwaukee River

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

FREDONIA 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MILWAUKEE RIVER								
A	1022	834	4422	3.2	652.9	652.9	652.9	0.0
B	2372	572	3254	4.4	653.5	653.5	653.5	0.0
C	4713	842	5941	2.4	655.0	655.0	655.0	0.0
D	5367	796	6969	2.0	655.2	655.2	655.2	0.0
E	8326	625	5149	2.8	655.9	655.9	655.9	0.0
F	10514	680	4446	3.2	656.6	656.6	656.6	0.0
G	11687	568	3850	3.7	657.1	657.1	657.1	0.0
H	13312	294	3036	4.7	658.0	658.0	658.0	0.0
I	13455	298	2964	4.8	658.1	658.1	658.1	0.0
J	13692	330	3322	4.3	658.4	658.4	658.4	0.0
K	14023	482	4239	3.4	658.7	658.7	658.7	0.0
L	14772	480	3870	3.7	658.9	658.9	658.9	0.0
M	17743	671	5754	2.5	660.3	660.3	660.3	0.0
N	17868	678	3983	3.6	660.2	660.2	660.2	0.0
O	18101	747	4606	3.1	660.4	660.4	660.4	0.0
P	19624	663	5163	2.8	660.8	660.8	660.8	0.0
Q	20985	473	4072	3.5	661.0	661.0	661.0	0.0
R	22436	720	5268	2.7	661.4	661.4	661.4	0.0

¹ Feet above the Ozaukee-Milwaukee County Line

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MILWAUKEE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MILWAUKEE RIVER								
S	24661	1294	7377	1.9	662.0	662.0	662.0	0.0
T	26302	1046	7305	2.0	662.3	662.3	662.3	0.0
U	28951	1907	10548	1.4	662.6	662.6	662.6	0.0
V	31015	2125	15064	0.9	662.8	662.8	662.8	0.0
W	32785	1878	13147	1.1	662.9	662.9	662.9	0.0
X	34811	1978	10742	1.3	663.1	663.1	663.1	0.0
Y	35654	1196	6159	2.3	663.2	663.2	663.2	0.0
Z	36441	630	5435	2.6	663.6	663.6	663.6	0.0
AA	37384	1436	8315	1.7	663.9	663.9	663.9	0.0
AB	38866	1742	8651	1.6	664.2	664.2	664.2	0.0
AC	40531	1213	9568	1.5	664.5	664.5	664.5	0.0
AD	41286	1175	7279	2.0	664.6	664.6	664.6	0.0
AE	45347	1662	11162	1.3	665.5	665.5	665.5	0.0
AF	46678	2089	11373	1.3	665.7	665.7	665.7	0.0
AG	48226	1057	5179	2.7	666.1	666.1	666.1	0.0
AH	49847	406	2573	5.5	667.5	667.5	667.5	0.0
AI	51121	1134	7383	1.9	668.9	668.9	668.9	0.0
AJ	51781	1160	7942	1.8	669.1	669.1	669.1	0.0

¹ Feet above the Ozaukee-Milwaukee County Line

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MILWAUKEE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MILWAUKEE RIVER								
AK	52589	227	2595	5.5	669.6	669.6	669.6	0.0
AL	54503	1523	5118	2.8	670.8	670.8	670.8	0.0
AM	55295	891	3592	4.0	671.8	671.8	671.8	0.0
AN	57127	1796	5030	2.8	675.4	675.4	675.4	0.0
AO	58895	984	4206	3.4	677.6	677.6	677.6	0.0
AP	59731	956	3726	3.4	678.9	678.9	678.9	0.0
AQ	61310	667	3978	3.2	681.2	681.2	681.2	0.0
AR	61858	367	2499	5.0	682.3	682.3	682.3	0.0
AS	63197	966	4689	2.7	684.0	684.0	684.0	0.0
AT	64184	1343	4295	2.9	685.1	685.1	685.1	0.0
AU	65074	607	2578	4.9	686.9	686.9	686.9	0.0
AV	66157	543	3085	4.1	689.3	689.3	689.3	0.0
AW	67274	1082	3351	3.8	691.3	691.3	691.3	0.0
AX	68201	657	2424	5.2	695.2	695.2	695.2	0.0
AY	69723	222	1625	7.7	701.2	701.2	701.2	0.0
AZ	70582	199	1664	7.6	704.8	704.8	704.8	0.0
BA	71369	386	4620	2.7	714.0	714.0	714.0	0.0
BB	72636	179	1643	7.7	714.0	714.0	714.0	0.0

¹ Feet above the Ozaukee-Milwaukee County Line

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MILWAUKEE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MILWAUKEE RIVER								
BC	73048	134	872	14.4	716.8	716.8	716.8	0.0
BD	73126	168	1454	8.6	719.6	719.6	719.6	0.0
BE	73490	171	1386	9.1	720.4	720.4	720.4	0.0
BF	74915	152	1204	10.4	724.7	724.7	724.7	0.0
BG	76180	170	1673	7.5	730.5	730.5	730.5	0.0
BH	76349	132	1020	12.3	730.5	730.5	730.5	0.0
BI	76427	98	818	15.4	730.5	730.5	730.5	0.0
BJ	76471	130	1680	7.5	732.9	732.9	732.9	0.0
BK	76501	256	2196	5.7	741.5	741.5	741.5	0.0
BL	76851	341	3698	3.4	742.2	742.2	742.2	0.0
BM	76979	359	3408	3.7	742.3	742.3	742.3	0.0
BN	77123	397	4584	2.7	742.5	742.5	742.5	0.0
BO	77657	502	4581	2.7	742.6	742.6	742.6	0.0
BP	78208	603	7159	1.8	742.7	742.7	742.7	0.0
BQ	80183	536	3655	3.4	742.9	742.9	742.9	0.0
BR	81366	730	3847	3.3	743.4	743.4	743.4	0.0
BS	82538	426	2898	4.3	744.1	744.1	744.1	0.0
BT	83605	441	3837	3.3	745.0	745.0	745.0	0.0

¹ Feet above the Ozaukee-Milwaukee County Line

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MILWAUKEE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MILWAUKEE RIVER								
BU	84129	395	3383	3.7	745.2	745.2	745.2	0.0
BV	85740	642	4228	2.9	746.0	746.0	746.0	0.0
BW	87731	344	1364	8.8	747.4	747.4	747.4	0.0
BX	89173	221	2689	4.5	749.2	749.2	749.2	0.0
BY	90611	912	4217	2.9	749.9	749.9	749.9	0.0
BZ	91597	983	4642	2.6	750.5	750.5	750.5	0.0
CA	93914	1284	6692	1.8	751.2	751.2	751.2	0.0
CB	94814	1450	7514	1.6	751.4	751.4	751.4	0.0
CC	95674	1586	6831	1.8	751.5	751.5	751.5	0.0
CD	97329	439	3357	3.6	751.8	751.8	751.8	0.0
CE	99191	828	4052	3.0	752.5	752.5	752.5	0.0
CF	100384	651	2798	4.3	752.9	752.9	752.9	0.0
CG	100942	649	3261	3.7	753.4	753.4	753.4	0.0
CH	101811	714	5120	2.4	754.0	754.0	754.0	0.0
CI	102947	683	5064	2.4	754.4	754.4	754.4	0.0
CJ	103155	701	4512	2.7	754.4	754.4	754.4	0.0
CK	103910	639	4066	3.0	754.7	754.7	754.7	0.0
CL	104224	534	3488	3.5	754.7	754.7	754.7	0.0

