memo

Project Name |	Long Lake Tributary – Degradation	**Date** |	Jun 30, 2015
To |	Brown's Creek Watershed District		
CC |	Karen Kill, District Administrator		
From |	Kevin Biehn		
Regarding |	Board Update & Recommendation		

BACKGROUND

At the 01/14/2013 regular meeting of the Board of Managers the Board authorized a study of the 'Diversion Structure' tributaries along with a similar assessment of Brown's Creek above 110th Street. A draft report titled, *Diversion Structure Tributaries and Brown's Creek (Above 110th Street) Resources Assessments*, was presented to the Board and discussed at the regular meeting of the Board of Managers on 12/9/2013.

Among the findings of this work was the identification of stream instability on the Long Lake tributary, downstream of Boutwell Road (Figure 1). As detailed in the above mentioned draft report, the instability warranted further investigation, which was supported by the Board. This memo summarizes the findings of this further study.

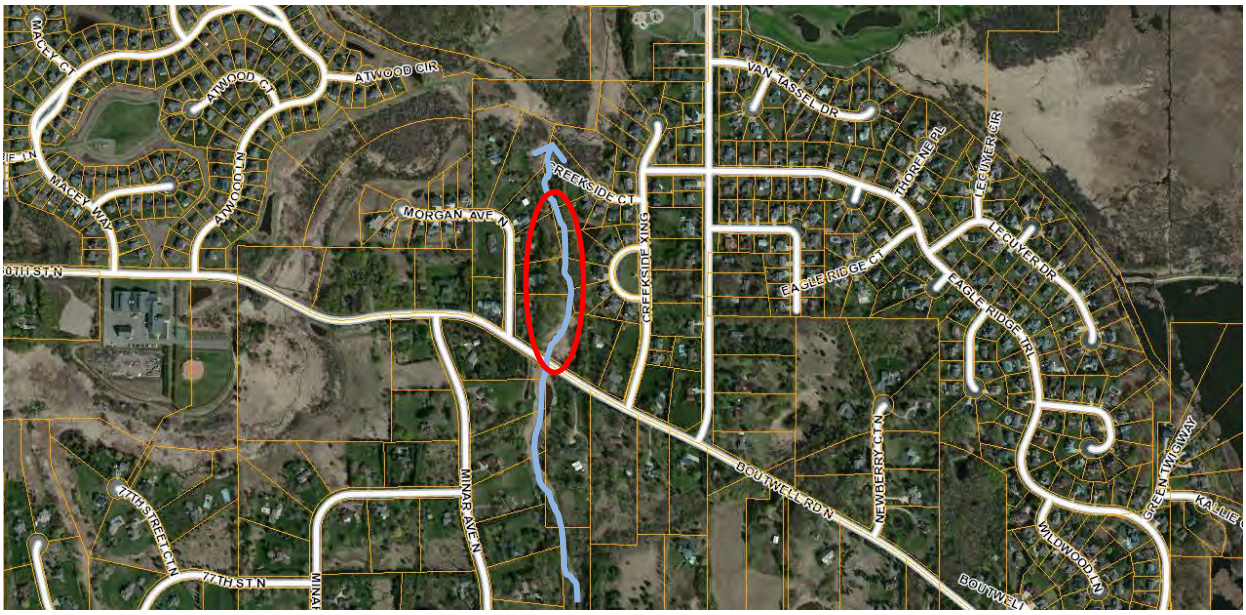

Figure 1 - Long Lake Tributary with area of focus (in red)

ASSESSMENT

A head cut and stream channel incision where identified and surveyed (6/6/2013) via the aforementioned study. This survey serves as reference point to which future survey(s) can be compared against, providing an estimated rate of progression and associated sediment and nutrient contributions.

The immediate area within the vicinity of the head cut was resurveyed as a part of this project on 11/12/2014 and compared to the 6/6/2013 survey. An estimated 22 cubic yards of soil was eroded from this area over the approximate 17 months between the survey dates (see Appendix A).

Between the two surveys dates the head cut did not substantially migrate up stream, but further channel incision was evident within the vicinity of the head cut. However, migration and further incision was apparent via recent visual observations (6/8/2015).

