Silver Bow Creek – Balancing Competing Priorities and Lessons Learned

2013 Mine Design, Operations and Closure Conference

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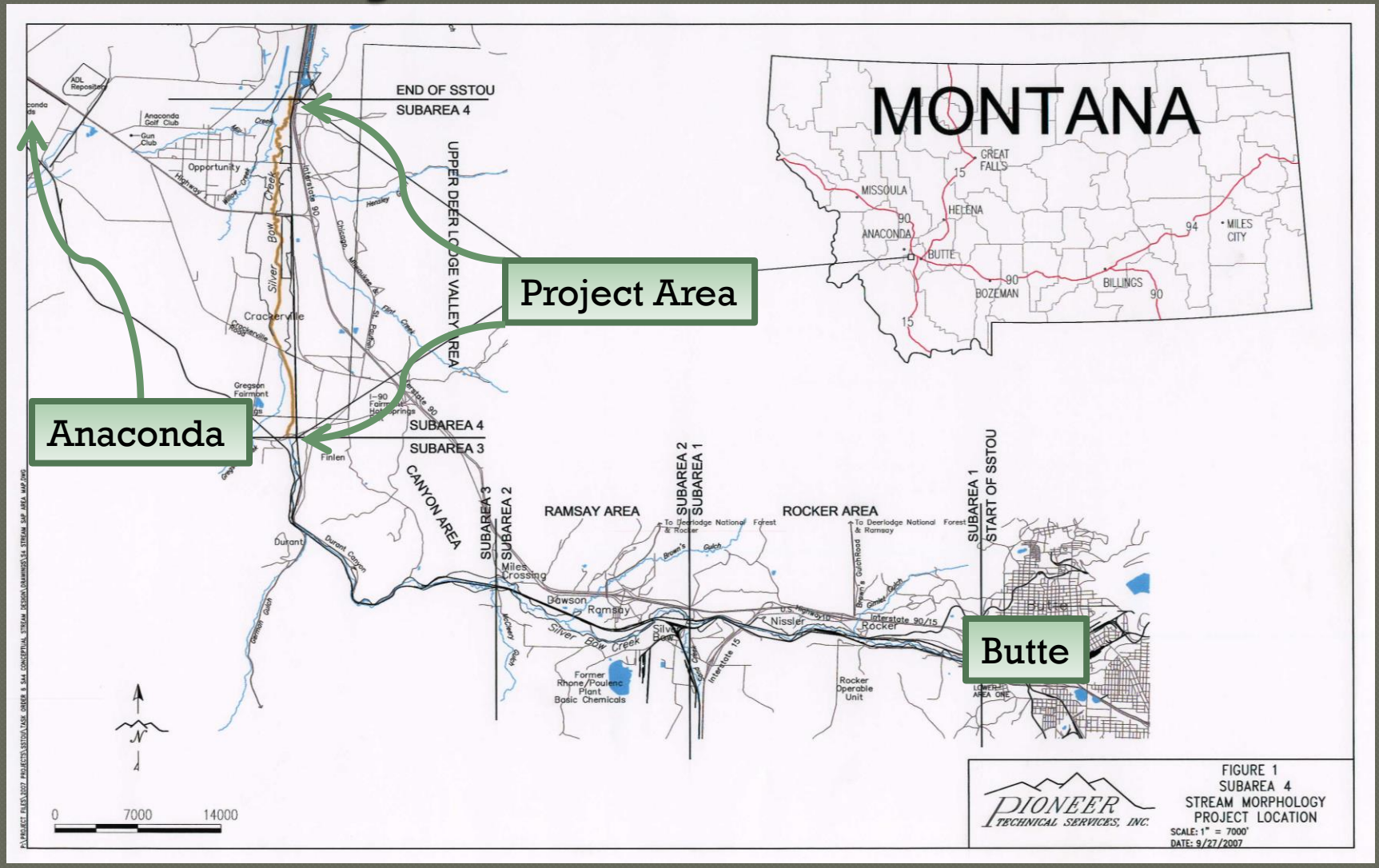
THANKS

- DEQ
- NRDP
- EPA
- Greenway Services District
- Pioneer Technical Services

WHATS IN STORE

- Brief Streamside Project Overview
- Summarize Key Criteria/Constraints
- Lessons Learned in Construction
- Lessons Taught by 2010 and 2011 Floods
- Design Changes
- Summary

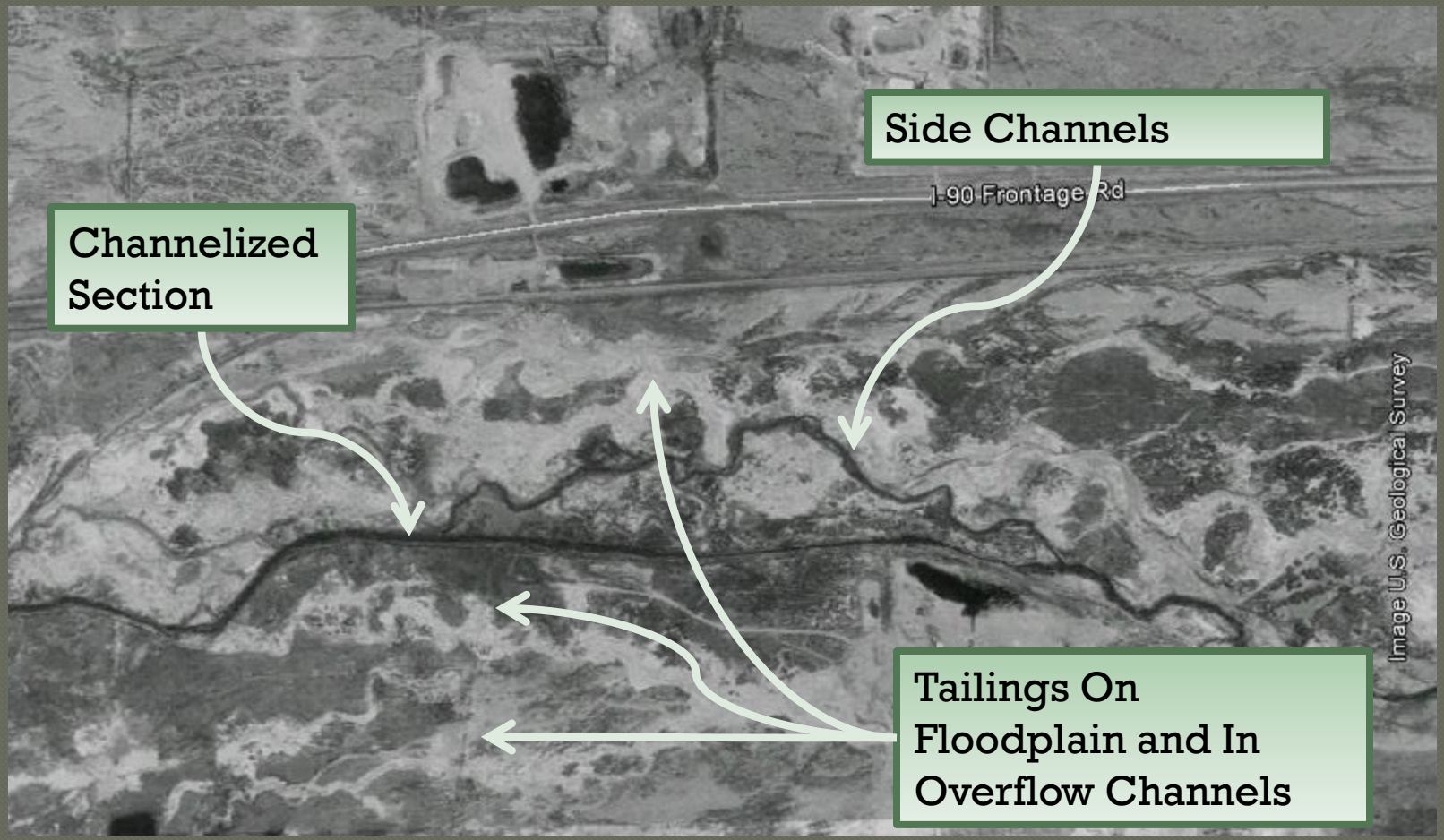
PROJECT OVERVIEW MAP



SA4 PROJECT OVERVIEW

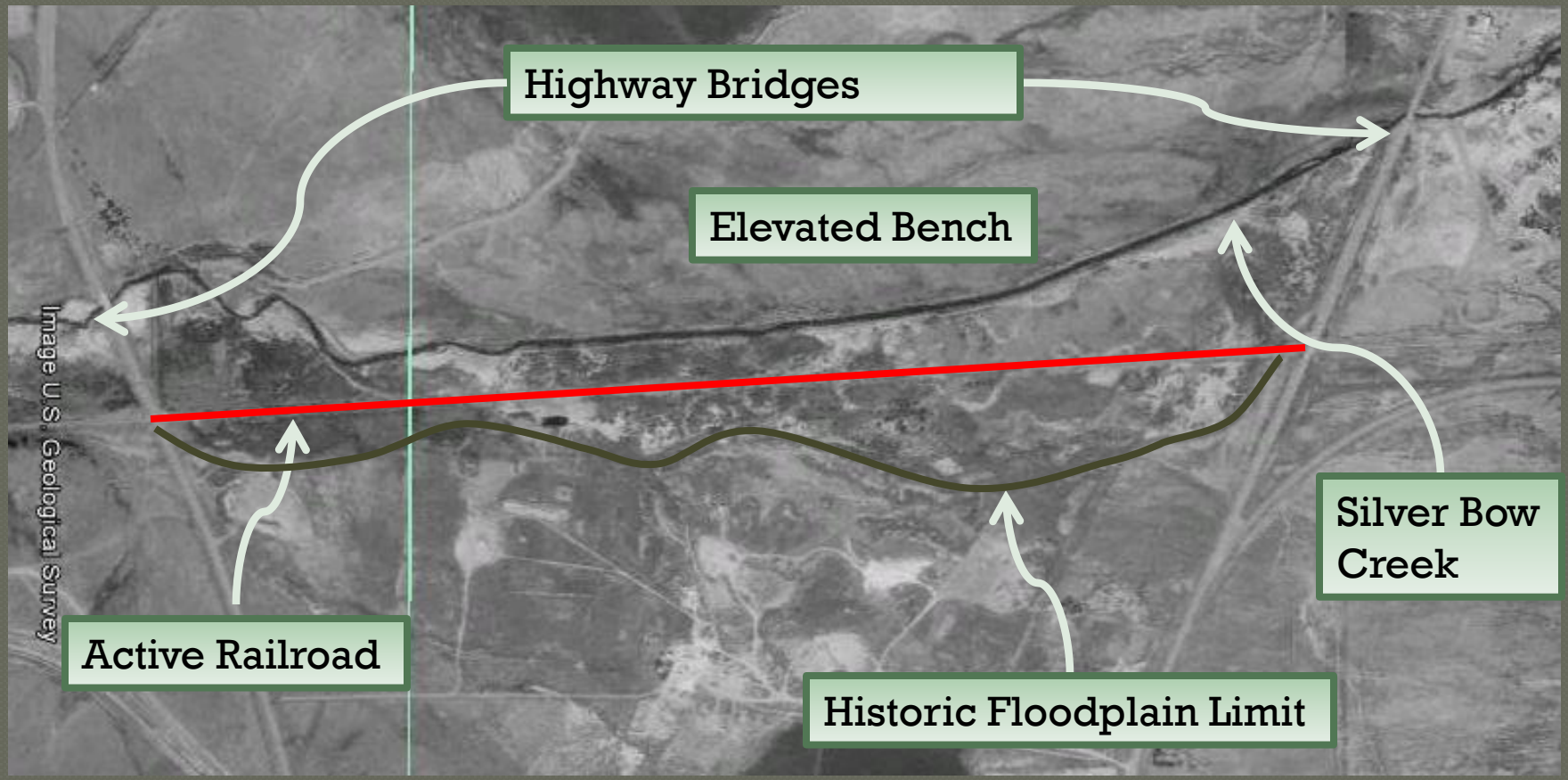
- Approximately 9 Miles of Stream
- Approximately 1.8MM CY Tailings
- Approximately 1300 Acres of Floodplain
- Long Channelized Reaches
- Few Owners – Mostly DEQ
- Numerous Existing Grade and Flood Controls
- Alluvial Fan/Depositional Area
- Ice Jams and Overflow Channels

