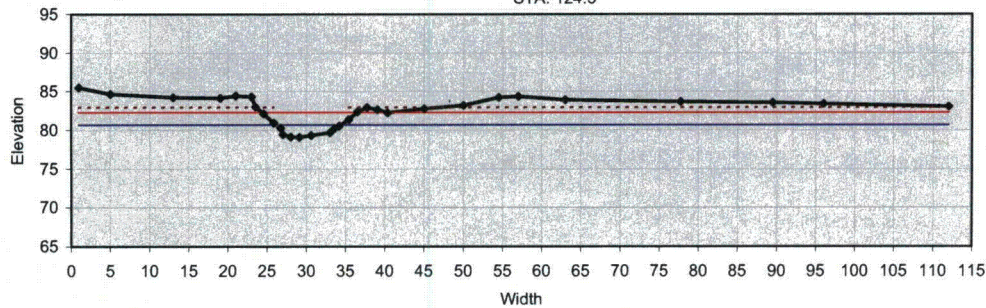


**On-Site Cross-Sections and Longitudinal Profile
with Photo-documentation**

Cross Section 1

XS#1(On-Site) - Walker Run
STA. 124.5



Bankfull Dimensions

8.8	x-section area (ft.sq.)
8.2	width (ft)
1.1	mean depth (ft)
1.6	max depth (ft)
9.3	wetted parimeter (ft)
0.9	hyd radi (ft)
7.6	width-depth ratio

Bankfull Flow

2.8	velocity (ft/s)
25.0	discharge rate (cfs)
0.51	Froude number

Flood Dimensions

12.0	W flood prone area (ft)
1.5	entrenchment ratio
3.8	low bank height (ft)
2.4	low bank height ratio

Flow Resistance

0.030	Manning's roughness
0.11	D'Arcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Materials

---	D50 (mm)
---	D84 (mm)
10	threshold grain size (mm)

Forces & Power

0.35	channel slope (%)
0.21	shear stress (lb/sq.ft.)
0.33	shear velocity (ft/s)
0.67	unit strm power (lb/ft/s)

Cross Section

reference ID	1
instrument height	88.24
longitudinal station	124.5

Bankfull Stage

FS	7.6	= 80.64 elev
elevation		80.10

Low Bank Height

FS	5.33	= 82.91 elev
elevation		

Flood Prone Area

width fpa	12.0
-----------	------

Channel Slope

percent slope	0.35	0.37
---------------	------	------

Flow Resistance

Manning's "n"	0.03
D'Arcy - Weisbach "f"	

Note:

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
1		88.24	2.76	85.48		L Pin
5		88.24	3.59	84.65		
13		88.24	4.03	84.21		
19		88.24	4.1	84.14		
21		88.24	3.84	84.4		
23		88.24	3.94	84.3		LTOB
23.5		88.24	5.26	82.98		
24.5		88.24	6.13	82.11		
25.8		88.24	7.31	80.93		
26.7		88.24	7.98	80.26		LEW
27		88.24	8.78	79.46		
28		88.24	9.12	79.12		
29.1		88.24	9.17	79.07		
30.6		88.24	8.9	79.34		
33		88.24	8.56	79.68		
33.6		88.24	7.99	80.25		REW
34.2		88.24	7.71	80.53		
35.4		88.24	6.88	81.36		
36.5		88.24	5.91	82.33		
37.7		88.24	5.33	82.91		RTOB
39		88.24	5.61	82.63		
40.3		88.24	6.01	82.23		
45		88.24	5.5	82.74		
50		88.24	5.07	83.17		
54.5		88.24	4.02	84.22		
57		88.24	3.89	84.35		
63		88.24	4.34	83.9		
77.7		88.24	4.59	83.65		
89.5		88.24	4.69	83.55		R Pin
96		88.24	4.86	83.38		cornfield
112		88.24	5.21	83.03		



Cross section #1 looking upstream



Cross section #1 looking downstream

Cross Section 2

XS#2 (On-Site) - Walker Run
STA. 575.5

Bankfull Dimensions

9.4	x-section area (ft.sq.)
9.1	width (ft)
1.0	mean depth (ft)
1.3	max depth (ft)
10.1	wetted parimeter (ft)
0.9	hyd radi (ft)
8.9	width-depth ratio

Bankfull Flow

2.8	velocity (ft/s)
26.1	discharge rate (cfs)
0.51	Froude number

Flood Dimensions

11.2	W flood prone area (ft)
1.2	entrenchment ratio
3.0	low bank height (ft)
2.3	low bank height ratio

Flow Resistance

0.030	Manning's roughness
0.11	D'Arcy-Weisbach fric.
---	resistance factor u/u^*
---	relative roughness

Materials

---	D50 (mm)
---	D84 (mm)
10	threshold grain size (mm):

Forces & Power

0.35	channel slope (%)
0.20	shear stress (lb/sq.ft.)
0.32	shear velocity (ft/s)
0.62	unit strm power (lb/ft/s)

[illegible]



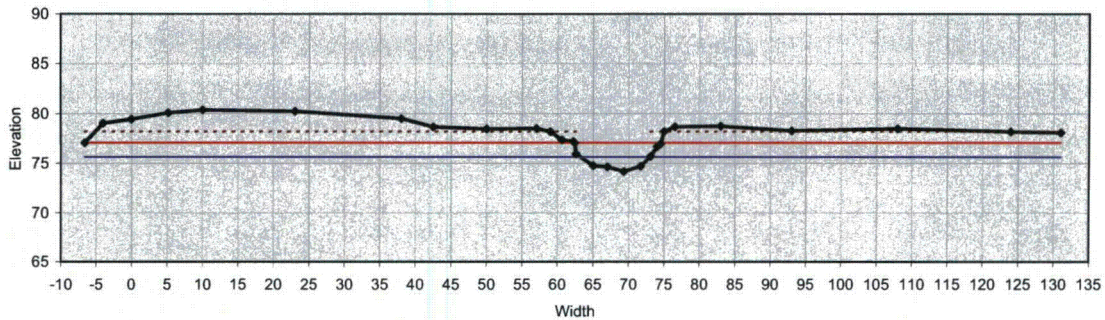
Cross section #2 looking upstream



Cross section #2 looking downstream

Cross Section 3

XS#3 (On-Site) - Walker Run
STA. 1171.6



Bankfull Dimensions

8.7	x-section area (ft.sq.)
9.7	width (ft)
0.9	mean depth (ft)
1.4	max depth (ft)
10.3	wetted perimeter (ft)
0.8	hyd radi (ft)
10.9	width-depth ratio

Flood Dimensions

12.1	W flood prone area (ft)
1.2	entrenchment ratio
4.0	low bank height (ft)
2.8	low bank height ratio

Materials

--	D50 (mm)
--	D84 (mm)
10	threshold grain size (mm):

Bankfull Flow

2.7	velocity (ft/s)
23.4	discharge rate (cfs)
0.52	Froude number

Flow Resistance

0.030	Manning's roughness
0.11	D'Arcy-Weisbach fric.
--	resistance factor u/u^*
--	relative roughness

Forces & Power

0.37	channel slope (%)
0.19	shear stress (lb/sq.ft.)
0.32	shear velocity (ft/s)
0.56	unit strm power (lb/ft/s)

Cross Section

reference ID	3
instrument height	89.09
longitudinal station	1171.6

Bankfull Stage

FS	13.5	= 75.59 elev
elevation		76.55

Low Bank Height

FS	10.92	= 78.17 elev
elevation		

Flood Prone Area

width fpa	12.1
-----------	------

Channel Slope

percent slope	0.37	0.37
---------------	------	------

Flow Resistance

Manning's "n"	0.03
D'Arcy - Weisbach "f"	

Note:

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
-6.6		89.09	12.03	77.06		Pond WS
-4		89.09	10.04	79.05		
0		89.09	9.65	79.44		
5.2		89.09	9	80.09		L Pin
10		89.09	8.72	80.37		
23		89.09	8.83	80.26		
38		89.09	9.58	79.51		
42.5		89.09	10.4	78.69		
50		89.09	10.62	78.47		
57		89.09	10.57	78.52		
59		89.09	10.92	78.17		
60.6		89.09	11.73	77.36		LBKFL?
62.2		89.09	11.9	77.19		
62.4		89.09	12.01	77.08		LEW
62.6		89.09	13.18	75.91		
65		89.09	14.35	74.74		
67		89.09	14.47	74.62		
69.3		89.09	14.93	74.16		
71.7		89.09	14.4	74.69		
73.1		89.09	13.42	75.67		
74		89.09	12.42	76.67		
74.5		89.09	12.12	76.97		REW
75		89.09	10.88	78.21		RTOB
76.5		89.09	10.4	78.69		
83		89.09	10.34	78.75		
93		89.09	10.81	78.28		
108		89.09	10.6	78.49		
124		89.09	10.9	78.19		
131		89.09	11	78.09		R Pin



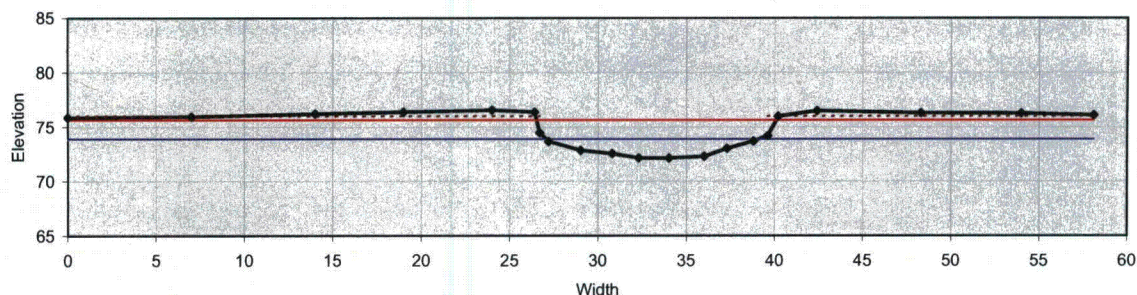
Cross section #3 looking upstream



Cross section #3 looking downstream

Cross Section 4

XS#4 (On-Site) - Walker Run
STA. 1968.0



Bankfull Dimensions

14.2	x-section area (ft.sq.)
12.0	width (ft)
1.2	mean depth (ft)
1.7	max depth (ft)
12.8	wetted perimeter (ft)
1.1	hyd radi (ft)
10.2	width-depth ratio

Flood Dimensions

13.6	W flood prone area (ft)
1.1	entrenchment ratio
3.8	low bank height (ft)
2.2	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
12	threshold grain size (mm):

Bankfull Flow

3.1	velocity (ft/s)
44.6	discharge rate (cfs)
0.53	Froude number

Flow Resistance

0.030	Manning's roughness
0.10	D'Arcy-Weisbach fric.
---	resistance factor u/u^*
---	relative roughness

Forces & Power

0.35	channel slope (%)
0.24	shear stress (lb/sq.ft.)
0.35	shear velocity (ft/s)
0.81	unit strm power (lb/ft/s)

Cross Section

reference ID	4
instrument height	80.77
longitudinal station	1968

Bankfull Stage

FS	6.9	= 73.87 elev
elevation		73.85

Low Bank Height

FS	4.8	= 75.97 ele
elevation		

Flood Prone Area

width fpa	13.6
-----------	------

Channel Slope

percent slope	0.35	0.37
---------------	------	------

Flow Resistance

Manning's "n"	0.03
D'Arcy - Weisbach "f"	

Note:

[illegible]



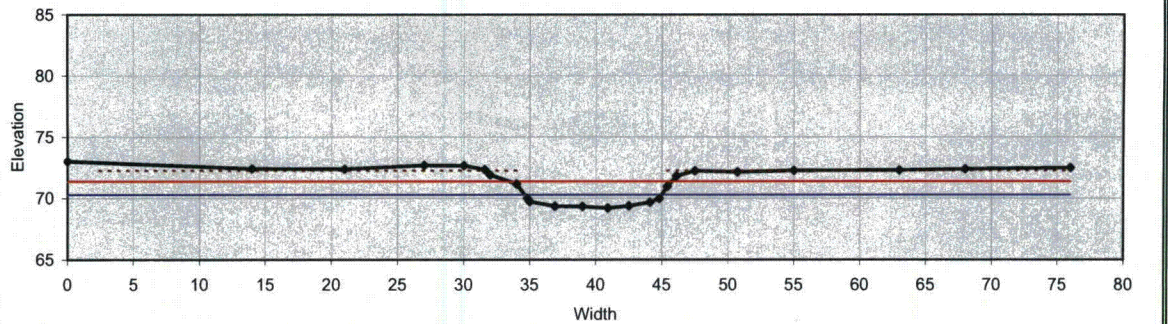
Cross section #4 looking upstream



Cross section #4 looking downstream

Cross Section 5

XS#5 (On-Site) - Walker Run
Station 3075.2



Bankfull Dimensions	
8.5	x-section area (ft.sq.)
10.4	width (ft)
0.8	mean depth (ft)
1.1	max depth (ft)
10.9	wetted perimeter (ft)
0.8	hyd radi (ft)
12.6	width-depth ratio

Flood Dimensions	
12.2	W flood prone area (ft)
1.2	entrenchment ratio
3.0	low bank height (ft)
2.8	low bank height ratio

Materials	
---	D50 (mm)
---	D84 (mm)
8	threshold grain size (mm):

Bankfull Flow	
2.5	velocity (ft/s)
21.1	discharge rate (cfs)
0.50	Froude number

Flow Resistance	
0.030	Manning's roughness
0.11	D'Arcy-Weisbach fric.
---	resistance factor u/u^*
---	relative roughness

Forces & Power	
0.35	channel slope (%)
0.17	shear stress (lb/sq.ft.)
0.30	shear velocity (ft/s)
0.44	unit strm power (lb/ft/s)

Cross Section	
reference ID	5
instrument height	79.67
longitudinal station	3075.2

