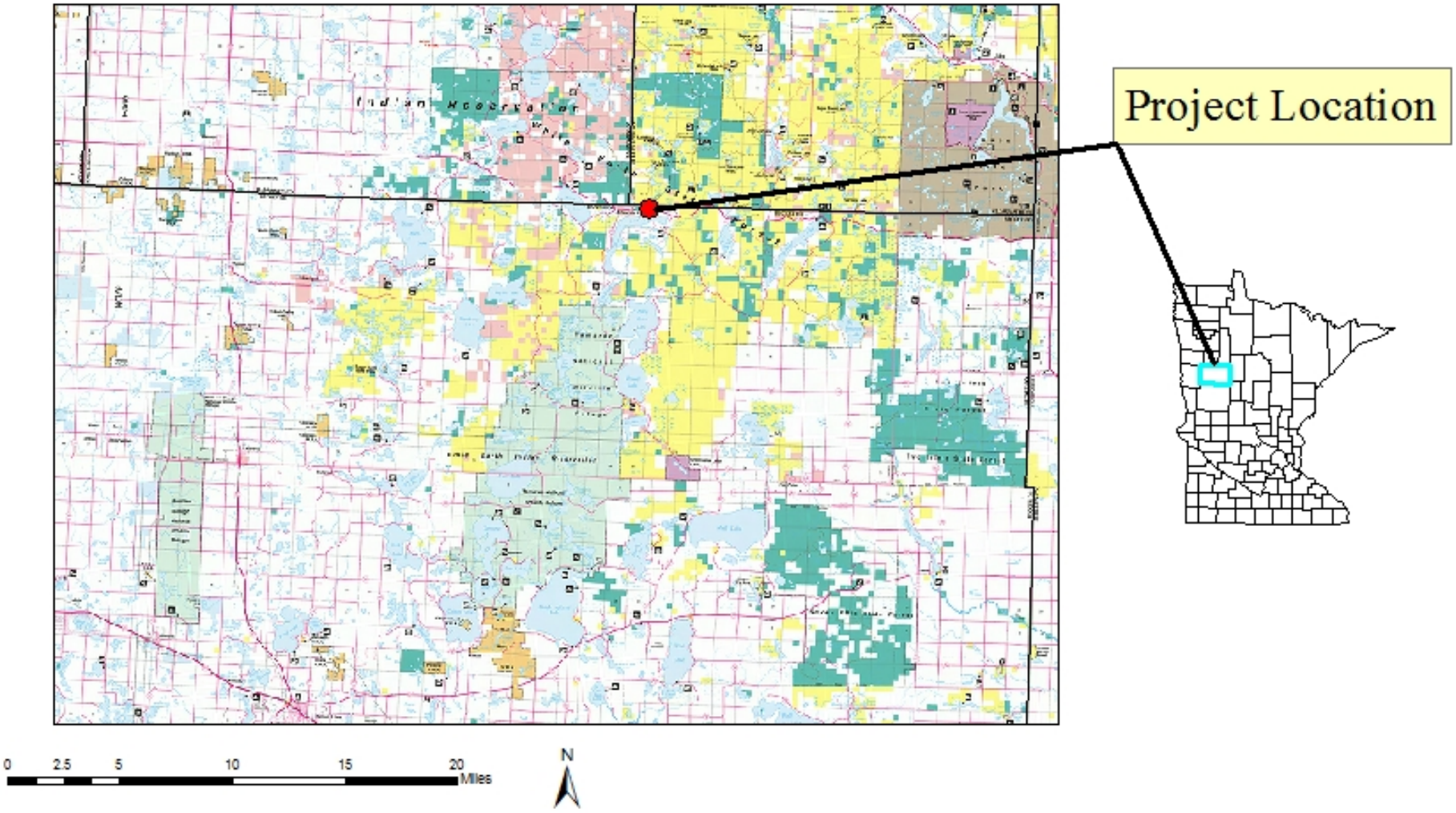
SOLID BOTTOM CREEK RESTORATION PROJECT FIGURES