¹ Feet above the Ozaukee-Milwaukee County Line

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MILWAUKEE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MILWAUKEE RIVER								
CM	105349	291	2467	4.9	755.6	755.6	755.6	0.0
CN	107275	918	8134	1.5	756.7	756.7	756.7	0.0
CO	107930	468	3999	3.0	756.8	756.8	756.8	0.0
CP	108166	976	5410	2.2	757.1	757.1	757.1	0.0
CQ	108559	1272	11006	1.1	757.4	757.4	757.4	0.0
CR	109841	1760	11944	1.0	757.5	757.5	757.5	0.0
CS	110219	2227	13421	0.9	757.5	757.5	757.5	0.0
CT	110653	2698	13002	0.9	757.6	757.6	757.6	0.0
CU	112278	2622	7761	1.6	757.8	757.8	757.8	0.0
CV	112917	2355	7298	1.7	758.0	758.0	758.0	0.0
CW	114000	2483	8623	1.4	758.3	758.3	758.3	0.0
CX	116473	625	3654	3.3	759.8	759.8	759.8	0.0
CY	117847	575	3727	3.2	760.8	760.8	760.8	0.0
CZ	119427	608	3881	3.1	761.5	761.5	761.5	0.0
DA	122146	405	2843	4.2	762.4	762.4	762.4	0.0
DB	123699	514	2852	4.2	763.4	763.4	763.4	0.0
DC	124351	252	2725	4.4	764.3	764.3	764.3	0.0
DD	125702	718	5199	2.3	764.9	764.9	764.9	0.0

¹ Feet above the Ozaukee-Milwaukee County Line

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MILWAUKEE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MILWAUKEE RIVER								
DE	126410	681	4924	2.5	765.0	765.0	765.0	0.0
DF	128175	951	5207	2.3	765.5	765.5	765.5	0.0
DG	129540	522	3905	3.1	766.0	766.0	766.0	0.0
DH	131052	436	2449	4.9	766.7	766.7	766.7	0.0
DI	132133	271	2657	4.5	767.6	767.6	767.6	0.0
DJ	134505	334	2859	4.2	768.9	768.9	768.9	0.0
DK	135028	298	2379	5.1	769.1	769.1	769.1	0.0
DL	136905	270	2249	5.4	770.8	770.8	770.8	0.0
DM	140213	300	2549	4.7	773.3	773.3	773.3	0.0
DN	140778	313	1736	7.0	773.7	773.7	773.7	0.0
DO	142921	305	2636	4.6	778.2	778.2	778.2	0.0
DP	144523	262	2626	4.6	779.9	779.9	779.9	0.0
DQ	146820	513	3890	3.1	782.4	782.4	782.4	0.0
DR	147949	454	3257	3.7	783.1	783.1	783.1	0.0
DS	149871	485	4427	2.7	784.0	784.0	784.0	0.0
DT	151529	591	4964	2.4	784.7	784.7	784.7	0.0
DU	153704	335	2761	4.4	785.9	785.9	785.9	0.0
DV	154149	228	2145	5.6	786.4	786.4	786.4	0.0

¹ Feet above the Ozaukee-Milwaukee County Line

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MILWAUKEE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MILWAUKEE RIVER								
DW	154650	388	3855	3.1	787.1	787.1	787.1	0.0
DX	157072	561	3076	3.9	788.3	788.3	788.3	0.0
DY	159723	452	2404	5.0	791.0	791.0	791.0	0.0
DZ	162603	491	3115	3.9	794.4	794.4	794.4	0.0
EA	165902	1164	5652	2.1	797.1	797.1	797.1	0.0
EB	167128	2033	9220	0.9	797.6	797.6	797.6	0.0
EC	185893	235	1194	6.6	809.7	809.7	809.7	0.0
ED	189103	612	2755	2.9	814.4	814.4	814.4	0.0
EE	193003	304	1317	6.0	821.3	821.3	821.3	0.0
EF	195503	459	2132	3.7	826.1	826.1	826.1	0.0
EG	196903	1212	2397	3.3	828.3	828.3	828.3	0.0
EH	197863	1274	2540	3.1	831.0	831.0	831.0	0.0
EI	198543	855	2559	3.1	832.2	832.2	832.2	0.0
EJ	199303	1047	3600	2.2	833.2	833.2	833.2	0.0

¹ Feet above the Ozaukee-Milwaukee County Line

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MILWAUKEE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MINERAL SPRINGS								
A	106	28	123	1.2	589.0	589.0	589.0	0.0
B	159	13	51	2.8	589.0	589.0	589.0	0.0
C	327	19	38	3.7	589.3	589.3	589.3	0.0
D	537	14	24	6.0	591.1	591.1	591.1	0.0
E	724	19	25	5.7	593.3	593.3	593.3	0.0
F	944	37	84	6.1	597.6	597.6	597.6	0.0
G	1365	30	84	6.1	603.0	603.0	603.0	0.0
H	1609	25	81	6.3	605.2	605.2	605.2	0.0
I	1749	47	119	4.3	608.7	608.7	608.7	0.0
J	2128	28	106	4.8	615.5	615.5	615.5	0.0
K	2201	19	85	6.0	616.1	616.1	616.1	0.0
L	2315	25	56	9.1	617.0	617.0	617.0	0.0
M	2718	18	53	9.0	624.4	624.4	624.4	0.0
N	3062	21	55	8.7	630.6	630.6	630.6	0.0
O	3351	24	59	8.0	640.6	640.6	640.6	0.0
P	3585	15	74	6.4	643.1	643.1	643.1	0.0
Q	3670	68	350	1.4	647.3	647.3	647.3	0.0
R	4100	43	151	3.2	647.6	647.6	647.6	0.0

¹ Feet above confluence with Sauk Creek

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MINERAL SPRINGS

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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MINERAL SPRINGS								
S	4203	40	127	3.7	647.9	647.9	647.9	0.0
T	4628	29	74	6.4	649.3	649.3	649.3	0.0
U	5080	30	170	2.8	656.1	656.1	656.1	0.0
V	5233	96	690	0.7	660.2	660.2	660.2	0.0
W	5526	194	531	0.6	660.3	660.3	660.3	0.0
X	5965	51	88	3.7	663.8	663.8	663.8	0.0
Y	6398	49	54	6.1	666.6	666.6	666.6	0.0
Z	7032	114	105	3.2	672.9	672.9	672.9	0.0
AA	7648	206	238	1.4	678.7	678.7	678.7	0.0
AB	8173	22	63	5.3	683.3	683.3	683.3	0.0
AC	8558	67	237	1.4	684.7	684.7	684.7	0.0
AD	8720	179	251	1.3	685.1	685.1	685.1	0.0
AE	8923	112	204	0.9	685.2	685.2	685.2	0.0
AF	9172	145	202	0.9	686.2	686.2	686.2	0.0
AG	9735	145	86	2.1	687.4	687.4	687.4	0.0
AH	10505	246	240	0.8	690.2	690.2	690.2	0.0
AI	10828	323	1001	0.2	693.3	693.3	693.3	0.0
AJ	11379	40	127	3.7	693.3	693.3	693.3	0.0

¹ Feet above confluence with Sauk Creek

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MINERAL SPRINGS

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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MINERAL SPRINGS								
AK	12146	745	1991	0.1	694.6	694.6	694.6	0.0
AL	12961	95	40	2.5	699.1	699.1	699.1	0.0
AM	13348	57	47	2.1	701.2	701.2	701.2	0.0
AN	13792	21	22	4.5	705.6	705.6	705.6	0.0
AO	13997	22	21	4.9	709.3	709.3	709.3	0.0
AP	14232	103	95	1.1	709.6	709.6	709.6	0.0
AQ	14423	35	41	2.4	711.2	711.2	711.2	0.0
AR	14539	11	15	6.6	713.2	713.2	713.2	0.0
AS	14688	31	37	2.7	713.7	713.7	713.7	0.0
AT	15024	26	36	2.8	718.7	718.7	718.7	0.0