Bankfull Stage		
FS	9.4	= 70.27 elev
elevation		70.09

Low Bank Height

FS	7.44	= 72.23 elev
elevation		

Flood Prone Area

width fpa	12.2
-----------	------

Channel Slope		
percent slope	0.35	0.37

Flow Resistance	
Manning's "n"	0.03
D'Arcy - Weisbach "f"	

Note:

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		79.67	6.66	73.01	■	LB Pin
14		79.67	7.28	72.39	■	
21		79.67	7.31	72.36	■	
27		79.67	6.99	72.68	■	
30		79.67	7.03	72.64	■	LTOB
31.6		79.67	7.36	72.31	■	
32		79.67	7.77	71.9	■	
34		79.67	8.5	71.17	■	
34.8		79.67	9.66	70.01	■	LEOW
35		79.67	9.94	69.73	■	
36.9		79.67	10.33	69.34	■	
39		79.67	10.34	69.33	■	
40.9		79.67	10.48	69.19	■	
42.5		79.67	10.29	69.38	■	
44.1		79.67	10	69.67	■	
44.8		79.67	9.69	69.98	■	
45.4		79.67	8.72	70.95	■	
46.1		79.67	7.87	71.8	■	RTOB
47.5		79.67	7.44	72.23	■	
50.7		79.67	7.55	72.12	■	
55		79.67	7.42	72.25	■	
63		79.67	7.4	72.27	■	
68		79.67	7.31	72.36	■	
76		79.67	7.21	72.46	■	
					■	
					■	
					■	
					■	



Cross section #5 looking upstream

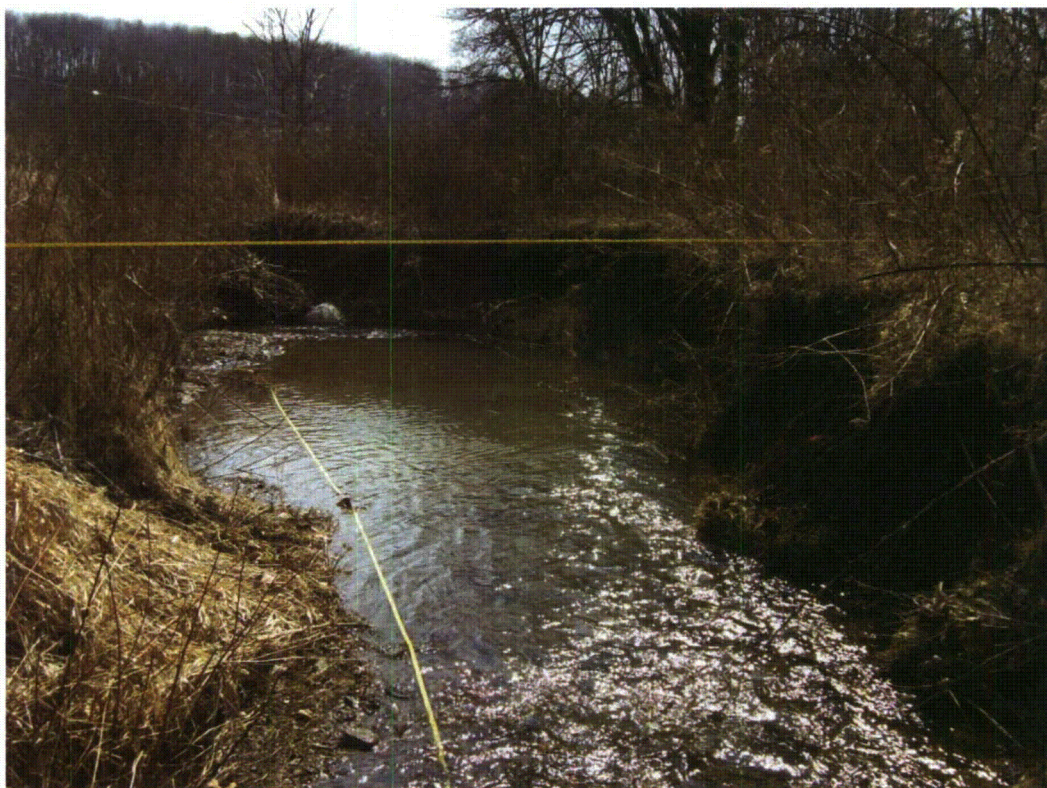


Cross section #5 looking downstream

**Bank Erosion Cross-Sections and Longitudinal Profiles
with Photo-documentation**



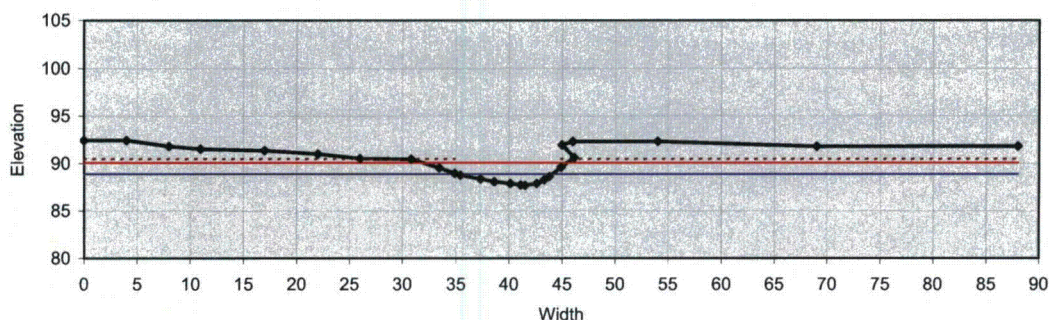
Bank erosion cross section #1 looking upstream



Bank erosion cross section #1 looking downstream

Cross Section 1

BEXS#1 - Walker Run



Bankfull Dimensions

6.0	x-section area (ft.sq.)
8.9	width (ft)
0.7	mean depth (ft)
1.2	max depth (ft)
9.3	wetted parimeter (ft)
0.6	hyd radi (ft)
13.0	width-depth ratio

Flood Dimensions

13.4	W flood prone area (ft)
1.5	entrenchment ratio
2.8	low bank height (ft)
2.4	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
16	threshold grain size (mm):

Bankfull Flow

3.3	velocity (ft/s)
20.1	discharge rate (cfs)
0.73	Froude number

Flow Resistance

0.030	Manning's roughness
0.12	D'Arcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

0.8	channel slope (%)
0.32	shear stress (lb/sq.ft.)
0.41	shear velocity (ft/s)
1.13	unit strm power (lb/ft/s)

Cross Section

reference ID	1
instrument height	100
longitudinal station	96 BEXS1

Bankfull Stage

FS	11.15	= 88.85 elev
elevation		#VALUE!

Low Bank Height

FS	9.56	= 90.44 elev
elevation		

Flood Prone Area

width fpa	13.4
-----------	------

Channel Slope

percent slope	0.8	1.5
---------------	-----	-----

Flow Resistance

Manning's "n"	0.03
D'Arcy - Weisbach "f"	

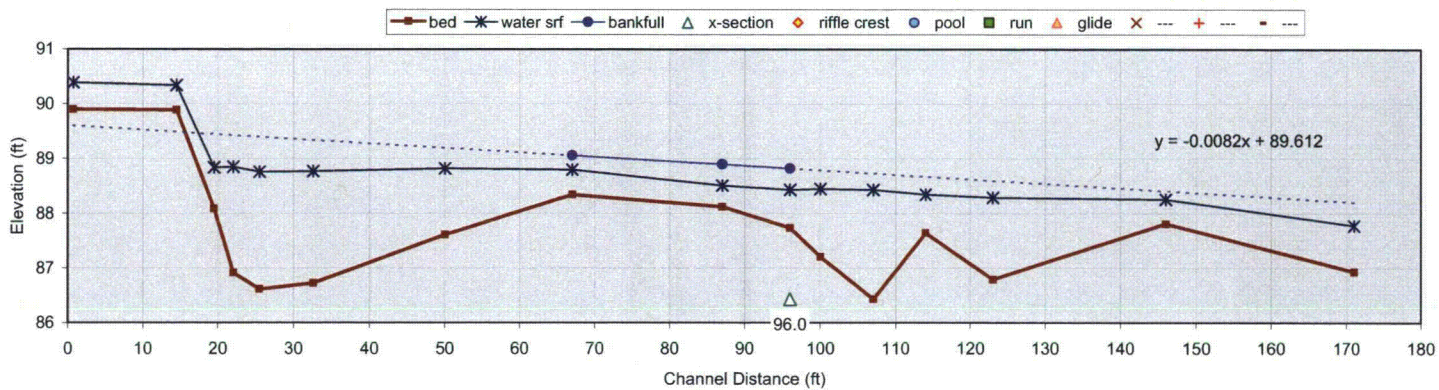
Note:

BP = Bank Pin; shot in control point along road between yield sign and bridge (HR=1.80'; elev.=98.20')

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		100	7.58	92.42		L Pin
4		100	7.55	92.45		
8		100	8.18	91.82		
11		100	8.47	91.53		
17		100	8.64	91.36		
22		100	8.98	91.02		
26		100	9.48	90.52		
30.8		100	9.56	90.44		LTOB
33.4		100	10.44	89.56		
34.9		100	11.04	88.96		LBKFL
35.4		100	11.24	88.76		LEW
37.3		100	11.61	88.39		
38.6		100	11.9	88.1		
40.1		100	12.12	87.88		
41.1		100	12.27	87.73		Thalweg
41.5		100	12.32	87.68		
42.6		100	12.11	87.89		R Toe
43.3		100	11.71	88.29		REW
43.8		100	11.35	88.65		BP (bot.)
44.9		100	10.38	89.62		BP (mid.)
46.15		100	9.37	90.63		BP (top)
45		100	8.05	91.95		RTOB
46		100	7.69	92.31		
54		100	7.69	92.31		
69		100	8.21	91.79		
88		100	8.19	91.81		R Pin

Longitudinal Slope Profile

Longitudinal Profile at BEXS#1 - Walker Run



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	1.5	---	171.0 (15.3 channel widths ^a)	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

[illegible]

Bank Erosion Prediction			
Stream <i>Walker Run</i>		Cross Section <i>B Exs # 1</i>	
		Date <i>3/18/09</i>	
Near Bank Stress Rating			
Mean Shear Stress		Conversion of Numerical Indices to: Adjective Ratings	
Bankfull Hydraulic Radius (ft) R	<i>0.6</i>		
Water Surface Facet Slope (ft/ft) S	<i>0.007</i>	Near Bank Stress Rating	Near Bank Stress/Mean Shear Stress
Shear Stress (lb/ft ²) $\tau = \gamma RS$ $\gamma = 62.4 \text{ lb/ft}^3$	<i>0.26</i>		
Near Bank Shear Stress		Very Low	<0.8
Bankfull Hydraulic Radius (ft) R (near bank 1/3)	<i>1.3</i>	Low	0.8 - 1.05
Near Bank Water Surface Slope (ft/ft) S	<i>0.004</i>	Moderate	1.06 - 1.14
Shear Stress (lb/ft ²) $\tau_{\text{near bank}} = \gamma RS$	<i>0.32</i>	High	1.15 - 1.19
		Very High	1.2 - 1.6
		Extreme	>1.6
Near Bank Stress/Mean Shear Stress ($\tau_{\text{near bank}}/\tau$)	<i>1.23</i>	Near Bank Stress Rating	<i>Very High</i>
Stream Bank Erodibility Rating			
BEHI Rating		<i>High</i>	
Bank Erosion Prediction at Cross Section			
A	B	C	D
Lateral Erosion at Cross Section (feet/year)	Bank Height (feet)	Length of Bank (feet)	Predicted Erosion feet ³
<i>1.75</i>	<i>4.06</i>	<i>1</i>	<i>5.07 ft³/yr.</i>

Circle graph used:

Colorado

Yellowstone

- Column A: Use Stream Bank Erodibility Rating and Near Bank Stress Rating in conjunction with Figure 6-27 in Rosgen, 1996.
- Column B: Study Bank Height (Use Cross Section Plot: top of bank - toe of bank)
- Column C: Input 1 foot for point erosion @ cross section
- Column D: Columns A*B*C

5520 543

BEHI Variable Worksheet

Stream: Walker Run	Cross Section: BEXS#1	Date: 3/18/09	Observers: BRU, EPS
--------------------	-----------------------	---------------	---------------------

Bank Height/Max Depth Bankfull (C)

Highest Bank Height (ft)	4.27 _A	Max Bankfull Depth (ft)	1.3 _B	A/B	3.28 _C
--------------------------	-------------------	-------------------------	------------------	-----	-------------------

Root Depth/Bank Height (F)

Root Depth (ft)	1.0 _D	Study Bank Height (ft)	4.06 _E	D/E	0.25 _F
-----------------	------------------	------------------------	-------------------	-----	-------------------

Weighted Root Density (H)

