

MEMORANDUM FOR RECORD

SUBJECT: Interbasin Flow, Browns Valley Dike, Browns Valley, Minnesota, 2001 Flood and Historical Information

1. References:

a. Browns Valley Dike, Browns Valley, Minnesota, History and Potential for Interbasin Flow, Kenton Spading, P.E., U.S. Army Corps of Engineers, St. Paul District, July 1999, Revised January 2000. (View at <http://www.ijc.org/boards/rrb/LTraverse.pdf> [August 2001] or <http://www.mvp-wc.usace.army.mil/org> [August 2001])

b. Post Ice Jam Flood Field Trip Report, Little Minnesota River at Browns Valley, MN, Richard Pomerleau, P.E., U.S. Army Corps of Engineers, St. Paul District, March 28, 1995.

c. "A Canoe Voyage Up The Minnay Sotor" by George Featherstonhaugh, published by Richard Bentley of London, England, in 1847. Reprint by Minnesota Historical Society, 1970, Library of Congress Card Catalog Number: 71-111618, Standard Book Number: 87351-057-7.

d. Engineer Department, United States Army. "An Essay concerning Important Physical Features Exhibited in the Valley of the Minnesota River, and Upon Their Significance" by G. K. Warren (Major of Engineers), Part II of Report on the Minnesota River, submitted to Brig. Gen. A. A. Humphreys, Chief of Engineers, October 31, 1874. Washington, Government Printing Office, 1874.

2. The purpose of this memorandum is to discuss the Little Minnesota River breakout flow that occurred during the Spring 2001 flood and how that information compares to the data presented in Reference 1.a. Reference 1.a. discusses interbasin flow between the Little Minnesota River (Upper Mississippi River basin) and Lake Traverse (Red River of the North basin). Water historically as well as presently flows from the Minnesota River basin to the Red River of the North. Water could also flow the opposite way if Lake Traverse were very high. Information is also provided on the history of ice/debris jam events that have occurred in and near the City of Browns Valley since the late 1980's as well as other historical information.

3. Reference 1.a. assumed that breakout flow began to occur at an open-water discharge of approximately 3,000 cfs (Reference 1.a., Paragraph 6.1.1). The Little Minnesota River at Peever, United States Geological Survey (USGS) gage number 05290000, had a peak discharge of 3,510 cfs at approximately 2030 hours on 12 April 2001 (preliminary data). On that same day, the USGS measured a flow of 2,990 cfs at the gage at approximately 1510 hours (river rising). There is approximately 5 square miles of drainage area below this gage and above the breakout area. See the left-center of Enclosure No. 1 for the gage location. In addition, on 12 April at approximately 1745 hours, the USGS measured a breakout flow of 132 cfs flowing into Lake Traverse at the triple box culvert, which passes through the Browns Valley dike. This

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water was flowing from the Little Minnesota River into Lake Traverse. The culverts are under Highway 10/28 directly east of the word "Easter" on Enclosure No. 1. The breakout flow measured by the USGS was probably slightly larger when the peak flow (3,510 cfs) occurred a few hours later. On 12 April, the pool level of Lake Traverse was 979.74 feet (1912 MSL) and rising. The pool peaked at 981.12 feet on 19 April. The continental divide is the left bank of the Little Minnesota River. The low point on the divide is at approximately elevation 983.9 feet. The top of White Rock Dam has an elevation of 986.0 feet.

4. Two Corps of Engineers flood reconnaissance engineers (Scott Jutila and Jim Murphy) visited the Browns Valley area on 12 April 2001 at approximately 1500 hours. They made observations on the Little Minnesota River at one of the breakout areas (Points A, B and C, Enclosure No. 1), at the small culvert at the road crossing to the northwest (Point E) and at the aforementioned Browns Valley dike triple box culverts (Point D). They directly observed breakout flow from the Little Minnesota River flowing toward and into Lake Traverse.

