05-23-2014 Status Update Meeting

Town of Saratoga

North Platte River Assessment

Stantec

Wildland Hydrology

05-23-2014

Agenda

1 Goals and Objectives
2 Gage Data and Flow Regime
3 Bed-load Sampling 2014
4 Geomorphic Data Collection 10-2013
5 Additional Geomorphic Assessment 4-2014
6 Causes and Effects of Geomorphology
7 Bridge Data
8 Additional Problem areas
9 Geomorphic Trajectory and Central Tendency
10 Bed-load Sampling 2014 and BANCS Assessment
11 Preliminary Design
12 Preliminary Structures
13 Schedule and Next Steps
14 Conclusion

1 Goals and Objectives

Our Group is here with the Town of Saratoga to Listen for additions and refinements in the project's Goals and Objectives

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Goals and Objectives

Preliminary Topics (April 2013)

- Land Use Issues
- Property Owner Issues
- Fisheries Concerns
- Bridge Stability
- Flooding
- Any other applicable issues

2 Gage Data and Flow Regime

Bankfull Flow is close to 5,200-5,500 cfs but our Design Team will be designing for a full range of flows

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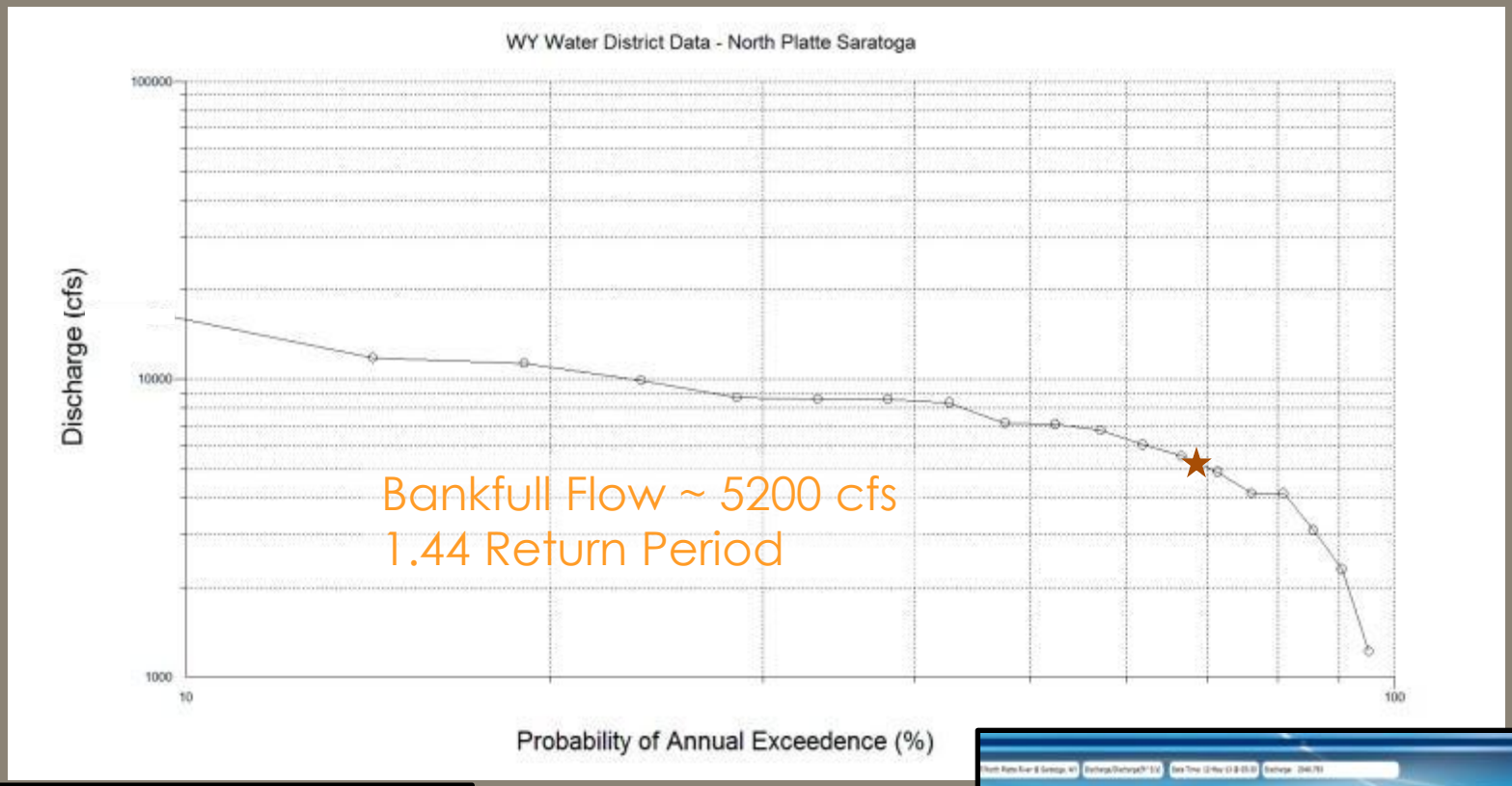
Gage Data


WY Water District Data - North Platte Saratoga
Discharge (cfs)
100000
10000
1000
10
100
Probability of Annual Exceedence (%)
Bankfull Flow ~ 5200 cfs
1.44 Return Period

3 Bed-load Sampling 2013

The River is Unpredictable in Nature, we can only guess at the magnitude and duration of flow

Bed-load Sampling 2013

Bankfull Flows - Trigger

- 5,000cfs – 5,500cfs (5,200cfs)
- Trigger 4,500 cfs
- High Flow May 18th 2013 @ 4,100 cfs
- Our Team had predicted the peak near May 28th 2013
- Sample Run on May 20th @ 3,800 cfs
  - No bed-load data collected

4 Geomorphic Data 10-2013

We must first understand the River and then we can be understood

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Geomorphic Data Collection

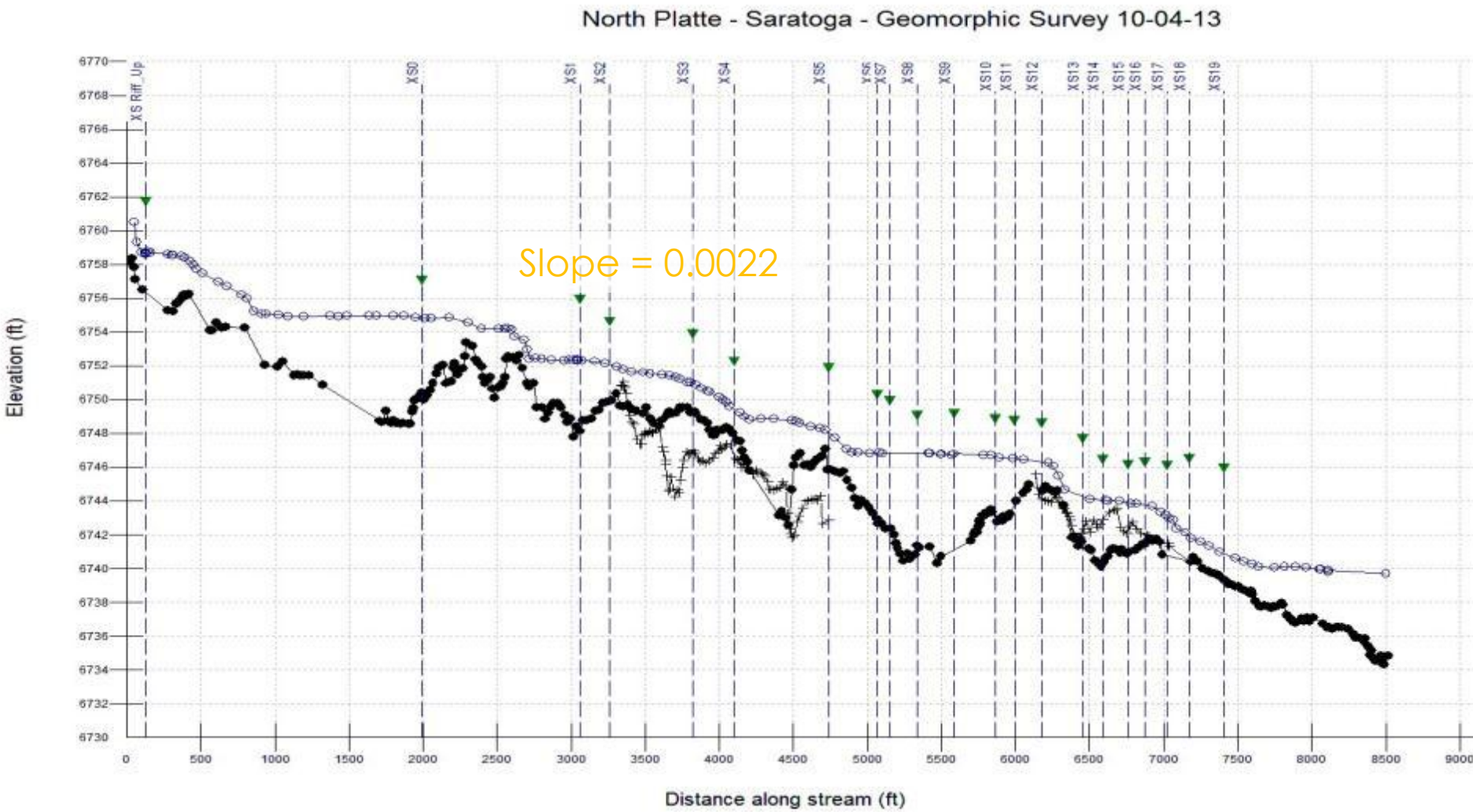
Survey Grade GPS

- 19 Cross-Sections
- Over 8,500 lf of Long Profile
- Over 2500 data points
- October data collection at low water stage

