APPENDIX A

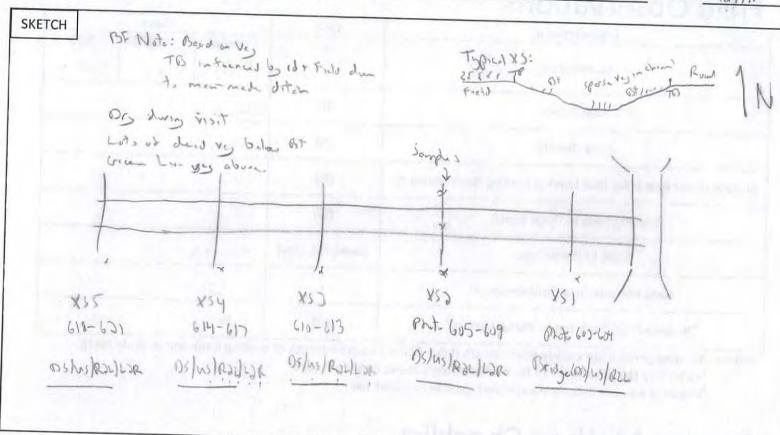
FIELD INVESTIGATION NOTES

Geomorphic Analysis Check List

Site Name: Lower Rush River -1

Date: 9/39/11

SKETCH



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		C: 1 1	
Section 1	Left	Top of Bank (TB)	/	2003	Bank Full (BF)	V	2002	Motor C. C	Staked	GPS Pt
	Right	Top of Bank (TB)	/	2000	Bank Full (BF)	~	2001	Water Surface (WS)	N/A N/A N/A	iti.
Section 2	Left	Top of Bank (TB)	~	2009	Bank Full (BF)	~	2008	Water Souf		
	Right	Top of Bank (TB)	~	2006	Bank Full (BF)	~	7007	Water Surface (WS)	N/A	
Section 3	Left	Top of Bank (TB)	V	2014	Bank Full (BF)	V	2013	1Mata - 5 - 5	N/A	
	Right	Top of Bank (TB)	~	2010	Bank Full (BF)	V	2011	Water Surface (WS)		
Section 4	Left	Top of Bank (TB)	/	2019	Bank Full (BF)	1	3018	3050		
30000114	Right	Top of Bank (TB)	~	2016	Bank Full (BF)	/	2017	Water Surface (WS)	NA	
Section 5	Left	Top of Bank (TB)	~	2024	Bank Full (BF)	V	3023			
	Right	Top of Bank (TB)	~	2021	Bank Full (BF)	V	9093	Water Surface (WS)	N/A	

-leid Observations	Unit		Value	
Measurement Manning's n	-	Channel 0.035	LOB U.U.	O.OL
Root Depth	(ft)	mercusa		
Root Density	(%)	na Known		
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	10%		
Eroding Bank in Study Reach ¹	(%)	5%		
Bank Material Type	(sand, silt, clay)	Sm):	6.	
Bank Material Stratification Score ²	+	0		
Distance from Bank Toe to Water Surface ³	(ft)	NIP		

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	ltem	Completed
Velocity Measurements	019	Riparian Vegetation Worksheet	~
Depositional Features Worksheet	/	Pfankuch Method	~
Channel Blockages Worksheet	/		

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	/	LR1-L63	2225
Right Bank (RB)	~	LB-1 - C+1	9936
Bed Surface (BED)			
Bed Core (BED-C)			
Bar (BAR)			

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Lower Rush River- 2-6.04 11/18/10

Geomorphic Analysis Check List

Site Name: Lower Rush 11/18/10 (RM6.50-6.03) FID

SKETCH

Shollow channel, swamp like O vel, heavily vesetates with grosses

and woods weeds / reeds. Mostly from during visit. Appears very stable. No evidence

O tree

Staking

Survey crew did not Sint. Old not resure 1 2011 A3 Q= 0

Jta	171118)				V		100		
Section #	Bank		Staked	GPS Pt	THE PERSON OF	Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)	/	3005	Bank Full (BF)	Same	3005	Water Surface		
Section 1	Right	Top of Bank (TB)	~	3001	Bank Full (BF)	~	3002	(WS)	~	3003
Section 2	Left	Top of Bank (TB)	~	3006	Bank Full (BF)	same	3006	Water Surface		
Section 2	Right	Top of Bank (TB)	~	3009	Bank Full (BF)	Same	3009 (WS)	~	3008	
6 2	Left	Top of Bank (TB)	~	2010	Bank Full (BF)	~	3011	Water Surface	~	
Section 3	Right	Top of Bank (TB)	/	3016	Bank Full (BF)	~	3015	(WS)		3014
Section 4	Left	Top of Bank (TB)	~	3024	Bank Full (BF)	Some	3024	Water Surface	~	
Section 4	Right	Top of Bank (TB)	/	3019	Bank Full (BF)	Same	3018	(WS)		3012
	Left	Top of Bank (TB)	V	3035	Bank Full (BF)	Some	3095	Water Surface		
Section 5	Right	Top of Bank (TB)	~	3021	Bank Full (BF)	Some	3021	(WS)		3020

Measurement	Unit	Value	
Manning's n at Bank Full Condition	-	006	
Root Depth	(ft)	est 0.5-1	estimates, not easily usual
Root Density	(%)	25	major high
Eroding Bank Surface Cover	(%)	0	
Eroding Bank Length	(ft)	0	
Bank Material Type	(sand, silt, clay)	See lob son	
Bank Material Stratification Score ¹	-	0	
Distance from Bank Toe to Water Surface ²	(ft)	~1.51	

Notes: 1+5 for any stratification, +10 for multiple layers above bank full mark

Rosgen Method Checklist

Item	Completed?	
Velocity Measurements Taken	No	- Frozen, also veg would be too that
Depositional Features Noted on Worksheet	~	in chimel for measurements
Channel Blockages Noted on Worksheet	~	
Pfankuch Method Completed	-	

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	~	LR-1	3025
Right Bank (RB)	~	LR-3	3026
Bed (BED)	-	TB-3	3027
Bar – Armor (B-A)			
Bar - Sub Armor (B-SA)			

River	Abbreviation		
Red River of the North	RR		
Sheyenne River	S		
Lower Rush	LR		
Rush	RUSH		
Maple	M		
Buffalo	В		
Sheyenne Diversion	SD		
Wild Rice	WR		
Wolverton Creek	WC		

²Negative number indicates water surface is below bank toe.

Site Name: Magle 1 Date: 10/1/11

SKETCH Water Surface unb

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt	
Section 1	Left	Top of Bank (TB)			Bank Full (BF)		1	Water Surface		211	
Section 1	Right	Top of Bank (TB)			Bank Full (BF)			(WS)	V	2404	
Section 2	Left	Top of Bank (TB)			Bank Full (BF)		/	Water Surface	Water Surface		4
Section 2	Right	Top of Bank (TB)		/	Bank Full (BF)		/	(WS)	1	2403	
	Left	Top of Bank (TB)			Bank Full (BF)	\		Water Surface		2	
Section 3	Right	Top of Bank (TB)	/		Bank Full (BF)	/		(WS)	V	240)	
Section 4	Left	Top of Bank (TB)	/		Bank Full (BF)			Water Surface	-		
Section 4	Right (TB) (BF) Water Surrace (WS)	(WS)	V	2401							
	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface		No.	
Section 5	Right	Top of Bank (TB)		1	Bank Full (BF)	/	1	(WS)		2400	

Unit		Value	
-	Channel O.03-35	LOB 0.045	ROB O.OHS
(ft)			/
(%)			
(%)		\ /	
(%)		X	1 00
(sand, silt, clay)	/	/	
			1
(ft)	/		
	- (ft) (%) (%) (%) (sand, silt, clay)	Channel - 0.03-35 (ft) (%) (%) (%) (sand, silt, clay)	Channel LOB - 0.03-35 0.045 (ft) (%) (%) (%) (sand, silt, clay)

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

ltem	Completed	Item	Completed
Velocity Measurements	OS Gage	Riparian Vegetation Worksheet	
Depositional Features Worksheet		Pfankuch Method	
Channel Blockages Worksheet			

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)			
Right Bank (RB)	X	,	
Bed Surface (BED)			
Bed Core (BED-C)	100 pt 610	ect (clas)	
Bar (BAR)			

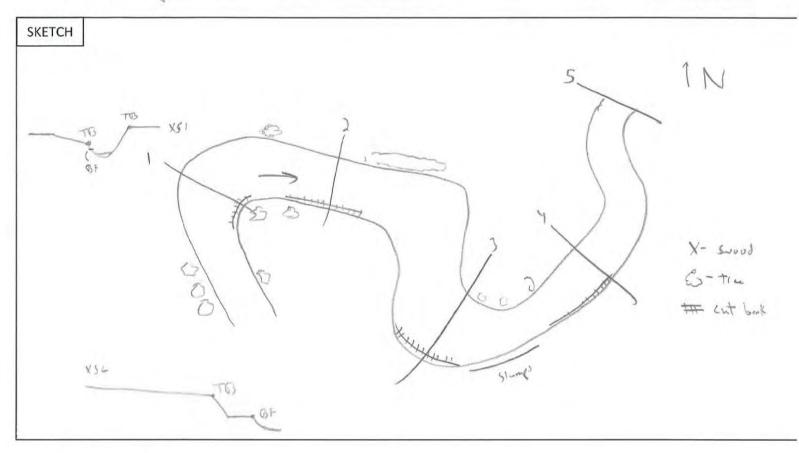
River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Maple River - 1 - 0.80 11/6/10 Geomorphic Analysis Check List

Site Name: More 11/16/10 170 18 (RM 131-0.77)



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)	/	1000	Bank Full (BF)	~	1003	Water Surface	_	
Section 1	Right	Top of Bank (TB)	/	1021	Bank Full (BF)	Same	1001	(WS)	4	1004
Section 2	Left	Top of Bank (TB)	~	1006	Bank Full (BF)	~	1007	Water Surface		
Section 2	Right	Top of Bank (TB)	/	1022	Bank Full (BF)	Some	1022	(WS)	~ \	1008
Cantian 2	Left	Top of Bank (TB)	Ų.		Bank Full (BF)			Water Surface		X
Section 3	Right	Top of Bank (TB)	/	1018	Bank Full (BF)	~	1017	(WS)	1	
Santian A	Left	Top of Bank (TB)	~	1072	Bank Full (BF)	~	1030	Water Surface	/	
Section 4	Right	Top of Bank (TB)	V	1024	Bank Full (BF)	N/A	Steep	(WS)	V/	1076
Continu F	Left	Top of Bank (TB)	~	1034	Bank Full (BF)	N/A	Stup	Water Surface	1	
Section 5	Right	Top of Bank (TB)	V	1025	Bank Full (BF)	~	1026	(WS)		1037

	Measurement	Unit	Value	
	Manning's n at Bank Full Condition	-	0.05-0.035	
	Root Depth —	(ft)	0.5-1.5	mojbe evg?
	Root Density	(%)	25%	mobe high
-	Eroding Bank Surface Cover	(%)	10%	
	Eroding Bank Length	(ft)	1300 54	50% of total dist
	Bank Material Type	(sand, silt, clay)	See lab	
	Bank Material Stratification Score ¹	-	0	
9	Distance from Bank Toe to Water Surface ²	(ft)	? See Surv.	• • •

Notes: 1+5 for any stratification, +10 for multiple layers above bank full mark

²Negative number indicates water surface is below bank toe.

Rosgen Method Checklist

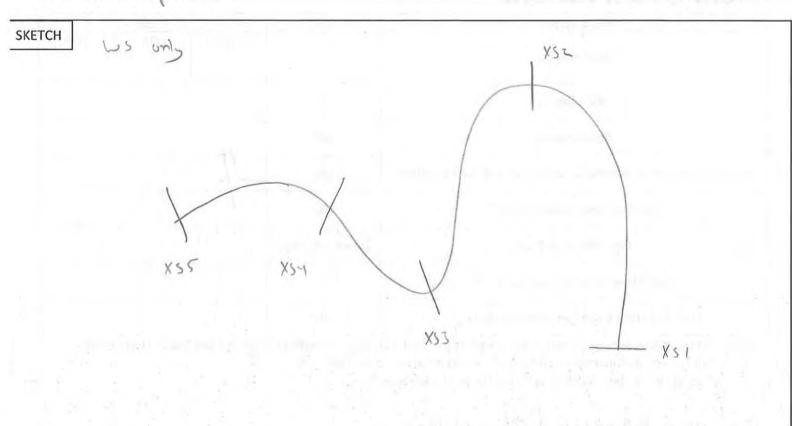
Item	Completed?
Velocity Measurements Taken	99900
Depositional Features Noted on Worksheet	none noted
Channel Blockages Noted on Worksheet	~
Pfankuch Method Completed	/

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	~	m-01	1010
Right Bank (RB)	/	m-02	1021
Bed (BED)	/	m-03	10)1 Showel
Bar – Armor (B-A)			likely book
Bar - Sub Armor (B-SA)			motord

River	Abbreviation		
Red River of the North	RR		
Sheyenne River	S		
Lower Rush	LR		
Rush	RUSH		
Maple	М		
Buffalo	В		
Sheyenne Diversion	SD		
Wild Rice	WR		
Wolverton Creek	WC		

Site Name: Maple 2 Date: 10/3/1/



Section #	Bank	NAME OF TAXABLE PARTY.	Staked	GPS Pt	The Late Co	Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface	SEMI YOU	2
Section 1	Right	Top of Bank (TB)			Bank Full (BF)			(WS)		3000
Section 2	Left	Top of Bank (TB)			Bank Full (BF)		lede	Water Surface	ilgiri	1
Section 2	Right	Top of Bank (TB)			Bank Full (BF)			(WS)		3001
Section 2	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface	NIP SI	
Section 3	Right	Top of Bank (TB)	. 1		Bank Full (BF)			(WS)	~	3002
Section 4	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface		2
Section 4	Right	Top of Bank (TB)			Bank Full (BF)			(WS)		5003
Section 5	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface	1	
Section 5	Right	Top of Bank (TB)			Bank Full (BF)			(WS))	3004

Measurement	Unit		Value	V 110 V
Manning's n	-	Channel	LOB	ROB
Root Depth	(ft)			/
Root Density	(%)		/	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)		X	
Eroding Bank in Study Reach ¹	(%)			
Bank Material Type	(sand, silt, clay)	/		
Bank Material Stratification Score ²	-	/		1
Distance from Bank Toe to Water Surface ³	(ft)	/		1

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	Item	Completed
Velocity Measurements	/	Riparian Vegetation Worksheet	
Depositional Features Worksheet	X	Pfankuch Method	
Channel Blockages Worksheet			

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)			
Right Bank (RB)	X	4	
Bed Surface (BED)			
Bed Core (BED-C)	/	MRZ-CH	3005
Bar (BAR)	X		

River	Abbreviation		
Red River of the North	RR		
Sheyenne River	S		
Lower Rush	LR		
Rush	RUSH		
Maple	M		
Buffalo	В		
Sheyenne Diversion	SD		
Wild Rice	WR		
Wolverton Creek	WC		

Sample Labeling: River Abbreviation / GPS Point # / Sampling Location Abbreviation

taken vie weding ~ 6' from edge water

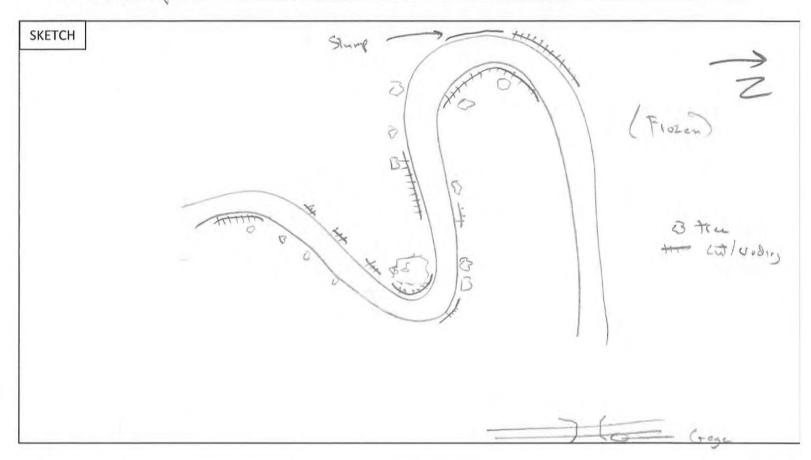
²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

111aple River - 2-11.41 11/20/10

Geomorphic Analysis Check List

Site Name: Make 11/30/10 (RM 12.28-11.40)



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt	
Section 1	Left	Top of Bank (TB)	/	6017	Bank Full (BF)	/	6016	Water Surface			
Section 1	Right	Top of Bank (TB)	/	6000	Bank Full (WS)	(WS)		6015			
Section 2	Left	Top of Bank (TB)	>	6019	Bank Full (BF)	/	1507	Water Surface (WS)	Water Surface		
Section 2	Right	Top of Bank (TB)	/	6001	Bank Full (BF)	Some	6001			6020	
Saction 2	Left	Top of Bank (TB)	/	6024	Bank Full (BF)	same	6 024	Water Surface (WS)			
Section 3	Right	Top of Bank (TB)	/	6005	Bank Full (BF)	/	6004			600)	
Section 4	Left	Top of Bank (TB)	1	6015	Bank Full (BF)	~	6026	Water Surface		, _	
Section 4	Right	Top of Bank (TB))	6009	Bank Full (BF)	/	6008	(WS)	~	600)	
Section F	Left	Top of Bank (TB)	~	6028	Bank Full (BF)	/	6023	Water Surface			
Section 5	Right	Top of Bank (TB)	\vee	601)	Bank Full (BF)	~	6032	(WS)		6011	

Measurement	Unit	Value
Manning's n at Bank Full Condition	-	0.035
Root Depth	(ft)	1-1.5
Root Density	(%)	10-20
Eroding Bank Surface Cover	(%)	10
Eroding Bank Length	(ft)	1500
Bank Material Type	(sand, silt, clay)	See 106
Bank Material Stratification Score ¹	-	5
Distance from Bank Toe to Water Surface ²	(ft)	? Frozen

Notes: 1+5 for any stratification, +10 for multiple layers above bank full mark

Rosgen Method Checklist

ltem	Completed?
Velocity Measurements Taken	gaged
Depositional Features Noted on Worksheet	none
Channel Blockages Noted on Worksheet	none
Pfankuch Method Completed	/

Sampling Checklist

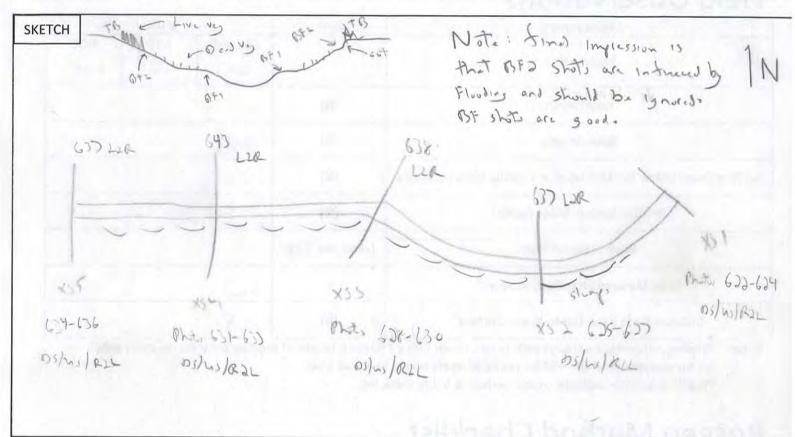
Location	Collected	Label	GPS Pt #
Left Bank (LB)			
Right Bank (RB)	/	m-6-1	
Bed (BED)		m-13-L	
Bar – Armor (B-A)		taken close	
Bar - Sub Armor (B-SA)		to shor-	

Abbreviation
RR
S
LR
RUSH
M
В
SD
WR
WC

²Negative number indicates water surface is below bank toe.

Geomorphic Analysis Check List

Site Name: Rhsh 1 Date: 9/39/11



Section #	Bank		Staked	GPS Pt	francisco de la constantina della constantina de	Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)	V)259	Bank Full (BF)	-	3928	Water Surface	1	
110000000000000000000000000000000000000	Right	Top of Bank (TB)	V	2227	Bank Full (BF)	~~	2)550F=	(WS)	V	2090
Section 2	Left	Top of Bank (TB)	1	2261	Bank Full (BF)	1	22603	Water Surface	1	3
Section 2	Right	Top of Bank (TB)	V	2234	Bank Full (BF)	7	2 259 852	(WS)	V	2933
Section 3	Left	Top of Bank (TB)	~	2263	Bank Full (BF)		2362	Water Surface		
section s	Right	Top of Bank (TB)	V	2278	Bank Full (BF)	Y	2)33 BF	(WS)	6	רנגנ
Section 4	Left	Top of Bank (TB)	1	2267	Bank Full (BF)		2266 -	Water Surface		
Section 4	Right	Top of Bank (TB)	V	2243	Bank Full (BF)	7	2)4) BED	(WS)	V	2239
Saction F	Left	Top of Bank (TB)		2249	Bank Full (BF)	V	2251	Water Surface	" man	-
Section 5	Right	Top of Bank (TB)		2247	Bank Full (BF)	-	2243082	(WS)		2244

Measurement	Unit		Value	
Manning's n	-	Channel	LOB 0.05	ROB
Root Depth	(ft)	0.5-1		
Root Density	(%)	25 %		
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	206		
Eroding Bank in Study Reach ¹	(%)	7 20%	→ 90%	
Bank Material Type	(sand, silt clay)			
Bank Material Stratification Score ²	-	0		
Distance from Bank Toe to Water Surface ³	(ft)	40.5		

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	ltem	Completed
Velocity Measurements		Riparian Vegetation Worksheet	~
Depositional Features Worksheet	V	Pfankuch Method	~
Channel Blockages Worksheet	V		

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)		RUSH- LD	
Right Bank (RB)			
Bed Surface (BED)		,	
Bed Core (BED-C)		Rush 2 - CH	
Bar (BAR)			

River	Abbreviation		
Red River of the North	RR		
Sheyenne River	S		
Lower Rush	LR		
Rush	RUSH		
Maple	M		
Buffalo	В		
Sheyenne Diversion	SD		
Wild Rice	WR		
Wolverton Creek	WC		

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Geomorphic Analysis Check List

Site Name: _	Rush K	wer -1	Date:
SKETCH		The state of	Winds programme to the contract of the contrac

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS P
	Left	Top of Bank (TB)		Selly A	Bank Full (BF)		19-11	Water Surface	HENN	197
Section 1	Right	Top of Bank (TB)			Bank Full (BF)			(WS)	Ť	
Section 2	Left	Top of Bank (TB)			Bank Full (BF)		talld	Water Surface	ilem	37
	Right	Top of Bank (TB)	-	-10	Bank Full (BF)	Educ		(WS)	ultroop!	
Section 3	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface	4111111	
	Right	Top of Bank (TB)			Bank Full (BF)			(WS)	1.176,	
Section 4	Left	Top of Bank (TB)	Hilly		Bank Full (BF)			Water Surface	a sibility	
Section 4	Right	Top of Bank (TB)	1-5		Bank Full (BF)			(WS)	111,000	
Section 5	Left	Top of Bank (TB)	THE PERSON		Bank Full (BF)			Water Surface	(Market)	
	Right	Top of Bank (TB)	1102	11	Bank Full (BF)			(WS)		

Measurement	Unit	Value			
Manning's n	-	Channel	LOB	ROB	
Root Depth	(ft)		X		
Root Density	(%)		X		
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)				
Eroding Bank in Study Reach ¹	(%)				
Bank Material Type	(sand, silt, clay)		X		
Bank Material Stratification Score ²	-		X		
Distance from Bank Toe to Water Surface ³	(ft)		X		

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

ltem	Completed	Item	Completed
Velocity Measurements		Riparian Vegetation Worksheet	X
Depositional Features Worksheet	X	Pfankuch Method	X
Channel Blockages Worksheet	X		

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	\times		
Right Bank (RB)	X		
Bed Surface (BED)	X		
Bed Core (BED-C)			
Bar (BAR)	X		

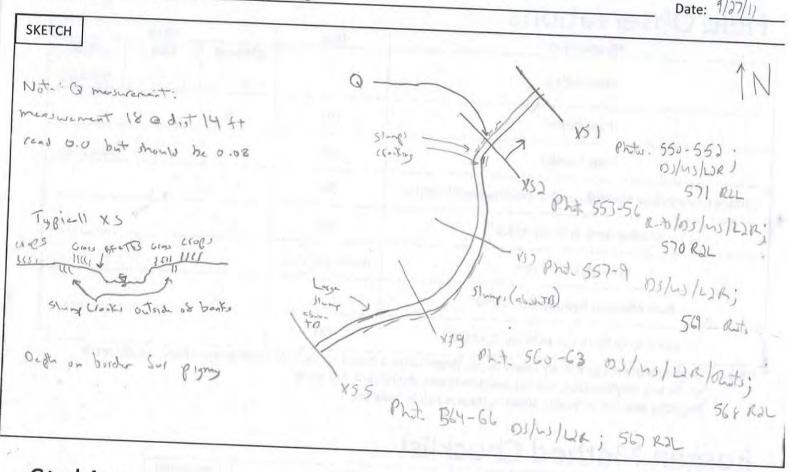
River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Geomorphic Analysis Check List

Site Name: Rush River - Z Date: 9/27/11



Section #	Bank		Staked	GPS Pt		Staked	CDCD			
Section 1	Left	Top of Bank (TB)	V	101	Bank Full (BF)	Staked	GPS Pt		Staked	GPS P
	Right	Top of Bank (TB)	V	125	Bank Full (BF)	V	125	Water Surface (WS)	V	100
Section 2	Left	Top of Bank (TB)	V	109	Bank Full (BF)	V	104			
	Right	Top of Bank (TB)	V	124	Bank Full (BF)	~	123	Water Surface (WS)	V	103
Section 3	Left	Top of Bank (TB)	~	106	Bank Full (BF)	1/	107			-
	Right	Top of Bank (TB)	~	120	Bank Full (BF)	/	120	Water Surface (WS)	V	100
Section 4	Left	Top of Bank (TB)	~	113	Bank Full	V	71.11	T white		
	Right	Top of Bank (TB)	~	119	(BF) Bank Full	V	119	Water Surface (WS)	/	111
Section 5	Left	Top of Bank (TB)	V	115	(BF) Bank Full	1			A B	
	Right	Top of Bank (TB)	~	116	(BF) Bank Full (BF)	V	115	Water Surface (WS)	V	114

Fleid Ops	ervations	Unit		Value	
	Measurement	Oilit	Channel	LOB	ROB
	Manning's n	-	0.035	.055-06	,055.06
2.1.3.3.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.	Root Depth	(ft)	0.5		
	Root Density	(%)	50% ? (25?) Anch gra		
Surface Cover below	Bankfull Level at Eroding Bank Locations	(%)	5-10	(.	
	ling Bank in Study Reach ¹	(%)	80%		
	Bank Material Type				
Pank I	Material Stratification Score ²	-	5		
	rom Bank Toe to Water Surface ³	(ft)	1,5	1	

 1 Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Rosgen Method		Item	Completed
Item	Completed		-
Velocity Measurements	1	Riparian Vegetation Worksheet	~
Depositional Features Worksheet	~	Pfankuch Method	V
Channel Blockages Worksheet	~		

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	~	Rush 2-LB	178
Right Bank (RB)	~	Rusha-RB	129
Bed Surface (BED)			Ph.t. 572
Bed Core (BED-C)	√	Rush2-CH	127
Bar (BAR)		/ GPS Point # / Sampl	

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Date: 10/6/11 Site Name: Sheyeme River. SKETCH 87 LDR 821-823 WILDS/RZL 808 LIR US) 05/20 XX 2 834-26 419-401 451051RIL 502 · Y54 836 KZL 836 842 2222 937-35 45/05/12A 839-841 us los/ler MERT

45/03/2R

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt	No.	Staked	GPS Pt
Section 1	Left	Top of Bank (TB)	~	7509	Bank Full (BF)	-	3508	Water Surface	1/	3507
	Right	Top of Bank (TB)	1	3501	Bank Full (BF)	~	3502	(WS)		7
	Left	Top of Bank (TB)	\ \	3512	Bank Full (BF)	/	3511	Water Surface (WS)	17	7/11
Section 2 Right	Right	Top of Bank (TB)	-	3506	Bank Full (BF)	~	3605			1604
Section 3	Left	Top of Bank (TB)	-	3578	Bank Full (BF)	V	3519	Water Surface		7517
	Right	Top of Bank (TB)	V	3515	Bank Full (BF)	~	3511	(WS)		100
	Left	Top of Bank (TB)	~	3522	Bank Full (BF)	~	3523	Water Surface	/	352
Section 4	Right	Top of Bank (TB)	~	3527	Bank Full (BF)	4	3521	(WS)	180	200
Section 5	Left	Top of Bank (TB)	V	3531	Bank Full (BF)	~	1532	Water Surface	V	3503
	Right	Top of Bank (TB)	V	3534	Bank Full (BF)	1	7515	(WS)		- 3
Set L	L		V	3538		V	3539		V	354

Measurement	Unit	Value			
Manning's n	4	Channel 0.035	LOB	ROB O.UST	
Root Depth	(ft)	1-3'			
Root Density	(%)	20%			
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	5%			
Eroding Bank in Study Reach ¹	(%)	75%			
Bank Material Type	(sand, silt, clay)				
Bank Material Stratification Score ²	-	D			
Distance from Bank Toe to Water Surface ³	(ft)	See Sw	104		

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

²+5 for any stratification, +10 for multiple layers above bank full mark ³Negative number indicates water surface is below bank toe

Rosgen Method Checklist

Item	Completed	ltem	Completed
Velocity Measurements	_	Riparian Vegetation Worksheet	~
Depositional Features Worksheet	\vee	Pfankuch Method	~
Channel Blockages Worksheet	1/		

Sampling Checklist

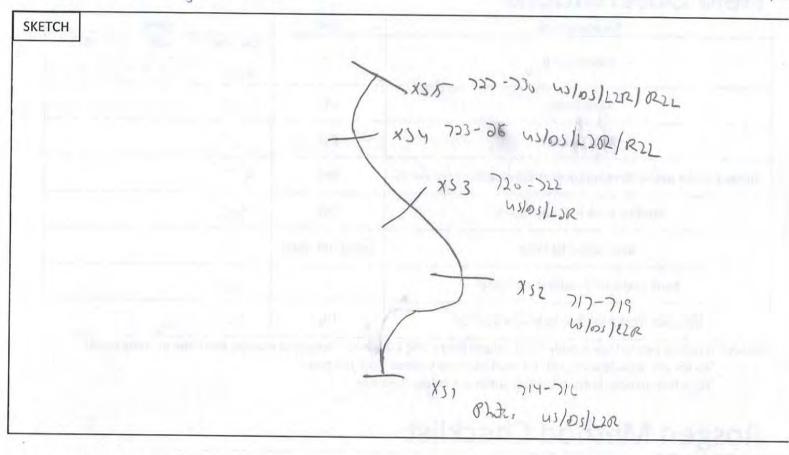
Location	Collected	Label	GPS Pt #
Left Bank (LB)		SR)/3525/LB	7525
Right Bank (RB)	~	5x1/3527/120	7529
Bed Surface (BED)		581/3530 1CH	3530
Bed Core (BED-C)	V,	7	4
Bar (BAR)			

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR 🖟
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

Sample Labeling: River Abbreviation / GPS Point # / Sampling Location Abbreviation