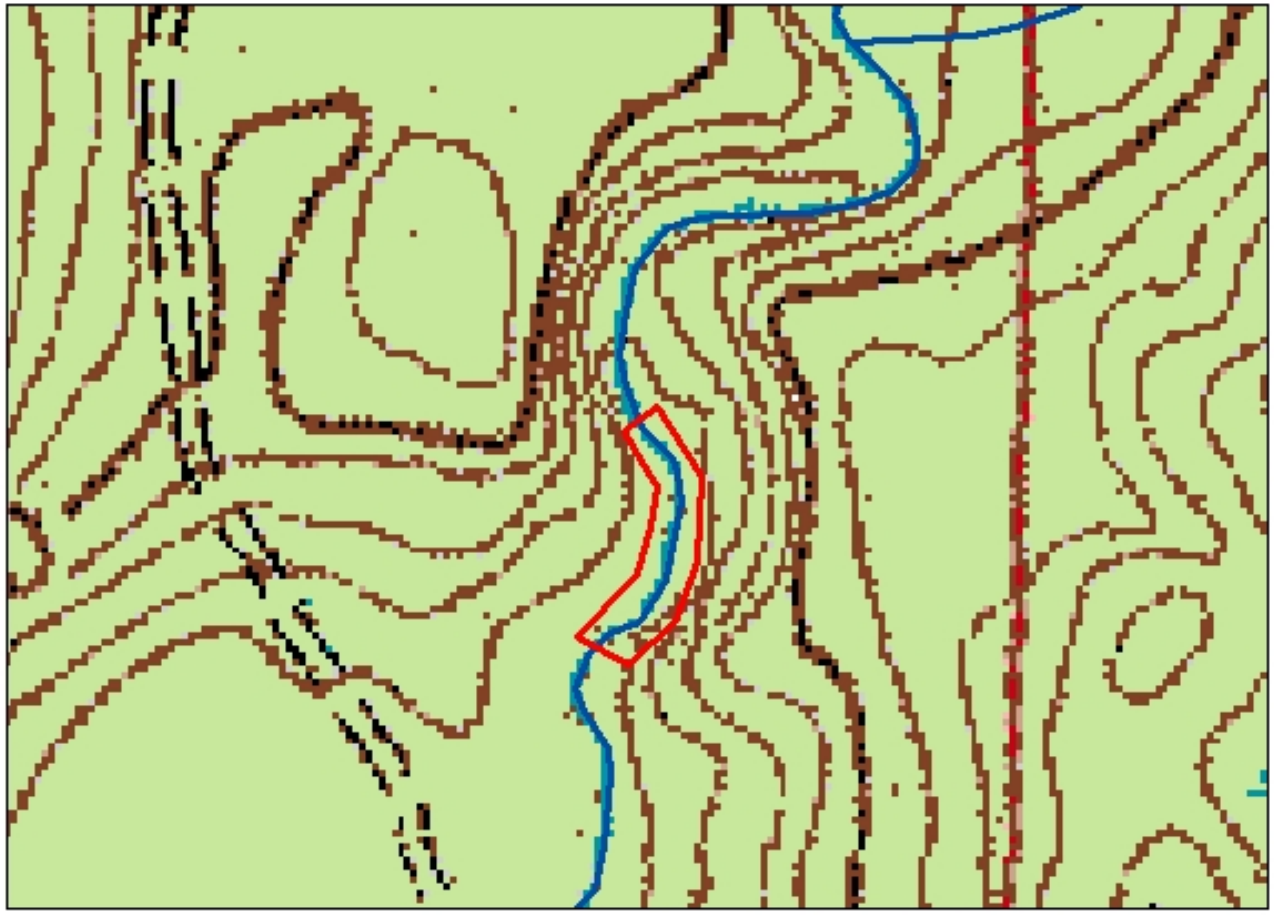


MNDNR

January 2015

Figure 1. Becker County map showing project location in Minnesota

Solid Bottom Creek Restoration Project
Environmental Assessment Worksheet
Becker County, MN

