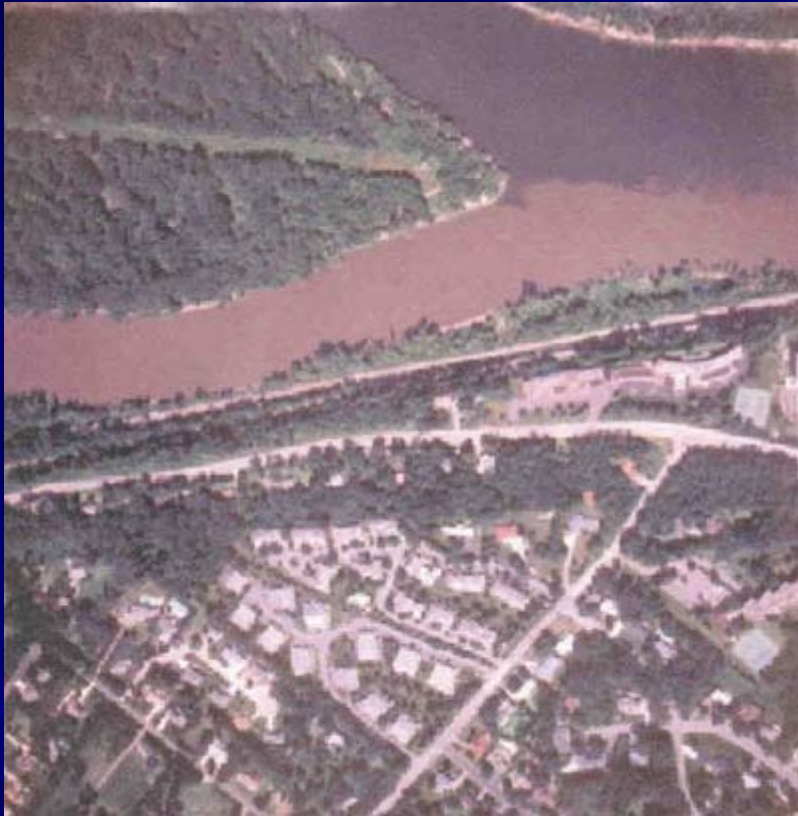


Streambank/Bluff Erosion Estimates for High Island Creek and Watonwan River Watersheds



Excess Sediment; what is the problem?



**Minnesota and
Mississippi**



**Mississippi and St.
Croix**

Sediment Sources:



Streambanks
and Bluffs



Construction Sites



Classic Gullies



Urban Stormwater



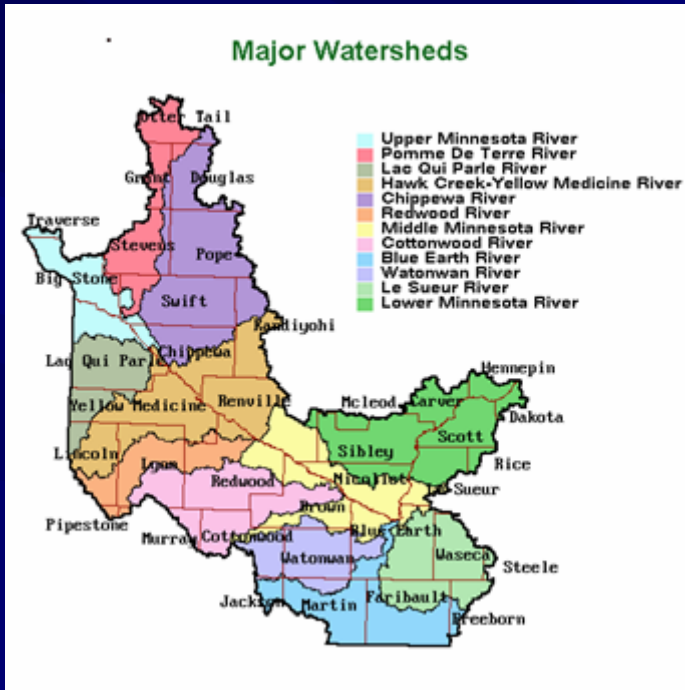
Agricultural Runoff/Open
Tile Intakes

Watonwan River: Streambank/bluff Erosion Estimates

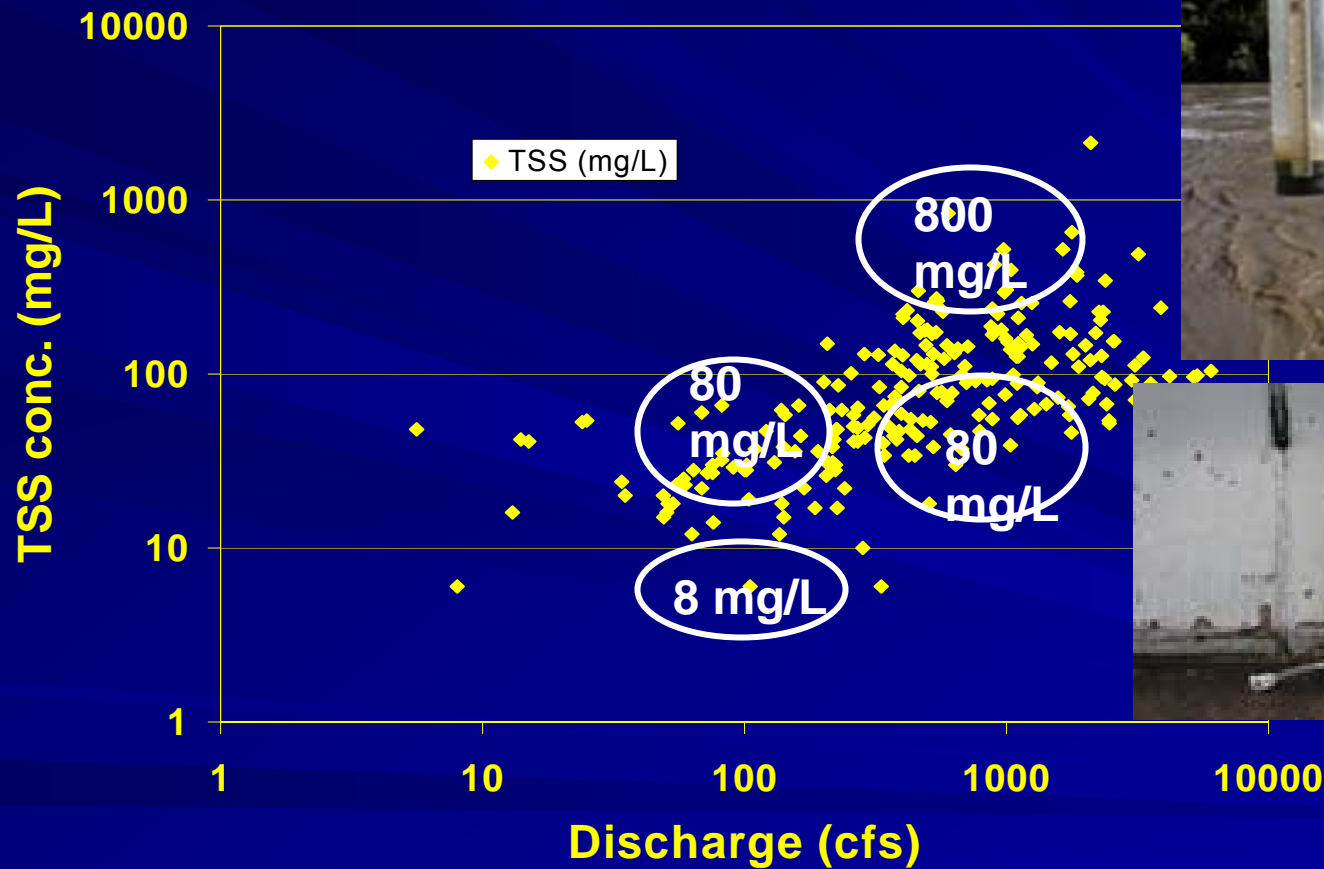
Major Watersheds



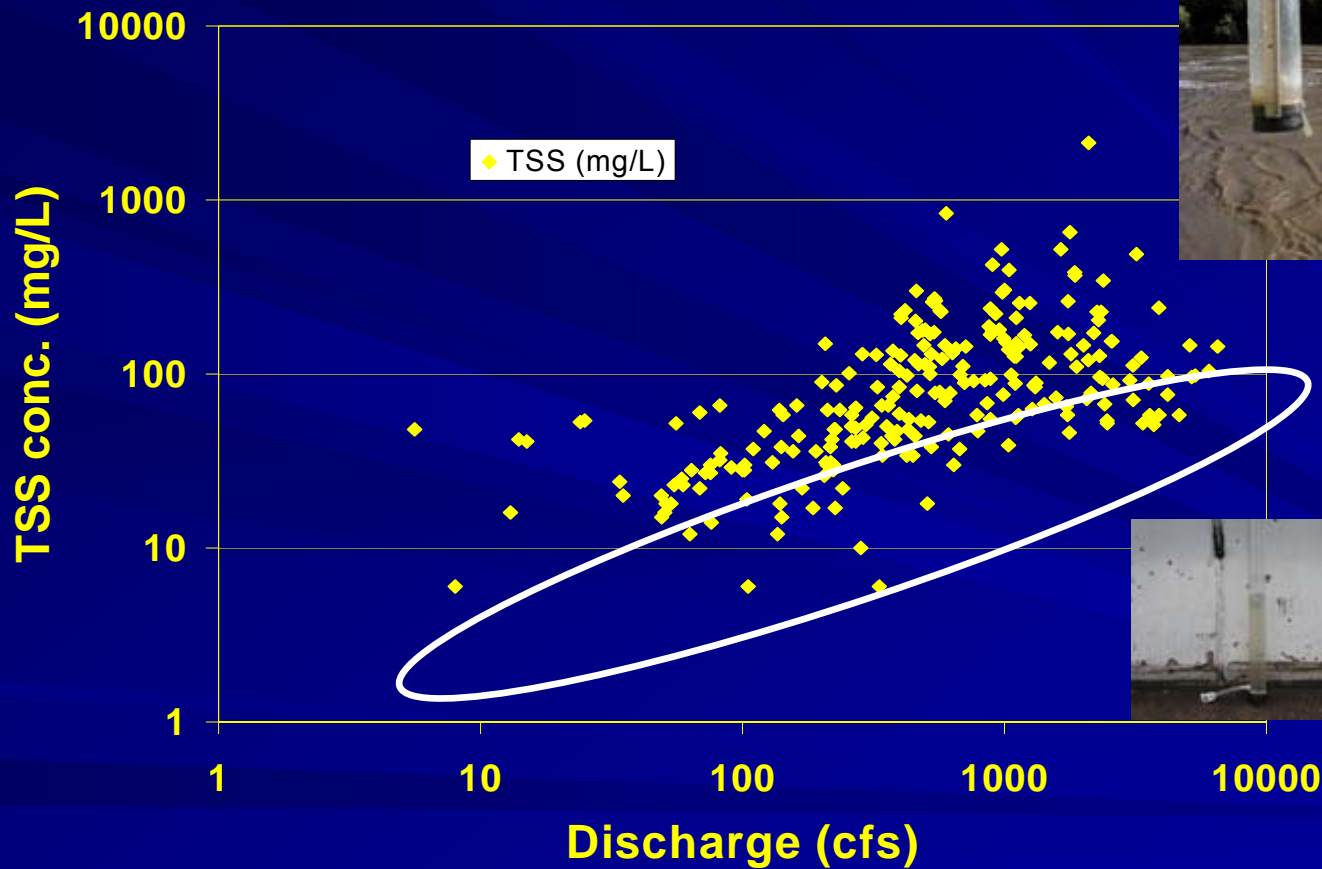
Watowan River: Erosion Estimates



Watsonwan River Total Suspended Solids and Corresponding Flow (2000 – 2006)



Watsonwan River Total Suspended Solids and Corresponding Flow (2000 – 2006)

