

Preliminary Caledonia-Lewiston Levee Analysis

Conducted by the Levee Working Group

Analysis Content

Overview

History of the Levees

Current Levee Management and Costs

Flood Event Analysis Methodology

Brief Synopsis of Each Event

Management Alternatives

Attachments

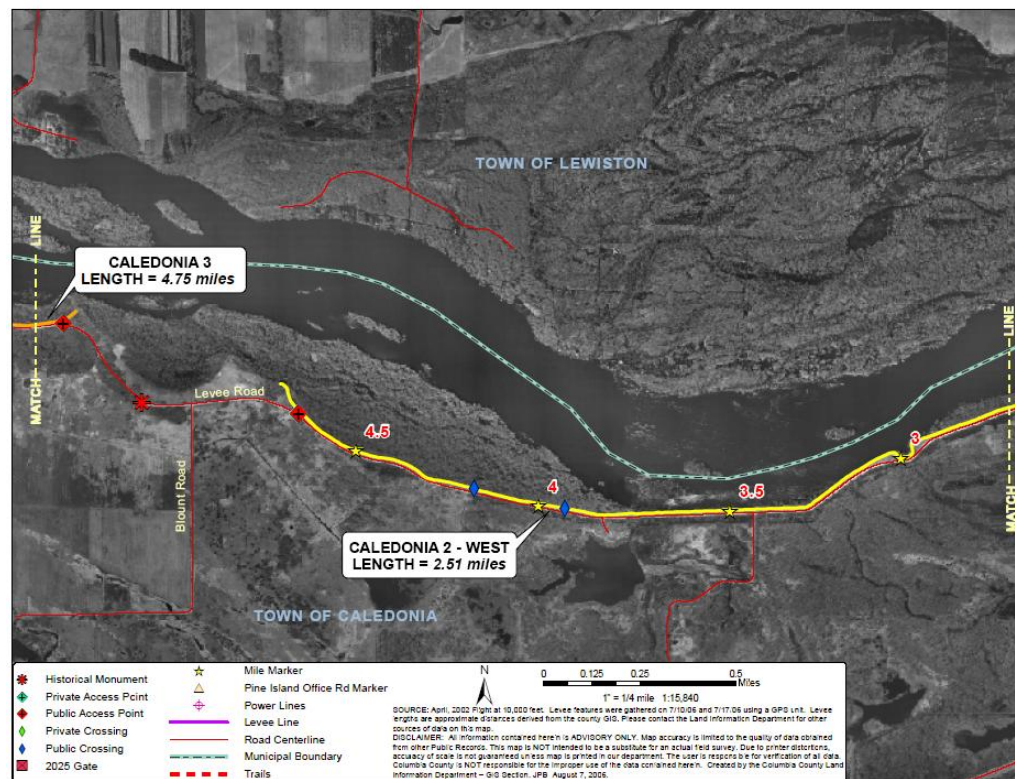
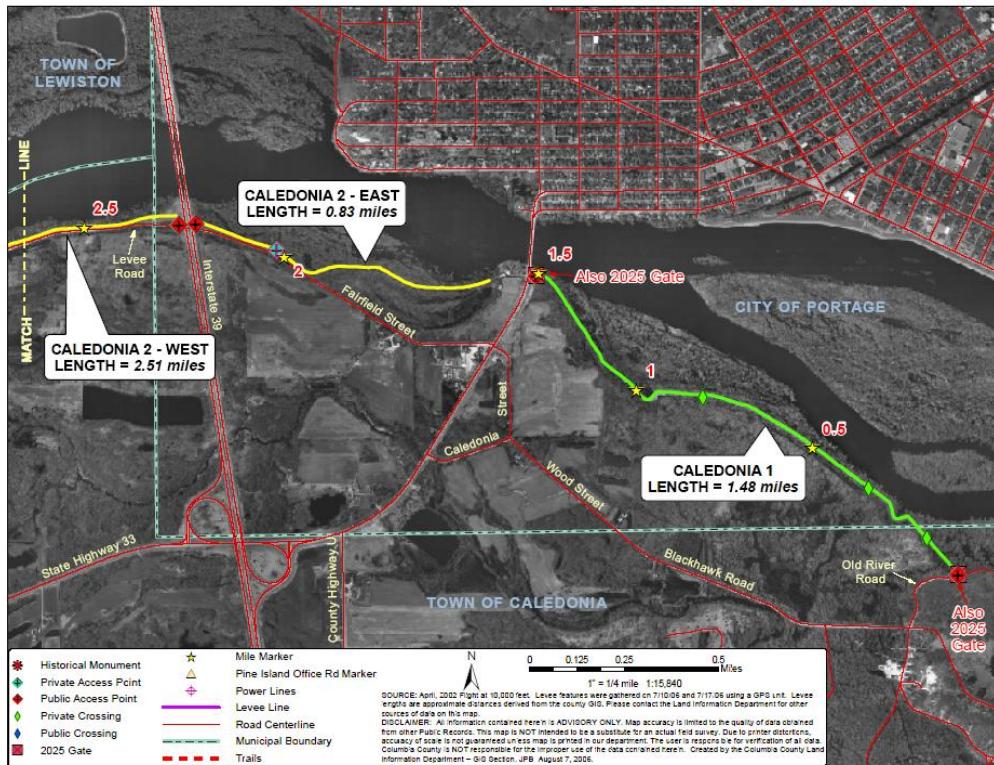
Overview