¹ Feet above confluence with Sauk Creek

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MINERAL SPRINGS

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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MOLE CREEK								
A	379	49	76	15.6	747.0	747.0	747.0	0.0
B	526	158	1496	0.8	754.7	754.7	754.7	0.0
C	706	166	1603	0.7	754.7	754.7	754.7	0.0
D	1004	50	483	2.4	754.7	754.7	754.7	0.0
E	1176	59	518	2.3	755.5	755.5	755.5	0.0
F	1477	136	708	1.7	755.8	755.8	755.8	0.0
G	2180	21	96	12.3	758.0	758.0	758.0	0.0
H	2297	44	517	2.3	765.2	765.2	765.2	0.0
I	2875	302	2559	0.5	765.4	765.4	765.4	0.0
J	3290	180	1429	0.8	765.4	765.4	765.4	0.0
K	3605	54	424	2.8	765.4	765.4	765.4	0.0
L	3717	142	1236	1.0	765.9	765.9	765.9	0.0
M	4349	210	987	1.0	766.0	766.0	766.0	0.0
N	4969	378	1034	1.0	766.2	766.2	766.2	0.0
O	5411	415	858	1.2	766.4	766.4	766.4	0.0
P	5502	309	648	1.6	767.4	767.4	767.4	0.0
Q	5835	207	635	1.6	768.3	768.3	768.3	0.0
R	6257	174	436	2.3	769.3	769.3	769.3	0.0
S	6709	206	524	2.0	770.7	770.7	770.7	0.0

¹ Feet above confluence with the Milwaukee River

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MOLE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MOLE CREEK								
T	7419	301	673	1.5	772.2	772.2	772.2	0.0
U	8516	347	757	1.4	773.8	773.8	773.8	0.0
V	9149	148	414	2.5	775.2	775.2	775.2	0.0
W	9926	106	225	4.5	778.0	778.0	778.0	0.0
X	9994	137	695	1.5	779.3	779.3	779.3	0.0
Y	10586	582	2078	0.5	779.4	779.4	779.4	0.0
Z	10870	594	2285	0.5	779.4	779.4	779.4	0.0
AA	11733	724	2745	0.4	779.5	779.5	779.5	0.0
AB	12112	563	1992	0.5	779.5	779.5	779.5	0.0
AC	12669	350	1350	0.7	779.6	779.6	779.6	0.0
AD	12904	563	2439	0.4	781.7	781.7	781.7	0.0
AE	13411	733	2558	0.4	781.7	781.7	781.7	0.0
AF	14016	503	1394	0.7	781.8	781.8	781.8	0.0
AG	14665	453	1102	0.8	782.2	782.2	782.2	0.0
AH	15309	331	701	1.3	782.7	782.7	782.7	0.0
AI	16175	490	1522	0.6	783.1	783.1	783.1	0.0
AJ	16743	525	1486	0.6	783.2	783.2	783.2	0.0
AK	17393	436	878	1.0	783.4	783.4	783.4	0.0
AL	17857	388	864	1.0	783.8	783.8	783.8	0.0

¹ Feet above confluence with the Milwaukee River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MOLE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MOLE CREEK								
AM	18857	966	2557	0.4	784.1	784.1	784.1	0.0
AN	20130	708	2058	0.4	784.3	784.3	784.3	0.0
AO	20513	240	906	0.9	784.4	784.4	784.4	0.0
AP	20717	63	387	2.2	786.2	786.2	786.2	0.0
AQ	21166	985	4614	0.2	786.3	786.3	786.3	0.0
AR	21540	1262	4781	0.2	786.3	786.3	786.3	0.0
AS	22283	1188	3857	0.2	786.3	786.3	786.3	0.0
AT	22930	1290	3619	0.2	786.3	786.3	786.3	0.0
AU	23606	1150	2749	0.3	786.4	786.4	786.4	0.0
AV	24577	1332	3034	0.2	786.4	786.4	786.4	0.0
AW	25086	1318	2937	0.3	786.5	786.5	786.5	0.0
AX	25881	630	961	0.8	786.6	786.6	786.6	0.0
AY	26138	563	1983	0.3	789.0	789.0	789.0	0.0
AZ	26676	917	2825	0.2	789.0	789.0	789.0	0.0
BA	27117	857	2190	0.3	789.0	789.0	789.0	0.0
BB	27709	574	1128	0.6	789.0	789.0	789.0	0.0
BC	28470	639	604	1.0	789.4	789.4	789.4	0.0
BD	28789	570	445	0.9	790.0	790.0	790.0	0.0
BE	29017	443	370	1.1	791.1	791.1	791.1	0.0

¹ Feet above confluence with the Milwaukee River

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MOLE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MOLE CREEK								
BF	29725	458	528	0.8	792.7	792.7	792.7	0.0
BG	30250	420	590	0.7	793.4	793.4	793.4	0.0
BH	31314	437	559	0.7	794.6	794.6	794.6	0.0
BI	32345	144	111	2.7	798.3	798.3	798.3	0.0
BJ	32828	22	54	5.6	800.2	800.2	800.2	0.0
BK	33317	339	2290	0.1	807.6	807.6	807.6	0.0
BL	33793	345	1398	0.1	807.6	807.6	807.6	0.0
BM	33875	351	1703	0.1	809.4	809.4	809.4	0.0
BN	34248	442	2070	0.1	809.4	809.4	809.4	0.0
BO	34916	451	1842	0.1	809.4	809.4	809.4	0.0
BP	35248	608	2060	0.1	809.4	809.4	809.4	0.0
BQ	35966	412	859	0.2	809.4	809.4	809.4	0.0
BR	36374	332	593	0.3	809.4	809.4	809.4	0.0
BS	36748	102	217	0.8	809.5	809.5	809.5	0.0
BT	37192	133	173	1.0	809.6	809.6	809.6	0.0
BU	37235	350	679	0.3	811.4	811.4	811.4	0.0
BV	37912	548	980	0.2	811.4	811.4	811.4	0.0
BW	38461	484	609	0.3	811.5	811.5	811.5	0.0
BX	39304	387	351	0.5	811.7	811.7	811.7	0.0

¹ Feet above confluence with the Milwaukee River

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MOLE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MOLE CREEK								
BY	39482	333	713	0.3	816.1	816.1	816.1	0.0
BZ	40166	318	446	0.4	816.1	816.1	816.1	0.0
CA	40810	84	46	3.8	818.3	818.3	818.3	0.0

¹ Feet above confluence with the Milwaukee River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

MOLE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
NORTH BRANCH MILWAUKEE RIVER								
A	1389	140	1300	5.1	797.9	797.9	797.9	0.0
B	3237	934	4862	1.4	798.6	798.6	798.6	0.0
C	4220	853	4567	1.4	799.1	799.1	799.1	0.0

¹ Feet above confluence with the Milwaukee River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

NORTH BRANCH MILWAUKEE 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
PIGEON CREEK								
A	136	43	348	6.6	659.9 ²	656.9	656.9	0.0
B	206	51	373	6.1	659.9 ²	657.1	657.1	0.0
C	557	121	382	6.0	659.9 ²	657.2	657.2	0.0
D	771	128	349	5.9	659.9 ²	657.5	657.5	0.0
E	1070	82	532	3.9	659.9 ²	658.9	658.9	0.0
F	1336	341	861	2.4	661.2	661.2	661.2	0.0
G	1748	108	607	3.4	661.3	661.3	661.3	0.0
H	1892	58	414	4.9	661.7	661.7	661.7	0.0
I	2023	188	578	3.5	662.3	662.3	662.3	0.0
J	2077	167	654	3.1	662.7	662.7	662.7	0.0
K	2228	103	550	3.7	662.9	662.9	662.9	0.0
L	2541	244	496	4.1	663.0	663.0	663.0	0.0
M	2752	144	338	6.1	663.0	663.0	663.0	0.0
N	2891	80	344	6.0	664.8	664.8	664.8	0.0
O	3179	480	3139	0.7	666.9	666.9	666.9	0.0
P	3334	529	1654	1.2	666.9	666.9	666.9	0.0
Q	4080	586	1408	1.5	667.0	667.0	667.0	0.0
R	4119	551	1507	1.4	667.3	667.3	667.3	0.0
S	4903	527	1606	1.3	668.2	668.2	668.2	0.0