& 1-2 cm souls leger on top, then phonolicala

Site Name: Sheyenne River - 2 Date: 10/3/11



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)	/	2900	Bank Full (BF)	V	2901	Water Surface	./	
Section 1	Right	Top of Bank (TB)			Bank Full (BF)			(WS)	V	238
Section 2	Left	Top of Bank (TB)	/	2905	Bank Full (BF)	~	2934	Water Surface	1000	
Section 2	Right	Top of Bank (TB)			Bank Full (BF)	_		(WS)	~	2907
Section 3	Left	Top of Bank (TB)	~	308	Bank Full (BF)	~	2909	Water Surface		20.
Jection 5	Right	Top of Bank (TB)			Bank Full (BF)		10 1	(WS)		2911
Section 4	Left	Top of Bank (TB)	/	7917	Bank Full (BF)	/	2917	Water Surface		10
Section 4	Right	Top of Bank (TB)	NV	5913	Bank Full (BF)	V	2914	(WS)	V	2912
Section 5	Left	Top of Bank (TB)	V	2920	Bank Full (BF)	~	2919	Water Surface		2000
occion 5	Right	Top of Bank (TB)	~	2923	Bank Full (BF)	-	2924	(WS)	V	3116

Measurement	Unit		Value	
Manning's n	•	Channel り、いろ	LOB	ROB 0-055-6
Root Depth	(ft)	1-1.5 '		
Root Density	(%)	20%		
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	5%		
Eroding Bank in Study Reach ¹	(%)	75		
Bank Material Type	(sand, silt, clay)			
Bank Material Stratification Score ²	-	0		
Distance from Bank Toe to Water Surface ³	(ft)	Suc	Twy	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	ltem	Completed
Velocity Measurements	~	Riparian Vegetation Worksheet	~
Depositional Features Worksheet	~	Pfankuch Method	1
Channel Blockages Worksheet	~		

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)			
Right Bank (RB)	~	5R2) 2924 RB	2924
Bed Surface (BED)		*	
Bed Core (BED-C)	V	503/2925/CH	2925
Bar (BAR)			

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Geomorphic Analysis Check List

Site Name: Sheyenne River -3 Date: 9/30/11 **SKETCH** ON, (49-5) 40/05/2062 652-659/ To garde shows be wife 45/05/4R 655-657 4 658-660 661-60 Lon/us/os 113 45/05/LZR 666 RIL PLI bly are いりのりにん 665 RLL

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt	4	Staked	GPS Pt
Section 1	Left	Top of Bank (TB)	V	2700	Bank Full (BF)	~	2301	Water Surface		The state of
Section 1	Right	Top of Bank (TB)	1	79-5-	Bank Full (BF)	/	Mall	(WS)		1307
Section 2	Left	Top of Bank (TB)	~	2301	Bank Full (BF)	1	2006	Water Surface		22.2
Section 2	Right	Top of Bank (TB)			Bank Full (BF)			(WS)		2307
Section 3	Left	Top of Bank (TB)	/	2309	Bank Full (BF)	~	nus	Water Surface		20
Section 3	Right	Top of Bank (TB)	1	2325	Bank Full (BF)	~	2324	(WS)	V	910)
Section 4	Left	Top of Bank (TB)	~	2312	Bank Full (BF)	~	3313	Water Surface	- y	
Section 4	Right	Top of Bank (TB)	1	73.79	Bank Full (BF)	/	2337	(WS)	V	2314
Section 5	Left	Top of Bank (TB)	V	2315	Bank Full (BF)	V	2016	Water Surface	1	
Jection 3	Right	Top of Bank (TB)	~	2721	Bank Full (BF)	V	2726	(WS)		2317

Measurement	Unit		Value	
Manning's n	-	Channel	LOB	ROB Large West Fast. 0.05
Root Depth	(ft)		X	
Root Density	(%)		X	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	0-12		
Eroding Bank in Study Reach ¹	(%)	75%		
Bank Material Type	(sand, silt, clay)		X	
Bank Material Stratification Score ²	-		\times	
Distance from Bank Toe to Water Surface ³	(ft)		X	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	Item	Completed
Velocity Measurements		Riparian Vegetation Worksheet	X
Depositional Features Worksheet	X	Pfankuch Method	X
Channel Blockages Worksheet	X		

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	X		
Right Bank (RB)	X		
Bed Surface (BED)	X		
Bed Core (BED-C))	
Bar (BAR)	X		

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R
С

Sample Labeling: River Abbreviation / GPS Point # / Sampling Location Abbreviation

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²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Sheyenne Kiver - 5 - 18.17/11/17/10

Geomorphic Analysis Check List

Site Name: Shayenne River @ 40th Ave Bridge (RM18.68 - 18.05)

SKETCH	to po	idge			
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	7		,		
	Fcsa2	Q ZTB	/		
		KOB Engle	10	4 3	
	fence of	A4			
	1/19	slumped /	THE		

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt		
Section 1	Left	Top of Bank (TB)	12	881	Bank Full (BF)	1	149	Water Surface	= ,	N (2)		
Section 1	Right	Top of Bank (TB))	1	Bank Full (BF)	-	-	(WS)	9	120		
Section 2	Left	Top of Bank (TB)	/	143	Bank Full (BF)	1	144	Water Surface (WS)	Water Surface	Water Surface	1	111
Section 2	Right	Top of Bank (TB)	_	-	Bank Full (BF)	_	~			145		
Section 3	Left	Top of Bank (TB)	J	138	Bank Full (BF)	1	139	Water Surface	1	11/1		
Section 5	Right	Top of Bank (TB)	_	-	Bank Full (BF)	-	_	(WS)	/	141		
Section 4	Left	Top of Bank (TB)	· V.	138	Bank Full (BF)	1	134	Water Surface	1	15		
Section 4	Right	Top of Bank (TB)	-	-	Bank Full (BF)	-	_	(WS)		135		
Section 5	Left	Top of Bank (TB)	1	129	Bank Full (BF)	/	130	Water Surface	1	121		
Section 5	Right	Top of Bank (TB))	4-	Bank Full (BF)	_	~	(WS)	\checkmark	DI		

Measurement	Unit	Value	
Manning's n at Bank Full Condition	-	0.03	
Root Depth	(ft)	2,	
Root Density	(%)	25	See also 2011
Eroding Bank Surface Cover	(%)	90B)	1 1 2 3 7 5 5
Eroding Bank Length	(ft)	750'5	Study reach length: 3280 Ft estimated proding to
Bank Material Type	(sand, silt, clay)	clay	,)
Bank Material Stratification Score ¹	-	-	
Distance from Bank Toe to Water Surface ²	(ft)	2.3'	

Notes: 1+5 for any stratification, +10 for multiple layers above bank full mark
Negative number indicates water surface is below bank toe.

Rosgen Method Checklist

ltem	Completed?
Velocity Measurements Taken	J
Depositional Features Noted on Worksheet	J
Channel Blockages Noted on Worksheet	J
Pfankuch Method Completed	J

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)		2/1710/TB	140
Right Bank (RB)	_		_
Bed (BED)	J	S/137/BED	137
Bar – Armor (B-A))	_	_
Bar - Sub Armor (B-SA)			_

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

Sample Labeling: River Abbreviation / GPS Point # / Sampling Location Abbreviation

See also 2011

Site Name: Sheyenne River - 4

Date: 10/1/11

SKETCH

X31 Bhit 673-75 43/05/02L

Syndowst Sumps

X32 676-78 N3/03/08L

X33 2 Seport TO. Bh. Ost orrs two To

(79-81 15 nt mithing

1 15 nt m

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS P1		
Section 1	Left	Top of Bank (TB)	14	2000	Bank Full (BF)			Water Surface				
Section 1	Right	Top of Bank (TB)	V	2600	Bank Full (BF)	V	2600	(WS)		2601		
Section 2	Left	Top of Bank (TB)			Bank Full (BF)	-		Water Surface	l _{ese}			
Section 2	Right	Top of Bank (TB)	V	2634	Bank Full (BF)	~	7626	(WS)		2605		
Section 3	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface (WS)	Vater Surface		La Paper	
Section 5	Right	Top of Bank (TB)	V	2609	Bank Full (BF)	V	2007			2608		
Section 4	Left	Top of Bank (TB)			Bank Full (BF)	-		Water Surface	-1-1			
Section 4	Right	Top of Bank (TB)	V	2011	Bank Full (BF)	V	Jen	(WS)	/	2617		
Section 5	Left	Top of Bank (TB)		•	Bank Full (BF)			Water Surface				
section 3	Right	Top of Bank (TB)	1	2613	Bank Full (BF)	V	2613	(WS)	V	26/4		

Measurement	Unit		Value	
Manning's n		Channel 0.03-35	COB	O.OS
Root Depth	(ft)	1,		
Root Density	(%)	200		
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	2%		
Eroding Bank in Study Reach ¹	(%)	85%		
Bank Material Type	(sand, silt, clay)			
Bank Material Stratification Score ²	-	0		
Distance from Bank Toe to Water Surface ³	(ft)	untruen	- See XS	Survey

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	ltem	Completed
Velocity Measurements		Riparian Vegetation Worksheet	V
Depositional Features Worksheet	V	Pfankuch Method	V
Channel Blockages Worksheet	~		

Sampling Checklist As send Like due to provinct to back and significant

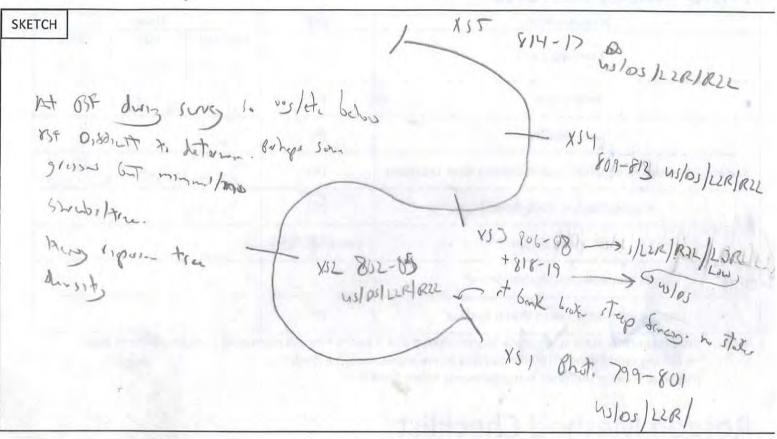
Location	Collected	Label	GPS Pt #
Left Bank (LB)	/		
Right Bank (RB)	~	5R4- RB	2511
Bed Surface (BED)			
Bed Core (BED-C)	V	SR4-CH	2617
Bar (BAR)			

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Site Name: Sheyenge River-5



Section #	Bank	District Market S	Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)	V	3403	Bank Full (BF)	/	3402	Water Surface		2
Section 1	Right	Top of Bank (TB)	-	-	Bank Full (BF)		_	(WS)	V	3401
Section 2	Left	Top of Bank (TB)	V	3604	Bank Full (BF)	V	1405	Water Surface	/	70/00
Section 2	Right	Top of Bank (TB)	~	3409	Bank Full (BF)		3404	(WS)	7-0	3706
Section 3	Left	Top of Bank (TB)	V	3410	Bank Full (BF)	~	3412	Water Surface		200
Section 5	Right	Top of Bank (TB)			Bank Full (BF)			(WS)		21/1
Section 4	Left	Top of Bank (TB)	V	7117	Bank Full (BF)	V	3416	Water Surface	1000	
Section 4	Right	Top of Bank (TB)	/	J418	Bank Full (BF)	~	3419	(WS)		3415
Section 5	Left	Top of Bank (TB)	V	7420	Bank Full (BF)	V	7421	Water Surface	1	
Section 5	Right	Top of Bank (TB)	1	1225	Bank Full (BF)		1424	(WS)		3423

Measurement	Unit		Value	
Manning's n	4	Channel U_354	LOB	ROB
Root Depth	(ft)	widly ver	1. be 1 -	3
Root Density	(%)	30%		
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	3 400	h with	My (Arl
Eroding Bank in Study Reach ¹	(%)	30%	o .	
Bank Material Type	(sand, silt, clay)			5
Bank Material Stratification Score ²	-	0		
Distance from Bank Toe to Water Surface ³	(ft)	Ju !	surva	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line-in study reach

Rosgen Method Checklist

ltem	Completed	Item	Completed
Velocity Measurements	~	Riparian Vegetation Worksheet	V
Depositional Features Worksheet	V	Pfankuch Method	V
Channel Blockages Worksheet			

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)			
Right Bank (RB)	/	585) 3426 RB	3426
Bed Surface (BED)			
Bed Core (BED-C)	/	285)3427/20	342)
Bar (BAR)			

River	Abbreviation		
Red River of the North	RR		
Sheyenne River	S		
Lower Rush	LR		
Rush	RUSH		
Maple	М		
Buffalo	В		
Sheyenne Diversion	SD		
Wild Rice	WR		
Wolverton Creek	WC		

Sample Labeling: River Abbreviation / GPS Point # / Sampling Location Abbreviation

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²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Geomorphic Analysis Check List

SKETCH WS 7 Col. only

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Section #	Bank	4	Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Saction 1	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface		
Section 1	Right	Top of Bank (TB)		41	Bank Full (BF)			(WS)		2000
C	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface		
Section 2	Right	Top of Bank (TB)			Bank Full (BF)			(WS)		1000
C11 2	Left	Top of Bank (TB)			Bank Full (BF)		,	Water Surface	1	
Section 3	Right	Top of Bank (TB)	1		Bank Full (BF)			(WS)		2702
C 4	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface		
Section 4	Right	Top of Bank (TB)			Bank Full (BF)			(WS)		2703
Sti F	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface		1
Section 5	Right	Top of Bank (TB)			Bank Full (BF)			(WS)		2704

Measurement	Unit		Value	
Manning's n	-	Channel	LOB	ROB
Root Depth	(ft)			
Root Density	(%)			
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)			
Eroding Bank in Study Reach ¹	(%)			
Bank Material Type	(sand, silt, clay)			
Bank Material Stratification Score ²	7			1
Distance from Bank Toe to Water Surface ³	(ft)			

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	ltem	Completed
Velocity Measurements	8	Riparian Vegetation Worksheet	
Depositional Features Worksheet		Pfankuch Method	1.5
Channel Blockages Worksheet			

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)			
Right Bank (RB)			
Bed Surface (BED)			
Bed Core (BED-C)		SR6-CH	2705
Bar (BAR)		/	

River	Abbreviation		
Red River of the North	RR		
Sheyenne River	S		
Lower Rush	LR		
Rush	RUSH		
Maple	M		
Buffalo	В		
Sheyenne Diversion	SD		
Wild Rice	WR		
Wolverton Creek	WC		

Sample Labeling: River Abbreviation / GPS Point # / Sampling Location Abbreviation

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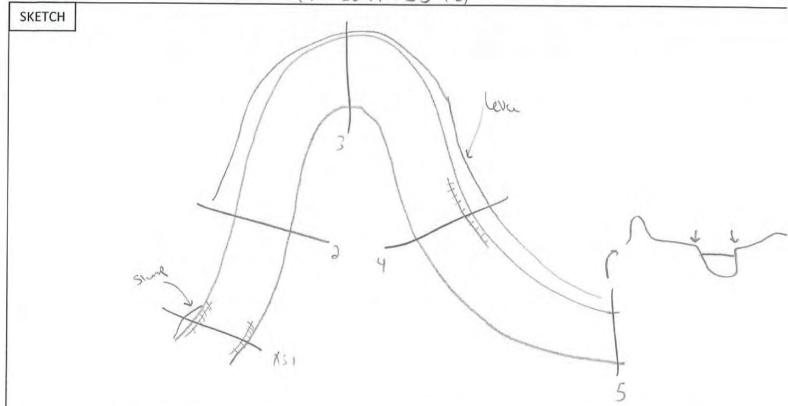
²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

meyerne KIVEL - 6- 55.04 11/21/10

Geomorphic Analysis Check List

Site Name: Sheyeme @ 170t & 64th (FID 29) 11/21/10



010 cot 5md

Staking

Section # Bank Staked GPS Pt **GPS Pt** Staked Staked GPS Pt Top of Bank Bank Full Left 7001 Same (TB) (BF) Water Surface Section 1 Top of Bank Bank Full (WS) 7014 Right 7013 Sam (TB) (BF) Top of Bank 5 lighty high (See pi) Bank Full Left 7000 7004 (TB) Water Surface (BF) Section 2 Too steve Top of Bank Bank Full (WS) 7016 Right 7015 (TB) (BF) Top of Bank Bank Full Left 700 2006 (TB) (BF) Water Surface Section 3 7005 Top of Bank Bank Full (WS) Right 7019 Same (TB) (BF) Top of Bank Bank Full Left 700 (TB) Jame (BF) Water Surface Section 4 Top of Bank Bank Full (WS) Right 7019 Som (TB) (BF) Top of Bank Bank Full 7011 Left Some (TB) (BF) Water Surface Section 5 Top of Bank Bank Full Som (WS) 1505 Right (TB) (BF)

Unit	Value
	0.035-04
(ft)	5-1.5 4
(%)	20%
(%)	10%
(ft)	500
(sand, silt, clay)	
-	? Snow
(ft)	? Fivzen
	- (ft) (%) (%) (ft) (sand, silt, clay)

Notes: 1+5 for any stratification, +10 for multiple layers above bank full mark
2 Negative number indicates water surface is below bank toe.

Rosgen Method Checklist

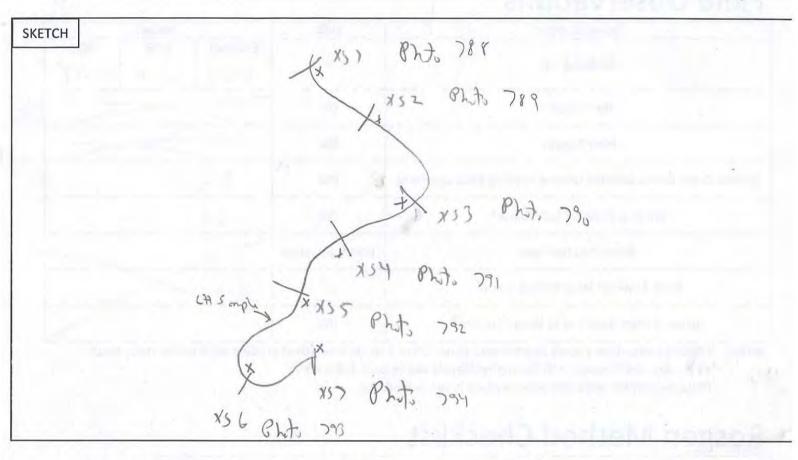
ltem	Completed?
Velocity Measurements Taken	gaga
Depositional Features Noted on Worksheet	none
Channel Blockages Noted on Worksheet	none
Pfankuch Method Completed	/

Sampling Checklist

Location	Collected	Label	GPS Pt #	
Left Bank (LB)	/	5-14-1	7023	
Right Bank (RB)		Similar Material		
Bed (BED)		Free		
Bar – Armor (B-A)				
Bar - Sub Armor (B-SA)				

River	Abbreviation			
Red River of the North	RR			
Sheyenne River	S			
Lower Rush	LR			
Rush	RUSH			
Maple	M			
Buffalo	В			
Sheyenne Diversion	SD			
Wild Rice	WR			
Wolverton Creek	WC			

Site Name: 5 10 Date: 16/5/1)



Staking

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)		1	Bank Full (BF)	1	1	Water Surface (WS)	V	3300
	Right	Top of Bank (TB)			Bank Full (BF)					
Section 2	Left	Top of Bank (TB)	1		Bank Full (BF)			Water Surface (WS)	~	330)
	Right	Top of Bank (TB)	1	1	Bank Full (BF)					
Section 3	Left	Top of Bank (TB)		X	Bank Full (BF)		X	Water Surface (WS)	~	3362
	Right	Top of Bank (TB)	/		Bank Full (BF)	/				
Section 4	Left	Top of Bank (TB)	1		Bank Full (BF)	/		Water Surface (WS)	/	33.03
	Right	Top of Bank (TB)			Bank Full (BF)					
Section 5	Left	Top of Bank (TB)	1		Bank Full (BF)			Water Surface (WS)	<u></u>	3364
	Right	Top of Bank (TB)	1	1	Bank Full (BF)		1			

X5 6 W5/3305

XS 7 WS/3301

Measurement	Unit		Value		
Manning's n		Channel U. U35	LOB 0.055	ROB	
Root Depth	(ft)				
Root Density	(%)		and the same of th	and the same of the same of	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	50	52,		
Eroding Bank in Study Reach ¹	(%)	60	2		
Bank Material Type	(sand, silt, clay)	- The same of the			
Bank Material Stratification Score ²	2			-	
Distance from Bank Toe to Water Surface ³	(ft)	-		The same of the sa	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

ltem	Completed	Item	Completed
Velocity Measurements	1	Riparian Vegetation Worksheet	\ /
Depositional Features Worksheet	X	Pfankuch Method	X
Channel Blockages Worksheet			

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	1		
Right Bank (RB)			
Bed Surface (BED)			
Bed Core (BED-C)	~	587/3306/CH	3306
Bar (BAR)	X		

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

Sample Labeling: River Abbreviation / GPS Point # / Sampling Location Abbreviation

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²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Sheyene River - 7-43.29 11/20/10 Geomorphic Analysis Check List

Sheyenne River west of I-29, Ext SY (RM43.85-43.15)

SKETCH		
Sprik	Section 2 Sound 5 simple	Scation 7
Staking	,	Survey OIN not Fin.

Staking

Section #	Bank	**1	Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt	
Section 1	Left	Top of Bank (TB)	J	261	Bank Full (BF)	1	262	Water Surface	J	260	
Section 1	Right	Top of Bank (TB)	J	258	Bank Full (BF)	J	259	(WS)			
Section 2	Left	Top of Bank (TB)	J	243	Bank Full (BF)	J	245	Water Surface	1 -10	711/	
Section 2	Right	Top of Bank (TB)	J	247	Bank Full (BF)	J	248	(WS)		246	
Section 3	Left	Top of Bank (TB)	J	252	Bank Full (BF)	1	253	Water Surface	1	2011	
Section 5	Right	t Top of Bank (TB) $\sqrt{255}$ Bank Full (WS)	(WS)	J	234						
Section 4	Left	Top of Bank (TB)	J	229	Bank Full (BF)	J	228	Water Surface	Water Surface	,	
Section 4	Right	Top of Bank (TB)	J	225	Bank Full (BF)	J	226	(WS)		727	
Section 5	Left	Top of Bank (TB)	745	219	Bank Full (BF)	J	220	Water Surface		771	
Section 5	Right Top of Bank (TB)	Top of Bank (TB)	J	222	Bank Full (BF)	J	223	(WS)	V	201	
6			1	237		3	5741		J	539	
2			U,	534		3/	2.55		./	252	

Measurement	Unit	Value
Manning's n at Bank Full Condition	-	0.03
Root Depth	(ft)	t,
Root Density	(%)	20
Eroding Bank Surface Cover	(%)	1
Eroding Bank Length	(ft)	325'
Bank Material Type	(sand, silt, clay)	silty clay
Bank Material Stratification Score ¹	-	-
Distance from Bank Toe to Water Surface ²	(ft)	2.3'

study reach length: 3,670 ft estimated eroding &=

Notes: 1+5 for any stratification, +10 for multiple layers above bank full mark

Rosgen Method Checklist

Item	Completed?			-	11-1
Velocity Measurements Taken	- «	too	cold	for	HACA
Depositional Features Noted on Worksheet	J				
Channel Blockages Noted on Worksheet	1				
Pfankuch Method Completed	J				

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	$\sqrt{}$	5/244/LB	244
Right Bank (RB)			
Bed (BED)			
Bar – Armor (B-A)	-	_	_
Bar - Sub Armor (B-SA)	_	_	_

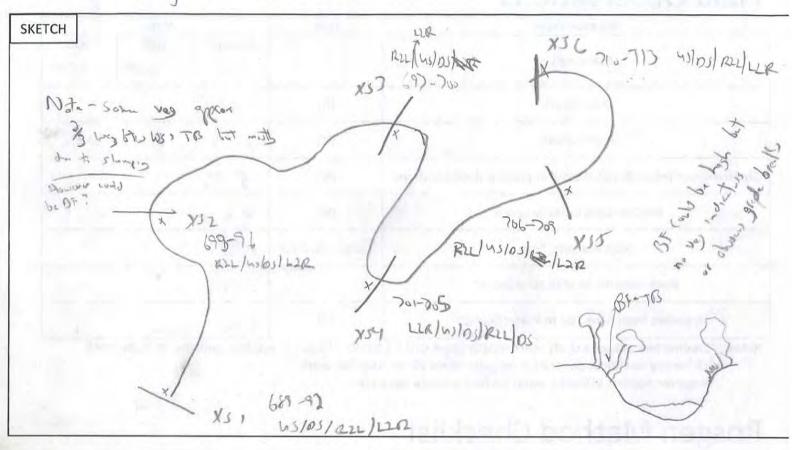
River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²Negative number indicates water surface is below bank toe.

Geomorphic Analysis Check List

Site Name: Sheyenne River -8

Date: 10/2/11



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)	V	Gosc	Bank Full (BF)	V	980	Water Surface	~	9803
Section 1	Right	Top of Bank (TB)	/	2800	Bank Full (BF)	V	284	(WS)		
Section 2	Left	Top of Bank (TB)	V	J805	Bank Full (BF)	V	2805	Water Surface	1	9804
Section 2	Right	Top of Bank (TB)	~	2906	Bank Full (BF)	~	2806	(WS)		
Section 3	Left	Top of Bank (TB)	~	284	Bank Full (BF)	~	284	(WS)	2	2
section s	Right	Top of Bank (TB)	V	2840	Bank Full (BF)	~	2710			2801
Section 4	Left	Top of Bank (TB)	_	2812	Bank Full (BF)	~	2812	Water Surface	/	2814
Section 4	Right	Top of Bank (TB)	~	2815	Bank Full (BF)	~	7816	(WS)		
Section E	Left	Top of Bank (TB)	/	X 7813	Bank Full (BF)	V	2819	Water Surface		2816
Section 5	Right Top of Bank (TB)	-	2817	Bank Full (BF)	-	2817	(WS)	V	2016	
	1		~	2823	T 1	-	2873		-	1210
1. 4 /	-1			202-		1	202			12820

Measurement	Unit		Value		
Manning's n	- 4	Channel 0.03	LOB	ROB UDS S	
Root Depth	(ft)	1.5			
Root Density	(%)	10%		4	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	57,			
Eroding Bank in Study Reach ¹	(%)	80%			
Bank Material Type	(sand, silt, clay)				
Bank Material Stratification Score ²	-	0	0		
Distance from Bank Toe to Water Surface ³	(ft)	5-00 5	wven		

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	ltem	Completed
Velocity Measurements	~	Riparian Vegetation Worksheet	~
Depositional Features Worksheet	~	Pfankuch Method	2
Channel Blockages Worksheet	~		

Sampling Checklist

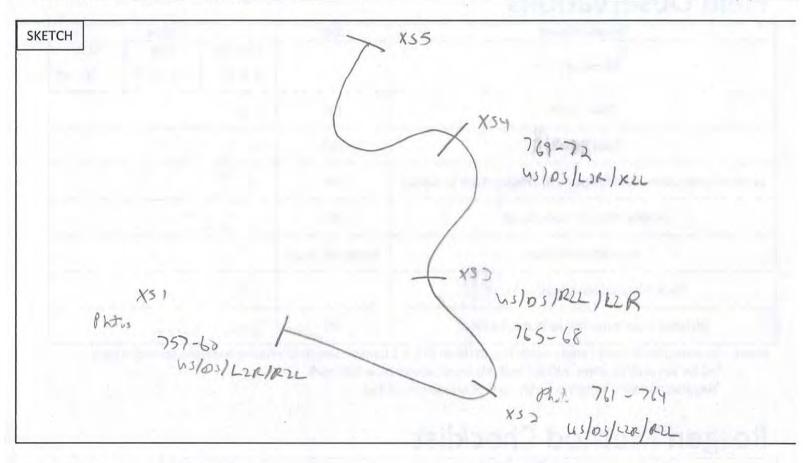
Location	Collected	Label	GPS Pt #
Left Bank (LB)		SR8-LB	2824
Right Bank (RB)			
Bed Surface (BED)			
Bed Core (BED-C)	1	SRE-CH	2825
Bar (BAR)			

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Site Name: Wild Rice River -1 Date: 10/4/1)



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)	V	2200	Bank Full (BF)	/	3200	Water Surface		7)
Section 1	Right	Top of Bank (TB)		3263	Bank Full (BF)	~	3204	(WS)		-B0)
Section 2	Left	Top of Bank (TB)	~	3205	Bank Full (BF)	~	7205	Water Surface	1/	77
Section 2	Right	Top of Bank (TB)	/	7209	Bank Full (BF)		3208	(WS)		3606
Section 3	Left	Top of Bank (TB)	V	3214	Bank Full (BF)	/	32/3	Water Surface		222
Section 5	Right	Top of Bank (TB)	V	3210	Bank Full (BF)	~	321)	(WS)		1221
Section 4	Left	Top of Bank (TB)	~	3216	Bank Full (BF)	V	3215	Water Surface	~	221
Section 4	Right	Top of Bank (TB)	~	3218	Bank Full (BF)	V	1219	(WS)	Aurosh	SLLC
Section F	Left	Top of Bank (TB)	V	3222	Bank Full (BF)	V	322)	Water Surface	. /	3224
Section 5	Right	Top of Bank (TB)	V	7225	Bank Full (BF)	V	7226	(WS)		7"19

Measurement	Unit		Value	
Manning's n	-	Channel 0.85	LOB	ROB ひょしかく
Root Depth	(ft)	1-2'		
Root Density	(%)	15%		
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	5%	A. V.	
Eroding Bank in Study Reach ¹	(%)	70	%	
Bank Material Type	(sand, silt, clay)		7	
Bank Material Stratification Score ²	-	b		
Distance from Bank Toe to Water Surface ³	(ft)	See guven		

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	ltem	Completed
Velocity Measurements		Riparian Vegetation Worksheet	-
Depositional Features Worksheet	V	Pfankuch Method	-
Channel Blockages Worksheet	V		

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	Clay - 1	10 Sample	
Right Bank (RB)	U.	on sayle	
Bed Surface (BED)	w .		7.000
Bed Core (BED-C)	/	WR1/3007/CH	3227
Bar (BAR)			

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Site Name: Wild Rice River-> Date: 10/4/1) SKETCH Pam XS) 454 748-51 732-735 USOS)LIR/RIL 45/15 | RZZ4/22R 605 Pt XS3 Z SK 740-747 744-47 45/05/LZR/RZL 45/05/LIR/RIL X55

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt	
Castian 1	Left	Top of Bank (TB)	~	3101	Bank Full (BF)	~	31000	Water Surface	1	3)02	
Section 1	Right	Top of Bank (TB)	~	CORC	Bank Full (BF)	~	3103	(WS)		-,00	
Section 2	Left	Top of Bank (TB)	~	3106	Bank Full (BF)	1	3/06	Water Surface	1-	7.	
Section 2	Right	Top of Bank (TB)	V	3108	Bank Full (BF)	~	3108	(WS)	V	3109	
Castian 2	Left	Top of Bank (TB)	V	3110	Bank Full (BF)	~	2110	Water Surface		-	
Section 3	Right	Top of Bank (TB)	/	3/13	Bank Full (BF)		3114	(WS)	/		3111
C + i 4	Left	Top of Bank (TB)	V	3115	Bank Full (BF)	V	3116	Water Surface	1	1	
Section 4	Right	Top of Bank (TB)	V	3118	Bank Full (BF)	/	3118	(WS)		311)	
Santian F	Left	Top of Bank (TB)	V	3119	Bank Full (BF)	V	7120	Water Surface		2124	
Section 5	Right	Top of Bank (TB)	~	3123	Bank Full (BF)	-	7124	(WS)		314	

Measurement	Unit		Value			
Manning's n	-	Channel	LOB	ROB 0,45		
Root Depth	(ft)	1-1.5	4			
Root Density	(%)	10-20 %				
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	51/1				
Eroding Bank in Study Reach ¹	(%)	40%	' a			
Bank Material Type	(sand, silt, clay)					
Bank Material Stratification Score ²		6				
Distance from Bank Toe to Water Surface ³	(ft)	Sec.	45 5W	ליין		

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	Item	Completed
Velocity Measurements	/	Riparian Vegetation Worksheet	-
Depositional Features Worksheet	~	Pfankuch Method	~
Channel Blockages Worksheet			

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	100		
Right Bank (RB)	/	WRJBnspo	3125
Bed Surface (BED)		/	
Bed Core (BED-C)	V	LAZ/3126/CA	3126
Bar (BAR)			

River	Abbreviation		
Red River of the North	RR		
Sheyenne River	S		
Lower Rush	LR		
Rush	RUSH		
Maple	M		
Buffalo	В		
Sheyenne Diversion	SD		
Wild Rice	WR		
Wolverton Creek	WC		

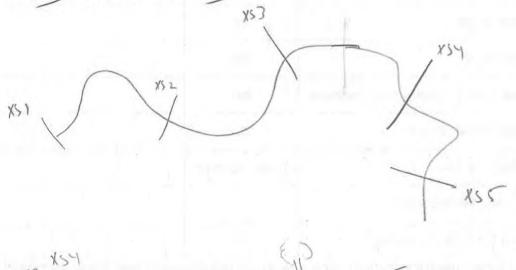
²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Site Name: Wolverton Creek 1 Date: 9/28/11

SKETCH Was scheduled Sor we stakes but Q < 1 chs. Staked 2 BF to

clarity 2010 BF staking.



