

The Effectiveness of the Tree Revetment Bioengineering Technique

by: Mark Packard

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The Division of Waters completed a performance audit of Tree Revetment Stream Bank Protection in Region V. The audit took place during the summer of 1996 during the months of June and July by Division of Waters intern, Mark Packard.

A tree revetment is a new form of Bio-engineering used to prevent shore line erosion and to heal existing eroding banks. It is a beneficial form of erosion remediation because of its low cost and ease of accessing materials. A tree revetment is made up of cedar trees which are used because of their extensive branch system and their resistance to rotting. The cedars are anchored to the toe of an eroding bank approximately half way into the stream at ordinary water level. The cedars are connected to one another by aircraft cable and clamps with each tree bottom attached to the top of another and so on. Each top and bottom of each tree is also attached to steel posts or anchors, also with aircraft cable, which are in turn driven into the toe of the bank. This chain of trees is positioned so that the butt of the trees faces up stream so as to trap sediment that is entrained in the water. Many times the bank is also planted with native shoreline grasses and sometimes willow stakes to help to hold the bank together with their extensive root systems. Nine permits, consisting of 17 actual sites, were applied for and granted throughout the Region V area, see list attachment. An additional site was completed without a permit bringing the total number of projects in the Region to 18. Of these sites, six had not been completed (specific reasons for each site are noted on the Tree Revetment Audit Forms). The remaining 12 sites had been finished and had varying degrees of success.

Of the 12 completed sites, nine were installed properly and are working, or they were installed and need time to accumulate sediment. A couple of locations were so overgrown that the revetment could not be seen. The three sites under permit # 95-5137A-C did not perform well. In this case three different methods were used on three locations in the same proximity. The bank was either seeded, reveted with cedars, or staked with willow stakes. Apparently none of the techniques were adequate in that there is virtually no evidence that the area had remediated at all and severely eroding banks still remain on the site. It should be noted, however, that heavy grazing and flood event followed the installation of the remediation and it is possible that the cedars, willows, and seeds did not have enough time to take hold.

In general, submerging the cedars half way into the water at ordinary water level on the toe of the slope seems to be important in that it provides more branch surface area for the sediment to accumulate, as intended. Shaping the slope above the cedars also seems to be an important factor in how fast the bank "heals", especially in cases where flood or high water episodes have not been present to deposit sediment. Shaping involves the movement of the soil at the top of the slope to the bottom partially on top of the cedars but not into the stream. This both removes the potential for the collapsing of a steep bank, a 2:1 slope is ideal, and it partially fills in the framework that the cedar provides so that plant life can ultimately take hold.

Tree Revetment Memo
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There should also be an effort to revet up and down stream of the problem area until the end cedars can be anchored to a healthy solid shore line, as some cases are in need of further maintenance, permit # 95-5129A. Some cases, permit # 95-5129B, could have also possibly used a second row of cedars above the first. This second row would not necessarily be submerged but could be filled in with collapsed material and could serve to trap sediment during flood stages once the bottom row of cedars have been filled, they would also serve simply to slow the velocity of the stream effectively lessening the blow to the bank.

Most of the streams that were involved in this study were very similar in size and velocity. Consequently, further determining parameters can not be defined at this time. Once more revetments are constructed on a wider variety of streams, it will become more evident what conditions are necessary for successful tree revetment projects.

Finally, the most obvious observation noted among the revetments was the more time and care that was taken in putting the revetments in, is directly proportional to how well they worked. This became evident after talking with several of the land owners and noting that the ones that really cared and were involved in its construction and maintenance usually had the most success with their tree revetments. Tree revetments do or have the potential to work very well to stabilize banks.

The following is a summary of the audit. Please see the Tree Revetment Audit Form for details of the specific cases.

Great 5-4-3-2-1 Poor

NS= Not Started

Permit #	Land Owner	Rating	Comments
96-5017	Tom Oevering	NS	No revetment started, however bank seems stable
96-5006	Dean Suffrins	NS	Not started as of July '96, banks not healed
95-5137 A-C	McCutcheon	1	Severe bank erosion, sufficient revetment not constructed.
95-5129A	Balow	3	Very young, however, more revetments could be used along with more collapsed bank over the existing revetments.
95-5129B	Jaeger	4	Looks good, could use attention in middle of arc of stream where water cuts behind cedars
95-5051	Flom	5	Banks completely grown in and revetments look good
94-5040	Don Peterson	NS	Revetment never started (07/17/96), Mrs. Peterson said she would contact SWCD/ DNR when needed.
94-5047	Graves	5	Revetments good & completely overgrown
92-5132A	Kalmes	NS	Not started as of 07/17/96, bank still unstable
92-5132B	Gallien	NS	Never started, bank looks healed though (07/22/96)
92-5132C	Goss	NS	Mr. Goss said he fixed the problem himself and wants no further action, 06/26/96
92-5132D	MLO Wiscoy TWP	5	Revetment appears completely grown in w/ veg.
92-5132E	Mueller	5	Working very well.
92-5132F	Wade	5	Works well, vegetated w/ native seeds.
93-5103	Olson	3	First section looks good and is holding, second section is blown out and in a log jam.
No Permit	Roger Lacher	5	Worked great, veg. w/ native plants, good example

TREE REVETMENT AUDIT FORM

SITE # _____

PICTURES TAKEN Y N

LAND OWNER _____

DATE _____

AUDITOR _____

	Rating	Comments/Impacts
A. Did the technique work (or is it working) to stabilize the bank?		
B. Was the technique applied correctly?		
C. Was a sufficient amount of revetment applied to the bank?		
D. Is any future maintenance required?		
E. Is the area well vegetated?		
F. Is the vegetation compatible with the surrounding bank vegetation?		
G. Overall, is the site in harmony with the pre-existing site?		
H. Is any further action needed to reduce stream bank erosion?		
I. Were there any adverse effects caused by the revetment?		
J. Stream Flow: Riffle Pool		
K. Stream Slope: Steep Medium Flat		
L. Water Depth at Site: Hi Medium Low		
M. Compare stream bottom width at site with that up and down stream:		
N. Describe the land usage around the site (stream).		