Mr. Jutila took some pictures of the breakout flow area during his visit. These are attached to this memorandum as Enclosures 2, 3 and 4. Enclosure No. 2 is a view south-southeast from [Point A](#) on Enclosure No. 1. Enclosure No. 3 is a view southwest from [Point B](#). Enclosure No. 4 is a view southeast from [Point C](#). Detailed explanations of each photograph are included on each enclosure. For additional reference, Points A, B, C, D and E can also be seen on some of the other enclosures to this memorandum. Point F is an additional breakout flow area, which is discussed below.

5. On 14 April 2001, Jon Boese of Holloway, Minnesota, took some oblique aerial photographs of the Browns Valley breakout flow area at approximately 1000 hours. David Craigmile of Boyd, Minnesota, provided the photographs to this office. They are attached as Enclosures 5 through 9. Enclosure No. 5 is an overall view of the area. Enclosure No. 6 is a view of the reach of the Little Minnesota River along which breakout flow occurs. Enclosure No. 7 is a view of the breakout flow area at Point F on Enclosure No. 1 (near the escarpment). Enclosure No. 8 is a close-up of Enclosure No. 7. Enclosure No. 9 is a close-up of the Browns Valley dike culverts under Highway 10/28 (see Point D on the enclosures). No field observations of breakout flow were made on the ground on 14 April. However, Enclosure No. 8 indicates that breakout flow is occurring. The discharge at the Little Minnesota River at the Peever gage was approximately 2,500 cfs at this time. Detailed explanations of each photograph are included on each enclosure.

6. On 14 April 2001, a Corps of Engineers contractor took some 1:12000 high altitude aerial photographs of the Browns Valley area. This information is attached as Enclosures 10 and 11. Enclosure No. 11 is a close-up view of Enclosure No. 10. Breakout flow from the Point F area can be seen on these photographs. Evidence of breakout flow from near Point B can also be seen on Enclosure No. 11. Details of each photograph are included on each enclosure.

7. There were no ice jam problems in Browns Valley during the 2001 flood (as there were in 1997 and other years). Open river conditions prevailed. Ice jams can, of course, cause water to break out of the channel regardless of the discharge in the main river. This increases the

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frequency at which breakout and interbasin flow will occur (see Reference 1.a., Paragraph 6.1.2). Browns Valley is known to experience ice jam events. In regard to that, Reference No. 1.b. states: "Browns Valley experienced significant ice jam floods during the spring snowmelt-runoff period in 1989, 1991, 1992, 1993, 1994 and again in 1995." The report also includes a discussion of a large ice jam that occurred in 1972.

Ice jams, however, are not the only problem experienced in the area. Reference 1.b. goes on to say: "A reconnaissance of the watershed revealed a large number of dead and dying elm trees....Phil McCaskell [Public Works Dept.] stated that this year [1995] a large debris jam formed upstream of the city on the South Dakota side of the border. The jam was large enough to cause a flow diversion from the Little Minnesota River direct to Lake Traverse."

8. Since Reference 1.a. was published, a reference to pre-European-settlement (1835) interbasin flow and biota transfer has been found. Although conditions have changed dramatically since 1835, I include the quote here for interested readers. Mr. Featherstonhaugh in Reference 1.c. states (St. Peter's is the Minnesota River):

"I walked down to the lake [Traverse], and found its waters very dead and turbid. The drought had lowered its level to such a degree, that the channel by which it communicates with [the] Red River, that flows into Lake Winnipeg, was dried up, and Lake Travers [sic] was consequently stagnant. I found several species of anadonta and unio, some of the latter of the same species as those inhabiting the St. Peter's, which is accounted for by the circumstances of the south end of this lake being only divided from the North end of Big Stone Lake by a low isthmus, two miles broad, so that when the waters of Lake Traverse are high, they flow into Big Stone Lake." [October 4, 1835]

A map (circa 1872) obtained from Reference 1.d. (see Enclosure No. 12) indicates that the meanders of the Little Minnesota River would, at times, enter the marshy wetland area that was directly linked to Lake Traverse.