HISTORICAL SATELLITE PHOTO



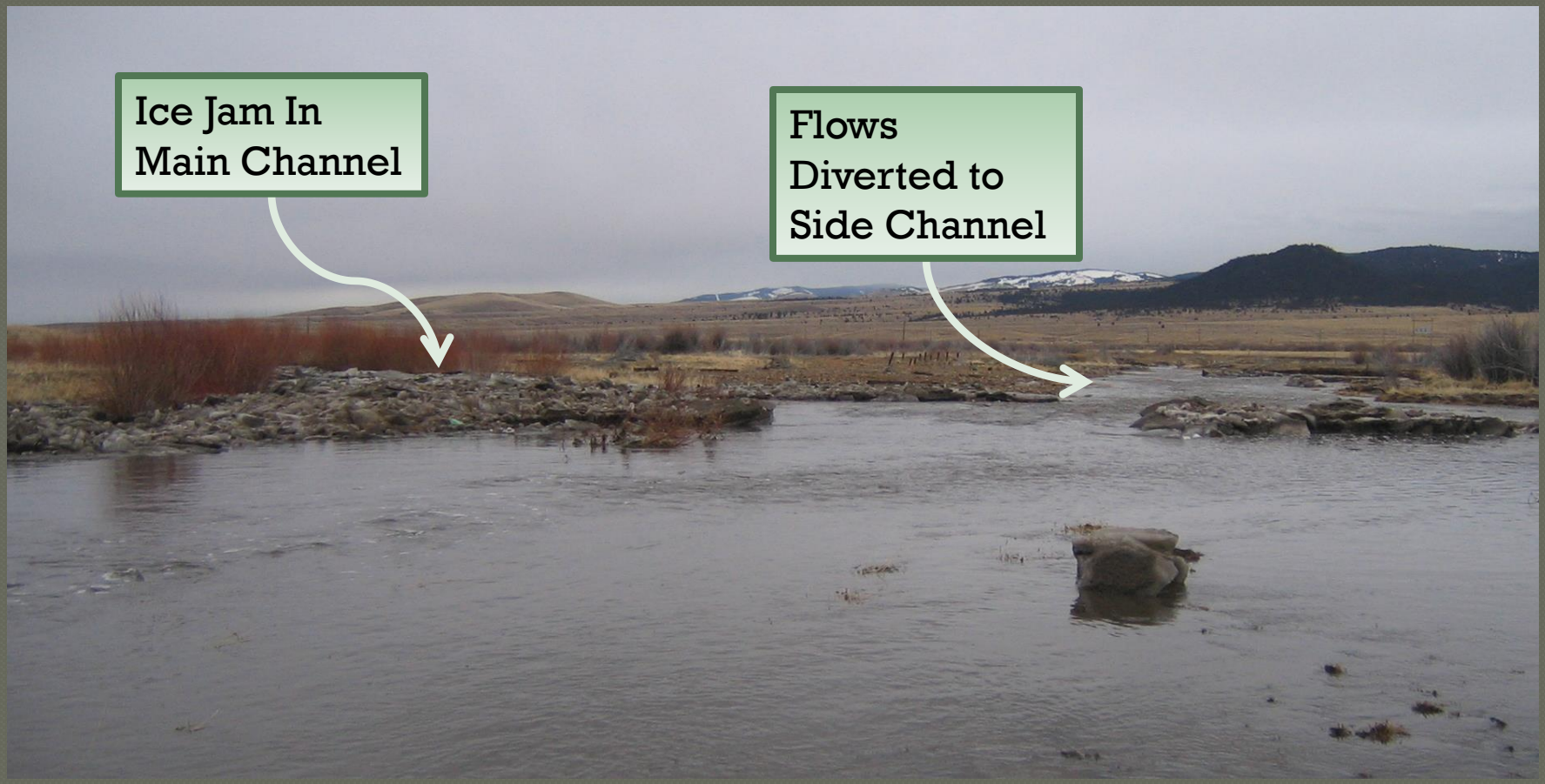
TAILINGS IN FLOODPLAIN

CONSTRAINTS AND CONTROLS

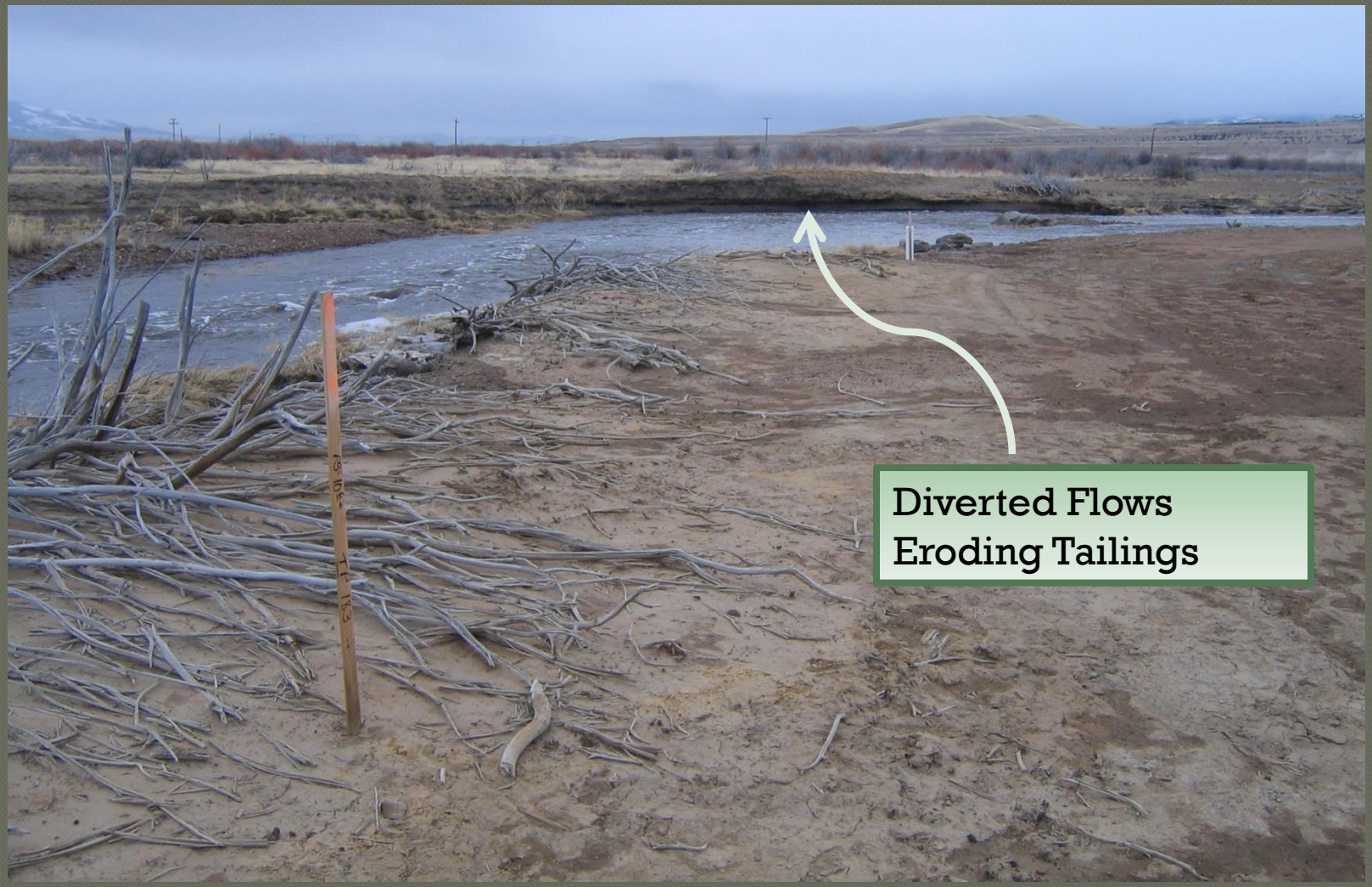


CHANNELIZED REACH

ICE JAMS



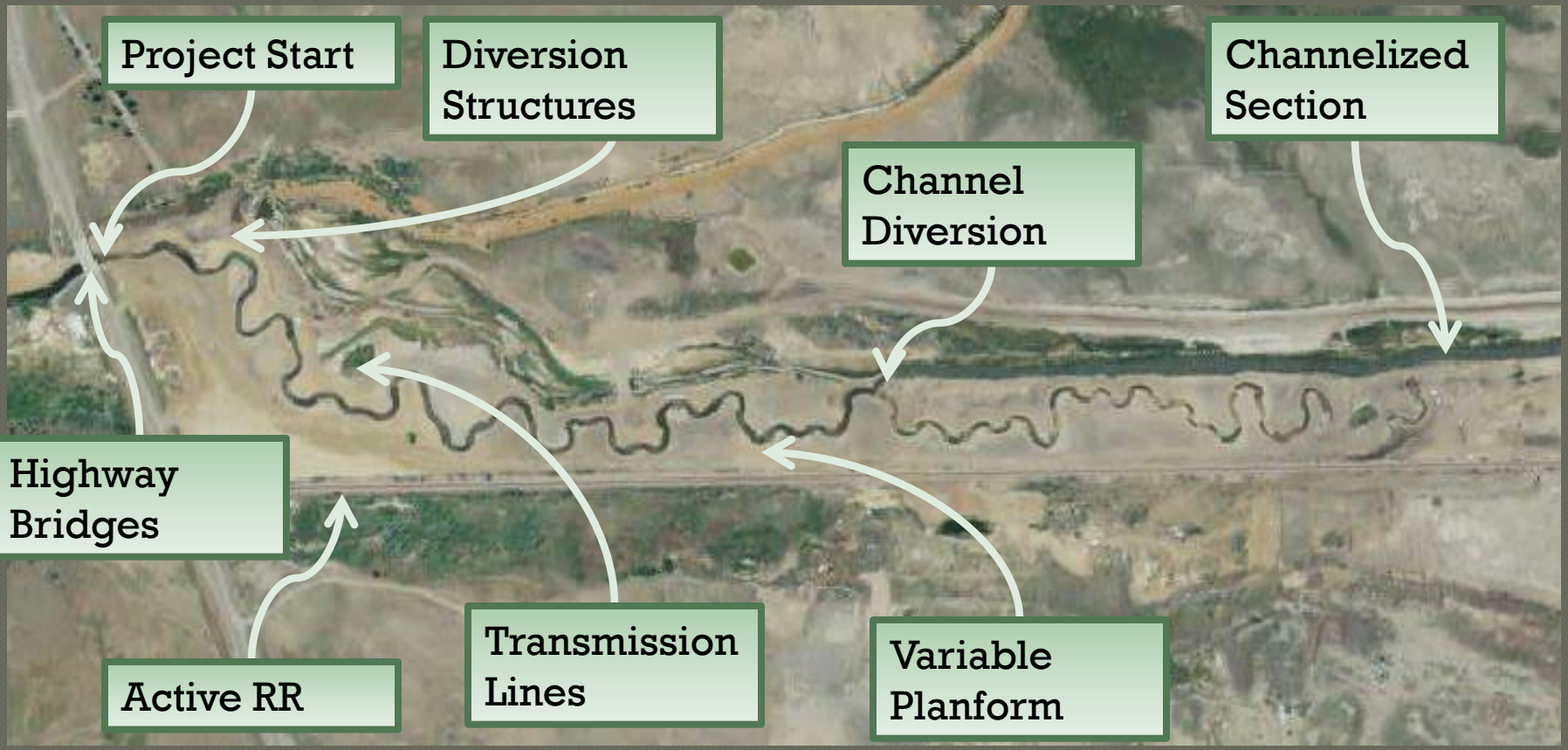
SIDE CHANNEL EROSION



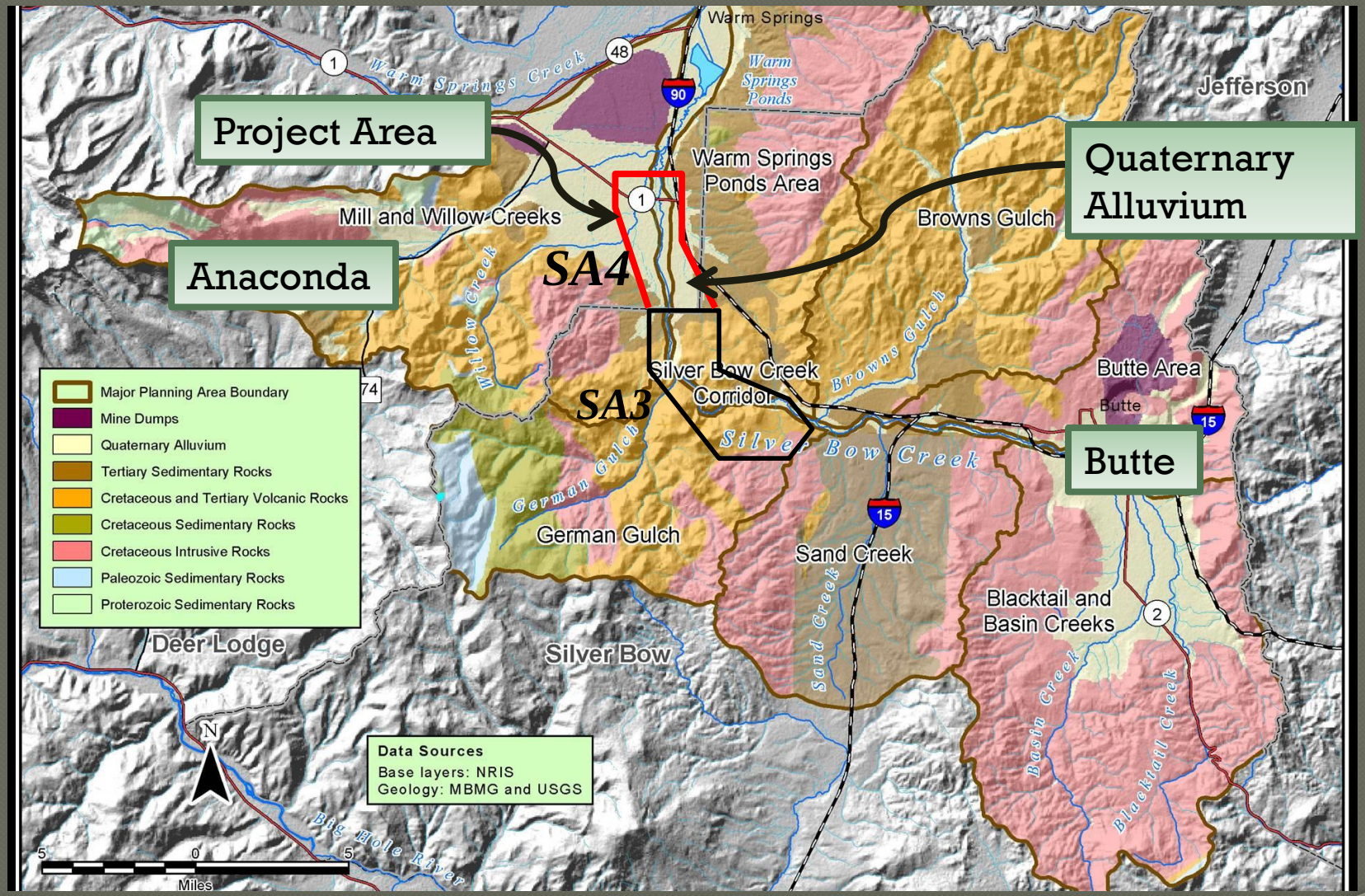
KEY DESIGN CRITERIA

- Coordinate Remedy/Restoration Actions
- Bankfull Flow – 210 CFS
- Floodplain Access/Flood-Prone Area
- Native Channel Substrate
- Sediment Transport Issues
- Infrastructure Protection/Constraints
- Variable Plan Form and Channel Width
- Minimal Existing Channel Crossings
- Flexible Floodplain Design
- Favorable Site Setting - Geology