*A **head cut** is an erosional feature of some intermittent streams and perennial streams where an abrupt vertical drop, also known as a knickpoint in the stream bed occurs. A small plunge pool may be present at the base of the head cut due to the high energy of falling water. As erosion of the knickpoint and the streambed continues, the head cut will migrate upstream.*

***Channel incision**, which is frequently associated with head cuts, is a process of channel adjustment by which the stream bed cuts into and ultimately establishes a lower bed elevation (*Figure 2*). The lowering bed elevation frequently separates the stream from its floodplain, which in turn results in higher channel erosivity. Channel incision is also frequently referred to as channel degradation.*

CAUSALITY

Causes of degradation are complex and can be related to many sources. It is important to note that degradation is caused and accelerated by both "natural" and/or anthropogenic disturbances. As is frequently the case, in this instance it appears the cause is a product of multiple compounding factors. The primary factor is likely a change in hydrology (increase in flow rate and volume), which has increased "stream power". The ~2,200 acre subwatershed, which includes Long Lake and portions of the Highway 36 corridor, has seen significant changes in landcover and drainage connectivity. Increases in impervious surfaces and stormsewer have likely increased the stream flow rates as well as total volumes.

These subwatershed changes coupled with vegetation changes within the area of focus and the presence of highly erosive peat soils are contributing to the change. The area in question was essentially void of trees from 1938 (date of earliest known aerial photography) to the late 1980's when the area began to be developed. A dense tree canopy has developed (natural & planted) in the area over the last couple of decades and as a result is limiting critical understory growth, which holds soil and more effectively resists erosion. As indicated above, the soils are primarily peat in nature, which are also more easily erodible.

Although likely less of a factor, common residential landuse practices, such as disposal of leaves and grass within the corridor and the planting of shallow rooted cultivated plants over native plants are contributing to the problem in a minor way.

In summary, the tributary has greater "stream power" as a result of changes in hydrology and this is likely resulting in degradation within this area because of limited understory plant growth over highly erosive soils.

ISSUES & THREATS

There are two primary issues associated with the identified stream degradation. The first is the increased sediment supply associated with the channel incision. Over the ~17 months between the surveys (6/6/2013 to 11/12/2014) an estimated 22 cubic yards of soil was eroded within the vicinity of the head cut and this volume of soil translates into ~24 pounds of phosphorus. While this tributary does not drain to Brown's Creek (as it is diverted to Lake McKusick), it equates to ~2.3% of Brown's Creek annual sediment load. McKusick Lake, which was impaired for aquatic recreation (pollutant or stressor was identified as excess nutrients) has since been de-listed (in 2012) due to the implementation of various watershed projects which have reduced stormwater runoff to the lake. While there would be a nutrient load associated with the annual sediment load it is safe to assume that this sediment load would deposit within the drainage path (including the wetlands upstream of the Diversion Structure) before making its way to McKusick Lake.

Secondly, the stream incision may be degrading the 0.6± acre wetland immediately adjacent to Boutwell Road, which the tributary segments. A wetland assessment was not conducted as part of this evaluation, but based on professional judgement, the lowering stream profile appears to be draining the wetland (as depicted in Figure 2). Thus, creating a dryer wetland and perhaps converting some of the wetland edge to upland. This disturbance can temporarily or permanently degrade the quality of wetland vegetation as well. If left unchecked further degradation can be expected, but it is worth noting that the current floristic quality of the wetland is poor.