16 XSY 10/64 TO/64

Section #	Bank		Staked	GPS Pt	Acres and the second	Staked	GPS Pt		Staked	GPS Pt				
Section 1	Left	Top of Bank (TB)			Bank Full (BF)	~	2100	Water Surface						
STATE OF STATE AND STATE OF ST	Right	Top of Bank (TB)			Bank Full (BF)			(WS)						
Sastian 2	Left	Top of Bank (TB)			Bank Full (BF)		2114	Water Surface (WS)	Water Surface	Water Surface	Water Surface	Water Surface		
Section 2	Right	Top of Bank (TB)		1111	Bank Full (BF)									
Section 3	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface (WS)	Water Surface					
	Right	Top of Bank (TB)			Bank Full (BF)									
Section 4	Left	Top of Bank (TB)	75		Bank Full (BF)	~	2101	Water Surface	+4					
Section 4	Right	Top of Bank (TB)			Bank Full (BF)			(WS)						
	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface						
Section 5	Right	Top of Bank (TB)			Bank Full (BF)			(WS)						

Measurement	Unit		Value	
Manning's n	-	Channel	LOB	ROB
Root Depth	(ft)			
Root Density	(%)			
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)			
Eroding Bank in Study Reach ¹	(%)			
Bank Material Type	(sand, silt, clay)			
Bank Material Stratification Score ²	4			*
Distance from Bank Toe to Water Surface ³	(ft)			7

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

ltem	Completed	ltem	Completed
Velocity Measurements		Riparian Vegetation Worksheet	
Depositional Features Worksheet		Pfankuch Method	
Channel Blockages Worksheet			[4]

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)			
Right Bank (RB)			
Bed Surface (BED)			
Bed Core (BED-C)			
Bar (BAR)			3

River	Abbreviation			
Red River of the North	RR			
Sheyenne River	S			
Lower Rush	LR			
Rush	RUSH			
Maple	M			
Buffalo	В			
Sheyenne Diversion	SD			
Wild Rice	WR			
Wolverton Creek	WC			

²+5 for any stratification, +10 for multiple layers above bank full mark

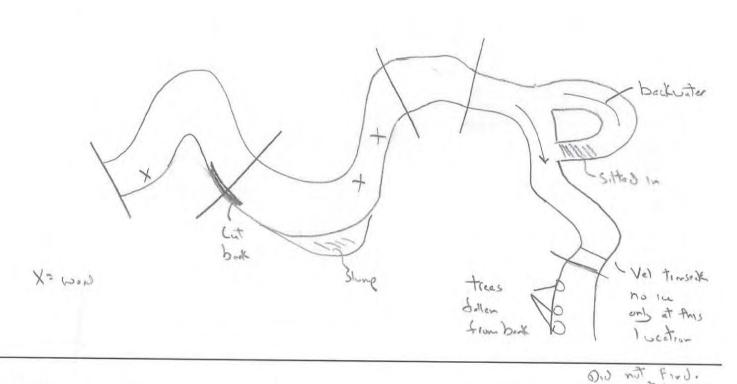
³Negative number indicates water surface is below bank toe

Wolverton Creek-1-0.6+ 11/19/10

Geomorphic Analysis Check List

Site Name: Wolity (K 11/19/10 FTD2) (RMS.41-5.15)

SKETCH



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)	/	4001	Bank Full (BF)	Same	4001	Water Surface		
Section 1	Right	Top of Bank (TB)	/	4019	Bank Full (BF)	Same	4019	(WS)	~	4018
Section 2	Left	Top of Bank (TB)	V	4004	Bank Full (BF)	~	4003	Water Surface	~	
Section 2	Right	Top of Bank (TB)	~	4027	Bank Full (BF)	~	1604	(WS)		4002
Section 3	Left	Top of Bank (TB)	/	800 H	Bank Full (BF)	Some	4008	Water Surface		
Section 3	Right	Top of Bank (TB)	-	4023	Bank Full (BF)	~	4024	(WS)	~	4025
Section 4	Left	Top of Bank (TB)	~	4013	Bank Full (BF)	/	4012	Water Surface		
Section 4	Right Top of Bank (TB)	~	350H	Bank Full (BF)	~	4026	(WS)	~	4027	
c .:	Left	Top of Bank (TB)		4017	Bank Full (BF)	Same	4	Water Surface		
Section 5	Right	Top of Bank (TB)	~	4029	Bank Full (BF)	/	4030	(WS)	~	4016

Measurement	Unit	Value
Manning's n at Bank Full Condition	-	0.04
Root Depth	(ft)	1-25
Root Density	(%)	25%
Eroding Bank Surface Cover	(%)	5 %
Eroding Bank Length	(ft)	700
Bank Material Type	(sand, silt, clay)	See Lab
Bank Material Stratification Score ¹	+	0
Distance from Bank Toe to Water Surface ²	(ft)	7 fiveen

75%, of total distance

Notes: 1+5 for any stratification, +10 for multiple layers above bank full mark
2 Negative number indicates water surface is below bank toe.

Rosgen Method Checklist

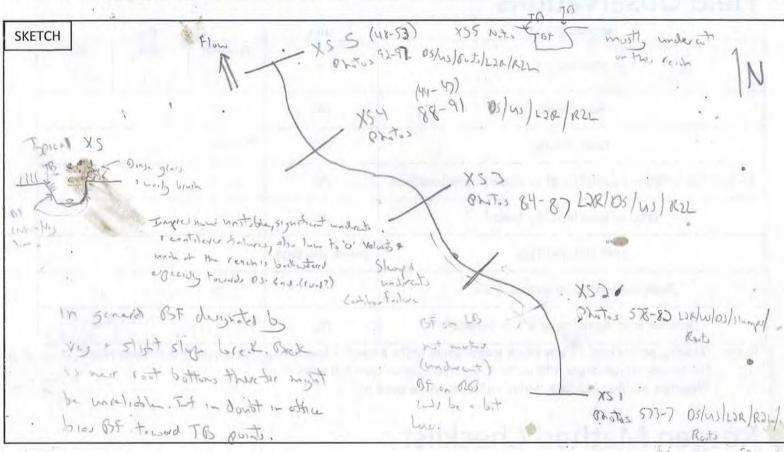
Item	Completed?
Velocity Measurements Taken	
Depositional Features Noted on Worksheet	/
Channel Blockages Noted on Worksheet	-
Pfankuch Method Completed	~

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)			
Right Bank (RB)	/	WC-1	4032
Bed (BED)	~	WL-2	4033
Bar – Armor (B-A)		UL-3	4034
Bar - Sub Armor (B-SA)			

River	Abbreviation		
Red River of the North	RR		
Sheyenne River	S		
Lower Rush	LR		
Rush	RUSH		
Maple	М		
Buffalo	В		
Sheyenne Diversion	SD		
Wild Rice	WR		
Wolverton Creek	WC		

Site Name: Wolverton Creek - 2 Date: 7/24/11



Staking

Glores

	31117	i e					0000		c. 1 1	0000
Section #	Bank		Staked	GPS Pt	- +	Staked	GPS Pt		Staked	GPS Pt
Section 1 Left	Left	Top of Bank (TB)	V	2003	Bank Full (BF)	~	2004	Water Surface		2005
	Right	Top of Bank (TB)	~	2001	Bank Full (BF)	1	2002	(WS)		
Section 2	Left	Top of Bank (TB)	~	2006	Bank Full (BF)		alld	Water Surface		
Section 2 Rig	Right	Top of Bank (TB)	V .	9008	Bank Full (BF)	/	2009	(WS)	V.	9010
Section 3	Left	Top of Bank (TB)	1	2014	Bank Full (BF)	1.	2015	Water Surface		,
	Right	Top of Bank (TB)	/	2011	Bank Full (BF)	V	2012	. / (WS)		9013
Saction 4	Left	Top of Bank (TB)	/	106	Bank Full (BF)	V	3018	Water Surface	1	
Section 4 R	Right	Top of Bank (TB)	/	2016	Bank Full (BF)	/	2016	(WS)		20)
Section 5	Left	Top of Bank (TB)	V	2025	Bank Full (BF)	V	2024	Water Surface		
	Right	Top of Bank (TB)	20/-	9059	Bank Full (BF)			(WS)		9073

Measurement	Unit		Value	(
Manning's n		Channel ().035	LOB 0,07	(0,0)
Root Depth	(ft)	1-1.5		.*
Root Density	(%)	Dens- Gren	J5%	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	20%		
Eroding Bank in Study Reach ¹	(%)	96%		
Bank Material Type	(sand, silt, day)			
Bank Material Stratification Score ²	-	5		
Distance from Bank Toe, to Water Surface ³	(ft)	0-1	5 Sems	Leavily

Notes: Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach Lot of

Rosgen Method Checklist

ltem	Completed	ltem	Completed
Velocity Measurements	V Estmater	Riparian Vegetation Worksheet	/
Depositional Features Worksheet	~	Pfankuch Method	~
Channel Blockages Worksheet	V	(

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	/	WC2 -LD	2028
Right Bank (RB)		1	Collection Collection
Bed Surface (BED)			
Bed Core (BED-C)		W62-6H	2027
Bar (BAR)		-	-

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD .
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Site Name: Buffala River -1 Date: 9/27/11

SKETCH

See GIS printout

Clayey sample with a small sheen of sand on top

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS P
Piz 105	Left	Top of Bank (TB)		103	Bank Full (BF)		104	Water Surface		
Section 1 192 4/3 14/2 193 D/s 195 1	Right	Top of Bank (TB)		100.	Bank Full (BF)	DIV	101	(WS)		102
MUSINAL Section 2	Left	Top of Bank (TB)	1	107	Bank Full (BF)		106	Water Surface	1	108
198 RB	Right	Top of Bank (TB)	1	110	Bank Full (BF)	/	109	(WS)		(00
200 Del Section 3	Left 17 CALB	Top of Bank (TB)	J	120	Bank Full (BF)	1	121	Water Surface	/	ur
702 4/5	Right	Top of Bank (TB)		117	Bank Full (BF)	1	116	(WS)		1/5
206 U/S Section 4	Left IR	Top of Bank (TB)	1	125	Bank Full (BF)	/	124	Water Surface	1	177
1202 172	Right	Top of Bank (TB)	1	126	Bank Full (BF)	1	127	(WS)	J	123
1210 U/S Section 5	Left	Top of Bank (TB)	J	133	Bank Full (BF)	1	132	Water Surface		170
12/1/0/5	Right	Top of Bank (TB)	J	131	Bank Full (BF)	1	170	(WS)	J	17

Measurement	Unit		Value	
Manning's n	-	Channel O.025	0.035	0.035
Root Depth	(ft)		2	
Root Density	(%)		3	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)		0	
Eroding Bank in Study Reach ¹	(%)		90	
Bank Material Type	(sand, silt, clay)		clay	
Bank Material Stratification Score ²	*		0	
Distance from Bank Toe to Water Surface ³	(ft)		3	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

ltem	Completed	Item	Completed
Velocity Measurements	/	Riparian Vegetation Worksheet	
Depositional Features Worksheet	/	Pfankuch Method	/
Channel Blockages Worksheet			

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)		BR/119/LB	119
Right Bank (RB)		BR/118/RB	118
Bed Surface (BED)	_	_	_
Bed Core (BED-C)	J	BR/114/BEDK	[14
Bar (BAR)	_	_	_

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

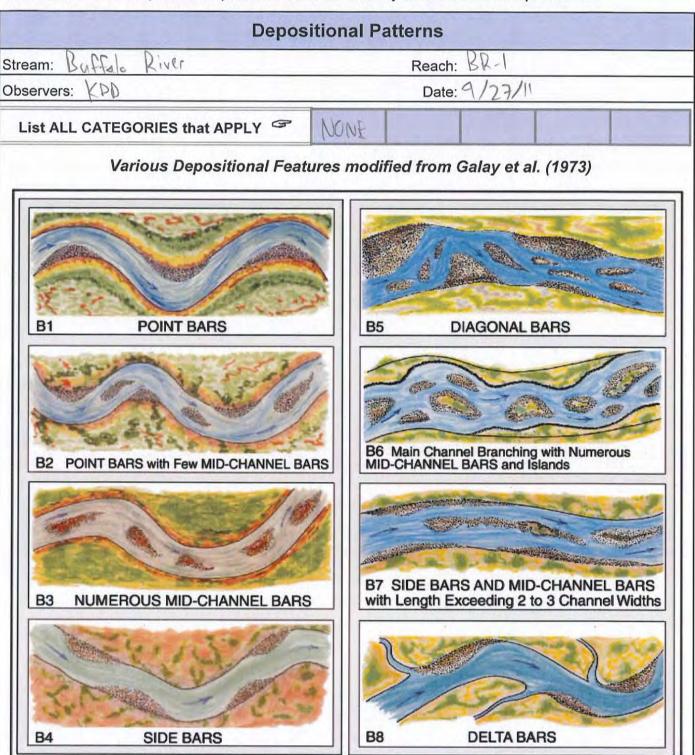
²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Worksheet 3-1. Riparian vegetation composition/density used for channel stability assessment (Rosgen, 2006b).

			Riparian \	/egetation	
OI		ATAIO R	Reference reach	Location: B 2 - 1 Disturbed (impacted reach) Date:	7/27/11
sp	cisting ecies emposition:	arge tr	eas inger	Potential species composition:	
0	Riparian cover categories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition
1. Overstory	Canopy layer	15	10	large trees	100%
2. Understory	Shrub layer		12	shouba nettle/buscs	100%
	Herbaceous		3	31215	100%
3. Ground level	Leaf or needle litter		0	Remarks: Condition, vigor and/or usage of existing reach:	100%
	Bare ground		85		
*Ba	ased on crown ased on basal Irface area.	closure. area to	Column total 100%		

Worksheet 3-5. Depositional patterns used for stability assessment interpretations.



Worksheet 3-6. Various categories of in-channel debris, dams and channel blockages used to evaluate channel stability.

		Channel Blockages	
Strea	m: Buffalo	River Location: BR-1	
Obse	rvers: KDD	Date: 9/27/1	
Desc	cription/extent	Materials that upon placement into the active channel or flood- prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime.	Check (✓) all that apply
D1	None	Minor amounts of small, floatable material.	X
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	Z.
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	×
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	X
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	×
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	г
D7	Beaver dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г
D8	Beaver dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	Г
D9	Beaver dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г
D10	Human influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	F

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Norksheet 3-10. Pfankuch (1975) channel stability rating	
Worksheet 3-10. Pfankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2001c, 2006b).	

Stream:	/	1700	LINGE	L		Location:		KK-1			Valle	Valley IVDE:		Ope	Observers:				Date: // / //	
Loca-	2				Excellent	llent		H		Good					Fair				Poor	
tion	Ney	Category			Description		Rai	Rating	J	Description		Rating		Description	ion	~	Rating	Descr	Description	Rating
5	-	Landform slope	Bank	Bank slope gradient <30%	adient <30	.%0		2 Bank		slope gradient 30-40%	.%0	4	Bank slop	Bank slope gradient 40–60%	.%09-0		6 Ba	Bank slope gradient > 60%	. 60%.	8
psuks	2	Mass erosion		vidence of on.	f past or f	No evidence of past or future mass erosion.		3 fut	Infrequent. Mostly healed over. Low future potential.	tly healed	over. Low) ω	Frequent or larg nearly yearlong	or large, cau	Frequent or large, causing sediment nearly yearlong.	ant	9 Fre	Frequent or large, causing sediment ne yearlong OR imminent danger of same.	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	(12)
bber	က	Debris jam potential	Esse	Essentially abs channel area.	sent from	Essentially absent from immediate channel area.		2 Prese	Present, but mostly small twigs and limbs.	stly small	twigs and	4	Moderate to larger sizes.	to heavy an	Moderate to heavy amounts, mostly larger sizes.)	6 pre	Moderate to heavy amounts, predominantly larger sizes.	nounts, sizes.	8
ın	4	Vegetative bank protection	> 900 Sugg	% plant de est a deep nass.	ensity. Vig p, dense	 90% plant density. Vigor and variety suggest a deep, dense soil-binding root mass. 	A)	3 les	70–90% density. Fewer species or less vigor suggest less dense or de root mass.	/. Fewer s est less de	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	φ	50-70% of fewer spendiscontinu	50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	er vigor and shallow, iss.		o vig	0% density plus fev jor indicating poor, allow root mass.	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	(12)
	5	Channel capacity	Bank I stage. referer Ratio (Bank heights sufficient to contain the bi stage. Width/depth ratio departure from reference width/depth ratio = 1.0, Bank Ratio (BHR) = 1.0,	ient to cont ratio depar pth ratio = 1	Bank heights sufficient to contain the bankfull stage. Width/depth ratio departure from reference width/depth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.		1 Wid Widt	Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0–1.2. Bank-Height Ratio (BHR) = 1.0–1.1.	ntained within sparture from 1.0–1.2. Banl	n banks. n reference k-Height Ratio	2	Bankfull stag departure fro 1.2-1.4. Ban	je is not contain im reference wi k-Height Ratio	Bankfull stage is not contained. Width/depth ratio departure from reference width/depth ratio = 1.2–1.4. Bank-Height Ratio (BHR) = 1.1–1.3.	h ratio	Ban S com Ban Ban	Bankfull stage is not contained; over-bank flows an common with flows less than bankfull. Width/depth ratio departure from reference width/depth ratio > 1 Bank-Height Ratio (BHR) > 1.3.	Bankfull stage is not contained; over-bank flows are recommon with flows less than bankfull. Width'depth ratio departure from reference width'depth ratio > 1.4. Bank-Height Ratio (BHR) > 1.3.	4
ика	φ	Bank rock content	> 65%	> 65% with larg 12"+ common.	ge angula	> 65% with large angular boulders. 12"+ common.	()	2 40	40-65%. Mostly boulders and small cobbles 6-12".	/ boulders	and small	4	20-40%. I class.	Most in the	20–40%. Most in the 3–6" diameter class.	16	9 0 0	<20% rock fragments or less.	<20% rock fragments of gravel sizes, 1–3" or less.	89
er baı	7	Obstructions to flow		Rocks and logs firmly imbedded pattern w/o cutting or deposition Stable bed.	s firmly in ting or de	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.		Some 2 curren fewer	Some present caus currents and minor fewer and less firm.	present causing erosive cross ts and minor pool filling. Obstruand less firm.	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	\$	Moderately fre move with high and pool filling	frequent, uns high flows cau ing.	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	ting	Fre 6 cau tra	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	s and deflectors earlong. Sediment gration occurring.	8
ГОМ	80	Cutting	Little <6".	or none. I	Infrequen	Little or none. Infrequent raw banks		Som 4 cons 12".	me, intermitti Istrictions. R	ently at ou aw banks	Some, intermittently at outcurves and constrictions. Raw banks may be up to 12".	9	Significan mat overh	t. Cuts 12–2 angs and sl	Significant. Cuts 12–24" high. Root mat overhangs and sloughing evident.	ot dent.	12 Aln	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	ts, some over 24" angs frequent.	(16)
	o	Deposition	Little	Little or no enla point bars.	argement	Little or no enlargement of channel or point bars.	\sim	So 00	Some new bar increase, mostly from coarse gravel.	ncrease, 1	mostly from	ω	Moderate coarse sal bars.	depostion o nd on old ar	Moderate depostion of new gravel and coarse sand on old and some new bars,	l and	12 Ex	Extensive deposit of predominantly fine particles. Accelerated bar development.	predominantly fine I bar development.	16
	10	Rock angularity	Shar surfa	Sharp edges and corners. Plane surfaces rough.	nd come	rs. Plane		1 Ro	Rounded corner smooth and flat.	rs and edg	Rounded corners and edges. Surfaces smooth and flat.	s 2	Corners and dimensions.	nd edges w	Corners and edges well rounded in 2 dimensions.	n 2	3 We	Well rounded in all dir smooth.	Well rounded in all dimensions, surfaces smooth.	4
	11	Brightness	Surfa	Surfaces dull, dark or stained Generally not bright.	dark or st oright.	ained.		1 Mo	Mostly dull, but surfaces.	may have	Mostly dull, but may have <35% bright surfaces.	t 2	Mixture dull ar mixture range	ull and bright nge.	Mixture dull and bright, i.e., 35–65% mixture range.	%	3 Scc	Predominantly bright, scoured surfaces.	Predominantly bright, > 65%, exposed or scoured surfaces.	4
ш	12	Consolidation of particles		Assorted sizes tightly packed or overlapping.	tightly pa	acked or		2 Mo	Moderately packed with some overlapping.	ked with s	some	4	Mostly loose asso apparent overlap.	Mostly loose assortment with no apparent overlap.	ent with no		6 ea	No packing evident. Loose assortment, easily moved.	.oose assortment,	80
otto	13	Bottom size distribution	No si mate	No size change evident. Stable material 80-100%.	e evident 10%.	Stable	O	4 Dis	Distribution shif 50–80%.	t light. Sta	Distribution shift light. Stable material 50–80%.	00	Moderate change materials 20-50%	Moderate change in sizes. Stable materials 20–50%.	izes. Stable		12 Ma	Marked distribution change. Stable materials 0-20%.	hange. Stable	16
3	41	Scouring and deposition		<5% of bottom affected by scour deposition.	affected	by scour or		6 and	5–30% affected. Scour at constrict and where grades steepen. Some deposition in pools.	i. Scour at les steepe ols.	5–30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	12	30–50% a at obstruc bends. So	30–50% affected. Deposits and s at obstructions, constrictions and bends. Some filling of pools.	30–50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.	cour	18 flux	More than 50% of the bottom ir flux or change nearly yearlong.	More than 50% of the bottom in a state of flux or change nearly yearlong.	24
	15	Aquatic vegetation	Abur	Abundant growth moss-like, dark green perennial. In swift water too	vth moss- al. In swiff	Abundant growth moss-like, dark green perennial. In swift water too.		1 Co	Common. Algae forms in low velocity and pool areas. Moss here too.	forms in Moss her	low velocity e too.	2	Present but spotty backwater. Season makes rocks slick.	Present but spotty, mostly in backwater. Seasonal algae g makes rocks slick.	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	-	3 gre	rennial types scarc een, short-term bloo	Perennial types scarce or absent. Yellow-green, short-term bloom may be present.	4
					Exc	Excellent total =	al =	5		0	Good total =	X			Fair total =		9		Poor total =	hh
Stream type	уре	A1 A2	2 A3	A4	A5	A6 E	B1 B	B2 [B3 B4	B5	B6 C1	C2	ငဒ		90				Grand total =	100
Good (Stable)	(ple)	38-43		_		_	_	_		_	_	_	60-85		60-85				nii-civi	3
Fair (Mod. unstable Poor (Unstable)	unstable table)	44-47 44-47	47 91-129 + 130+	29 96-132	143+	111+ 5	59+ 56 59+ 56	59+ 7	79+ 85+	+68	79+ 62+	62+	106+	111+ 111+	+901	133+ 1	133+ 13	133+ 126+	stream type =	
Stream type	уре	DA3 DA4							F1 F2	F3	F4 F5	F6	61		64	99	95		*Potential	
Good (Stable) Fair (Mod. unstable	ible) unstable	40-63 40-63 64-86 64-86	63 40-63 86 64-86	3 40-63	40-63	50-75 50-75 76-96 76	50-75 40 76-96 64	40-63 60 64-86 86	60-85 60-85 86-105 86-105	85-110 85-110 111-125 111-125	85-110 90-115 111-125 116-130	5 80-95 30 96-110	40-60	40-60 85-107 61-78 108-120	85-107 108-120	90-112 88 113-125 10	85-107 108-120		stream type = Modified channel	Janu
Poor (Unstable)	table)	87+ 87+	+ 87+	+18	87+	97+ 9	97+ 8	87+ 11	106+ 106+	126+	126+ 131+	111+	+62	79+ 121+	121+	126+ 1	121+		stability rating	= 6
														"Rating Is	adjusted to p	ootential	stream t	"Rating is adjusted to potential stream type, not existing.		

Geomorphic Analysis Check List

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Date: 9/28/11

Clayer sample with a light sheer of sand at the top.

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS P
Section 1	Left 1216 LR	Top of Bank (TB)	1	137	Bank Full (BF)	/	136	Water Surface		
214 4/5	Right	Top of Bank (TB)	V.	138	Bank Full (BF)	.J	139	(WS)	J	135
Section 2	Left 1771 LR	Top of Bank (TB)		147	Bank Full (BF)	1	146	Water Surface		
Section 2	Right	Top of Bank (TB)	1	143	Bank Full (BF)	J	142	(WS)	V	1 =10
Section 3	Left 1725 LB	Top of Bank (TB)	1	154	Bank Full (BF)	1	153	Water Surface	1	
223 WS	Right	Top of Bank (TB)	J	152	Bank Full (BF)	J	151	(WS)	1	150
277 U/S Section 4	Left.	Top of Bank (TB)		159	Bank Full (BF)	1	157	Water Surface		
1728 D/K	Right	Top of Bank (TB)	J	160	Bank Full (BF)		159.	(WS)	/	156
Pic K7 Section 5	Left 1255LB	Top of Bank (TB)		164	Bank Full (BF)	1	163	Water Surface	-)	1/7
1237 0/5	Right	Top of Bank (TB)	/	165	Bank Full (BF)	/	166	(WS)	J	162

Measurement	Unit		Value	
Manning's n	-	Channel 0.03	O.04	0.045
Root Depth	(ft)		1	
Root Density	(%)		2	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)		15	
Eroding Bank in Study Reach ¹	(%)		75	
Bank Material Type	(sand, silt, clay)		elay	
Bank Material Stratification Score ²	-		Ø	
Distance from Bank Toe to Water Surface ³	(ft)		3	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

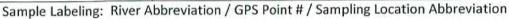
Rosgen Method Checklist

Item	Completed	Item	Completed
Velocity Measurements		Riparian Vegetation Worksheet	/
Depositional Features Worksheet	/	Pfankuch Method	/
Channel Blockages Worksheet			

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	/	RR/148/LB	148
Right Bank (RB)	J	RR/144/RB	144
Bed Surface (BED)	_	_	
Bed Core (BED-C)	J	RR/145/REDY	145
Bar (BAR)	_	_	_

Abbreviation
RR
S
LR
RUSH
M
В
SD
WR
WC



²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Worksheet 3-1. Riparian vegetation composition/density used for channel stability assessment (Rosgen, 2006b).

			Riparian \	/egetation	
St	ream: Rea	1 River		Location: RR - 1	
OI	bservers: K	00	Reference reach	Disturbed (impacted reach) Date:	1/28/11
sp	disting ecies mposition:	rees, b	cush	Potential species composition:	
c	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total specie compositio
1. Overstory	Canopy layer	15	5		/_0
					100%
2. Understory	Shrub layer		70		100
					100%
evel	Herbaceous		10	To sel morels	100
3. Ground level	Leaf or needle litter		0	Remarks: Condition, vigor and/or usage of existing reach:	100%
	Bare ground		65		
*Ba	ased on crown ased on basal Irface area.		Column total 100%		

Worksheet 3-5. Depositional patterns used for stability assessment interpretations.

Deposition	al Patterns
Stream: Red River	Reach: RR-
Observers: KDD	Date: 9/28/11
List ALL CATEGORIES that APPLY	NE
Various Depositional Features	modified from Galay et al. (1973)
B1 POINT BARS	B5 DIAGONAL BARS
B2 POINT BARS with Few MID-CHANNEL BARS	B6 Main Channel Branching with Numerous MID-CHANNEL BARS and Islands
	B7 SIDE BARS AND MID-CHANNEL BARS
B3 NUMEROUS MID-CHANNEL BARS	with Length Exceeding 2 to 3 Channel Widths
B4 SIDE BARS	B8 DELTA BARS

Worksheet 3-6. Various categories of in-channel debris, dams and channel blockages used to evaluate channel stability (adapted from Rosgen, 1996, 2006b).

		Channel Blockages	
Stre	eam: Red R	Location: RR-	
Obs	servers: KĎ	Date: 9/28/11	
	scription/ tent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check / all that apply
D1	None	Minor amounts of small, floatable material.	
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	×
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	k
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	П

Worksheet 3-10. Pfankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2001c, 2006b).