KEY DESIGN CONSTRAINTS



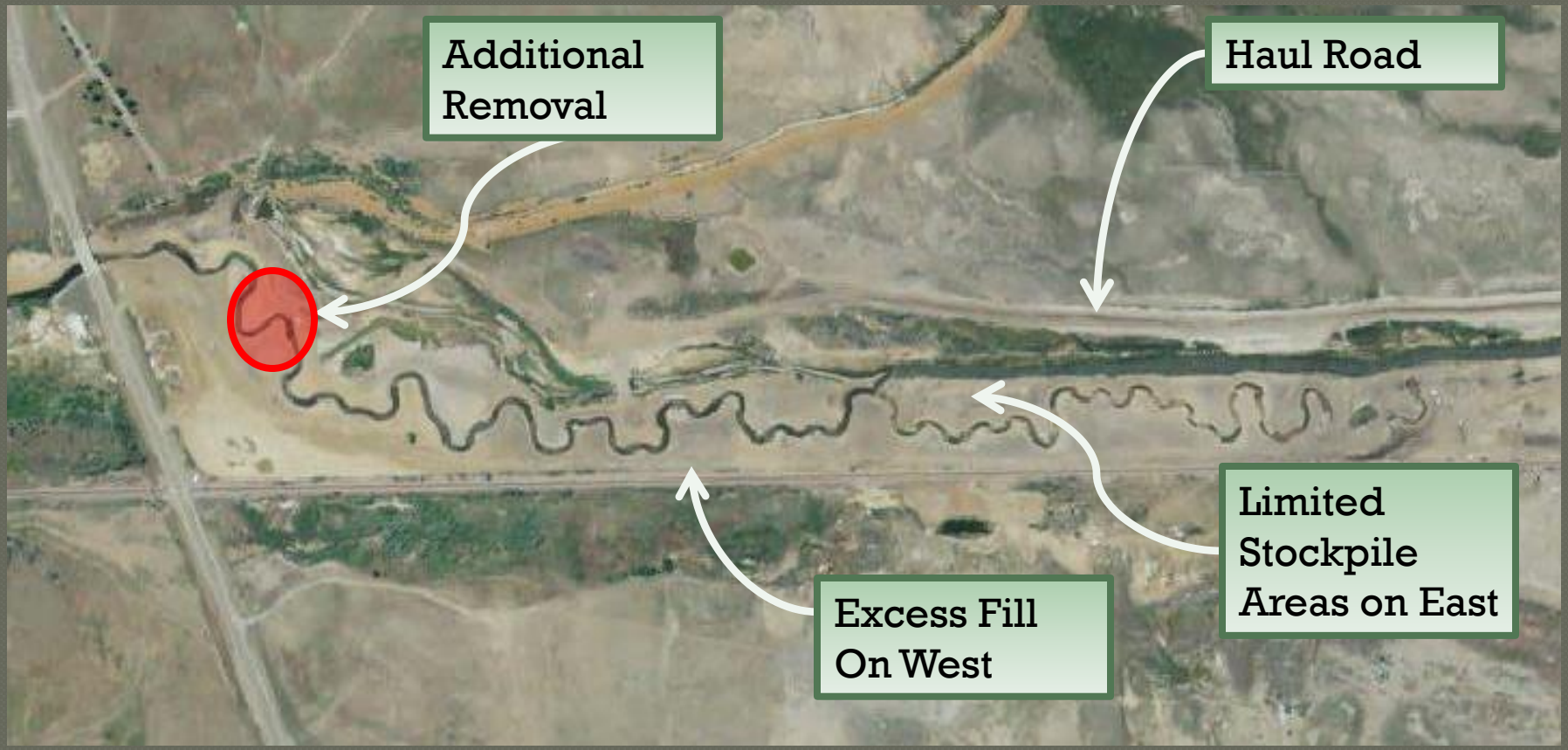
STREAMSIDE GEOLOGIC MAP



LESSONS LEARNED IN CONSTRUCTION

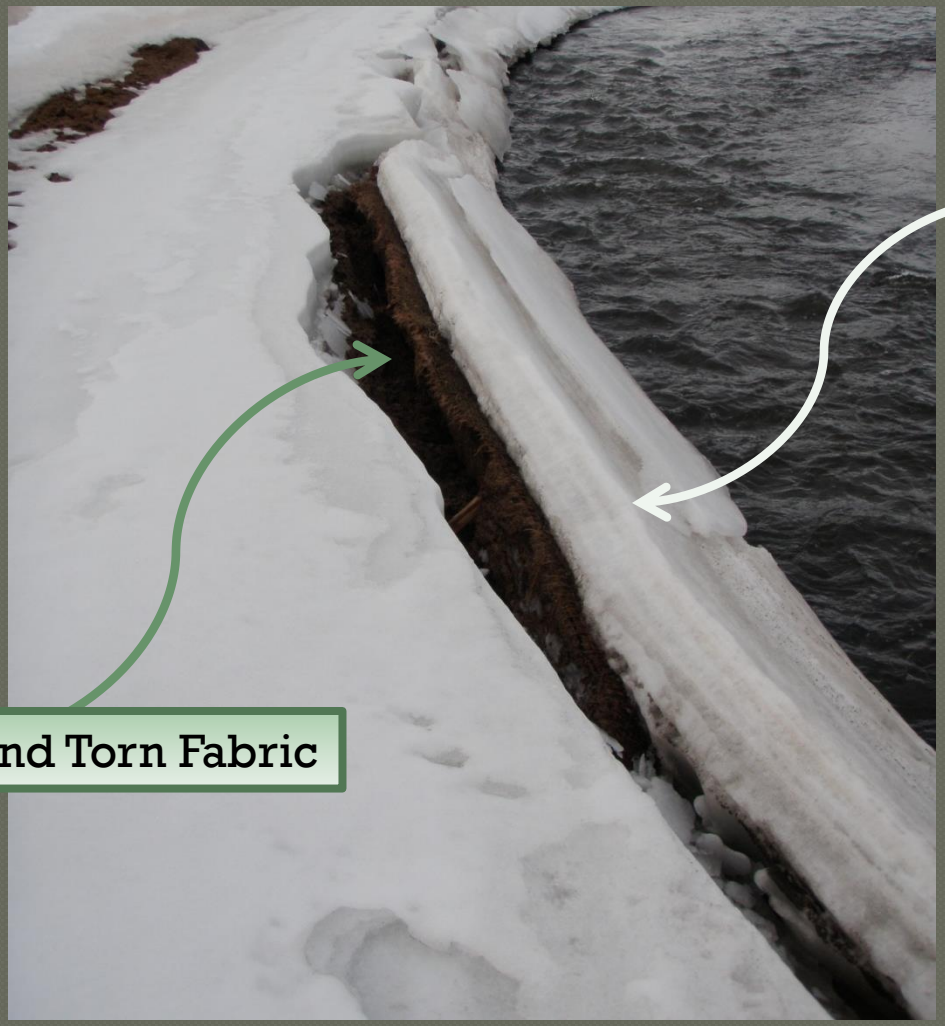
- Compaction of Fill In Channel Corridor
- Floodplain Grading and Fill Haul
- Point Bars/Bend Radii
- Tighter QA/QC
- Fabric Issues -
  - Reseeding
  - Ice Damage
- Channel Shelf