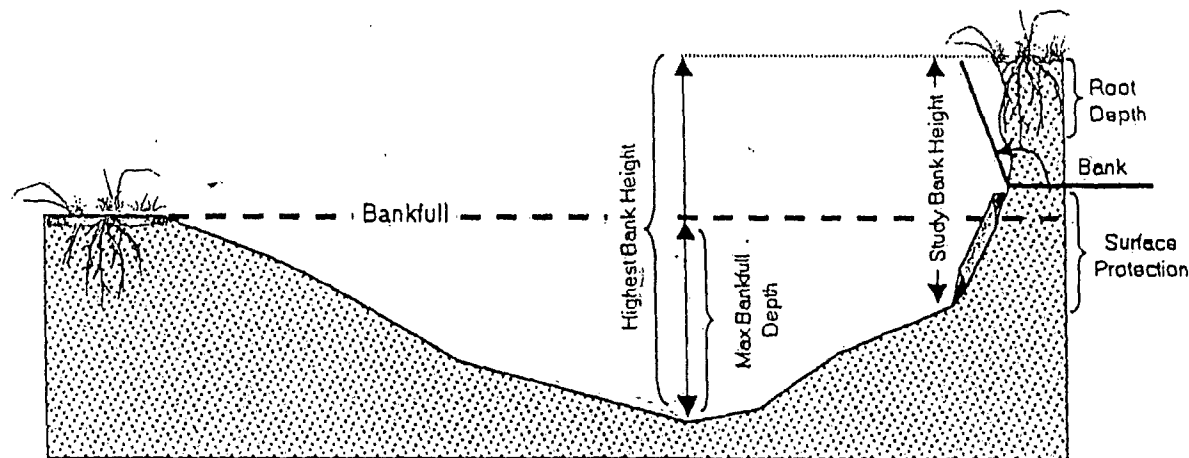
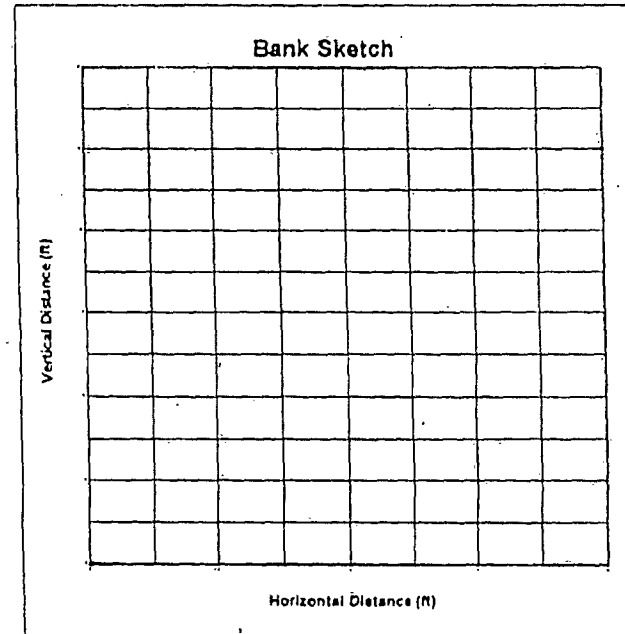
Root Density (%)	< 5% _G	G*F	1.25 _H
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Bank Angle (I)

Bank Angle (Degrees)	75° _I
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Weighted Surface Protection (K)

Height of Bank Protection (ft)	0.5 _J	J/E	0.15 _K
--------------------------------	------------------	-----	-------------------



Bank Erodibility Hazard Rating Guide						
Stream <u>Walker Run</u>		Reach <u>BEXS #</u>		Date <u>3/18/09</u>		Crew <u>BRU, EPS</u>
Bank Height (ft):	Bankfull Height (ft):	Bank Height/	Root Depth/	Root	Bank Angle	Surface
		Bankfull Ht	Bank Height	Density %	(Degrees)	Protection%
VERY LOW	Value	1.0-1.1	1.0-0.9	100-80	0-20	100-80
	Index	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
LOW	Value	1.11-1.19	0.89-0.5	79-55	21-60	79-55
	Index	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
MODERATE	Value	1.2-1.5	0.49-0.3	54-30	61-80	54-30
	Index	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9
	Choice	V: I:	V: I:	V: I:	V: <u>75</u> I: <u>5.5</u>	V: I:
HIGH	Value	1.6-2.0	0.29-0.15	29-15	81-90	29-15
	Index	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9
	Choice	V: I:	V: <u>0.25</u> I: <u>7</u>	V: I:	V: I:	V: <u>15</u> I: <u>7.9</u>
VERY HIGH	Value	2.1-2.8	0.14-0.05	14-5.0	91-119	14-10
	Index	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0
	Choice	V: I:	V: I:	V: <u>5%</u> I: <u>9</u>	V: I:	V: I:
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: <u>3.25</u> I: <u>10</u>	V: I:	V: I:	V: I:	V: I:
V = value, I = index						SUB-TOTAL (Sum one index from each column)
						<u>39.4</u>

Bank Material Description:

Bank Materials

- Bedrock (Bedrock banks have very low bank erosion potential)
- Boulders (Banks composed of boulders have low bank erosion potential)
- Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
- Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
- Sand (Add 10 points)
- Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT 0

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 0

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.5	10-19.5	20-29.5	30-39.5	40-45	46-50
Bank location description (circle one)					GRAND TOTAL
Straight Reach <u>Outside of Bend</u>					BEHI RATING <u>39.4</u>

Table 1. Documentation of ratios and derived values for near-bank stress

Stream:	Location:				Date:	Crew:	
Method 1	Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High Extensive deposition (continuous, cross channel). NBS = Extreme Chute cutoffs, down-valley meander migration, converging flow (See NBS #1). NBS = Extreme						
Method 2	Radius of Curvature Rc (feet)	Bankfull Width W _{bf} (feet)	Ratio Rc/W	Method 3	Pool Slope S _p	Average Slope S	Ratio S _p /S
Method 4	Pool Slope S _p	Riffle Slope S _{rif}	Ratio S _p /S _{rif}	Method 5	Near-Bank Max Depth d _{nb} (feet)	Mean Depth d (feet)	Ratio d _{nb} /d
Method 6	Near-Bank Max Depth d _{nb} (feet)	Near-Bank Slope S _{nb}	Near-Bank Shear Stress τ _{nb} (lb/ft ²)	Mean Depth d (feet)	Average Slope S	Bankfull Shear Stress τ (lb/ft ²)	Ratio τ _{nb} /τ
	1.3	0.004	0.32	0.6	0.007	0.26	1.23
Method 7	Velocity Gradient						

Table 2. Converting Ratio Values to an Overall Near-Bank Stress Rating

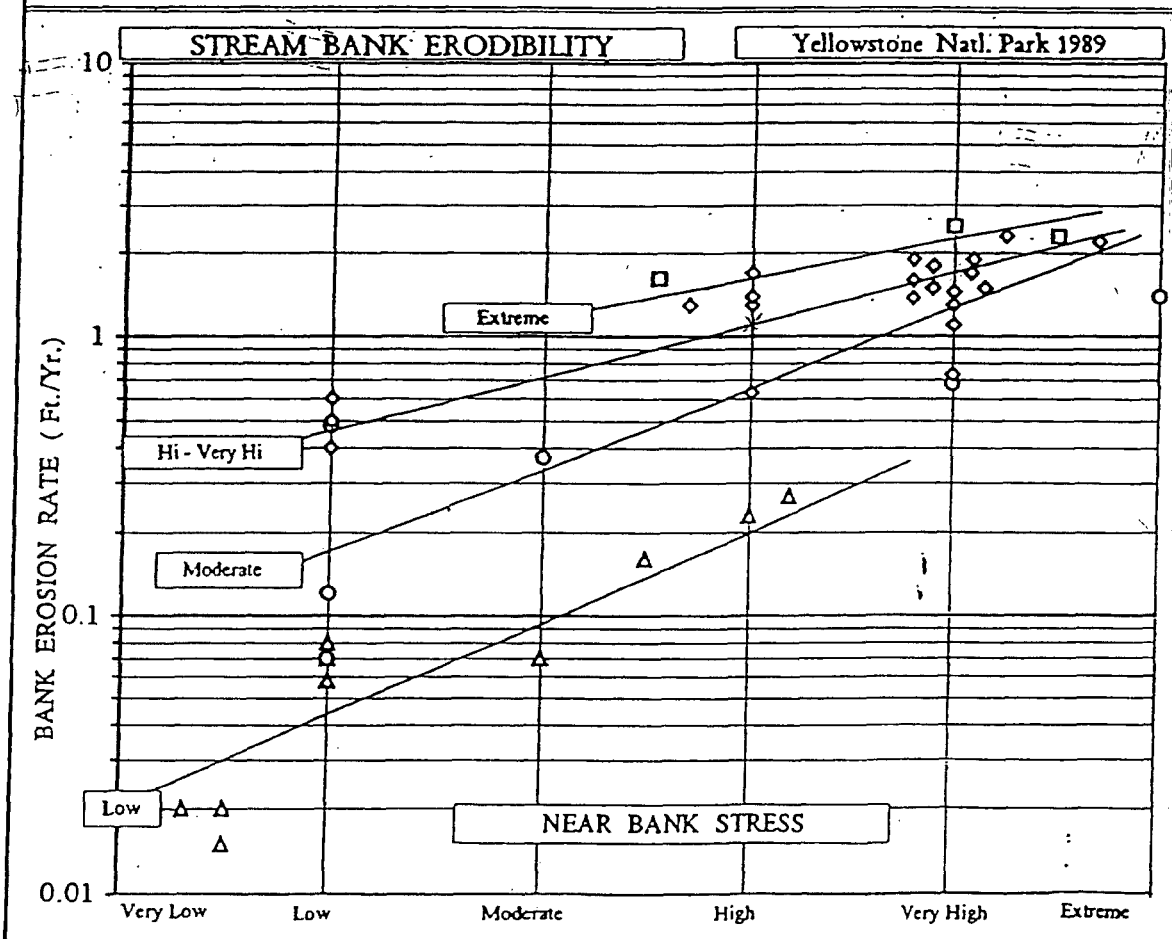
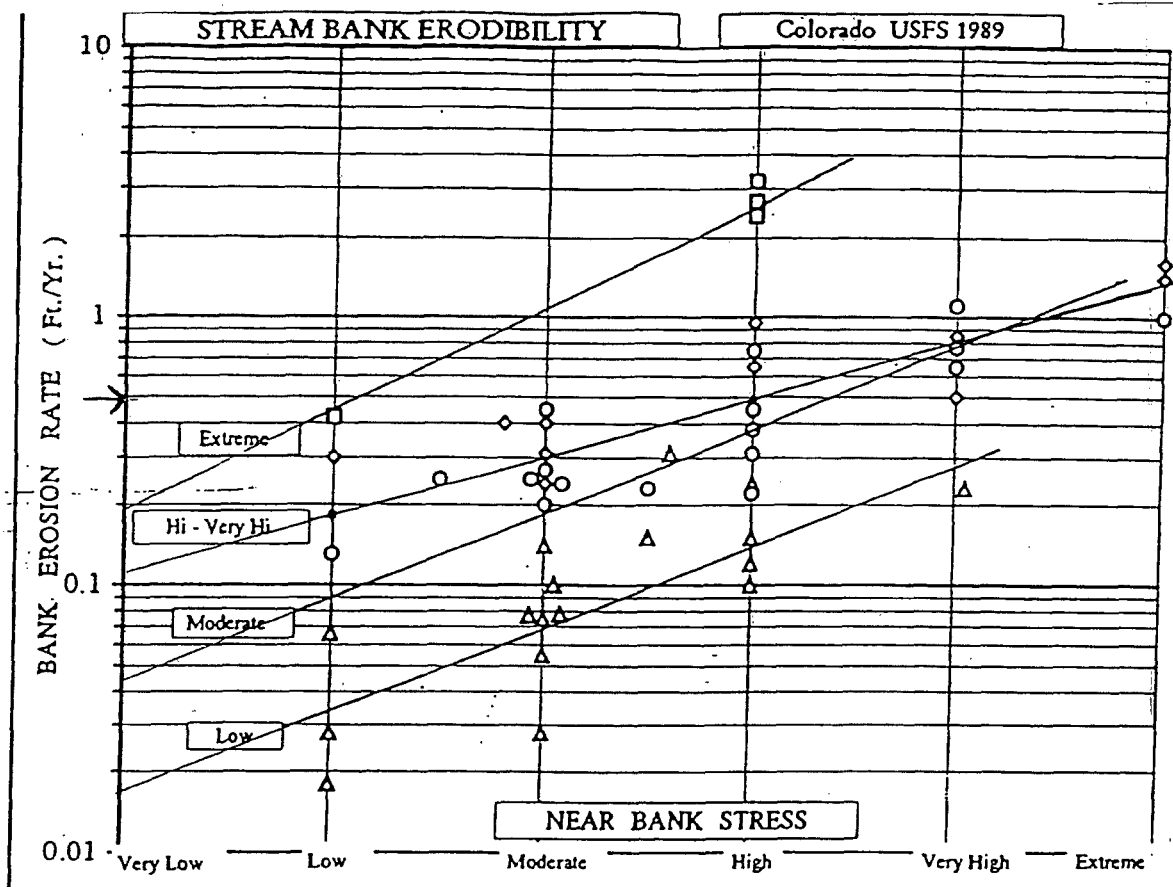
Method Number	1	2	3	4	5	6	7
Rating*							
Very Low	N/A	>3.0	<0.20	<0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		<1.5	>1.0	>1.2	>3.0	>1.6	>2.3

*Circle the dominant near-bank stress rating selected.

Methods for Estimating Near-Bank Stress

1. Transverse bar or split channel/central bar creating NBS/high velocity gradient: Level I - Reconnaissance.
2. Channel pattern (Rc/W): Level II - General Prediction.
3. Ratio of pool slope to average water surface slope (S_p/S): Level II - General Prediction.
4. Ratio of pool slope to riffle slope (S_p/S_{rif}): Level II - General Prediction.
5. Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bf}): Level III - Detailed Prediction.
6. Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bf}): Near bank = 1/3 of channel width at study site. Level III - Detailed Prediction.
7. Velocity profiles/Isovels/Velocity gradient: Level IV - Validation.

Note: Only select the method(s) appropriate for level of assessment and site conditions. It is not necessary to select all methods to obtain an average near-bank stress rating.