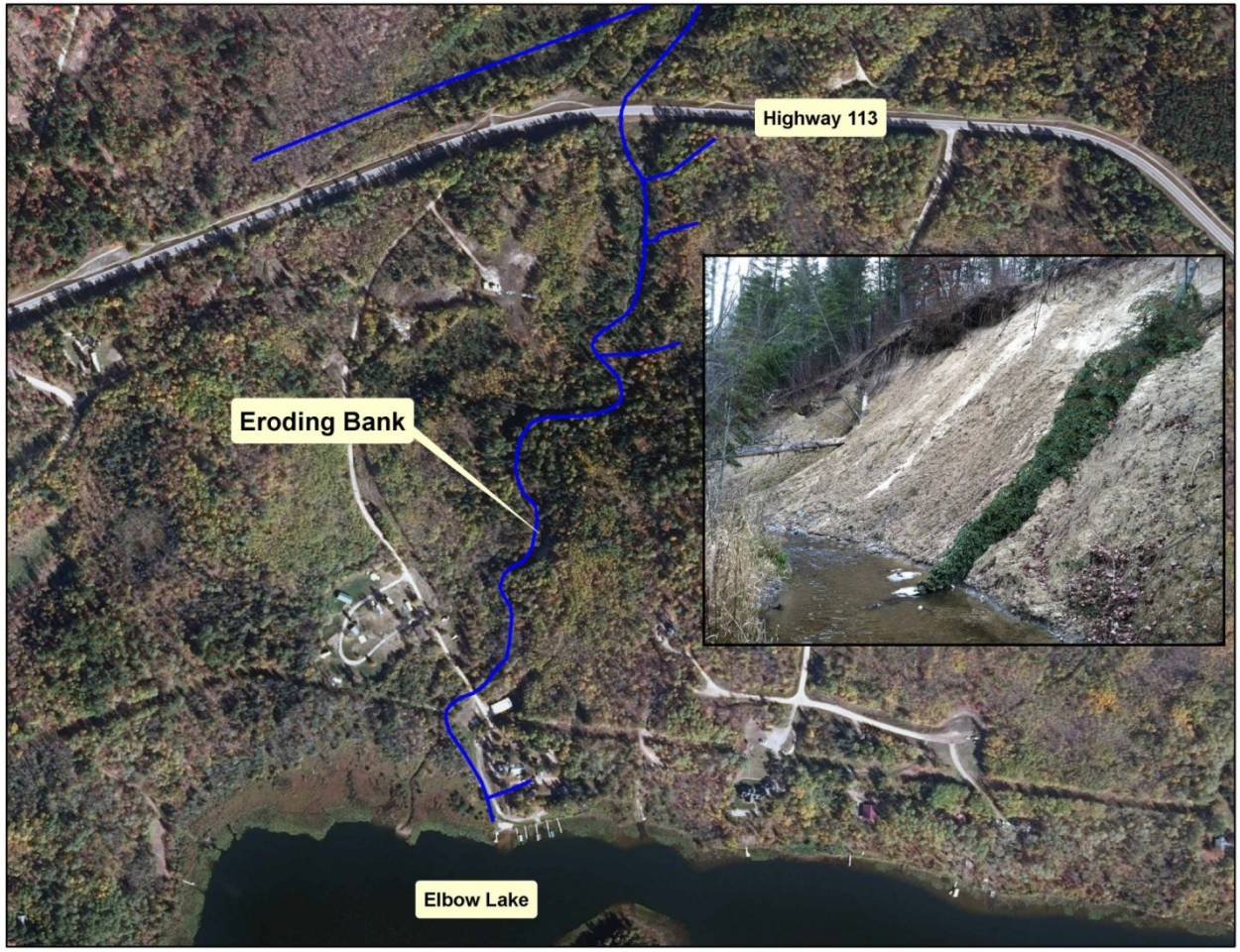


MNDNR

January 2015

Figure 2. Solid Bottom Creek Restoration project boundaries.