9. Summary: Two Corps of Engineers flood reconnaissance engineers observed breakout flow, from the left bank of the Little Minnesota River, flowing into Lake Traverse on 12 April 2001. This observation was made about 400 yards southwest of the intersection of Highway Nos. 27 and 28. At this time, the discharge at the Peever gage was approximately 3,000 cfs (approximately a 10-year recurrence interval). This matches very well with the data presented in Enclosure No. 1.a. On 12 April, the USGS measured the breakout flow into Lake Traverse at 134 cfs. On 14 April, a number of oblique and high altitude aerial photographs were taken of the breakout flow area. These photos indicate that breakout flow from the left bank was also occurring on 14 April approximately 1 mile southwest of the aforementioned intersection. The discharge at the Peever gage was approximately 2,500 cfs on that date. When the aforementioned ice and debris jams are considered, it is clear that breakout flow from the left bank of the river and into Lake Traverse occurs more frequently than a 10-year event.

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10. Breakout flow from the right bank of the Little Minnesota River is not discussed in this memorandum, as it does not result in interbasin flow. Interested readers can consult Reference 1.b. for information on the history of road raises and levees that have been constructed (and in some cases removed) to restrict or manage the flow in this direction.

11. Questions regarding this memorandum can be addressed to me at 651-290-5623 or spading@usace.army.mil.

12 Encls

1. Map

2-4. Photographs

5-11. Aerial Photographs

12. Map

KENTON E. SPADING, P.E.

Hydraulic Engineer

CF:

Dwight Williamson, Manitoba Environment, 123 Main St., Suite 160, Winnipeg, MB, R3C 1A5

Robert Halliday, Halliday and Assoc., 717 Sixth Ave. N, Saskatoon, SK, S7K 2S8

Rick Bowering, Manitoba Dept. of Conservation, 200 Saulteaux Crescent, Winnipeg, MB, R3J 3W3

Mel Sinn, MnDNR, Division of Waters, 500 Lafayette Rd., St. Paul, MN 55155

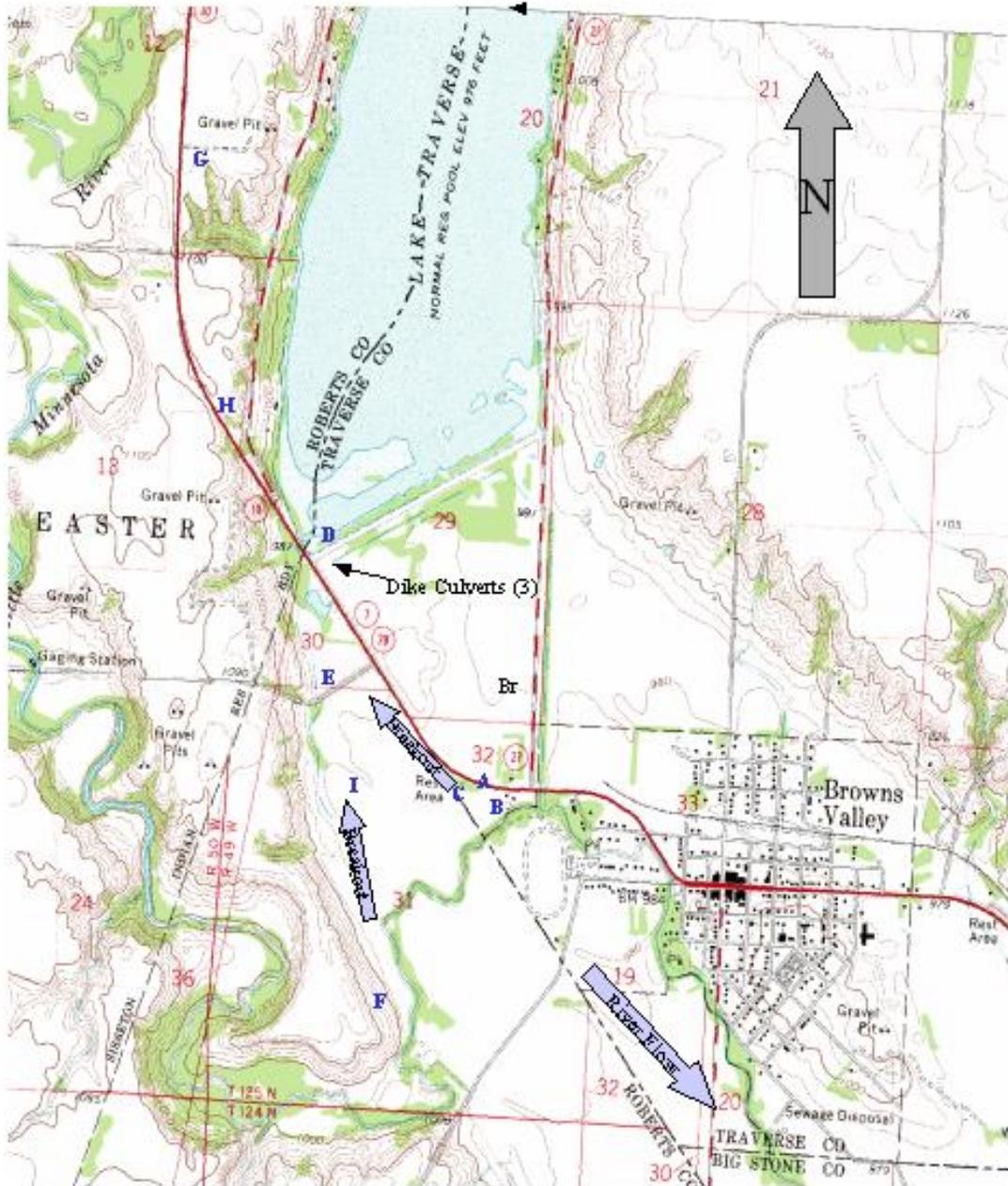
David Craigmile, RR No. 1, Box 205, Boyd, MN 56218