Stream:	4	1300 000			100		ALL W	ı			
Loca-	Kev	Category	Excellent		G000					Poor	
IION			Description	Rating	Description	Rating	Description	Rating	Description	tion	Rating
KZ	-	Landform slope	Bank slope gradient <30%.	2	Bank slope gradient 30-40%.	4	Bank slope gradient 40–60%.	9	Bank slope gradient > 60%	.%09	80
Ban	2	Mass erosion	No evidence of past or future mass erosion.	e .	Infrequent. Mostly healed over. Low future potential.	9	Frequent or large, causing sediment nearly yearlong.	O	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	ng sediment nearly t danger of same.	12)
ber	60	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.	4	Moderate to heavy amounts, mostly larger sizes.	9	Moderate to heavy amounts, predominantly larger sizes.	ounts, izes.	8
Idn	4	Vegetative bank protection	> 90% plant density. Vigor and variety suggest a deep, dense soil-binding root mass.) m	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	9	50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	တ	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	rer species and sor, discontinuous	(5)
S	5	Channel capacity	Bank heights sufficient to contain the bankfull stage. Width/depth ratio departure from reference width/depth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.	0	Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0-1.2. Bank Height Ratio (BHR) = 1.0-1.1.	2	Bankfull stage is not contained. Width/depth ratio departure from reference width/depth ratio = 1,2-1,4. Bank-Height Ratio (BHR) = 1,1-1,3.	ო	Bankfull stage is not contained, overbank flows are common with flows less than bankfull. Width/depth railo departure from reference width/depth ratio 11.4. Bank-Height Railo (EHR) > 1.3.	ed, overbank flows are i bankfull. Widih/depth is widih/depth ratio RR) > 1.3.	4
ank	9	Bank rock content	> 65% with large angular boulders. 12"+ common.	3	40-65%. Mostly boulders and small cobbles 6-12".	4	20–40%. Most in the 3–6" diameter class.	9	<20% rock fragments of gravel sizes, 1-3" or less.	of gravel sizes,	8
er Ba	7	Obstructions to flow	Rocks and logs firmly imbedded.) Flow pattern w/o cutting or deposition. Stable bed.	(2)	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	ဖ	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	and deflectors sarlong. Sediment ration occurring.	00
MOT	8	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcurves and constrictions. Raw banks may be up to 12".	9	Significant. Cuts 12–24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over high. Failure of overhangs frequent.	s, some over 24" ings frequent,	(4)
	0	Deposition	Little or no enlargement of channel or point bars.	4	Some new bar increase, mostly from coarse gravel.	œ	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development.	redominantly fine bar development.	16
	10	Rock angularity	Sharp edges and comers. Plane surfaces rough.	O	Rounded comers and edges. Surfaces smooth and flat.	2	Corners and edges well rounded in 2 dimensions.	m	Well rounded in all dimensions, surfaces smooth.	nensions, surfaces	4
	11	Brightness	Surfaces dull, dark or stained. Generally not bright.	0	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35–65% mixture range.	8	Predominantly bright, > 65%, exposed or scoured surfaces.	· 65%, exposed or	4
шо	12	Consolidation of particles		(2)	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	9	No packing evident. Loose assortment, easily moved.	bose assortment,	80
Hot	13	Bottom size distribution	No size change evident. Stable material 80-100%.	4	Distribution shift light. Stable material 50–80%.	80	Moderate change in sizes. Stable materials 20–50%.	12	Marked distribution change. Stable materials 0-20%.	ange. Stable	16
3	4	Scouring and deposition	<5% of bottom affected by scour or deposition.	9	5-30% affected. Soour at constrictions and where grades steepen. Some deposition in pools.	(12)	30–50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	bottom in a state ly yearlong.	24
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	-	Common, Algae forms in low velocity and pool areas, Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	က	Perennial types scarce or absent. Yellow- green, short-term bloom may be present.	or absent. Yellow- n may be present.	4
			Excellent Total =	12	Good Total =	17	Fair Total =	0		Poor Total =	計
Stream Ty	Stream Type	A1	A2 A3 A4 A5 A6 B1 38-43 54-90 60-95 60-95 50-80 38-45	38-45	B3 B4 B5 B6 C1 40-60 40-64 48-68 40-60 38-50	38-50	C3 C4 C5 C6 D3 60-85 85-107 8	D4 85-107	D5 D6 85-107 67-98	Grand Total =	4
Fair (Mod. Unstable)	Fair (Mod. Unstable)	44-47	96-132		61-78 65-84 69-88 61-78 51-61 79+ 85+ 89+ 79+ 62+	51-61	91-110 91-110 86-105 108-132 111+ 111+ 106+ 133+	133+	108-132 99-125 133+ 126+	Existing Stream Type =	
ream	Stream Type	DA3	DAS DA6 E3 E4	1000	F1 F2 F3 F4 F5	F6	G1 G2 G3 G4 G5	66		*Potential Stream Type =	
Good (Stable) Fair (Mod Unstable) Poor (Unstable)	Fair (Mod. Unstable) Poor (Unstable)	64-86 64-86 87+ 87+	64-86 64-86 64-86 76-96 87+ 87+ 87+ 97+		86-105 86-105 111-125 111-125 116-130 106+ 106+ 126+ 126+ 131+	96-110	61-78 108-120 108-120 113-125 79+ 121+ 121+ 128+	108-120		Modified Channel Stability Rating =	anne ting =
		1							۳		

Geomorphic Analysis Check List

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SOUTH STATE OF SOUTH STATE

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left ₁₂₃ LB	Top of Bank (TB)	J	173	Bank Full (BF)	J	172	Water Surface	1	1.0
1235 4/5	Right	Top of Bank (TB)	1	171	Bank Full (BF)		170	(WS)	J	169
Piz 182 Section 2	Left 1741LB	Top of Bank (TB)	J	179	Bank Full (BF)	J	181	Water Surface	1	178
1234 4/5	Right 1217 PS	Top of Bank (TB)	1	175	Bank Full (BF)	1	177	(WS)		
Pic 190	Left 1248 LB	Top of Bank (TB)		189	Bank Full (BF)	/	188	Water Surface		107
Section 3	Right (244)	Top of Bank (TB)	1	186	Bank Full (BF)	J	185	(WS)	J	18+
Pic 196	Left R	Top of Bank (TB)	J	MS	Bank Full (BF)	J	194	Water Surface		101
Section 4 1250 U/S 1251 D/S	Right	Top of Bank (TB)	1	193	Bank Full (BF)	1	192	(WS)	V	141
Pic ZOZ	Left 8	Top of Bank (TB)	1	197	Bank Full (BF)	J	198	Water Surface		M
Section 5 1254 U/5 1255 D/5	Right 1257	Top of Bank (TB)	J	200	Bank Full (BF)	V	201	(WS)		M

Measurement	Unit		Value	
Manning's n	-	Channel (),()3	0.05	0.05
Root Depth	(ft)		3	
Root Density	(%)		5	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)		2	
Eroding Bank in Study Reach ¹	(%)		70%	
Bank Material Type	(sand, silt, clay)		clay	
Bank Material Stratification Score ²	•		6	· k
Distance from Bank Toe to Water Surface ³	(ft)		1.8	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	ltem	Completed
Velocity Measurements	/	Riparian Vegetation Worksheet	J
Depositional Features Worksheet	J	Pfankuch Method	J
Channel Blockages Worksheet	. 1		

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	1	RR/18/0/LB	180
Right Bank (RB)	1	RR/176/ RB	176
Bed Surface (BED)	_	_	-
Bed Core (BED-C)	113	RR/184/8FDLC	183 (P. 124
Bar (BAR)	_	_	~

RR S
S
LR
RUSH
M
В
SD
WR
WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Worksheet 3-1. Riparian vegetation composition/density used for channel stability assessment (Rosgen, 2006b).

		F	Riparian \	/egetation	
St	ream: Re	Riva		Location: RR-Z	
OI	bservers: k	00	Reference reach	Disturbed (impacted reach) Date:	1/29/16
sp	cisting ecies mposition:	rees, sh	icubs	Potential species composition:	
0	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition
1. Overstory	Canopy layer	40	10	_ ±sq.	700
					100%
2. Understory	Shrub layer		15	nether	90
evel	Herbaceous		10	- grass, meeds	100%
3. Ground level	Leaf or needle litter		0	Remarks: Condition, vigor and/or usage of existing reach:	100%
	Bare ground		65		
*Ba	ased on crowr ased on basal ırface area.		Column total 100%		

Worksheet 3-5. Depositional patterns used for stability assessment interpretations.

Worksheet 3-5. Depositional patterns used for	stability assessment interpretations.
Deposition	nal Patterns
Stream: Red River	Reach: RR-Z
Observers: KDD	Date: 9/29/11
List ALL CATEGORIES that APPLY	NE
Various Depositional Features	modified from Galay et al. (1973)
B1 POINT BARS B2 POINT BARS with Few MID-CHANNEL BARS	B5 DIAGONAL BARS B6 Main Channel Branching with Numerous MID-CHANNEL BARS and Islands
B3 NUMEROUS MID-CHANNEL BARS	B7 SIDE BARS AND MID-CHANNEL BARS with Length Exceeding 2 to 3 Channel Widths
B4 SIDE BARS	B8 DELTA BARS

Worksheet 3-6. Various categories of in-channel debris, dams and channel blockages used to evaluate channel stability (adapted from Rosgen, 1996, 2006b).

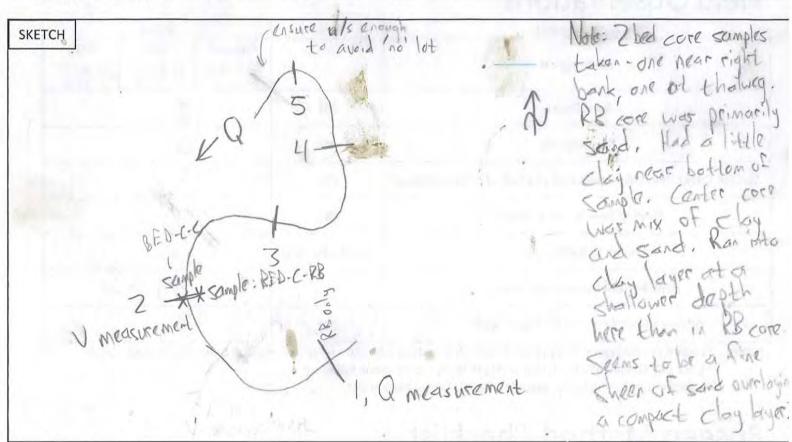
		Channel Blockages	
Stre	eam: Red Ri	Location: RR-2	
	servers: KDD	Date: 9/29/11	
	scription/ ent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check / all that apply
D1	None	Minor amounts of small, floatable material.	×
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	X
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	X
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	Г
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	г
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	۲
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	Г
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	1

Worksheet 3-10. Pfankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2001c, 2006b).

Stream:		Ked KINE	_	2	Valley lype.		Choco con con con con con con con con con			1	-
loca.	,		Excellent		Good		Fair		P(Poor	П
tion Key	Key	Category	Description	Rating		Rating	Description R	Rating	Descr	ion	Rating
KS	-	Landform slope	Bank slope gradient <30%.	2	Bank slope gradient 30-40%.	4	Bank slope gradient 40–60%.	10	Bank slope gradient > 60%	90%.	
Ban	2	Mass erosion	No evidence of past or future mass erosion.	6	Infrequent. Mostly healed over. Low future potential.	9	Frequent or large, causing sediment nearly yearlong.	0	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	g sediment nearly danger of same.	(4)
Jec	က	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.	4	Moderate to heavy amounts, mostly larger sizes.	0	Moderate to heavy amounts predominantly larger sizes.	ounts, zes.	
ldn	4	Vegetative bank protection	> 90% plant density. Vigor and variety suggest a deep, dense soil-binding root mass.	6	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	9	50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	6	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	er species and or, discontinuous	(12)
5	5	Channel	Bank heights sufficient to contain the bankful stage. Width/depth ratio departure from reference width/depth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.	(-)	Bankfull stage is contained within banks.) Width/depth ratio departure from reference width/depth ratio = 1.0–1.2. Bank Height Ratio (BHR) = 1.0–1.1.	2	Bankfull stage is not contained. Width/depth ratio departure from reference width/depth ratio = 172-14. Bank-Height Ratio (BHR) = 1.1-1.3.	8	Bankfull stage is not contained; overbank flows are common with flows less than bankfull. Width/depth railo departure from reference width/depth railo > 1.4. Bank-Height Railo (BHR) > 1.3.	ed, overbank flows are bankfull. Width/depth e width/depth ratio R) > 1,3.	m =
ıuk	9	Bank rock content	> 65% with large angular boulders, 12"+ common.	3	40-65%. Mostly boulders and small cobbles 6-12".	4	20-40%. Most in the 3-6" diameter class.	9	<20% rock fragments of gravel sizes, 1—3" or less.	of gravel sizes,	00
sa ne	7	Obstructions to flow	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	9	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	and deflectors arlong. Sediment ation occurring.	80
Mo-	00	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcurves and constrictions. Raw banks may be up to12".	9	Significant. Cuts 12–24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	s, some over 24" ngs frequent.	(2)
I	თ	Deposition	Little or no enlargement of channel or point bars.	(4	Some new bar increase, mostly from coarse gravel.	œ	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles, Accelerated bar development.	deposit of predominantly fine Accelerated bar development.	16
	9	Rock	Sharp edges and comers. Plane surfaces rough.	0	Rounded comers and edges. Surfaces smooth and flat.	2	Corners and edges well rounded in 2 dimensions.	3	Well rounded in all dimensions, surfaces smooth.	ensions, surface:	10
	Ξ	1	Surfaces dull, dark or stained. Generally not bright.	0	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35–65% mixture range.	3	Predominantly bright, > 65%, exposed or scoured surfaces.	· 65%, exposed o	_
uic	12		Consolidation Assorted sizes tightly packed of particles or overlapping.	(2)	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	9	No packing evident. Loose assortment, easily moved.	ose assortment,	80
otto	13			1	Distribution shift light. Stable material 50–80%.	89	Moderate change in sizes. Stable materials 20–50%.	12	Marked distribution change. Stable materials 0-20%.	ange. Stable	16
8	4			0	5-30% affected. Soour at constrictions and where grades steepen. Some deposition in pools.	12	30–50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	bottom in a state y yearlong.	24
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	-	Common. Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	8	Perennial types scarce or absent. Yellow- green, short-term bloom may be present.	or absent. Yellow n may be present	\vee
			Excellent Total =	12	Good Total =	4	Fair Total =	12		Poor Total =	于
Stream Type	Type	A1	A4 A5 A6 B1	B2	B4 B5 B6 C1	C2	C3 C4 C5 C6 D3	D4	D5 D6	Grand Total =	50
Good (Stable) Fair (Mod. Unstable)	able) Unstable	38-43	1 54-90 60-95 60-95 50-80 38-45 91-129 96-132 96-142 81-110 46-58 130+ 133+ 143+ 111+ 59+	46-58		51-61	91-110 91-110 86-105 108-132 111+ 111+ 106+ 133+	133+	108-132 99-125 133+ 126+	Existing Stream Type =	п
Stream Type	Type	DA3	DA6 E3 E4 E5	E6	F1 F2 F3 F4	F6	G2 G3 G4	95		*Potential	11
Good (Stable) Fair (Mod. Unstable)	able) Unstable	40-63 40-63 9) 64-86 64-86 87+ 87+	40-63 40-63 40-63 50-75 50-75 64-86 64-86 76-96 76-96 87+ 87+ 87+ 97+ 97+	40-63 64-86 87+	60-85 60-85 85-110 85-110 80-115 86-105 86-105 111-125 111-125 116-130 106+ 106+ 126+ 126+ 131+	80-95 96-110 111+	40-50 40-50 85-107 85-107 90-112 61-78 61-78 108-120108-120113-125 79+ 79+ 121+ 121+ 126+	108-120 108-120 121+		Modified Chann Stability Rating	Channel Rating =
100 (00)	Sidnici	+						1			

Site Name: Red River-7

Date: 9/30/11



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Pic ZCG	Left 1240 LB	Top of Bank (TB)		_	Bank Full (BF)	-	-	Water Surface	ri anno	705
Section 1 1259 U/S 1254 D/S	Right	Top of Bank (TB)	/	203	Bank Full (BF)	/	204	(WS)		205
Pic 214 Section 2	Left LB	Top of Bank (TB)	1		Bank Full (BF)	_	-	Water Surface	1	711
1262 W/5	Right	Top of Bank (TB)	1	208	Bank Full (BF)	J	210	(WS)	V	211
Pic ZZO	Left 1208 LR	Top of Bank (TB)	>	219	Bank Full (BF)	J	218	Water Surface		วำา
Section 3 1266 U/S 1267 D/S	Right	Top of Bank (TB)	1	216	Bank Full (BF)	1	.215	(WS)		4
Pic 226	Left 1272 LR	Top of Bank (TB)		275	Bank Full (BF)	/	224	Water Surface	/	200
Section 4 1270 U/3 1271 D/3	Right	Top of Bank (TB)	J	222	Bank Full (BF)	/	721	(WS)		13
Pic 232	Left LB	Top of Bank (TB)	J	230	Bank Full (BF)	1	231	Water Surface	,	777
Section 5 1274 4/5 1275 D/S	Right (Z77 KB	Top of Bank (TB)	J	227	Bank Full (BF)	1	228	(WS)	1	229

Measurement	Unit		Value	
Manning's n	-	Channel 0.035	0.05	0.05
Root Depth	(ft)		3	
Root Density	(%)		10	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)		5	
Eroding Bank in Study Reach ¹	(%)		70	
Bank Material Type	(sand, silt, clay)		clay	
Bank Material Stratification Score ²			0)	
Distance from Bank Toe to Water Surface ³	(ft)	4	9'	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	ltem	Completed
Velocity Measurements	J	Riparian Vegetation Worksheet	
Depositional Features Worksheet	J	Pfankuch Method	/
Channel Blockages Worksheet			u

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	_	_	_
Right Bank (RB)		RR/209/RB	209
Bed Surface (BED)	-	_	
Bed Core (BED-C)	1	BB /SIS/RD-C-B	513
Bar (BAR)	_	_	-

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

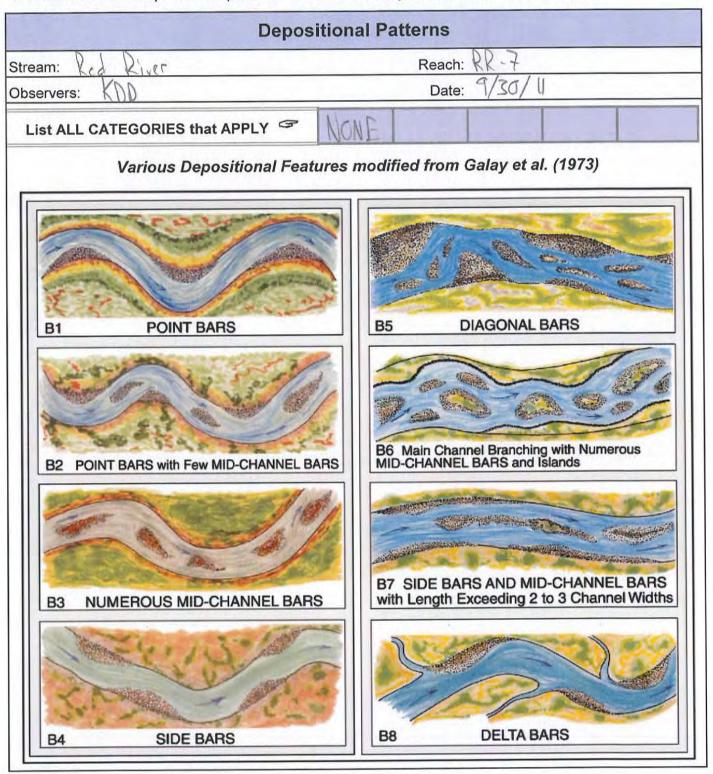
²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Worksheet 3-1. Riparian vegetation composition/density used for channel stability assessment (Rosgen, 2006b).

		F	Riparian V	/egetation	
Stream: Red River				Location: RR- 7	
Observers: KDD		Reference reach	Disturbed (impacted reach) Date: 7/30/11		
Existing species composition:				Potential species composition:	
Riparian Percent cover aerial categories cover*		Percent of site coverage**	Species composition	Percent of total species composition	
1. Overstory	Canopy layer	899	15		100
2. Understory	Shrub		40	weels, should	100%
	layer		***		100%
3. Ground level	Herbaceous		70	- Grass, wreds	700
	Leaf or needle litter		5	Remarks: Condition, vigor and/or usage of existing reach:	100%
	Bare ground		20		
*B	ased on crowr ased on basal urface area.	closure. area to	Column total 100%		

Worksheet 3-5. Depositional patterns used for stability assessment interpretations.



		Channel Blockages	
Stre	eam: Red Ri	ver Location: RR-7	
Obs	servers: KDA	Date: 9/30/11	
	scription/ ent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check / all that apply
D1	None	Minor amounts of small, floatable material.	K
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	X
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	又
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	×
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	Г
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	Г
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	Г
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	г

Worksheet 3-10. Pfankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2001c, 2006b).

Stream:	11:	SEA KIN	Location	· KP.	indi i hori				-0150	700 1 100	
Loca-	Kev	Category	Excellent		Good		Fair		Poor	or	
tion			Description	Rating	Description	Rating	Description	Rating	Description	UI.	Rating
ks	-	Landform slope	Bank slope gradient <30%.	2	Bank slope gradient 30–40%.	4	Bank slope gradient 40-60%.	9	Bank slope gradient > 60%	19%.	
Ban	2	Mass erosion	No evidence of past or future mass erosion.	3	Infrequent. Mostly healed over. Low future potential.	9	Frequent or large, causing sediment nearly yearlong.	6	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	sediment nearly anger of same.	/
ber	က	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.	4	Moderate to heavy amounts, mostly arger sizes.	(6)	Moderate to heavy amounts, predominantly larger sizes.	unts,	
Idn	4	Vegetative bank protection	> 90% plant density. Vigor and variety suggest a deep, dense soil-binding root mass.	က	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	9	50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	6	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	species and , discontinuous	
S	ည	Channel capacity	Bank heights sufficient to contain the bankful stage. Width/depth ratio departure from reference width/depth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.	0	Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0-1.2. Bank Height Ratio (BHR) = 1.0-1.1.	2	Bankfull stage is not contained. Width/depth ratio departure from reference width/depth ratio = 1.2-1.4. Bank-Height Ratio (BHR) = 1.1-1.3.	ო	Bankfull stage is not contained; overbank flows are common with flows less than bankful. Width/depth ratio departure from reference width/depth ratio 1.4. Bank-fleight Ratio [B4R] > 1.3.	overbank flows are ankfull, Width/depth width/depth ratio >1.3.	
auk	9	Bank rock content	> 65% with large angular boulders, 12"+ common.	(2)	40-65%. Mostly boulders and small cobbles 6-12".	4	20-40%. Most in the 3-6" diameter class.	9	<20% rock fragments of gravel sizes, 1–3" or less.	gravel sizes,	
et B	7	Obstructions to flow	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	6	Frequent obstructions and deflectors cause bank erosion yearlong. Sedime traps full, channel migration occurring	nd deflectors long. Sediment ion occurring.	
MOJ	8	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcurves and constrictions, Raw banks may be up to12".	9	Significant. Cuts 12–24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over high. Failure of overhangs frequent.	some over 24" is frequent.	~
	o	Deposition	Little or no enlargement of channel or point bars.	4	Some new bar increase, mostly from coarse gravel.	80	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development	dominantly fine ir development.	
	10	Rock angularity	Sharp edges and comers. Plane surfaces rough.	9	Rounded corners and edges. Surfaces smooth and flat.	2	Corners and edges well rounded in 2 dimensions.	6	Well rounded in all dimensions, surfaces smooth.	nsions, surfaces	
	11	Brightness	Surfaces dull, dark or stained, Generally not bright.	0	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35–65% mixture range.	8	Predominantly bright, > 65%, exposed or scoured surfaces.	5%, exposed or	
шо	12	Consolidation of particles	Assorted sizes tightly packed or overlapping.	2	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	9	No packing evident, Loose assortment, easily moved.	se assortment,	
1108	13	Bottom size distribution	No size change evident. Stable material 80-100%.	4		(w)	Moderate change in sizes. Stable materials 20–50%.	12	Marked distribution change. Stable materials 0-20%.	ge. Stable	_
3	4	Scouring and deposition	<5% of bottom affected by scour or deposition.	9	5-30% affected. Scour at constrictions, and where grades steepen. Some deposition in pools.	12	30–50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	ttom in a state rearlong.	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	Common. Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	က	Perennial types scarce or absent. Yellow-green, short-term bloom may be present.	absent. Yellow- nay be present.	1
			Excellent Total =	0	Good Total =	82	Fair Total =	7	4	Poor Total =	
Stream Type	Type	A1 38-43	A2 A3 A4 A5 A6 B1 38-43 54-90 60-95 60-95 50-80 38-45	B2 38-45	B3 B4 B5 B6 C1 40-60 40-64 48-68 40-60 38-50	C2 38-50	C3 C4 C5 C6 D3 60-85 70-90 70-90 60-85 85-107 8	D4 85-107	D5 D6 Gr	Grand Total =	6
Fair (Mod. Unstable) Poor (Unstable)	Unstable stable)	44-47	96-132 96-14281-110 133+ 143+ 111+	46-58	61-78 65-84 69-88 61-78 51-61 79+ 85+ 89+ 79+ 62+	51-61	86-105 91-110 91-110 86-105 108-1321 106+ 111+ 111+ 106+ 133+	108-132 133+	108-132 99-125 133+ 126+	Existing Stream Type =	
Stream Type	Type	40-63 40-63	DAS DA6 E3 E4 E5 40-63 40-63 40-63 50-75 50-75	E6	F1 F2 F3 F4 F5 86-85 85-110 85-110 90-115	F6 80-95	G1 G2 G3 G4 G5 40-60 85-107 85-107 90-112 8	G6 85-107	4* St.	*Potential Stream Type =	
Fair (Mod. Unstable) Poor (Unstable)	Unstable)	64-86	64-86 64-86 64-86 76-96 87+ 87+ 87+ 97+	64-86 87+	86-105 86-105 111-125 111-125 116-130 106+ 126+ 126+ 131+	96-110	61-78 108-120 108-120 113-125 79+ 121+ 121+ 126+	108-120	M	Modified Channel Stability Rating =	2.5
									۰		

Site Name: Wild Rice River - 6 Date: W/1/11

SKETCH

QK y5

Sample near RB on bed was more had more sand on dop than did mid-channel sample.

X sumple to Q m

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left 1201 LB	Top of Bank (TB)	J	Z33	Bank Full (BF)	1	234	Water Surface	1	725
274 U/S	Right	Top of Bank (TB)	1	236	Bank Full (BF)	1	237	(WS)	J	250
Section 2	Left 1284 LB	Top of Bank (TB)	J	245	Bank Full (BF)	1	244	Water Surface	/	7112
Section 2 1289 u/s 1285 D/S	Right 1287 LV	Top of Bank (TB)	1	240	Bank Full (BF)	1	241	(WS)	J	241
Section 3	Left	Top of Bank (TB))	752	Bank Full (BF)	J	253	Water Surface	1	201
288 11/5	Right	Top of Bank (TB)	J	249	Bank Full (BF)	J	250	(WS)	J	231
Section 4	Left	Top of Bank (TB)	1	258	Bank Full (BF)	1	259	Water Surface	1	700
292 1/5	Right	Top of Bank (TB)	1	257	Bank Full (BF)	1	256	(WS)	V	255
2 266	Left B	Top of Bank (TB)	1	262	Bank Full (BF)	/	261	Water Surface	,	7/7
Section 5	Right	Top of Bank (TB)	V	264	Bank Full (BF)	1	265	(WS)-		200

Measurement	Unit		Value	
Manning's n	2	Channel ()35	0.05	().05
Root Depth	(ft)	-	3	
Root Density	(%)	,	10	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)		5	
Eroding Bank in Study Reach ¹	(%)		70	
Bank Material Type	(sand, silt, clay)	C	by	
Bank Material Stratification Score ²	-		Q	
Distance from Bank Toe to Water Surface ³	(ft)	-	2.5	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	Item	Completed
Velocity Measurements	1	Riparian Vegetation Worksheet	J
Depositional Features Worksheet		Pfankuch Method	1
Channel Blockages Worksheet	1		

Sampling Checklist

Location	Collected	⁻ Label	GPS Pt #
Left Bank (LB)	J	WR/243/LB	243
Right Bank (RB)	/	WR/234/RR	239
Bed Surface (BED)	-	_	_
Bed Core (BED-C)	J	WR/Z46/BED-Z-C WR/Z46/BEDZ-RB	246
Bar (BAR)	_	_	_

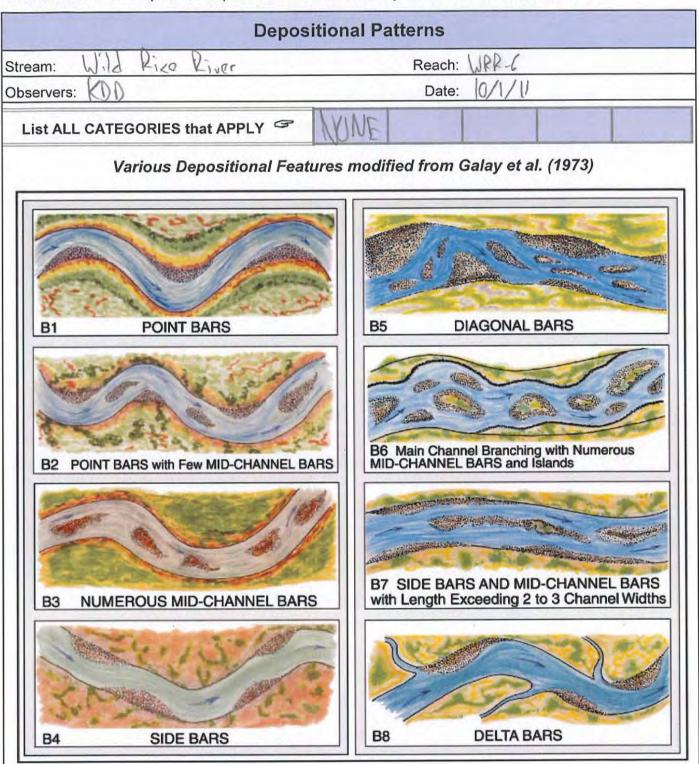
Abbreviation
RR
S
LR
RUSH
M
В
SD
WR
WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

		F	Riparian \	/egetation	
St	ream: W	ld Rice	12 iver	Location: URP-6	
Ol	oservers: (00	Reference reach	Disturbed (impacted reach) Date:	0/1/11
sp	isting ecies mposition:			Potential species composition:	
c	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition
1. Overstory	Canopy layer	85	20	trees.	700
					100%
2. Understory	Shrub layer		20		
evel	Herbaceous		5	grass, weads	100%
3. Ground level	Leaf or needle litter		5	Remarks: Condition, vigor and/or usage of existing reach:	100%
	Bare ground		50		
*Ba	ased on crowi ased on basa irface area.		Column total 100%		

Worksheet 3-5. Depositional patterns used for stability assessment interpretations.



		Channel Blockages							
Stre	eam: (1):12	Rice River Location: URR-6							
Obs	ervers: KD	Date: 0/1/11							
	scription/ ent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check / all that apply						
D1	None	Minor amounts of small, floatable material.	X						
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	X						
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	X						
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	Г						
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.							
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	Г						
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г						
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	Г						
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г						
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	1						

Worksheet 3-10. Pfankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2001c, 2006b).