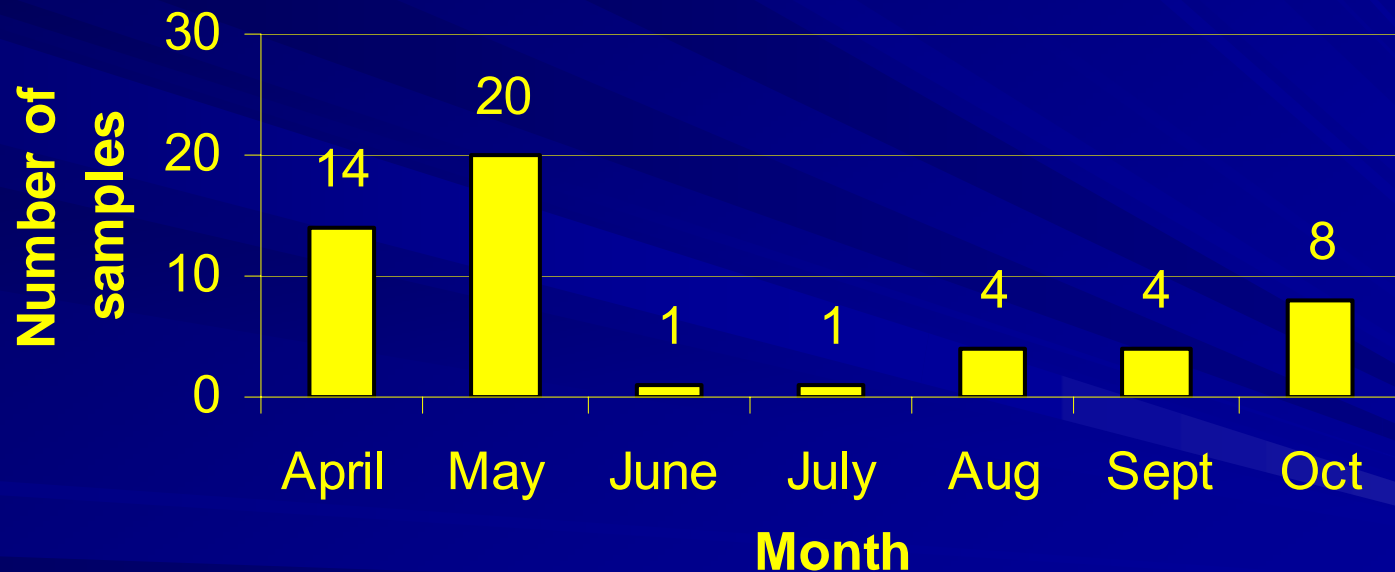


Sample Selection Method

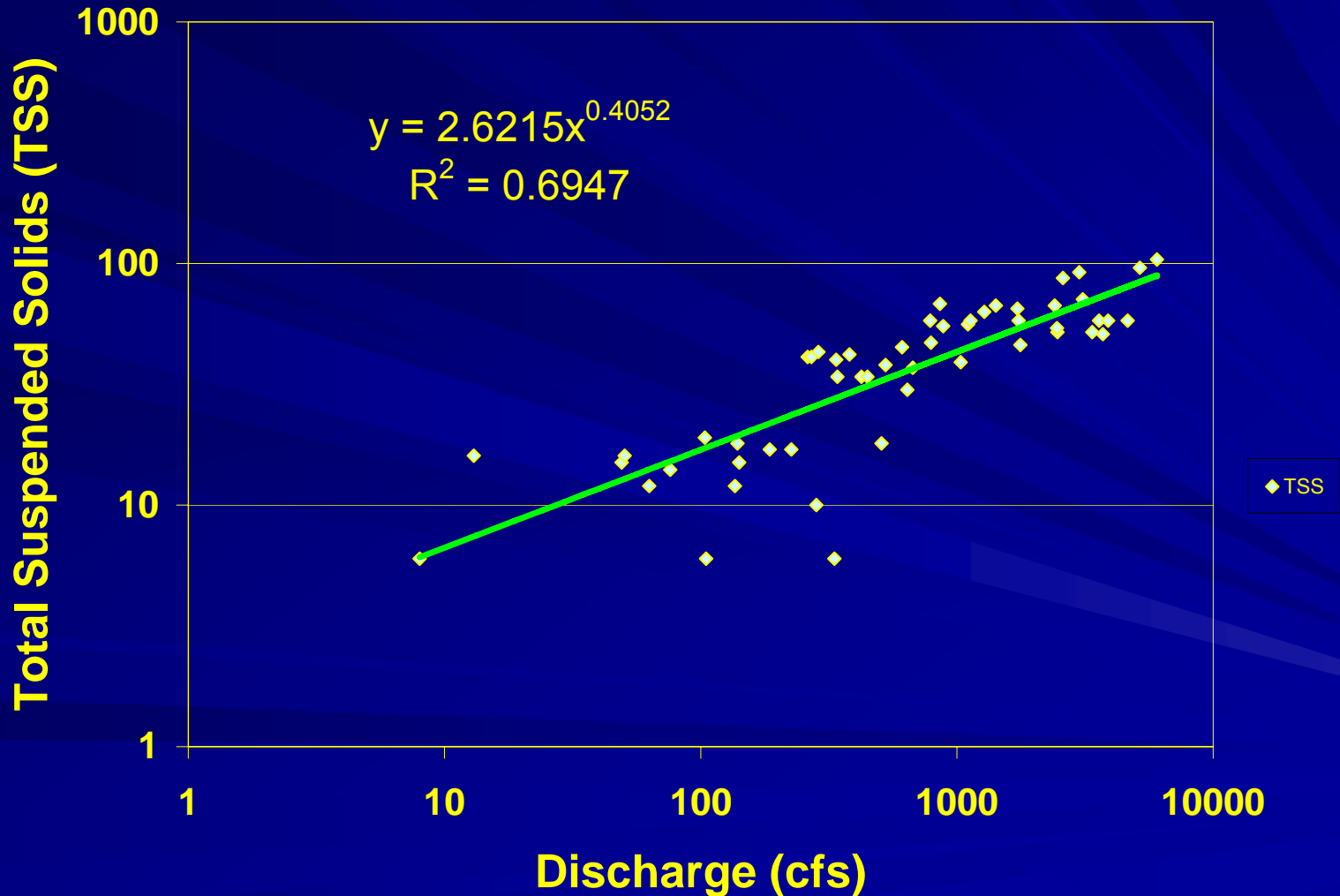
Flow Range (cfs)	Total # Samples	% of Samples Used in Each Cat.
0-100	31	19%
100-250	36	19%
250-500	50	20%
500-750	28	18%
750-1000	19	21%
1000-1500	23	22%
1500-2500	28	21%
2500-3500	9	44%
<3500 cfs	13	46%
sample total	237	52
Percent of samples used = 22%		

Sample Selection Method

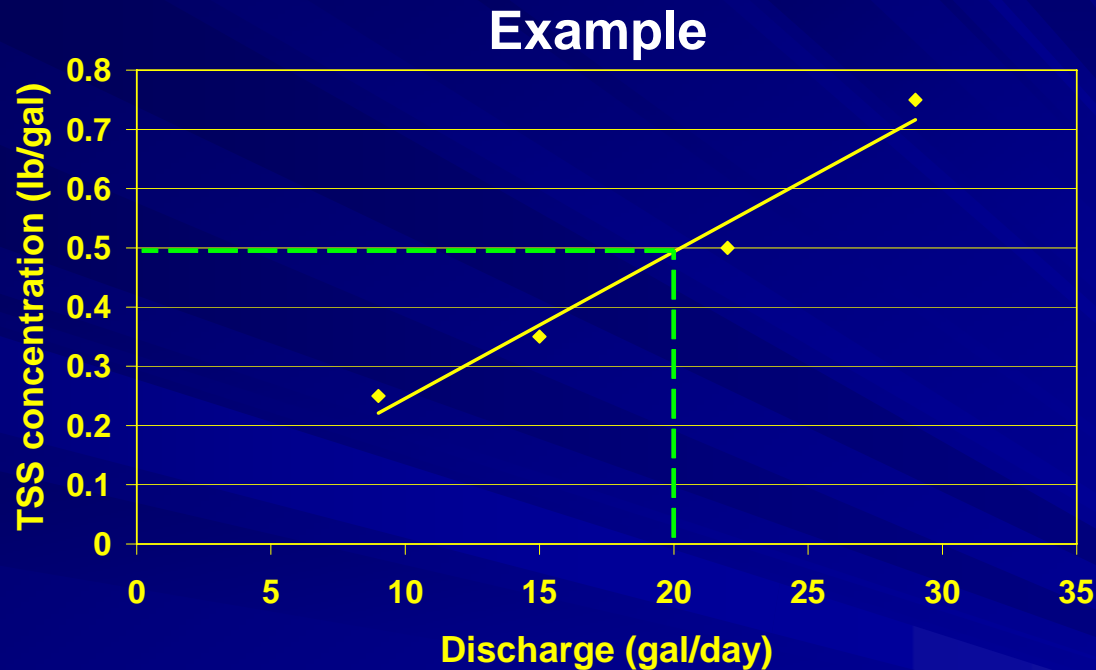
Sample Distribution By Month



Step 1: Watonwan River Streambank Erosion Regression



Step 2: Compute Daily Streambank Erosion (SBE) Loads



Example:

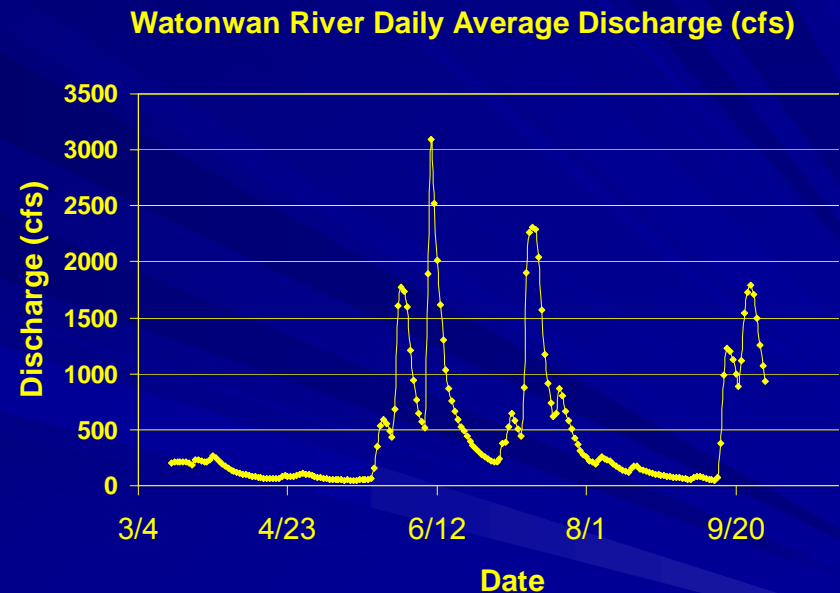
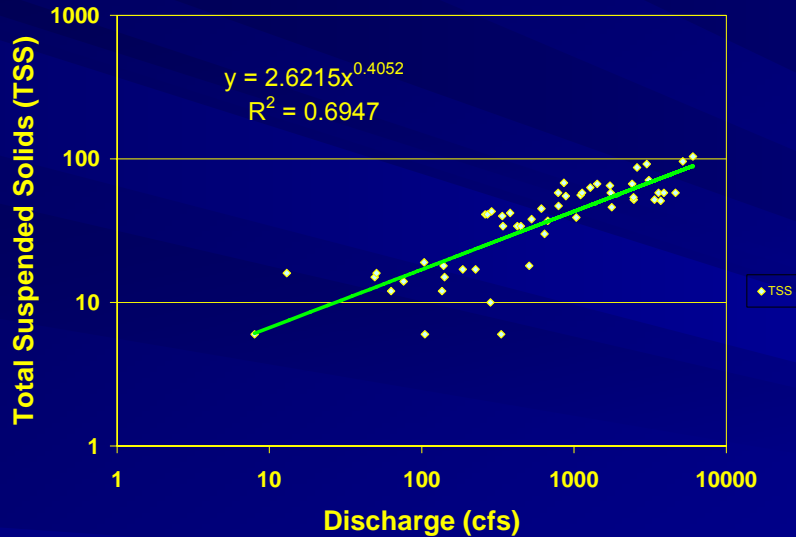
Daily Average Discharge = 20 gal/day