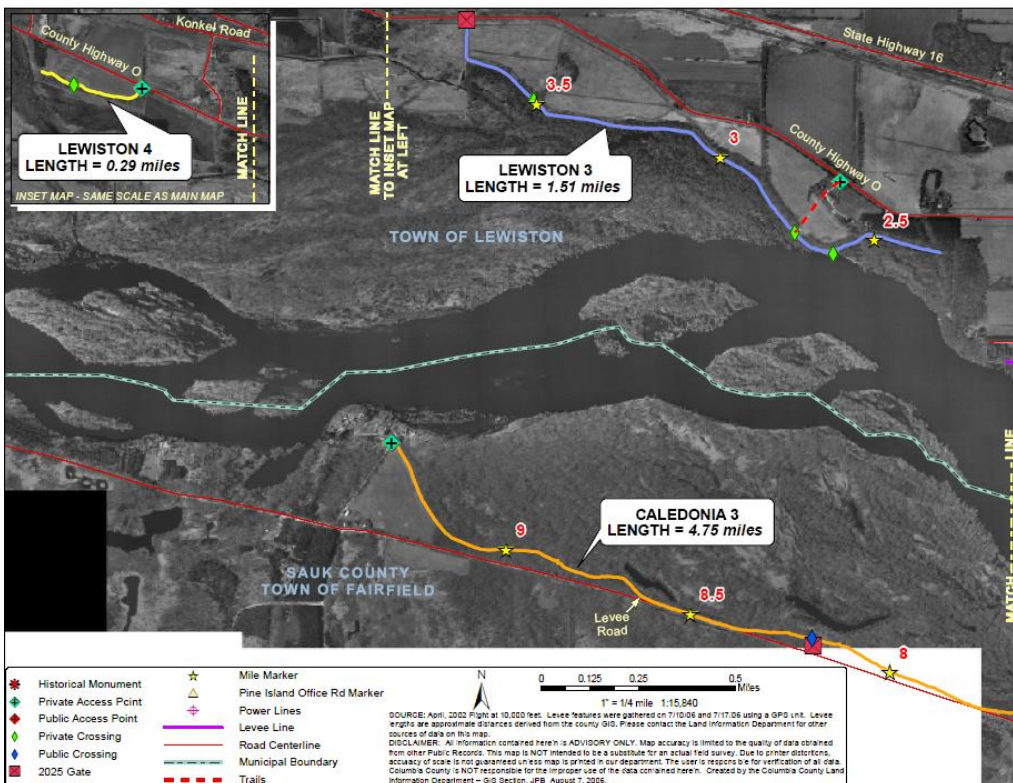
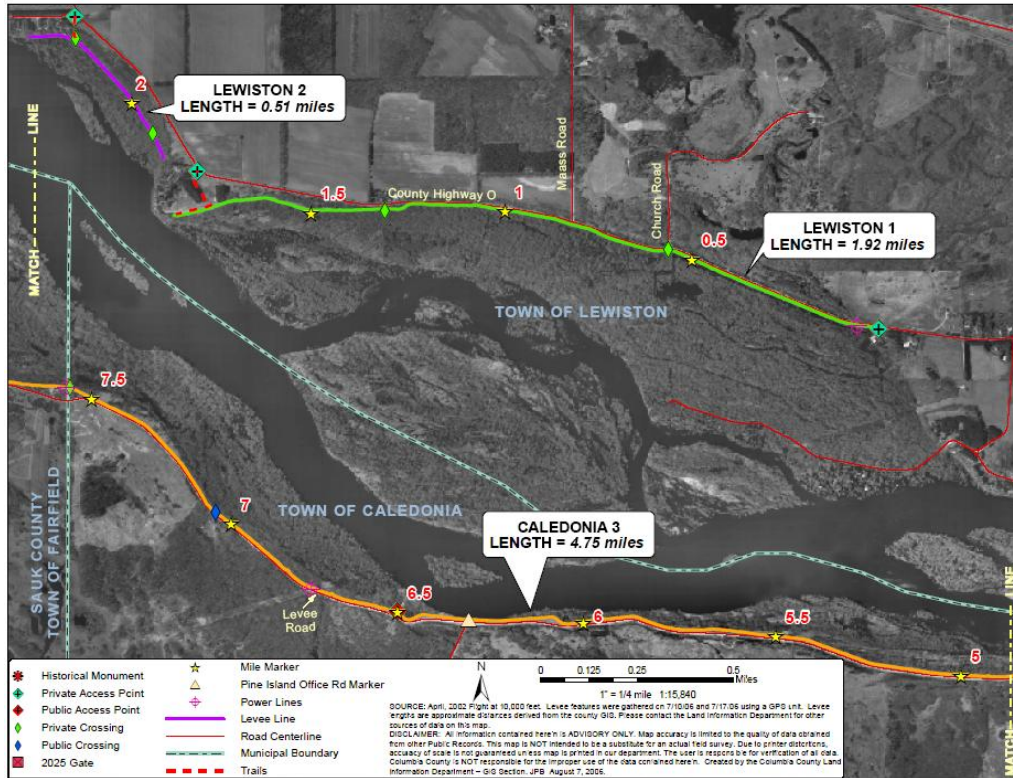
The Wisconsin Department of Natural Resources (WDNR) in cooperation with the local units of government of Columbia and Sauk Counties, including local townships, cities and villages situated along the Wisconsin River formed a working group to investigate questions concerning the long term sustainability and practicality of maintaining the existing Caledonia-Lewiston Levee System. The WDNR and others have had a longstanding concern about what level of flood protection the levees actually provide and how cost effective from a public expenditure standpoint is it to maintain them in their current state. In addition, WDNR would like to identify what eventually is a sustainable approach to managing this floodplain area from a long term sustainability perspective.