CONSTRUCTION ISSUES

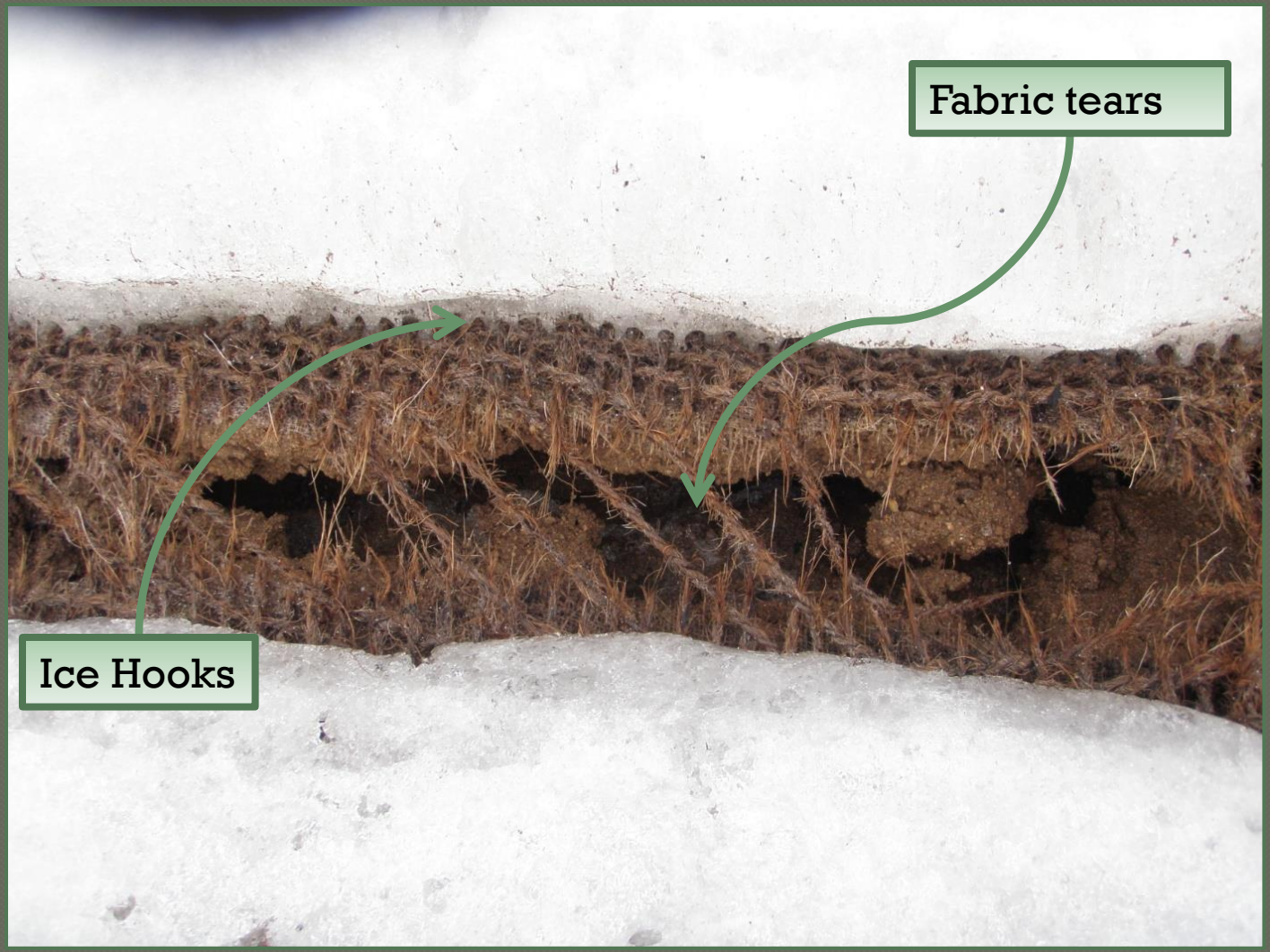


SPACE CONSTRAINTS

ICE DAMAGE



ICE DAMAGE

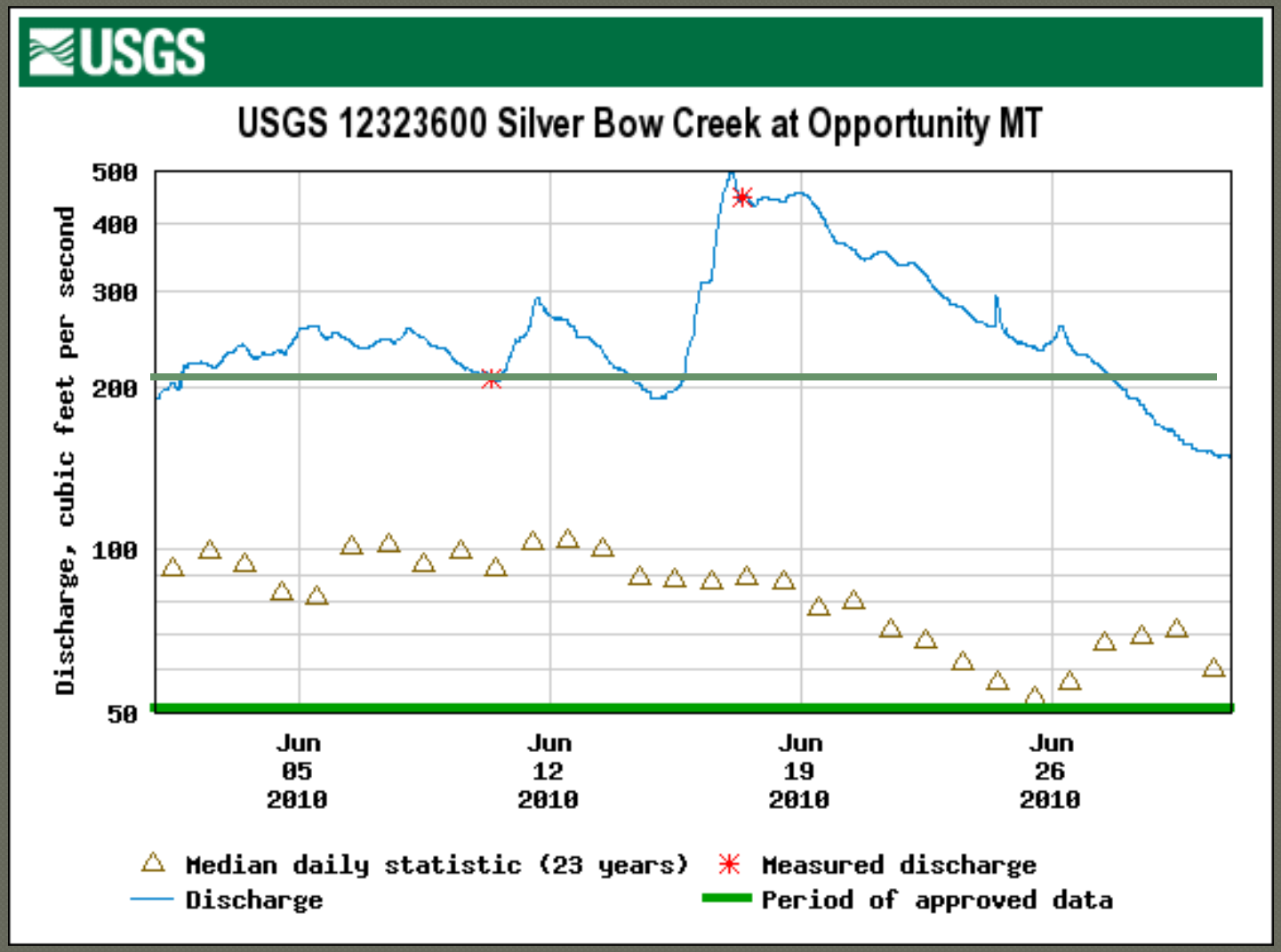


ICE DAMAGE

2010 AND 2011 FLOODS

- Summarize Flows Experienced
- Damage Areas and Repairs
- Aerial Photos
- Ground Photos
- Effects on the Bankfull Flow Estimates