Stream:]	7	EICE FIVE LOCATION:	C.N.K			Case rele.	١		anna.	
Loca- Kay	Kov	Category	Excellent		Good		Fair			Poor	
tion	1		Description	Rating	Description	Rating	Description	Rating	Description	otion	Rating
KZ	~	Landform slope	Bank slope gradient <30%.	2	Bank slope gradient 30-40%.	4	Bank slope gradient 40–60%.	(0)	Bank slope gradient > 60%	. 60%.	œ
Ban	2	Mass erosion	No evidence of past or future mass erosion.	m	Infrequent. Mostly healed over. Low future potential.	9	Frequent or large, causing sediment nearly yearlong.	o	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	ing sediment nearly it danger of same.	(12)
ber	က	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.	4	Moderate to heavy amounts, mostly larger sizes.	(o)	Moderate to heavy amounts, predominantly larger sizes.	nounts, sizes.	œ
ldn	4	Vegetative bank protection	 90% plant density. Vigor and variety suggest a deep, dense soil-binding root mass. 	ო	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	9	50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	6	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	ver species and oor, discontinuous s.	(12)
5	2	Channel capacity	Bank heights sufficient to contain the bankfull stage. Withhologht ratio departure from reference width/depth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.	(3)	Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0–1.2. Bank Heicht Ratio (BHR) = 1.0–1.1.	2	Bankfull stage is not contained. Width/depbt ratio departure from reference width/depth ratio = 1.2-1.4. Bank-Height Ratio (BHR) = 1.1-1.3.	ო	Bankfull stage is not contained; overbank flows are ocrimon with flows sess than bankfull. Wothheleph ratio departure from reterence width/depth ratio 1914. Bank-Height Ratio (BHR) > 1.3.	ned; overbank flows are in bankfull. Widthdepth ice width/depth ratio HR) >1.3.	4
ıuk	9	Bank rock content	> 65% with large angular boulders. 12"+ common.	(2)	40-65%. Mostly boulders and small cobbles 6-12".	4	20-40%. Most in the 3-6" diameter class.	9	<20% rock fragments of gravel sizes, 1-3" or less.	of gravel sizes,	00
er Ba	7	Obstructions to flow	Rocks and logs firmly imbedded. S Flow pattern w/o cutting or deposition. Stable bed.	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	(0)	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	s and deflectors earlong. Sediment gration occurring.	∞
MOT	00	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcurves and constrictions. Raw banks may be up to12".	9	Significant. Cuts 12–24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over 24" high, Failure of overhangs frequent.	ts, some over 24" angs frequent.	(2)
1	o	Deposition	Little or no enlargement of channel or point bars.	4	Some new bar increase, mostly from coarse gravel.	œ	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development.	oredominantly fine bar development.	16
	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	0	Rounded comers and edges. Surfaces smooth and flat.	2	Corners and edges well rounded in 2 dimensions.	6	Well rounded in all dimensions, surfaces smooth.	nensions, surfaces	4
	#	Brightness	Surfaces dull, dark or Generally not bright.	0	Mostly dull, but may have <35% bright surfaces.	2	Wixture dull and bright, i.e., 35–65% mixture range.	m	Predominantly bright, > 65%, exposed or scoured surfaces.	> 65%, exposed or	4
шо	12	Consolidation of particles		(2)	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	9	No packing evident. Loose assortment, easily moved.	.oose assortment,	∞
Hotto	13	Bottom size distribution	_	(4)	Distribution shift light. Stable material 50–80%.	89	Moderate change in sizes. Stable materials 20–50%.	12	Marked distribution change, Stable materials 0-20%.	hange. Stable	16
3	4	Scouring and deposition	d <5% of bottom affected by scour or deposition.	(%)	5-30% affected. Soour at constrictions and where grades steepen. Some deposition in pools.	12	30–50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	bottom in a state rly yearlong.	24
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	*	Common, Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	က	Perennial types scarce or absent. Yellow- green, short-term bloom may be present.	e or absent. Yellow- im may be present.	4
			Excellent Total =	17	Good Total =	0	Fair Total =	18		Poor Total =	市
tream	Stream Type		A4 A5 A6		B3 B4 B5 B6 C1	C2	C3 C4 C5 C6 D3	D4	D5 D6	Grand Total =	83
Good (Stable) Fair (Mod. Unstable)	Instable)	44.47	44.47 91-129 96-132 96-14281-110 46-58	46-58	61-78 65-84 69-88 61-78 51-61 79+ 85+ 89+ 79+ 62+	51-61	91-110 91-110 86-105 108-132	133+	108-132 99-125 133+ 126+	Existing Stream Type =	
ream	Stream Type		DAS DA6 E3 E4		F1 F2 F3 F4 F5	F6	G1 G2 G3 G4 G5	95		*Potential	
Good (Stable) Fair (Mod Unstable) Poor (Unstable)	Good (Stable) Fair (Mod Unstable) Poor (Unstable)	40-63 40-63 64-86 64-86 87+ 87+	3 40-63 40-63 50-75 50-75 6 64-86 64-86 76-96 76-96 87+ 87+ 87+ 97+ 97+	40-63 64-86 87+	60-85 60-85 85-110 85-110 90-115 86-105 86-105 111-125 111-125 116-130 106+ 106+ 126+ 126+ 131+	80-95 96-110 111+	40-60 40-60 85-107 85-107 90-112 61-78 61-78 108-120 108-120 113-125 79+ 79+ 121+ 121+ 126+	85-107 108-120 121+	0	Modified Channel Stability Rating =	anne
2	1	1				1					

Geomorphic Analysis Check List

Site Name: Wild Rice River - 5 Date: 10/2/11

SKETCH

* staked RB only 5 / 1 Q Z, V moasure m 1, Q measur

sheen of sank on top of clay layer in bed

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
P. (270	Left 1303 i R	Top of Bank (TB)	1 -	1	Bank Full (BF)			Water Surface	1	200
Section 1 1301 U/S	Right	Top of Bank (TB)	1	267	Bank Full (BF)	1	768	(WS)	Y	269
11277	Left ₃	Top of Bank (TB)	-	-	Bank Full (BF)			Water Surface	1.	200
Section 2 305 LV/5 306 D/5	Right	Top of Bank (TB)	J	271	Bank Full (BF)	/	272	(WS)	5	1+
Vik 281	Left R	Top of Bank (TB)		-	Bank Full (BF)	_	-	Water Surface	1	770
Section 3 301 U/5	Right	Top of Bank (TB)	1	274	Bank Full (BF)	/	280	(WS)	V.	2 70
Pix 285	Left B	Top of Bank (TB)			Bank Full (BF)	-	-	Water Surface	/	705
Section 4 (313) WS	Right	Top of Bank (TB)		284	Bank Full (BF)	1	283	(WS)	~	202
Dic 289	LeftB	Top of Bank (TB)		-	Bank Full (BF)	-	-	Water Surface		786
Section 5	Right	Top of Bank (TB)	J	288	Bank Full (BF)	1	787	(WS)		

Measurement	Unit		Value	
Manning's n	-	0.035	O 045	пов С С45
Root Depth	(ft)		2	
Root Density	(%)		15	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)		5	
Eroding Bank in Study Reach ¹	(%)		50	
Bank Material Type	(sand, silt, clay)		clay	
Bank Material Stratification Score ²	-		Ø	
Distance from Bank Toe to Water Surface ³	(ft)	-	2.3	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	ltem	Completed
Velocity Measurements	~	Riparian Vegetation Worksheet	1
Depositional Features Worksheet	$\sqrt{}$	Pfankuch Method	/
Channel Blockages Worksheet	\checkmark		

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	_	_	~
Right Bank (RB)	$\sqrt{}$	WR/274/RB	274
Bed Surface (BED)	_	_	1
Bed Core (BED-C)	J	WR/275/BED-C-C UR/276/RED-C-RS	275
Bar (BAR)	_		

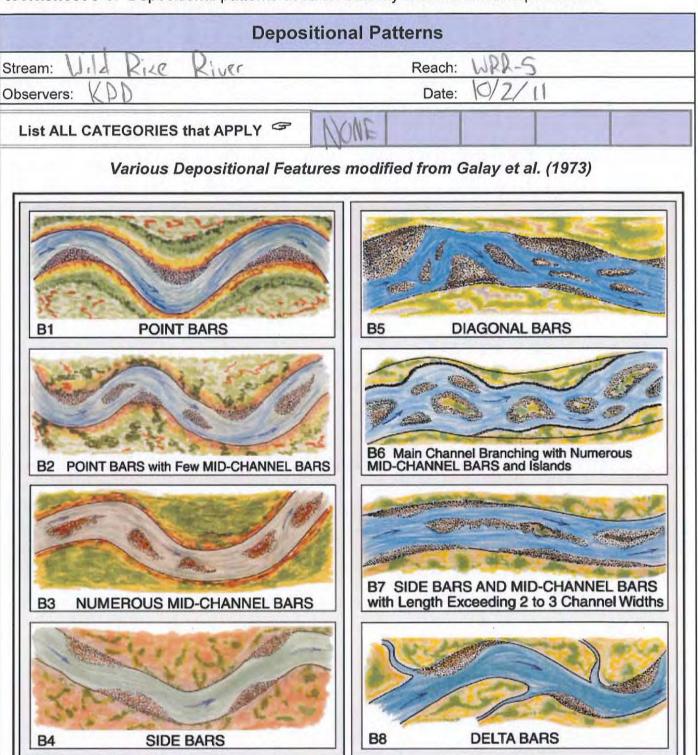
River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

		F	Riparian V	egetation	
Str	eam: Wil	1 Rice	River	Location: URR-	5
Ob	servers: K	00	Reference reach	Disturbed (impacted reach) Date:	0/2/11
Existing species composition:			Potential species composition:		
	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition
1. Overstory	Canopy layer	70	15	tses	lde
					100%
2. Understory	Shrub layer		10	_ \$hcub\$	-100
		,,,,,,			100%
vel	Herbaceous		5	- STESS Meds -	
3. Ground level	Leaf or needle litter		10	Remarks: Condition, vigor and/or usage of existing reach:	100%
	Bare ground		60		
**B	ased on crow ased on basa urface area.		Column total		

Worksheet 3-5. Depositional patterns used for stability assessment interpretations.



		Channel Blockages	
Stre	eam: Wild	Rice River Location: LIRR-5	
Obs	servers: KDT	Date: (0/2/(1	
	scription/ tent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check / all that apply
D1	None	Minor amounts of small, floatable material.	×
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	×
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	Г
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	×
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	×
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	Г
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	Γ
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	1

Worksheet 3-10. Pfankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2001c, 2006b).

Stream:	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Vild Rid	ed Kinde Location:	3	K > Valley lype:		Observers: KDD		Date:	1770	
Loca-	Ϋ́ον	Category	Excellent		Good	Ī	Fair		Poor		
tion	ne)		Description	Rating	Description	Rating	Description Ra	Rating	Description	R	Rating
ka	~	Landform slope	Bank slope gradient <30%.	(2)	Bank slope gradient 30-40%.	4	Bank slope gradient 40–50%.	9 9	Bank slope gradient > 60%.		8
Ban	2	Mass erosion	No evidence of past or future mass erosion.	3	Infrequent. Mostly healed over. Low future potential.	9	Frequent or large, causing sediment nearly yearlong.	(6)	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	ent nearly of same.	12
ber	ო	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.	4	A CA	200	Moderate to heavy amounts, predominantly larger sizes.		80
ldn	4	Vegetative bank protection		60	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	9	pu	9 8	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	es and ontinuous	(12)
S	5	Channel capacity	Bank heights sufficient to contain the bankful stage. Widthidepth ratio departure from reference widthidepth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.	(-)	Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0-1.2. Bank Height Ratio (BHR) = 1.0-1.1.	2	Bankfull stage is not contained. Whothhoteph ratio departure from reference width/depth ratio = 1.2–1.4. Bank-Height Ratio [BHR] = 1.1–1.3.	ю 8 2 5 7	Bankfull stage is not contained; overbank flows are common with flows less than bearkfull. Width/depth ratio departure from reference width/depth ratio >1.4. Bank-Height Ratio (BHR) >1.3.	nk flows are Width/depth opth ratio	4
uk	9	Bank rock content	> 65% with large angular boulders. 12"+ common.	(3)	40-65%. Mostly boulders and small cobbles 6-12".	4	20–40%. Most in the 3–6" diameter class.	9	<20% rock fragments of gravel sizes, 1-3" or less.	l sizes,	00
er B	7	Obstructions to flow	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	6	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	lectors Sediment scurring.	œ
мот	œ	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcurves and constrictions. Raw banks may be up to12".	9	Significant. Cuts 12–24" high. Root mat overhangs and sloughing evident.	(2)	Almost continuous cuts, some over high. Failure of overhangs frequent.	over 24" juent.	16
	თ	Deposition	Little or no enlargement of channel or point bars.	(4)	Some new bar increase, mostly from coarse gravel.	80	Moderate deposition of new gravel and coarse sand on old and some new bars.	12 E	Extensive deposit of predominantly fine particles, Accelerated bar development.	antly fine slopment.	16
	10	Rock angularity	Sharp edges and comets. Plane surfaces rough.	0	Rounded comers and edges. Surfaces smooth and flat.	2	Corners and edges well rounded in 2 dimensions.	3 ×	Well rounded in all dimensions, surfaces smooth.	, surfaces	4
	7	Brightness	Surfaces dull, dark or stained. Generally not bright.	9	Mostly dull, but may have <35% bright surfaces.	2	nd bright, i.e., 35–65%	e s	Predominantly bright, > 65%, exposed or scoured surfaces.	xposed or	4
шо	12	Consolidation of particles		(2)	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	9	No packing evident. Loose assortment, easily moved.	sortment,	œ
330	13	Bottom size distribution	No size change evident. Stable material 80–100%.	4	Distribution shift light. Stable material 50–80%.	8		12 n	Marked distribution change. Stable materials 0-20%.	table	16
3	14	Scouring and deposition	Scouring and <5% of bottom affected by deposition scour or deposition.	(9)	5-30% affected. Soour at constrictions and where grades steepen. Some deposition in pools.	12	d scour and	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	n a state ng.	24
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	+	Common. Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	6	Perennial types scarce or absent. Yellow- green, short-term bloom may be present.	nt. Yellow- e present.	4
			Excellent Total =	23	Good Total =	0	Fair Total =	33	Poor	Poor Total =	2
Stream Type	Type	A1	A2 A3 A4 A5 A6 B1	B2	B3 B4 B5 B6 C1 40-60 40-64 48-68 40-60 38-50	C2 38-50	C3 C4 C5 C6 D3 I	D4 85-107 8	D5 D6 Grand	Grand Total =	75
Fair (Mod. Unstable)	Instable	44-47	96-132 96-142 81-110 46		61-78 65-84 69-88 61-78 51-61 79+ 85+ 89+ 79+ 62+	51-61	91-110 91-110 86-105 108-132 111+ 111+ 106+ 133+	133+	108-132 99-125 Existi 133+ 126+ Strean	Existing Stream Type =	
Stream Type	Type		DAS DA6 E3 E4	E6 40-63	F1 F2 F3 F4 F5 60-85 60-85 85-110 85-110 90-115	F6 80-95	G1 G2 G3 G4 G5 G G G G G G G G G G	G6	*Potential Stream Ty	*Potential Stream Type =	
Fair (Mod. Unstable)	Instable)	64-86	84-86 64-86 64-86 76-96 87+ 87+ 87+ 97+	64-86	86-105 88-105 111-125 111-125 116-130 106+ 106+ 126+ 131+	96-110	61-78 61-78 108-120 108-120 113-125 108 79+ 79+ 121+ 121+ 126+ 13	108-120	Modi	Modified Channel Stability Rating =	nnel ng =
							"Pating is adjusted to notantial stream type at patieting	t mee	no not existing		

Geomorphic Analysis Check List

Access @ 54th St Crossing (NE corner)

Site Name: Wild Rice River - 4

Date: 1073/17

SKETCH	
* Sample Desc	
RB channel sample Q ,5	N
was pushed in No	4
before being pounted in	
a 6' additional. Very	
dark, sandy along throughout. Very different from channel center sample, which was	
conter sample, which was	
boarged in 5 this 2 mble	X3
was light in color Z, V measurement (Leave to top). Sticky Zamples	
chay. VI, Q mass	atement
	Harring to Beat August

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Pic 295 Section 1	Left LR	Top of Bank (TB)	/	292	Bank Full (BF)	/	291	Water Surface	/	7011
1321 11/S 1377 11/S	Right	Top of Bank (TB)	$\sqrt{}$	294	Bank Full (BF)	/	293	(WS)	/	210
Section 2	Left 13721 R	Top of Bank (TB)	/	302	Bank Full (BF)	J	300	Water Surface		701
325 0/5	Right	Top of Bank (TB)	1	299	Bank Full (BF)	1	297	(WS)		276
Section 3	Left 133) LR	Top of Bank (TB)	1	310	Bank Full (BF)	1	309	Water Surface	1	~~~
13301/5	Right	Top of Bank (TB)	/	306	Bank Full (BF)	1	307	(WS)	J	SO 8
Section 4	Left 1335 LB	Top of Bank (TB)		314	Bank Full (BF)	J	313	Water Surface)	212
333 475	Right	Top of Bank (TB)	/	316	Bank Full (BF)		315	(WS)		312
Section 5	Left R	Top of Bank (TB)	J	320	Bank Full (BF)	1	319	Water Surface	1	210
Section 5	Right	Top of Bank (TB)	J	322	Bank Full (BF)	1	321	(WS)		218

Measurement	Unit	Value
Manning's n	-	Channel LOB ROB 0.035 0.045 0.045
Root Depth	(ft)	7
Root Density	(%)	2
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	10
Eroding Bank in Study Reach ¹	(%)	65
Bank Material Type	(sand, silt, clay)	clay
Bank Material Stratification Score ²	-	O '
Distance from Bank Toe to Water Surface ³	(ft)	2.3

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

ltem	Completed	ltem	Completed
Velocity Measurements		Riparian Vegetation Worksheet	
Depositional Features Worksheet		Pfankuch Method	
Channel Blockages Worksheet	<i>J</i>		

Sampling Checklist

•			
Location	Collected	Label	GPS Pt #
Left Bank (LB)		WR/301/LR	301
Right Bank (RB)		WR/298/RB	298
Bed Surface (BED)	ginteriorismo	Signature.	et dan persona
Bed Core (BED-C)	J	WR/307/BED-C-C	301 303
Bar (BAR)	esistancia,	TO PROGRAM STORY	- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1

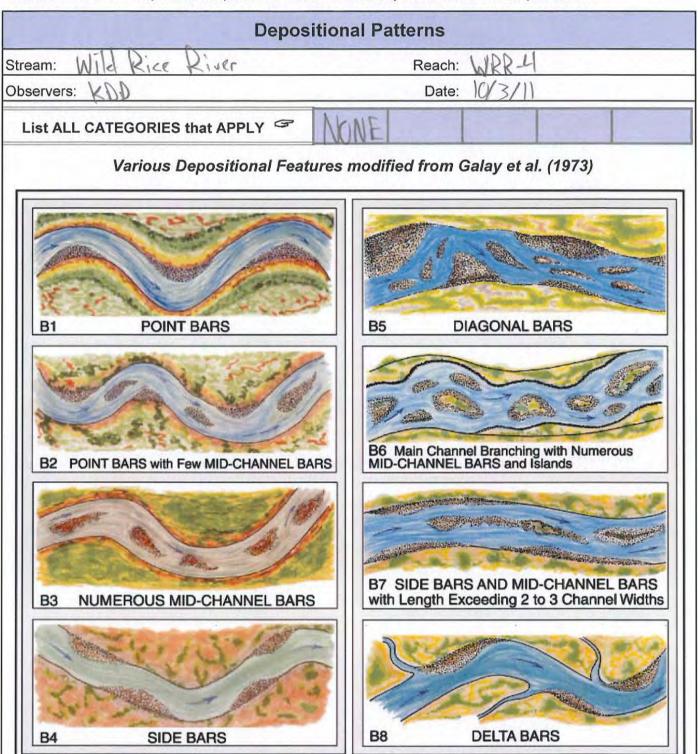
River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	М
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

		I	Riparian \	/egetation					
St	ream: \\\\\\\\\\\	d Rice	River	Location: WRR-4					
Ol	oservers: K	aa:	Reference reach						
sp	risting ecies mposition:		4	Potential species composition:					
c	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition				
1. Overstory	Canopy layer	75	15	Irges	100				
2. Understory	Shrub layer		5		100%				
el	Herbaceous		\5	1201/2 Grass	100%				
3. Ground level	Leaf or needle litter		5	Remarks: Condition, vigor and/or usage of existing reach:	100%				
	Bare ground		60						
*Ba	ased on crowr ased on basal ırface area.		Column total 100%						

Worksheet 3-5. Depositional patterns used for stability assessment interpretations.



		Channel Blockages	
Stre	eam: Wild R	ice River Location: WRR-4	
Obs	servers: KON	Date: \0/ S/ 11	
	scription/ tent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check / all that apply
D1	None	Minor amounts of small, floatable material.	K
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	以
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	仗
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	Г
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	Г
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	Г
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	Г
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	Г

Worksheet 3-10. Pfankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2001c, 2006b).

on call.	1	LI A K	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			Ì	77	I	-		
Loca-	Kev	Category		1	Cood						1
Tion		_	Description	Rating	Description	Rating	Description	Kating	Description		Kating
ka	-	slope	Bank slope gradient <30%.	2	Bank slope gradient 30-40%.	4	Bank slope gradient 40–60%.	9	Bank slope gradient > 60%		00
Bsn	2	Mass erosion	No evidence of past or future mass erosion.	က	Infrequent. Mostly healed over. Low future potential.	9	Frequent or large, causing sediment nearly yearlong.	6	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	ediment nearly iger of same.	(2)
190	ю	Debris jam potential	Essentially absent from immediate channel area.	7	Present, but mostly small twigs and limbs.	4	Moderate to heavy amounts, mostly larger sizes.	9	Moderate to heavy amounts, predominantly larger sizes.	.5,	80
Idn	4	Vegetative bank protection	> 90% plant density. Vigor and variety suggest a deep, dense soil-binding root mass.	က	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	9	50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	6	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	pecies and discontinuous	(2)
9	2	Channel capacity	Bank heights sufficient to contain the bankfull stage. Width/depth ratio departure from reference width/depth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.	0	Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0-1.2. Bank Height Ratio (BHR) = 1.0-1.1.	2	Bankfull stage is not contained. Widthidepul hato doparture from reference width/depth ratio = 1.2-1.4. Bank-Height Ratio (BHR) = 1.1-1.3.	m	Bankfull stage is not contained; overbank flows are ornmon with flows less than bankfull. Width/depth raflo departure from reference width/depth raflo > 1.4. Bank-Height Ratio (BHR) > 1.3.	erbank flows are dull. Width/depth tfr/depth ratio 1.3.	4
ınka	9	Bank rock content	> 65% with large angular boulders. 12"+ common.	(2)	40-65%. Mostly boulders and small cobbles 6-12".	4	20–40%. Most in the 3–6" diameter class.	9	<20% rock fragments of gravel sizes, 1-3" or less.	avel sizes,	80
eg Je	7	Obstructions to flow	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.	7	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	(4)	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	9	Frequent obstructions and deflectors cause bank erosion yearlong. Sedime traps full, channel migration occurring	deflectors ng. Sediment n occurring.	∞
MO	00	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcurves and constrictions. Raw banks may be up to 12".	9	Significant. Cuts 12–24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over high. Failure of overhangs frequent.	some over 24" gs frequent.	(4)
ı	o	Deposition	Little or no enlargement of channel or point bars.	4	Some new bar increase, mostly from coarse gravel.	œ	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development.	minantly fine development.	16
	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	0	Rounded comers and edges. Surfaces smooth and flat.	2	Corners and edges well rounded in 2 dimensions.	က	Well rounded in all dimensions, surfaces smooth.	ions, surfaces	4
	=	Brightness	Surfaces dull, dark or stained. Generally not bright.	0	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35–65% mixture range.	60	Predominantly bright, > 65%, exposed or scoured surfaces.	%, exposed or	4
шс	12	Consolidation of particles	Assorted sizes tightly packed or overlapping.	(2)	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	9	No packing evident. Loose assortment, easily moved.	assortment,	00
otto	13	Bottom size distribution	No size change evident. Stable material 80–100%.	4	Distribution shift light. Stable material 50–80%.	89	Moderate change in sizes. Stable materials 20–50%.	12	Marked distribution change. Stable materials 0-20%.	e. Stable	16
8	14	Scouring and deposition		0	5-30% affected. Sour at constrictions and where grades steepen. Some deposition in pools.	12	30–50% affected. Deposits and sour at obstructions, constrictions and bends. Some filling of pools.	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	om in a state arlong.	24
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	-	Common, Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	က	Perennial types scarce or absent. Yellow- green, short-term bloom may be present.	ibsent. Yellow- ay be present.	(4)
			Excellent Total =	3	Good Total =	00	Fair Total =	0	A.	Poor Total =	三
Stream Type	Type	A1	A4 A5 A6		B3 B4 B5 B6	C2	C4 C5 C6 D3	D4	D5 D6	Grand Total =	it
Good (Stable) Fair (Mod Unstable)	(ble) Instable)	38-43	38-43 54-90 60-95 60-95 50-80 38-45 44-47 91-129 96-132 96-142 81-110 46-58	38-45	1 40-60 40-84 48-88 40-60 38-50 1 61-78 65-84 69-88 61-78 51-61 70- 85- 80- 70+ 62+	38-50 51-61 62+	86-105 91-110 91-110 86-105 108-1321 106+ 111+ 111+ 116+ 133+	108-132 133+	108-132 99-125 133+ 126+	Existing Stream Type =	
Stream Type	Type	DA3	DA6 E3 E4		F1 F2	F6	G2 G3 G4 G5	95		*Potential Stream Type =	
Good (Stable) Fair (Mod Unstable) Poor (Unstable)	ible) Instable)	40-63 40-63) 64-86 64-86 87+ 87+	3 40-63 40-63 50-75 50-75 6 64-86 64-86 76-96 76-96 87+ 87+ 97+ 97+ 97+	64-86 87+	86-105 86-105 111-125 111-125 116-130 110-115 116-130 116+ 126+ 126+ 131+	80-95 96-110 111+	113-125 126+	108-120	N	Modified Chann Stability Rating	Channel Rating =
200 000	ranie)	Н			22.				_		1

Access = A12

Geomorphic Analysis Check List book trailer behind qu

- Hollow recently moved pa

Site Name: Wild Rice River - 3

Date: 10/4/11

to edge of water

Samples from center a near

RB of channel were both

, a measurement

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Pic 329	Left ₂	Top of Bank (TB)	/	326	Bank Full (BF)	/	325	Water Surface	1	274
Section 1 1345 U/S	Right	Top of Bank (TB)		328	Bank Full (BF)	/	327	(WS)	J	321
Fig 335 Section 2	Left 1351 LB	Top of Bank (TB)	1	332	Bank Full (BF)	1	331	Water Surface	1	351
1341 N/5	Right 1352 23	Top of Bank (TB)	1	334	Bank Full (BF)	/	333	(WS)	J	220
Pic 341	Left 1355LR	Top of Bank (TB)	J	340	Bank Full (BF)	1	339	Water Surface	1	3-30
Section 3 353 W/S 354 D/S	Right	Top of Bank (TB)	1	336	Bank Full (BF)	1	337	(WS)	J	238
Section 4	13STLR	Top of Bank (TB)	1	348	Bank Full (BF)	1	346	Water Surface	1	7/17
1357 U/S	Right	Top of Bank (TB)	1	345	Bank Full (BF)	1	343	(WS)		245
Pic.359	Left B	Top of Bank (TB)	1	35%	Bank Full (BF)	1	355	Water Surface	1	71-
Section 5 1347 D/S	Right	Top of Bank (TB)		354	Bank Full (BF)		353	(WS)	~	225

Measurement	Unit		Value	
Manning's n	÷	Channel 0.035	O.045	0.045
Root Depth	(ft)		Z	
Root Density	(%)			
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)		2	
Eroding Bank in Study Reach ¹	(%)		80	
Bank Material Type	(sand, silt, clay)		clay	
Bank Material Stratification Score ²	4		0	
Distance from Bank Toe to Water Surface ³	(ft)		2.0	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	ltem	Completed
Velocity Measurements	1	Riparian Vegetation Worksheet	
Depositional Features Worksheet		Pfankuch Method	1
Channel Blockages Worksheet	/		

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	1	WR/347/LB	347
Right Bank (RB)	J	WR/344/RB	344
Bed Surface (BED)	_	_	_
Bed Core (BED-C)	1	WR/349/BED-(-(WR/350/BED-(-RB	349
Bar (BAR)	_	_	_

River	Abbreviation			
Red River of the North	RR			
Sheyenne River	S			
Lower Rush	LR			
Rush	RUSH			
Maple	M			
Buffalo	В			
Sheyenne Diversion	SD			
Wild Rice	WR			
Wolverton Creek	WC			

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

		F	Riparian \	/egetation	
St	ream: $\backslash \backslash \backslash \backslash \backslash$	d Rice	River	Location: WRR-3	
Ok	servers: K	00	Reference reach	Oisturbed (impacted reach) Date:	5/4/11
sp	isting ecies mposition:			Potential species composition:	
	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition
1. Overstory	Canopy layer	60	10	tces	100
2. Understory	Shrub layer		25		100%
vel	Herbaceous		5	- grass, meds.	100%
3. Ground level	Leaf or needle litter		5	Remarks: 10 Condition, vigor and/or usage of existing reach:	
	Bare ground		55		
*Ba	ased on crowr ased on basal urface area.		Column total 100%		

Worksheet 3-5. Depositional patterns used for stability assessment interpretations.