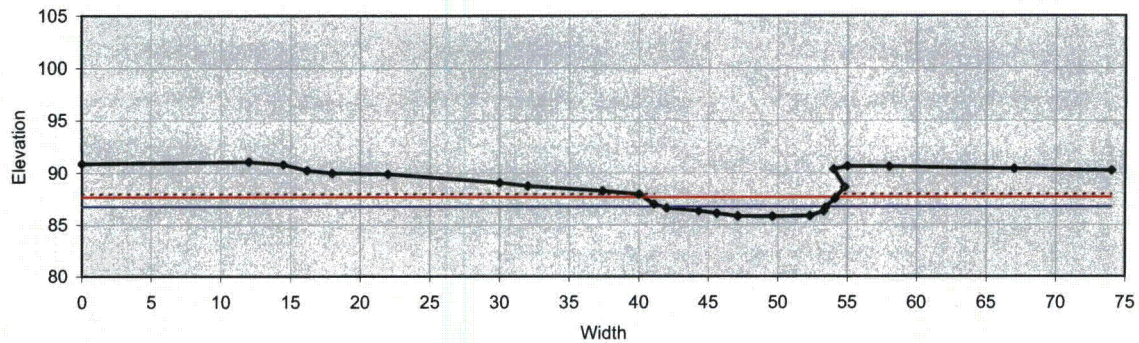
Bank erosion cross section #2 looking upstream



Bank Erosion cross section #2 looking downstream

Cross Section 2

BEXS#2 - Walker Run



Bankfull Dimensions

7.7	x-section area (ft.sq.)
11.7	width (ft)
0.7	mean depth (ft)
0.9	max depth (ft)
12.2	wetted perimeter (ft)
0.6	hyd radi (ft)
17.8	width-depth ratio

Flood Dimensions

13.8	W flood prone area (ft)
1.2	entrenchment ratio
2.1	low bank height (ft)
2.3	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
14	threshold grain size (mm):

Bankfull Flow

3.1	velocity (ft/s)
23.8	discharge rate (cfs)
0.69	Froude number

Flow Resistance

0.030	Manning's roughness
0.12	D'Arcy-Weisbach fric.
---	resistance factor u/u^*
---	relative roughness

Forces & Power

0.72	channel slope (%)
0.28	shear stress (lb/sq.ft.)
0.38	shear velocity (ft/s)
0.92	unit strm power (lb/ft/s)

Cross Section

reference ID	2
instrument height	95.7
longitudinal station	104 BEXS2

Bankfull Stage

FS	9	= 86.7 elev
elevation		#VALUE!

Low Bank Height

FS	7.79	= 87.91 elev
elevation		

Flood Prone Area

width fpa	13.8
-----------	------

Channel Slope

percent slope	0.72	1.5
---------------	------	-----

Flow Resistance

Manning's "n"	0.03
D'Arcy - Weisbach "f"	

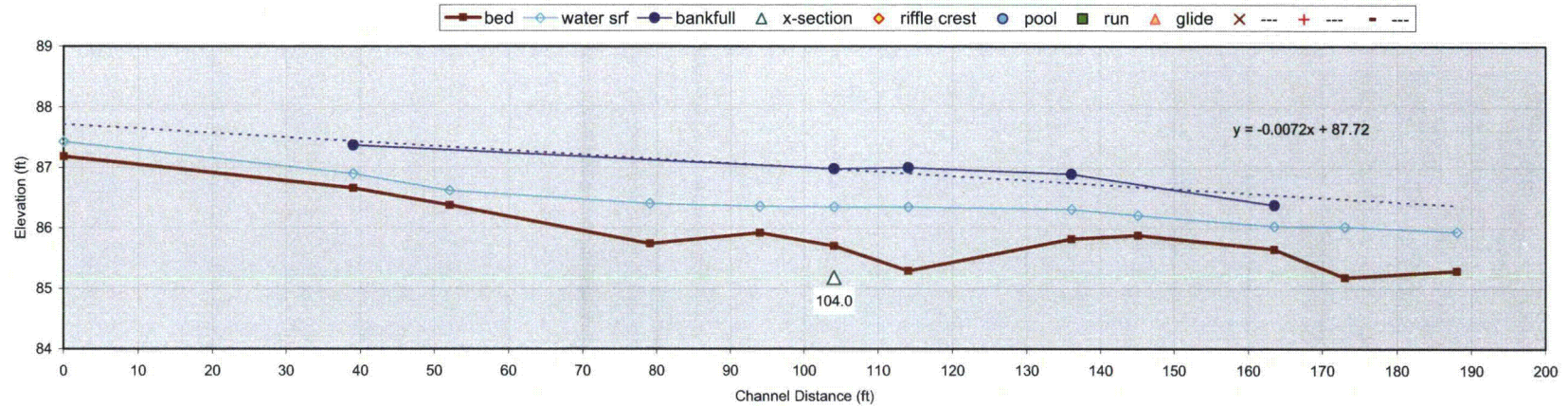
Note:

Used BM3 (elev.=94.66') as TP; got FS HR=1.04 therefore HI=95.70'.

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		95.7	4.82	90.88	<input type="checkbox"/>	L Pin
12		95.7	4.64	91.06	<input type="checkbox"/>	
14.5		95.7	4.91	90.79	<input type="checkbox"/>	
16.2		95.7	5.49	90.21	<input type="checkbox"/>	
18		95.7	5.75	89.95	<input type="checkbox"/>	
22		95.7	5.82	89.88	<input type="checkbox"/>	
30		95.7	6.67	89.03	<input type="checkbox"/>	
32		95.7	6.99	88.71	<input type="checkbox"/>	
37.4		95.7	7.45	88.25	<input type="checkbox"/>	
40		95.7	7.79	87.91	<input type="checkbox"/>	LTOB
41.1		95.7	8.72	86.98	<input type="checkbox"/>	LBKFL?
42		95.7	9.1	86.6	<input type="checkbox"/>	
44.3		95.7	9.38	86.32	<input type="checkbox"/>	LEW
45.6		95.7	9.62	86.08	<input type="checkbox"/>	
47.1		95.7	9.89	85.81	<input type="checkbox"/>	
49.6		95.7	9.92	85.78	<input type="checkbox"/>	
52.3		95.7	9.86	85.84	<input type="checkbox"/>	R Toe
53.3		95.7	9.41	86.29	<input type="checkbox"/>	REW
53.4		95.7	9.04	86.66	<input type="checkbox"/>	BP (bot.)
54.1		95.7	8.16	87.54	<input type="checkbox"/>	BP (mid.)
54.8		95.7	7.11	88.59	<input type="checkbox"/>	BP (top)
54		95.7	5.35	90.35	<input type="checkbox"/>	RTOB
55		95.7	5.05	90.65	<input type="checkbox"/>	
58		95.7	5.1	90.6	<input type="checkbox"/>	
67		95.7	5.31	90.39	<input type="checkbox"/>	
74		95.7	5.48	90.22	<input type="checkbox"/>	R Pin
					<input type="checkbox"/>	
					<input type="checkbox"/>	

Longitudinal Slope Profile

Longitudinal Profile at BEXS#2 - Walker Run



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	0.79	---	188.0 (16.9 channel widths)	---	---	---
rifle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---

notes	cross section ID	bed feature	station	station	Benchmark Elevation			FS bed	water	FS bankfull	user defined			azimuth AZ	ELEV bed	ELEV water srf	ELEV bankfull	ELEV ---	ELEV ---	ELEV ---	
					Turning Points						FS	FS	FS								
					BS	HI	FS														
back sight to benchmark			0		0	95.7									87.18	87.43					
Begin Study Bank			39			95.7		8.52	0.25						86.66	86.9	87.37				
			52			95.7		9.04	0.24	8.33					86.38	86.62					
			79			95.7		9.32	0.24						85.74	86.41					
								9.96	0.67												
BEXS#2	BEXS2		94			95.7		9.78	0.44						85.92	86.36					
			104			95.7		10	0.65	8.72					85.7	86.35	86.98				
			114			95.7		10.41	1.06	8.7					85.29	86.35	87				
End Study Bank			136			95.7		9.88	0.49	8.81					85.82	86.31	86.89				
			145			95.7		9.82	0.33						85.88	86.21					
			163.5			95.7		10.05	0.38	9.32					85.65	86.03	86.38				
buried log exposed (right)			173			95.7		10.52	0.84						85.18	86.02					
			188			95.7		10.41	0.65						85.29	85.94					

Bank Erosion Prediction																					
Stream <i>Walker Run</i>		Cross Section <i>BEXS # 2</i>	Date <i>3/18/09</i>																		
Near Bank Stress Rating																					
Mean Shear Stress		<div style="display: flex; align-items: center; justify-content: center;"> <div style="font-size: 4em; margin-right: 10px;">↑</div> <div style="text-align: center;"> <table border="1" style="border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Conversion of Numerical Indices to Adjective Ratings</th> </tr> <tr> <th style="text-align: center;">Near Bank Stress Rating</th> <th style="text-align: center;">Near Bank Stress/Mean Shear Stress</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Very Low</td> <td style="text-align: center;"><0.8</td> </tr> <tr> <td style="text-align: center;">Low</td> <td style="text-align: center;">0.8 - 1.05</td> </tr> <tr> <td style="text-align: center;">Moderate</td> <td style="text-align: center;">1.06 - 1.14</td> </tr> <tr> <td style="text-align: center;">High</td> <td style="text-align: center;">1.15 - 1.19</td> </tr> <tr> <td style="text-align: center;">Very High</td> <td style="text-align: center;">1.2 - 1.6</td> </tr> <tr> <td style="text-align: center;">Extreme</td> <td style="text-align: center;">>1.6</td> </tr> <tr> <td style="text-align: center;">Near Bank Stress Rating</td> <td style="text-align: center;"><i>Low</i></td> </tr> </tbody> </table> </div> </div>		Conversion of Numerical Indices to Adjective Ratings		Near Bank Stress Rating	Near Bank Stress/Mean Shear Stress	Very Low	<0.8	Low	0.8 - 1.05	Moderate	1.06 - 1.14	High	1.15 - 1.19	Very High	1.2 - 1.6	Extreme	>1.6	Near Bank Stress Rating	<i>Low</i>
Conversion of Numerical Indices to Adjective Ratings																					
Near Bank Stress Rating	Near Bank Stress/Mean Shear Stress																				
Very Low	<0.8																				
Low	0.8 - 1.05																				
Moderate	1.06 - 1.14																				
High	1.15 - 1.19																				
Very High	1.2 - 1.6																				
Extreme	>1.6																				
Near Bank Stress Rating	<i>Low</i>																				
Bankfull Hydraulic Radius (ft) R	<i>0.6</i>																				
Water Surface Facet Slope (ft/ft) S	<i>0.008</i>																				
Shear Stress (lb/ft ²) $\tau = \gamma RS \gamma = 62.4 \text{ lb/ft}^3$	<i>0.29</i>																				
Near Bank Shear Stress																					
Bankfull Hydraulic Radius (ft) R (near bank 1/3)	<i>0.9</i>																				
Near Bank Water Surface Slope (ft/ft) S	<i>0.005</i>																				
Shear Stress (lb/ft ²) $\tau_{\text{near bank}} = \gamma RS$	<i>0.28</i>																				
Near Bank Stress/Mean Shear Stress ($\tau_{\text{near bank}}/\tau$)	<i>0.96</i>																				
Stream Bank Erodibility Rating																					
BEHI Rating		<i>High</i>																			
Bank Erosion Prediction at Cross Section																					
A	B	C	D																		
Lateral Erosion at Cross Section (feet/year)	Bank Height (feet)	Length of Bank (feet)	Predicted Erosion feet ³																		
<i>0.45</i>	<i>4.51</i>	<i>1</i>	<i>2.02 ft³/yr.</i>																		

Circle graph used:

Colorado

Yellowstone

- Column A: Use Stream Bank Erodibility Rating and Near Bank Stress Rating in conjunction with Figure 6-27 in Rosgen, 1996.
- Column B: Study Bank Height (Use Cross Section Plot: top of bank - toe of bank)
- Column C: Input 1 foot for point erosion @ cross section
- Column D: Columns A*B*C

180 ft³ | 150 lbs | 13 ft³
413 704 lbs

1.

Stream: Walker Run	Cross Section: DEXS #2	Date: 3/18/09	Observers: BRU, EPJ
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Bank Height/Max Depth Bankfull (C)

Highest Bank Height (ft)	4.57 A	Max Bankfull Depth (ft)	0.9 B	A/B	5.08 C
--------------------------	-----------	-------------------------	----------	-----	-----------

Root Depth/Bank Height (F)

Root Depth (ft)	2.2 D	Study Bank Height (ft)	4.5 E	D/E	0.49 F
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Weighted Root Density (H)

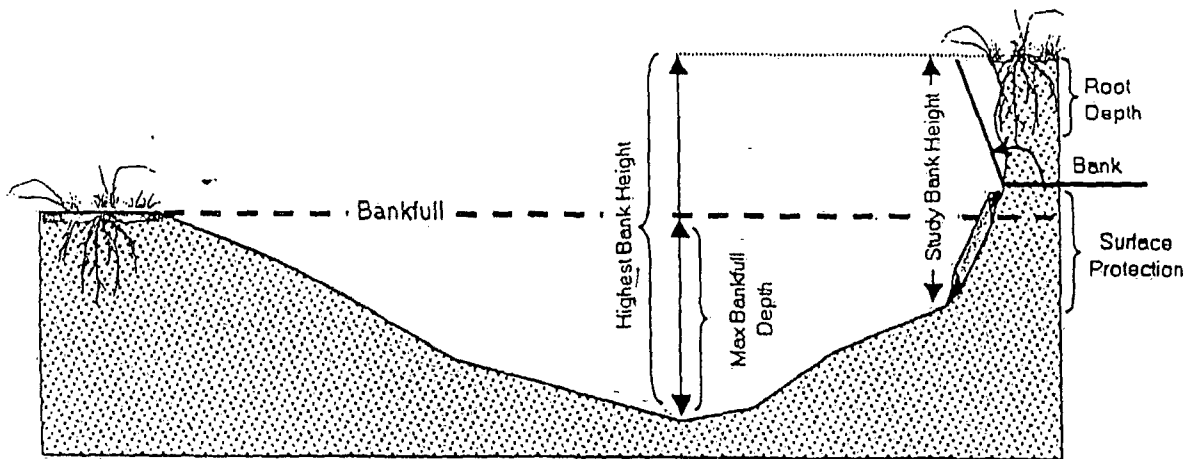
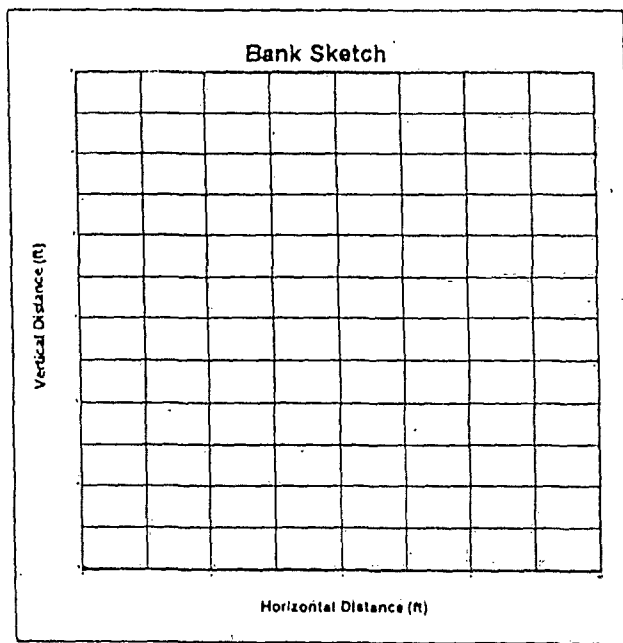
Root Density (%)	8 G	G*F	3.92 H
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Bank Angle (I)