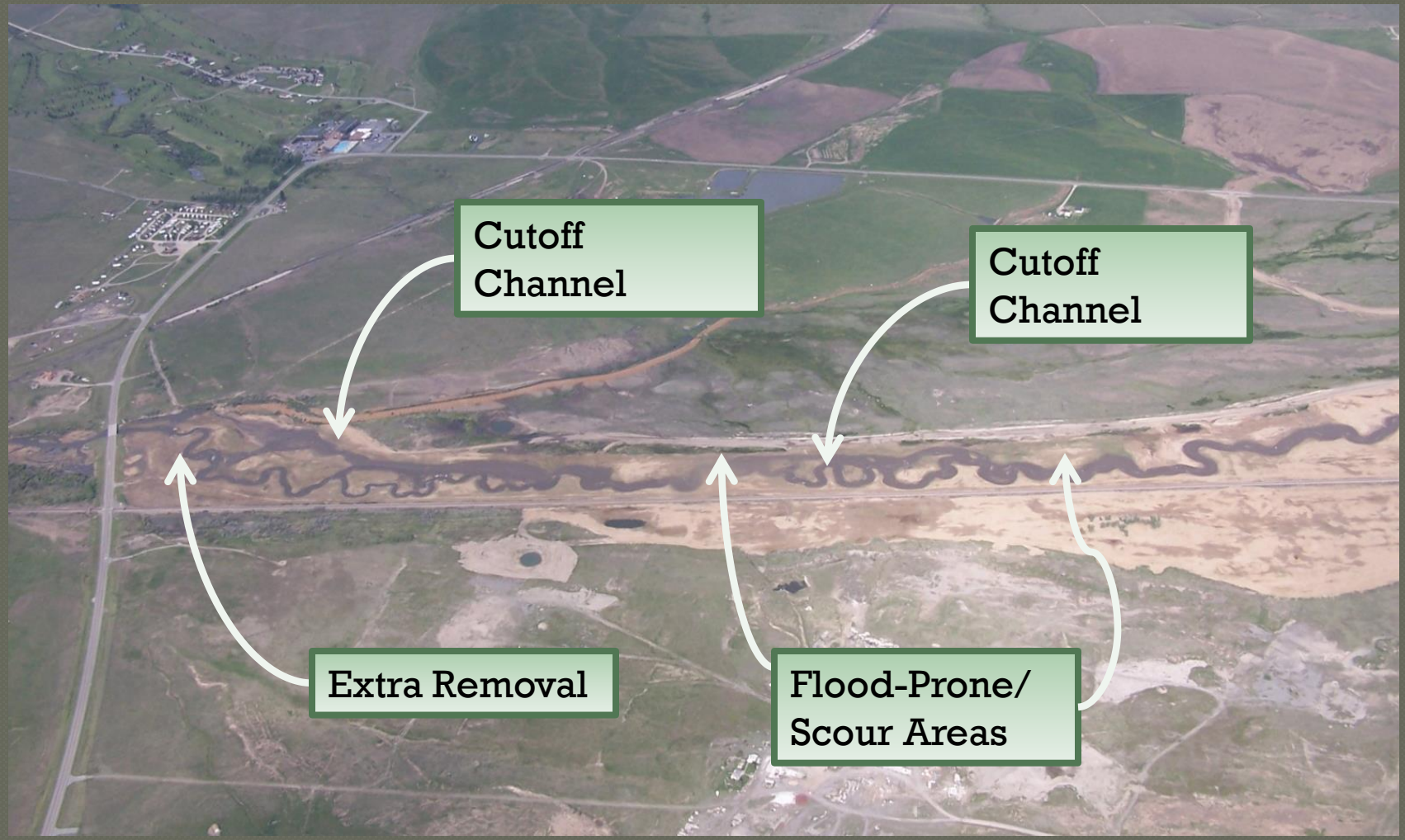
2010 FLOOD FLOWS



2010 FLOOD PHOTO

SA4 CHANNEL AT BANKFULL

AERIAL FLOOD PHOTO



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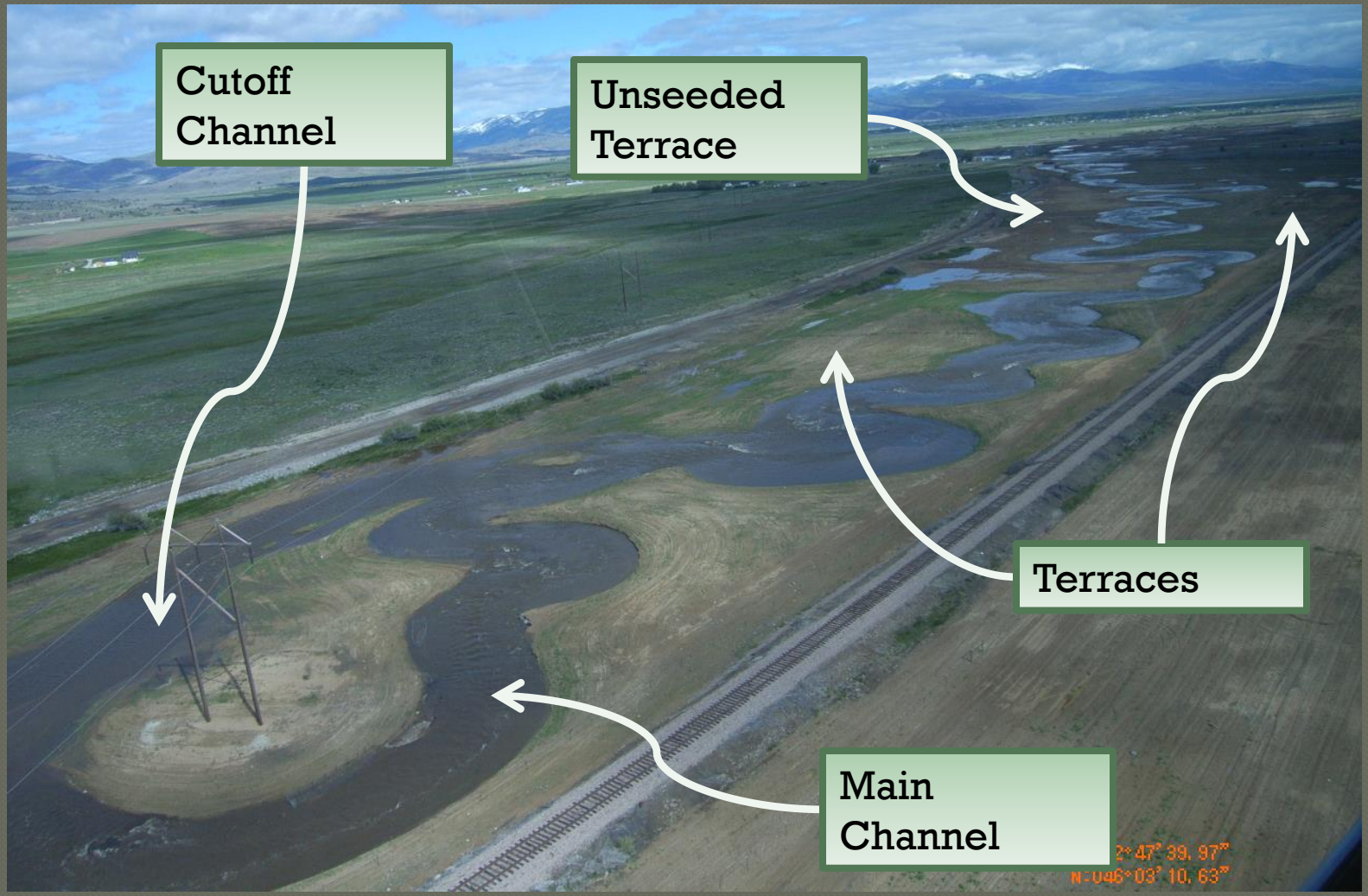