David Salberg, Corps of Engineers, (CO-WF-LKT), R2, Box 59, Wheaton, MN 56296-9630

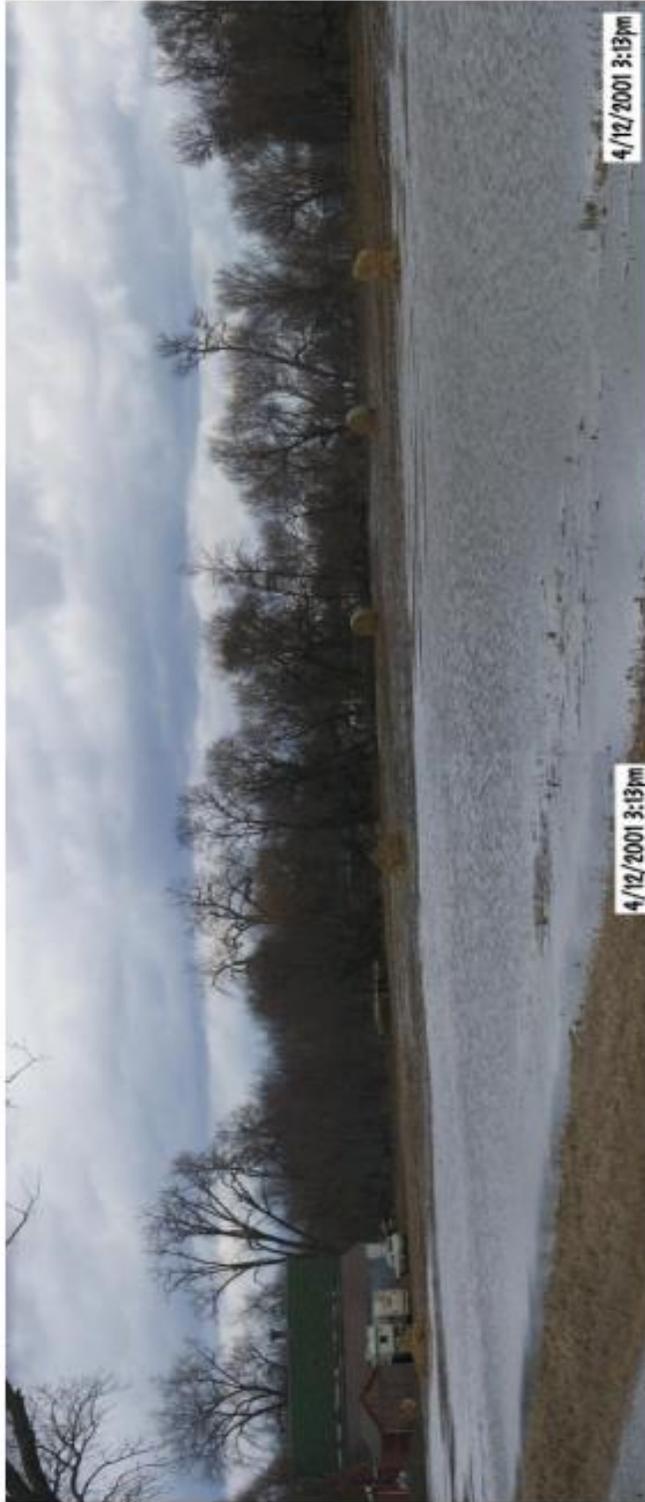
David Loss, Corps of Engineers, (PM-A), 190 Fifth St. E., St. Paul, MN 55101-1638