Depositional Patterns Reach: WRR-3 Stream: Date: Observers: List ALL CATEGORIES that APPLY G Various Depositional Features modified from Galay et al. (1973) **B1 POINT BARS B5 DIAGONAL BARS** B6 Main Channel Branching with Numerous MID-CHANNEL BARS and Islands B2 POINT BARS with Few MID-CHANNEL BARS **B7 SIDE BARS AND MID-CHANNEL BARS** with Length Exceeding 2 to 3 Channel Widths NUMEROUS MID-CHANNEL BARS **B8 DELTA BARS** SIDE BARS

		Channel Blockages	
Stre	eam: Wild R	ice River Location: WRR-3	
Obs	ervers: KDD	Date: \0/4/1\	
	scription/ ent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check / all that apply
D1	None	Minor amounts of small, floatable material.	×
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	X
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	×
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	×
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	Г
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	г
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	Г
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	

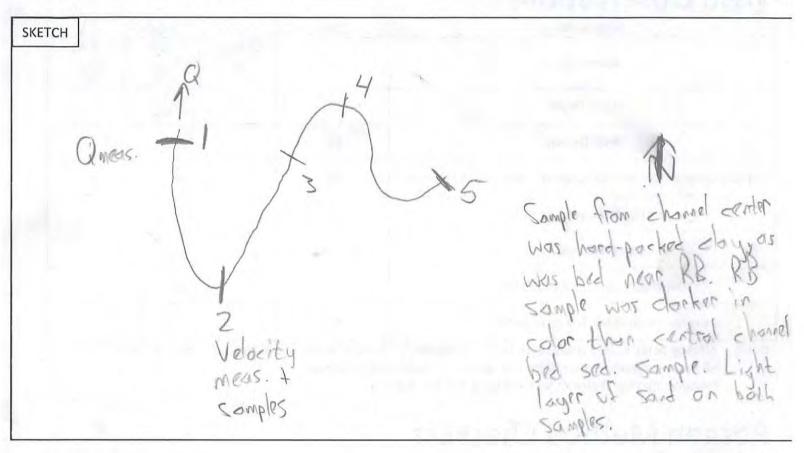
Worksheet 3-10. Pfankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2001c, 2006b).

orream:	11. 5	ILG P	CE WINTI				61			1 200	
Loca-	Kov	Catanon	Excellent				Fair			Poor	
tion	vey		Description	Rating	Description	Rating	Description R	Rating	Descr		Rating
ks	**	Landform slope	Bank slope gradient <30%.	(2)	Bank slope gradient 30–40%.	4	Bank slope gradient 40–60%.	9	Bank slope gradient > 60%	.%09	∞
Ban	2	Mass erosion	No evidence of past or future mass erosion.	n	Infrequent. Mostly healed over. Low future potential.	9	Frequent or large, causing sediment nearly yearlong.	9	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	ng sediment nearly danger of same.	12)
ber	3	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.	4	Moderate to heavy amounts, mostly larger sizes.	(0)	Moderate to heavy amounts, predominantly larger sizes.	ounts, izes.	80
ldN	4	Vegetative bank protection	-	6	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	9	50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	0	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	rer species and oor, discontinuous	12
8	22	Channel capacity	Bank heights sufficient to contain the bankful stage. Width/depth ratio departure from reference width/depth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.	0	Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0-1.2. Bank Heicht Ratio (BHR) = 1.0-1.1.	2	Bankfull stage is not contained. Wichthdepth ratio departure from reference widthdepth ratio = 1.2-1.4. Bank-Height Ratio (BHR) = 1.1-1.3.	m	Bankfull stage is not contained; overbank flows are common with flows less than bankful, Width/depth ratio departure from reference width/depth ratio 114. Bank-Height Ratio (BHR) > 1.3.	ed, overbank flows are 1 bankfull, Width/depth 2e width/depth ratio 1R) > 1.3.	4
ıuka	9	Bank rock content	> 65% with large angular boulders. 12"+ common.	(2)	40–65%. Mostly boulders and small cobbles 6–12".	4	20–40%. Most in the 3–6" diameter class.	9	<20% rock fragments of gravel sizes, 1–3" or less.	of gravel sizes,	60
sa ne	2	Obstructions to flow	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	(0)	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	and deflectors sarlong. Sediment ration occurring.	œ
гомо	00	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcurves and constrictions. Raw banks may be up to12".	9	Significant. Cuts 12–24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over high. Failure of overhangs frequent	s, some over 24" ings frequent.	(16)
	თ	Deposition	Little or no enlargement of channel or point bars.	4	Some new bar increase, mostly from coarse gravel.	œ	Moderate depostion of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development.	redominantly fine bar development.	16
	10	Rock angularity	Sharp edges and comers. Plane surfaces rough.	0	Rounded comers and edges. Surfaces smooth and flat.	2	Comers and edges well rounded in 2 dimensions.	က	Well rounded in all dimensions, surfaces smooth.	nensions, surfaces	4
	Ξ	Brightness	Surfaces dull, dark or stained. Generally not bright.	0	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35–65% mixture range.	3	Predominantly bright, > 65%, exposed or scoured surfaces.	> 65%, exposed or	4
шо	12	Consolidation of particles		(3)	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	9	No packing evident. Loose assortment, easily moved.	oose assortment,	00
30tt	13	Bottom size distribution		9	Distribution shift light. Stable material 50–80%.	8	Moderate change in sizes. Stable materials 20–50%.	12	Marked distribution change. Stable materials 0-20%.	ange. Stable	16
3	4	Scouring and deposition	d <5% of bottom affected by scour or deposition.	()	5-30% affected. Sour at constrictions and where grades steepen. Some deposition in pools.	12	30–50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	bottom in a state ly yearlong.	24
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	-	Common, Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	3	Perennial types scarce or absent. Yellow- green, short-term bloom may be present.	or absent. Yellow- m may be present.	(4)
			Excellent Total =	23	Good Total =	0	Fair Total =	21		Poor Total =	7
Stream Type	Type	A1	A4 A5 A6		B3 B4 B5 B6 C1	C2	700 7000 60 05 05 107	D4 407	D5 D6	Grand Total =	X
Good (Stable) Fair (Mod. Unstable)	able) Unstable	38-43 44-47 48+	38-43 54-90 60-95 60-95 50-80 38-45 44-47 91-129 96-132 96-142 81-110 46-58 48+ 130+ 133+ 143+ 111+ 59+	58 46 58 45 59 45	40-60 40-64 48-68 40-60 38-50 61-78 65-84 69-88 61-78 51-61 79+ 62+	38-30 51-61 62+	91-110 86-105 108-132 111+ 106+ 133+	133+	108-132 99-125 133+ 126+	Existing Stream Type =	
Stream Type	Type	DA3	DAS DAG E3 E4		F1 F2 F3 F4 F5	F6	G2 G3 G4 G5	G6		*Potential Stream Type =	
Good (Stable) Fair (Mod. Unstable) Poor (Unstable)	able) Unstable, stable)	64-86 64-86 87+ 87+	5 40-65 40-65 50-75 50-75 6 64-86 64-86 76-96 76-96 87+ 87+ 87+ 97+ 97+ 97+	64-86	86-705 86-105 111-125 111-125 116-130 108+ 106+ 126+ 126+ 131+	96-110	61-78 108-120 108-120 113-125 79+ 121+ 121+ 126+	108-120		Modified Channel Stability Rating =	nne ng =
		1					the state of the s		-		

Geomorphic Analysis Check List

Site Name: Red River -3

Date: 10/4/11



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left LR	Top of Bank (TB)	/	360	Bank Full (BF)	/	359	Water Surface	1	2
1365 NK	Right	Top of Bank (TB)	1	362	Bank Full (BF)	1	361	(WS)		558
Pic 369 Section 2	Left LR	Top of Bank (TB)	J	365	Bank Full (BF)	J	364	Water Surface	1	311
1369 U/S	Right	Top of Bank (TB)		367	Bank Full (BF)	V	368	(WS)		26.6
Pic 377	Left	Top of Bank (TB)	/	376	Bank Full (BF)		375	Water Surface	1	~
Section 3 1374 (WS	Right	Top of Bank (TB)	1	373	Bank Full (BF)	1	372	(WS)	J. J.	374
Piz 383	Left LR	Top of Bank (TB)	1	378	Bank Full (BF)	1	379	Water Surface)	7/10
Section 4 1378 175 [374 175	Right	Top of Bank (TB)	1	382	Bank Full (BF)	1	381	(WS)	J	280
PBE 319	Left	Top of Bank (TB)		384	Bank Full (BF)	1	385	Water Surface	1	300
Section 5 1382 0/5	Right	Top of Bank (TB)	J	388	Bank Full (BF)	1	387	(WS)	5	286

Measurement	Unit		Value	o louis
Manning's n	(2)	Channel	LOB	ROB
Root Depth	(ft)		\times	
Root Density	(%)	,	\times	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)		3	
Eroding Bank in Study Reach ¹	(%)	1	85	
Bank Material Type	(sand, silt, clay)		\times	
Bank Material Stratification Score ²	•		X	
Distance from Bank Toe to Water Surface ³	(ft)		X	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

ltem	Completed	Item	Completed
Velocity Measurements	1	Riparian Vegetation Worksheet	X
Depositional Features Worksheet	X	Pfankuch Method	X
Channel Blockages Worksheet	X		

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	X	X	X
Right Bank (RB)	X	X	X
Bed Surface (BED)	X	X	X
Bed Core (BED-C)	5	RR 370 BED-6	862 SE
Bar (BAR)	X	X	X

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	М
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Shey & Mecess = A16
Shey S Access = A16
Geomorphic Analysis Check List

Date: 10/5/1 Site Name: Red RIVER -

> 1, a measurement 68 only 2, V measurement + samples RBonly

Bed sample from Channel center had thin layer of gravelly sand at the top. Was underlain by clay (dark in color). Bod however, was all sand, Mirroring the notorial Sampler mas

Staking

SKETCH

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
7: 395 Section 1	Left 1344 LB	Top of Bank (TB)	1	390	Bank Full (BF)	1	391	Water Surface	1	297
1392 U/S	Right	Top of Bank (TB)	J	394	Bank Full (BF)		393	(WS)		215
Section 2	Left IZSE LR	Top of Bank (TB)	1	398	Bank Full (BF)	/	397	Water Surface		255
1346 U/5	Right 134 KB	Top of Bank (TB)	1	402	Bank Full (BF)	/	401	(WS)		396
Section 3	Left 1404 LB	Top of Bank (TB)		_	Bank Full (BF)		1	Water Surface	,	1100
402 WS	Right 1405 VIS	Top of Bank (TB)	/	408	Bank Full (BF)		407	(WS)		406
Pic 415	Left 14081 R	Top of Bank (TB)	J	412	Bank Full (BF)	J	411	Water Surface		(11)
Section 4 1406 U/S	Right	Top of Bank (TB)	J	414	Bank Full (BF)	J	413	(WS)	V	410
Section 5	Left	Top of Bank (TB)	-,	1	Bank Full (BF)	-	1	Water Surface	1	1110
1410 WS	Right	Top of Bank (TB)		417	Bank Full (BF)		416	(WS)	\vee	418

Measurement	Unit		Value	
Manning's n	4	Channel 0.035	0.05	ROB 9-05
Root Depth	(ft)		2	
Root Density	(%)		3	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)		5	
Eroding Bank in Study Reach ¹	(%)		80	
Bank Material Type	(sand, silt, clay)		clay	
Bank Material Stratification Score ²	14		0	
Distance from Bank Toe to Water Surface ³	(ft)		5.5	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

ltem	Completed	Item	Completed
Velocity Measurements	J	Riparian Vegetation Worksheet	1
Depositional Features Worksheet	\checkmark	Pfankuch Method	J
Channel Blockages Worksheet			

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	J	RR/399/LB	399
Right Bank (RB)	1	RR/400/RB	400
Bed Surface (BED)	_	_	_
Bed Core (BED-C)	J	RR/405/ RED-C-RB	404
Bar (BAR)	_		_

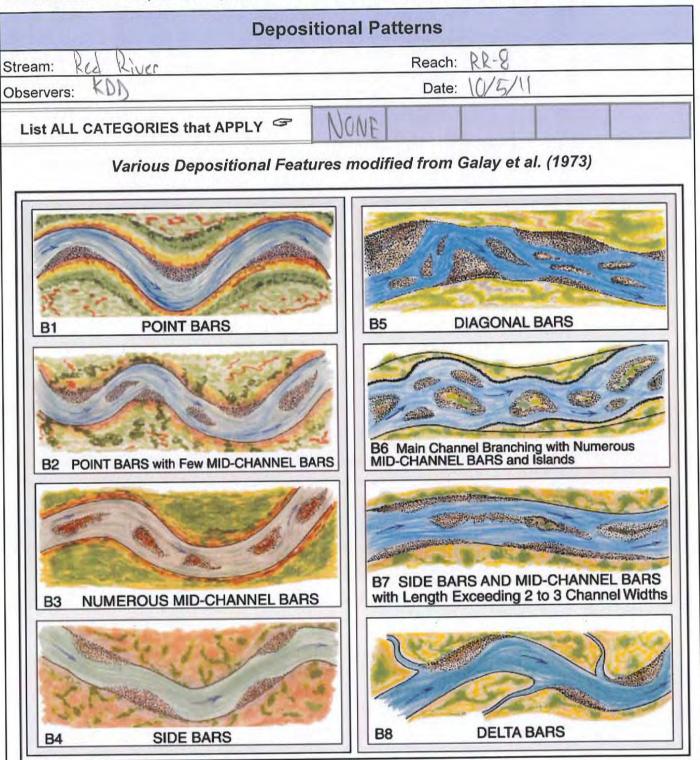
River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

			Riparian \	/egetation	
St	ream: Red	River		Location: RR-8	
OI	oservers: K	(dd)	Reference reach	Disturbed (impacted reach) Date:	0/5/11
sp	isting ecies mposition:			Potential species composition:	
c	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition
1. Overstory	Canopy layer	60	10		100
2. Understory	Shrub layer		35		100%
evel	Herbaceous		15		100%
3. Ground level	Leaf or needle litter		5	Remarks: Condition, vigor and/or usage of existing reach:	100%
	Bare ground		35		
*Ba	ased on crowr ased on basal Irface area.		Column total 100%		

Worksheet 3-5. Depositional patterns used for stabiilty assessment interpretations.



		Channel Blockages	
Stre	am: Red Ri	ver Location: DORK-8	
Obs	ervers: KDD	Date: 0/5/()	
Des	scription/ ent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check / all that apply
D1	None	Minor amounts of small, floatable material.	×
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	X
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	×
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	Г
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	Г
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	Г
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	Г
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	1

Worksheet 3-10. Pfankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2001c, 2006b).

Stream:	7: 7	ed RIVER		KK.	'S valley lype:		Observers: KNV		Date:	e: 10/5/	
Loca-	Kov	Cafedon	nt		Good		Fair		Poor	1	
lon	ney		Description	Rating	Description	Rating	Description R	Rating	Descr		Rating
Ke	1	Landform slope	Bank slope gradient <30%.	(2)	Bank slope gradient 30-40%.	4	Bank slope gradient 40–60%.	9	Bank slope gradient > 60%	0-	89
Ban	2	Mass erosion	No evidence of past or future mass erosion.	က	Infrequent. Mostly healed over. Low future potential.	9	Frequent or large, causing sediment nearly yearlong.	6	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	ediment nearly iger of same.	(12)
ber	3	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.	4	Moderate to heavy amounts, mostly larger sizes.	(9	Moderate to heavy amounts, predominantly larger sizes.	ts,	80
dn	4	Vegetative bank protection	>90% plant density. Vigor and variety suggest a deep, dense soil-binding root mass.	က	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	9	50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.) 00	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	pecies and discontinuous	(12)
S	2	Channel capacity	Bank heights sufficient to contain the bankfull stage. Widthdepth ratio departure from reference widthdepth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.	0	Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0–1.2. Bank Height Ratio (BHR) = 1.0–1.1.	2	Bankfull stage is not contained. Width/depth ratio departure from reference width/depth ratio = 1.2-1.4. Bank-Height Ratio (BHR) = 1.1-1.3.	က	Bankfull stage is not contained; overbank flows are conmon with flows less than bankful. Width/depth ratio departure from reference width/depth ratio 11.4. Bank-Height Ratio (EHR) > 1.3.	verbank flows are kfull. Width/depth ffh/depth ratio f.3.	4
JUK	9	Bank rock content	> 65% with large angular boulders. 12" + common.	(2)	40-65%. Mostly boulders and small cobbles 6-12".	4	20-40%. Most in the 3-6" diameter class.	9	<20% rock fragments of gravel sizes, 1–3" or less.	avel sizes,	8
er Ba	7	Obstructions to flow	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	(9)	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	deflectors ng. Sediment n occurring.	80
MOT	8	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcurves and constrictions. Raw banks may be up to12".	9	Significant. Cuts 12–24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over 24' high. Failure of overhangs frequent.	ome over 24" frequent.	16
	თ	Deposition	Little or no enlargement of channel or point bars.	(4)	Some new bar increase, mostly from coarse gravel.	œ	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development.	minantly fine development.	16
	10	Rock angularity	Sharp edges and comers. Plane surfaces rough.	0	Rounded comers and edges. Surfaces smooth and flat.	2	Corners and edges well rounded in 2 dimensions.	3	Well rounded in all dimensions, surfaces smooth.	ions, surfaces	4
	7	Brightness	Surfaces dull, dark or stained. Generally not bright.	D	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35–65% mixture range.	3	Predominantly bright, > 65%, exposed or scoured surfaces.	%, exposed or	4
шо	12	Consolidation of particles		3	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	9	No packing evident. Loose assortment, easily moved.	assortment,	89
30tt	13	Bottom size distribution	No size change evident. Stable material 80–100%.	9	Distribution shift light. Stable material 50–80%.	8	Moderate change in sizes. Stable materials 20–50%.	12	Marked distribution change. Stable materials 0-20%.	e. Stable	16
3	4	Scouring and deposition	<5% of bottom affected by scour or deposition.	(9)	5–30% affected. Soour at constrictions and where grades steepen. Some deposition in pools.	12	30–50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	om in a state arlong.	24
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	-	Common, Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	3	Perennial types scarce or absent. Yellow- green, short-term bloom may be present.	bsent. Yellow- ay be present.	4
			Excellent Total =	23	Good Total =	0	Fair Total =	7	Po	Poor Total =	1
Stream Ty	8	A1 A2 A3	A4 A5 A6 B1	B2	40 50 40 54 85 86 C1	C2	C3 C4 C5 C6 D3	D4 85-107	D5 D6	Grand Total =	A
Fair (Mod. Unstable) Poor (Linstable)	ar a	44.47	96-132 96-142 81-110 46-58 133+ 143+ 111+ 58+		61-78 65-84 69-88 61-78 51-61 79+ 85+ 89+ 79+ 62+	51-61	86-105 91-110 91-110 86-105 108-132 106+ 111+ 111+ 106+ 133+	133+	108-132 99-125 133+ 126+	Existing Stream Type =	
геаш	Туре	Stream Type DA3 DA4	DAS DA6 E3 E4 E5	9 3	F1 F2 F3 F4 F5	F6	G1 G2 G3 G4 G5	99	1	*Potential	
Good (Stable) Fair (Mod. Unstable) Poor (Unstable)		40-63 40-63 64-86 64-86 87+ 87+	40-63 40-63 40-63 50-75 50-75 64-86 64-86 76-96 76-96 87+ 87+ 87+ 97+ 97+	40-63 64-86 87+	60-85 60-85 85-110 85-110 90-115 86-105 86-105 111-125 111-125 116-130 106+ 106+ 126+ 126+ 131+	80-95 96-110 111+	40-60 40-60 85-107 85-107 90-112 61-78 61-78 108-120108-120113-125 79+ 79+ 121+ 121+ 126+	108-120 108-120 121+	MO	Modified Channel Stability Rating =	anne ing =
		1						١			

Geomorphic Analysis Check List

Site Name: Red River-S Date: 10/6/11

Semple From channel that way 5 RB only
was medium colored clay w
very little sand on top.

Sample From near LB on
the shelf was primarily
Sand, top portion was a
lighter colored sand and
soften portion was a darker
soften portion was a darker

Land clay mix.

I, a measurement

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1 1451 U/S 1440 D/S	Left.	Top of Bank (TB)	J	442	Bank Full (BF)	1	441	Water Surface (WS))	446
	Right	Top of Bank (TB)	J	444	Bank Full (BF)	J	443			
Section 2 1435 W/S	Left	Top of Bank (TB)	1	436	Bank Full (BF)	1	435	Water Surface (WS)	1	434
	Right	Top of Bank (TB)	- /	438	Bank Full (BF)		437			
Section 3 443 0/5	Left 1445 LB	Top of Bank (TB)	_	-	Bank Full (BF)	_	_	Water Surface (WS)	J	446
	Right	Top of Bank (TB)	J	448	Bank Full (BF)	J	447			
Section 4 1417 WS	Left	Top of Bank (TB)	~	-	Bank Full (BF)	_	_	Water Surface (WS)	1	450
	Right	Top of Bank (TB)		452	Bank Full (BF)	1	451			
Section 5	Left 1453LB	Top of Bank (TB)		-	Bank Full (BF)	-	_	Water Surface (WS)	7	454
	Right	Top of Bank (TB)	1	456	Bank Full (BF)	1	455			

Measurement	Unit		Value	
Manning's n	-	().035	0.05	0.05
Root Depth	(ft)		\times	
Root Density	(%)		\times	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)		3	
Eroding Bank in Study Reach ¹	(%)		75	
Bank Material Type	(sand, silt, clay)		X	- 1
Bank Material Stratification Score ²	-		×	ķ-
Distance from Bank Toe to Water Surface ³	(ft)		X	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

ltem	Completed	ltem	Completed
Velocity Measurements		Riparian Vegetation Worksheet	X
Depositional Features Worksheet	\times	Pfankuch Method	X
Channel Blockages Worksheet	X		

Sampling Checklist

Location	Collected	Label	GPS Pt #
Left Bank (LB)	\times	\times	X
Right Bank (RB)	X	X	X
Bed Surface (BED)	1	X	X
Bed Core (BED-C)	1	RR/432/BED-C-L	432
Bar (BAR)	X	X	X

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Site Name: Red River - 6

Date: 106/11

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Pic 421	Left LB	Top of Bank (TB)		/	Bank Full (BF)	/	420	Water Surface	\	/
Section 1 1414 4/5	Right	Top of Bank (TB)			Bank Full (BF)	_	_	(WS)		/
Piz 423	Left 1426 LR	Top of Bank (TB)			Bank Full (BF)	/	422	Water Surface		
Section 2	Right 1421 RR	Top of Bank (TB)			Bank Full (BF)	_	_	(WS)		
Dic 425	Left 1424 L R	Top of Bank (TB)	/	\setminus	Bank Full (BF)	1	424	Water Surface		
Section 3 1427 11/5 1423 11/5	Right	Top of Bank (TB)			Bank Full (BF)	_	_	(WS)		
P.2 428	Left 1479LB	Top of Bank (TB)			Bank Full (BF)	/	426	Water Surface		
Section 4	Right	Top of Bank (TB)			Bank Full (BF)	_	_	(WS)		
Pie 431	Left.	Top of Bank (TB)	1		Bank Full (BF)	1	430	Water Surface		
Section 5 1431 145 1432 D/S	Right 434 kB	Top of Bank (TB)			Bank Full (BF)		1	(WS)		

Measurement	Unit		Value	
Manning's n	-	Channel	LOB	ROB
Root Depth	(ft)		X	
Root Density	(%)		X	
Surface Cover below Bankfull Level at Eroding Bank Locations	(%)	2	print.	
Eroding Bank in Study Reach ¹	(%)	90	77	
Bank Material Type	(sand, silt, clay)		X	
Bank Material Stratification Score ²			X	
Distance from Bank Toe to Water Surface ³	(ft)		X	

Notes: ¹Eroding percentage x study reach length (from GIS) x 2 banks = length of eroding bank line in study reach

Rosgen Method Checklist

Item	Completed	Item	Completed
Velocity Measurements	\times	Riparian Vegetation Worksheet	X
Depositional Features Worksheet	X	Pfankuch Method	X
Channel Blockages Worksheet	X		

Sampling Checklist

Location	Collected	Label	GPS Pt#
Left Bank (LB)	X	\times	X
Right Bank (RB)	X	X	X
Bed Surface (BED)	X	X	X
Bed Core (BED-C)		RR/427/BED-C-LB	427 -
Bar (BAR)	X	X	X

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

Sample Labeling: River Abbreviation / GPS Point # / Sampling Location Abbreviation

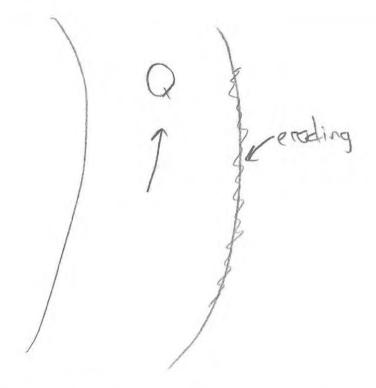
Pic 1426

²+5 for any stratification, +10 for multiple layers above bank full mark

³Negative number indicates water surface is below bank toe

Site Name: Red River near Linderwood Dr

SKETCH



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)	J	(58	Bank Full (BF)	1	127	Water Surface	/	
Section 1	Right	Top of Bank (TB)		124	Bank Full (BF)	1	125	(WS)	1	120
Section 2	Left	Top of Bank (TB)		119	Bank Full (BF)	/	150	Water Surface	,	13.
Section 2	Right	Top of Bank (TB)	1	(23	Bank Full (BF)	1	122	(WS)	1	121
Section 2	Left	Top of Bank (TB)		114	Bank Full (BF)	/	115	Water Surface	1	
Section 3	Right	Top of Bank (TB)	1	111	Bank Full (BF)		115	(WS)	J	113
Section 4	Left	Top of Bank (TB)	/	FOY	Bank Full (BF)	1	106	Water Surface	/	100
Section 4	Right	Top of Bank (TB)	/	110	Bank Full (BF)	1	109	(WS)		108
Soction F	Left	Top of Bank (TB)	1	105	Bank Full (BF)	1	104	Water Surface	/	100
Section 5	Right	Top of Bank (TB)	1	101	Bank Full (BF)		(02	(WS)		(03

Measurement	Unit	Value
Manning's n at Bank Full Condition		0.03
Root Depth	(ft)	1,
Root Density	(%)	15
Eroding Bank Surface Cover	(%)	10
Eroding Bank Length	(ft)	260
Bank Material Type	(sand, silt, clay)	clay
Bank Material Stratification Score ¹	-	0
Distance from Bank Toe to Water Surface ²	(ft)	8P.0

Notes: ¹+5 for any stratification, +10 for multiple layers above bank full mark ²Negative number indicates water surface is below bank toe.

Rosgen Method Checklist

Item	Completed?
Velocity Measurements Taken	1
Depositional Features Noted on Worksheet	1
Channel Blockages Noted on Worksheet	1
Pfankuch Method Completed	/

Sampling Checklist

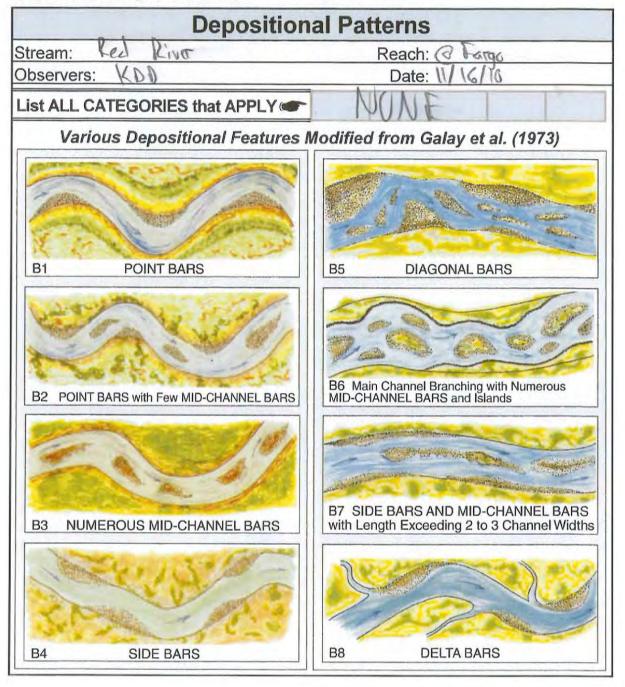
Location	Collected	Label	GPS Pt #
Left Bank (LB)	1	RR/117/LB	117
Right Bank (RB)	J	RR/116/RB	116
Bed (BED)	1	RR/[18/8ED	118
Bar – Armor (B-A)	-	-	-
Bar - Sub Armor (B-SA)	-	_	-

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

Worksheet 3-1. Riparian vegetation composition/density used for channel stability assessment (Rosgen, 2006b).

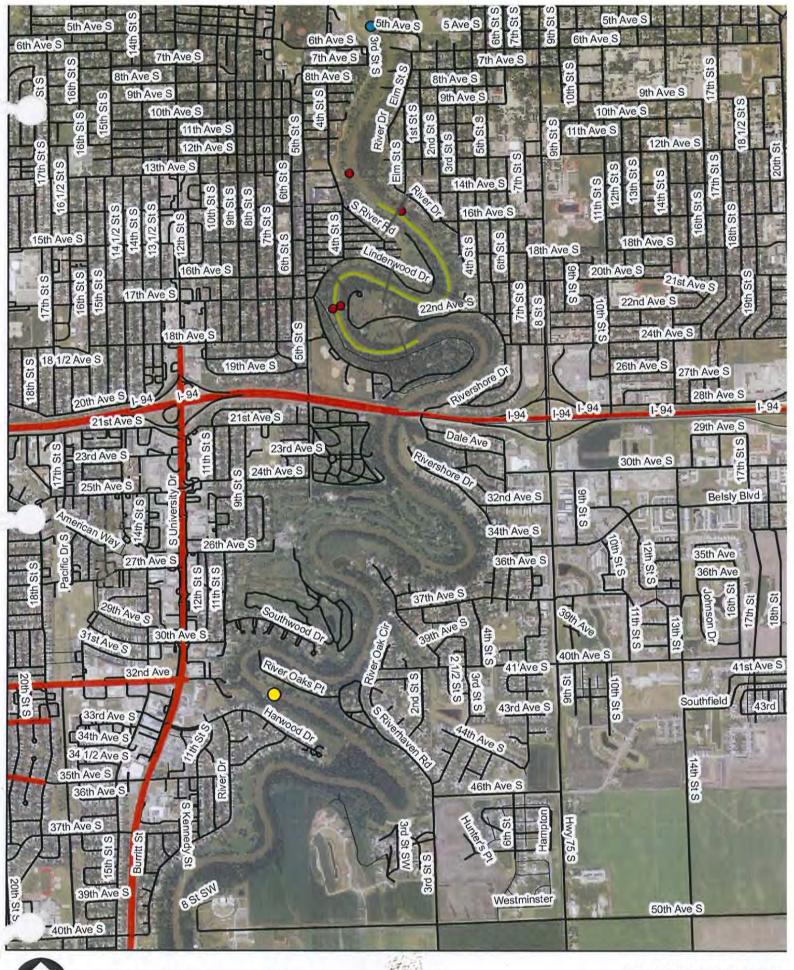
			Riparian \	/egetation	
St	ream: R	ed Riv	79)	Location: @ Fara	6
OI	oservers:	KDD	Reference reach	Disturbed (impacted reach) Date:	/16/10
sp	risting ecies mposition:		4	Potential species composition:	
c	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition
1. Overstory	Canopy layer	5% w/o. 1 coves: 80% w/ exxes	2016 W/s	- Eve	180
					100%
2. Understory	Shrub layer		75	Prince	-94)10i
					100%
evel	Herbaceous		10		100
3. Ground level	Leaf or needle litter		10	Remarks: Condition, vigor and/or usage of existing reach:	100%
	Bare ground		80	-	
*Ba	ased on crowr ased on basal arface area.		Column total 100%		

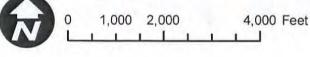
Worksheet 3-5. Depositional patterns used for stability assessment interpretations (modified from Galay *et al.*, 1973; Rosgen, 1996, 2006b).