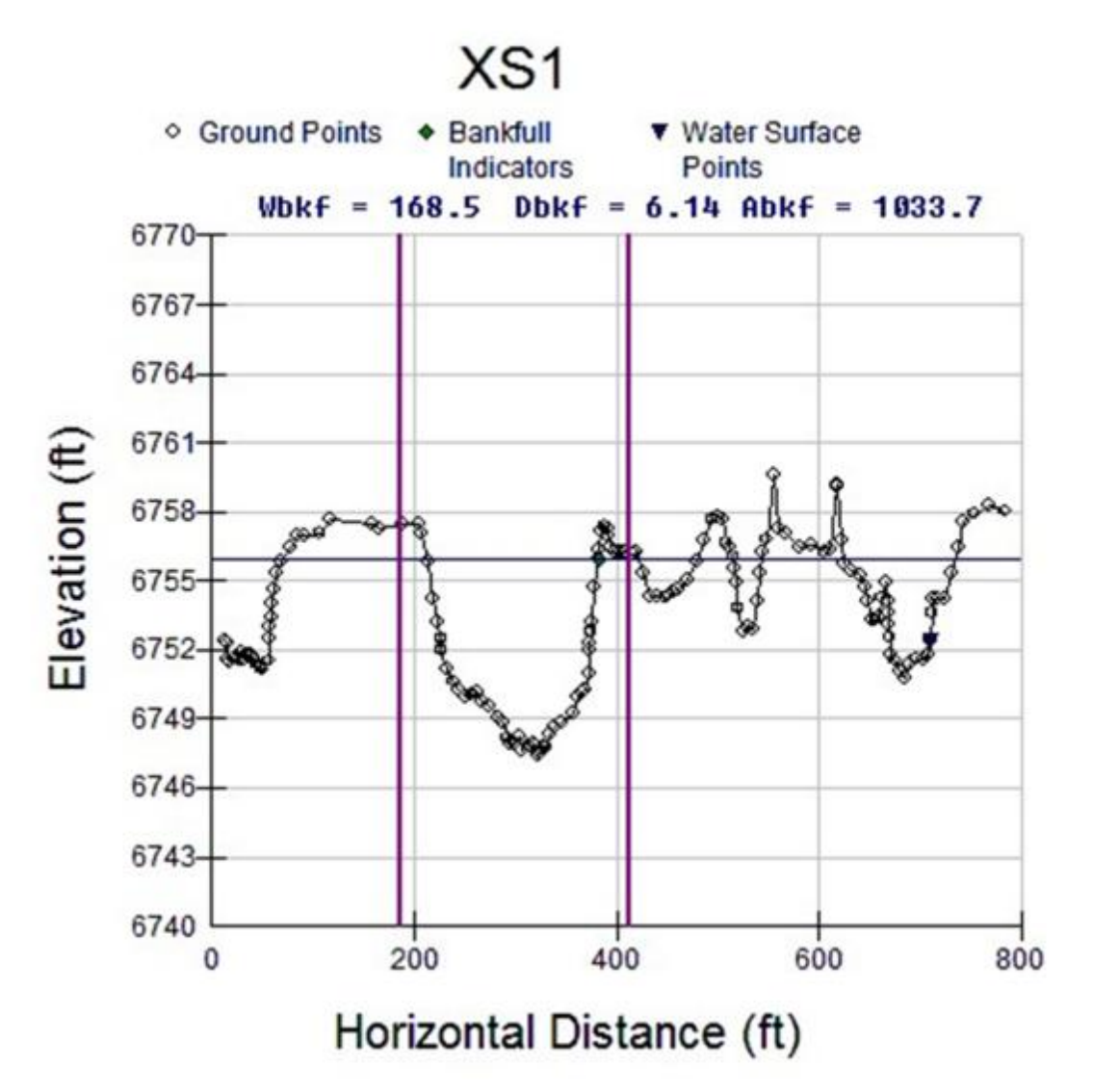
GPS Point Data Collection

Over 2500
Data points

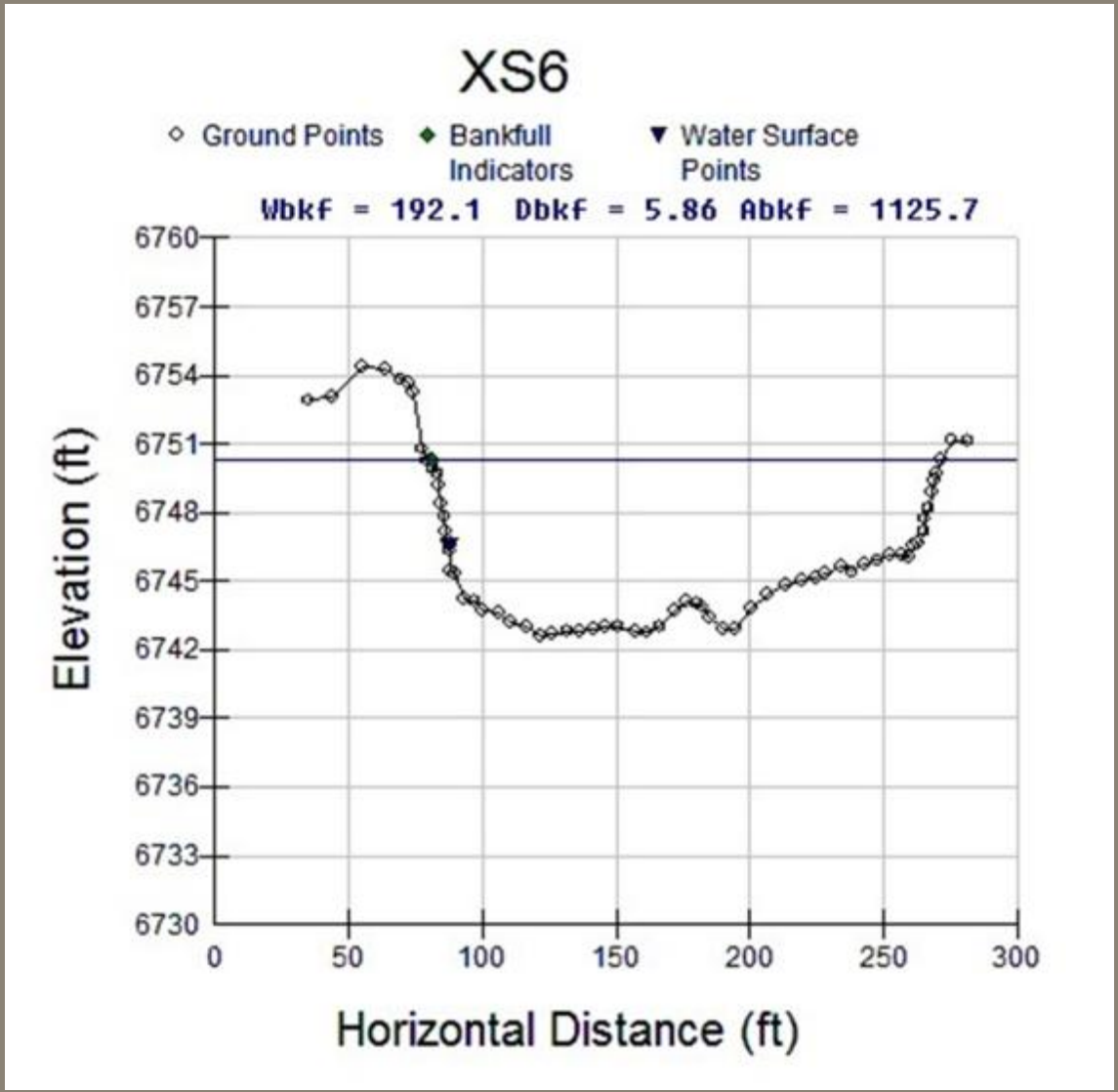
Long Profile – North Platte River



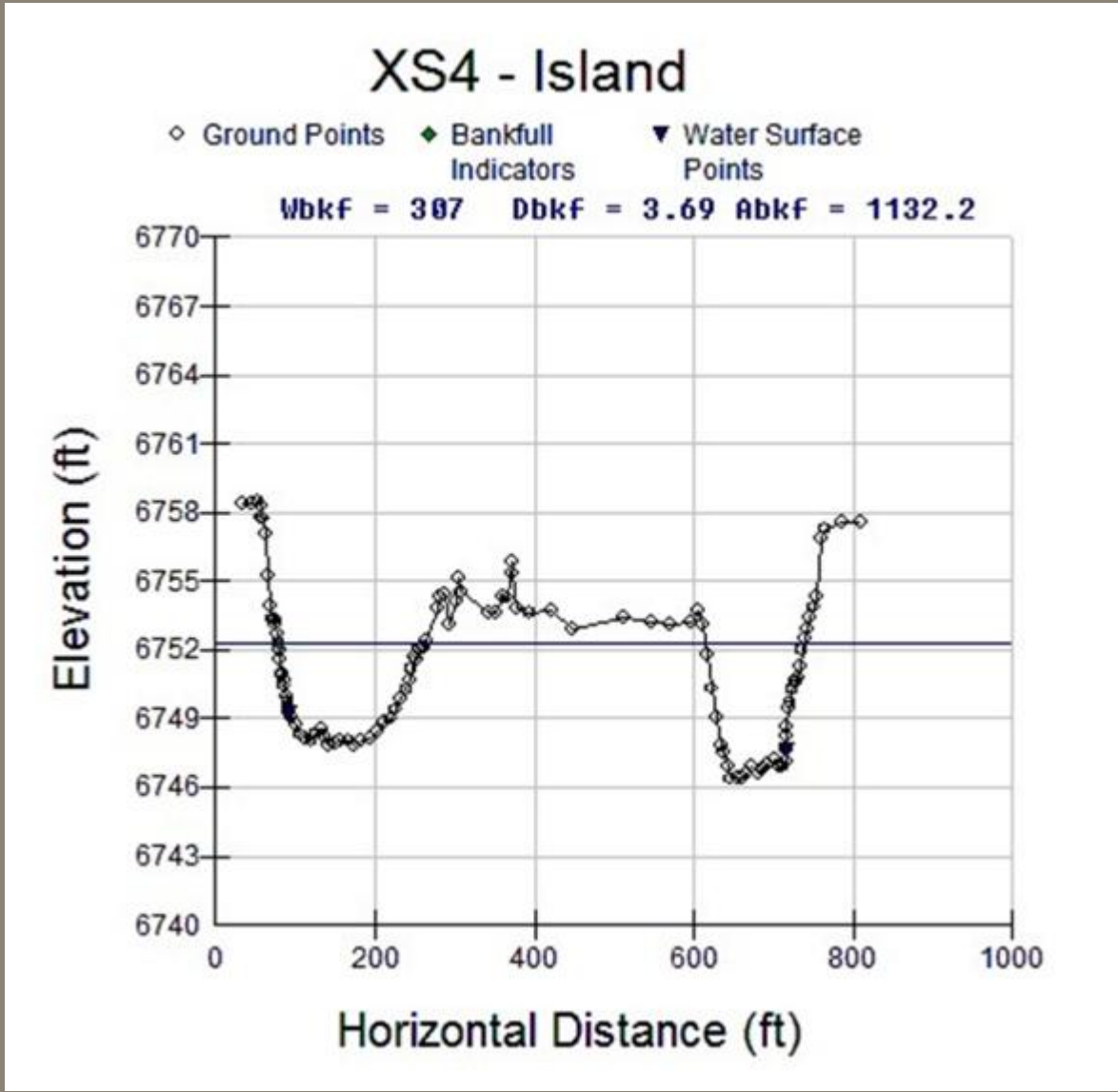
Cross-Section – Upstream



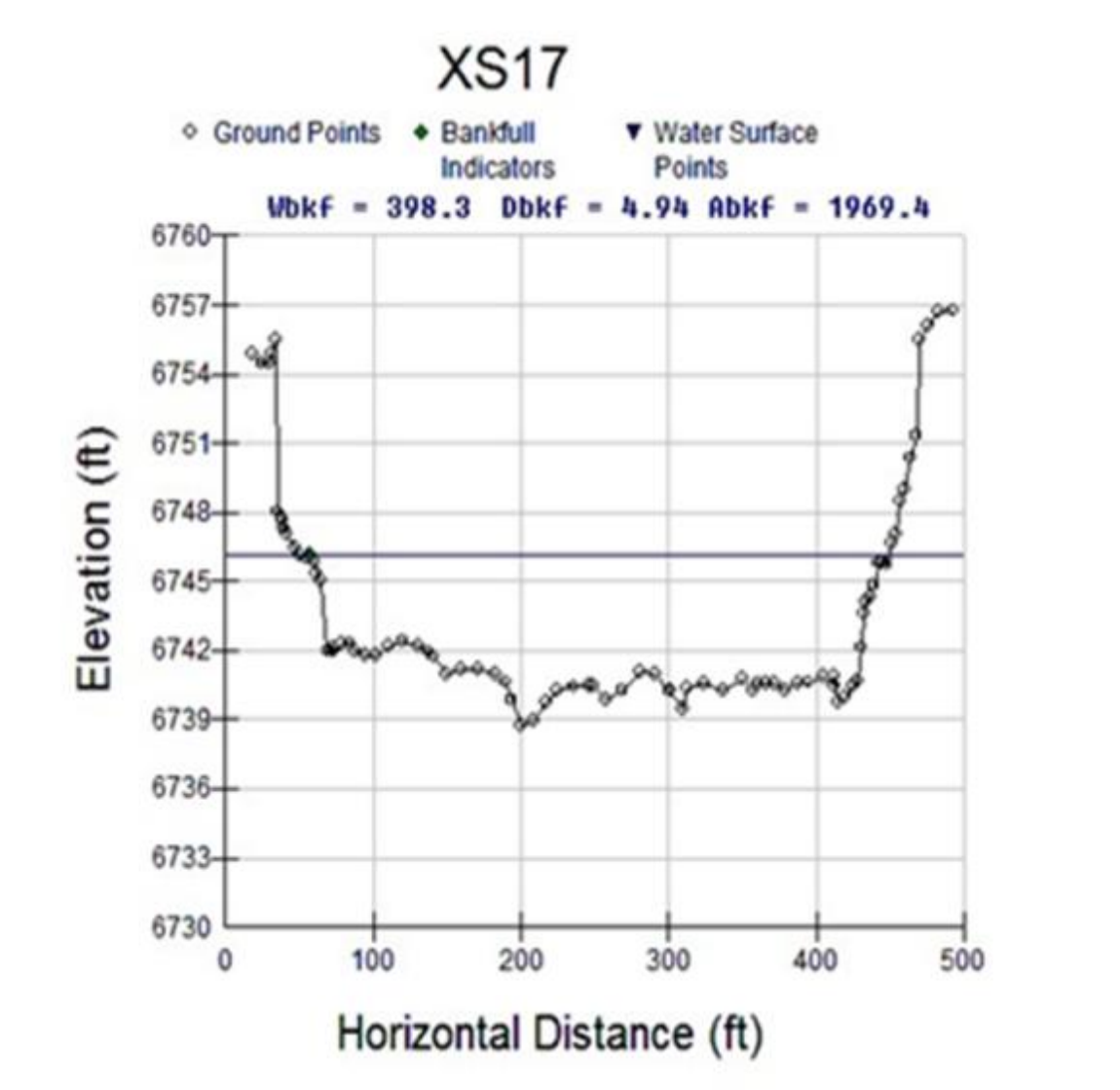
Cross-Section – Upstream Narrow



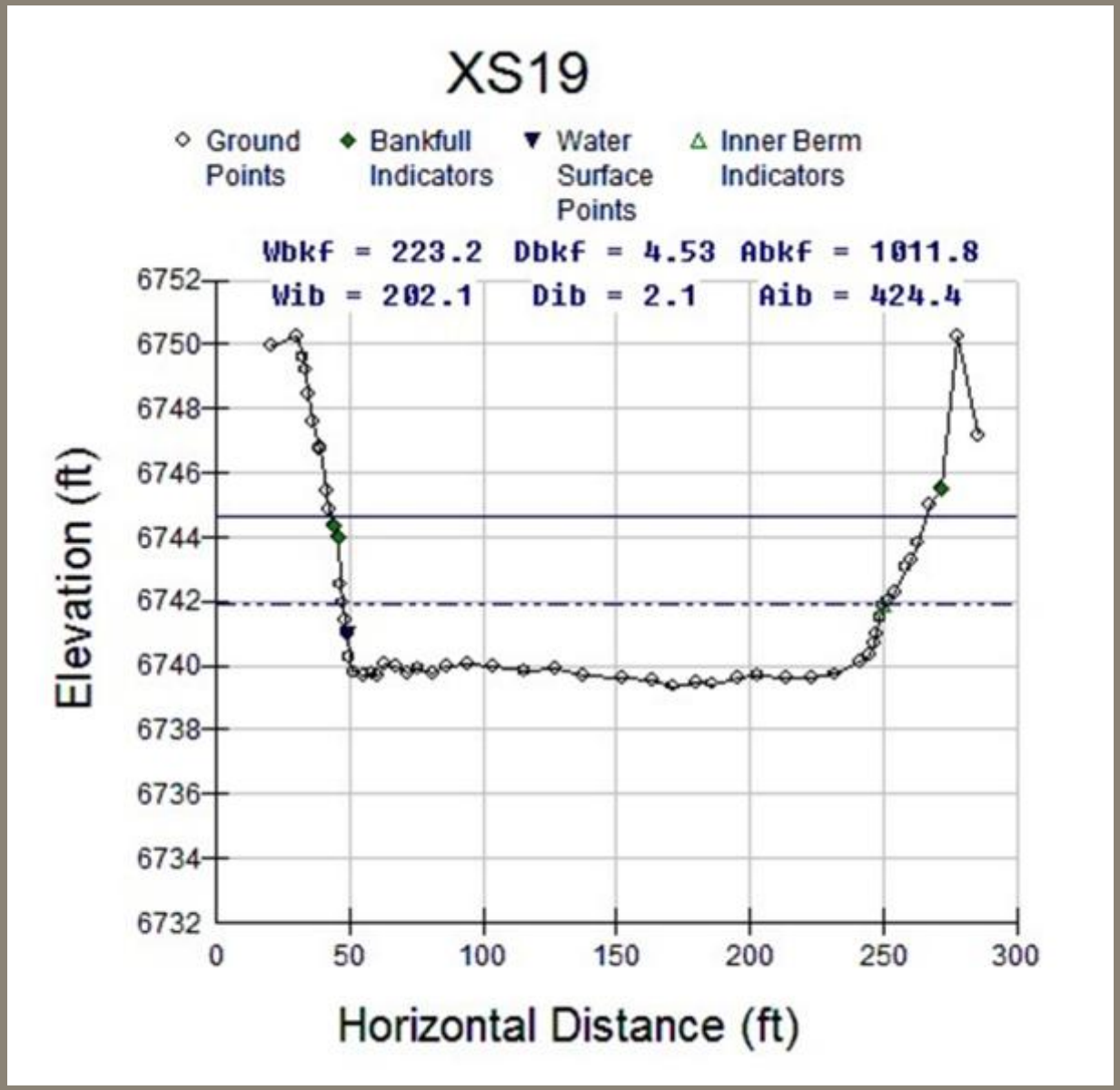
Cross-Section – Veteran's Island



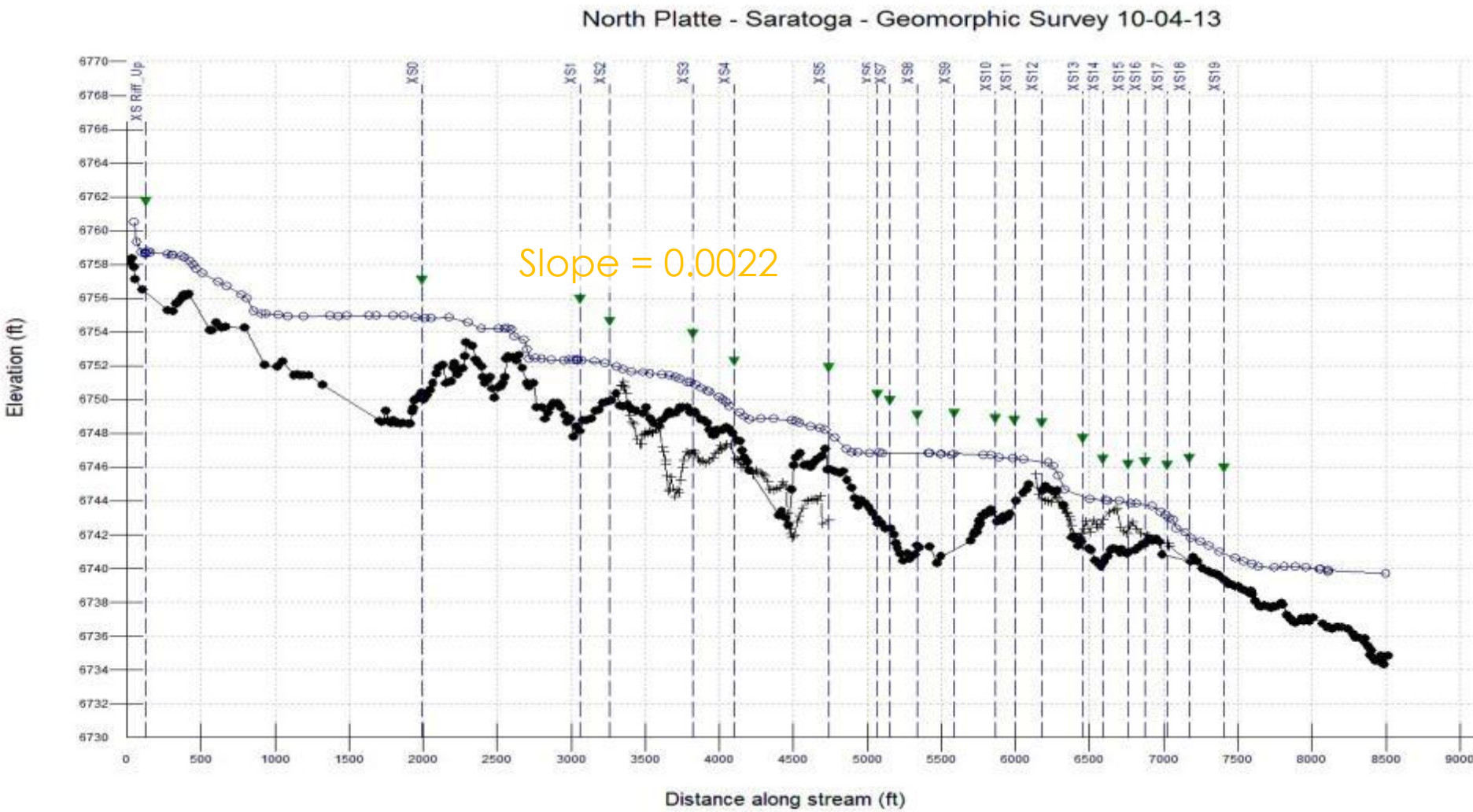
Cross-Section – AT WY 130



Cross-Section – Downstream



Long Profile – North Platte River



5 Additional Geomorphic Data

Our Team collected some BANCS data and Bed-load data in Spring 2014

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Geomorphic Data

BANCS - Bank Erosion Prediction

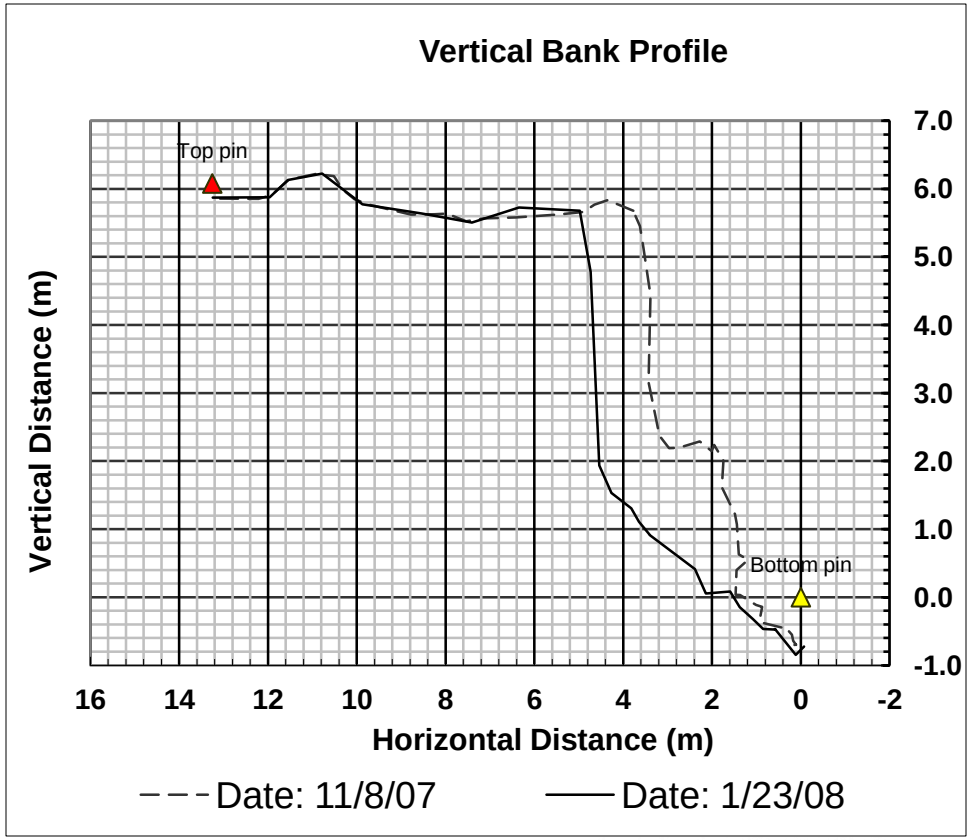