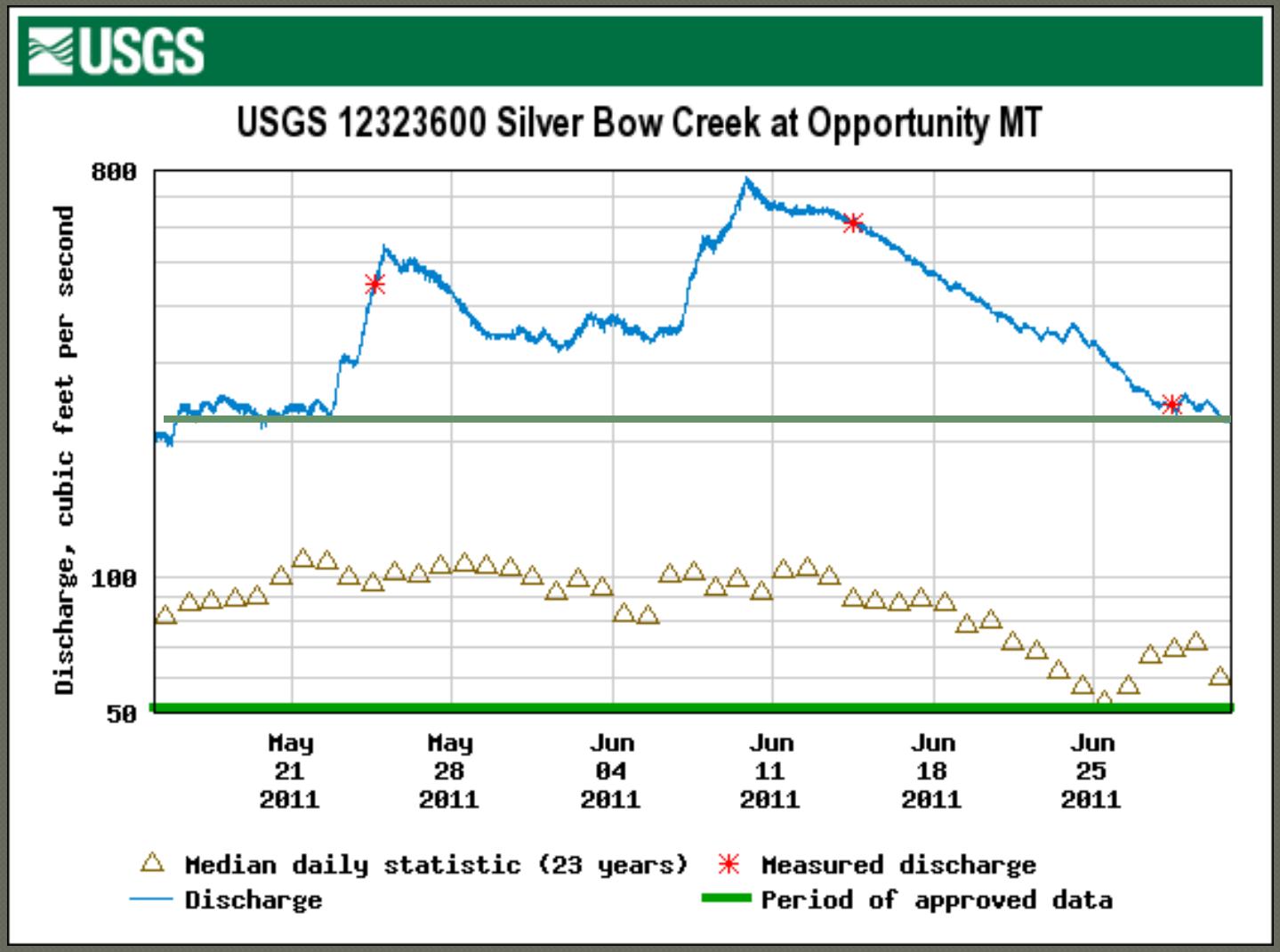
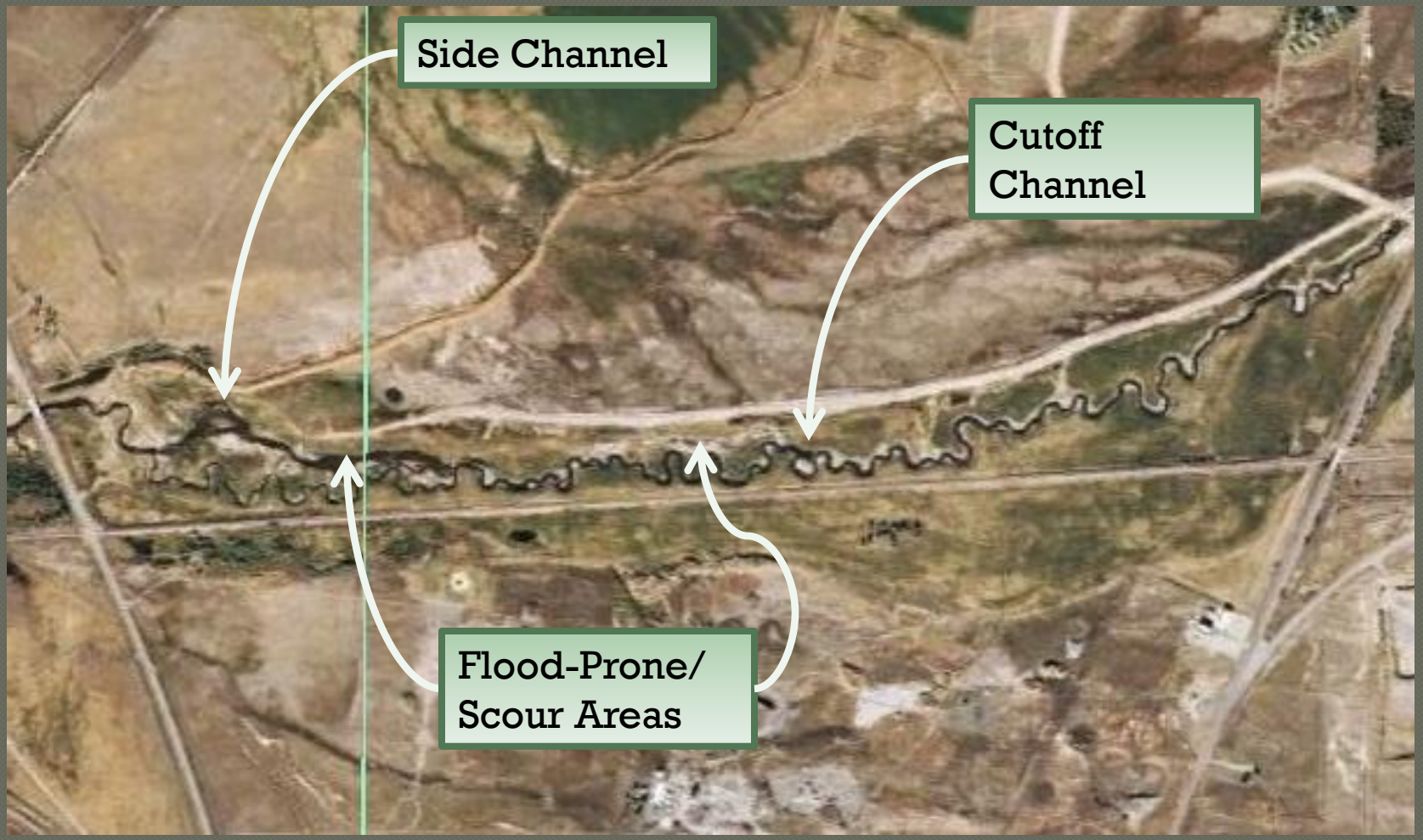


2011 FLOOD FLOWS



2011 FLOOD PHOTO

POST FLOOD PHOTO



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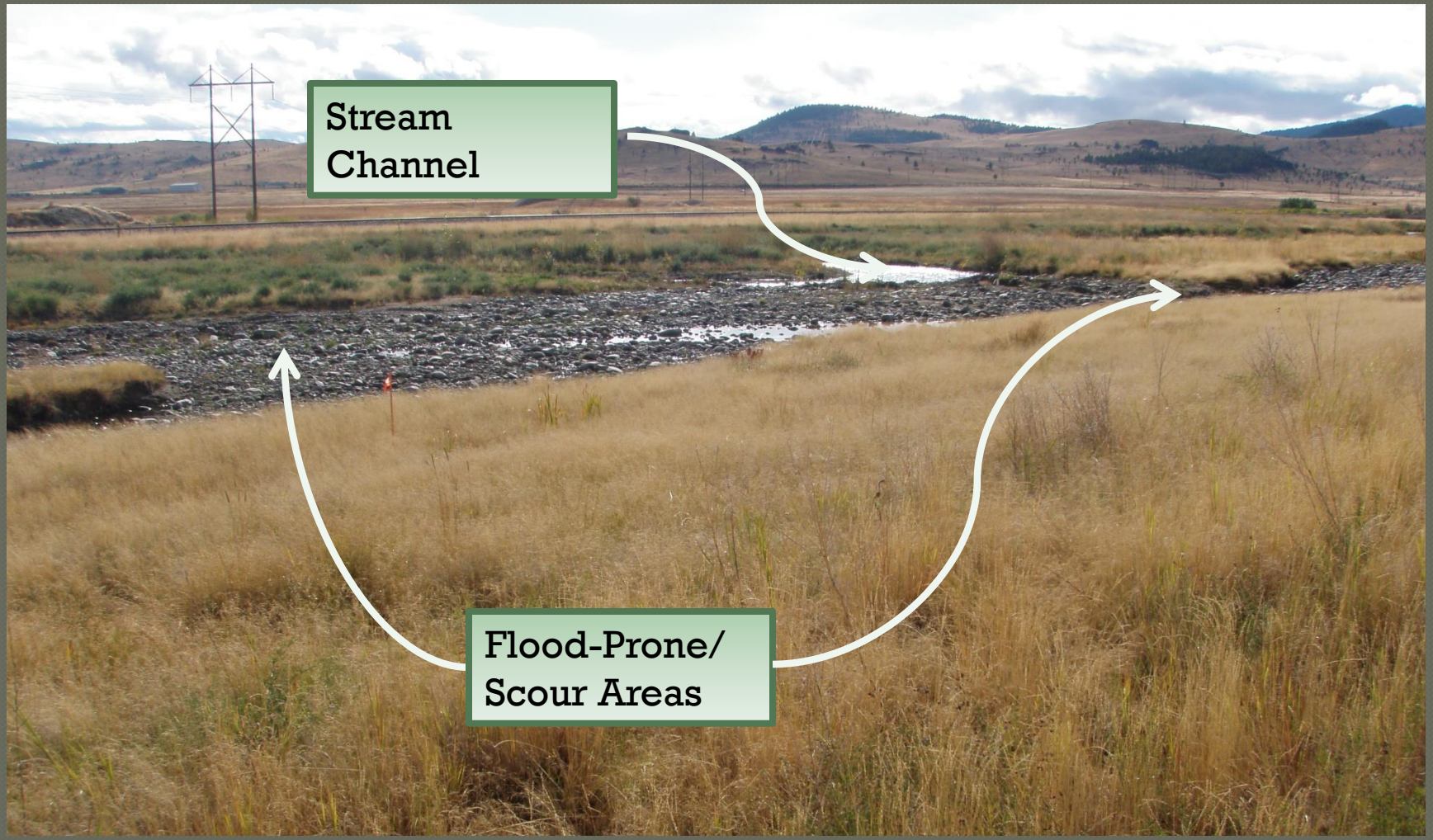