This basic and initial analysis was conducted to serve several purposes and to address the following issues:

1. Define the level of protection that the existing levees actually provide to properties from flooding events.
2. For the level of protection afforded by the levees; is this worth the amount of expenditure in public dollars on a sustained basis?
3. Identify which properties in the flood plain are actually protected or not protected by the levees under different flooding scenarios.
4. Provide information on the financial impacts from flooding and how the levees influence these costs or property impacts.

It should be noted that the term “levee” is used throughout this document when in fact these structures should be more appropriately be referred to as “dikes” since they are not built to any engineering design standards.





History of the Levees

The Caledonia-Lewiston Levee System consists of 13.8 miles of discontinuous sand dikes that were constructed along the Wisconsin River by various groups of landowners that lived adjacent to the Wisconsin River. Most of the levees were constructed during the 1890's. The Caledonia Levee consists of two segments totaling 9.57 miles along the south side of the Wisconsin River, and the Lewiston Levee consists of four segments totaling 4.23 miles on the north side of the river. The height of the levees is typically 8 to 12 feet above the ground surface on the landward toe of the levee. Slopes vary from 6:1 to 3:1

The Levees were built from locally available materials without any engineering design or adherence to any design standards. These levees were intended to protect adjacent lands from periodic flood events of Wisconsin River. Despite their shortcomings the levees have, in fact, withstood frequent floods. A failure occurred in 1938, but since that time the levees have remained relatively intact. However, this is due primarily to the direct result of substantial and timely flood emergency action by the local governments and the WDNR. It should be noted that despite substantial maintenance and emergency actions by local government and WDNR, the continued integrity of the levees has survived because there have been no major flood events that would have damaged them or require major repairs to be undertaken. In short, it could be said that the integrity of these levees has not been tested by any significant flood events.

In their present condition the Caledonia-Lewiston Levees do not and should not be expected to provide any meaningful protection from the Wisconsin River flooding with or without human intervention during flood events. With ever increasing development in the flood prone areas along the Wisconsin River, reliance on these levees for providing flood protection elevates the risk of putting lives and properties in harm's way.

On numerous occasions local units of government have been strongly advised not to rely on these levees to protect human life, health and property and that any attempts to repair or operate these levees during flood events were extremely dangerous and might result in loss of human life.

Responsibility for the levees was vested in the Portage Levee Commission through Chapter 282, Laws of 1901. In 1961, this commission was abolished (Chapter 191, Section 108, Laws of 1961) and its duties were reassigned to the Water Regulatory Board. However, the Board was eliminated and the Public Service Commission was vested with the responsibility of maintaining the levee system. Finally through state government reorganization, the Department of Natural Resources inherited the mandate of the Portage Levee Commission. (see WI Statutes Chapter 31.309 (2) (a) (b)).

Current Levee Management and Costs

Within the Department of Natural Resources oversight and maintenance of the Levees is performed by Southern Region staff assigned to the Lower Wisconsin Riverway Work Unit.

Budgeting for the Levees is provided through the Bureau of Facilities and Lands in DNR's central office. Levee management is supervised by the Program Supervisor for the Lower Wisconsin Riverway who is stationed in Dodgeville. A levee management plan has been prepared which describes the short and long term levee management needs. There is also an emergency management plan that describes actions to be taken in the event of a flood or failure of the levee. This supervisory position generally utilizes two Limited Term Employees (LTE's) who perform maintenance activities such as of routine dike inspections, dike mowing, filling any slumping areas or animal burrows and tree removal from within 25 feet of the toe of the dikes. This work occurs generally between spring and fall. Expenditures for annual levee maintenance for fiscal years 2003-2007 were as follows. The costs include LTE labor, supplies and equipment operation costs.

FY 2003 -- \$42,635
FY 2004 -- \$42,768
FY 2005 -- \$50,110
FY 2006 -- \$63,275
FY 2007 -- \$47,787

In addition to annual maintenance, the following additional work was also done on the levees between 1991 and 2007.

Rip-rapping -- \$230,350
Tree removal -- \$ 72,200
Levee repairs -- \$ 36,671
Emergency Levee Protection \$ 24,491 (response to 1993 flood event)

Flood Event Analysis Methodology.

Floodplain delineations for 10-year, 50-year and 100-year flood events were prepared based on the floodplain study of the Wisconsin River developed by the US Army CORPS of Engineers St. Paul District (USCOE) in 2003 as part of the "Portage, Wisconsin Flood Control Certification" project. This study was approved by the DNR and is now included by The Federal Emergency Management Agency (FEMA) into the preliminary Flood Insurance Study of Wisconsin River for Columbia and Sauk counties.