- Bank Erosion Hazard Index (BEHI)
- Near Bank Shear Stress (NBS)
- Float Trip May 2014
  - Flows were high at ~ 3,500 on May 5th
  - Much of the lower bank erosion was under water
  - Another float trip and low flow ~1000 cfs will be needed

Bed-load Data in 2014

- May 19th 2014

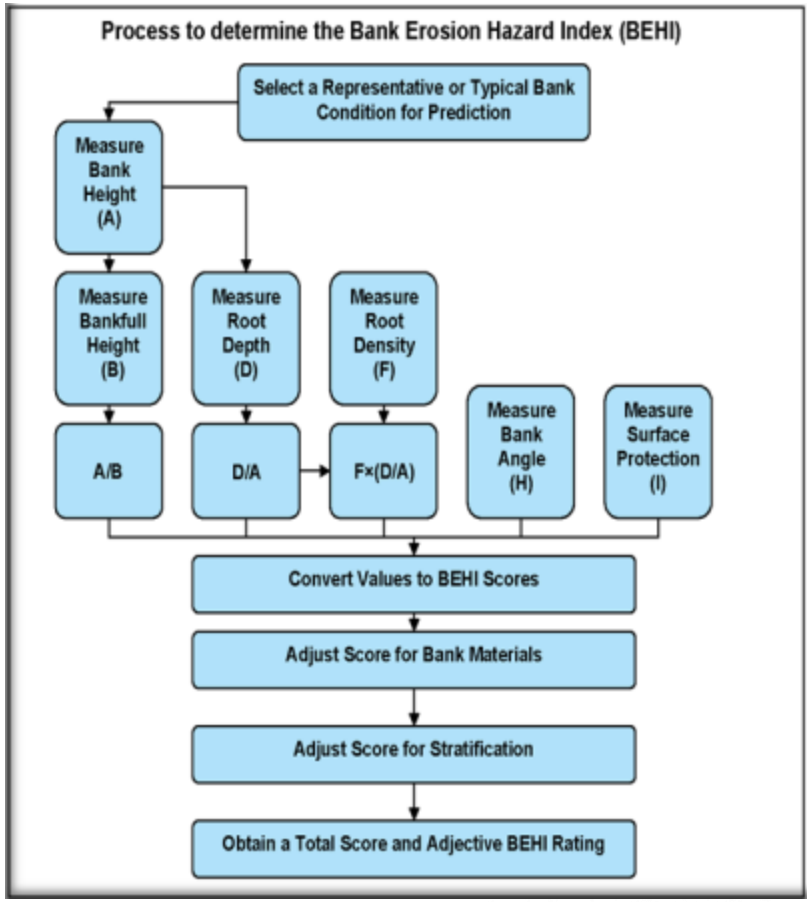
Bank Erosion Occurs in Most Rivers

- Rate of Bank Erosion - Sedimentation
- Property Loss



Bank Erosion Hazard Index (BEHI)

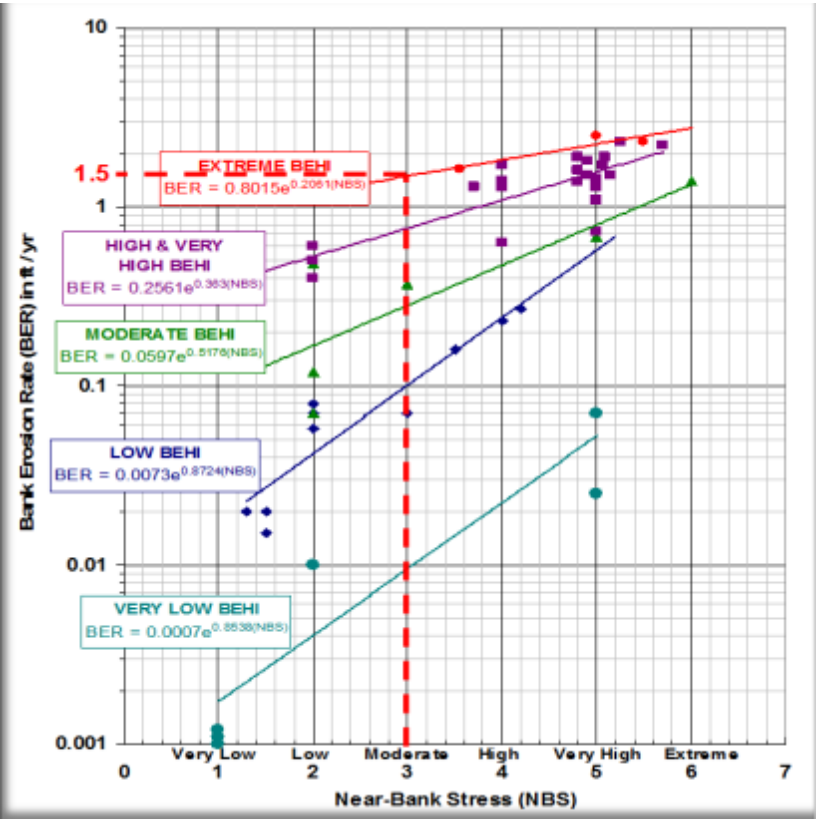
The Amount of Force (shear stress) exerted by Flowing Water to Initiate Erosion

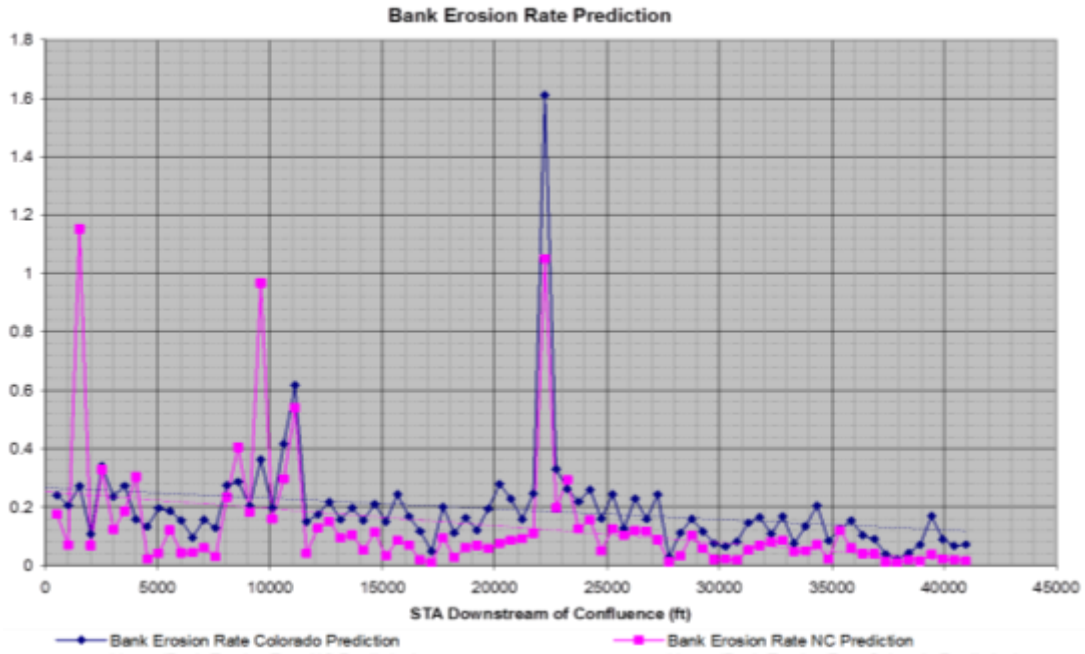


- # Near- Bank Shear Stress

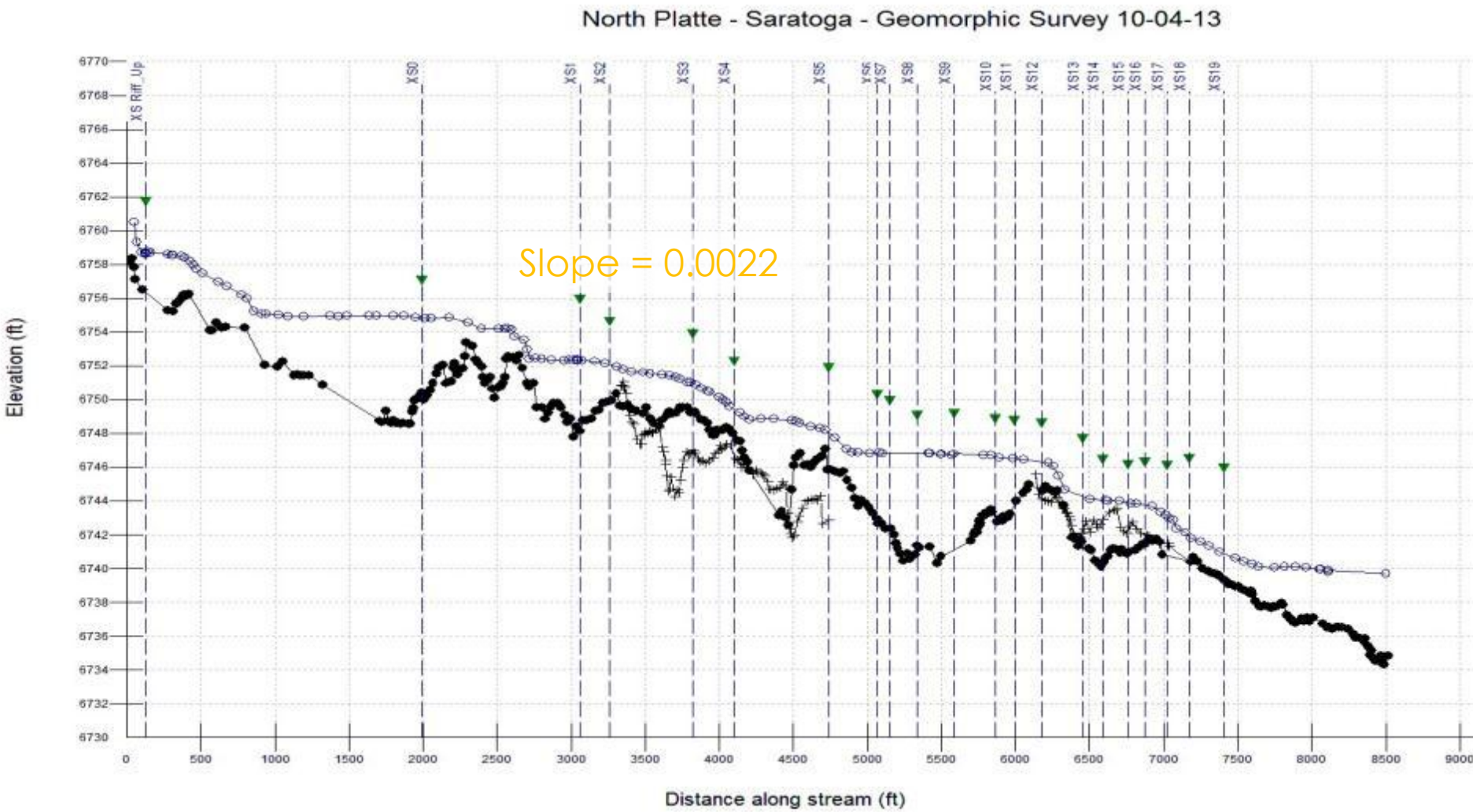
The Amount of Force (shear stress) exerted by Flowing Water to Initiate Erosion