¹ Feet above confluence with the Milwaukee River

² Regulatory Backwater Elevation from the Milwaukee River

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

PIGEON 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
PIGEON CREEK								
T	5188	763	3097	0.7	668.3	668.2	668.3	0.0
U	6000	896	3313	0.6	668.3	668.3	668.3	0.0
V	6472	846	2194	0.9	668.3	668.3	668.3	0.0
W	7293	593	1155	1.8	668.6	668.6	668.6	0.0
X	8000	702	2065	1.0	671.6	671.6	671.6	0.0
Y	8767	180	564	3.5	672.6	672.6	672.6	0.0
Z	8924	64	497	4.0	674.7	674.7	674.7	0.0
AA	9747	493	1809	1.1	675.1	675.1	675.1	0.0
AB	10458	439	1322	1.5	675.3	675.3	675.3	0.0
AC	11916	412	994	2.0	676.8	676.8	676.8	0.0
AD	12626	60	202	9.8	677.9	677.9	677.9	0.0
AE	12966	798	1934	1.0	680.4	680.4	680.4	0.0
AF	13302	705	2003	0.8	681.4	681.4	681.4	0.0
AG	14106	332	582	2.7	688.9	688.9	688.9	0.0
AH	14697	47	212	7.3	697.8	697.8	697.8	0.0
AI	14747	250	905	1.7	699.7	699.7	699.7	0.0
AJ	15561	172	404	3.8	710.1	710.1	710.1	0.0
AK	16183	548	830	1.9	716.9	716.9	716.9	0.0
AL	16418	365	668	2.3	721.0	721.0	721.0	0.0

¹ Feet above confluence with the Milwaukee River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

PIGEON 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
PIGEON CREEK								
AM	17106	129	196	0.9	725.8	725.8	725.8	0.0
AN	17480	149	124	1.4	726.9	726.9	726.9	0.0
AO	17764	149	161	1.1	727.2	727.2	727.2	0.0
AP	18473	8	23	6.1	728.6	728.6	728.6	0.0
AQ	18535	187	927	0.2	732.1	732.1	732.1	0.0
AR	18886	556	1230	0.1	732.1	732.1	732.1	0.0
AS	19477	451	766	0.2	732.1	732.1	732.1	0.0
AT	20385	254	56	0.8	732.2	732.2	732.2	0.0

¹ Feet above confluence with the Milwaukee River

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

PIGEON 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SAUK CREEK								
A	518	39	268	14.8	589.8	589.8	589.8	0.0
B	635	44	400	9.8	593.9	593.9	593.9	0.0
C	795	67	700	5.6	595.3	595.3	595.3	0.0
D	940	89	590	6.6	595.3	595.3	595.3	0.0
E	1051	91	555	7.1	595.4	595.4	595.4	0.0
F	1253	58	394	9.9	595.6	595.6	595.6	0.0
G	1765	57	293	13.4	599.6	599.6	599.6	0.0
H	2007	78	640	6.1	603.6	603.6	603.6	0.0
I	2140	74	455	8.6	603.7	603.7	603.7	0.0
J	2697	75	446	8.8	607.8	607.8	607.8	0.0
K	3065	72	352	11.1	610.1	610.1	610.1	0.0
L	3394	71	275	14.3	610.5	610.5	610.5	0.0
M	3585	57	366	10.7	615.3	615.3	615.3	0.0
N	3911	58	248	15.7	616.4	616.4	616.4	0.0
O	4301	69	271	14.4	621.7	621.7	621.7	0.0
P	4899	80	277	14.0	628.0	628.0	628.0	0.0
Q	5052	51	281	13.6	631.2	631.2	631.2	0.0
R	5706	66	283	13.5	638.6	638.6	638.6	0.0
S	5916	62	476	8.0	645.6	645.6	645.6	0.0

¹ Feet above Lake Michigan

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

SAUK 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SAUK CREEK								
T	6228	136	502	7.6	654.3	654.3	654.3	0.0
U	6597	238	810	4.7	659.7	659.7	659.7	0.0
V	6934	239	806	4.7	662.2	662.2	662.2	0.0
W	7124	199	546	7.0	663.1	663.1	663.1	0.0
X	7597	172	758	5.0	668.3	668.3	668.3	0.0
Y	7837	170	858	4.5	669.8	669.8	669.8	0.0
Z	8597	100	524	7.3	674.1	674.1	674.1	0.0
AA	9146	201	1449	2.6	677.0	677.0	677.0	0.0
AB	9603	221	1587	2.4	677.6	677.6	677.6	0.0
AC	9844	250	1444	2.6	678.3	678.3	678.3	0.0
AD	10262	247	849	4.5	678.8	678.8	678.8	0.0
AE	11016	192	596	6.4	680.8	680.8	680.8	0.0
AF	11469	181	501	7.6	684.3	684.3	684.3	0.0
AG	11931	303	1188	3.2	687.2	687.2	687.2	0.0
AH	12314	281	1300	2.9	688.1	688.1	688.1	0.0
AI	12646	315	1221	3.1	688.9	688.9	688.9	0.0
AJ	12928	253	834	4.5	689.4	689.4	689.4	0.0
AK	13226	123	567	6.7	691.5	691.5	691.5	0.0
AL	13389	131	605	6.2	692.5	692.5	692.5	0.0

¹ Feet above Lake Michigan

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

SAUK 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SAUK CREEK								
AM	13536	93	420	8.9	693.0	693.0	693.0	0.0
AN	13661	94	434	8.6	694.6	694.6	694.6	0.0
AO	13823	294	1616	2.3	696.6	696.6	696.6	0.0
AP	13993	400	2978	1.3	697.5	697.5	697.5	0.0
AQ	14291	481	2985	1.3	697.5	697.5	697.5	0.0
AR	14780	416	2239	1.7	697.7	697.6	697.7	0.0
AS	15246	362	1347	2.8	697.8	697.8	697.8	0.0
AT	16053	246	769	4.9	699.8	699.8	699.8	0.0
AU	16656	351	1530	2.4	702.2	702.2	702.2	0.0
AV	17402	321	1290	2.9	703.6	703.6	703.6	0.0
AW	17750	79	397	9.4	703.8	703.8	703.8	0.0
AX	17942	156	826	4.3	705.9	705.9	705.9	0.0
AY	19076	558	2556	1.4	707.4	707.4	707.4	0.0
AZ	19949	687	3152	1.1	707.6	707.6	707.6	0.0
BA	20665	535	1995	1.8	707.7	707.7	707.7	0.0
BB	21661	439	1304	2.7	708.2	708.2	708.2	0.0
BC	22329	336	731	4.9	708.6	708.6	708.6	0.0
BD	23066	378	1419	2.5	710.5	710.5	710.5	0.0
BE	23780	136	645	5.5	711.1	711.1	711.1	0.0