The study reach extends from I-90 on the downstream end to near cross section "BA" of the new FIS on the upstream end (station 653261). This reach corresponds with the availability of 2-foot contour data from the COE. The following GIS layers were developed:

- 10-year flood event with levee failure polygon layer – shows where the water would go when failure of levee at a 10-year flood event occurs
- 10-year levees fail smoothed line layer – similar to above but the line indicating the 10-year flood level was "smoothed" to better confirm with the existing topography

- 10-year flood event with levees holding polygon layer – shows where the water would go when levees hold at a 10-year flood event
- 10-year levees hold smoothed line layer – similar to above but the line indicating the 10-year flood level was “smoothed” to better confirm with the existing topography
- 50-year levees fail polygon layer – shows where the water would go when failure of levee at a 50-year flood event occurs
- 50-year levees fail smoothed line layer – similar to above but the line indicating the 50-year flood level was “smoothed” to better confirm with the existing topography
- 50-year levees hold polygon layer – shows where the water would go when levees hold at a 50-year flood event
- 50-year levees hold smoothed line layer – similar to above but the line indicating the 50-year flood level was “smoothed” to better confirm with the existing topography
- 100-year levees hold polygon layer – where water would go when the levees hold at a 100-year event
- 100-year levees hold smoothed line layer – shows where water would go at a 100-year event with “smoothing” to better confirm with the existing topography

All delineations were performed using the custom GeoRAS extension in ArcView 3.x called ‘WDNR-Floodplain Mapping Tool’. Delineations are based on a rasterization cell size of 2 meters. All line and polygon editing was done in ArcMap 9. Lines were smoothed using the PAEK method and a 10-meter smoothing tolerance. The line work was then cleaned up, leaving any islands roughly 10 feet across and larger.

All mapping was adjusted to account for the construction of the new Portage Levee, which was not reflected in 2-foot contours (shows old levee). Contours of the new levee were provided by the COE.

The following assumptions (not relevant for the scope of this project) were made for all profiles:

- Assumed water could get north of CTH O and RR near section 653261
- Mapping does not extend north of the RR near Big Slough area
- Mapping does not extend south of I-90 or backwater into the Baraboo River
- Mapping does not extend into backwater past the railroad on Rocky Run
- Mapping does not extend into backwater on Duck Creek past USH 51
- Mapping does not extend into areas behind the Portage Levee or the Portage Canal

Columbia County Land Information Department then overlaid the developed floodplain polygons referenced above with GIS layers containing property boundaries and their assessment values for the 2006 final assessments and prepared summary tables demonstrating

land, improvement and total assessed values for each flood frequency and levees hold/fail scenarios.

Following FEMA guidelines on determining feasibility of levees, only assessed values of improvements were compared for different flood scenarios. That is in making comparisons between the different flood events to determine which properties were impacted and how much they were impacted, we did not include the value of the land itself in totaling up “the cost of a flood event” but used the improvements that were installed on the property. The rationale behind this assumes that a structure would be the “property” damaged by high water and not the land itself.

It should be remembered that the levee itself is a topographical feature and therefore is an obstruction to the flowing waters and results in increased water surface elevations, thus impacting more lands during the given flood event. The mass of the levee will thus “displace” water and result in flood waters reaching higher elevations on the land if the levee structure were absent.

Brief Synopsis for Each Event

For each flooding scenario, the results of the GIS layer comparison will be discussed.

10-year flood event – The parcels impacted or inundated to some degree by flood waters with the levee holding number 1205; while the parcels impacted by the levee failing number 1281—a difference of only 76 properties. The total value of these properties in terms of assessed value would be \$1,381,100---out of a value of approximately \$50,000,000 for the total value of assessed properties. However, the Caledonia-Lewiston Levee System actually causes ***additional flooding*** for dwellings in Dekorra Township and the City of Portage Columbia County and in Fairfield Township Sauk County (**\$2,662,800** total assessed improvements value) due to increased flood elevations. This is likely because the levee displaces water and will create high water in another part of the floodplain.

50-year flood event – Under this scenario, more properties are impacted by the levees holding (1373-- property values of \$62, 788,900) versus the levees failing (1345—property values of \$54,638,900). The Caledonia-Lewiston Levees System causes additional flooding for dwellings in Caledonia, Dekorra, Lewiston, Pacific Townships and the City of Portage Columbia County (\$7,211,900 total assessed value of property improvements) due to increased flood elevations. This again is explained by the “displacement” effect of the levee in that flood waters have less opportunity to dissipate and thus inundate additional floodplain areas in the townships mentioned above during this event.