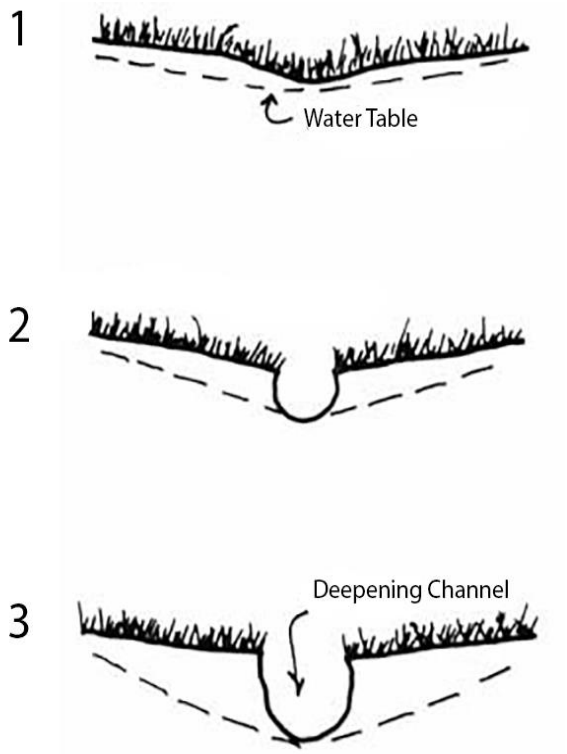

Figure 2 - Progression of Channel Incision

Prior to the changes in hydrology the tributary likely only carried flow during and following a period of rainfall and had less of a discernable channel [Stage 1]; The tributary has since become incised and has more perennial flow [Stage 2]; Further incision results in streambank instability and a lowering of the local water table [Stage 3].

IDENTIFICATION OF OPTIONS

There are four primary discernable options to this issue: 1) Do Nothing; 2) Install grade control structure(s) to limit further incision; 3) Thin Canopy to foster understory growth; and 4) Complete #2 and #3 in conjunction with one another.

Option #2 would likely be constructed by imported rock within the area of the active head cut. The grade control structure(s) would be intended to halt further incision and would mitigate some of the damage upstream of the structure, but would not address downstream instabilities. Option #3 would invigorate understory plant growth, with the intent of stabilizing the tributary via a predictable stream

response (succession) to the change in vegetation. Stability would occur naturally and gradually over 2-10 year timeframe. Option #4 is a project that simultaneously employs the methods of both Options #3 and #4 to increase the probability and rate of stability.

Estimated Cost

A rough estimate of probable implementation cost can be found in Table 1. Given the simplicity of the solutions and the complexity of garnering buy-in and executing the project, planning and design costs are anticipated to be high relative to a percentage of construction averages.

Table 1 - Estimate of Implementation Cost

Option	Admin.	Design	Legal	Const.	10-Yr Maint.	Total
1 - Do Nothing	-	-	-	-	-	-
2 - Grade Control	N/C	$10,000	$4,000	$20,000	$3,500	$37,500
3 - Thin Canopy	N/C	$7,500	$6,000	$15,000	$5,000	$33,500
4 - #2 & #3	N/C	$15,750	$8,505	$31,500	$8,000	$63,755

Feasibility

The landscape in question is privately owned (parcels illustrated in Figure 1) and buy-in on any action is anticipated to be challenging. Both the number of potentially affected landowners and the required tree removal required to execute the identified options are anticipated challenges to garnering support (see Table 2 for Primary estimated impacts).

Table 2 – Primary estimated landowner impacts of identified options

Option	Number of landowners directly affected	Tree Removal necessary	Required Maintenance
1 - Do Nothing	-	-	-
2 - Grade Control	2-5	Limited	Limited maintenance as required
3 - Thin Canopy	6-10	Substantial	Every 5± years –mowing & vegetation management
4 - #2 & #3	6-10	Substantial	Every 5± years –mowing & vegetation management

RECOMMENDATION

With no commitment to a particular option at this time, EOR advises the District to engage the landowners and alert them of the instability and options for addressing. With the investment in 1 to 3 meetings the District could gage the acceptance of the identified options. At a minimum the investment would alert the residents of the problem and elevate their understanding of the resource and the District.