¹ Feet above Lake Michigan

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

SAUK 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SAUK CREEK								
BF	24493	381	1655	2.2	712.1	712.1	712.1	0.0
BG	25143	717	2154	1.7	712.6	712.6	712.6	0.0
BH	26593	440	1964	1.8	713.6	713.6	713.6	0.0
BI	27400	536	1657	2.2	714.0	714.0	714.0	0.0
BJ	28228	479	1619	2.2	714.4	714.4	714.4	0.0
BK	28843	500	1597	2.2	714.7	714.7	714.7	0.0
BL	29511	391	1230	2.9	715.4	715.4	715.4	0.0
BM	30030	474	1944	1.8	716.8	716.8	716.8	0.0
BN	31081	539	2267	1.6	717.9	717.9	717.9	0.0
BO	31574	565	1855	1.9	718.3	718.3	718.3	0.0
BP	31892	609	2235	1.6	718.5	718.5	718.5	0.0
BQ	32692	538	1858	1.9	719.0	719.0	719.0	0.0
BR	33485	700	2715	1.3	719.4	719.4	719.4	0.0
BS	33677	800	3562	1.0	720.8	720.8	720.8	0.0
BT	34328	788	3650	0.9	720.9	720.9	720.9	0.0
BU	34928	626	2725	1.2	720.9	720.9	720.9	0.0
BV	35690	652	2712	1.2	721.1	721.1	721.1	0.0
BW	36078	602	2393	1.4	721.1	721.1	721.1	0.0
BX	36572	576	1690	2.0	721.3	721.3	721.3	0.0

¹ Feet above Lake Michigan

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

SAUK 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SAUK CREEK								
BY	37026	611	1818	1.8	721.7	721.7	721.7	0.0
BZ	37718	536	2179	1.5	722.2	722.2	722.2	0.0
CA	38718	601	2092	1.6	722.5	722.5	722.5	0.0
CB	39671	345	1080	3.0	722.7	722.7	722.7	0.0
CC	39819	570	3485	0.9	725.3	725.3	725.3	0.0
CD	40674	691	3612	0.9	725.3	725.3	725.3	0.0
CE	41239	671	3600	0.9	725.4	725.4	725.4	0.0
CF	41925	716	2690	1.2	725.4	725.4	725.4	0.0
CG	42454	720	1676	2.0	725.4	725.4	725.4	0.0
CH	43698	906	2849	1.0	725.8	725.8	725.8	0.0
CI	44996	608	1453	2.0	726.1	726.1	726.1	0.0
CJ	45521	526	1238	2.3	726.6	726.6	726.6	0.0
CK	45931	693	2561	1.1	728.6	728.6	728.6	0.0
CL	46702	976	3434	0.8	728.6	728.6	728.6	0.0
CM	47716	819	2556	1.1	728.7	728.7	728.7	0.0
CN	48984	934	2614	1.1	728.9	728.9	728.9	0.0
CO	49910	1035	2737	1.1	729.2	729.2	729.2	0.0
CP	50388	1328	4185	0.7	729.2	729.2	729.2	0.0
CQ	51057	1077	2435	1.2	729.3	729.3	729.3	0.0

¹ Feet above Lake Michigan

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

SAUK 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SAUK CREEK								
CR	51489	781	1812	1.6	729.6	729.6	729.6	0.0
CS	52284	796	1337	2.2	730.4	730.4	730.4	0.0
CT	54385	1419	2584	1.1	731.7	731.7	731.7	0.0
CU	55161	1392	2058	1.4	732.0	732.0	732.0	0.0
CV	55939	588	783	3.7	733.0	733.0	733.0	0.0
CW	56184	1012	4891	0.6	737.7	737.7	737.7	0.0
CX	56628	717	2068	1.3	737.7	737.7	737.7	0.0
CY	57305	522	946	2.9	737.9	737.9	737.9	0.0
CZ	58510	453	1071	2.6	739.9	739.9	739.9	0.0
DA	59416	412	1047	2.7	741.0	741.0	741.0	0.0
DB	60081	542	1672	1.7	741.8	741.8	741.8	0.0
DC	60511	617	1638	1.7	741.9	741.9	741.9	0.0
DD	61046	278	757	3.7	742.2	742.2	742.2	0.0
DE	62165	217	941	1.9	747.1	747.1	747.1	0.0
DF	62946	277	1108	1.7	748.2	748.2	748.2	0.0
DG	63810	393	1445	1.3	748.9	748.9	748.9	0.0
DH	64377	149	368	1.8	749.2	749.2	749.2	0.0
DI	64620	148	451	1.5	750.6	750.6	750.6	0.0
DJ	65148	164	199	3.3	751.2	751.2	751.2	0.0

¹ Feet above Lake Michigan

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

SAUK 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SAUK CREEK								
DK	65846	226	413	1.6	753.8	753.8	753.8	0.0
DL	66815	112	177	3.7	756.1	756.1	756.1	0.0
DM	67703	238	369	1.8	760.2	760.2	760.2	0.0
DN	68607	203	259	2.5	763.5	763.5	763.5	0.0
DO	69676	183	218	1.2	767.6	767.6	767.6	0.0
DP	70291	130	126	1.5	769.5	769.5	769.5	0.0
DQ	70827	104	131	1.4	771.4	771.4	771.4	0.0
DR	71474	98	106	1.8	773.7	773.7	773.7	0.0
DS	72150	80	85	2.2	776.7	776.7	776.7	0.0
DT	72844	88	54	3.5	778.1	778.1	778.1	0.0
DU	73576	104	111	1.7	781.3	781.3	781.3	0.0
DV	74248	60	42	4.4	782.9	782.9	782.9	0.0
DW	75020	15	26	7.1	785.8	785.8	785.8	0.0
DX	75103	33	141	1.3	789.5	789.5	789.5	0.0
DY	75645	22	34	3.3	789.5	789.5	789.5	0.0
DZ	76204	53	48	2.3	790.6	790.6	790.6	0.0
EA	77411	117	58	1.9	793.4	793.4	793.4	0.0

¹ Feet above Lake Michigan

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

SAUK 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
ULAO CREEK								
A	2424	1363	4688	0.4	664.5 ²	663.6	663.6	0.0
B	3350	474	1396	1.4	664.5 ²	663.8	663.8	0.0
C	3699	620	2204	0.9	664.5 ²	664.3	664.3	0.0
D	4328	984	3659	0.4	664.5 ²	664.4	664.4	0.0
E	5254	885	3117	0.5	664.5 ²	664.4	664.4	0.0
F	5851	1224	3521	0.5	664.5	664.5	664.5	0.0
G	6992	1192	2630	0.6	664.8	664.8	664.8	0.0
H	7159	1104	2921	0.6	664.8	664.8	664.8	0.0
I	7757	326	715	2.3	664.9	664.9	664.9	0.0
J	8478	925	2581	0.6	665.8	665.8	665.8	0.0
K	9521	1057	2606	0.6	666.0	666.0	666.0	0.0
L	10361	675	727	2.2	666.4	666.4	666.4	0.0
M	10421	505	1136	1.4	667.5	667.5	667.5	0.0
N	10893	385	1433	1.0	667.6	667.6	667.6	0.0
O	11153	640	2362	0.5	667.7	667.7	667.7	0.0
P	11452	266	971	1.2	669.3	669.3	669.3	0.0
Q	12878	562	1141	1.2	669.5	669.5	669.5	0.0
R	13051	460	992	1.4	669.6	669.6	669.6	0.0
S	13836	532	1065	1.3	669.9	669.9	669.9	0.0