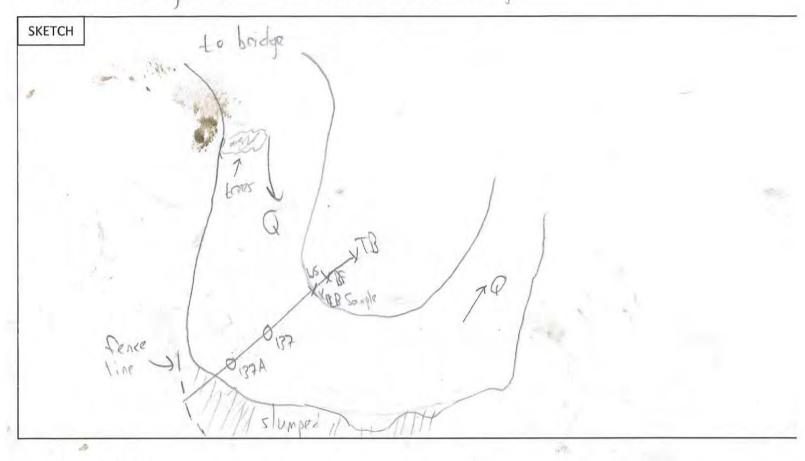
		Channel Blockages	
Stre	eam: Rud	River Location: @ Fargo	
Obs	servers: 4	DB Date: 11/16/10	
	scription/ tent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check / all that apply
D1	None	Minor amounts of small, floatable material.	Г
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	X
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	Г
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	Г
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	F
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	Г
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	Г
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	г

Excellent Range Description Range Description Range Description Descri	Stream			Loc	ocation:	Valley Type:	1	Observers:		J	Date:	
Bears door production Rating Description Reservable by Bears and Productive Reservable by Bears Reservable by Bears Reservable by Reservable	-eoc	Kov	Category	Excellent				Fair		P	oor	
Hardium Hasser House gradient -G076. All the violence of past or future Bank slope gradient -G076. Bank slope gradient or large causing sediment Bank slope gradient or large -G076. Bank slope gradient or large -G076. Bank slope gradient or large -G076. Bank slope gradient -G	no	vey	category	Description		Description	Rating		Rating	Descript	tion	Rating
Production of the production	KS		Landform slope	Bank slope gradient <30%		Bank slope gradient 30-40%.		Bank slope gradient 40–60%.		nk slope gradient > k	60%.	(0)
Debters Immediate Charmel area. 2 Activity Fewer species from a potential minerial and the charmel area. 3 Charmel area. 3 Charmel area. 4 Activity Fewer species from a Few bases. Species from a Fewer species from a Fewe	Ban	700	Mass erosion	No evidence of past or fu mass erosion.		Infrequent. Mostly healed over. Low future potential.		Frequent or large, causing sediment nearly yearlong.	1	equent or large, causing along OR imminent.	ng sediment nearly danger of same.	12
Page	ber	11/1	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.		Moderate to heavy amounts, mostly larger sizes.	0,5	derate to heavy amo	ounts, izes.	00
Bankful stage Bankful stag	dn		Vegetative bank protection	> 90% plant density. Vigor variety suggest a deep, d soil-binding root mass.	and	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.		50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	~	0% density plus fewers vigor indicating por shallow root mass.	er species and or, discontinuous	12
Basic rock	S		Channel	Bank heights sufficient to contable bankfull stage. Width/depth ratio of from reference width/depth ratio Bank-Height Ratio (BHR) = 1.		Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0-1.2. Bank Height Ratio (BHR) = 1.0-1.1.		Bankfull stage is not contained. Width/depth ratio departure from reference width/depth ratio = 1.2-1.4. Bank-Height Ratio (BHR) = 1.1-1.3.		nkfull stage is not containe nmon with flows less than 3 departure from reference 4. Bank-Height Ratio (BHR	ed; overbank flows are bankfull, Width/depth e width/depth ratio R) > 1,3.	4
Obstructions Recent and togs from the medded of control in the control	yue		Bank rock content	> 65% with large angular boulders, 12"+ common.		40–65%. Mostly boulders and small cobbles 6–12".	AMERICAN	20–40%. Most in the 3–6" diameter class.		0% rock fragments o 3" or less.	of gravel sizes,	(00)
Little or none. Infrequent raw A	er B		Obstructions to flow	Rocks and logs firmly imbe Flow pattern w/o cutting c deposition. Stable bed.		Some present causing erosive cross currents and minor pool filling. (Obstructions fewer and less firm.	^	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.		equent obstructions a use bank erosion year os full, channel migra	and deflectors arlong. Sediment ation occurring.	00
Common channel or no enlargement of the properties of positive of now gravel channel or point bars. A	том	1000	Cutting	Little or none, Infrequent banks <6".		Some, intermittently at outcurves and constrictions. Raw banks may be up to12".		Significant. Cuts 12–24" high. Root mat overhangs and sloughing evident.	1	nost continuous cuts h. Failure of overhar	s, some over 24" ngs frequent.	16
Surfaces rough. Surfaces and comers. Plane 1 Rounded comers and edges. 2 Comers and edges well rounded in all din and plant, surfaces rough. Surfaces smooth and flat. 2 Surfaces smooth and flat. 2 Surfaces rough. Surfaces rough. Surfaces smooth and flat. 3 Without both in the sacrated sizes tightly packed 1 Mostly dull, but may have <35% 2 Mixture angle and bright, i.e., 35–65% 3 Scoured surfaces. Consolidation Assorted sizes tightly packed 2 Moderately packed with some 4 Mostly looks assortment with no of particles Converlapping. Moderately packed with some 4 Mostly looks assortment with no of particles Converlapping. Moderately packed with some 4 Mostly looks assortment with no of particles Converlapping.			Deposition	in .		Some new bar increase, mostly from coarse gravel.	1007	Moderate deposition of new gravel and coarse sand on old and some new bars.		tensive deposit of pri- ticles. Accelerated b	edominantly fine bar development.	16
Surfaces dull, dark or stained. 1 Mostly dull, but may have <35% 2 Mixture range. 2 Mixture range. 3 Societal surfaces. 3 So			Rock angularity	Sharp edges and corners. surfaces rough.	Plane	Rounded comers and edges. Surfaces smooth and flat.		Corners and edges well rounded in 2 dimensions.		sil rounded in all dime ooth.	ensions, surfaces	(4)
Consolidation Assorted sizes tightly packed 2 Moderately packed with some of particles 2 Moderately packed with some of particles 3 Moderately packed with some of particles 3 Moderately packed with some of particles 3 Moderately packed 4 Mode			Brightness	Surfaces dull, dark or stai Generally not bright.		Mostly dull, but may have <35% bright surfaces.		Mixture dull and bright, i.e., 35–65% mixture range.	1 3 7	edominantly bright, > ured surfaces.	. 65%, exposed or	4
South of the position of the	шо	_	Consolidation of particles	Assorted sizes tightly pact or overlapping.		Moderately packed with some overlapping.		Mostly loose assortment with no apparent overlap.	1	packing evident. Lo sily moved.	ose assortment,	00
Scouring and Scour of deposition Scour at constrictions 12 30-50% affected Deposits and scour 18 More than 50% of flux or change near steepen. Some deposition	300		Bottom size distribution		~	Distribution shift light. Stable material 50-80%.		Moderate change in sizes, Stable materials 20-50%.		rrked distribution cha terials 0-20%,	ange. Stable	16
Aduatic Abundant growth moss-like, dark 1 Common. Algae forms in low velocity green perennial. In swift water too. 2 Present but spottly, mostly in green perennial. In swift water too. 1 Present but spottly, mostly in makes rocks slick. 3 Perennial types scane algae growth 3 <t< td=""><td>3</td><td></td><td>Scouring and deposition</td><td><5% of bottom affected b scour or deposition.</td><td></td><td>5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.</td><td>~</td><td>30–50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.</td><td></td><td>ive than 50% of the b Tux or change nearly</td><td>bottom in a state y yearlong.</td><td>24</td></t<>	3		Scouring and deposition	<5% of bottom affected b scour or deposition.		5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	~	30–50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.		ive than 50% of the b Tux or change nearly	bottom in a state y yearlong.	24
At A2 A3 A4 A5 A6 B1 B2 B3 B4 B5 B6 C1 C2 C3 C4 C5 C6 D3 D4 D5 D6 A447 A447 G1-129 G6-125 G6-125 G6-125 G6-125 G7-120 G			Aquatic vegetation	Abundant growth moss-like green perennial. In swift wa		Common, Algae forms in low velocity and pool areas. Moss here too.		Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.		rennial types scarce or en, short-term bloom	or absent. Yellow- n may be present.	0
A1 A2 A3 A4 A5 A6 B1 B2 B3 B4 B5 B6 C1 C2 C3 C4 C5 C6 D3 D4 D5 D6 38-43 38-43 38-49 60-85 50-80 38-45 38-46 40-60 40-64 48-68 40-60 38-50 38-50 50-80 58-107 88-107				Excellent To			2	Fair Total =	36		Poor Total =	2
38-43 38-43 66-95 60-95 60-95 60-95 60-96 60-95 60-96	ream		A1 A2	A4		B3 B4 B5 B6 C1		C4 C5 C6 D3		90	Grand Total =	8
DA3 DA4 DA5 DA6 E3 E4 E5 F3 F4 F5 F6 G1 G2 G3 G4 G5 G6 40-63 40-63 40-63 60-85 60-85 60-81 60-10 60-11 80-95 40-60 40-60 85-107 80-112 85-107 64-86 64-86 44-86 76-86 76-86 84-86 86-86 64-86 64-86 86-105 80-10	od (Stab (Mod. Un	0		60-95 60-95 96-132 96-142 133+ 143+	38-45 46-58 59+	40-60 40-64 48-68 40-60 38-50 61-78 65-84 69-88 61-78 51-61 79+ 85+ 89+ 79+ 62+		70-90 70-90 80-85 85-107 91-110 91-110 86-105 108-132 111+ 111+ 106+ 133+		99-125 126+	Existing	-
64-86 64-86 64-86 64-86 64-86 76-96 76-96 76-96 76-96 76-97 87+ 108+ 108+ 126+ 126+ 131+ 111+ 78+ 78+ 121+ 121+ 127+ 128+ 121+ 121+ 128+ 121+ 121+ 128+ 121+ 121	ream d (Stah	(a)	DA3 DA4	DA6 E3	E5 50-75	F1 F2 F3 F4 F5 80-85 85-110 85-110 90-115		G2 G3 G4 G5 40-60 85-107 85-107 90-112	-		*Potential Stream Type =	
	(Mod. Uh		64-86 64-86 87+ 87+	64-86 64-86 64-86 87+ 87+ 87+	76-96	86-105 86-105 111-125 111-125 116-130 106+ 106+ 126+ 128+ 131+		61-78 108-120 108-120 78+ 121+ 121+	108-120	<	Modified Channe Stability Rating =	ani





Site Name: Sheyenne River @ 40th Ave Bridge



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)	1	148	Bank Full (BF)	1	149	Water Surface	- 1	11-2
Section 1	Right	Top of Bank (TB))	~	Bank Full (BF)	-	-	(WS)	V	120
Santian 2	Left	Top of Bank (TB)	/	143	Bank Full (BF)	1	144	Water Surface	,	1115
Section 2	Right	Top of Bank (TB))	-	Bank Full (BF)	-	_	(WS)		145
	Left	Top of Bank (TB)	J	138	Bank Full (BF)	1	139	Water Surface	1	1171
Section 3	Right	Top of Bank (TB)	-	_	Bank Full (BF)	-	-	(WS)	/	141
Castian A	Left	Top of Bank (TB)	1	138	Bank Full (BF)	/	134	Water Surface	er Surface	135
Section 4	Right	Top of Bank (TB)	-	_	Bank Full (BF)	-	~	(WS)		100
Cartina F	Left	Top of Bank (TB)	1	129	Bank Full (BF)	V	130	Water Surface	1	121
Section 5	Right	Top of Bank (TB)		_	Bank Full (BF)	_	~	(WS)	\checkmark	DI

Measurement	Unit	Value
Manning's n at Bank Full Condition	-	0.03
Root Depth	(ft)	2,
Root Density	(%)	5
Eroding Bank Surface Cover	(%)	90 about 8F
Eroding Bank Length	(ft)	250'
Bank Material Type	(sand, silt, clay)	clay
Bank Material Stratification Score ¹	-	_
Distance from Bank Toe to Water Surface ²	(ft)	2.3'

Notes: ¹+5 for any stratification, +10 for multiple layers above bank full mark ²Negative number indicates water surface is below bank toe.

Rosgen Method Checklist

Item	Completed?
Velocity Measurements Taken	J
Depositional Features Noted on Worksheet	J
Channel Blockages Noted on Worksheet	J
Pfankuch Method Completed	J

Sampling Checklist

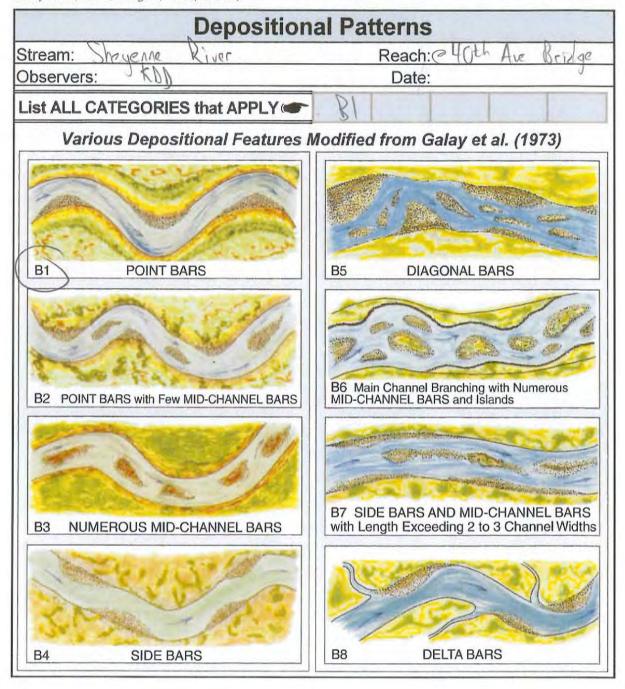
Location	Collected	Label	GPS Pt #
Left Bank (LB)		2/170/TB	140
Right Bank (RB)	_	_	_
Bed (BED)	J	S/137/BED	137
Bar – Armor (B-A))		_
Bar - Sub Armor (B-SA)		_	-

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

Worksheet 3-1. Riparian vegetation composition/density used for channel stability assessment (Rosgen, 2006b).

			Riparian \	/egetation	
St	ream:	neyenne	Z	Location: UO+L A	e Bridge
O	oservers:	KDO	Reference reach	Disturbed	/17/10
sp	risting ecies mposition:			Potential species composition:	
c	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition
1. Overstory	Canopy layer	15 Wo leaves (5 W)	1.0	tree- (021)	100
					100%
2. Understory	Shrub layer		NONE		
evel	Herbaceous		10 P	Lall grow	100%
3. Ground level	Leaf or needle litter		_	Remarks: Condition, vigor and/or usage of existing reach:	100%
	Bare ground		. (()		
*Ba	ased on crowingsed on basa arface area.		Column total 100%		

Worksheet 3-5. Depositional patterns used for stability assessment interpretations (modified from Galay *et al.*, 1973; Rosgen, 1996, 2006b).



		Channel Blockages	
Stre	eam: Sleven	Me Location: Q 40th Ave &	idge
Obs	servers: 1	Date: \(\/\(7/\(6\)	J
	scription/ tent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check / all that apply
D1	None	Minor amounts of small, floatable material.	Г
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	Г
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	X
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	Г
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	П
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	г
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	Г
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	

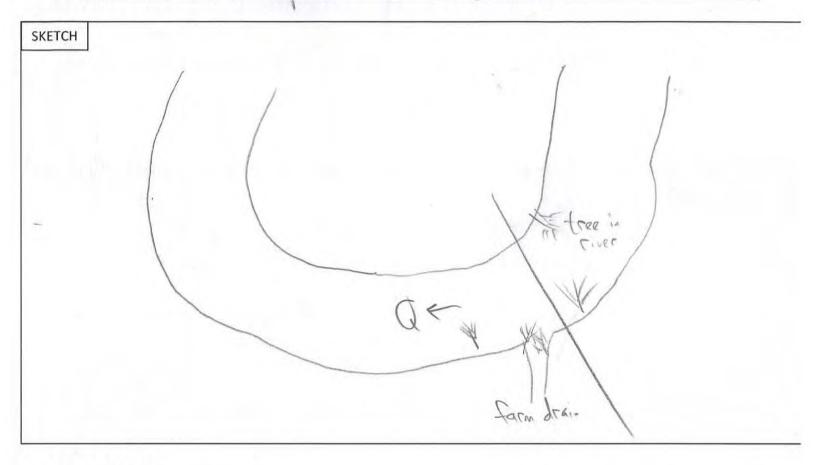
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h (1975) channel stability rating J
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Worksheet 3-10. Pfankuch (1975) channel stability rating J

Landform Bank slope grassope transform Bank slope grassope grassop					Chaci vela.			Date:	
Landform slope Mass erosion Debris jam potential Vegetative bank Protection Channel capacity Bank rock content Obstructions to flow Cutting Cutting Cutting Brightness Consolidation of particles Bottom size Bottom size	nt		Good	Ī	Fair			Poor	
Landform slope 2 Mass erosion 3 Debris jam potential 4 Vegetative bank protection 5 Channel capacity 6 Bank rock content 7 Obstructions to flow 8 Cutting 9 Deposition 10 Rock angularity 11 Brightness 12 Consolidation of particles 13 Bottom size distribution	Description Ra	Rating D	Description	Rating	Description	Rating	Description	ption	Rating
2 Mass erosion 3 Debris jam potential 4 Vegetative bank protection 5 Channel capacity 6 Bank rock content 7 Obstructions 7 Obstructions 8 Cutting 9 Deposition 10 Rock 11 Brightness 11 Bottom size distribution	Bank slope gradient <30%.	2 Bank slope g	Bank slope gradient 30-40%.	P	Bank slope gradient 40-60%.	9	Bank slope gradient > 60%	» 80%.	00
3 Debris jam potential 4 Vegetative bank bank bank capacity 6 Bank rock content 7 Obstructions to flow angularity 11 Brightness 12 Consolidation of particles distribution size	of past or future	Infrequent. Mostly h Low future potential	Infrequent. Mostly healed over. Low future potential.	9	Frequent or large, causing sediment nearly yearlong.	o	Frequent or large, causing sediment hearly yearlong OR imminent danger of same.	sing sediment nearly at danger of same.	(2)
4 bank bank bank bank bank corpection capacity 6 Channel 7 Obstructions 7 Obstructions 10 Deposition 10 Rock 11 Brightness 12 Consolidation 12 of particles distribution size bancom size distribution 12 Deposition of particles 13 Bottom size distribution 15 Deposition 16 Deposition 17 Of Deposition 18 Deposition 18 Deposition 19 Of Deposition 19		Present, but and limbs.	Present, but mostly small twigs and limbs.	4	Moderate to heavy amounts, mostly larger sizes.	9	Moderate to heavy amounts, predominantly larger sizes.	nounts, sizes.	00
6 Bank rock content 7 Obstructions to flow 8 Cutting 9 Deposition 10 Rock angularity 11 Brightness 13 Bottom size 13 distribution	> 90% plant density. Vigor and variety suggest a deep, dense soil-binding root mass.	3 or less vigor sugge or deep root mass.	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	9	50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	O	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	wer species and loor, discontinuous s.	12
6 Bank rock content 7 Obstructions to flow 8 Cutting 9 Deposition 10 Rock angularity 11 Brightness 13 Bottom size distribution size	82 -:	Bankfull stage is Width/depth ra reference width Bank Height Ra	Banktull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0-1.2. Bank Height Ratio (BHR) = 1.0-1.1.	2	Bankfull stage is not contained. Width/depth ratio departure from reference width/depth ratio = 1.2-1.4. Bank-Height Ratio (BHR) = 1.1-1.3.	ო	Bankfull stage is not contained; overbank flows are common with flows less than bankfull. Width/depth robio departure from reference width/depth ratio 7.1.4; Bank-Height Ratio (BHRS) > 1.3.	ned, overbank flows are in bankfull. Widh/depth nce width/depth ratio HR) > 1.3.	4
7 Obstructions 8 Cutting 9 Deposition 10 Rock 10 Rock 11 Brightness 12 Consolidation 12 of particles 13 Bottom size 13 distribution		2 40–65%. Mostly bou	40-65%. Mostly boulders and small cobbles 6-12".	4	20–40%. Most in the 3–6" diameter class.	9	<20% rock fragments of gravel sizes, 1-3" or less.	of gravel sizes,	8
9 Deposition 10 Rock 11 Brightness 12 Consolidation 13 Bottom size 13 distribution	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.	Some present currents and Obstructions	Some present causing erosive cross currents and minor pool filling. (Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	9	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	s and deflectors earlong. Sediment gration occurring.	œ
9 Deposition 10 Rock 11 Brightness 12 Consolidation 12 of particles 13 Bottom size 13 distribution	one. Infrequent raw	Some, intermitte 4 and constriction may be up to12	Some, intermittently at outcurves and constrictions. Raw banks may be up to12".	9	Significant. Cuts 12–24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	its, some over 24" angs frequent.	9
10 Rock angularity 11 Brightness 12 Consolidation 12 of particles 13 distribution 13 distribution 10	Little or no enlargement of channel or point bars.	Some new bar incre from coarse gravel.	Some new bar increase, mostly from coarse gravel.	80	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development	predominantly fine bar development.	16
11 Brightness Consolidation of particles 13 Bottom size	d comers. Plane	Rounded comers and ed	Rounded comers and edges. Surfaces smooth and flat.	2	Corners and edges well rounded in 2 dimensions.	3	Well rounded in all dimensions, surfaces smooth.	nensions, surfaces	4
12 Consolidation of particles 13 Bottom size distribution	Surfaces dull, dark or stained. Generally not bright.	Mostly dull, but bright surfaces	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35–65% mixture range.	3	Predominantly bright, > 65%, exposed scoured surfaces.	> 65%, exposed or	4
13 Bottom size distribution	tightly packed	2 Moderately p overlapping.	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	9	No packing evident, Loose assortment, easily moved.	cose assortment,	00
	No size change evident. Stable amaterial 80–100%.	Distribution shift material 50–80%	Distribution shift light. Stable material 50–80%.	80	Moderate change in sizes. Stable materials 20–50%.	12	Marked distribution change. Stable materials 0-20%.	nange. Stable	16
14 Scouring and deposition	<5% of bottom affected by scour or deposition.	5-30% affected and where gr Some deposi	5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	12	30–50% affected. Deposits and soour at obstructions, constrictions and bends. Some filling of pools.	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	bottom in a state rly yearlong.	24
15 Aquatic Abundant vegetation green pers	Abundant growth moss-like, dark green perennial. In swift water too.	Common. Alga	Common, Algae forms in low velocity and pool areas. Moss here too.	7	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	က	Perennial types scarce or absent. Yellow- green, short-term bloom may be present.	e or absent. Yellow- m may be present.	4
	Excellent Total =	7	Good Total =	20	Fair Total =	0		Poor Total =	4
Stream Type A1 A2 A3 A Cood (Stable) 38-43 38-43 54-90 60-	A4 A5 A6 B1 B2 60-95 60-80 38-45 38-4	B2 B3 B4 38-45 40-60 40-64	B5 B6 C1 48-68 40-60 38-50	38-50	C3 C4 C5 C6 D3 60-85 70-90 70-90 60-85 85-107	D4 85-107	D5 D6 85-107 67-98	Grand Total =	88
Fair (Mod, Unstable) 44-47 44-47 91-129 96-1 Poor (Unstable) 48+ 48+ 130+ 13	44-47 91-129 96-132 96-142 81-110 46-58 46 48+ 130+ 133+ 143+ 111+ 59+ 56	46-58 61-78 65-84 59+ 79+ 85+	69-88 61-78 51-61 89+ 79+ 62+	51-61	86-105 91-110 91-110 86-105 108-1321 106+ 111+ 111+ 106+ 133+	108-132	108-132 99-125 133+ 126+	Existing Stream Type =	
Stream Type DA3 DA4 DA5 DA Good (Stable) 40-63 40-63 40-63 40-	DA6 E3 E4 E5 E6 40-63 50-75 50-75 40-6	F1 F2 3 60-85 60-85	F3 F4 F5 85-110 85-110 90-115	F6 80-95	G1 G2 G3 G4 G5 40-60 85-107 85-107 90-112	G6		*Potential Stream Type =	
Fair (Mod Unstable) 64-86 64-86 64-86 64- Poor (Unstable) 87+ 87+ 87+ 87	64-86 64-86 76-96 76-96 64 87+ 87+ 97+ 87+ 8	64-86 86-105 86-105 87+ 106+ 106+	86-105 111-125 111-125 116-130 8 106+ 126+ 126+ 131+	96-110	61-78 61-78 108-120108-120113-1251 78+ 78+ 121+ 121+ 126+	108-120		Modified Channel Stability Rating =	nne ng =
					*Rating is adjusted to potential stream type, not existing	tream	type, not existing.		



2,000

Site Name: Red River Upstocon of Wild Rice



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface		
Section 1	Right	Top of Bank (TB)			Bank Full (BF)			(WS)		
Saction 2	Left	Top of Bank (TB)	J	170	Bank Full (BF)	1	171	Water Surface	1	1
Section 2	Right	Top of Bank (TB)			Bank Full (BF)			(WS)	J	135
Castian 2	Left	Top of Bank (TB)	J	(7)	Bank Full (BF)	1	168	Water Surface (WS)	J	
Section 3	Right	Top of Bank (TB)	J	164	Bank Full (BF)	J	165			166
Section 4	Left	Top of Bank (TB)	J	162	Bank Full (BF)	J	161	Water Surface		1/0
Section 4	Right	Top of Bank (TB)	J	[58	Bank Full (BF)	J	159	(WS)	J	160
Sastian F	Left	Top of Bank (TB)	J	156	Bank Full (BF)	1	155	Water Surface	1	1011
Section 5	Right	Top of Bank (TB)	J	152	Bank Full (BF)	J	(53	(WS)	V	12

Measurement	Unit	Value
Manning's n at Bank Full Condition	-	0.03
Root Depth	(ft)	Z
Root Density	(%)	5
Eroding Bank Surface Cover	(%)	15
Eroding Bank Length	(ft)	450
Bank Material Type	(sand, silt, clay)	silt/clay
Bank Material Stratification Score ¹	-	_
Distance from Bank Toe to Water Surface ²	(ft)	

Notes: ¹+5 for any stratification, +10 for multiple layers above bank full mark ²Negative number indicates water surface is below bank toe.

Rosgen Method Checklist

Item	Completed?
Velocity Measurements Taken	1
Depositional Features Noted on Worksheet	J
Channel Blockages Noted on Worksheet	J
Pfankuch Method Completed	

Sampling Checklist

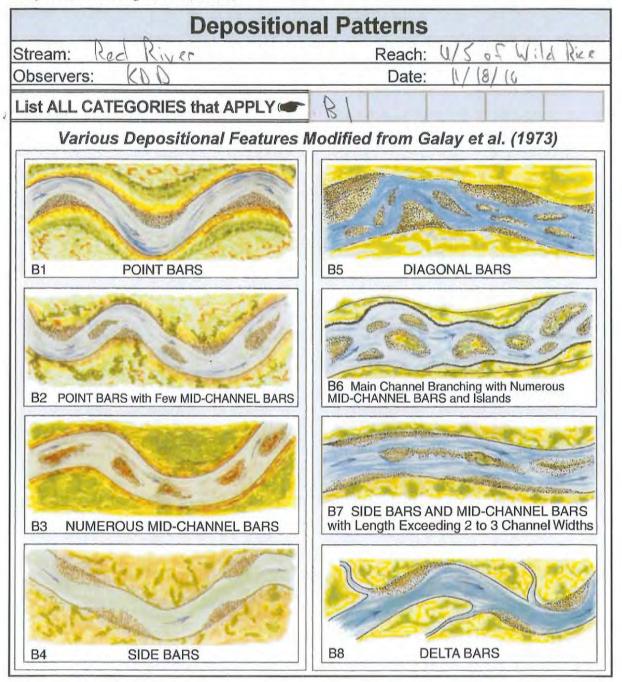
Location	Collected	Label	GPS Pt #
Left Bank (LB)	1	RR/173/18	173
Right Bank (RB)	1	RR/171/RB	174
Bed (BED)	1	RR/174/BED	174
Bar – Armor (B-A)	_		_
Bar - Sub Armor (B-SA)		_	_

Abbreviation
RR
S
LR
RUSH
M
В
SD
WR
WC

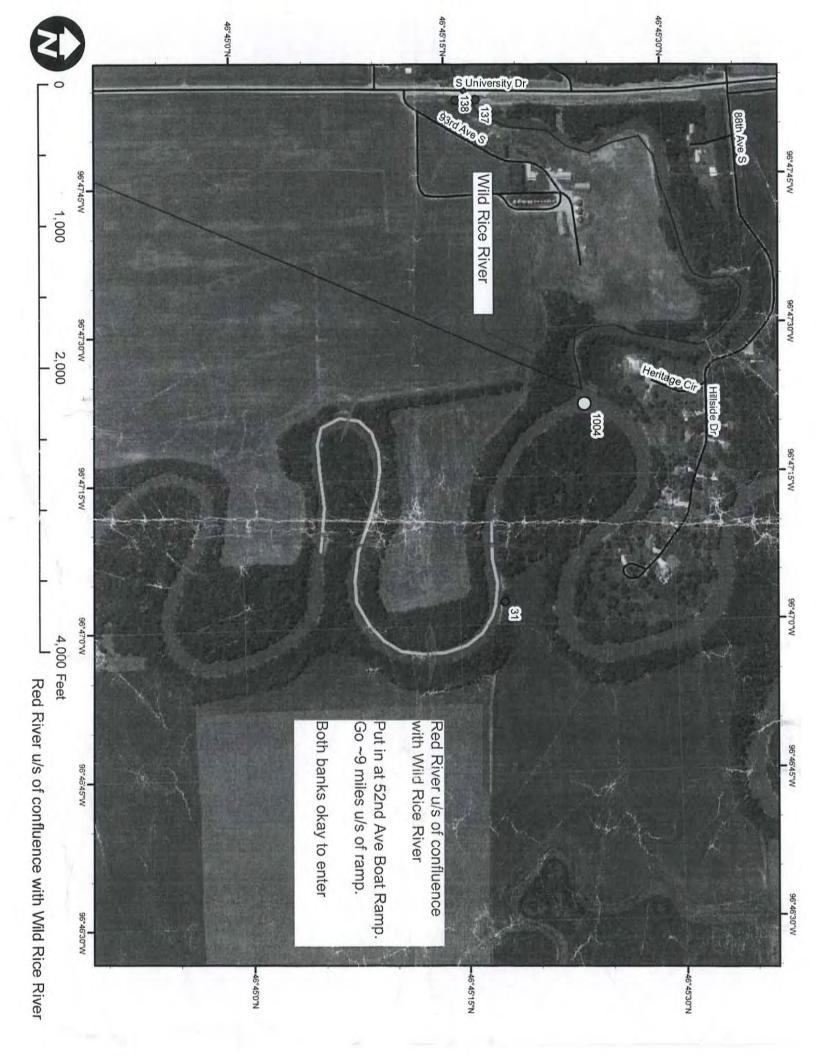
Worksheet 3-1. Riparian vegetation composition/density used for channel stability assessment (Rosgen, 2006b).

			Riparian \	/egetation	
St	ream: Re	River		Location: WS of	Wild Rice
Observers: KDD			Reference reach	Disturbed (impacted reach) Date:	1/18/10
sp	ecies	- 14	mall our bushes	Potential species composition:	
	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition
Overstory	Canopy layer	20% w/o (eaves 85% w/	i.i.		700
		(Bang 2			100%
2. Understory	Shrub layer		60%	Cocklebuccs	
		<i> </i>			100%
evel	Herbaceous		,		
3. Ground level	Leaf or needle litter		_	Remarks: Condition, vigor and/or usage of existing reach:	100%
10.2	Bare ground		/00		
*Ba	ased on crow ased on basa urface area.		Column total 100%		

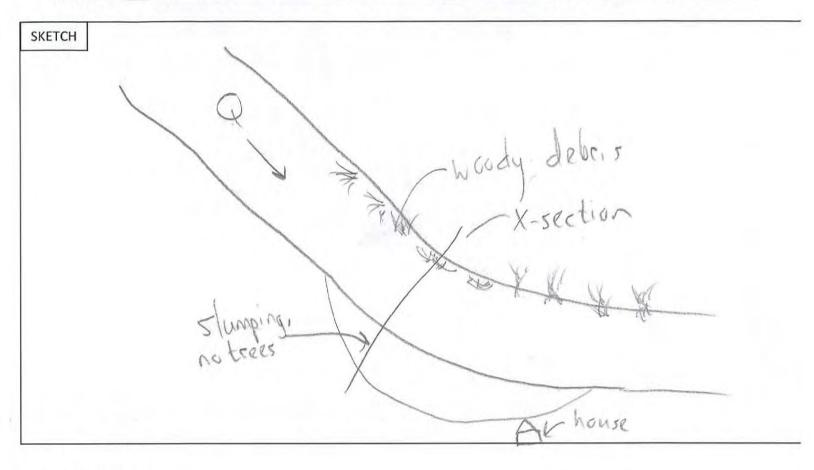
Worksheet 3-5. Depositional patterns used for stability assessment interpretations (modified from Galay *et al.*, 1973; Rosgen, 1996, 2006b).



Channel Blockages								
Stre	eam: Red	River Location: U/S of Wild	Rice					
Obs	servers: KD	Date: \\/(\theta/\to						
	scription/ tent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime						
D1	None	Minor amounts of small, floatable material.	Г					
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	Г					
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	Г					
D4	active channel cross-section area.							
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	Г					
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	Г					
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г					
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	г					
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г					
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.						



Site Name: Red River 2mi U/S of 52rd Ave Book Counch



Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
C	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface		
Section 1	Right	Top of Bank (TB)			Bank Full (BF)			(WS)		
Castian 2	Left	Top of Bank (TB)			Bank Full (BF)	1		Water Surface	1	
Section 2	Right	Top of Bank (TB)	J	204	Bank Full (BF)	J	206	(WS)	J ·	207
Castian 2	Left	Top of Bank (TB)	J	199	Bank Full (BF)	V	200	Water Surface	J	100
Section 3	Right	Top of Bank (TB)	J	202	Bank Full (BF)	J	201	(WS)		1-18
Saatian 1	Left	Top of Bank (TB)	J	192	Bank Full (BF)	1	143	Water Surface	1	1011
Section 4	Right	Top of Bank (TB)	1	195	Bank Full (BF)	J	196	(WS)	J	199
Castian F	Left	Top of Bank (TB)	J	381	Bank Full (BF)	J	F3)	Water Surface	1	188
Section 5	Right	Top of Bank (TB)	>	189	Bank Full (BF)	J.	190	(WS)		Po

Measurement	Unit	Value
Manning's n at Bank Full Condition		0.035
Root Depth	(ft)	('
Root Density	(%)	5%
Eroding Bank Surface Cover	(%)	90%
Eroding Bank Length	(ft)	N381
Bank Material Type	(sand, silt, clay)	Silt/clay
Bank Material Stratification Score ¹	-	-)
Distance from Bank Toe to Water Surface ²	(ft)	3.2'

Notes: ¹+5 for any stratification, +10 for multiple layers above bank full mark ²Negative number indicates water surface is below bank toe.