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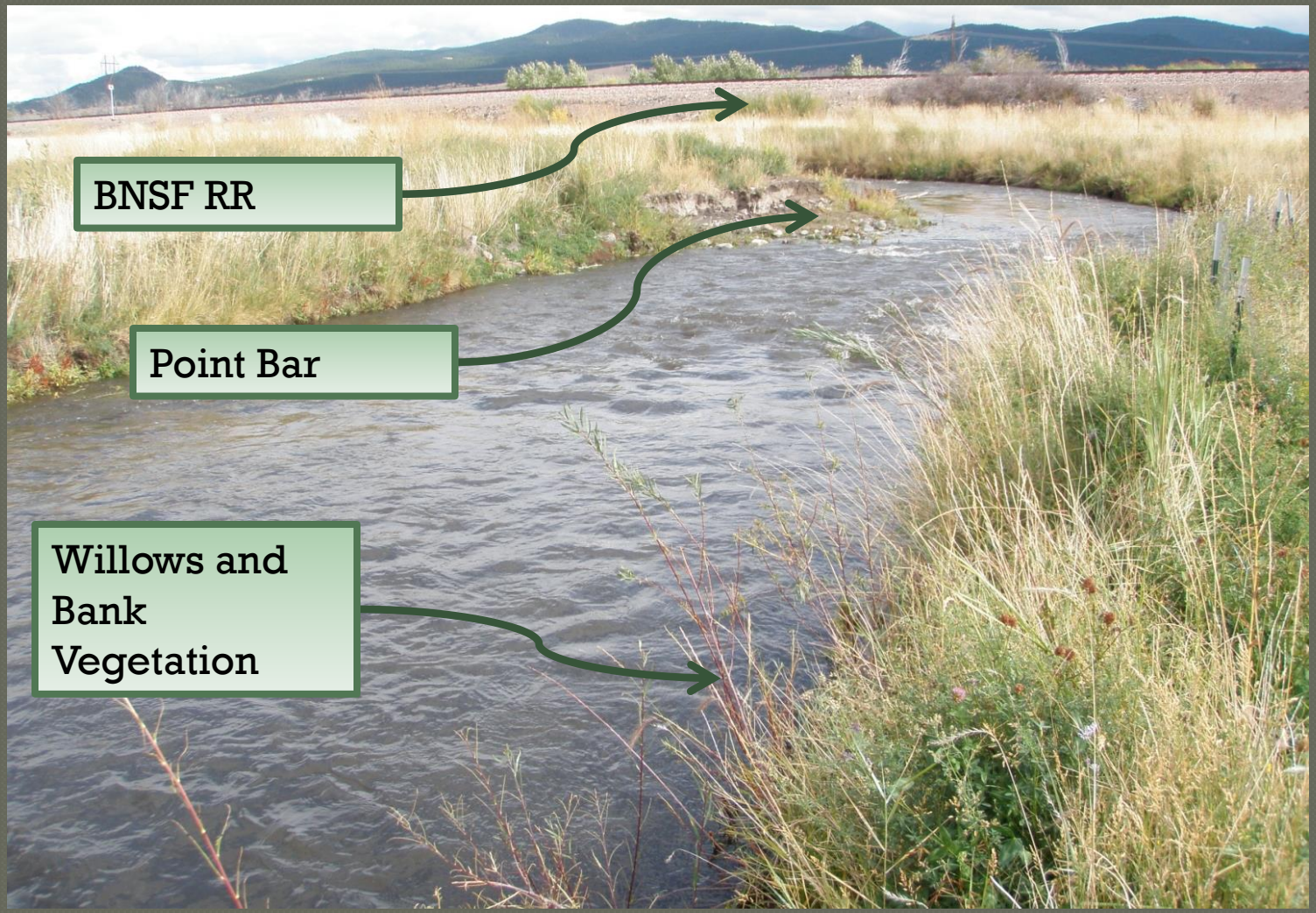


POST FLOOD PHOTO

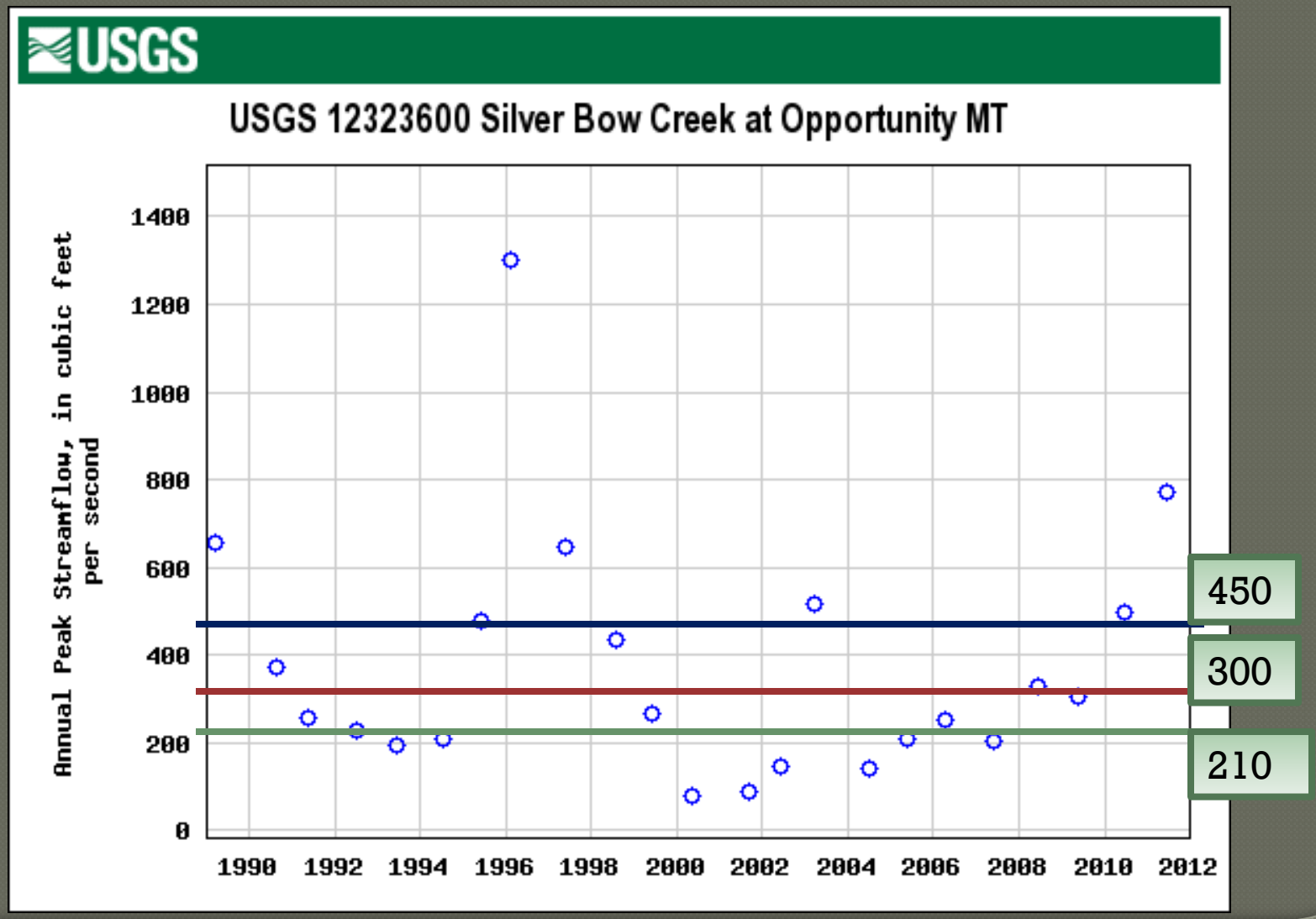
DAYS OF BANKFULL FLOW

Years of Record	23
Normal Range of Bankfull Days/Year	7-14
Bankfull Days Before 2010	115
Bankfull Days/Year Before 2010	5.5
Bankfull Days in 2010	24
Bankfull Days in 2011	47
Bankfull Days After 2011	186
Bankfull Days/Year After 2010	6.3
Bankfull Days/Year After 2011	8.1