¹ Feet above confluence with the Milwaukee River

² Regulatory Backwater Elevation from the Milwaukee River

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

ULAO 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
ULAO CREEK								
T	14344	331	358	3.9	670.1	670.1	670.1	0.0
U	14964	108	316	4.4	671.6	671.6	671.6	0.0
V	15368	101	299	4.6	672.3	672.3	672.3	0.0
W	16041	94	310	4.5	673.5	673.5	673.5	0.0
X	16505	40	348	3.5	675.0	675.0	675.0	0.0
Y	16747	45	204	6.0	675.0	675.0	675.0	0.0
Z	16819	45	255	4.8	676.7	676.7	676.7	0.0
AA	17088	129	640	1.9	677.2	677.2	677.2	0.0
AB	17473	188	832	1.5	677.7	677.7	677.7	0.0
AC	18838	543	720	1.7	678.0	678.0	678.0	0.0
AD	19215	343	635	1.9	678.5	678.5	678.5	0.0
AE	19855	297	724	1.7	679.7	679.7	679.7	0.0
AF	20566	436	641	1.9	681.5	681.5	681.5	0.0
AG	21861	800	1723	0.7	683.0	683.0	683.0	0.0
AH	23385	746	1003	1.2	684.1	684.1	684.1	0.0
AI	23814	720	1656	0.6	685.7	685.7	685.7	0.0
AJ	24072	1080	2509	0.4	685.7	685.7	685.7	0.0
AK	25170	131	183	5.6	686.0	686.0	686.0	0.0
AL	26095	453	655	1.6	688.6	688.6	688.6	0.0

¹ Feet above confluence with the Milwaukee River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

ULAO 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
ULAO CREEK								
AM	27014	470	556	1.8	689.6	689.6	689.6	0.0
AN	27429	298	284	3.3	690.7	690.7	690.7	0.0
AO	27733	185	374	2.5	691.6	691.6	691.6	0.0
AP	28077	293	493	1.9	692.0	692.0	692.0	0.0
AQ	28530	118	179	5.2	692.5	692.5	692.5	0.0
AR	28773	108	463	2.0	695.3	695.3	695.3	0.0
AS	29230	641	1332	0.7	695.6	695.6	695.6	0.0
AT	29950	957	2264	0.4	695.8	695.8	695.8	0.0
AU	30533	708	1440	0.6	695.9	695.9	695.9	0.0
AV	31548	28	105	6.1	696.2	696.2	696.2	0.0
AW	31599	28	136	4.7	697.3	697.3	697.3	0.0
AX	32053	490	1789	0.4	697.9	697.9	697.9	0.0
AY	32492	553	1841	0.3	697.9	697.9	697.9	0.0
AZ	33030	637	1467	0.4	697.9	697.9	697.9	0.0
BA	33303	575	1197	0.5	697.9	697.9	697.9	0.0
BB	34402	799	1709	0.4	698.1	698.1	698.1	0.0
BC	35106	856	1272	0.4	698.2	698.2	698.2	0.0
BD	35821	818	2248	0.2	698.2	698.2	698.2	0.0
BE	36331	1311	3200	0.2	698.2	698.2	698.2	0.0

¹ Feet above confluence with the Milwaukee River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

ULAO 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
ULAO CREEK								
BF	37494	1755	2070	0.2	698.3	698.3	698.3	0.0
BG	38287	1363	417	0.9	698.4	698.4	698.4	0.0
BH	39429	1128	1051	0.4	700.0	700.0	700.0	0.0
BI	40111	1359	1155	0.3	700.4	700.4	700.4	0.0
BJ	40497	1370	1366	0.2	700.5	700.5	700.5	0.0
BK	41254	1370	1618	0.2	700.6	700.6	700.6	0.0
BL	42259	1216	1241	0.2	700.8	700.8	700.8	0.0
BM	43490	676	530	0.6	701.4	701.4	701.4	0.0
BN	44660	276	100	1.4	704.4	704.4	704.4	0.0
BO	44964	24	140	1.0	710.7	710.7	710.7	0.0
BP	45667	88	42	3.3	711.6	711.6	711.6	0.0
BQ	46307	21	34	4.1	717.5	717.5	717.5	0.0
BR	46592	30	74	1.2	720.3	720.3	720.3	0.0
BS	47170	70	31	2.8	726.3	726.3	726.3	0.0
BT	47573	92	44	2.0	728.6	728.6	728.6	0.0
BU	47879	52	30	3.0	731.5	731.5	731.5	0.0
BV	48264	65	38	2.3	736.6	736.6	736.6	0.0
BW	48805	77	38	2.4	744.0	744.0	744.0	0.0

¹ Feet above confluence with the Milwaukee River

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

ULAO 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
UNNAMED TRIBUTARY NO. 1 TO THE BELGIUM-HOLLAND DRAINAGE DITCH								
A	403	260	422	1.4	721.2	721.2	721.2	0.0
B	973	737	1202	0.5	721.4	721.4	721.4	0.0
C	1351	1046	2182	0.3	721.4	721.4	721.4	0.0
D	1752	1540	3131	0.2	721.4	721.4	721.4	0.0
E	2709	1590	3140	0.2	721.4	721.4	721.4	0.0
F	3237	1330	2735	0.2	721.4	721.4	721.4	0.0
G	3822	796	1020	0.5	721.5	721.5	721.5	0.0
H	4215	26	90	4.2	723.0	723.0	723.0	0.0
I	4907	173	393	1.2	723.9	723.9	723.9	0.0
J	5393	137	280	1.7	724.2	724.2	724.2	0.0
K	5603	104	287	1.7	725.0	725.0	725.0	0.0
L	6130	413	763	0.6	725.3	725.3	725.3	0.0
M	6404	110	380	1.3	725.3	725.3	725.3	0.0
N	6493	42	187	1.6	725.4	725.4	725.4	0.0
O	6602	135	662	0.5	726.2	726.2	726.2	0.0
P	7315	158	325	0.9	726.3	726.3	726.3	0.0
Q	7997	37	136	2.2	726.6	726.6	726.6	0.0
R	8856	38	135	2.2	728.0	728.0	728.0	0.0
S	9714	35	147	2.0	729.0	729.0	729.0	0.0

¹ Feet above model start, 180' downstream of County Highway K

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

**UNNAMED TRIBUTARY NO. 1 TO THE BELGIUM-
HOLLAND DRAINAGE DITCH**

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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
UNNAMED TRIBUTARY NO. 1 TO THE BELGIUM-HOLLAND DRAINAGE DITCH								
T	10404	63	240	1.2	729.5	729.5	729.5	0.0
U	11282	118	436	0.7	730.2	730.2	730.2	0.0
V	11596	256	578	0.4	730.3	730.3	730.3	0.0
W	12003	557	1297	0.2	730.4	730.4	730.4	0.0
X	12601	900	1915	0.1	730.4	730.4	730.4	0.0
Y	13375	1640	4682	0.0	730.4	730.4	730.4	0.0
Z	14422	62	130	1.3	730.4	730.4	730.4	0.0
AA	14932	34	122	1.3	730.6	730.6	730.6	0.0
AB	15271	38	128	1.3	730.8	730.8	730.8	0.0
AC	15423	39	132	1.4	730.9	730.9	730.9	0.0
AD	15773	35	134	1.7	730.9	730.9	730.9	0.0
AE	16145	29	112	2.0	730.9	730.9	730.9	0.0

¹ Feet above model start, 180' downstream of County Highway K

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

**UNNAMED TRIBUTARY NO. 1 TO THE BELGIUM-
HOLLAND DRAINAGE DITCH**

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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
UNNAMED TRIBUTARY NO. 1 TO THE BELGIUM-HOLLAND DRAINAGE DITCH OVERFLOW #1								
A	449	704	664	0.1	721.5	721.5	721.5	0.0
B	717	473	203	0.2	721.6	721.6	721.6	0.0
C	1197	177	42	0.8	722.1	722.1	722.1	0.0