• BANCS - Bank Erosion Prediction





Long Profile – North Platte River



6 Causes and Effects

For every action there is an equal and opposite reaction

Geomorphology

Cause

- High WDR – Maintenance
- Incised River – Exposed Banks
- Flattened River Slope – Flood Conveyance
- Reduction Riparian Vegetation

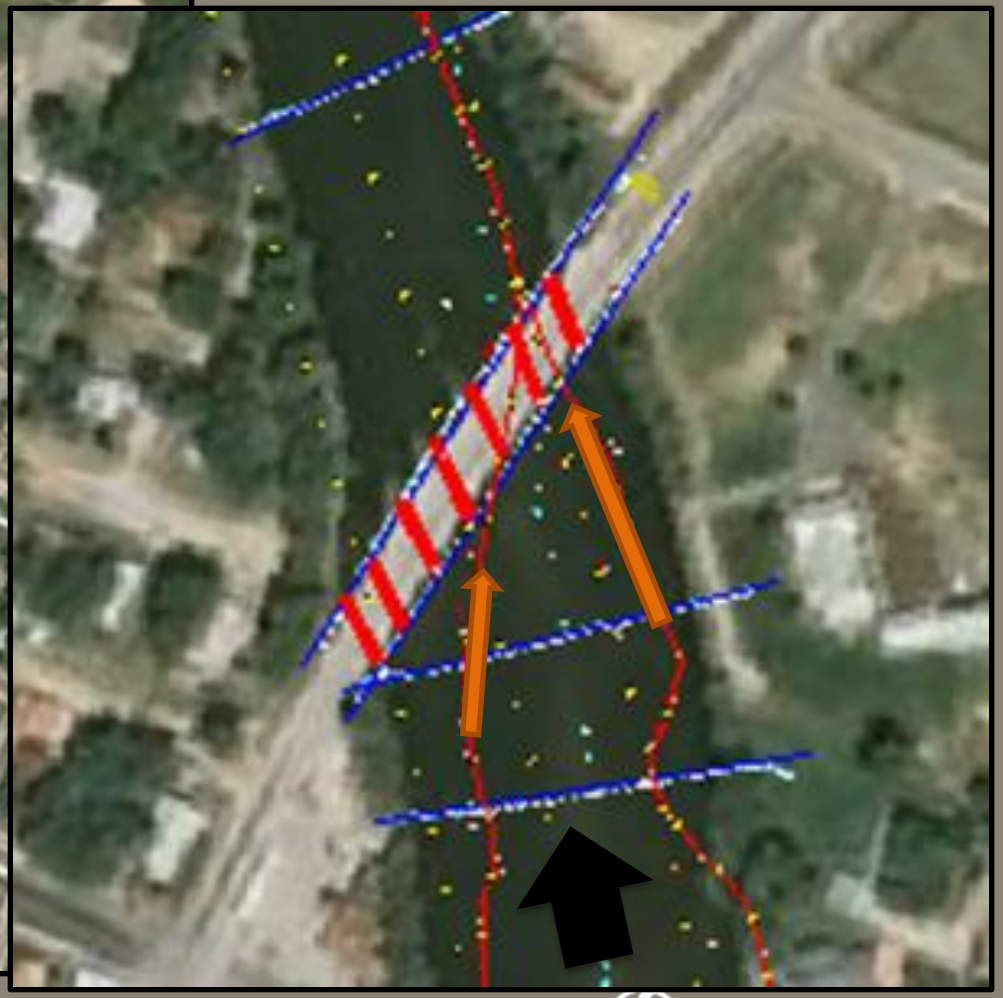
Effect

- Sediment Deposition and Filling of Pools
- Increased Localized Bed Scour and Bank Erosion
- Increase in Flood Stage at Sediment Deposits
- High Hazard for Bank Erosion – Land Loss

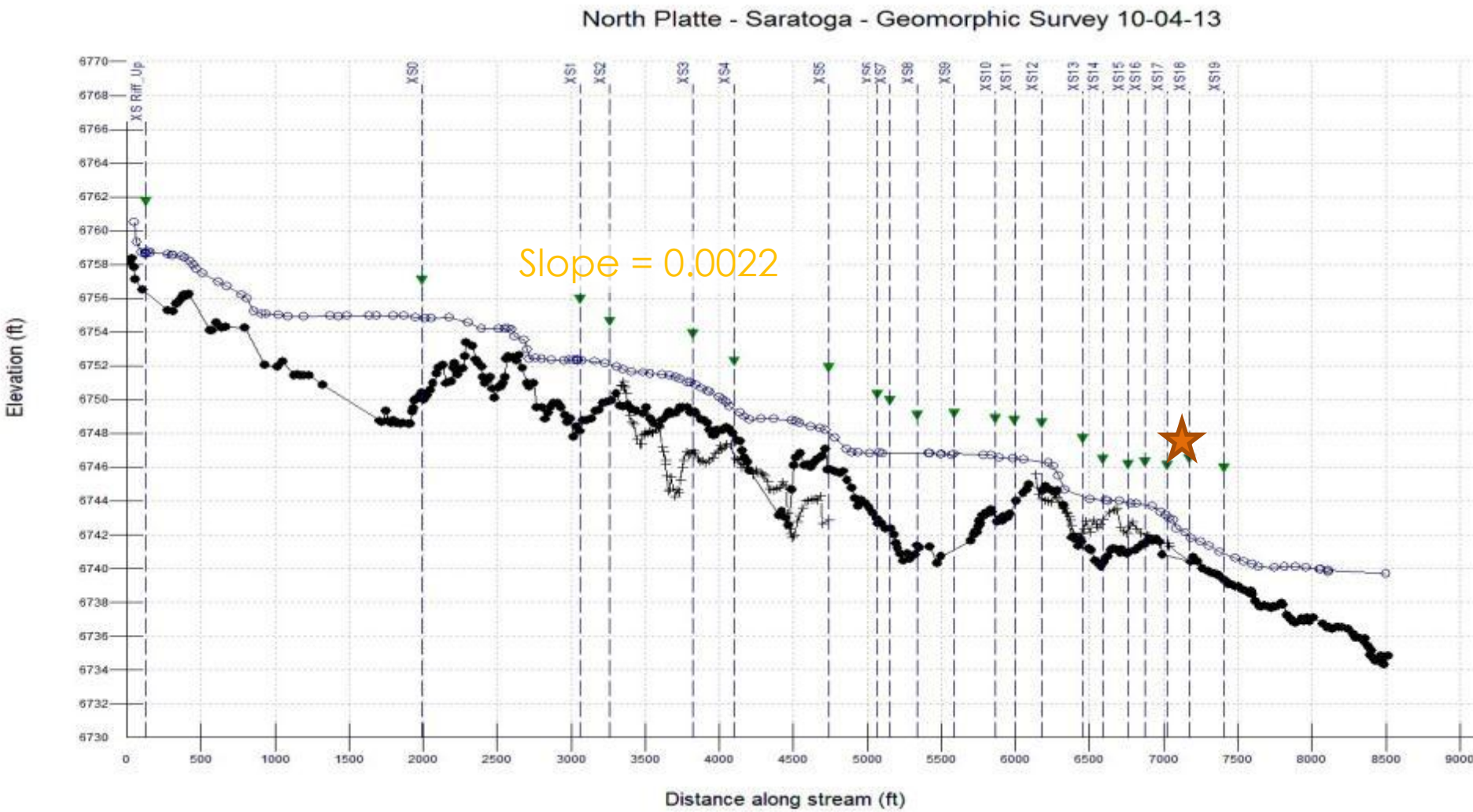
7 Bridge Data

Road Bridges should be Designed to cross in Tangent sections to the River with Flow parallel to the Flow of the River

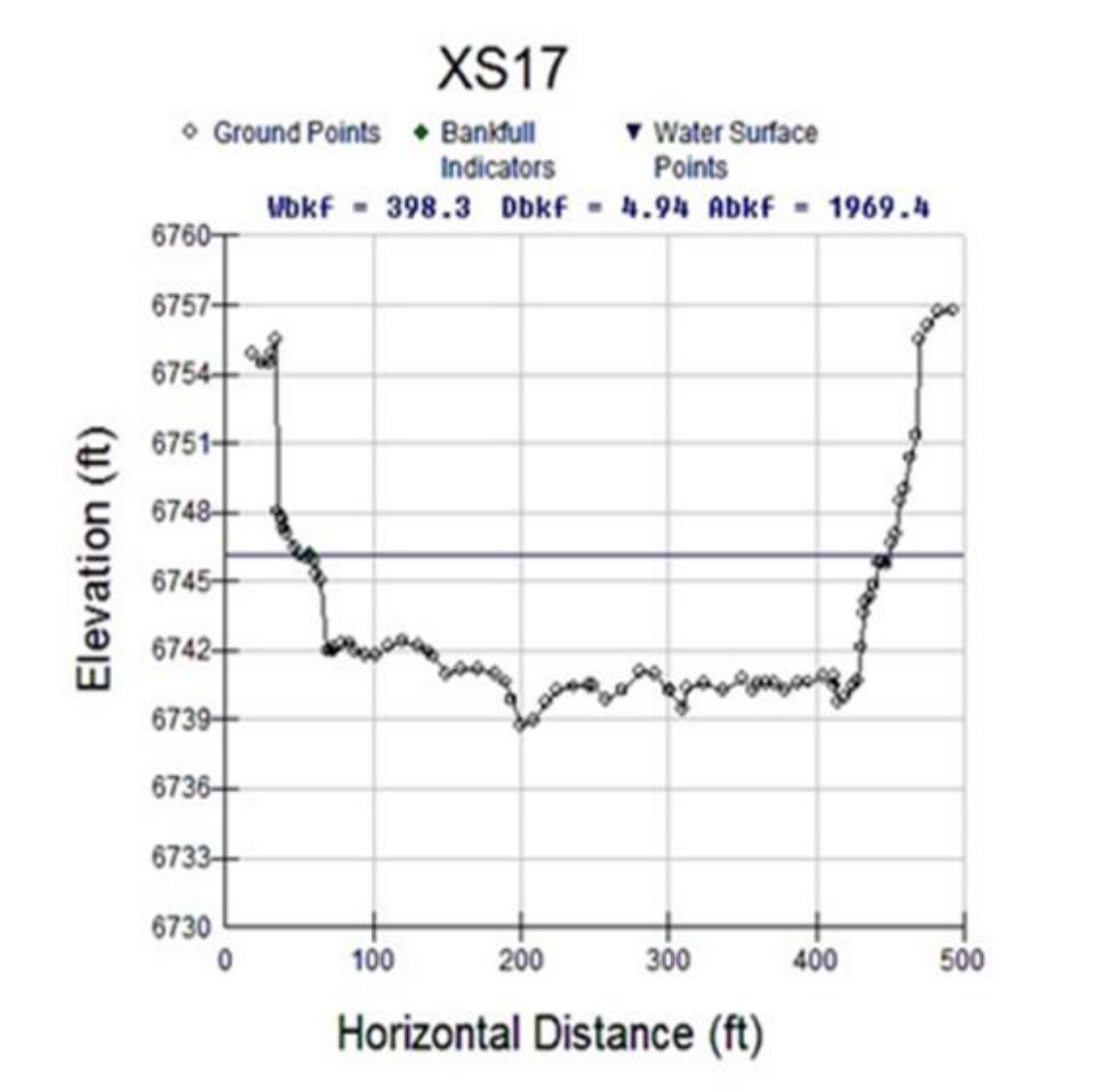
Wyoming 130 Bridge



Long Profile – North Platte River



Cross-Section – AT WY 130



Bridge Data

Requirements

- Detailed Structural Evaluation and Report
    - Stantec has industry leading bridge inspectors in Denver Colorado
- HEC-RAS Model for Flood Study
- Detailed 3-D Surface and River 2D to support Bridge Pier scour assessment

8 Additional Problem Areas

Are there additional concerns and issues to share with our Design Team

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Additional Problem Areas

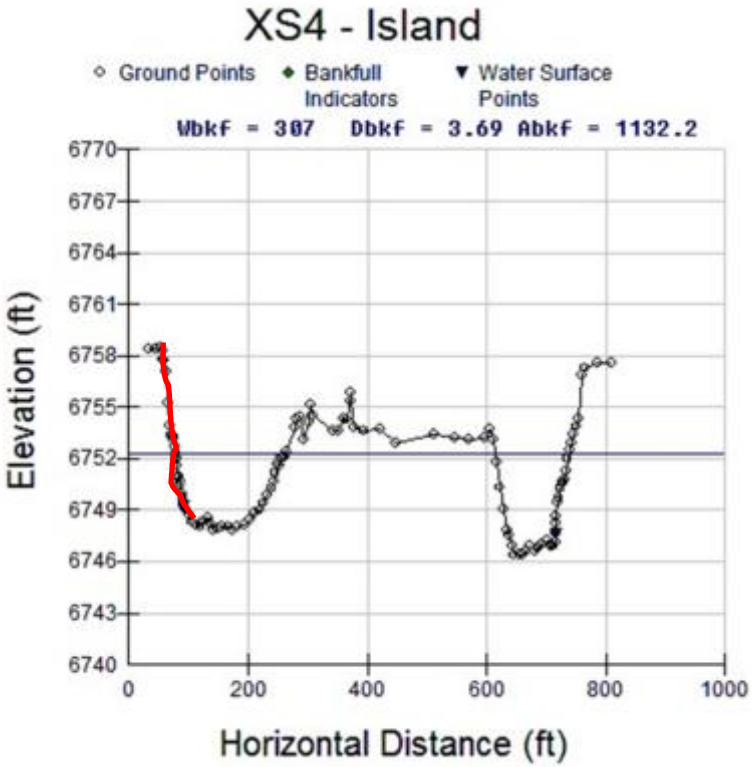
- Land Use Issues
  - Boating and Angler Access
- Property Owner Issues
  - Land Loss due to Bank Erosion
  - Flooding Levees and Berms
- Fisheries Concerns
  - Lack of Riparian Inputs from Vegetation
  - Lack of Overhead Cover
  - Lack of In-stream Cover
  - Lack of Riffle for Bug Production
- Aesthetic Values

9 Geomorphic Tendency

What is the potential for the River be able to fix itself?