Scott Jutila, Corps of Engineers, (ED-H), 190 Fifth St. E., St. Paul, MN 55101-1638

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- Little Minnesota River, Browns Valley, MN, Breakout Flow
 - 2001 Flood Photo Index Map
- Enclosure No. 1**



Browns Valley, MN, Continental Divide, Breakout Flow April 12, 2001

The above view is south-southeast from Point A on Enclosure No. 1. The tree line is the left bank of the Little Minnesota River. River flow is right-to-left. The breakout water in the foreground is flowing directly at the viewer to the right of the farmstead. The round bales of hay are sitting in the path of the breakout flow.

The farmstead on the left is between points A and B on Enclosure No. 1.

Enclosure 2

Enclosure 2



Browns Valley, MN, Continental Divide, Breakout Flow April 12, 2001

The above view is southwest from Point B on Enclosure No. 1. The photographer is behind the barn shown on Enclosure No. 2. The tree line is the left bank of the Little Minnesota River. The breakout flow can clearly be seen in the foreground of the picture flowing left-to-right. Breakout flow is also occurring further southwest of here along the toe of the escarpment seen in the background (see Point F on Enclosure Nos. 1, 5, 6, 7, 10, and 11). The discharge at the Peever gage is approximately 3,000 cfs at this time.

Enclosure 3

Enclosure 3



Continental Divide, Breakout Flow April 12, 2001

The above view is southeast from Point C on Enclosure No. 1 along the Roberts/Traverse County Line. The telephone line follows the county line (see Enclosure Nos. 5 and 6). The tree line in the background is the left bank of the Little Minnesota River. This water (from Point B) follows the Highway 7/28 ditch to the small culvert at Point E on Enclosure No. 1 and on into Lake Traverse. The ditch in the foreground can be seen on Enclosure Nos. 10 and 11. **Enclosure 4**

Enclosure 4

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Browns Valley, MN



Continental Divide, Breakout Flow Area, April 14, 2001

The above view is southeast from **Point G** on Enclosure No. 1. The Little Minnesota River enters the picture on the right side of the photograph. The water in the background is backwater from Big Stone Lake. The water in the foreground is Lake Traverse. The white arrows illustrate breakout flow paths.

Enclosure 5

Browns Valley, MN



Continental Divide, Breakout Flow Area, April 14, 2001

The above view is southeast from **Point H** on Enclosure No. 1. The Little Minnesota River enters the picture in the upper-right corner of the photograph. The Little Minnesota River flow is from right-to-left. The white lines represent breakout flow paths. **Enclosure 6**

Browns Valley, MN



Continental Divide, Breakout Flow Area, April 14, 2001, approx. 1000 hrs.

The above view is southeast from [Point I](#) on Enclosure No. 1 toward [Point F](#). The

Little Minnesota River enters the picture in the upper-right corner of the photograph. The Little Minnesota River flow is from right-to-left. The white lines represent breakout flow paths. The discharge at the Peever gage is approximately 2,500 cfs at this time.