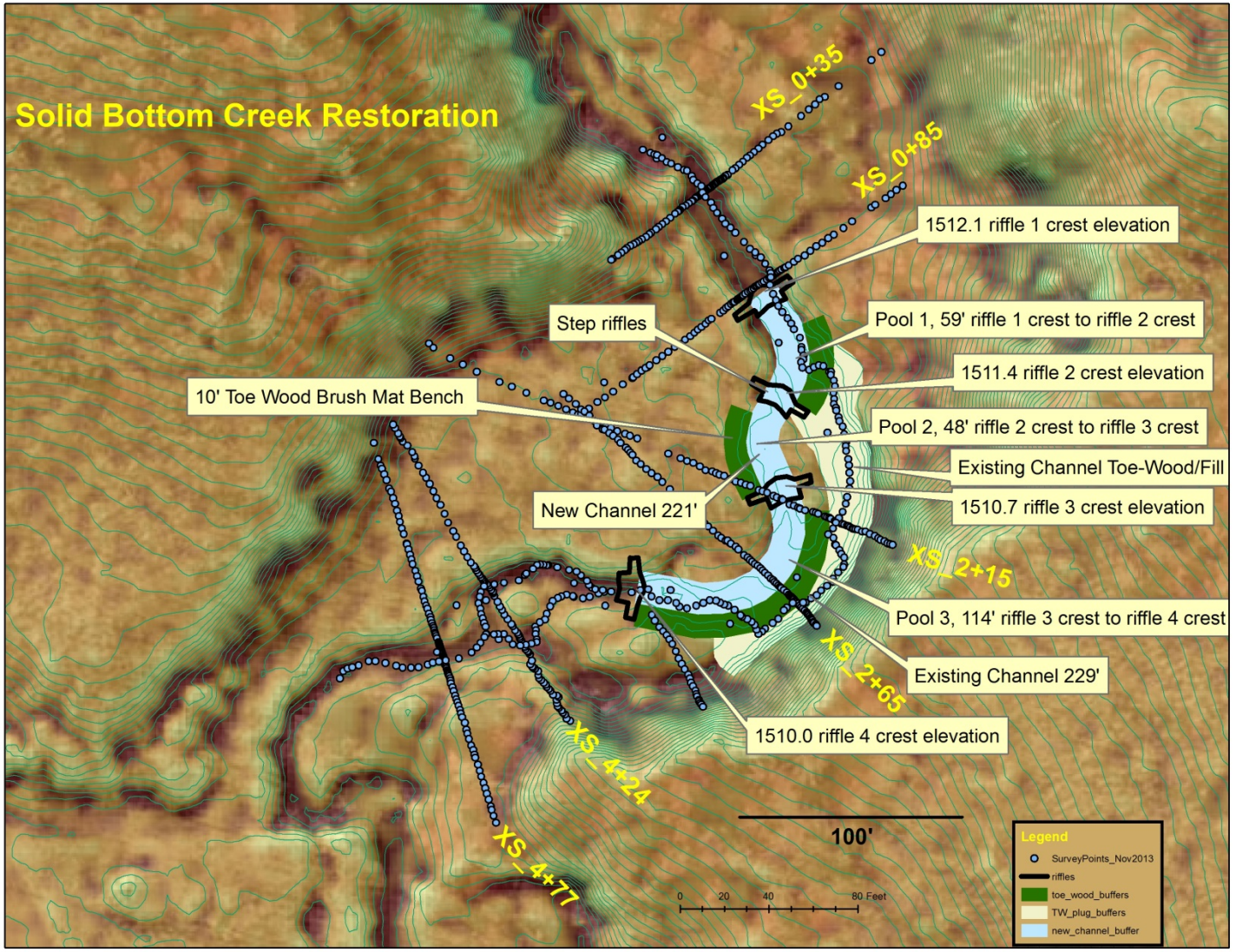
Solid Bottom Creek Restoration Project
Environmental Assessment Worksheet
Becker County, MN



January 2015

Figure 3. Solid Bottom Creek restoration project aerial view.

Solid Bottom Creek Restoration Project
Environmental Assessment Worksheet
Becker County, MN