100-year flood event – Even though no specific flood profile was developed for the levees fail scenario during the regional flood events, the engineering analysis shows that the Caledonia-Lewiston Levees System would contribute to additional increases of the regional flood elevations because of the displacement of floodwater as explained above, thus impacting additional properties in both counties.

Management Alternatives

One of the charges of the Levee Working group is to develop a set of management alternatives for local elected officials, decisions makers and managers to consider. In developing alternatives the Working Group utilized the following findings and considerations.

- 1.) The current levees are actually earthen dikes that were never constructed according to any engineering design for flood control. They provide minimal flood protection for relatively small flood events (approximately a 4.2 year event).
- 2.) The floodplain area where the levees are now located should be managed in a way that is sustainable over the long run. The floodplain is highly susceptible to flooding and damage to property will occur. The expenditure of maintaining the levees is not without real costs and over the long term these annual maintenance costs do not produce the flood protection that these levees are assumed to provide.
- 3.) From an emergency management perspective it would not appear cost effective to maintain the levees and provide emergency services to those areas that have flood protection but in fact do not. At some point, it is more cost effective to provide alternatives so that people can relocate with economic incentives than to provide emergency services into areas that are in reality not protected by the levees.
- 4.) In the long term, what is the best eventual use of the property “protected” by the levees. When first constructed, the intent was to protect farm land from flooding. That is not the general case now and it would not appear prudent to continue to expend public funds protecting large expanses of undeveloped land.

Based on these considerations, the Working Group offers the following range of management alternatives for future consideration. Each alternative has its costs and implications and the details of each would need further development. Based on the flood event analyses and the above considerations, the Working Group would favor selection and further development of Alternative 6.

- 1) Maintain the status quo – under this scenario the WDNR would continue to do annual maintenance that would afford some protection from relatively small flood events (approximately 4.2 year event), but the levees would not provide flood protection from larger events. A large scale flood event could have very devastating impacts.
- 2.) Transfer existing levee management to a different entity - WDNR does not feel its state conservation and recreation program responsibilities benefit from the levee or its management. WDNR feels if others feel they benefit from the levee then they should assume its management.

3.) Rebuild the levees up to USCOE standards – this scenario has already been discussed and evaluated in the “Portage Flood Control Project” and was deemed not to be cost effective based on the value of the property protected and the cost of bringing the levees up to standards.

4.) Stopping Maintaining the Levees – this scenario would leave the levees in place and they would eventually degrade. This would require a change in State Statutes to allow the Department to abandon the levees. This would likely not be publicly acceptable.

5.) Decommission and partially remove the levees – this scenario may result in removal of certain properties from the now designated floodplain areas in both counties. This will remove properties from the floodplain designation for some residents in Sauk and Columbia Counties (including the City of Portage).

6.) Disable the levees and provide for flood plain restoration in a managed sequence – Allow for levee maintenance for smaller flood events in the short term, but begin a program of property buyout and other programs that would enhance movement of residents from the area behind the levee. Partnerships could be formed so that residents could be “made whole” financially and groups that have an interest in natural restoration of the area could form contribute to the floodplain restoration. Creation of a floodplain management district may help to facilitate this effort. In time the levees would no longer need to be maintained.

COLUMBIA COUNTY

LAND INFORMATION DEPARTMENT

2007

Current Tax Parcels 2006 Assessment Values

COLUMBIA COUNTY

Land Information

Department April

10 Year Event -Levee Hold

COMMUNITY	PARCEL COUNT	2006 FINAL ASSESSMENTS		TOTAL VALUE
		LAND VALUE	BLDG. VALUE	
11004 Town of Caledonia	646	9,621,900	12,662,800	22,284,700
11010 Town of Dekorra	98	3,774,500	4,575,600	8,350,100
11020 Town of Lewiston	280	4,595,400	4,819,200	9,414,600
11032 Town of Pacific	46	542,700	696,100	1,238,800
11271 City of Portage	135	1,619,100	9,357,900	10,977,000
	1,205	20,153,600	32,111,600	52,265,200