Bar Formation and Bank Erosion

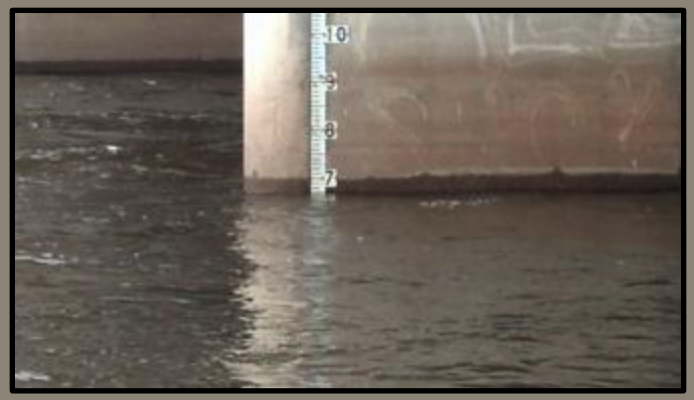
Bar Formation and Bank Erosion



10 Bed-load Sampling 2014

If at First you don't succeed….

Bed-load Sampling 2014



Digital Gage Height 7.11'
Physical Gage Height 7.35' on Pier

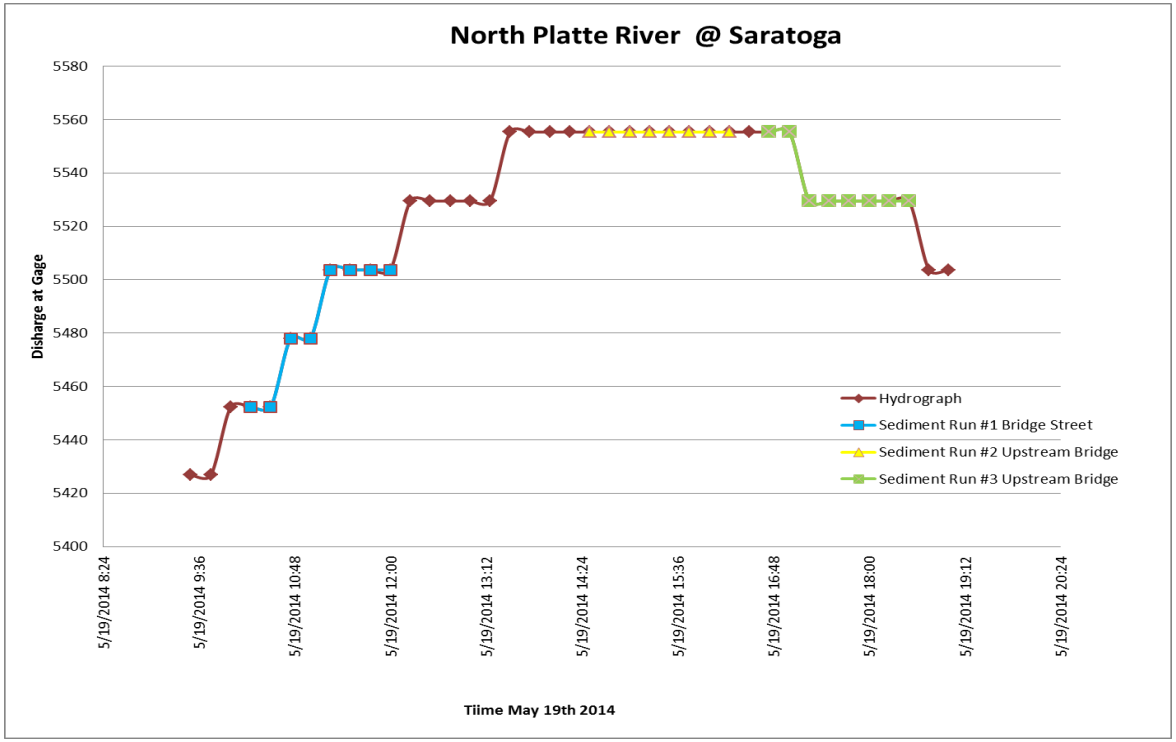
Bed-load Sampling 2014

Bankfull Flows - Trigger

- 5,000cfs – 5,500cfs (5,200cfs)
- Sample Run on May 19th 2014 @ 5,400 – 5,500 cfs
  - Three sample runs collected

Bed-load Sampling 2014

- Sample Run on May 19th 2014 @ 5,440 – 5,560 cfs
  - Three sample runs collected
  - At Two Locations Bridge Street and Shay Bridge (upstream 3.05 miles)



Bed-load Sampling 2014

Bed-load Sampling 2014

Bridge Street:
205ft Wide
4.9 fps
Bedload Sample ~ 6.34 kg

Transport Rate ~ 1.06 kg/sec
Transport Rate ~ 100.9 Tons/day

Upstream Shay Bridge:
Upstream 3.05 miles
160ft Wide
5.3 fps
Bedload Sample ~ 11.31 kg

Transport Rate ~ 1.51 kg/sec
Transport Rate ~ 143.6 Tons/day

11 Preliminary Design

This is only a Preliminary Design we have not analyzed the data needed for a Concept Design.

Restoration requires changes in dimension, pattern and profile

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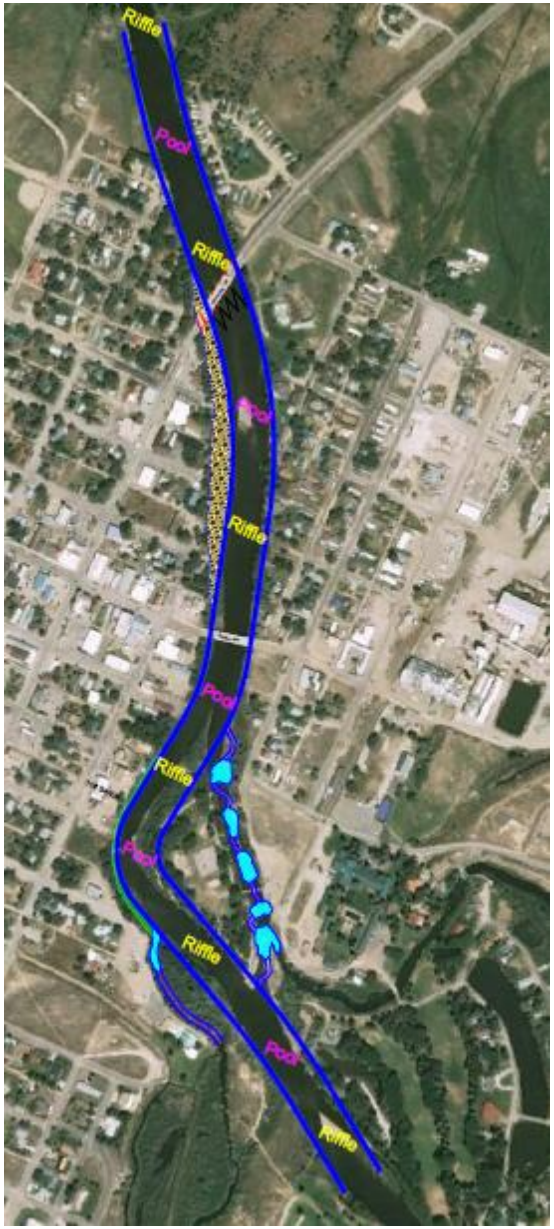
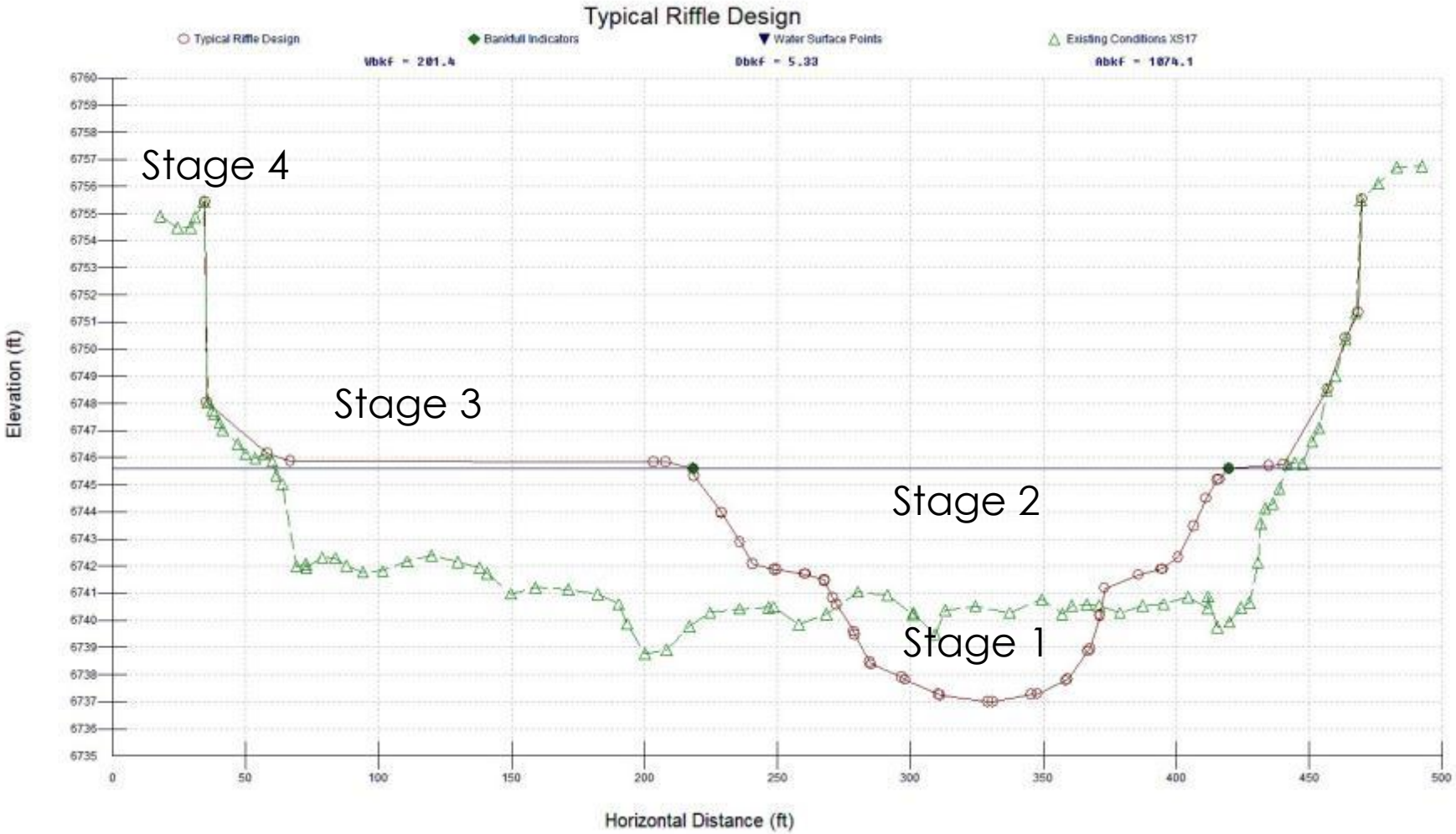


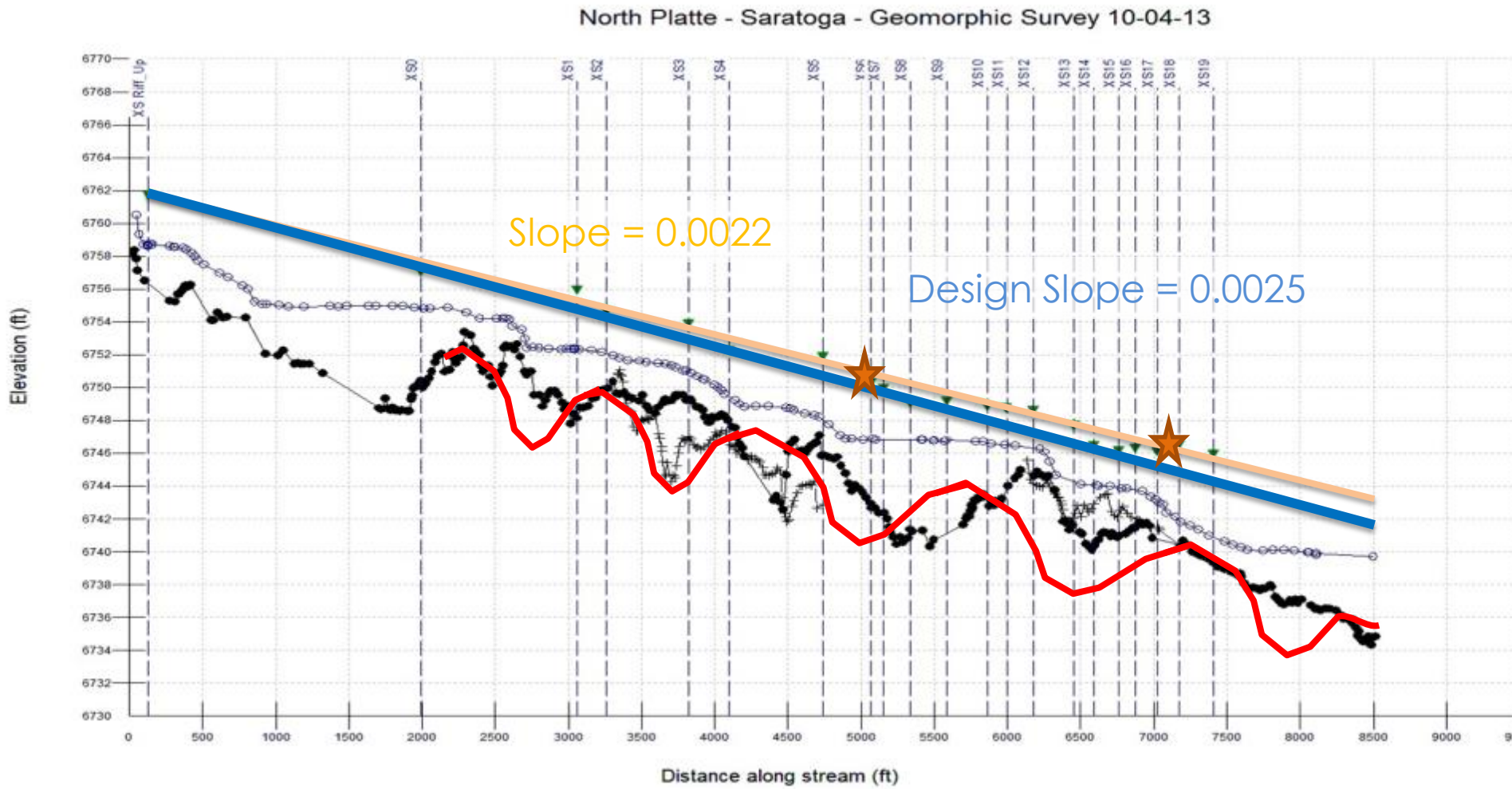
Illinois River, Oklahoma 375' → 225'