MNDNR

January 2015

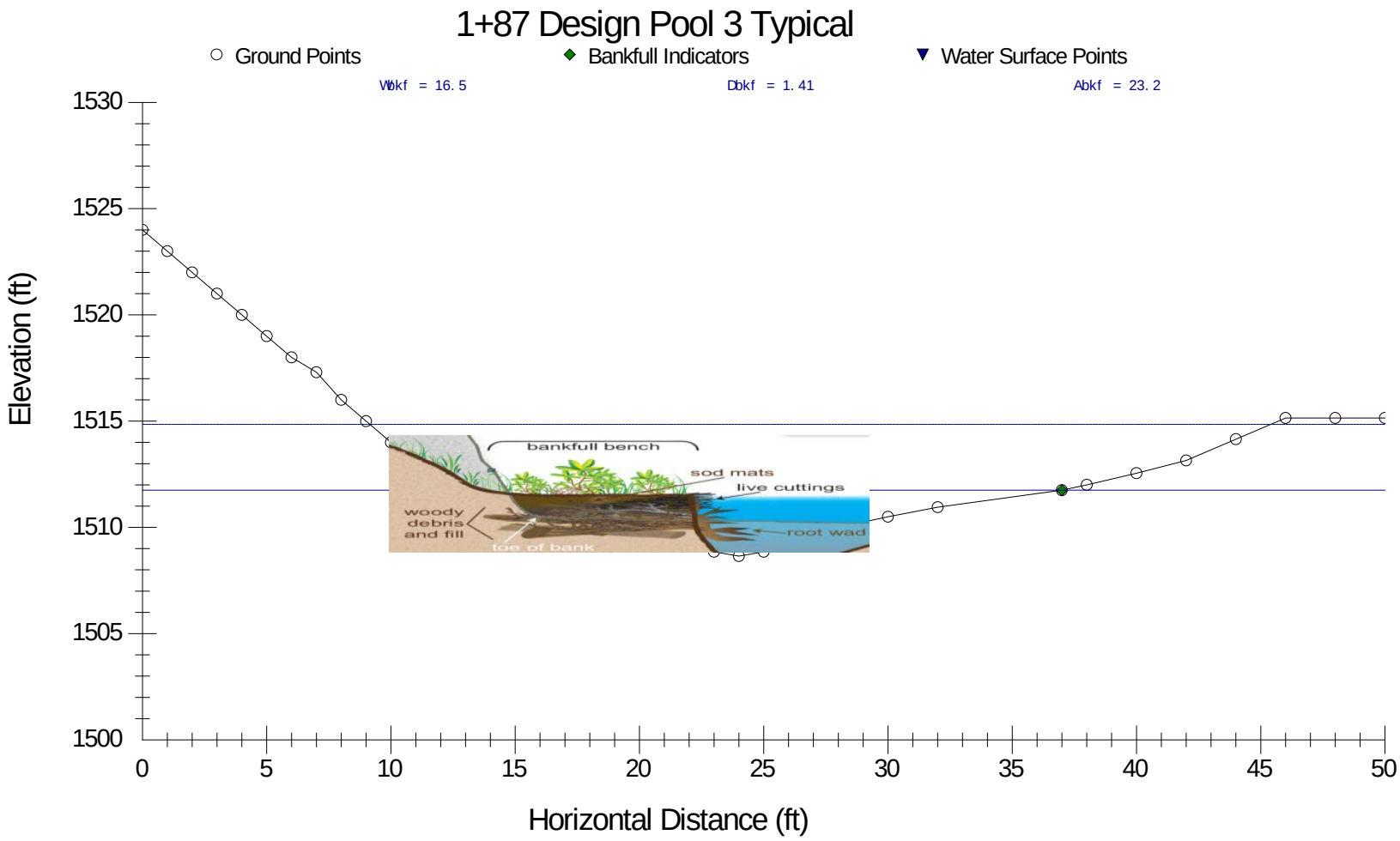
Figure 4. Solid Bottom Creek restoration project features and site plan.

Solid Bottom Creek Restoration Project
Environmental Assessment Worksheet
Becker County, MN

January 2015

Figure 5. Solid Bottom Creek restoration project eroding bank.