10 Year Event -Levee Fail

COMMUNITY	PARCEL COUNT	2006 FINAL ASSESSMENTS		TOTAL VALUE
		LAND VALUE	BLDG. VALUE	
11004 Town of Caledonia	718	10,301,800	13,112,800	23,414,600
11010 Town of Dekorra	92	3,644,700	4,265,500	7,910,200
11020 Town of Lewiston	319	5,687,800	4,985,000	10,672,800
11032 Town of Pacific	46	542,700	696,100	1,238,800
11271 City of Portage	106	1,148,100	6,499,600	7,647,700
	1,281	21,325,100	29,559,000	50,884,100

50 Year Event -Levee Hold

COMMUNITY	PARCEL COUNT	2006 FINAL ASSESSMENTS		TOTAL VALUE
		LAND VALUE	BLDG. VALUE	
11004 Town of Caledonia	695	10,453,200	13,547,100	24,000,300
11010 Town of Dekorra	112	4,138,600	5,674,200	9,812,800
11020 Town of Lewiston	346	5,796,100	6,794,900	12,591,000
11032 Town of Pacific	53	684,800	822,400	1,507,200
11271 City of Portage	167	2,065,400	12,802,200	14,867,600
	1,373	23,138,100	39,640,800	62,778,900

50 Year Event -Levee Fail

COMMUNITY	PARCEL COUNT	2006 FINAL ASSESSMENTS		TOTAL VALUE
		LAND VALUE	BLDG. VALUE	
11004 Town of Caledonia	725	10,378,800	13,302,800	23,681,600
11010 Town of Dekorra	106	3,970,200	5,244,100	9,214,300
11020 Town of Lewiston	357	6,091,800	6,487,000	12,578,800
11032 Town of Pacific	50	599,700	771,700	1,371,400
11271 City of Portage	107	1,169,500	6,623,300	7,792,800
	1,345	22,210,000	32,428,900	54,638,900

100 Year Event

COMMUNITY	PARCEL COUNT	2006 FINAL ASSESSMENTS		TOTAL VALUE
		LAND VALUE	BLDG. VALUE	
11004 Town of Caledonia	731	10,468,800	13,641,600	24,110,400
11010 Town of Dekorra	122	4,378,800	6,358,600	10,737,400
11020 Town of Lewiston	361	6,183,800	6,994,500	13,178,300
11032 Town of Pacific	53	684,800	822,400	1,507,200
11271 City of Portage	176	2,171,000	13,607,200	15,778,200
	1,443	23,887,200	41,424,300	65,311,500

SAUK COUNTY

MAPPING DEPARTMENT

April 2007

2005 Tax Parcels 2005 Assessment Values

Sauk County data generously provided by the Sauk County Mapping

COLUMBIA COUNTY

Land Information

Department

10 Year Event -Levee Hold

COMMUNITY	PARCEL COUNT	2006 FINAL ASSESSMENTS		
		LAND VALUE	BLDG. VALUE	TOTAL VALUE
012 Town Of Fairfield	64	754,300	2,507,700	3,262,

10 Year Event -Levee Fail

COMMUNITY	PARCEL COUNT	2006 FINAL ASSESSMENTS		
		LAND VALUE	BLDG. VALUE	TOTAL VALUE
012 Town Of Fairfield	83	945,600	2,397,500	3,343,