SBE concentration = 0.5 lb./gal.

Daily SBE load = 20 gal/day x .5 lb/gal = 10 lbs

Step 2: Compute Daily Streambank Erosion (SBE) Loads

Example



Daily Average Flow x TSS Concentration = Daily SBE Load

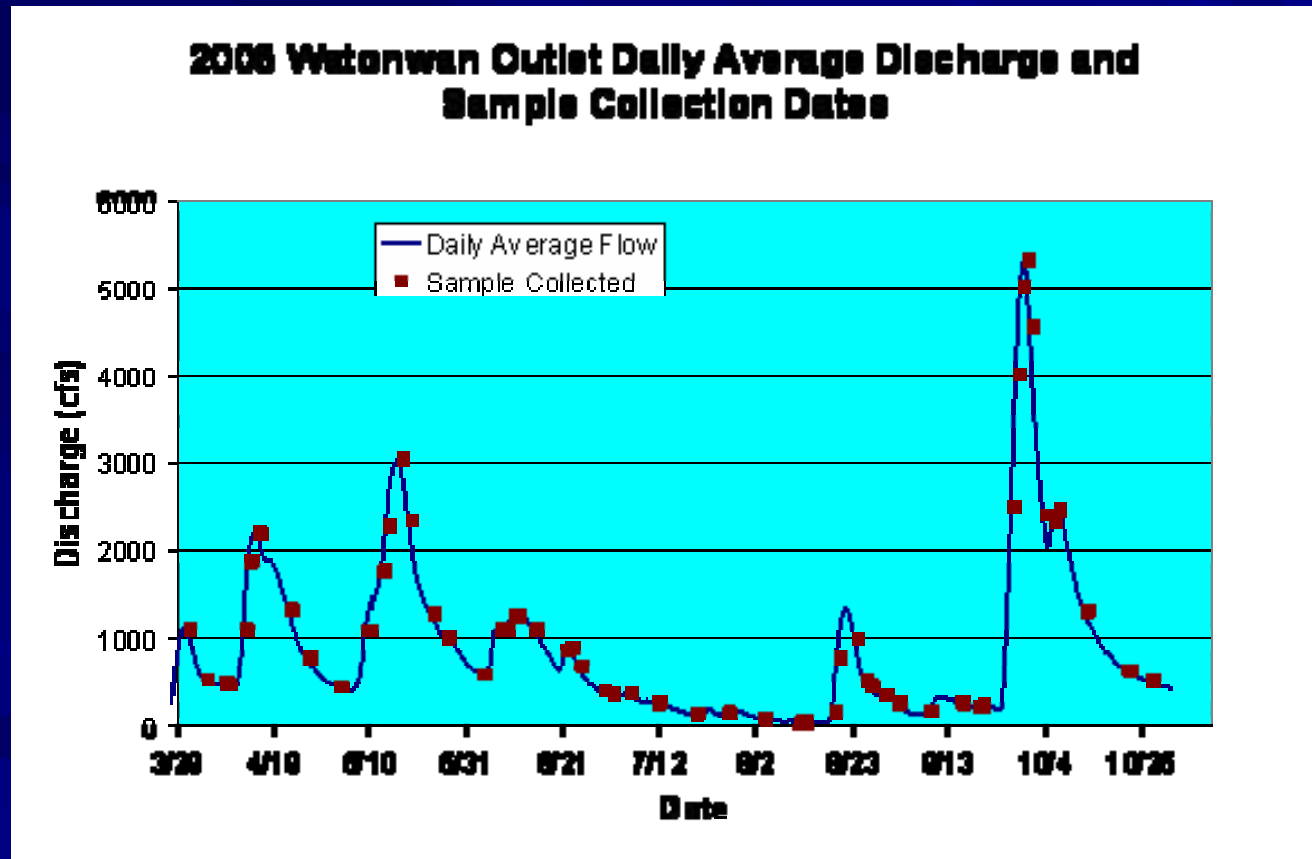
Step 3: Compute Seasonal Streambank Erosion Load (generally 4/1 through 9/30)

- Sum of Daily SBE loads = Seasonal SBE load

Example: 3 day season, 4/1 through 4/3

$$\begin{array}{ccccccc} \text{April 1 SBE load} & + & \text{April 2 SBE load} & + & \text{April 3 SBE load} & = & \text{Seasonal SBE load} \\ \text{30 kg} & & \text{50 kg} & & \text{100 kg} & & \text{180 kg} \end{array}$$

Step 3: Compute Actual Seasonal Total Suspended Solids Load



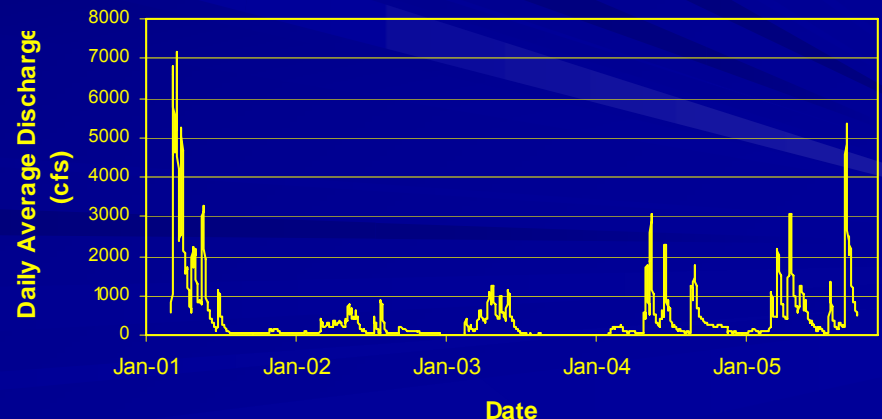
Step 4: Compute SBE Proportion of Seasonal TSS Load