Rosgen Method Checklist

ltem	Completed?				
Velocity Measurements Taken	No <	toc	cold	For	AGCP
Depositional Features Noted on Worksheet					
Channel Blockages Noted on Worksheet					
Pfankuch Method Completed					

Sampling Checklist

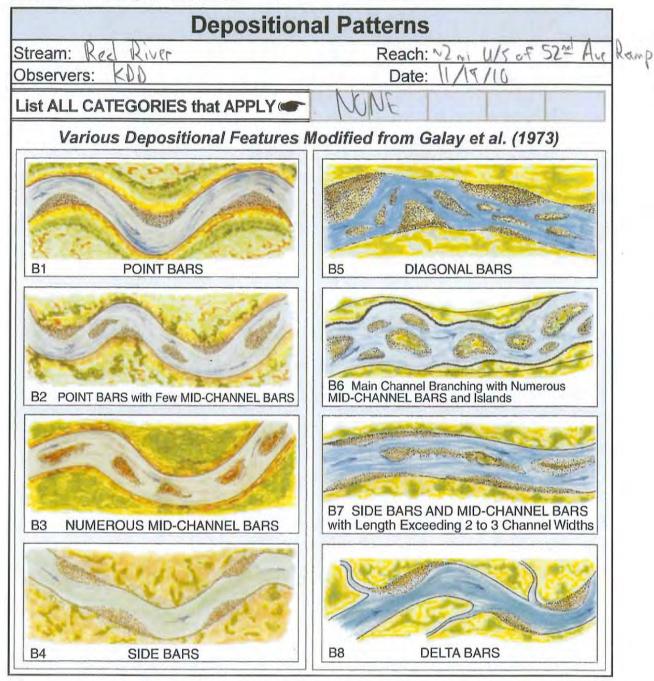
Location	Collected	Label	GPS Pt #
Left Bank (LB)	J	RR/208/LB	208
Right Bank (RB)	J	RR/205/RB	205
Bed (BED)		R8/515/8ED	515
Bar – Armor (B-A)	-	-	- 1
Bar - Sub Armor (B-SA)	-	_	-

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

Worksheet 3-1. Riparian vegetation composition/density used for channel stability assessment (Rosgen, 2006b).

		I	Riparian \	/egetation	
St	ream: Red	River		Location: 522 Ave	of Boat Romp
Ol	oservers: K	00	Reference reach	Disturbed (impacted reach) Date:	1/19/10
sp	tisting CO ecies mposition:	ckleburs,	tall	Potential species composition:	
	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition
1. Overstory	Canopy layer	1%	1%	1 tree	
7		//////	COL	cocklehure	100%
2. Understory	Shrub layer		98	- Fall Fraze	70
					100%
evel	Herbaceous		-		
3. Ground level	Leaf or needle litter		-	Remarks: Condition, vigor and/or usage of existing reach:	100%
SITIO	Bare ground		01		
*Ba	ased on crowr ased on basal urface area.		Column total 100%		

Worksheet 3-5. Depositional patterns used for stability assessment interpretations (modified from Galay *et al.*, 1973; Rosgen, 1996, 2006b).



Channel Blockages							
	1 . 0	iver Location: "2 mi U/S of 52"	& Auc Re				
Obs	ervers: KD	Date: 11/19/10					
	scription/ ent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check all that apply				
D1	None	Minor amounts of small, floatable material.	Г				
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	×				
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	Г				
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	Г				
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	Г				
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	Г				
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г				
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	Г				
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г				
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.					

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Stream:			Location:		Valley Type:		Observare:			Date:	
Loca-	Vou		Excel				Fair			Poor	
tion hey	vey	category	Description	Rating	Description	Rating	Description	Rating	Descr		Rating
ks	+	Landform slope	Bank slope gradient <30%.	2	Bank slope gradient 30-40%.	4	Bank slope gradient 40–60%.	9	Bank slope gradient > 60%	> 60%.	80
Ban	2	Mass erosion	No evidence of past or future mass erosion.	60	Infrequent. Mostly healed over. Low future potential.	9	Frequent or large, causing sediment nearly yearlong.	6	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	using sediment nearly ant danger of same.	12
ber	3	Debris jam potential	Essentially absent from immediate channel area.	(2)	Present, but mostly small twigs and limbs.	4	Moderate to heavy amounts, mostly larger sizes.	9	Moderate to heavy amounts, predominantly larger sizes.	mounts,	00
dη	4	Vegetative bank protection	 90% plant density. Vigor and variety suggest a deep, dense soil-binding root mass. 	က	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	6	50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	6	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	ewer species and poor, discontinuous ss.	12
S	2	Channel capacity	Bank heights sufficient to contain the bankful stage. Width/depth ratio departure from reference width/depth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.	(Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0–1.2. Bank Height Ratio (BHR) = 1.0–1.1.	2	Bankfull stage is not contained. Width/depth ratio departure from reference width/depth ratio = 1.2-1.4. Bank-Height Ratio (BHR) = 1.1-1.3.	6	Bankfull stage is not contained; overbank flows are common with flows less than bankful. Width/depth ratio departure from reference width/depth ratio 1.4, Bank-Heigrt Ratio (B-HR) > 1.3.	lined, overbank flows are ren bankfull. Widhidepth rnce widhidepth ratio BHR) >1.3.	4 (
ank	9	Bank rock content	> 65% with large angular boulders. 12"+ common.	2	40–65%. Mostly boulders and small cobbles 6–12".	4	20–40%. Most in the 3–6" diameter class.	9	<20% rock fragments of gravel sizes, 1-3" or less.	s of gravel sizes,	8
er B	7	Obstructions to flow	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows (causing bank cutting and pool filling.)	(0)	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	is and deflectors yearlong. Sediment igration occurring.) ∞
MoJ	60	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcurves and constrictions. Raw banks may be up to12".	9	Significant. Cuts 12–24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	uts, some over 24" hangs frequent.	(4)
	6	Deposition	Little or no enlargement of channel or point bars.	(4)	Some new bar increase, mostly from coarse gravel.	œ	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development.	predominantly fine d bar development.	16
	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	- '	Rounded comers and edges. Surfaces smooth and flat.	2	Corners and edges well rounded in 2 dimensions.	3	Well rounded in all dimensions, surfaces smooth.	imensions, surfaces	4
	11	Brightness	Surfaces dull, dark or stained. Generally not bright.	0	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35–65% mixture range.	8	Predominantly bright, scoured surfaces.	, > 65%, exposed or	4
шо	12	Consolidation of particles	Assorted sizes tightly packed or overlapping.	2	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	9	No packing evident. easily moved.	Loose assortment,	6
3108	13	Bottom size distribution	No size change evident. Stable material 80–100%.	4	Distribution shift light. Stable material 50–80%.	(00)	Moderate change in sizes, Stable materials 20–50%.	12	Marked distribution change. Stable materials 0-20%.	change. Stable	16
3	14	Scouring and deposition	<5% of bottom affected by scour or deposition.	9	5-30% affected. Soour at constrictions and where grades steepen. Some deposition in pools.	12	30–50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	e bottom in a state arly yearlong.	24
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	-	Common. Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	3	Perennial types scarce or absent. Yellow- green, short-term bloom may be present.	se or absent. Yellow- om may be present.	4
			Excellent Total =	60	Good Total =	30	Fair Total =	5		Poor Total =	가
Stream Type	Type	A1 A2 A3	A3 A4 A5 A6 B1	B2	40-60 40-64 48-68 40-60 38-50	C2 38-50	C3 C4 C5 C6 D3	D4 85-107	D5 D6	Grand Total =	88
Fair (Mod. Unstable)	Instable)	44-47	96-132 96-142 81-110 133+ 143+ 111+		61-78 65-84 69-88 61-78 51-61 79+ 85+ 89+ 79+ 62+	_	91-110 91-110 86-105 108-132	108-132	99-125	Existing Stream Type =	
Stream Type DA3	Type	DA3 DA4	40-63 40-63 40-63 50-75 50-75	40.63	F1 F2 F3 F4 F5	F6	G1 G2 G3 G4 G5 40-60 40-80 85-107 85-107 80-112 8	G6		*Potential Stream Type =	
Fair (Mod. Unstable) Poor (Unstable)	Instable)	64-86	64-86 64-86 64-86 76-96 87+ 87+ 87+ 97+	64-86	86-105 86-105 111-125 111-125 116-130 106+ 106+ 126+ 126+ 131+		61-78 108-120 108-120 113-125 79+ 121+ 121+ 126+	108-120		Modified Chann Stability Rating	Channel Rating =
							*Rating is adjusted to potential stream type, not existing.	stream	type, not existing.		

Site Name: Sheyenne River west of I-29, Ext 54

SKETCH

Section 2

South Scape

Staking

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Castian 1	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface		
Section 1	Right	Top of Bank (TB)			Bank Full (BF)			(WS)		
C11 2	Left	Top of Bank (TB)	J	243	Bank Full (BF)	J	245	Water Surface		711/
Section 2	Right	Top of Bank (TB)			Bank Full (BF)			(WS)	J	296
C1: 2	Left	Top of Bank (TB)			Bank Full (BF)			Water Surface		
Section 3	Right	Top of Bank (TB)			Bank Full (BF)			(WS)		2
Castian A	Left	Top of Bank (TB)	J	229	Bank Full (BF)	J	228	Water Surface	,	1
Section 4	Right	Top of Bank (TB)	J	225	Bank Full (BF)	J	226	(WS)	J	727
C	Left	Top of Bank (TB)	245	219	Bank Full (BF)	J	220	Water Surface		771
Section 5	Right	Top of Bank (TB)	J	222	Bank Full (BF)	J	223	(WS)		CL
G			1	237	, i	1	5747	4	J	539

233

Measurement	Unit	Value
Manning's n at Bank Full Condition		0.03
Root Depth	(ft)	1,
Root Density	(%)	5%
Eroding Bank Surface Cover	(%)	15%
Eroding Bank Length	(ft)	325'
Bank Material Type	(sand, silt, clay)	silty chan
Bank Material Stratification Score ¹	-	-
Distance from Bank Toe to Water Surface ²	(ft)	2.3'

Notes: 1+5 for any stratification, +10 for multiple layers above bank full mark

²Negative number indicates water surface is below bank toe.

Rosgen Method Checklist

Item	Completed?		. (0	111
Velocity Measurements Taken	- <	-(00	cold	700	Horci
Depositional Features Noted on Worksheet	J				
Channel Blockages Noted on Worksheet					
Pfankuch Method Completed	J				

Sampling Checklist

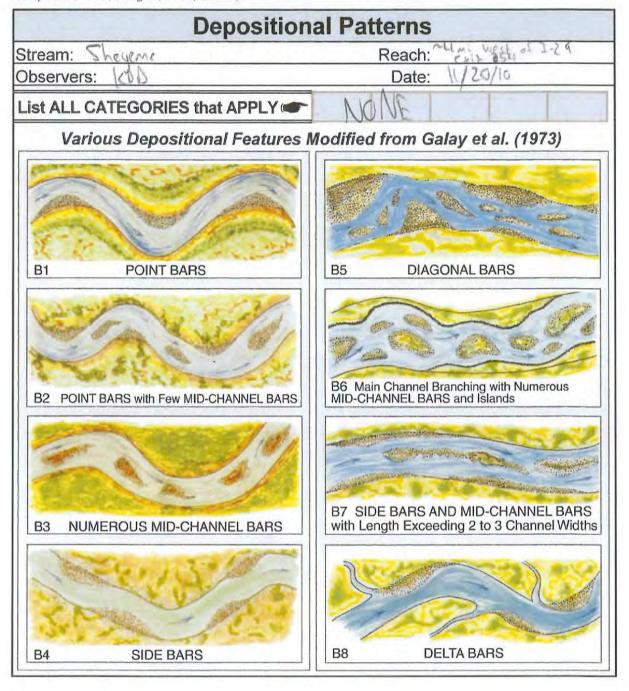
Location	Collected	Label	GPS Pt #
Left Bank (LB)	J	5/244/LB	244
Right Bank (RB)			
Bed (BED)			
Bar – Armor (B-A)	_	_	-
Bar - Sub Armor (B-SA)	-	_	hour

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	М
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

Worksheet 3-1. Riparian vegetation composition/density used for channel stability assessment (Rosgen, 2006b).

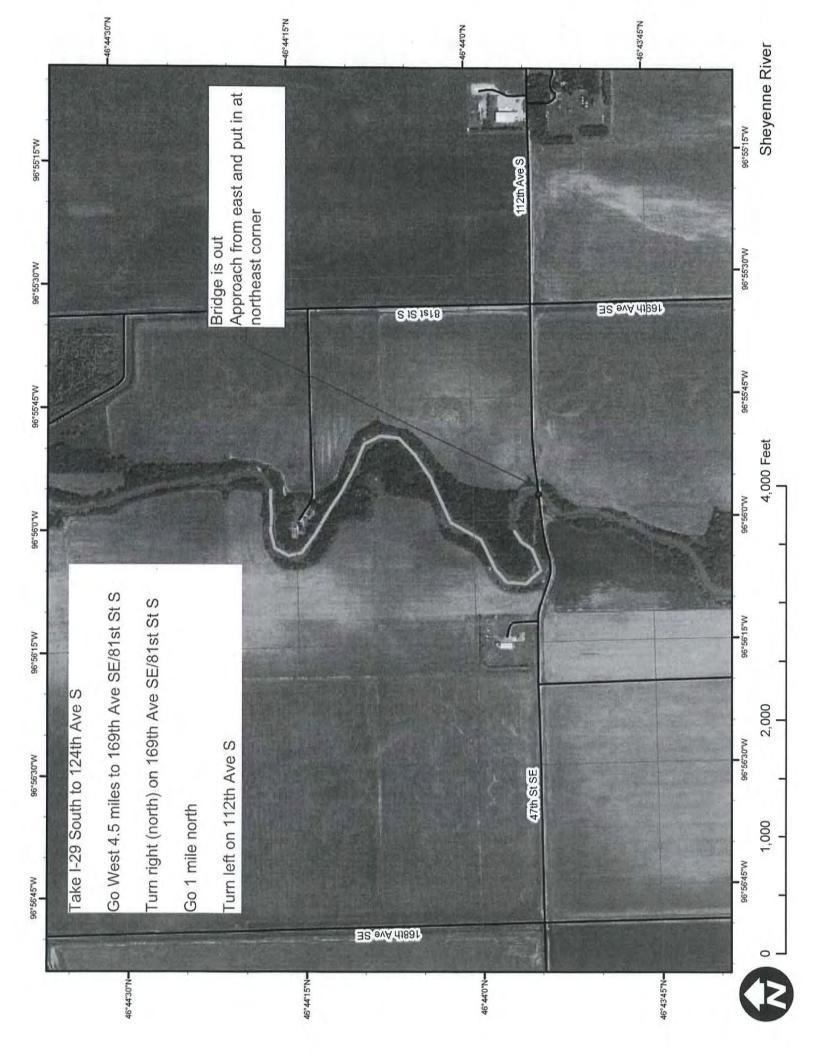
		F	Riparian \	/egetation	
St	ream: She	cykane !	River	Location: I 29 ex	est of
Ok	oservers:	200	Reference reach	Disturbed (impacted reach) Date:	120/10
sp	isting ecies mposition:	small 5	nru bs	Potential species composition:	
	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition
1. Overstory	Canopy layer	2	7	Ezecz	700
2. Understory	Shrub layer		70	small strubs	100%
2. Ur			70		100%
vel	Herbaceous		_		
3. Ground leve	Leaf or needle litter		4	Remarks: Condition, vigor and/or usage of existing reach:	100%
	Bare ground		24		
*Ba	ased on crown ased on basal urface area.		Column total 100%		

Worksheet 3-5. Depositional patterns used for stability assessment interpretations (modified from Galay *et al.*, 1973; Rosgen, 1996, 2006b).



		Channel Blockages	
Stre	eam: Sheye		9 0-1 34
Obs	ervers: KM	Date: \\/ 20/(0	
	scription/ ent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check / all that apply
D1	None	Minor amounts of small, floatable material.	г
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	X
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	Г
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	Г
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	П
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	Г
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	г
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	Г
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	

-			Location:		valley lype:		Observers:		Date:		
Loca-	Kou	Catoroni	Excellent		Good		Fair	7	Poor		
tion hey	Ney			Rating	Description	Rating	Description	Rating	Descr		Rating
ke	v -	Landform slope	Bank slope gradient <30%.	2	Bank slope gradient 30-40%.	4	Bank slope gradient 40–60%.	10	Bank slope gradient > 60%		8
Ban	2	Mass erosion	No evidence of past or future mass erosion.	ო	Infrequent. Mostly healed over. Low future potential.	9	Frequent or large, causing sediment nearly yearlong.	6	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	diment nearly ler of same.	12
beı	က	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.	(4)	Moderate to heavy amounts, mostly larger sizes.	9	Moderate to heavy amounts predominantly larger sizes.	4	8
dn	4	Vegetative bank protection	> 90% plant density. Vigor and variety suggest a deep, dense soil-binding root mass.	m	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	(6)	50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	6	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	scies and scontinuous	12
S	r2	Channel capacity	Bank heights sufficient to contain the bankfull stage. Workholeght ratio departury from reference width/depth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.	(-	Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0–1.2. Bank Height Ratio (BHR) = 1.0–1.1.	2	Bankfull stage is not contained. Width/depth ratio departure from reference width/depth ratio = 1.2-1.4. Bank-Height Ratio (BHR) = 1.1-1.3.	m	Bankfull stage is not contained; overbank flows are common with flows lass than bankful. Width/depth ratio departure from reference width/depth ratio >1.4. Bank-Height Ratio (BHR) >1.3.	rbank flows are at. Width/depth videpth ratio 3.	4
yur	9	Bank rock content	> 65% with large angular boulders, 12"+ common.	100	40-65%. Mostly boulders and small cobbles 6-12".	4	20–40%. Most in the 3–6" diameter class.	9	<20% rock fragments of gravel sizes, 1–3" or less.	vel sizes,	(8)
er B	7	Obstructions to flow	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	(4)	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	9	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	leflectors g. Sediment occurring.	89
мод	8	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcurves and constrictions. Raw banks may be up to12".	9	Significant. Cuts 12–24" high. Root/ mat overhangs and sloughing evidents	12	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	ne over 24" equent.	16
	o	Deposition	Little or no enlargement of channel or point bars.	4	Some new bar increase, mostly from coarse gravel.	80	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development.	ninantly fine evelopment.	16
	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	-	Rounded comers and edges. Surfaces smooth and flat.	2	Corners and edges well rounded in 2 dimensions.	3	Well rounded in all dimensions, surfaces smooth.	ns, surfaces	(7)
	11	Brightness	Surfaces dull, dark or stained. Generally not bright.	(-	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35–65% mixture range.	3	Predominantly bright, > 65%, exposed or scoured surfaces.	, exposed or	4
шо	12	Consolidation of particles	Assorted sizes tightly packed or overlapping.	2	Moderately packed with some overlapping.	(4)	Mostly loose assortment with no apparent overlap.	9	No packing evident, Loose assortment, easily moved.	assortment,	00
330	13	Bottom size distribution	No size change evident. Stable material 80-100%.	4	Distribution shift light. Stable material 50–80%.	8	Moderate change in sizes. Stable materials 20–50%.	12	Marked distribution change. materials 0-20%.	Stable	16
3	14	Scouring and deposition	<5% of bottom affected by scour or deposition.	9	5–30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	12	30–50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	n in a state rlong.	24
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	-	Common. Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	က	Perennial types scarce or absent. Yellow- green, short-term bloom may be present.	sent. Yellow- be present.	(4)
			Excellent Total =	0	Good Total =	88	Fair Total =	73	Pool	Poor Total =	10
Stream Type	Type ole)	A1 38-43	A2 A3 A4 A5 A6 B1 38-43 54-90 60-95 60-95 50-80 38-45	B2 38-45	B3 B4 B5 B6 C1 40-60 40-64 48-68 40-60 38-50	38-50	C3 C4 C5 C6 D3 60-85 70-90 70-90 60-85 85-107	D4 85-107	D5 D6 85-107 67-98	Grand Total =	協
Fair (Mod. Unstable) Poor (Unstable)	Instable)		96-132	46-58	8 61-78		86-105 91-110 91-110 86-105 108-132 108-132 108-132 108-132 108+132 133+ 133+ 133+	133+	99-125 126+	Existing Stream Type =	
Stream Ty	Type	DA3 DA4	DA5 DA6 E3 E4	E6	F1 F2 F3 F4 F5	F6.95	G1 G2 G3 G4 G5	G6 85-107	*Pot	*Potential Stream Type =	
Fair (Mod. Unstable) Poor (Unstable)	nstable) able)	64-86	64-86 64-86 64-86 76-96 87+ 87+ 87+ 97+	64-86	86-105 106+	96-110	61-78 61-78 108-120 108-120 113-125 79+ 79+ 121+ 121+ 126+	121+	Mod	Modified Channel Stability Rating =	annel ing =
							*Rating is adjusted to potential stream type, not existing.	ream	_		



Site Name: Red Diver U/S of 4th Ave Bridge

SKETCH Slumped banks Steelin 2

Section #	Bank		Staked	GPS Pt		Staked	GPS Pt		Staked	GPS Pt
Section 1	Left	Top of Bank (TB)		764	Bank Full (BF)		765	Water Surface	,	3//
Section 1	Right	Top of Bank (TB)	_	_	Bank Full (BF)	_		(WS)	\vee	566
Section 2	Left	Top of Bank (TB)		268	Bank Full (BF)		769	Water Surface	1	770
Section 2	Right	Top of Bank (TB)	_	_	Bank Full (BF)		_	(WS)		276
Section 3	Left	Top of Bank (TB)	J	272	Bank Full (BF)	J	273	Water Surface	1	774
Section 5	Right	Top of Bank (TB)	_	_	Bank Full (BF)		_	(WS)	J. 1.	24
Section 4	Left	Top of Bank (TB)	J	278	Bank Full (BF)	J	277	Water Surface	./	
Section 4	Right	Top of Bank (TB)	_	-	Bank Full (BF)	-,	j	(WS)	V	2-16
Sastian F	Left	Top of Bank (TB)	J	V	Bank Full (BF)	J		Water Surface	1	
Section 5	Right	Top of Bank (TB)	_	_	Bank Full (BF)	-	_	(WS)	~	

Measurement	Unit	Value
Manning's n at Bank Full Condition	-	C).()3
Root Depth	(ft)	Ift
Root Density	(%)	30
Eroding Bank Surface Cover	(%)	90
Eroding Bank Length	(ft)	~625 Ft
Bank Material Type	(sand, silt, clay)	Silt/elas
Bank Material Stratification Score ¹	-	-
Distance from Bank Toe to Water Surface ²	(ft)	

Notes: ¹+5 for any stratification, +10 for multiple layers above bank full mark ²Negative number indicates water surface is below bank toe.

Rosgen Method Checklist

Item	Completed?
Velocity Measurements Taken	_
Depositional Features Noted on Worksheet	J
Channel Blockages Noted on Worksheet	J
Pfankuch Method Completed	J

Sampling Checklist

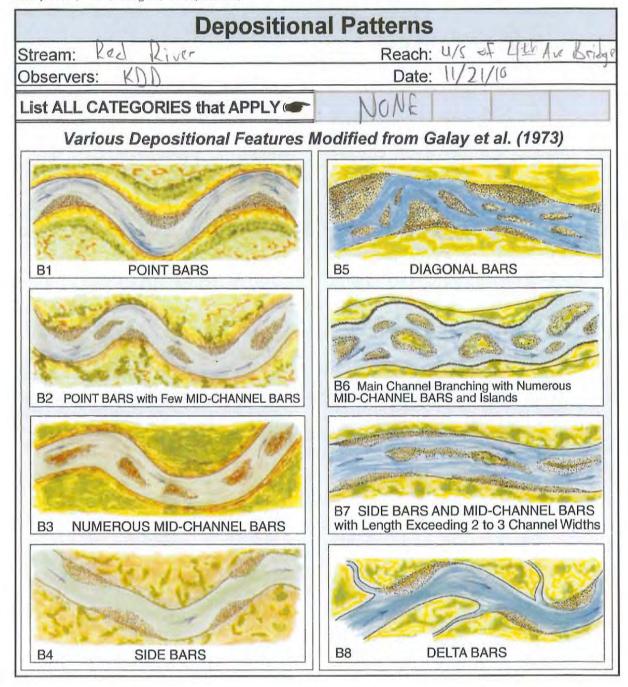
Location	Collected	Label	GPS Pt #
Left Bank (LB)	J	RR/278/LB	778
Right Bank (RB)	_	_	7
Bed (BED)			
Bar – Armor (B-A)	_	-	_
Bar - Sub Armor (B-SA)	_	_	~

River	Abbreviation
Red River of the North	RR
Sheyenne River	S
Lower Rush	LR
Rush	RUSH
Maple	M
Buffalo	В
Sheyenne Diversion	SD
Wild Rice	WR
Wolverton Creek	WC

Worksheet 3-1. Riparian vegetation composition/density used for channel stability assessment (Rosgen, 2006b).

		F	Riparian V	/egetation	
St	ream: RE	River		Location: U/S of 4	th Ave
Ok	oservers: X	DO	Reference reach	Disturbed V	121/10
Ex	isting Secies mposition:	Herroz		Potential species composition:	
	Riparian cover ategories	Percent aerial cover*	Percent of site coverage**	Species composition	Percent of total species composition
1. Overstory	Canopy layer	0	0		
					100%
2. Understory	Shrub layer		90	SMrubs	100
					100%
evel	Herbaceous		0		
3. Ground level	Leaf or needle litter		19 U	Remarks: Condition, vigor and/or usage of existing reach:	100%
	Bare ground		910	4,	
*Ba	ased on crowr ased on basal urface area.		Column total 100%		

Worksheet 3-5. Depositional patterns used for stability assessment interpretations (modified from Galay *et al.*, 1973; Rosgen, 1996, 2006b).



		Channel Blockages	
Stre	1 4	Location: U/S of 4th Au	c Brige
Des	scription/ ent	Materials that upon placement into the active channel or flood-prone area may cause adjustments in channel dimensions or conditions due to influences on the existing flow regime	Check / all that apply
D1	None	Minor amounts of small, floatable material.	Г
D2	Infrequent	Debris consists of small, easily moved, floatable material, e.g., leaves, needles, small limbs and twigs.	×
D3	Moderate	Increasing frequency of small- to medium-sized material, such as large limbs, branches and small logs, that when accumulated, affect 10% or less of the active channel cross-section area.	Г
D4	Numerous	Significant build-up of medium- to large-sized materials, e.g., large limbs, branches, small logs or portions of trees that may occupy 10–30% of the active channel cross-section area.	Г
D5	Extensive	Debris "dams" of predominantly larger materials, e.g., branches, logs and trees, occupying 30–50% of the active channel cross-section area, often extending across the width of the active channel.	Г
D6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section area. Such accumulations may divert water into the flood-prone areas and form fish migration barriers, even when flows are at less than bankfull.	Г
D7	Beaver Dams: Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	Г
D8	Beaver Dams: Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures where streamflow velocities are reduced and channel dimensions or conditions are influenced.	Г
D9	Beaver Dams: Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments, such as bank erosion, lateral migration, avulsion, aggradation and degradation.	г
D10	Human Influences	Structures, facilities or materials related to land uses or development located within the flood-prone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures and various transportation encroachments that have an influence on the existing flow regime, such that significant channel adjustments occur.	

	orream:		Location:		Valley Type:		Observers:		Date:	1
tion	Key	Category	Description	Rating	Good	Rating	Fair	Rating	Poor	Rating
CV	1 51	Landform slope	Bank slope gradient <30%.	3	Bank slope gradient 30-40%.	4	Bank slope gradient 40-60%.	ဖ	Bank slope gra	- 00
Banl	2 6 8	Mass erosion	No evidence of past or future mass erosion.	en	Infrequent. Mostly healed over. Low future potential.	9	Frequent or large, causing sediment nearly yearlong.	()	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	rank 12
120	3	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.	(4)	Moderate to heavy amounts, mostly larger sizes.	9	Moderate to heavy amounts, predominantly larger sizes.	00
do	4 > g g	Vegetative bank protection	> 90% plant density. Vigor and variety suggest a deep, dense soil-binding root mass.	6	70–90% density. Fewer species or less vigor suggest less dense or deep root mass.	0	50–70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	o	<50% density plus fewer species and less vigor indicating poor, discontinuous and shallow root mass.	d ous 12
	2 2	Channel	Bank heights sufficient to contain the bankfull stage. Width/depth ratio departure from reference width/depth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.	0	Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0–1.2. Bank Height Ratio (BHR) = 1.0–1.1.	2	Bankfull stage is not contained. Width/depth ratio departure from reference width/depth ratio = 1.2-1.4. Bank-Height Ratio (BHR) = 1.1-1.3.	ო	Bankfull stage is not contained; overbank flows are common with flows less than benkfull. Width/depth ratio depenture from reference width/depth ratio 14. Bank-Height Ratio (BHR) >1.3.	s are epth
MIII	9	Bank rock content	> 65% with large angular boulders. 12"+ common.	2	40-65%. Mostly boulders and small cobbles 6-12".	4	20–40%. Most in the 3–6" diameter class.	9	<20% rock fragments of gravel sizes, 1-3" or less.	8
er Ba	7 to	Obstructions to flow		2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	9	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	s nent 8 g.
TOAN	8	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcurves and constrictions. Raw banks may be up to 12".	9	Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	16
	6	Deposition	Little or no enlargement of channel or point bars.	(4)	Some new bar increase, mostly from coarse gravel.	60	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development.	ine 16
	10 R	Rock angularity	Sharp edges and corners. Plane surfaces rough.	-	Rounded comers and edges. Surfaces smooth and flat.	2	Corners and edges well rounded in 2 dimensions.	3	Well rounded in all dimensions, surfaces smooth.	(A)
	11 8	Brightness	Surfaces dull, dark or stained. Generally not bright.	0	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35–65% mixture range.	n	Predominantly bright, > 65%, exposed scoured surfaces.	d or 4
1110	12 C	Consolidation of particles		2	Moderately packed with some overlapping.	(4)	Mostly loose assortment with no apparent overlap.	9	No packing evident. Loose assortment, easily moved.	ent, 8
Hot	13 B	Bottom size distribution	No size change evident. Stable material 80–100%.	4	Distribution shift light. Stable material 50–80%.	(8)	Moderate change in sizes. Stable materials 20–50%.	12	Marked distribution change. Stable materials 0-20%.	16
-	14 S	Scouring and deposition	<5% of bottom affected by scour or deposition.	9	5–30% affected. Soour at constrictions and where grades steepen. Some deposition in pools.	(12)	30–50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.	- 62	More than 50% of the bottom in a state of flux or change nearly yearlong.	ate 24
	15 4 ×	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	-	Common. Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	က	Perennial types scarce or absent. Yellow- green, short-term bloom may be present.	low-
1			Excellent Total =	9	Good Total =	20	Fair Total =	0	Poor Total =	=
Stream Type		A1 A2	A3 A4 A5 A6 B1		B3 B4 B5 B6 C1	C2	C3 C4 C5 C6 D3	D4	D5 D6	==
Good (Stable) Fair (Mod. Unstable) Door (Unstable)		44-47 44-47 48+ 48+	36-45 36-45 34-90 60-80 60-80 30-90 30-90 44-47 44-47 91-129 96-132 96-14281-110 46-58 48+ 130+ 133+ 143+ 141+ 59+	46-58	69-88 61-78		86-105 91-110 91-110 86-105 106+ 111+ 111+ 106+		133+	11 0
Stream Type Good (Stable)	0	DA3 DA4 0-63 40-63	DAS DAS E3 E4 40-63 40-63 40-63 50-75		F2 F3 F4 5 60-85 85-110 85-110 9		G1 G2 G3 G4 40-60 40-60 85-107 85-107	100		II o
Fair (Mod. Unstable)		64-86 64-86 87+ 87+	64-86 64-86 76-96 76-96 87+ 87+ 87+ 97+ 97+	64-86	86-105 86-105 111-125 111-125 116-130 106+ 106+ 126+ 126+ 131+	1114	61-78 61-78 108-120 108-120 113-125 79+ 79+ 121+ 121+ 126+	121+	Modified Channel Stability Rating =	Chan