50 Year Event -Levee Hold

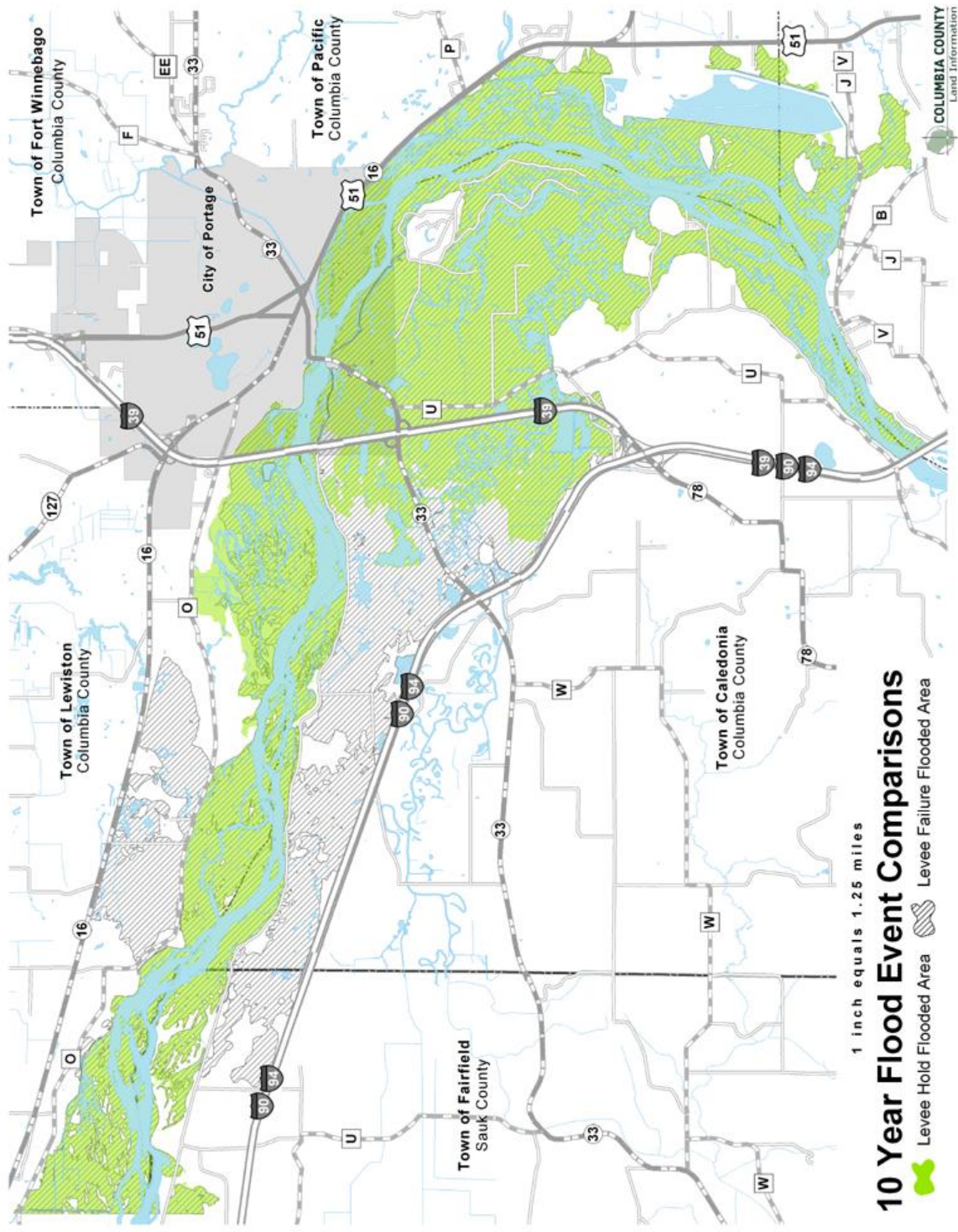
COMMUNITY	PARCEL COUNT	2006 FINAL ASSESSMENTS		
		LAND VALUE	BLDG. VALUE	TOTAL VALUE
012 Town Of Fairfield	73	803,400	2,862,100	3,665,

50 Year Event -Levee Fail

COMMUNITY	PARCEL COUNT	2006 FINAL ASSESSMENTS		
		LAND VALUE	BLDG. VALUE	TOTAL VALUE
012 Town Of Fairfield	105	1,388,800	2,921,900	4,310,

100 Year Event

COMMUNITY	PARCEL COUNT	2006 FINAL ASSESSMENTS		
		LAND VALUE	BLDG. VALUE	TOTAL VALUE
012 Town Of Fairfield	115	1,492,900	3,430,900	4,923,



10 Year Flood Event Comparisons

1 inch equals 1.25 miles

Levee Hold Flooded Area

Levee Failure Flooded Area

COLUMBIA COUNTY
Land Information