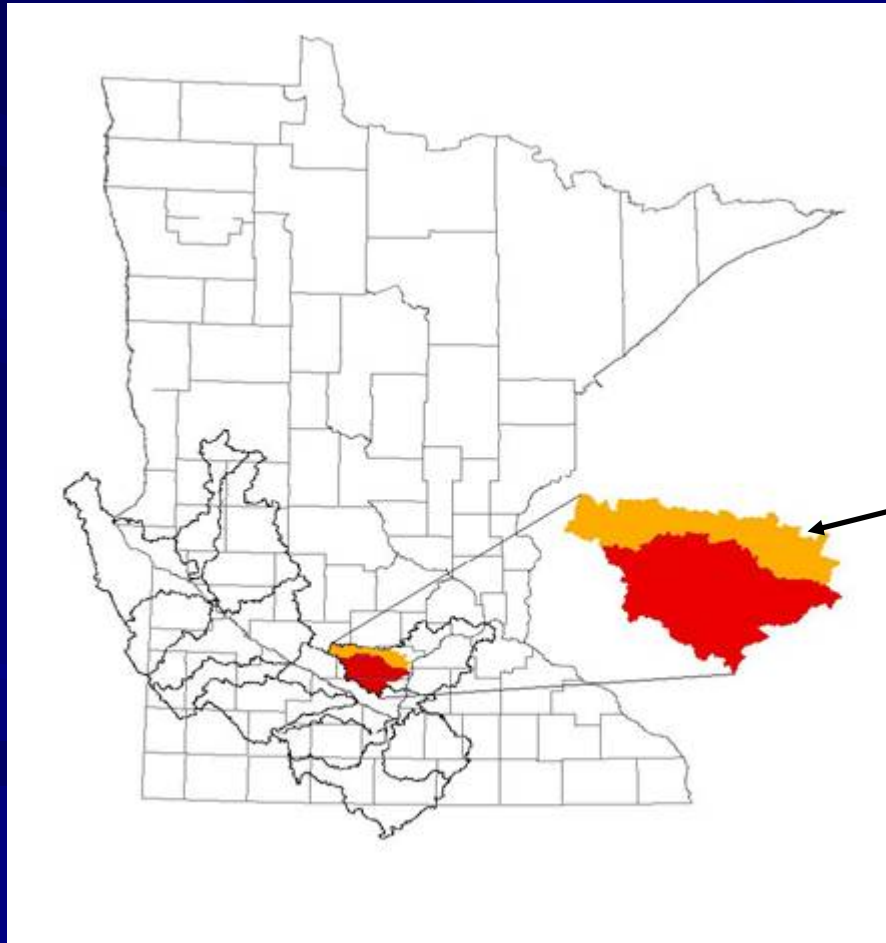
Watonwan River SBE estimates 2000-2005

Year	monitoring season dates	Seasonal Flow Weighted Mean TSS Conc.	% of TSS from SBE
2001	4/1-9/30	99.9	67%
2002	4/1-9/30	143.6	20%
2003	4/1-9/30	155.0	23%
2004	4/1-10/15	207.8	21%
2005	4/1-10/26	131	39%
five year average			34%

Watonwan River Near Garden City
Daily Average Discharge
2001-2005



Streambank/Bluff Erosion Estimates for High Island Creek Watershed



**High Island Creek
Watershed**

Scott Matteson

Patrick Baskfield

Percentage of Land with Slopes Greater than 12% by Watershed

Watowan River Watershed and High Island Creek Watershed
Steeply Sloped Lands (>12%)

Watowan River Watershed Outlet Area



Watershed Acreage = 544,545
Percentage of Watershed >12% Slope = 0.4%

High Island Creek Watershed Outlet Area



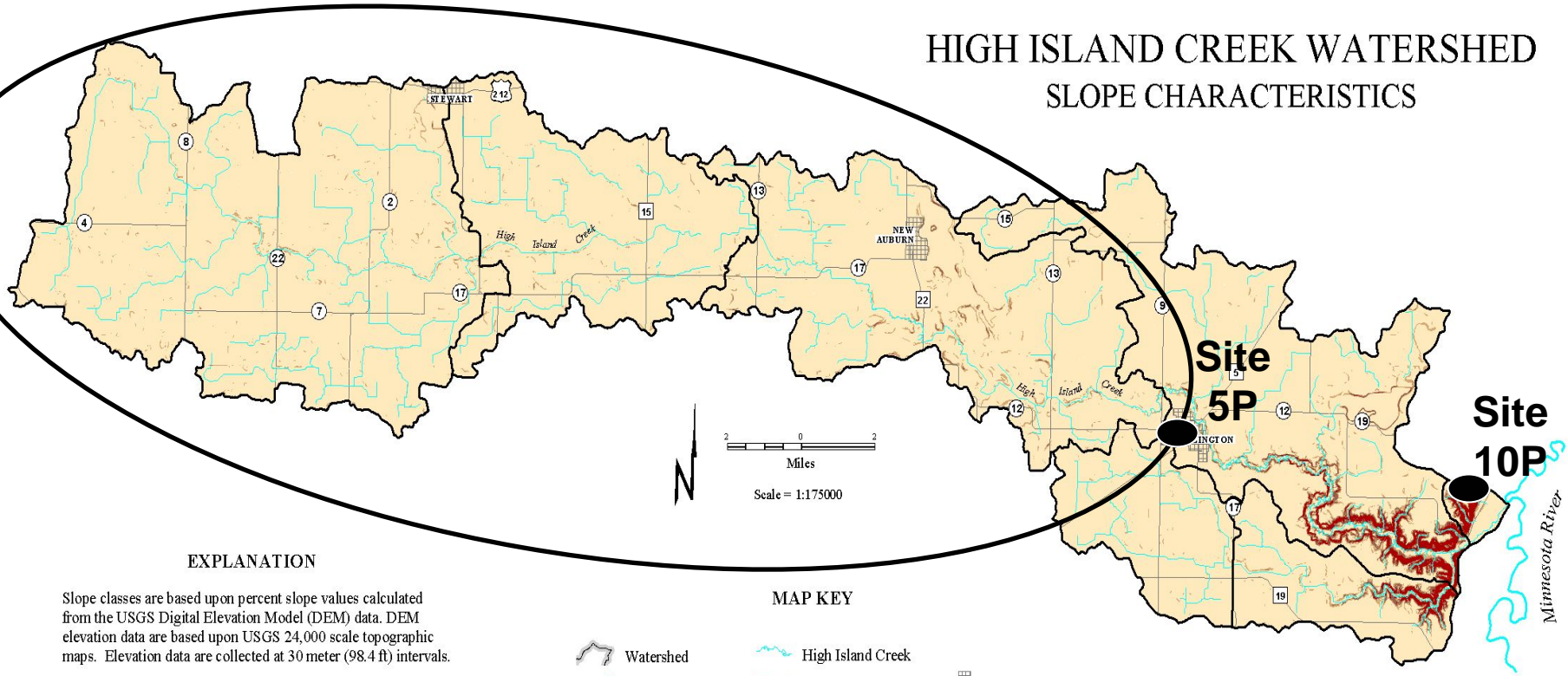
Watershed Acreage = 152,149
Percentage of Watershed >12% Slope = 1.2%

- ▲ Monitoring Site
- >12% Sloped Land
- City
- ~ Stream

3 0 3 6 9 Miles





Map Prepared by: Scott Mattoon
Water Resources Center
Minnesota State University, Mankato
9/3/2006

HIGH ISLAND CREEK WATERSHED SLOPE CHARACTERISTICS




EXPLANATION

Slope classes are based upon percent slope values calculated from the USGS Digital Elevation Model (DEM) data. DEM elevation data are based upon USGS 24,000 scale topographic maps. Elevation data are collected at 30 meter (98.4 ft) intervals.