SCALE IN FEET

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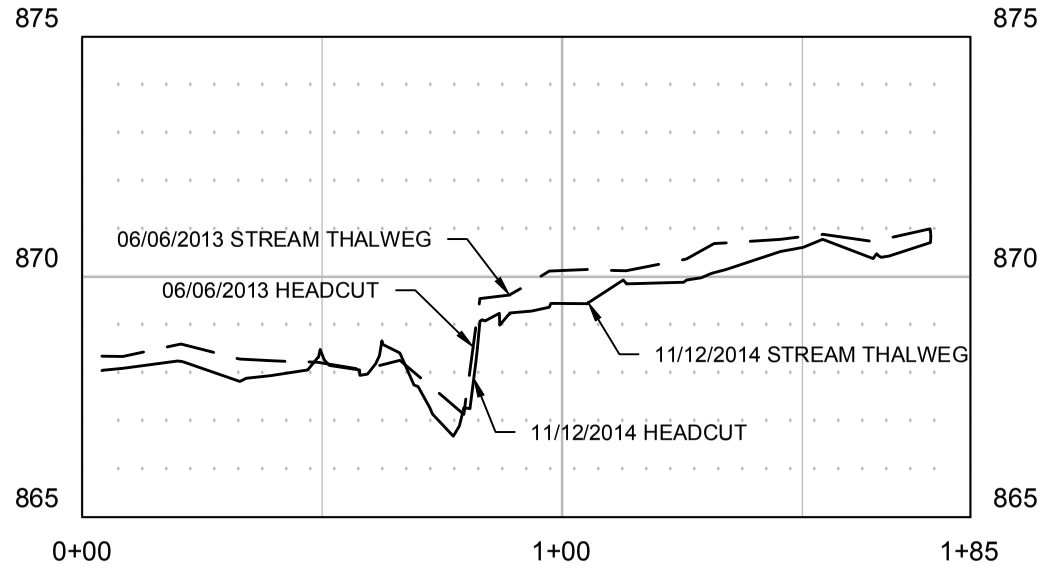
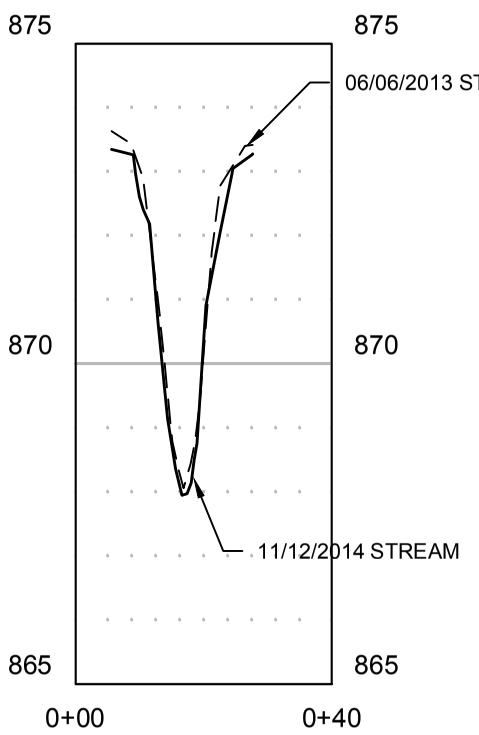
NAVD 88

Stream Thalweg



Sta 0+50



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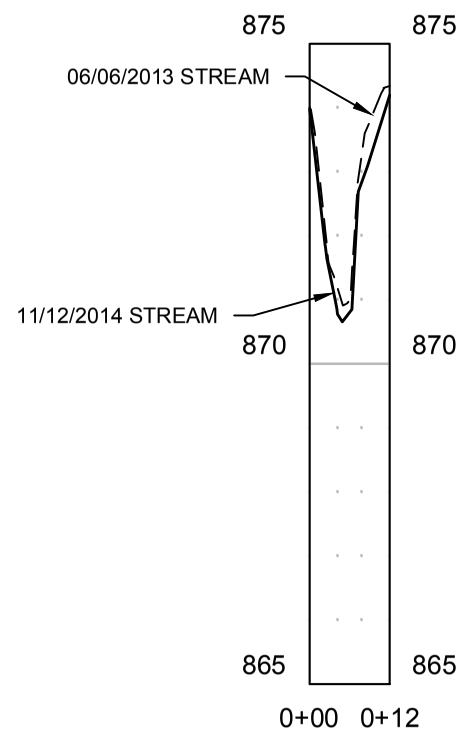

NO	DATE	BY	REVISION
6			
5			
4			
3			
2			
1			

SUBMISSION DATE: 03-09-2015

DESIGN BY KB | DRAWN BY KDC

EOR PROJECT NO. 041-0222

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BROWN'S CREEK
WASHINGTON COUNTY, MN

STATE PROJECT NO. | CITY PROJECT NO.

HEADCUT DEGRADATION

SHEET 1 OF 1 SHEETS

Plot Date: 03/09/2015
Drawing name: X:\Clients_WD\041_BCWD\0222_Diversion_Trib_Resource_Assessment\09_GIMS_ProjectName\dwg\X-BASE_041-0222.dwg
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