Bank Angle (Degrees)	85
-------------------------	----

Weighted Surface Protection (K)

Height of Bank Protection (ft)	0.8	J/E	0.18
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Bank Erodibility Hazard Rating Guide						
Stream <u>Walker Run</u>		Reach <u>BEYS # 2</u>		Date <u>3/18/09</u>		Crew <u>BRM, EPS</u>
Bank Height (ft):	Bank Height/ Bankfull Ht	Root Depth/ Bank Height	Root Density %	Bank Angle (Degrees)	Surface Protection%	
VERY LOW	Value	1.0-1.1	1.0-0.9	100-80	0-20	100-80
	Index	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
LOW	Value	1.11-1.19	0.89-0.5	79-55	21-60	79-55
	Index	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
MODERATE	Value	1.2-1.5	0.49-0.3	54-30	61-80	54-30
	Index	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9
	Choice	V: I:	V: <u>0.44</u> I: <u>4</u>	V: I:	V: I:	V: I:
HIGH	Value	1.6-2.0	0.29-0.15	29-15	81-90	29-15
	Index	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9
	Choice	V: I:	V: I:	V: I:	V: <u>85</u> I: <u>7.0</u>	V: <u>18</u> I: <u>7.75</u>
VERY HIGH	Value	2.1-2.8	0.14-0.05	14-5.0	91-119	14-10
	Index	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0
	Choice	V: I:	V: I:	V: <u>88</u> I: <u>8.75</u>	V: I:	V: I:
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: <u>5.08</u> I: <u>10</u>	V: I:	V: I:	V: I:	V: I:
SUB-TOTAL (Sum one index from each column)						<u>37.5</u>

V = value, I = index

Bank Material Description:

Bank Materials

- Bedrock (Bedrock banks have very low bank erosion potential)
- Boulders (Banks composed of boulders have low bank erosion potential)
- Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
- Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
- Sand (Add 10 points)
- Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT 0

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 0

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.5	10-19.5	20-29.5	30-39.5	40-45	46-50
Bank location description (circle one)					GRAND TOTAL
Straight Reach <u>Outside of Bend</u>					BEHI RATING <u>37.5</u>

Table 1. Documentation of ratios and derived values for near-bank stress

Stream:	Location:				Date:			Crew:
Method 1	Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High Extensive deposition (continuous, cross channel). NBS = Extreme Chute cutoffs, down-valley meander migration, converging flow (See NBS #1). NBS = Extreme							
Method 2	Radius of Curvature Rc (feet)	Bankfull Width W _{bf} (feet)	Ratio Rc/W	Method 3	Pool Slope S _p	Average Slope S	Ratio S _p /S	
Method 4	Pool Slope S _p	Riffle Slope S _{rif}	Ratio S _p /S _{rif}	Method 5	Near-Bank Max Depth d _{nb} (feet)	Mean Depth d (feet)	Ratio d _{nb} /d	
Method 6	Near-Bank Max Depth d _{nb} (feet)	Near-Bank Slope S _{nb}	Near-Bank Shear Stress τ _{nb} (lb/ft ²)	Mean Depth d (feet)	Average Slope S	Bankfull Shear Stress τ (lb/ft ²)	Ratio τ _{nb} /τ	
	1.3	0.004	0.32	0.6	0.007	0.26	1.23	
Method 7	Velocity Gradient							

Table 2. Converting Ratio Values to an Overall Near-Bank Stress Rating

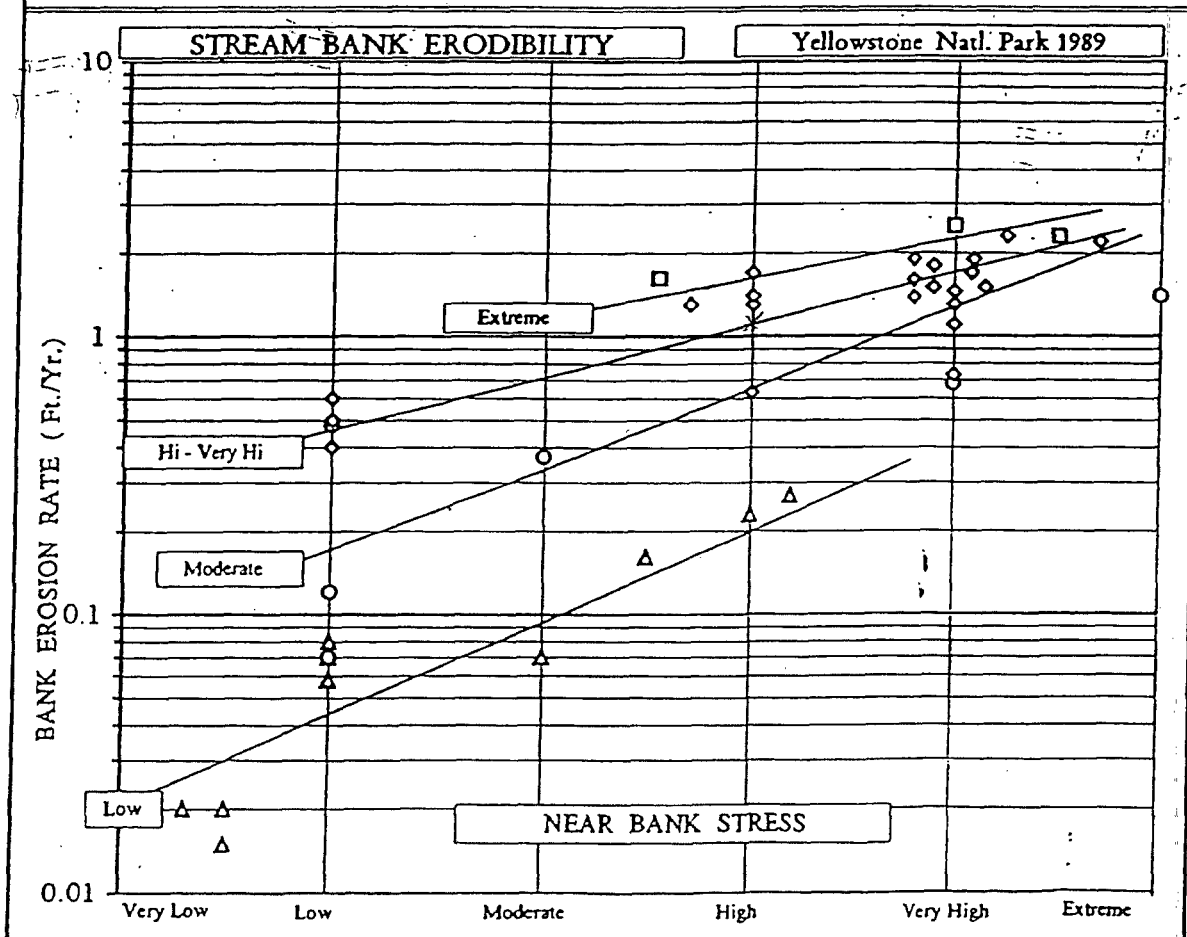
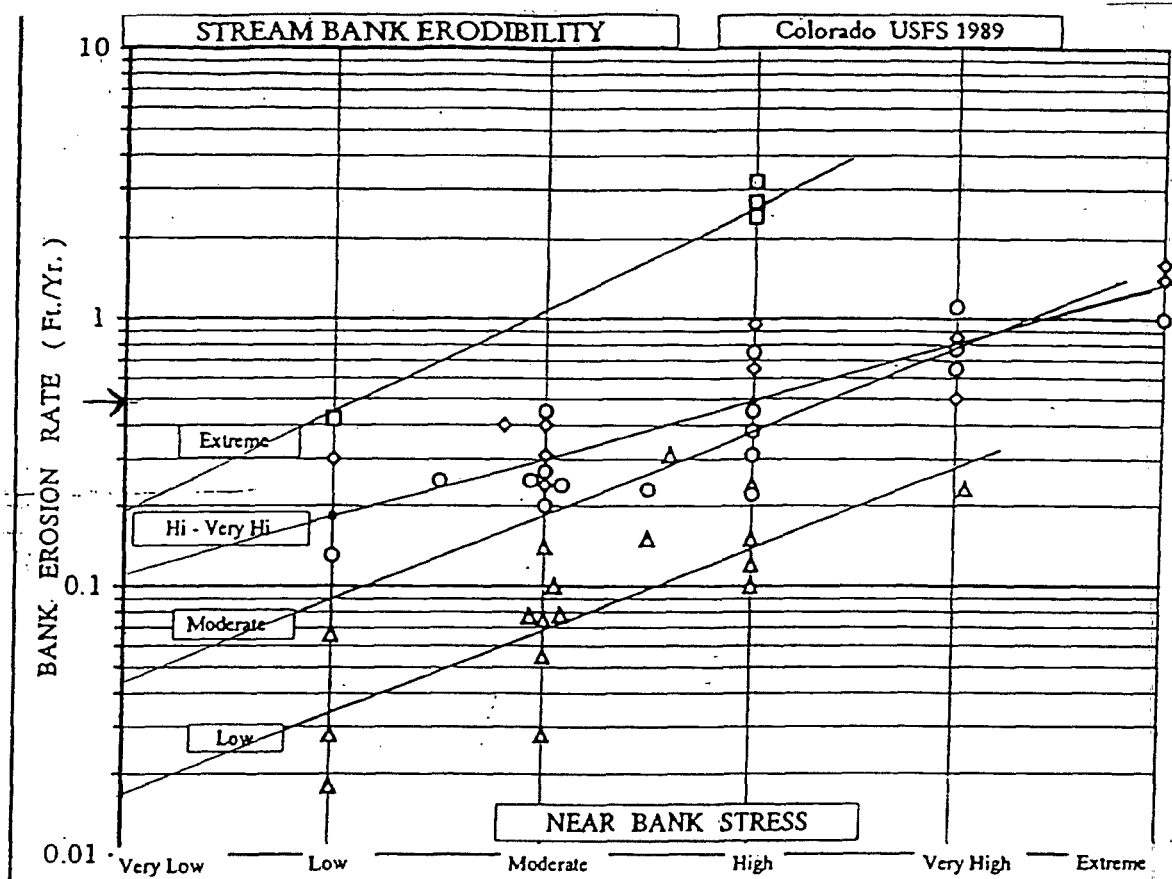
Method Number	1	2	3	4	5	6	7
Rating*							
Very Low	N/A	>3.0	<0.20	<0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		<1.5	>1.0	>1.2	>3.0	>1.6	>2.3

*Circle the dominant near-bank stress rating selected.

Methods for Estimating Near-Bank Stress

1. Transverse bar or split channel/central bar creating NBS/high velocity gradient: Level I - Reconnaissance.
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5. Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bf}): Level III - Detailed Prediction.
6. Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bf}): Near bank = 1/3 of channel width at study site. Level III - Detailed Prediction.
7. Velocity profiles/Isovels/Velocity gradient: Level IV - Validation.

Note: Only select the method(s) appropriate for level of assessment and site conditions. It is not necessary to select all methods to obtain an average near-bank stress rating.