ACRES	PERCENT	SLOPE CLASS	
146,485	96%		≤ 3%
3,593	2%		> 3% and ≤ 6%
1,586	1%		> 6% and ≤ 12%
1,558	1%		> 12%

MAP KEY

-  Watershed
-  Minnesota River
-  Lake
-  High Island Creek
-  Stream
-  Public Ditch
-  Municipality
-  Road

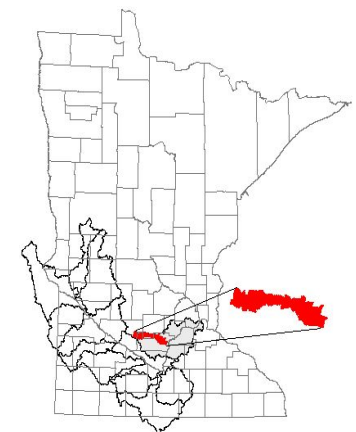


INDEX MAP
PRIMARY SAMPLESHEDS

Prepared for: High Island Creek Watershed Assessment Project
 Prepared by: Cis Berg
 Water Resources Center, Minnesota State University, Mankato
 Date: September 26, 2002
 Software: ARC/INFO 7.1.2 and ArcView 3.2

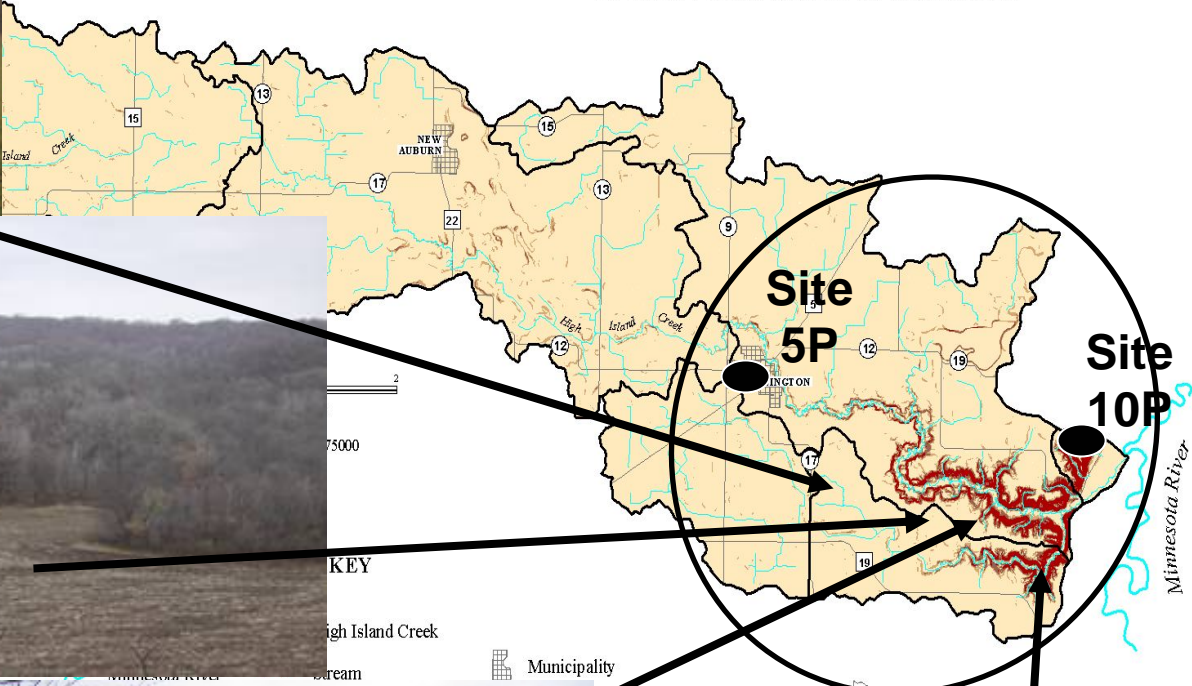
Data Sources include the International Coalition Land Use/Land Cover; MNDOT Roads, Municipalities and Wildlife Management Areas; Minnesota River Basin Data Center Watershed Boundaries, Streams and Lakes; USGS Digital Elevation Model (DEM) data

The High Island Creek Watershed Assessment Project is a Minnesota Pollution Control Agency (MPCA) Clean Water Partnership.



LOCATION MAP

HIGH ISLAND CREEK WATERSHED SLOPE CHARACTERISTICS

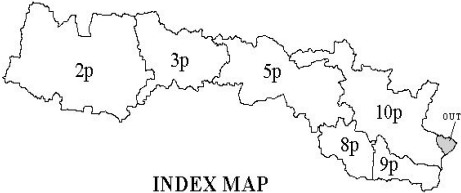


EXPLANATION

Slope classes are based upon percent from the USGS Digital Elevation Model. Elevation data are based upon USGS maps. Elevation data are collected at

ACRES	PERCENT	SLOPE CLASS	
146,485	96%		<= 3%
3,593	2%		> 3% and <= 6%
1,586	1%		> 6% and <= 12%
1,558	1%		> 12%

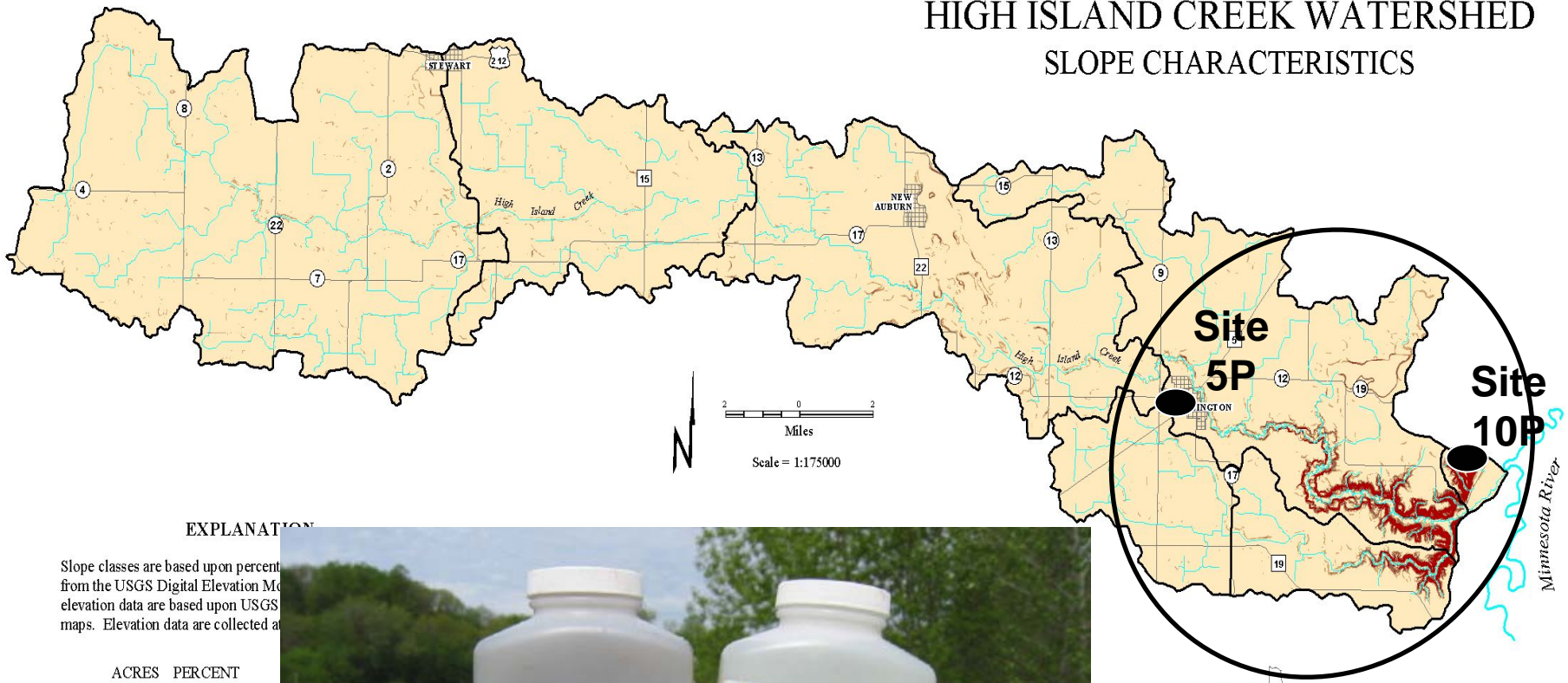
KEY
~ Minnesota River
~ High Island Creek
 Municipality