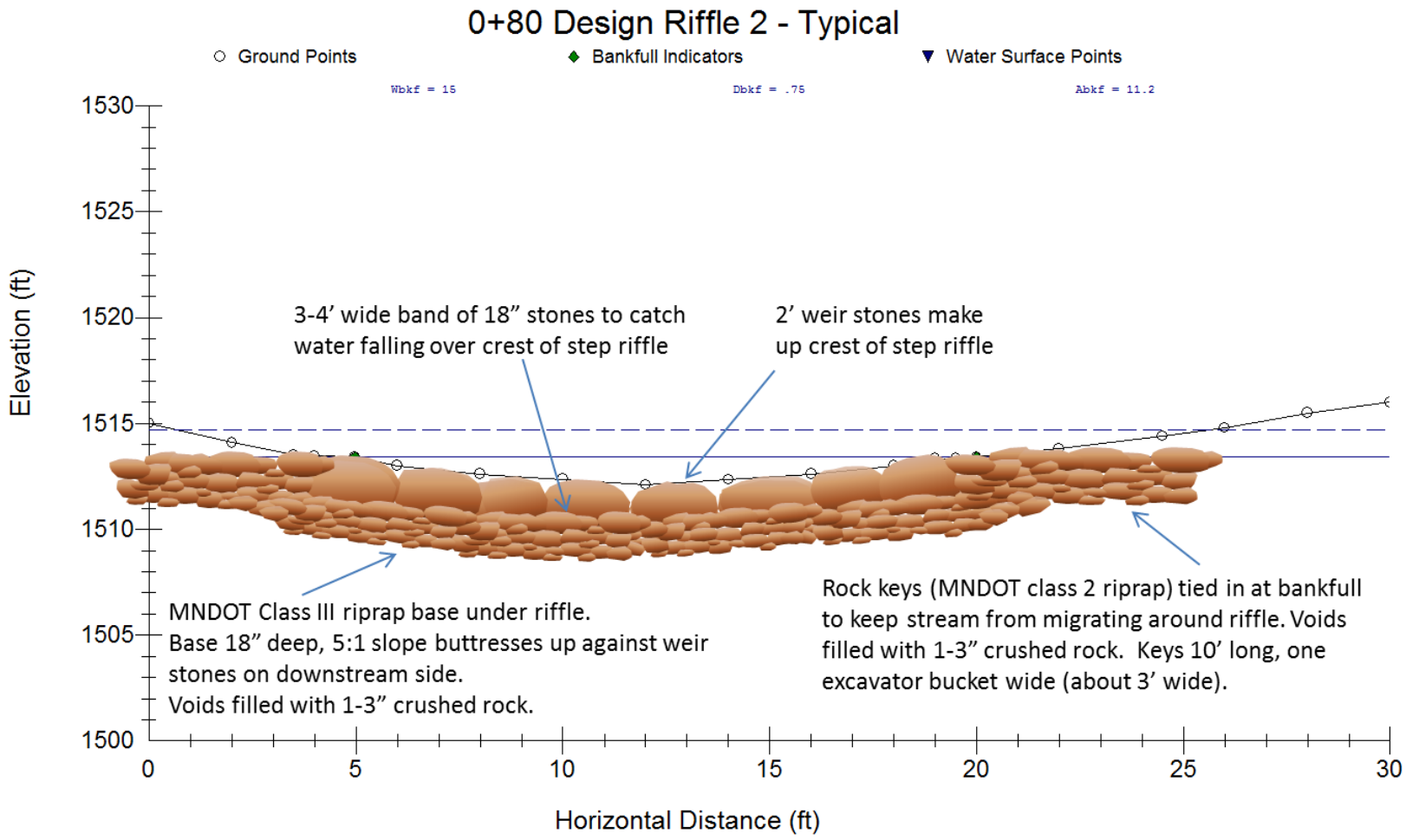
Solid Bottom Creek Restoration Project
Environmental Assessment Worksheet
Becker County, MN



January 2015

Figure 6. Solid Bottom Creek restoration project typical design pool showing toe-wood placement.

Solid Bottom Creek Restoration Project
Environmental Assessment Worksheet
Becker County, MN



MNDNR

January 2015

Figure 7. Solid Bottom Creek restoration project typical design riffle.

Solid Bottom Creek Restoration Project
Environmental Assessment Worksheet
Becker County, MN

Cut Volumes - yd³		
New Channel	Toe Wood Benches	Riffle Keys
188	224	36

Fill Volumes - yd³													
Toe Wood Benches	Material	Riffle Keys	Material	Old Channel Plugs - Fill from New	Material	Riffle Base	Material	Sill	Material	Small Fill	Material	Weir Stones (10 each riffle)	Material
157	Wood	28	Class II Riprap	143	Cut Material, New Channel	15	Class III Riprap	13	18" Rock	10	1-3" crushed rock	7	40 - 2' Rocks
67	Earthen Fill, Sod, Brush Mats	8	1-3" crushed rock										

MNDNR

January 2015

Table 1. Solid Bottom Creek restoration project cut and fill volumes.