¹ Feet above downstream confluence with Unnamed Tributary No. 1 to the Belgium-Holland Drainage Ditch

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

**UNNAMED TRIBUTARY NO. 1 TO THE BELGIUM-
HOLLAND DRAINAGE DITCH OVERFLOW #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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
UNNAMED TRIBUTARY NO. 1 TO THE BELGIUM-HOLLAND DRAINAGE DITCH OVERFLOW #2								
A	1006	1330	3248	0.0	730.4	730.4	730.4	0.0
B	1686	722	519	0.1	730.4	730.4	730.4	0.0
C	2415	358	306	0.2	730.4	730.4	730.4	0.0
D	2706	447	300	0.0	730.4	730.4	730.4	0.0

¹ Feet above downstream confluence with Unnamed Tributary No. 1 to the Belgium-Holland Drainage Ditch

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

**UNNAMED TRIBUTARY NO. 1 TO THE BELGIUM-
HOLLAND DRAINAGE DITCH OVERFLOW #2**

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANGE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
UNNAMED TRIBUTARY NO. 1 TO THE MILWAUKEE RIVER								
A	165	76	267	1.1	758.1 ²	754.5	754.5	0.0
B	592	76	204	1.4	758.1 ²	755.3	755.3	0.0
C	827	111	187	1.5	758.1 ²	755.5	755.5	0.0
D	989	250	468	0.6	758.1 ²	755.6	755.6	0.0
E	1534	80	82	3.4	758.1 ²	755.9	755.9	0.0
F	1569	77	93	3.0	758.1 ²	756.3	756.3	0.0
G	1917	36	55	5.1	758.1 ²	757.5	757.5	0.0
H	1952	45	92	2.5	758.1	758.1	758.1	0.0
I	2206	119	54	2.9	758.4	758.4	758.4	0.0
J	2604	36	100	1.5	760.9	760.9	760.9	0.0
K	2735	42	70	2.2	761.3	761.3	761.3	0.0
L	2858	61	103	1.5	763.9	763.9	763.9	0.0
M	3377	50	44	3.1	765.7	765.7	765.7	0.0
N	3660	142	143	0.9	767.1	767.1	767.1	0.0
O	3931	130	103	1.3	767.4	767.4	767.4	0.0
P	4284	245	292	0.5	768.1	768.1	768.1	0.0
Q	4659	41	81	1.7	769.2	769.2	769.2	0.0

¹ Feet above confluence with the Milwaukee River

² Regulatory Backwater Elevation from the Milwaukee River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

**UNNAMED TRIBUTARY NO. 1 TO THE MILWAUKEE
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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
UNNAMED TRIBUTARY NO. 1 TO THE MILWAUKEE RIVER								
R	4817	41	72	1.9	769.2	769.2	769.2	0.0
S	5226	290	173	0.8	770.5	770.5	770.5	0.0
T	5550	102	73	1.2	771.4	771.4	771.4	0.0
U	5608	181	129	0.7	772.1	772.1	772.1	0.0
V	5997	255	121	0.8	772.4	772.4	772.4	0.0
W	6373	361	282	0.3	774.5	774.5	774.5	0.0

¹ Feet above confluence with the Milwaukee River

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

**UNNAMED TRIBUTARY NO. 1 TO THE MILWAUKEE
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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
UNNAMED TRIBUTARY NO. 1 TO ULAO CREEK								
A	640	644	1960	0.2	664.4	664.4	664.4	0.0
B	1930	783	2126	0.1	664.4	664.4	664.4	0.0
C	2515	806	2499	0.1	664.4	664.4	664.4	0.0
D	3236	770	2386	0.0	664.4	664.4	664.4	0.0
E	3995	388	527	0.2	664.4	664.4	664.4	0.0
F	4751	34	29	3.5	665.3	665.3	665.3	0.0
G	5237	74	65	1.6	668.4	668.4	668.4	0.0
H	5707	16	34	2.3	670.9	670.9	670.9	0.0
I	5788	24	41	1.9	671.6	671.6	671.6	0.0
J	6056	87	49	1.6	672.6	672.6	672.6	0.0
K	6583	180	202	0.4	673.0	673.0	673.0	0.0
L	6923	128	210	0.4	673.0	673.0	673.0	0.0
M	7285	97	104	0.8	673.0	673.0	673.0	0.0
N	7605	57	47	1.7	673.4	673.4	673.4	0.0

¹ Feet above confluence with Ulao Creek

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

UNNAMED TRIBUTARY NO. 1 TO ULAO 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
UNNAMED TRIBUTARY TO UNNAMED TRIBUTARY NO. 1 TO ULAO CREEK								
A	1333	1379	5098	0.0	664.4	664.4	664.4	0.0
B	1858	830	2828	0.0	664.4	664.4	664.4	0.0
C	2254	662	1633	0.1	665.5	665.5	665.5	0.0
D	2554	874	2256	0.1	665.5	665.5	665.5	0.0
E	2892	608	968	0.1	665.5	665.5	665.5	0.0
F	4468	19	68	0.8	666.1	666.1	666.1	0.0
G	5238	10	38	1.5	666.8	666.8	666.8	0.0
H	5410	291	582	0.0	667.5	667.5	667.5	0.0
I	5753	279	442	0.0	667.5	667.5	667.5	0.0
J	6271	59	26	0.5	667.5	667.5	667.5	0.0
K	7210	97	11	1.3	671.9	671.9	671.9	0.0
L	7744	71	11	1.3	673.4	673.4	673.4	0.0

¹ Feet above confluence with Unnamed Tributary No. 1 to Ula0 Creek

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

**UNNAMED TRIBUTARY TO UNNAMED TRIBUTARY
NO. 1 TO ULAO 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
UNNAMED TRIBUTARY NO. 2 TO PIGEON CREEK								
A	540	375	539	2.6	727.0	727.0	727.0	0.0
B	1046	55	239	5.8	732.5	732.5	732.5	0.0
C	1115	69	398	3.5	734.7	734.7	734.7	0.0
D	1606	92	279	5.0	739.2	739.2	739.2	0.0
E	2193	80	274	5.0	745.8	745.8	745.8	0.0
F	2822	20	134	10.2	753.6	753.6	753.6	0.0
G	2923	200	2283	0.6	764.0	764.0	764.0	0.0
H	3419	184	704	0.6	764.0	764.0	764.0	0.0
I	3957	104	97	4.0	764.9	764.9	764.9	0.0
J	4528	157	157	2.3	771.0	771.0	771.0	0.0
K	4953	111	103	3.5	773.3	773.3	773.3	0.0
L	5331	206	254	1.4	775.5	775.5	775.5	0.0
M	5777	218	315	1.2	776.0	776.0	776.0	0.0
N	6140	18	70	5.1	776.0	776.0	776.0	0.0
O	6298	165	437	0.8	776.7	776.7	776.7	0.0
P	7099	281	218	1.7	776.8	776.8	776.8	0.0
Q	7502	41	125	2.9	777.3	777.3	777.3	0.0
R	7589	39	146	2.5	778.4	778.4	778.4	0.0
S	7751	264	416	0.6	778.7	778.7	778.7	0.0