**INDEX MAP
PRIMARY SAMPLESHEDS**







HIGH ISLAND CREEK WATERSHED SLOPE CHARACTERISTICS

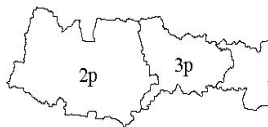


EXPLANATION

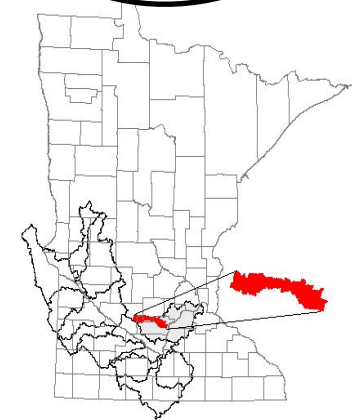
Slope classes are based upon percent from the USGS Digital Elevation Model. Elevation data are based upon USGS maps. Elevation data are collected at

ACRES PERCENT

146,485	96%	
3,593	2%	
1,586	1%	
1,558	1%	

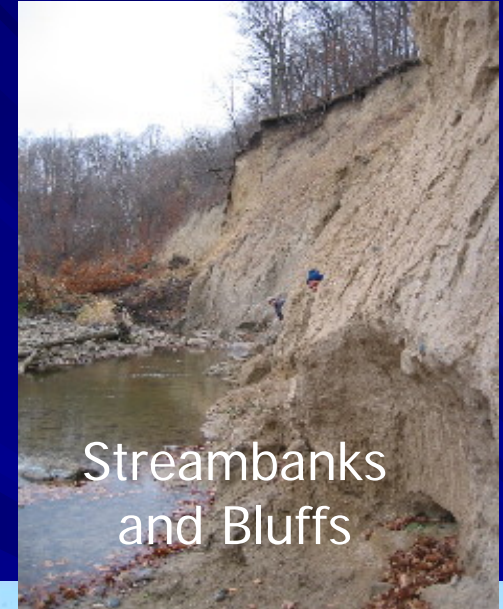


INDEX MAP
PRIMARY SAMPLE



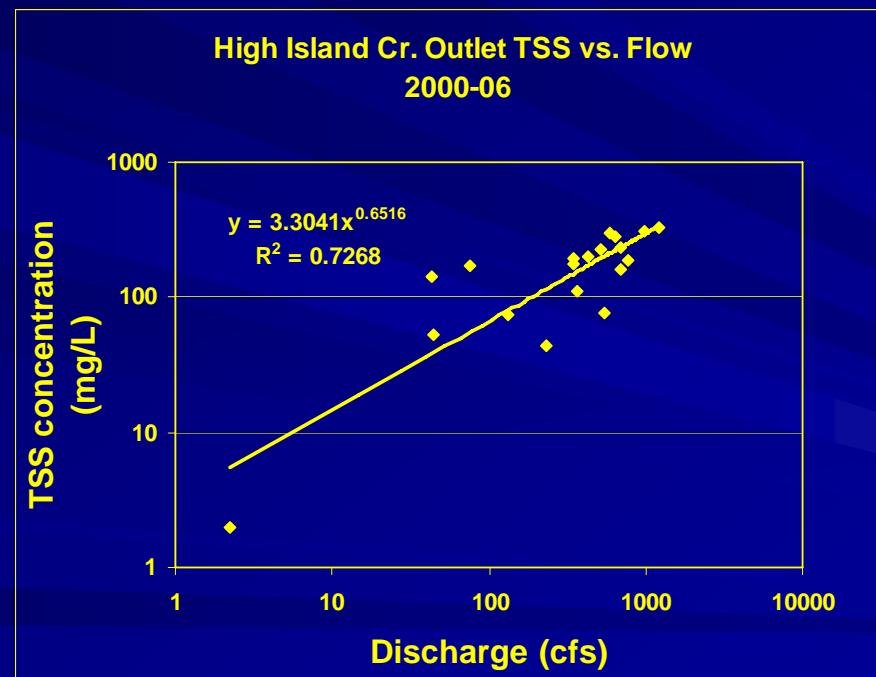
LOCATION MAP

Sediment Sources for High Island Creek Watershed:



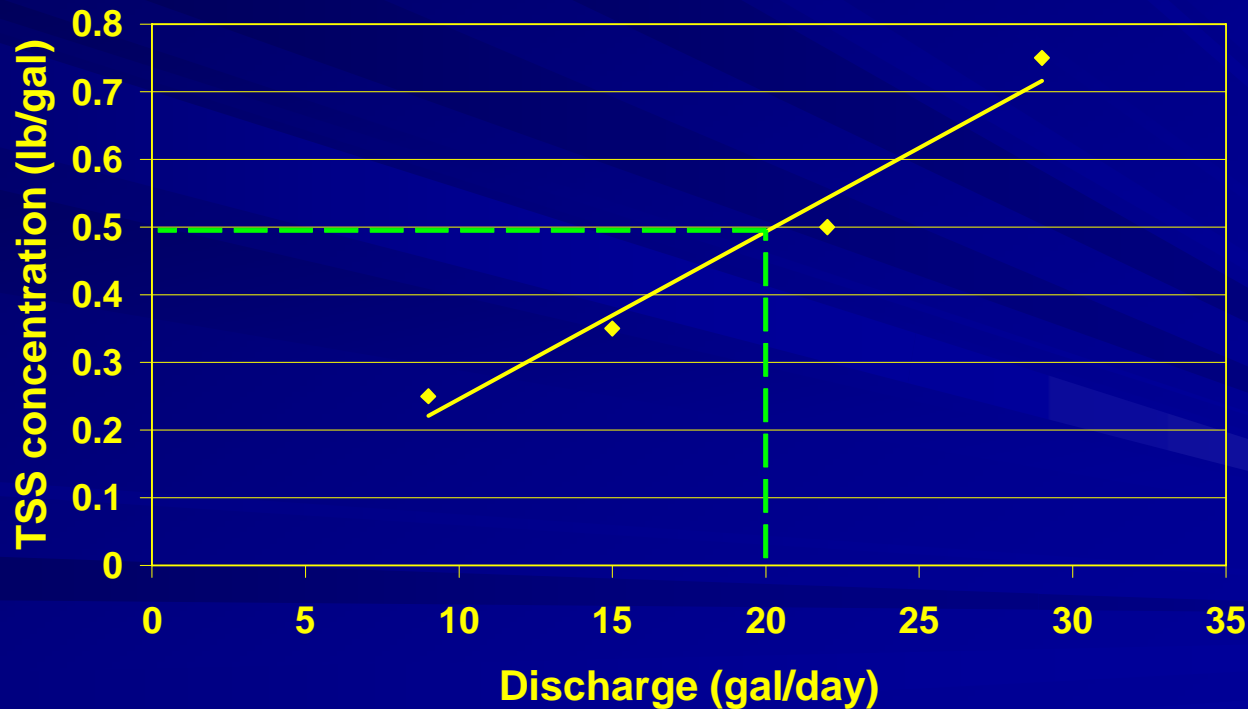
High Island Streambank Erosion (SBE) Load Computation Methods