Solid Bottom Creek Restoration Project
Environmental Assessment Worksheet
Becker County, MN

Solid Bottom Creek - Calculations of Key Morphological Parameters																
Cross Section Station	Bankful Area (ft^2)	Bankfull Width (ft^2)	Mean Bankfull Depth (ft)	Width/ Depth Ratio	Depth Max	Width of Flood-Prone Area (ft)	Entrenchment Ratio	Reach/ Feature Slope	LEP Lat	LEP Long	REP Lat	REP Long	TW Elevation	Rosgen Stream Classification	Movable Particle (mm)	Notes
Riffle 0+35	8.7	15.5	0.56	27.6	1.29	24	1.5	0.006	47.149032	-95.531515	47.148764	-95.531992	1512.378	**B4c**	43	
Riffle 0+85	11.1	17.2	0.65	26.4	1.28	21	1.2	0.006	47.148868	-95.531469	47.148573	-95.532037	1512.184	**F4**	51	
Pool 2+15	17.5	15.6	1.12	14.0	1.84	38	2.5	0.004	47.148424	-95.531467	47.148654	-95.532317	1510.855		55	
Riffle 2+65	9.8	14.7	0.67	22.0	1.06	36	2.4	0.010	47.148321	-95.531599	47.148597	-95.532070	1511.202	**C4c-**	77	
Split 4+24	19.4	22.9	0.85	26.9	1.43	44	1.9	0.014	47.148194	-95.532038	47.148553	-95.532377	LC/1507.873 RC/1508.178	**B4c**	119	Split channel Right is main
Riffle 4+77	10.4	11.3	0.92	12.3	1.49	23	2.1	0.014	47.148065	-95.532167	47.148529	-95.532411	1507.763	**B4c**	120	
Existing Riffle Mean	**10.0**	**14.7**	**0.70**	**22.1**	**1.28**	**26**	**1.8**	**0.010**						**B4c**	**73**	
Existing Pool Mean	**17.5**	**15.6**	**1.12**	**14.0**	**1.84**	**38**	**2.5**	**0.004**							**55**	
Design Typical Riffle	**11.3**	**15.0**	**0.75**	**20.0**	**1.30**	**25**	**1.7**	**0.100**						**B4c**	**464**	**Design riffle**
Design Typical Pool	**23.2**	**16.5**	**1.41**	**12.0**	**3.10**	**32**	**2.2**	**0.003**							**53**	**Design Pool**

MNDNR

January 2015

Table 2. Solid Bottom Creek restoration project morphological features.

Solid Bottom Creek Restoration Project
Environmental Assessment Worksheet
Becker County, MN

Solid Bottom Creek Pattern Geometry - Existing and Design														
	Radius of Curvature (ft)				Meander Belt Width (ft)				Meander Belt Width Ratio	Valley Length (ft)	Valley Slope	Stream Length (ft)	Stream Overall Slope	Sinuosity
	N	Max	Min	Mean	Number	Max	Min	Mean						
Existing Stream*	7	83	20	46	53	76	19	48	3.2	532	0.02	807	1.36%	1.5
Design Stream	3	36	25	29	3	73	33	53	3.5	532*	0.02	799*	1.38%*	1.5
*Reference data including surrounding reach and restored reach. *Reference and design slope through project area is 1%.														

January 2015

Table 3. Solid Bottom Creek restoration project pattern geometry.

Stream/County	Natural Heritage	SHPO
Bank Stabilization Solid Bottom Creek Becker County (Detroit Lakes)	NH findings within 1.5 miles of site, submit to Lisa Joyal – 3/21/11 4/24/11 - This area has been preliminarily identified by the Minnesota County Biological Survey as a sedge meadow native plant community within a Site of Moderate Biodiversity Significance. To protect this area during construction, disturbance should be minimized as feasible. This may include, but is not limited to, the following recommendations: (1) As much as possible, operate within already-disturbed areas; (2) Minimize vehicular disturbance in the area (allow only vehicles necessary for project completion); (3) Do not park equipment or stockpile supplies in the area; (4) If possible, do work in autumn or winter, to avoid damaging plants during the growing season; (5) Reduce runoff by completing the work as rapidly as possible and using erosion control measures such as straw bales or silt fencing; and (6) Re-vegetate disturbed soil with native species suitable to the local habitat as soon after construction as possible, to decrease the opportunity for exotic species to invade the area.	The SHPO review is waiting for NH review of documents 4/24/11 – Submitted to Mike Magner for review 4/27/11 – comments from Mike Magner - It appears that this undertaking should not impact intact upland soils. No cultural resource review is recommended.

MNDNR

January 2015

Table 4. DNR Natural Heritage and Cultural Resources internal review for the Solid Bottom Creek restoration project.