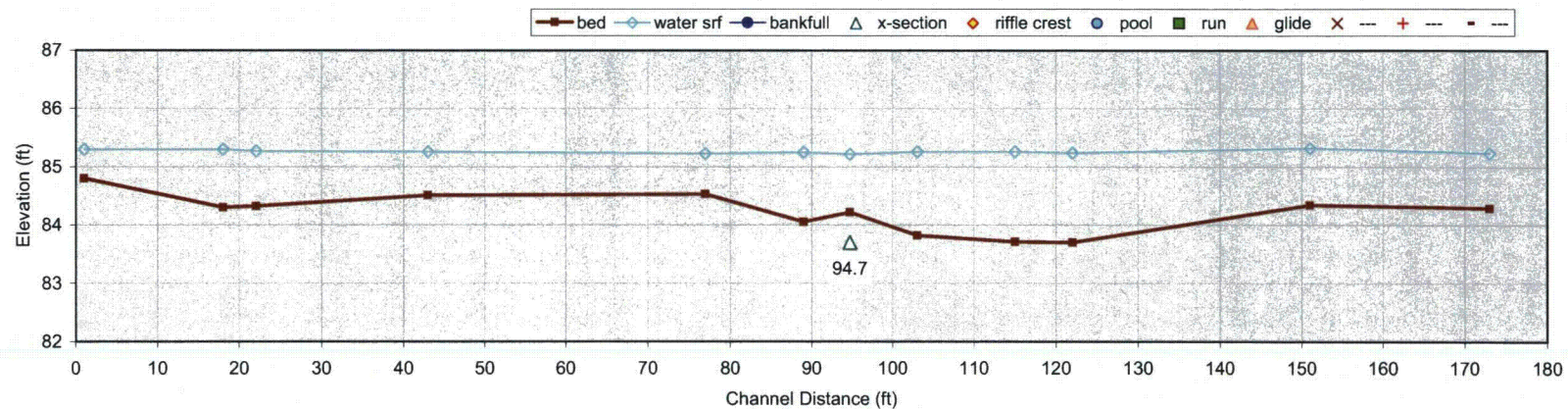
Bank erosion cross section #3 looking upstream



Bank erosion cross section#3 looking downstream

Longitudinal Slope Profile

Longitudinal Profile at BEXS#3 - Walker Run

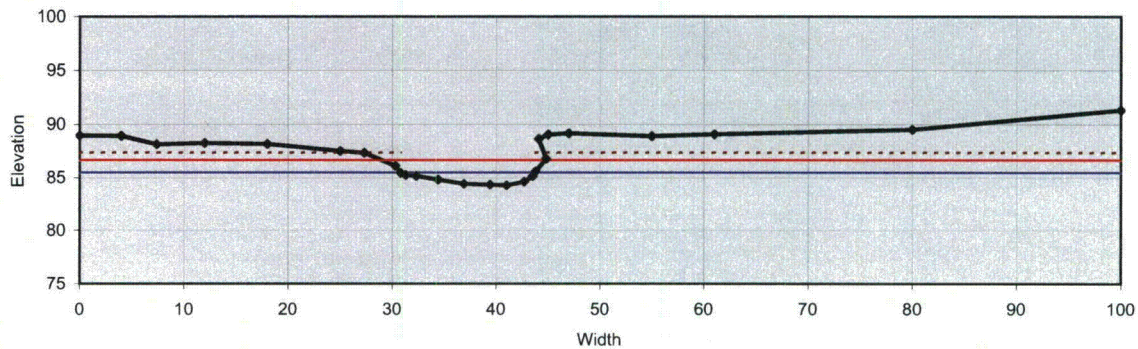


	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	0.035	---	173.0 (15.5 channel widths)	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

[illegible]

Cross Section 3

BEXS#3 - Walker Run



Bankfull Dimensions

10.1	x-section area (ft.sq.)
12.9	width (ft)
0.8	mean depth (ft)
1.2	max depth (ft)
13.4	wetted parimeter (ft)
0.8	hyd radi (ft)
16.5	width-depth ratio

Flood Dimensions

15.7	W flood prone area (ft)
1.2	entrenchment ratio
3.0	low bank height (ft)
2.6	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
0	threshold grain size (mm):

Bankfull Flow

0.2	velocity (ft/s)
1.9	discharge rate (cfs)
0.04	Froude number

Flow Resistance

0.030	Manning's roughness
0.11	D'Arcy-Weisbach fric.
---	resistance factor u/u^*
---	relative roughness

Forces & Power

0.002	channel slope (%)
0.00	shear stress (lb/sq.ft.)
0.02	shear velocity (ft/s)
0.00018	unit strm power (lb/ft/s)

Cross Section

reference ID	3
instrument height	93.32
longitudinal station	---

Bankfull Stage

FS	7.85	= 85.47 elev
elevation	---	

Low Bank Height

FS	5.98	= 87.34 elev
elevation	---	

Flood Prone Area

width fpa	15.7
-----------	------

Channel Slope

percent slope	0.002	1.5
---------------	-------	-----

Flow Resistance

Manning's "n"	0.03
D'Arcy - Weisbach "f"	---

Note:

BS to BM4 (elev.=89.52') and got HR=3.80 therefore the HI=93.32'; valley wall continues beyond sta. 100 at even slope beginning at

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		93.32	4.36	88.96		L Pin
4		93.32	4.41	88.91		
7.4		93.32	5.16	88.16		
12		93.32	5.06	88.26		
18		93.32	5.15	88.17		
25		93.32	5.81	87.51		
27.3		93.32	5.98	87.34		LTOB
30.3		93.32	7.2	86.12		LBKFL?
30.8		93.32	7.85	85.47		
31.3		93.32	8.05	85.27		LEW
32.3		93.32	8.14	85.18		
34.4		93.32	8.48	84.84		
36.9		93.32	8.89	84.43		
39.4		93.32	8.97	84.35		
41		93.32	9.02	84.3		
42.7		93.32	8.69	84.63		R Toe
43.5		93.32	8.17	85.15		REW
43.8		93.32	7.71	85.61		BP (bot.)
44.8		93.32	6.53	86.79		BP (top)
44.1		93.32	4.69	88.63		RTOB
45		93.32	4.29	89.03		
47		93.32	4.18	89.14		
55		93.32	4.42	88.9		
61		93.32	4.25	89.07		R Pin
80		93.32	3.81	89.51		Toe of slog
100		93.32	2	91.32		up valley w

Bank Erosion Prediction																	
Stream <i>Walker Run</i>		Cross Section <i>BEXS #3</i>	Date <i>3/18/09</i>														
Near Bank Stress Rating																	
Mean Shear Stress		<div style="display: flex; align-items: center; justify-content: center;"> <div style="font-size: 4em; margin-right: 10px;">↑</div> <div style="text-align: left;"> <table border="1" style="border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Near Bank Stress Rating</th> <th style="text-align: center;">Near Bank Stress/Mean Shear Stress</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Very Low</td> <td style="text-align: center;"><0.8</td> </tr> <tr> <td style="text-align: center;">Low</td> <td style="text-align: center;">0.8 - 1.05</td> </tr> <tr> <td style="text-align: center;">Moderate</td> <td style="text-align: center;">1.06 - 1.14</td> </tr> <tr> <td style="text-align: center;">High</td> <td style="text-align: center;">1.15 - 1.19</td> </tr> <tr> <td style="text-align: center;"><u>Very High</u></td> <td style="text-align: center;">1.2 - 1.6</td> </tr> <tr> <td style="text-align: center;">Extreme</td> <td style="text-align: center;">>1.6</td> </tr> </tbody> </table> </div> </div>		Near Bank Stress Rating	Near Bank Stress/Mean Shear Stress	Very Low	<0.8	Low	0.8 - 1.05	Moderate	1.06 - 1.14	High	1.15 - 1.19	<u>Very High</u>	1.2 - 1.6	Extreme	>1.6
Near Bank Stress Rating	Near Bank Stress/Mean Shear Stress																
Very Low	<0.8																
Low	0.8 - 1.05																
Moderate	1.06 - 1.14																
High	1.15 - 1.19																
<u>Very High</u>	1.2 - 1.6																
Extreme	>1.6																
Bankfull Hydraulic Radius (ft) R	<i>0.8</i>																
Water Surface Facet Slope (ft/ft) S	<i>0.00035</i>																
Shear Stress (lb/ft ²) $\tau = \gamma RS \gamma = 62.4 \text{ lb/ft}^3$	<i>0.017</i>																
Near Bank Shear Stress																	
Bankfull Hydraulic Radius (ft) R (near bank 1/3)	<i>1.2</i>																
Near Bank Water Surface Slope (ft/ft) S	<i>0.0003</i>																
Shear Stress (lb/ft ²) $\tau \text{ near bank} = \gamma RS$	<i>0.022</i>																
Near Bank Stress/Mean Shear Stress ($\tau \text{ near bank} / \tau$)	<i>1.29</i>	Near Bank Stress Rating	<i>Very High</i>														
Stream Bank Erodibility Rating																	
BEHI Rating		<i>High</i>															
Bank Erosion Prediction at Cross Section																	
A	B	C	D														
Lateral Erosion at Cross Section (feet/year)	Bank Height (feet)	Length of Bank (feet)	Predicted Erosion feet ³														
<i>1.75</i>	<i>4</i>	<i>1</i>	<i>7 ft³/yr.</i>														

Circle graph used:

Colorado

Yellowstone

- Column A: Use Stream Bank Erodibility Rating and Near Bank Stress Rating in conjunction with Figure 6-27 in Rosgen, 1996.
- Column B: Study Bank Height (Use Cross Section Plot: top of bank - toe of bank)
- Column C: Input 1 foot for point erosion @ cross section
- Column D: Columns A*B*C

BEHI Variable Worksheet

Stream: Walker Run	Cross Section: BEXS #3	Date: 3/18/09	Observers: BRU, EPS
--------------------	------------------------	---------------	---------------------

Bank Height/Max Depth Bankfull (C)

Highest Bank Height (ft)	4.33 A	Max Bankfull Depth (ft)	1.2 B	A/B	3.61 C
--------------------------	-----------	-------------------------	----------	-----	-----------

Root Depth/Bank Height (F)

Root Depth (ft)	Z D	Study Bank Height (ft)	4 E	D/E	0.5 F
-----------------	--------	------------------------	--------	-----	----------

Weighted Root Density (H)

Root Density (%)	15 % G	G*F	7.5 H
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Bank Angle (I)

Bank Angle (Degrees)	90°
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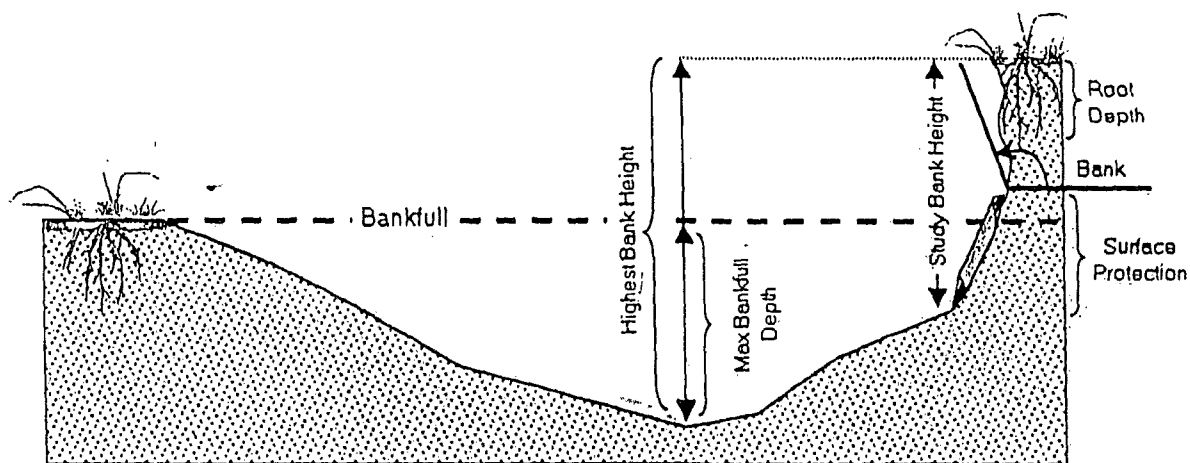
Weighted Surface Protection (K)

Height of Bank Protection (ft)	0	J/E	0
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Bank Sketch

Vertical Distance (ft)

Horizontal Distance (ft)



Bank Erodibility Hazard Rating Guide							
Stream <u>Walker Run</u>		Reach <u>BEXS #3</u>		Date <u>3/18/09</u>		Crew <u>BRU, EPS</u>	
Bank Height (ft):	Bank Height/	Root Depth/	Root	Bank Angle	Surface		
Bankfull Height (ft):	Bankfull Ht	Bank Height	Density %	(Degrees)	Protection%		
VERY LOW	Value	1.0-1.1	1.0-0.9	100-80	0-20	100-80	
	Index	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9	
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:	
LOW	Value	1.11-1.19	0.89-0.5	79-55	21-60	79-55	
	Index	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9	
	Choice	V: I:	V: <u>6.5</u> I: <u>3.9</u>	V: I:	V: I:	V: I:	
MODERATE	Value	1.2-1.5	0.49-0.3	54-30	61-80	54-30	
	Index	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9	
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:	
HIGH	Value	1.6-2.0	0.29-0.15	29-15	81-90	29-15	
	Index	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9	
	Choice	V: I:	V: I:	V: <u>15.8</u> I: <u>7.9</u>	V: <u>40</u> I: <u>7.9</u>	V: I:	
VERY HIGH	Value	2.1-2.8	0.14-0.05	14-5.0	91-119	14-10	
	Index	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0	
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:	
EXTREME	Value	>2.8	<0.05	<5	>119	<10	
	Index	10	10	10	10	10	
	Choice	V: <u>3.6</u> I: <u>10</u>	V: I:	V: I:	V: I:	V: <u>0</u> I: <u>10</u>	
V = value, I = index						SUB-TOTAL (Sum one index from each column)	39.7

Bank Material Description:

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT 0

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 0

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.5	10-19.5	20-29.5	30-39.5	40-45	46-50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING 39.7