1. Develop streambank regression equation



High Island Streambank Erosion (SBE) Load Computation Methods

2. Compute daily SBE loads

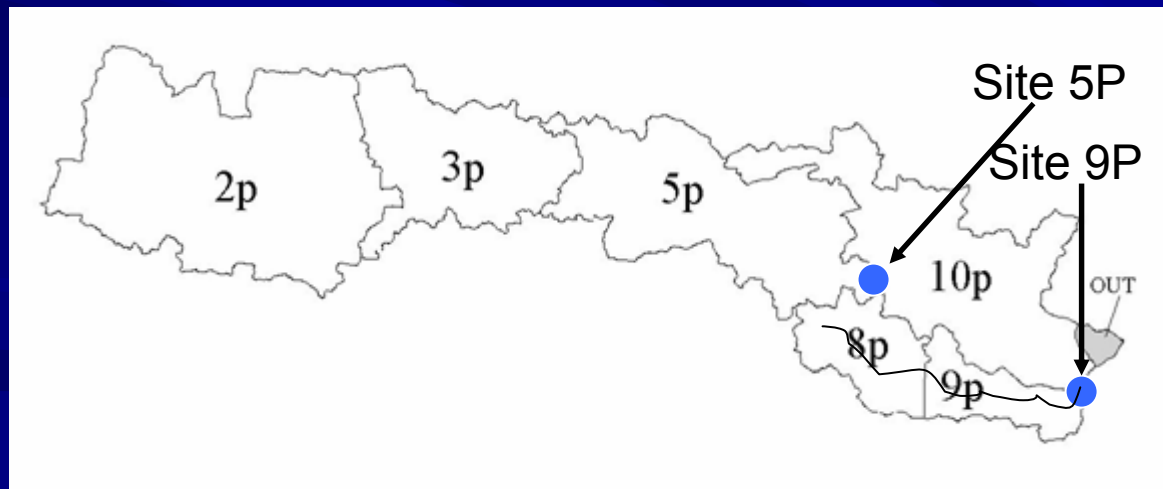


High Island Streambank Erosion (SBE) Load Computation Methods

3. Sum daily SBE loads to get seasonal SBE load
4. Compute SBE proportion of the seasonal TSS Load

Sample Selection Criteria

- TSS concentrations at 5P less than 36 mg/L (clean water at the top of the transitional area)
- Low TSS concentrations at 9P – Buffalo Creek indicate gulley contributions of TSS are insignificant at the time the sample was collected

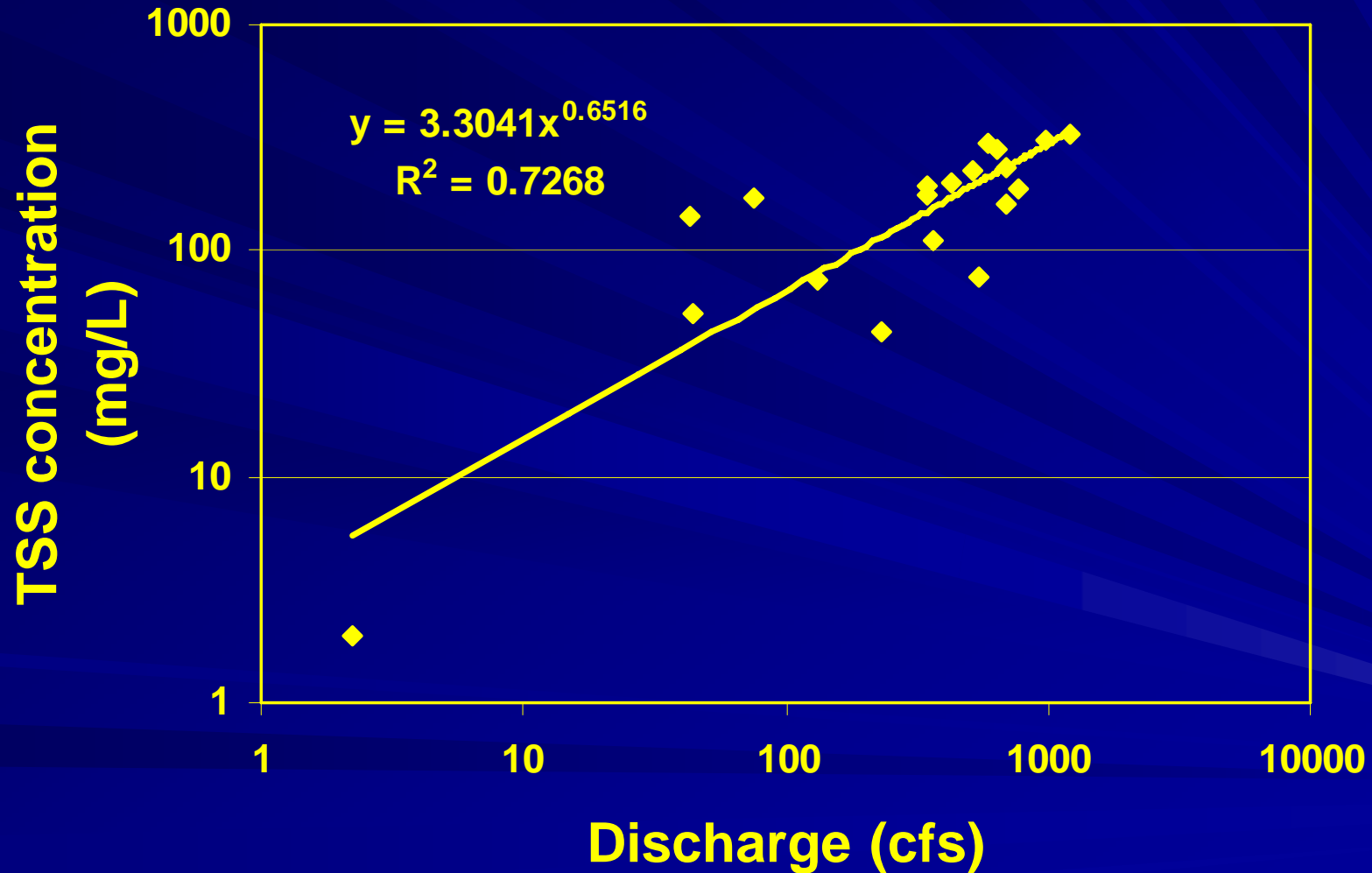


Sample Selection Criteria

- If above criteria are met, TSS concentration at 10P is assumed to be from SBE/bluff erosion



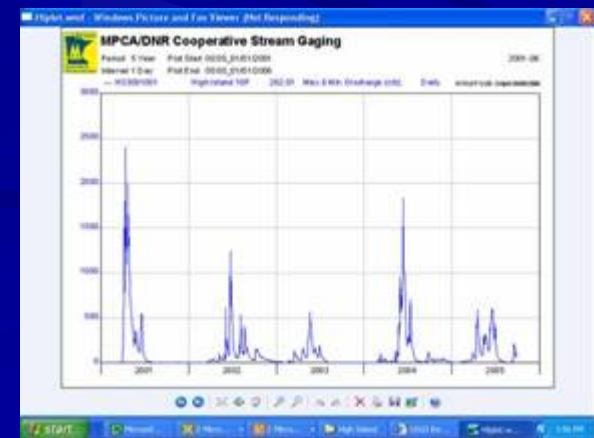
High Island Creek Outlet SBE Total Suspended Solids vs. Flow Regression



Results

Year	Seasonal TSS FW MC (mg/L)	% of seasonal TSS load from stream bank/bluff erosion
2001	507	52%
2002	1223	11%
2003	347	25%
2004	643	32%
2005	358	33%
Five Year Average		31%

Upland and Classic Gulley TSS contributions \approx 69%



Conclusions

- Streambank/bluff proportion of seasonal TSS load:
 - **Watonwan River = 34%**
 - Primary sources of sediment include streambank/bluff and upland
 - **High Island Creek = 31%**
 - Primary sources of sediment include streambank/bluff, upland, and classic gully
- Streambank/bluff contributions vary according to seasonal climatic conditions; precipitation type, amount, intensity and timing