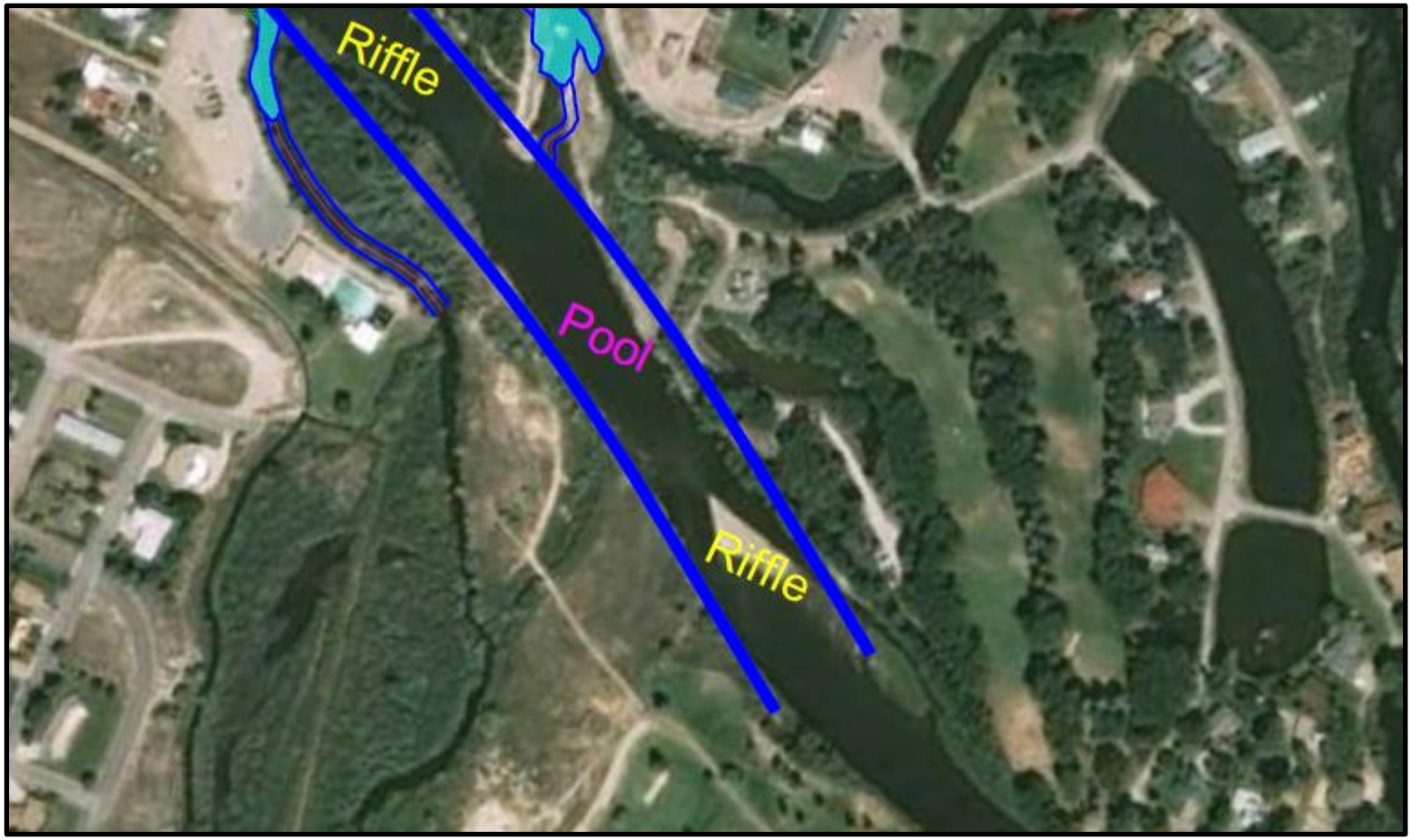
Yampa River, Colorado 185' → 90'

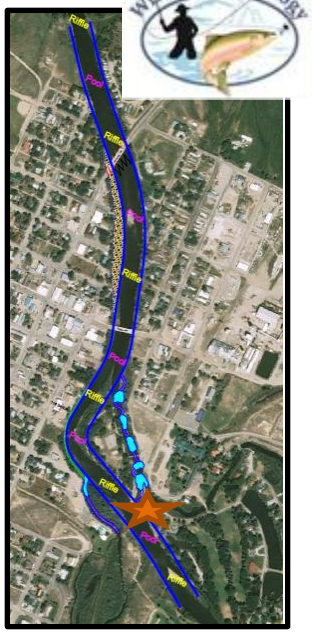
Typical Cross-Section



Reach Profile







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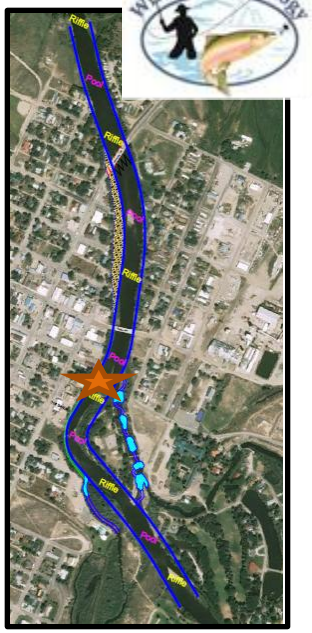

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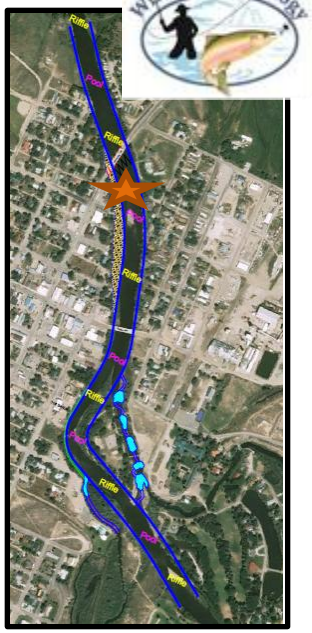
Riffle
Wyoming 130
Pool
Riffle


Wildland Hydrology
Riffle
Pool
Riffle
Pool
Riffle
Pool
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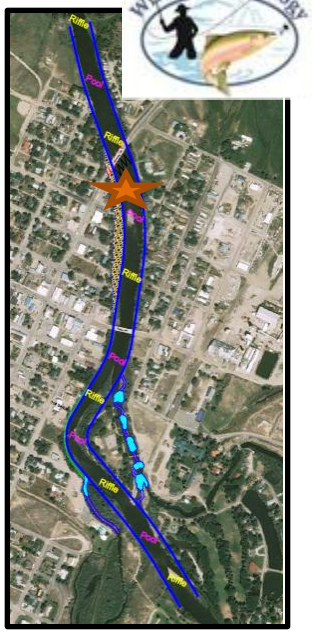
Pool
Riffle

Stantec



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Preliminary Design

Assumptions

- Channel Cross-Sectional Area of ~1000 sqft
- Channel Width of ~170ft

Concerns

- Cost of Excavation
- Supply of Woody Debris
- Boulder Cost and Source of Rock
- Flood Modeling

12 Preliminary Structures

Structures don't restore a River but produce Habitat, Grade Control and Temporary Bank Stabilization

Preliminary Structures

Habitat, Access and Bank Protection

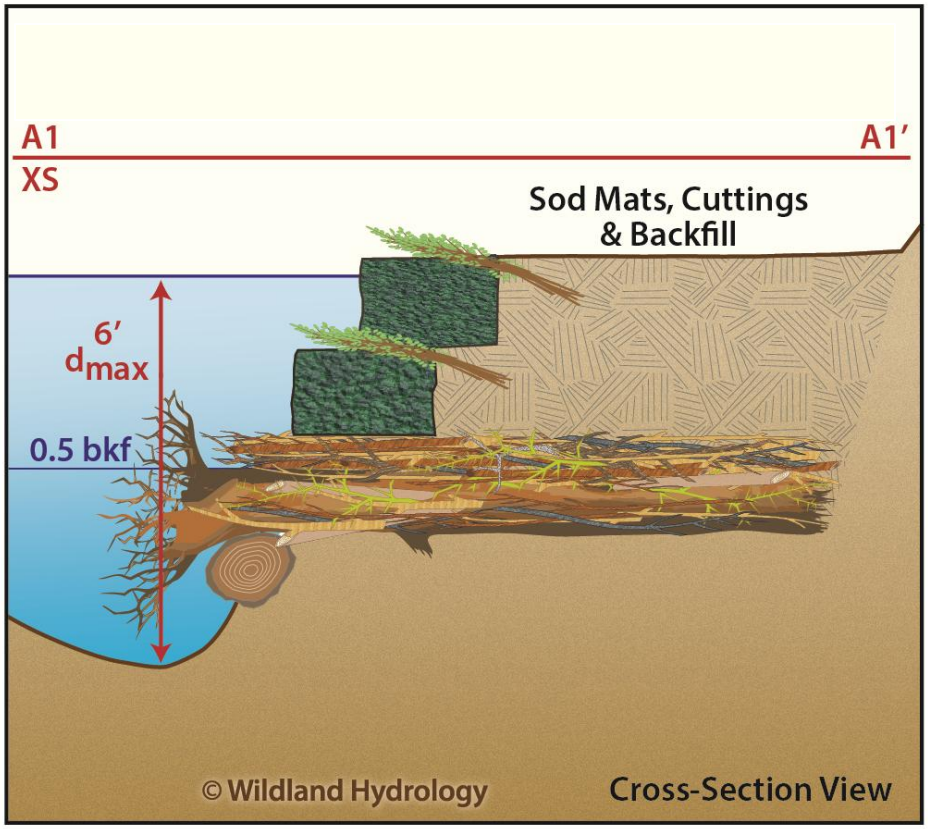
- Bankfull Bench
- Toe Wood
- J-Hooks
- Rock Clusters

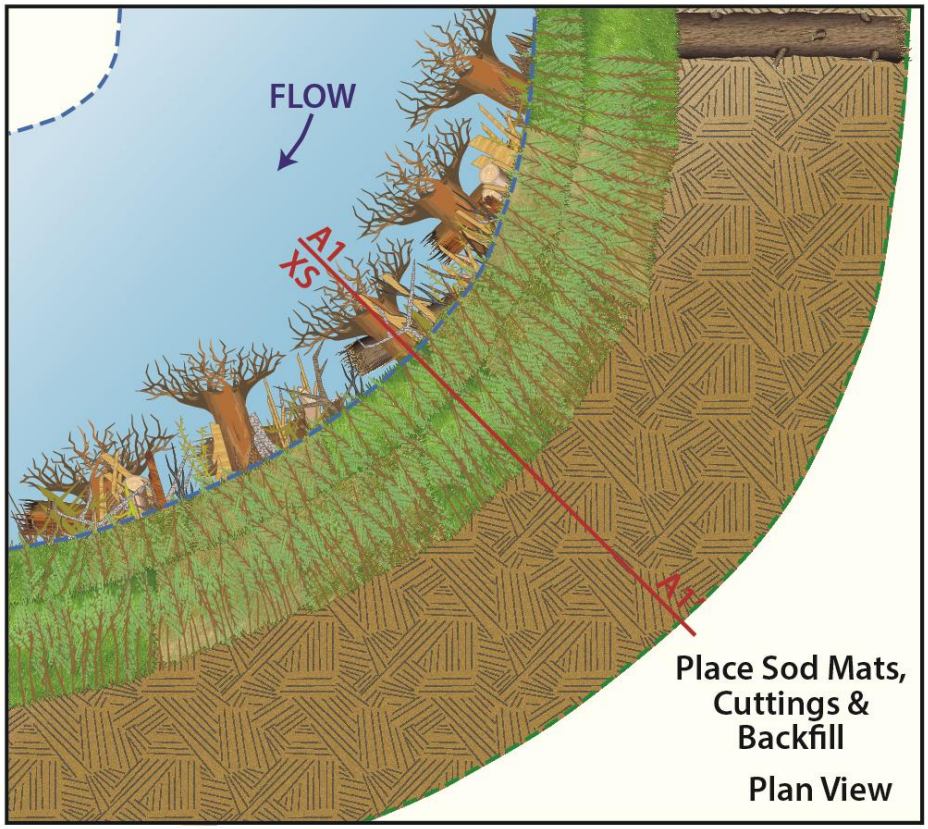
Grade Control and Bridge Protection

- Cross-Vane
- Constructed Riffle
- W-Weir
- Double W- Weir

Bankfull Bench
Illinois River, Oklahoma

Toe Wood


A1
A1'
XS
Sod Mats, Cuttings
& Backfill
6'
dmax
0.5 bkf
© Wildland Hydrology
Cross-Section View

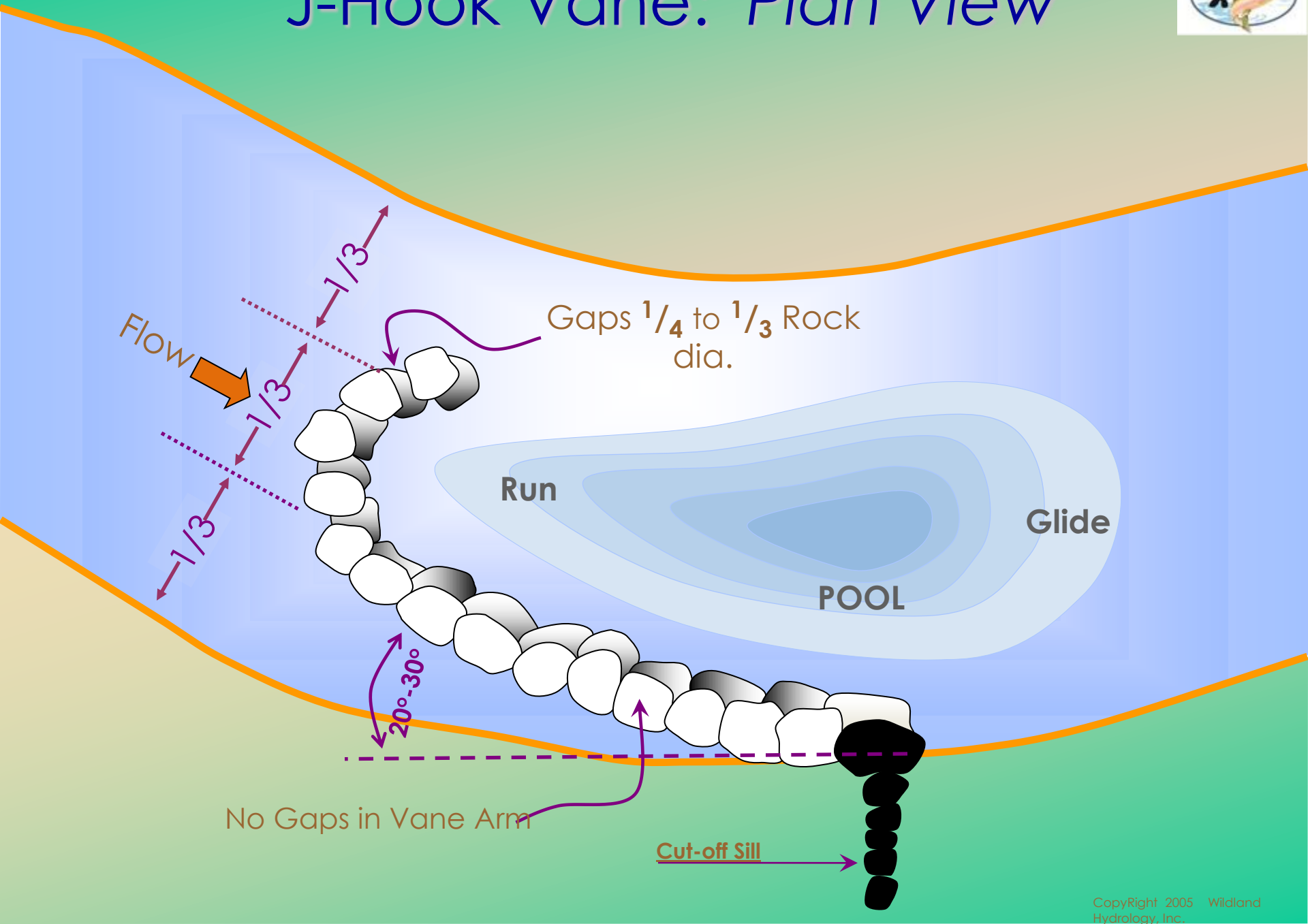

FLOW
A1
XS
A1'
Place Sod Mats,
Cuttings &
Backfill
Plan View

Post-restoration Toe Wood with sod mats and willow transplants, Bitterroot River, MT