¹ Feet above confluence with Pigeon Creek

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

UNNAMED TRIBUTARY NO. 2 TO PIGEON 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
UNNAMED TRIBUTARY NO. 2 TO PIGEON CREEK								
T	8289	359	495	0.5	778.8	778.8	778.8	0.0
U	8733	355	472	0.6	778.9	778.9	778.9	0.0
V	9366	259	290	0.9	779.2	779.2	779.2	0.0
W	9719	237	206	1.3	779.4	779.4	779.4	0.0
X	10237	450	158	1.7	781.5	781.5	781.5	0.0
Y	10846	533	446	0.6	782.4	782.4	782.4	0.0
Z	11257	43	55	4.8	782.7	782.7	782.7	0.0
AA	11446	296	941	0.3	785.4	785.4	785.4	0.0
AB	12008	329	729	0.4	785.4	785.4	785.4	0.0
AC	12353	70	43	3.4	786.6	786.6	786.6	0.0
AD	12754	86	45	3.2	790.5	790.5	790.5	0.0
AE	13142	44	115	1.3	793.1	793.1	793.1	0.0
AF	13237	143	435	0.3	796.9	796.9	796.9	0.0
AG	13830	228	190	0.8	796.9	796.9	796.9	0.0
AH	14278	182	107	1.3	798.5	798.5	798.5	0.0
AI	14761	158	96	1.5	800.3	800.3	800.3	0.0
AJ	15062	9	14	3.7	801.8	801.8	801.8	0.0
AK	15519	226	64	0.8	806.1	806.1	806.1	0.0

¹ Feet above confluence with Pigeon Creek

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

UNNAMED TRIBUTARY NO. 2 TO PIGEON 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 NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
UNNAMED TRIBUTARY NO. 3 TO THE MILWAUKEE RIVER								
A	150	44	57	3.7	790.9	790.9	790.9	0.0
B	220	151	190	1.1	792.9	792.9	792.9	0.0
C	511	178	428	0.5	793.1	793.1	793.1	0.0
D	669	158	389	0.5	793.2	793.2	793.2	0.0
E	1018	201	691	0.3	798.1	798.1	798.1	0.0
F	1192	320	503	0.4	798.1	798.1	798.1	0.0
G	1275	265	515	0.4	798.1	798.1	798.1	0.0
H	1419	219	647	0.3	798.1	798.2	798.1	0.0
I	1825	214	396	0.5	798.2	798.2	798.2	0.0

¹ Feet above confluence with Fredonia Creek

**TABLE
4**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY, WI
AND INCORPORATED AREAS**

FLOODWAY DATA

**UNNAMED TRIBUTARY NO. 3 TO THE MILWAUKEE
RIVER**

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 VE

Zone VE is the flood insurance risk zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals 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.

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.

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 Ozaukee County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. Historical data relating to the maps prepared for each community are presented in Table 4.

7.0 OTHER STUDIES

FISs have been prepared for the City of Milwaukee; the Villages of Bayside, Brown Deer, and Germantown; and the unincorporated areas of Sheboygan and Washington Counties (References 20, 21, 22, 23, 24, 25, 26).

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.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	FIRM EFFECTIVE DATE	FIRM REVISION DATE
Bayside, Village of	February 22, 1974	April 16, 1976	June 15, 1977	None
Belgium, Village of	December 6, 1999	None	December 6, 1999	None
Cedarburg, City of	December 28, 1973	November 12, 1976	May 15, 1980	None
Fredonia, Village of	January 9, 1974	June 4, 1976	January 2, 1981	None
Grafton, Village of	May 31, 1974	April 2, 1976	May 15, 1980	None
Mequon, City of	November 7, 1972	None	November 7, 1972	July 1, 1974 March 26, 1976
Newberg, Village of	December 4, 2007	None	December 4, 2007	None
Ozaukee County (Unincorporated Areas)	May 16, 1977	None	May 16, 1977	October 8, 1982
Port Washington, City of	May 31, 1974	June 11, 1976	October 15, 1981	None
Saukville, Village of	January 16, 1974	June 4, 1976	December 16, 1980	None
Theinsville, Village of	May 24, 1974	April 23, 1976	August 1, 1978	None

TABLES
5

FEDERAL EMERGENCY MANAGEMENT AGENCY

**OZAUKEE COUNTY
AND INCORPORATED AREAS**

COMMUNITY MAP HISTORY

9.0 **BIBLIOGRAPHY AND REFERENCES**

1. United States Census Bureau, <http://www.census.gov/>, 2000
2. United States Army Corps of Engineers, Report on Great Lakes Open-Coast Flood Levels; Detroit, Michigan; February, 1977
3. Federal Emergency Management Agency (FEMA), Flood Insurance Study – Ozaukee County, Wisconsin and Incorporated Areas, Washington D.C., December 6, 1999
4. National Climatic Data Center (NCDC), Storm Events Database, <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms> , 2005
5. Interagency Advisory Committee on Water Data, Bulletin 17B, Guidelines for Determining Flood Flow Frequency, 1982
6. United States Army Corps of Engineers, Detroit District Phase I, Revised Report on Great Lakes Open Coast Flood Levels, April 1988
7. United States Army Corps of Engineers, Waterways Experiment Station, Jon M. Hubertz, David B. Driver, and Robin Reinhard, Hindcast Wave Information for the Great Lakes: Lake Michigan, Vicksburg Mississippi, October 1991
8. Federal Emergency Management Agency, Guidelines and Specifications for Wave Elevation Determination and V-Zone Mapping – Great Lakes, Draft Report, August 1996, Unpublished
9. United States Army Corps of Engineers, Hydrologic Engineering Center, HEC-HMS V2.2.2, Davis, California, May 28, 2003
10. United States Department of Commerce, National Weather Service, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, Washington D.C., January 1963
11. Ozaukee County Land Information Office, Topographic Maps, Scale 1:800, Contour Interval 2 feet, <http://www.co.ozaukee.wi.us/landinfo/Topographic.htm> ; Port Washington, Wisconsin, 1993-2000
12. Southeastern Wisconsin Regional Planning Commission, Photogrammetric Maps, Scale 1:200 and 1:400, March 2000
13. United States Department of Agriculture, Soil Conservation Service, Technical Release No. 55, Urban Hydrology for Small Watersheds, June 1986

14. National Conservation Service, Soil Survey Geographic Database, Ozaukee County (WI089), Scale 1:1000 relative to original basemaps – the original hardcopy map scales vary from 1:12000 to 1:24000, 2004
15. Wisconsin Department of Natural Resources, Wisconsin's Floodplain Management Program, Chapter NR 116, August 2004
16. Federal Emergency Management Agency, Manual for Wave Runup Analysis, Coastal Flood Insurance Studies, November 1981
17. United States Army Corps of Engineers, Detroit District, Great Lakes Wave Runup Methodology Study, June 1989
18. United States Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, 1984
19. United States Army Corps of Engineers, Hydrologic Engineering Center, HEC-RAS V3.1.1, Davis, California, May 2003
20. Federal Emergency Management Agency, Flood Insurance Study, City of Milwaukee, Wisconsin (in the process of being revised), Washington D.C., November 19, 1987
21. Federal Emergency Management Agency, Flood Insurance Study, Village of Brown Deer, Milwaukee County, Wisconsin (in the process of being revised), Washington D.C., September 28, 1979
22. Federal Emergency Management Agency, Flood Insurance Study, Village of Bayside, Milwaukee and Ozaukee Counties, Wisconsin (in the process of being revised), Washington D.C., December 15, 1976
23. Federal Emergency Management Agency, Flood Insurance Study, Village of River Hills, Milwaukee County, Wisconsin (in the process of being revised), Washington D.C., October 15, 1979
24. Federal Emergency Management Agency, Flood Insurance Study, Village of Germantown, Milwaukee County, Wisconsin, Washington D.C., November 3, 1981
25. Federal Emergency Management Agency, Flood Insurance Study, Washington County and Unincorporated Areas, Wisconsin, Washington D.C., September 1, 1983

26. Federal Emergency Management Agency, Flood Insurance Study, Sheboygan County and Unincorporated Areas, Wisconsin, Washington D.C., November 21, 2002
27. Hydrocomp, Inc., Hydrocomp Simulation Programming Operations Manual, Fourth Edition, January 1976