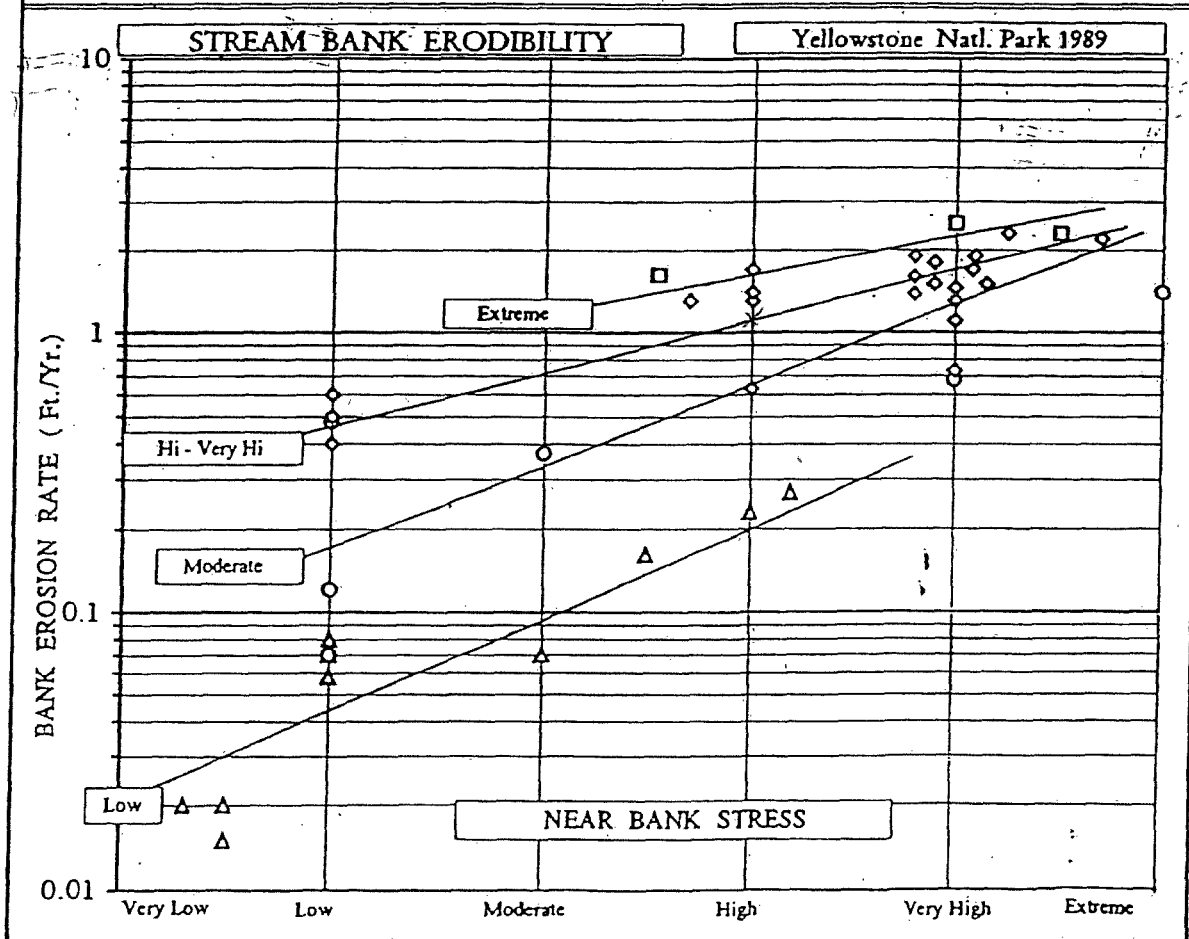
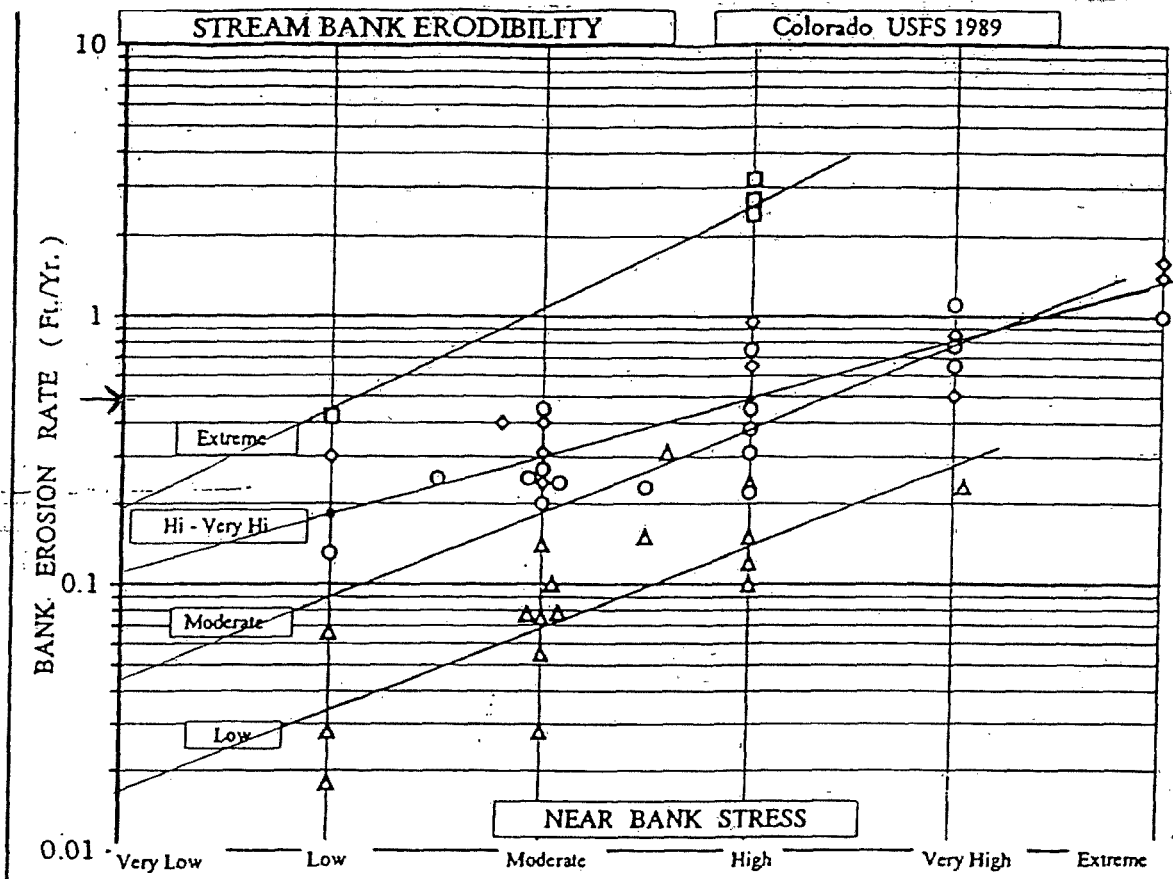


Table 1. Documentation of ratios and derived values for near-bank stress

Stream:	Location:				Date:	Crew:	
Method 1	Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High Extensive deposition (continuous, cross channel). NBS = Extreme Chute cutoffs, down-valley meander migration, converging flow (See NBS #1). NBS = Extreme						
Method 2	Radius of Curvature Rc (feet)	Bankfull Width W _{bkf} (feet)	Ratio Rc/W	Method 3	Pool Slope S _p	Average Slope S	Ratio S _p /S
Method 4	Pool Slope S _p	Riffle Slope S _{rit}	Ratio S _p /S _{rit}	Method 5	Near-Bank Max Depth d _{nb} (feet)	Mean Depth d (feet)	Ratio d _{nb} /d
Method 6	Near-Bank Max Depth d _{nb} (feet)	Near-Bank Slope S _{nb}	Near-Bank Shear Stress τ _{nb} (lb/ft ²)	Mean Depth d (feet)	Average Slope S	Bankfull Shear Stress τ (lb/ft ²)	Ratio τ _{nb} /τ
	1.3	0.004	0.32	0.6	0.007	0.26	1.23
Method 7	Velocity Gradient						

Table 2. Converting Ratio Values to an Overall Near-Bank Stress Rating

Method Number	1	2	3	4	5	6	7
Rating*							
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

*Circle the dominant near-bank stress rating selected.

Methods for Estimating Near-Bank Stress

1. Transverse bar or split channel/central bar creating NBS/high velocity gradient: Level I - Reconnaissance.
2. Channel pattern (Rc/W): Level II - General Prediction.
3. Ratio of pool slope to average water surface slope (S_p/S): Level II - General Prediction.
4. Ratio of pool slope to riffle slope (S_p/S_{rit}): Level II - General Prediction.
5. Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): Level III - Detailed Prediction.
6. Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): Near bank = 1/3 of channel width at study site. Level III - Detailed Prediction.
7. Velocity profiles/Isovels/Velocity gradient: Level IV - Validation.

Note: Only select the method(s) appropriate for level of assessment and site conditions. It is not necessary to select all methods to obtain an average near-bank stress rating.

**Assessment Reach Cross-Sections and Longitudinal Profile
with Photo-documentation**



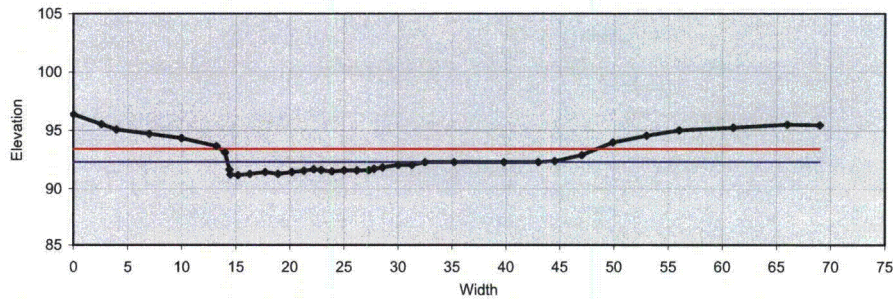
Assessment reach cross section #1 looking upstream



Assessment reach cross section #1 looking downstream

Cross Section 1

Assessment XS#1 - Walker Run



Bankfull Dimensions

12.3	x-section area (ft.sq.)
18.3	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
19.2	wetted perimeter (ft)
0.6	hyd radi (ft)
27.1	width-depth ratio

Bankfull Flow

2.4	velocity (ft/s)
29.3	discharge rate (cfs)
0.52	Froude number

Flood Dimensions

34.7	W flood prone area (ft)
1.9	entrenchment ratio
--	low bank height (ft)
--	low bank height ratio

Flow Resistance

0.059	Manning's roughness
0.47	D'Arcy-Weisbach fric.
4.1	resistance factor u/u^*
1.5	relative roughness

Materials

57	D50 Riffle (mm)
140	D84 Riffle (mm)
32	threshold grain size (mm):

Forces & Power

1.6	channel slope (%)
0.64	shear stress (lb/sq.ft.)
0.58	shear velocity (ft/s)
1.6	unit strm power (lb/ft/s)

Cross Section

reference ID	1
instrument height	100
longitudinal station	275

Bankfull Stage

FS	7.74	= 92.26 elev
elevation		

Low Bank Height

FS	
elevation	

Flood Prone Area

width fpa	34.7	34.7
-----------	------	------

Channel Slope

percent slope	1.6	#REF!
---------------	-----	-------

Flow Resistance

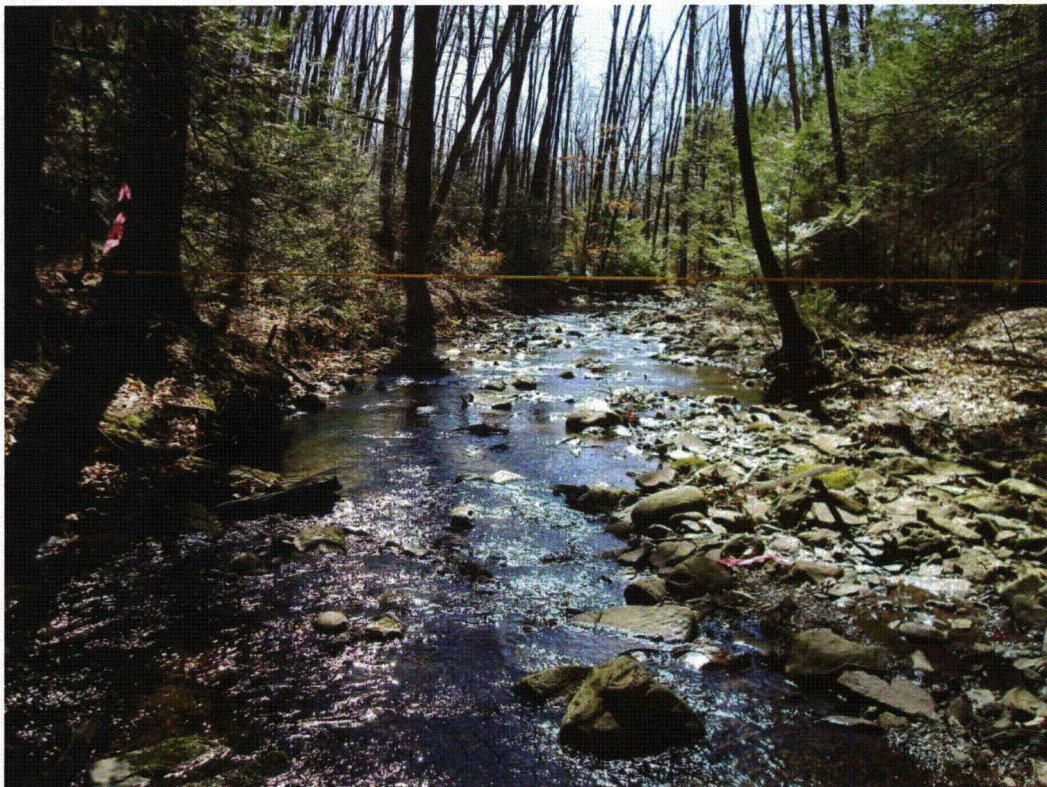
Manning's "n"	0.059	0.059
D'Arcy - Weisbach "f"		0.47

Note:

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		100	3.61	96.39		
2.6		100	4.47	95.53		
4		100	4.91	95.09		
7		100	5.28	94.72		
10		100	5.65	94.35		
13.2		100	6.35	93.65		LTOB
14		100	6.92	93.08		
14.4		100	8.37	91.63		
14.5		100	8.79	91.21		
15.2		100	8.85	91.15		
16.3		100	8.74	91.26		
17.7		100	8.58	91.42		
18.9		100	8.74	91.26		
20.2		100	8.57	91.43		
21.3		100	8.48	91.52		
22.2		100	8.35	91.65		
22.9		100	8.42	91.58		
23.9		100	8.53	91.47		
25		100	8.44	91.56		
26.2		100	8.45	91.55		
27.3		100	8.42	91.58		
27.8		100	8.31	91.69		REOW
28.6		100	8.17	91.83		
30		100	7.98	92.02		BKFL #1
31.3		100	7.96	92.04		
32.5		100	7.74	92.26		BKFL #2
35.2		100	7.74	92.26		
39.8		100	7.74	92.26		
43		100	7.74	92.26		
44.5		100	7.65	92.35		
47		100	7.12	92.88		
49.9		100	6.03	93.97		RTOB
53		100	5.46	94.54		
56		100	4.99	95.01		
61		100	4.75	95.25		
66		100	4.49	95.51		
69		100	4.56	95.44		