EXCELLENT 5	4	SATISFACTORY 3	2	POOR 1
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ADDITIONAL COMMENTS (cont. on back):

***REGION V STREAM BANK PROTECTION - BIOENGINEERING MASTER LIST**

STREAM	TECHNIQUE	LANDOWNER	SUPPORT	COUNTY	PERMIT #	COMPLETED
1 GARVIN BROOK	TREE REVETMENT	OEVERING	TOM OEVERING	WINONA	96-5017	COMPLETED
2 LITTLE TROUT CREEK	TREE REVETMENT	SUFFRINS	DEAN SUFFRINS	WINONA	96-5006	SCHD '96
3 LITTLE CANNON RIVER	TREE REVETMENT	MCCUTCHEON	GOODHUE SWCD	GOODHUE	95-5137A	COMPLETED
4 LITTLE CANNON RIVER	TREE REVET/COVER	MCCUTCHEON	GOODHUE SWCD	GOODHUE	95-5137B	COMPLETED
5 LITTLE CANNON RIVER	RESLOPE/SEED	MCCUTCHEON	GOODHUE SWCD	GOODHUE	95-5137C	COMPLETED
6 WELLS CREEK	TREE REVETMENT	BARLOW	GOODHUE SWCD	GOODHUE	95-5129A	COMPLETED
7 WELLS CREEK	TREE REVETMENT	JAEGER	GOODHUE SWCD	GOODHUE	95-5129B	COMPLETED
8 LITTLE CANNON RIVER	TREE REVET/WILLOW	FLOM	GOODHUE SWCD	GOODHUE	95-5051	COMPLETED
9 GILLMORE CREEK	TREE REVETMENT	PETERSON	DON PETERSON	WINONA	94-5040	UNKNOWN
10 NB WHITEWATER RIVER	TREE REVETMENT	GRAVES	CITY OF ELBA	WINONA	94-5047	COMPLETED
11 BEAR CREEK	TREE REVET/SHAPE	KALMES	WINONA SWCD	WINONA	92-5132A	COMPLETED
12 BURNS VALLEY CREEK	TREE REVET/SHAPE	GALLIEN	WINONA SWCD	WINONA	92-5132B	SCHD '96
13 CAMPBELL CREEK	TREE REVET/SHAPE	GOSS	WINONA SWCD	WINONA	92-5132C	SCHD '96
14 COREY CREEK	TREE REVET/SHAPE	MLO WISCOY TWP	WINONA SWCD	WINONA	92-5132D	SCHD '96
15 MONEY CREEK	TREE REVET/SHAPE	MUELLER	WINONA SWCD	WINONA	92-5132E	COMPLETED
16 UNNAMED TRIB TO MONEY	TREE REVET/SHAPE	WADE	WINONA SWCD	WINONA	92-5132F	COMPLETED
17 ROOT RIVER	TREE REVETMENT	OLSON	BRIAN OLSON	FILLMORE	93-5103	COMPLETED
18 UNNAMED TRIB TO MONEY	TREE REVETMENT	LACHER	WINONA SWCD	WINONA		COMPLETED

*GOODHUE, WABASHA, WINONA, HOUSTON, FILLMORE, OLMSTEAD, MOWER, STEELE, RICE, FREEBORN AND DODGE COUNTIES.

Associated Tree Retreatment Slides

<u>SLIDE #</u>	<u>LANDOWNER</u>	<u>COMMENTS</u>
1-2	Overing	-Off of 14 showing naturally healed bank, no revetment
3-6	McCutcheon	-View up and downstream showing inadequate revetments
7-8	Balow	-Views up and downstream showing steep reveted banks and unreveted banks in the background.
9-10	Jaeger	-Views downstream, gap behind tree and bank in the middle of the revetment
11-12	Flom	-View downstream of healed bank with revetment, small beaver dam in background
13-14	Peterson	-Up and down stream of unreveted steep bank that has temporarily healed
15-17	City of Elba	-Two locations of the North Branch of the White Water River
18-19	Kalmes	-Unretved, unhealed locations in Kalmes' pasture (2 locations)
20-23	Gallien	-Two locations both looking upstream, both unreveted but partially healed
24-28	MLO WISCOY TWP	-Five locations of completely healed banks on Corey Creek
29-31	Mueller	-Retved and healed banks looking downstream, the last tree on the left is loose
32-33	Wade	- (32) Healed bank with collapsing bank on revetments (33) Healed bank without collapsed bank on revetment
34-39	Olson	-Five views of Root River moving away from Bridge
40-43	Lacher	-First three are looking upstream of the first bend the last slide is looking downstream of the second bed