January 9, 2012

Board of Managers
Buffalo-Red River Watershed District
PO Box 341
Barnesville, MN  56514

Subject:  Floodplain Mapping – Wolverton Creek Restoration
2011 BWSR Clean Water Fund
HEI Project No. 1915_189

Dear Managers:

In 2011, the Buffalo-Red River Watershed District was awarded a Clean Water Fund grant through the Board of Water and Soil Resources for the Wolverton Restoration Project. As part of the workplan, Houston Engineering, Inc. (HEI) has completed hydraulic modeling to determine floodplain levels for various flood events and has mapped these water surface elevations using a Digital Elevation Model (DEM) of the Wolverton Creek area to show the extents of these floodplains.

In 2008, the International Water Institute completed a LIDAR survey of the Wolverton Creek area as part of a larger survey of the entire Red River Valley. The data from the LIDAR collect was used to generate a DEM of the drainage area of Wolverton Creek. The DEM was then “hydrologically reconditioned” using burnlines in the DEM. This ensured that flow directions in the DEM matched what is seen on the landscape. The type of LIDAR used in the IWI survey, does not reliably penetrate in areas with dense vegetation or through areas that had water on them at the time of the survey. Field survey was completed in 2008, to pick up information that would not readily be picked up by the LIDAR.

As part of a 2007 Clean Water Legacy Grant awarded to the Clay Soil and Water Conservation District (SWCD), survey was completed in 2008 on the Wolverton Creek Channel. Survey included channel profile and cross-sections as well as measurement of existing culverts (size, material, and invert elevations.

A hydraulic model of Wolverton Creek was developed starting at the Red River and proceeding upstream into Section 17 of Mitchell Township. In total, approximately 23.5 miles of river channel was analyzed using HEC-RAS. HEC-RAS is hydraulic modeling software developed by the US Army Corps of Engineers. 166 cross sections of Wolverton Creek were developed by merging HEIR survey data with LIDAR.

Hydrology used in the hydraulic modeling was determined by using the 1997 USGS Regression Equations. These equations were applied to determine discharge rates at flow change locations. Flow change locations correspond to locations where subbasins in the Wolverton Creek drainage area converge to form larger and larger contributing drainage areas. The Wolverton Creek drainage area was broken down into 20 subbasins which contribute to the flow of Wolverton Creek.
The model was then calibrated by Highwater marks from local residents. These floods were compared to USGS flood events recorded for the Buffalo River in Sabin, MN and the model flows determined using the 1997 USGS Regression Equations were adjusted (increased) accordingly.

The floodplain mapping was then performed for the 2-year, 5-year and 10-year floods by intersecting the water surface elevation with the LIDAR based DEM. Flooding was then determined by the locations where the water surface remained above the ground surface. In locations where smaller streams or ditches merged with Wolverton Creek, the water surface elevation at the intersection was used to map the flood level back into the contributing stream/ditch.

For the 10-year floodplain, the flooding extent along Wolverton Creek can be broken down into three sections. From the Red River to County State Aid Highway No. 2, a flood corridor of approximately 250 feet in width roughly represents the effective flooding area. From County State Aid Highway No. 2 to 170 ST (Wilken County) there is a flood corridor of approximately 400 feet. From 170 ST to 180 AVE there is a flood corridor of approximately 200 feet.

The attached maps show the 2-year, 5-year, and 10-year floodplains. Currently we have not identified any RIM or WRP easements along the Wolverton Creek. Based on the mapping and the location of CRP easements, additional buffering needs along the channel for various floodplain levels are as follows:

<table>
<thead>
<tr>
<th>Floodplain</th>
<th>Total Area within the floodplain (Acres)</th>
<th>Area within Floodplain Under the 2007 Conservation Reserve Program (CRP)</th>
<th>Area Not Currently Under Conservation Easement (Acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-year</td>
<td>579</td>
<td>100</td>
<td>479</td>
</tr>
<tr>
<td>5-year</td>
<td>1009</td>
<td>157</td>
<td>852</td>
</tr>
<tr>
<td>10-year</td>
<td>1429</td>
<td>177</td>
<td>1252</td>
</tr>
</tbody>
</table>

We recommend that the BRRWD continue to work with the Clay and Wilkin SWCDs on implementing additional bufferstrips along Wolverton Creek.

If you have any questions or comments, feel free to give me a call at (701) 499-2055.

Sincerely,

HOUSTON ENGINEERING, INC.

Erik S. Jones, PE
ESJ:sh
cc: Pete Waller, BWSR, 1004 Frontier DR, Fergus Falls, MN 56537
    Kevin Kassenborg, Clay SWCD, 1615 30th Ave South, Moorhead, MN 56560
    Donald Bajumpaa, Wilkin SWCD, 1150 Highway 75 North, Breckenridge, MN 56520
Floodplain Mapping

Wolverton Creek Restoration
2011 BWSR Clean Water Fund
Buffalo-Red River Watershed District
Barnesville, Minnesota

Datum: NAVD 1988

Legend
- River
- 1 ft Contour
- 5 ft Contour
- County Boundary
- Township Boundary
- Section Boundary
- US Highway
- State Highway
- County Highway
- CRP (2007 Coverage)
- 2 Year Floodplain
- 5 Year Floodplain
- 10 Year Floodplain
Floodplain Mapping
Wolverton Creek Restoration
2011 BWSR Clean Water Fund
Buffalo-Red River Watershed District
Barnesville, Minnesota

Datum: NAVD 1988

Legend
- River
- 1 ft Contour
- 5 ft Contour
- County Boundary
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- County Highway
- CRP (2007 Coverage)
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- 5 Year Floodplain
- 10 Year Floodplain

Scale: Drawn by: Checked by: Project No: Date: Sheet:

Wolverton Twp.
Sec. 23
Sec. 25
Sec. 26

Clay County
Wilkin County

701.237.5065
Floodplain Mapping

Wolverton Creek Restoration
2011 BWSR Clean Water Fund
Buffalo-Red River Watershed District
Barnesville, Minnesota

Datum: NAVD 1988

Legend
- River
- 1 ft Contour
- 5 ft Contour
- County Boundary
- Township Boundary
- US Highway
- State Highway
- County Highway
- CRP (2007 Coverage)
- 2 Year Floodplain
- 5 Year Floodplain
- 10 Year Floodplain

Scale: 1 inch = 50 feet
Drawn by: 781-227-5085
Checked by:
Project No: 10
Date: Jan 06, 2012
Sheet: 1 of 12

Wolverton Twp.
Sec. 35

Roberts Twp.
Sec. 2

Clay County
Wilkin County

Houston Engineering Inc.
1 W. 2nd Avenue North Fargo, ND 58102