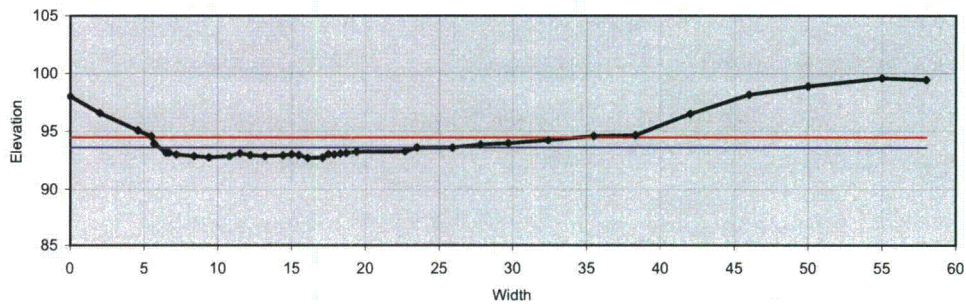
Assessment reach cross section #2 looking upstream



Assessment reach cross section #2 looking downstream

Cross Section 2

Assessment XS#2 - Walker Run



Bankfull Dimensions

9.8	x-section area (ft.sq.)
17.4	width (ft)
0.6	mean depth (ft)
0.9	max depth (ft)
17.9	wetted perimeter (ft)
0.5	hyd radi (ft)
31.0	width-depth ratio

Flood Dimensions

34.3	W flood prone area (ft)
2.0	entrenchment ratio
---	low bank height (ft)
---	low bank height ratio

Materials

57	D50 Riffle (mm)
140	D84 Riffle (mm)
27	threshold grain size (mm):

Bankfull Flow

2.0	velocity (ft/s)
19.3	discharge rate (cfs)
0.47	Froude number

Flow Resistance

0.064	Manning's roughness
0.58	D'Arcy-Weisbach fric.
3.7	resistance factor u/u*
1.2	relative roughness

Forces & Power

1.6	channel slope (%)
0.55	shear stress (lb/sq.ft.)
0.53	shear velocity (ft/s)
1.11	unit strm power (lb/ft/s)

Cross Section

reference ID	2
instrument height	102.21
longitudinal station	180.1

Bankfull Stage

FS	8.64	= 93.57 elev
elevation		

Low Bank Height

FS	
elevation	

Flood Prone Area

width fpa	34.3	29.0
-----------	------	------

Channel Slope

percent slope	1.6	#REF!
---------------	-----	-------

Flow Resistance

Manning's "n"	0.064	0.064
D'Arcy - Weisbach "f"		0.59

Note:

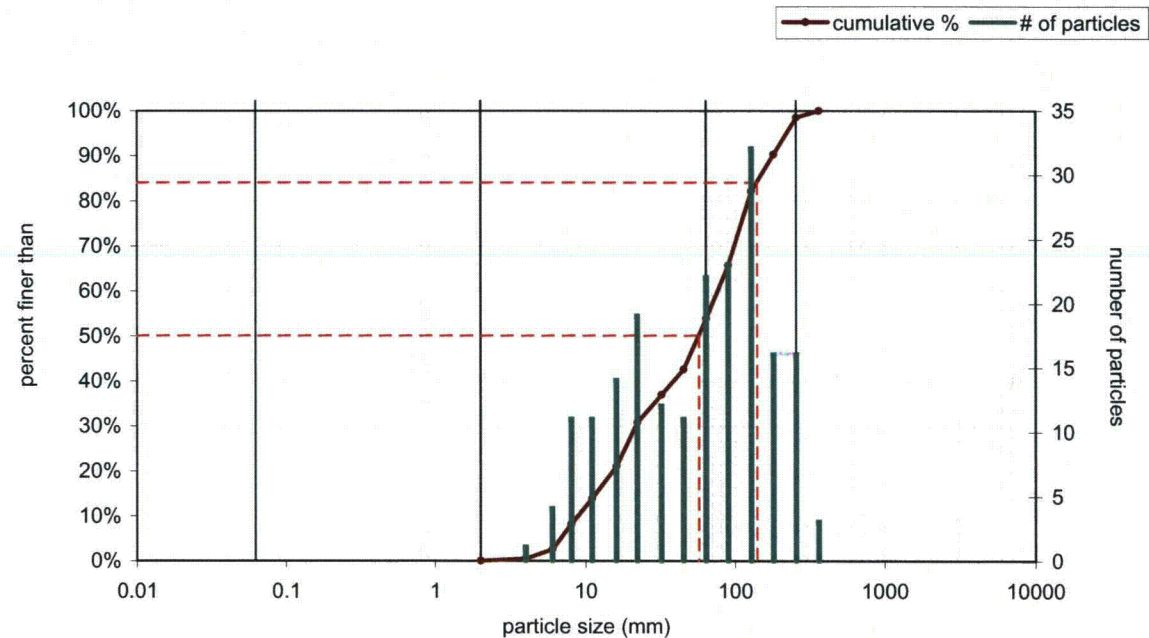
Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		102.21	4.19	98.02		
2		102.21	5.66	96.55		
4.6		102.21	7.16	95.05		
5.5		102.21	7.63	94.58		
5.7		102.21	8.29	93.92		
6.5		102.21	9.06	93.15		
6.7		102.21	9.07	93.14		LEOW
7.2		102.21	9.23	92.98		
8.4		102.21	9.37	92.84		
9.4		102.21	9.46	92.75		
10.8		102.21	9.36	92.85		
11.5		102.21	9.13	93.08		
12.2		102.21	9.28	92.93		
13.2		102.21	9.36	92.85		
14.4		102.21	9.3	92.91		
15		102.21	9.19	93.02		
15.5		102.21	9.29	92.92		
16.1		102.21	9.52	92.69		
17.1		102.21	9.5	92.71		
17.5		102.21	9.19	93.02		
17.9		102.21	9.22	92.99		
18.3		102.21	9.15	93.06		REOW
18.7		102.21	9.1	93.11		
19.4		102.21	8.99	93.22		BKFL #1
22.7		102.21	8.95	93.26		
23.5		102.21	8.64	93.57		BKFL #2
25.9		102.21	8.63	93.58		
27.8		102.21	8.37	93.84		
29.7		102.21	8.25	93.96		
32.4		102.21	7.99	94.22		
35.5		102.21	7.65	94.56		
38.3		102.21	7.56	94.65		
42		102.21	5.72	96.49		
46		102.21	4.06	98.15		
50		102.21	3.33	98.88		
55		102.21	2.65	99.56		
58		102.21	2.78	99.43		

1) Individual Pebble Count

Two individual samples may be entered below. Select sample type for each.

Riffle Surface		
Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	
coarse sand	0.5 - 1	
very coarse sand	1 - 2	
very fine gravel	2 - 4	1
fine gravel	4 - 6	4
fine gravel	6 - 8	11
medium gravel	8 - 11	11
medium gravel	11 - 16	14
coarse gravel	16 - 22	19
coarse gravel	22 - 32	12
very coarse gravel	32 - 45	11
very coarse gravel	45 - 64	22
small cobble	64 - 90	23
medium cobble	90 - 128	32
large cobble	128 - 180	16
very large cobble	180 - 256	16
small boulder	256 - 362	3
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		195
bedrock -----		1
clay hardpan -----		
detritus/wood -----		
artificial -----		
total count:		196
Note:		

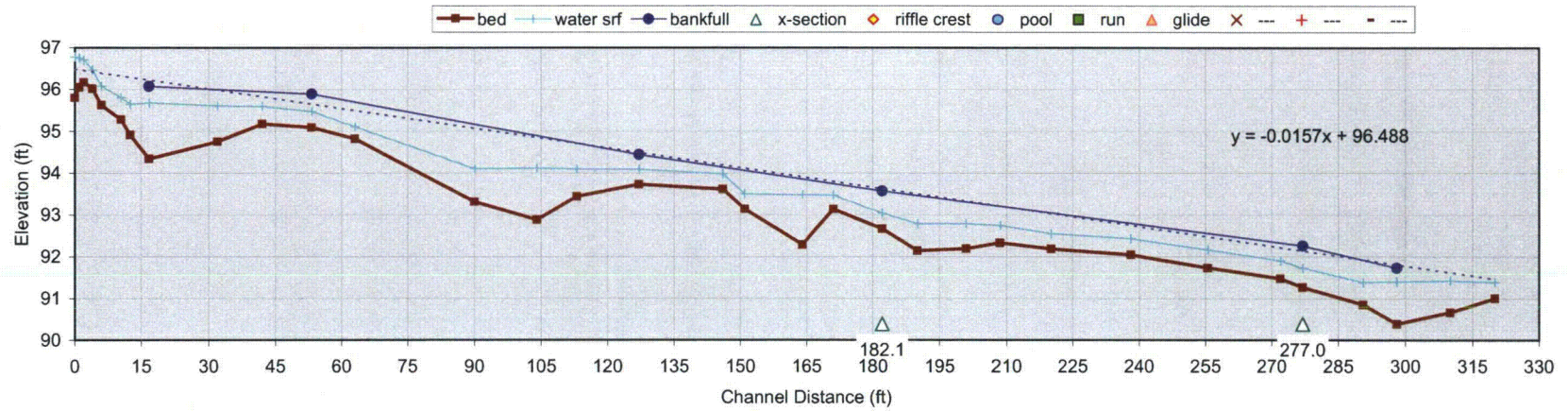
Riffle Surface Pebble Count, Walker Run



Size (mm)		Size Distribution		Type		
D16	12	mean	41.0	silt/clay	0%	bedrock 1%
D35	28	dispersion	3.6	sand	0%	
D50	57	skewness	-0.14	gravel	54%	
D65	88			cobble	44%	
D84	140			boulder	2%	
D95	220					

Longitudinal Slope Profile

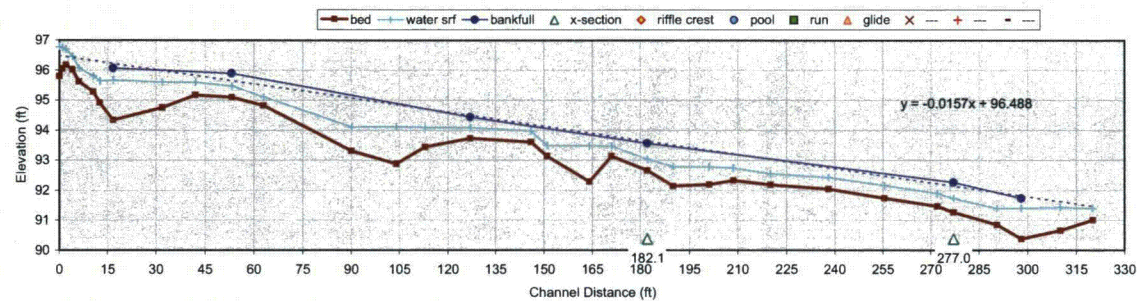
Longitudinal Profile - Walker Run



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	1.7	---	320.0 (20.5 channel widths)	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---

Longitudinal Slope Profile

Longitudinal Profile - Walker Run



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	1.7	---	320.0 (20.5 channel widths)	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---

notes	cross section ID	bed feature	station	station	Benchmark Elevation			FS bed	water	FS bankfull	user defined			azimuth AZ	ELEV bed	ELEV water	ELEV srt	ELEV bankfull	ELEV --	ELEV --	ELEV --
					Turning Points						FS	FS	FS								
					BS	HI	FS														
back sight to benchmark			0		0	100.78									95.8	96.78					
HOR			1			100.78		4.98	0.98						96.05	96.75					
			2			100.78		4.73	0.7						96.17	96.71					
			4			100.78		4.61	0.54						96.02	96.47					
			6			100.78		4.76	0.45						95.62	96.08					
			10.5			100.78		5.16	0.46						95.28	95.81					
TOR			12.5			100.78		5.5	0.53						94.91	95.65					
Dmax			16.7			100.78		5.87	0.74						94.34	95.68	96.07				
HOR			32			100.78		6.44	1.34	4.71					94.75	95.61					
			42			100.78		6.03	0.86						95.17	95.6					
TOR			53.2			100.78		5.61	0.43						95.09	95.47	95.89				
			63			100.78		5.69	0.38	4.89					94.82	95.11					
			90			100.78		5.96	0.29						93.31	94.11					
Dmax			104			100.78		7.47	0.8						92.88	94.12					
Dmax			113			100.78		7.9	1.24						93.44	94.1					
			127			100.78		7.34	0.66						93.73	94.09	94.44				
			146			100.78		7.05	0.36	6.34					93.61	93.98					
			151			100.78		7.17	0.37						93.14	93.5					
			164			100.78		7.64	0.36						92.29	93.48					
HOR			171			100.78		8.49	1.19						93.14	93.47					
XS #2	2		182.1			100.78		7.64	0.33						92.66	93.04	93.57				
TOR			190			100.78		8.12	0.38	7.21					92.14	92.79					
HOR			201			100.78		8.64	0.65						92.19	92.79					
			208.5			100.78		8.59	0.6						92.33	92.75					
			220			100.78		8.45	0.42						92.18	92.55					
XS #1			238			100.78		8.6	0.37						92.04	92.43					
			255.5			100.78		8.74	0.39						91.73	92.16					
			272			100.78		9.05	0.43						91.47	91.9					
			277			100.78		9.31	0.43						91.26	91.73	92.26				
TOR			290.5			100.78		9.52	0.47	8.52					90.85	91.39					
Dmax			298			100.78		9.93	0.54						90.38	91.4	91.73				
HOR			310			100.78		10.4	1.02	9.05					90.66	91.42					
			320			100.78		10.12	0.76						91	91.39					