The flow separation during flood, Bitterroot River, MT

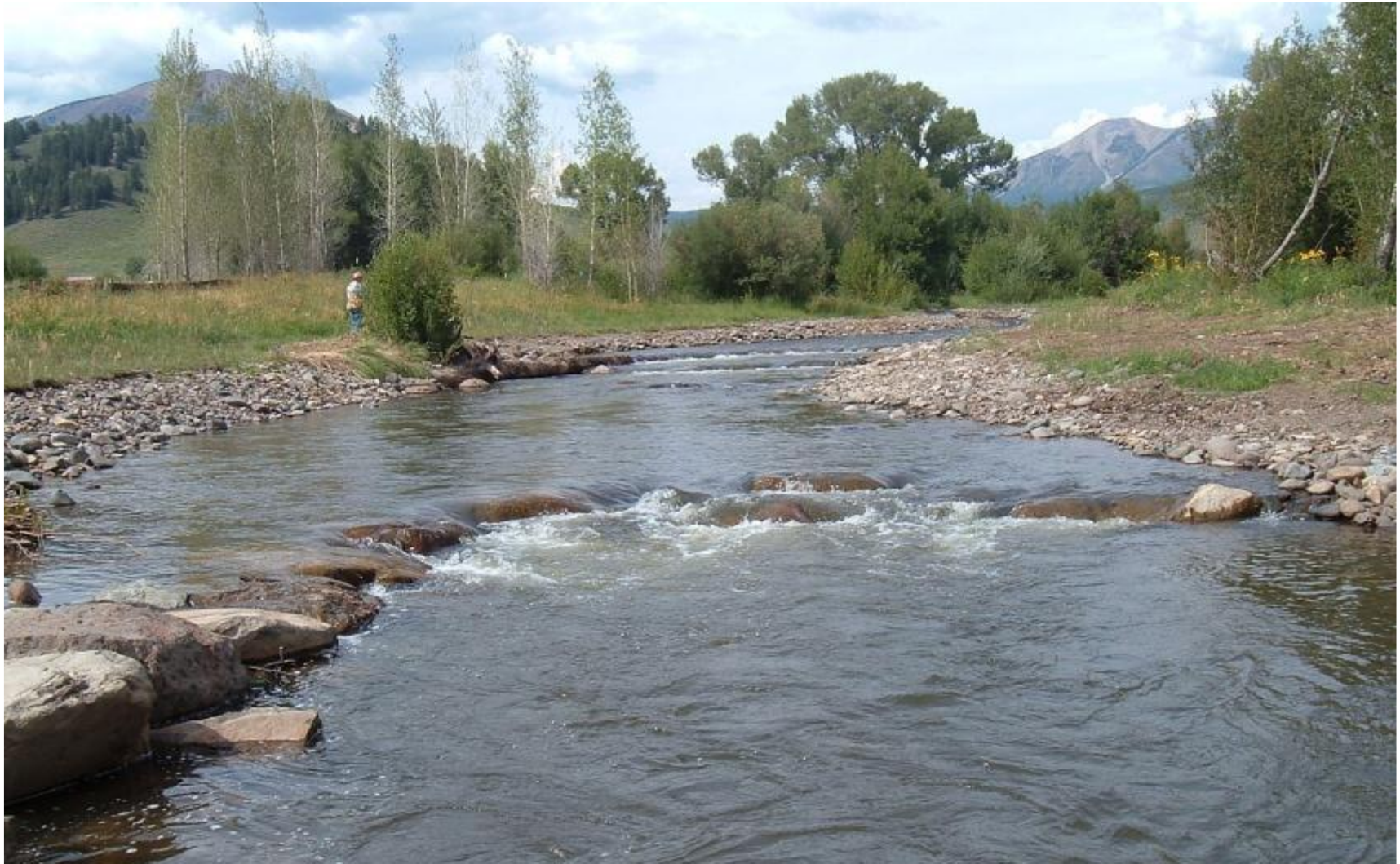
Toe Wood with sod mats and willow transplants, Yampa River, CO

J-Hook Vane: *Plan View*



CopyRight 2005 Wildland Hydrology, Inc.

Rock J-Hook Vane with a chute cutoff sill, Ohio Creek, CO, post-construction, 2005



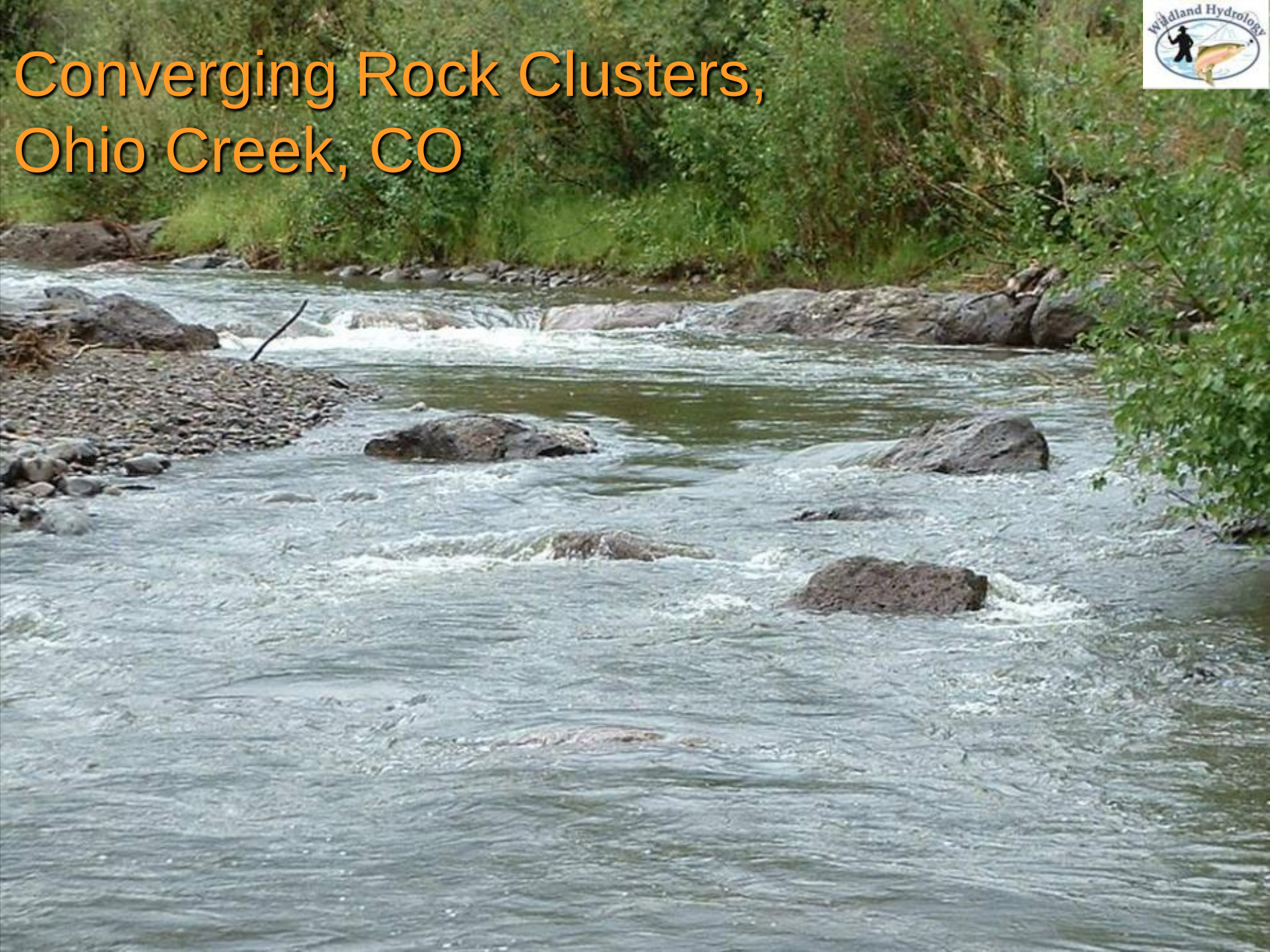
Rock J-Hook Vane with cutoff sill, 2003

Converging Rock Clusters

1. Provide grade control at the head of the riffle
2. Provide instream cover for fish throughout the riffle
3. Dissipate energy
4. Create pocket water pools

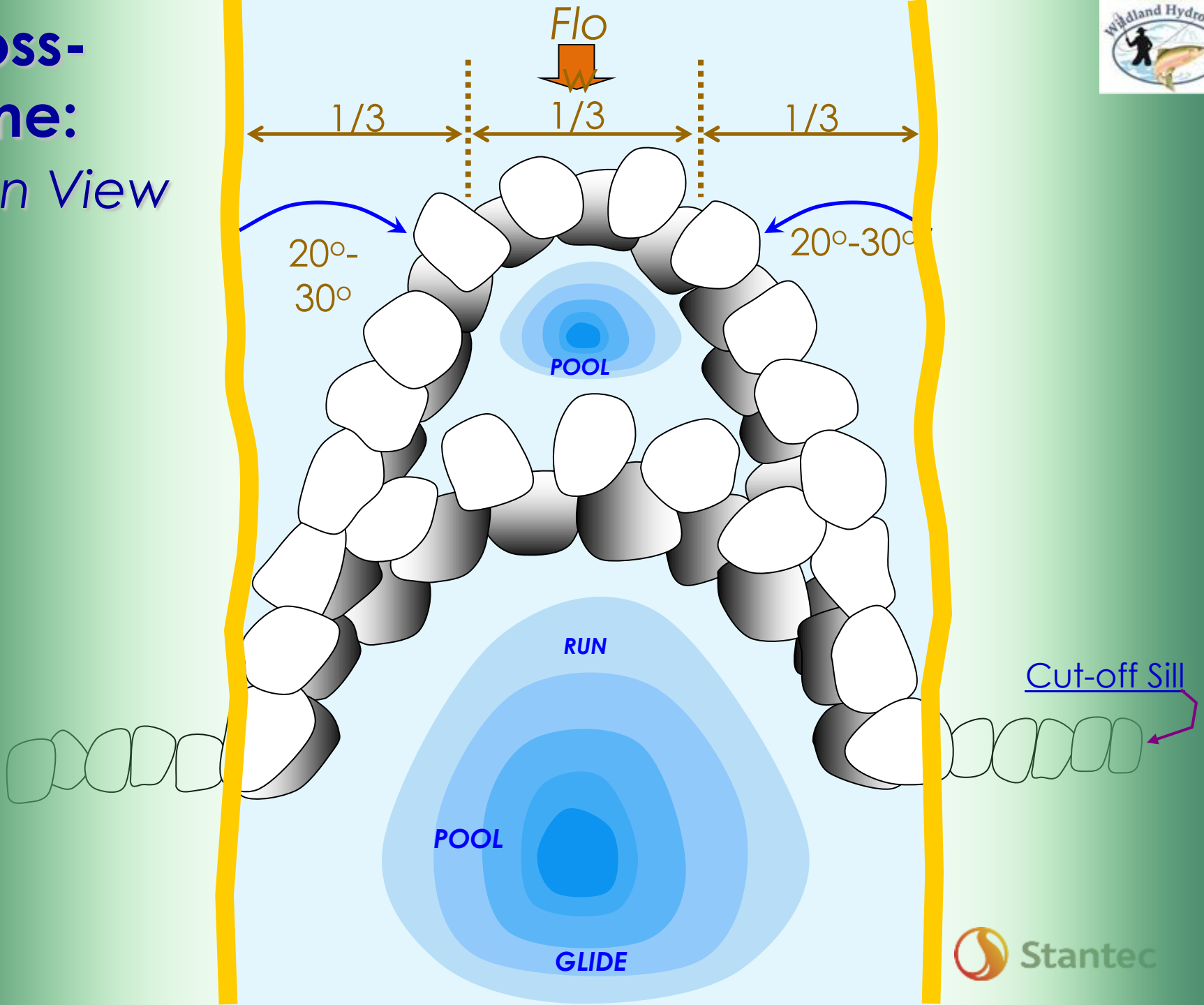
Converging rock clusters constructed (photo taken in 2012)