Enclosure 7

Browns Valley, MN



Continental Divide, Breakout Flow Area, April 14, 2001

The above view is southeast and is a close-up of the Point F area on Enclosure No. 7 (also see Pt. F on Enclosure No. 1). The Little Minnesota River is in the upper left corner of the photograph. Breakout flow can be seen escaping from the left bank of the Little Minnesota River and flowing into a ditch along the toe of the adjoining ridge. The white lines represent breakout flow paths. **Enclosure 8**

Browns Valley, MN



Continental Divide, Breakout Flow Area, April 14, 2001

The above view is south-southeast and is a close-up of the Point D area on Enclosure No. 1 (also see pt. D on the other Enclosures). The main portion of the Browns Valley Dike can be seen in the upper left corner of the picture. The road also forms a portion of the dike in a northwest direction. The triple box culvert/bridge can be seen in the center of the picture. The white lines represent breakout flow paths. **Enclosure 9**

Browns Valley, MN



Continental Divide, Breakout Flow Area, April 14, 2001

The Browns Valley Dike culverts are just off the top edge of this photograph. The white lines represent breakout flow paths. **Enclosure 10**

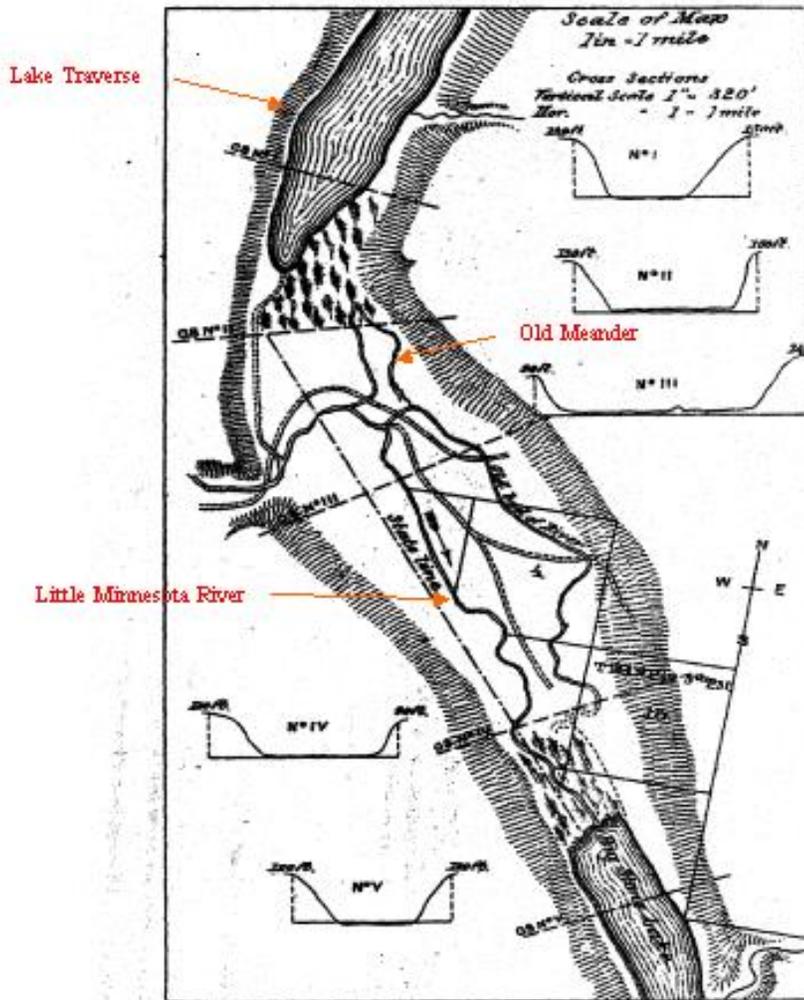
Browns Valley, MN



Continental Divide, Breakout Flow Area, April 14, 2001

This is a close-up of Enclosure No. 10. The breakout flow paths can be seen in the Point A-B-C and F areas. The white lines represent breakout flow paths.

Enclosure 11



The body of water at the top of the map is Lake Traverse. The river flowing into Big Stone Lake is the Little Minnesota River.

Note the meander of the river that enters the wetland that is directly adjacent to Lake Traverse. **Enclosure 12**