Converging Rock Clusters, Ohio Creek, CO

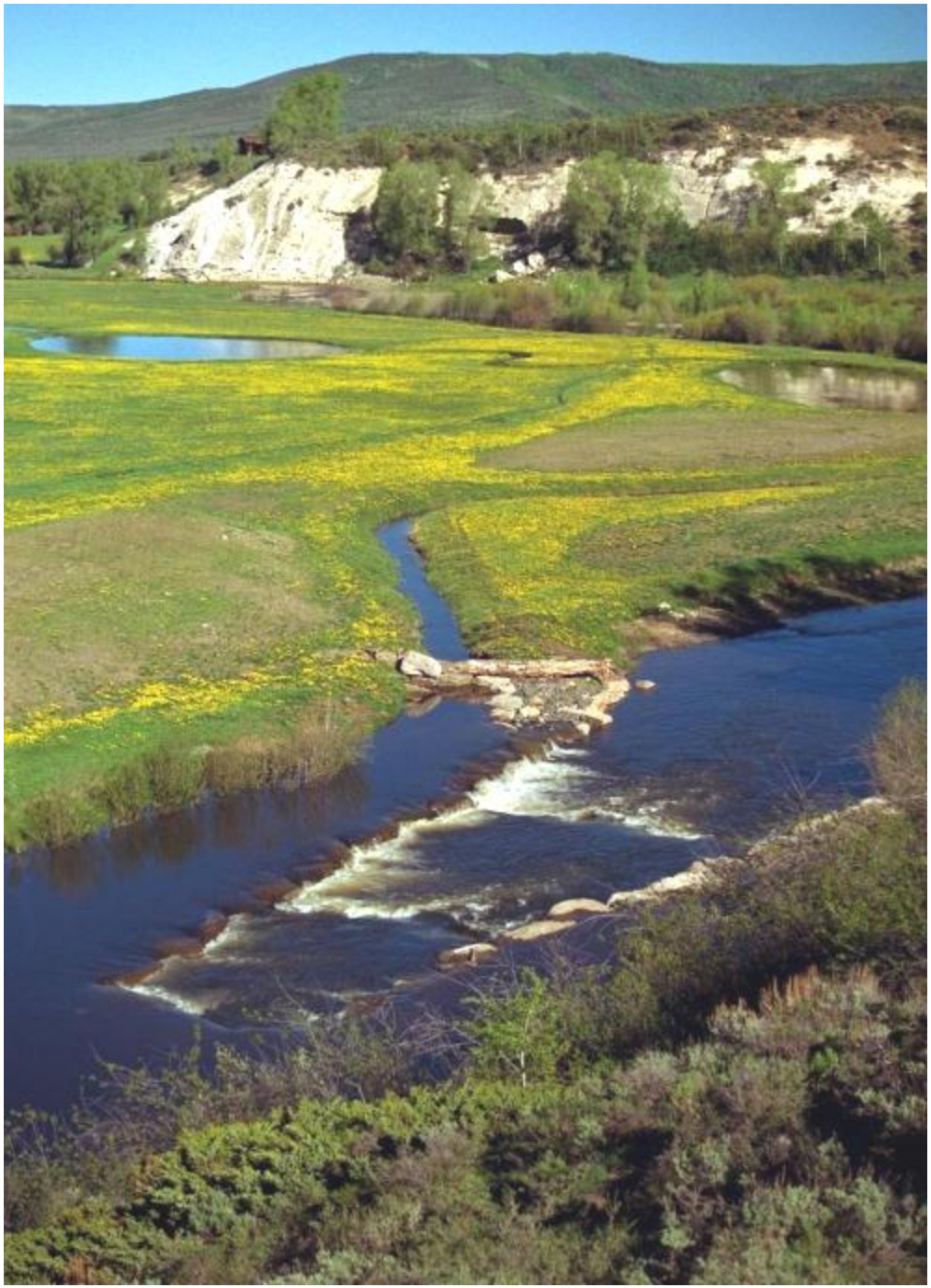


Cross-Vane:

Plan View

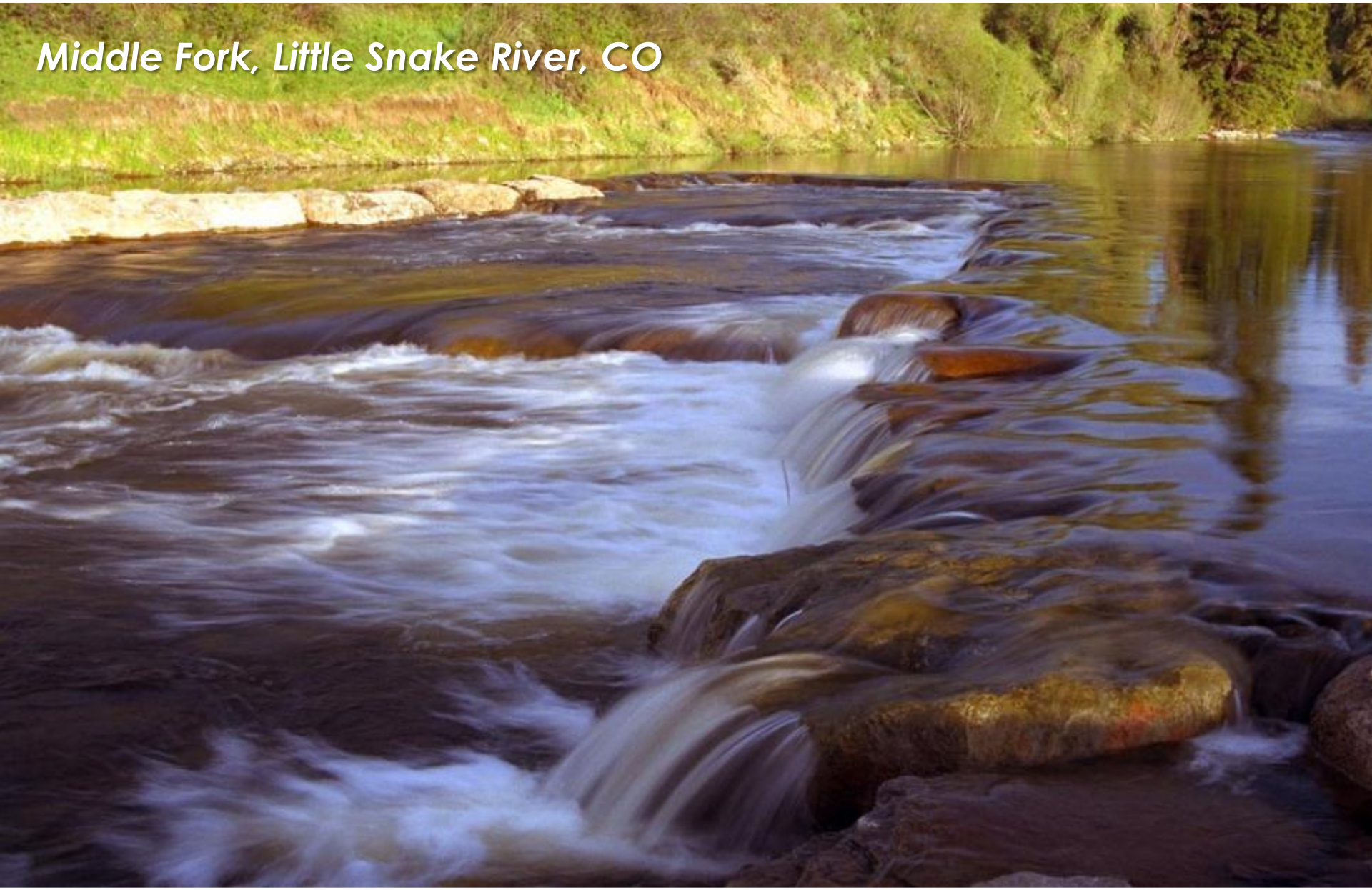


Cross-Vane Diversion



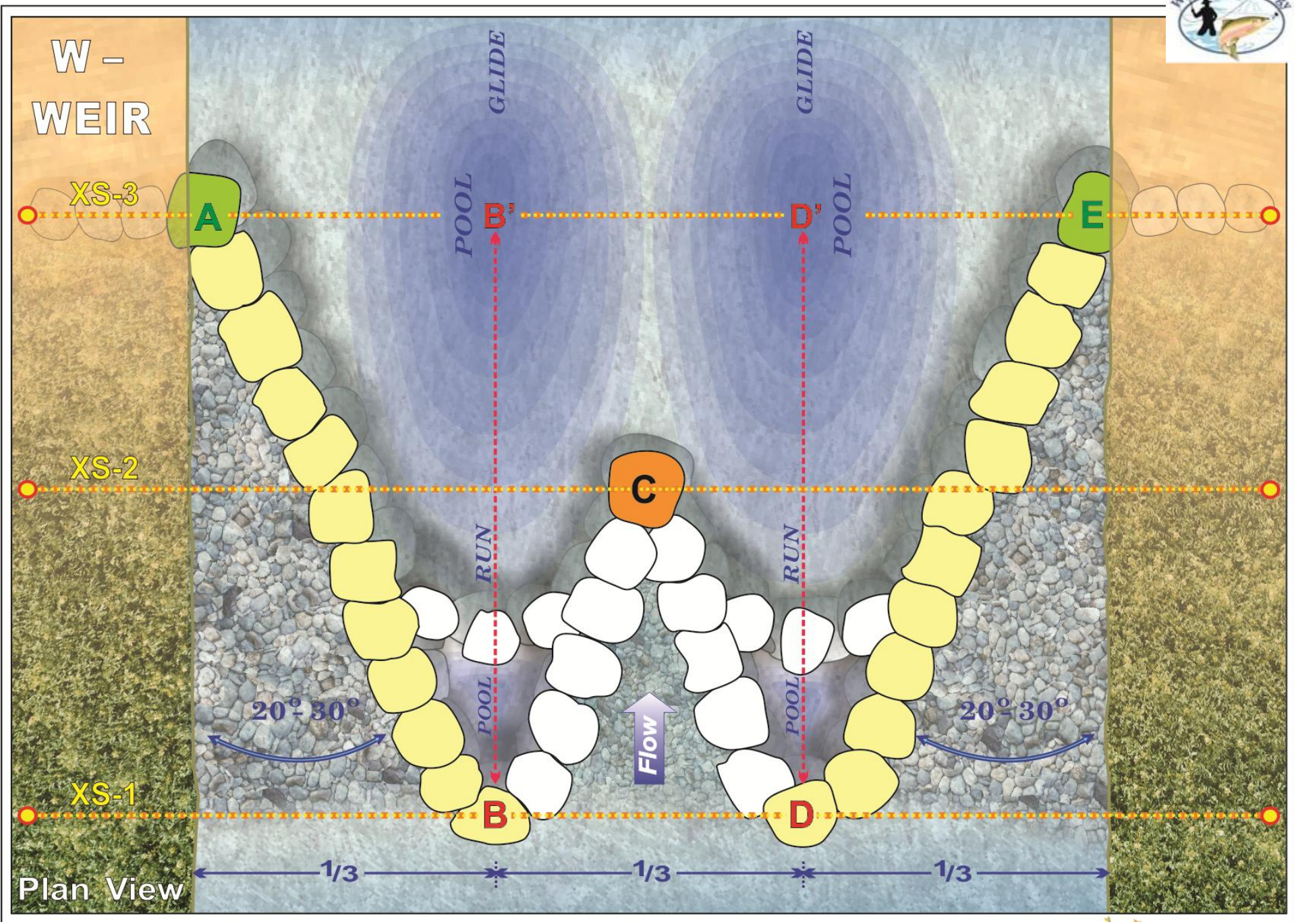
Cross-Vane Diversion, Middle Fork, Little Snake River, CO

Cross-Vane Diversion



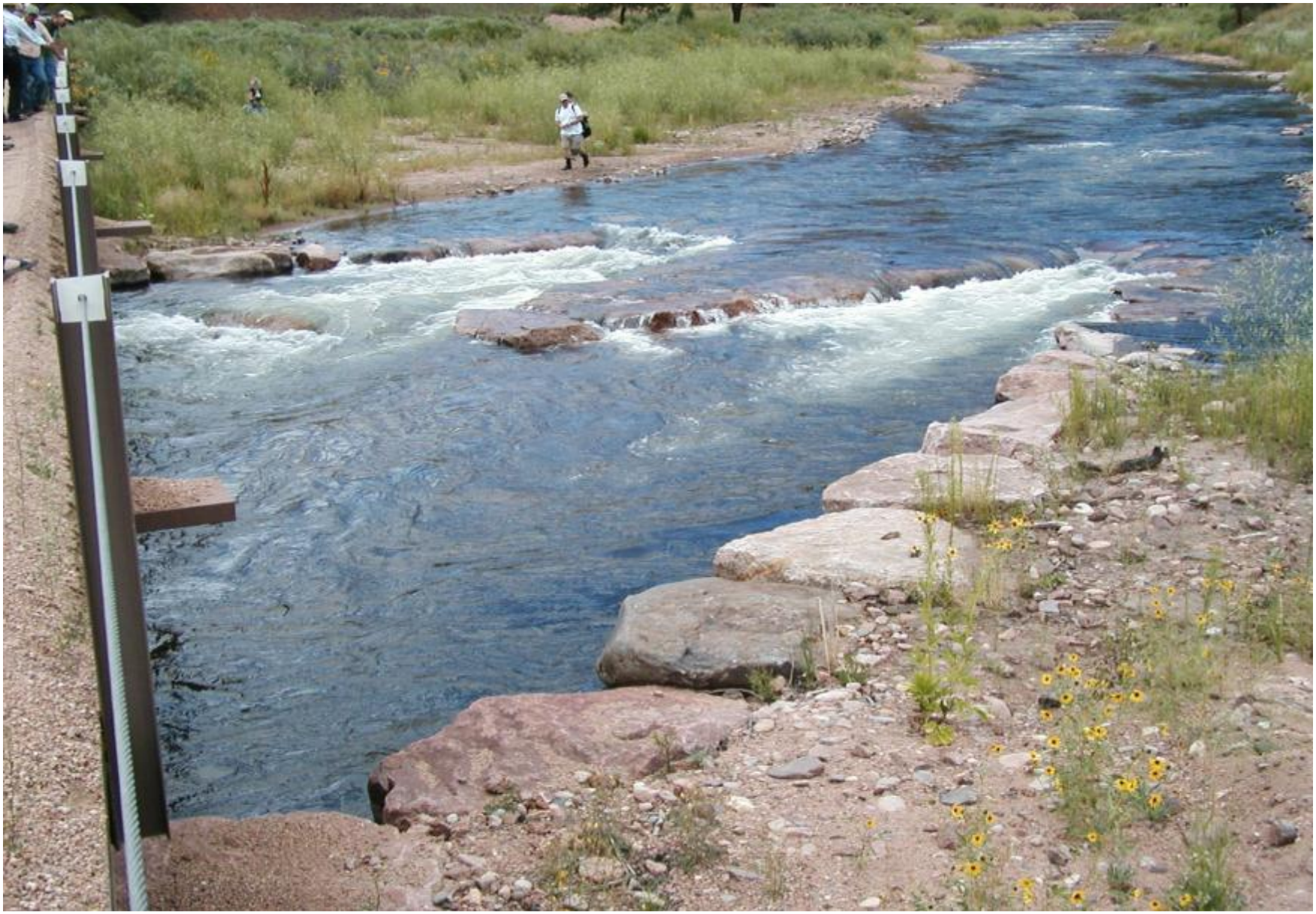
Constructed Riffle

Constructed Riffle


W –
WEIR
XS-3
XS-2
XS-1
A
B'
D'
E
C
B
D
GLIDE
GLIDE
POOL
POOL
RUN
RUN
POOL
POOL
Flow
20°-30°
20°-30°
1/3
1/3
1/3
Plan View

W-Weir: Blue River, Colorado

W-Weir at Bridge



Double W-Weir: Blue River, Colorado

Riffle
Wyoming 130

13 Schedule and Next Steps

Our team is here to consult and guide the Community through this process

Next Steps

Data Collection

- BANCS data and assessment – April- May 2014
  - **Additional Float Trip at or below 1,500 cfs**
- Bed-load Data Collection – May 19th 2014
- Any additional survey data collected – April 2014

Concept Design 06-21-14

- Geomorphic Assessment Report
- Concept Design
  - Plan, Profile, 10 Cross-Sections
- Typical Details with Photos scaled to the North Platte at Saratoga

Town Responsibilities

14 Conclusion

Any Additional Thoughts?

Questions?
Thanks
We must
understand to be
understood