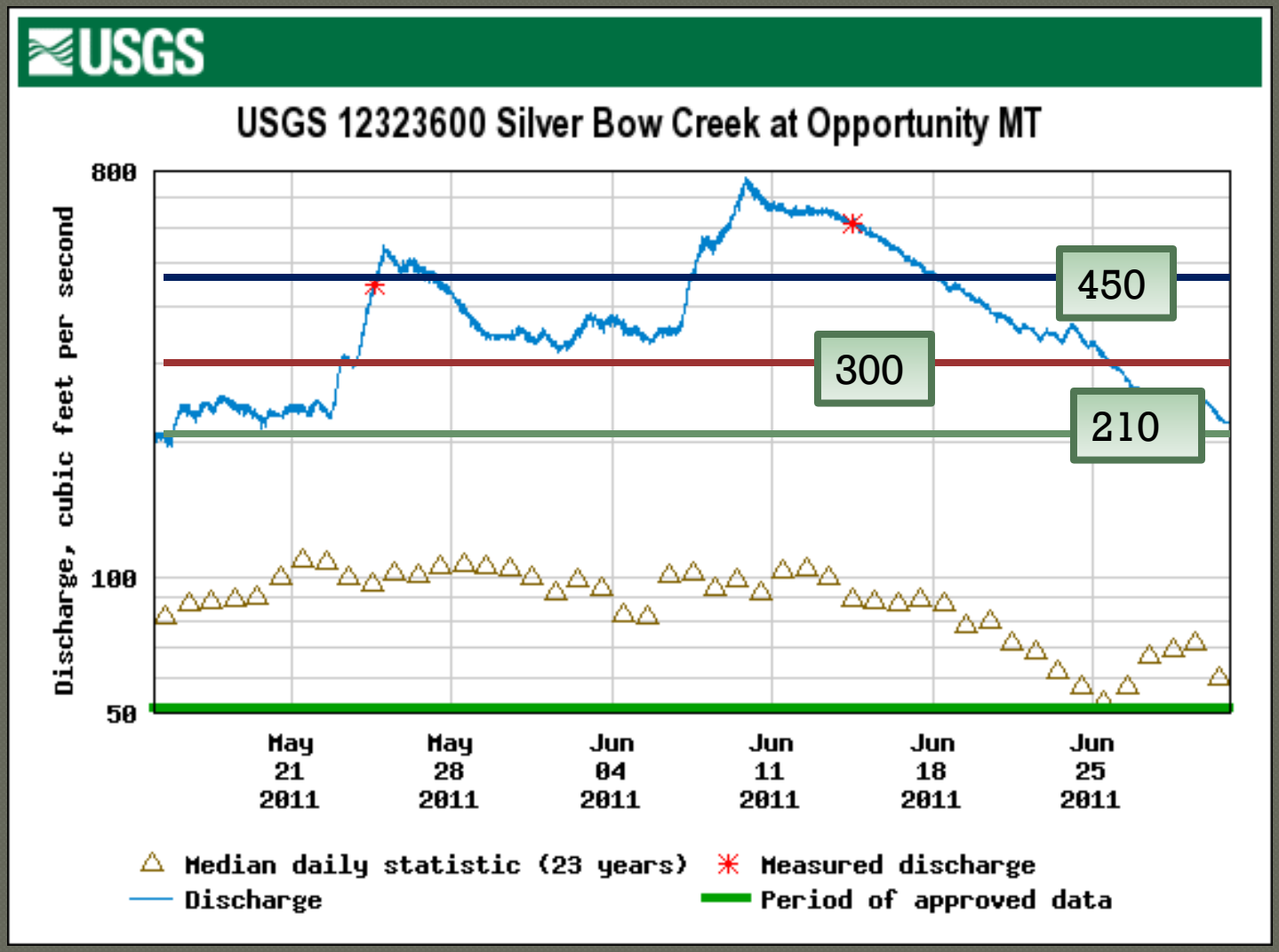
KEY CHANGES

- Larger Channel
- Coir Fabric/Coir Rolls
- Shallower Bank Slopes
- Floodplain Swales or Side Channels
- QA/QC
- Compaction in Fill Areas
- Minimum Channel Dimensions

REVISED CHANNEL CAPACITY



2011 FLOOD FLOWS



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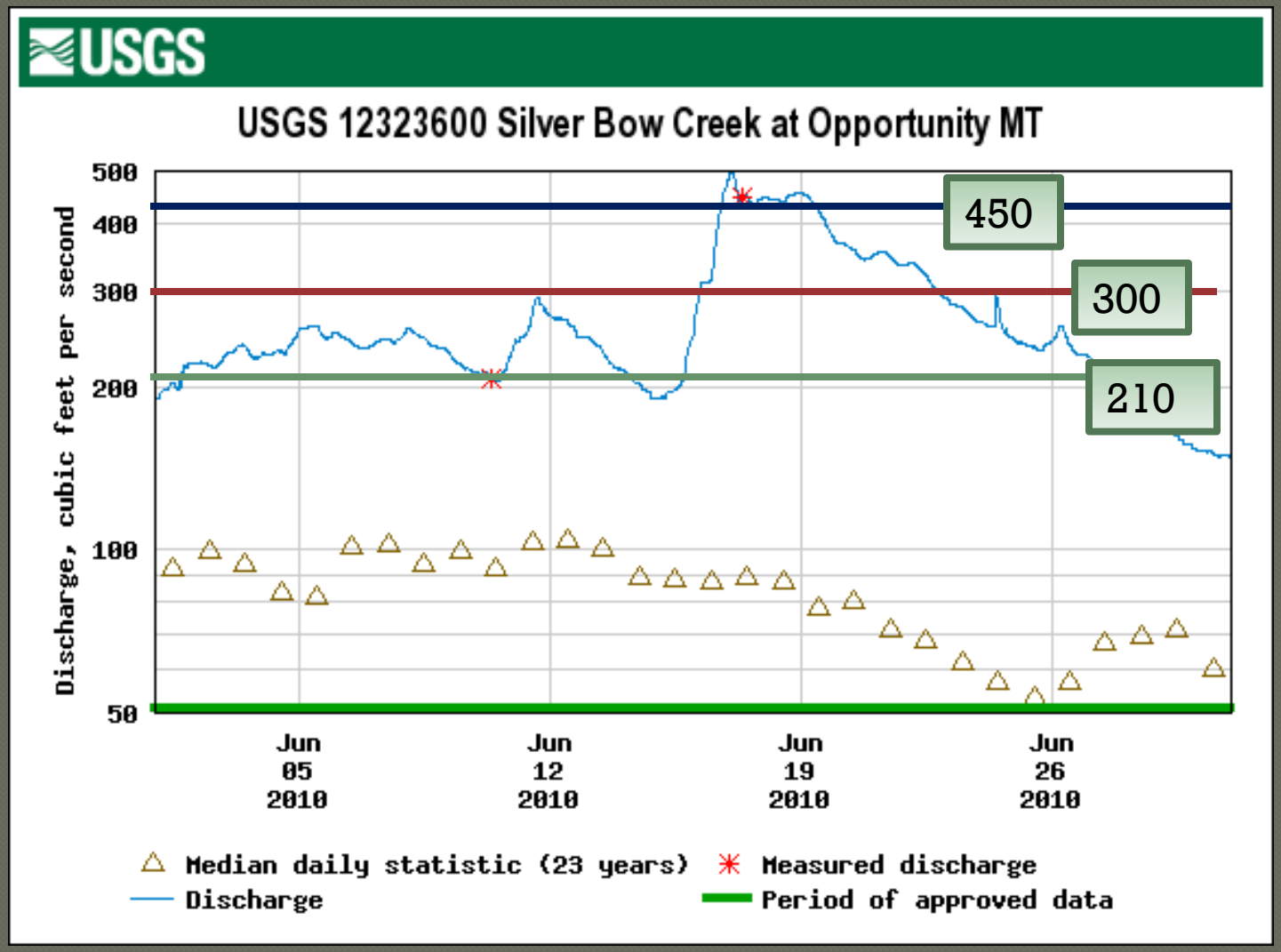
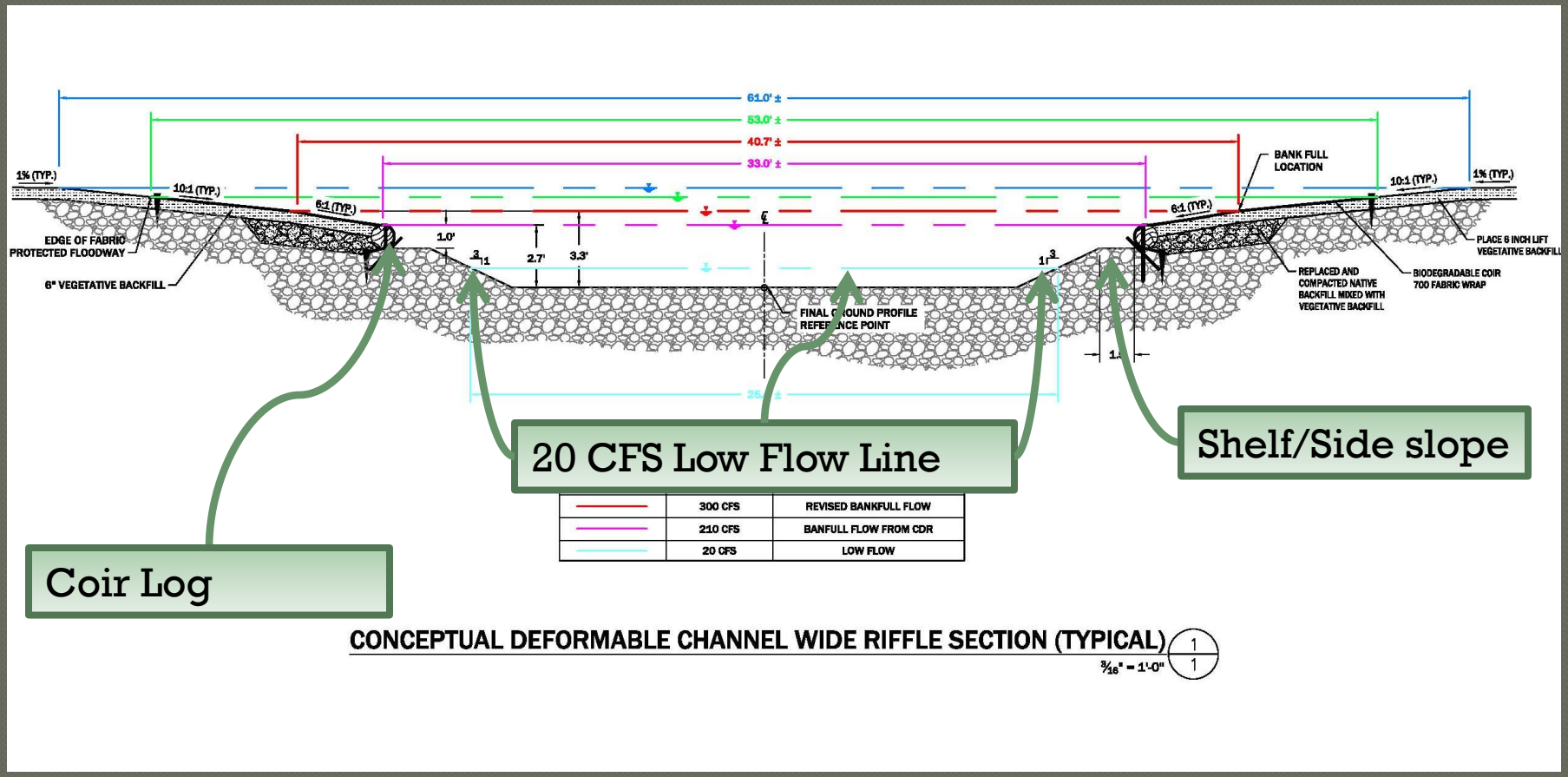


REVISED CHANNEL



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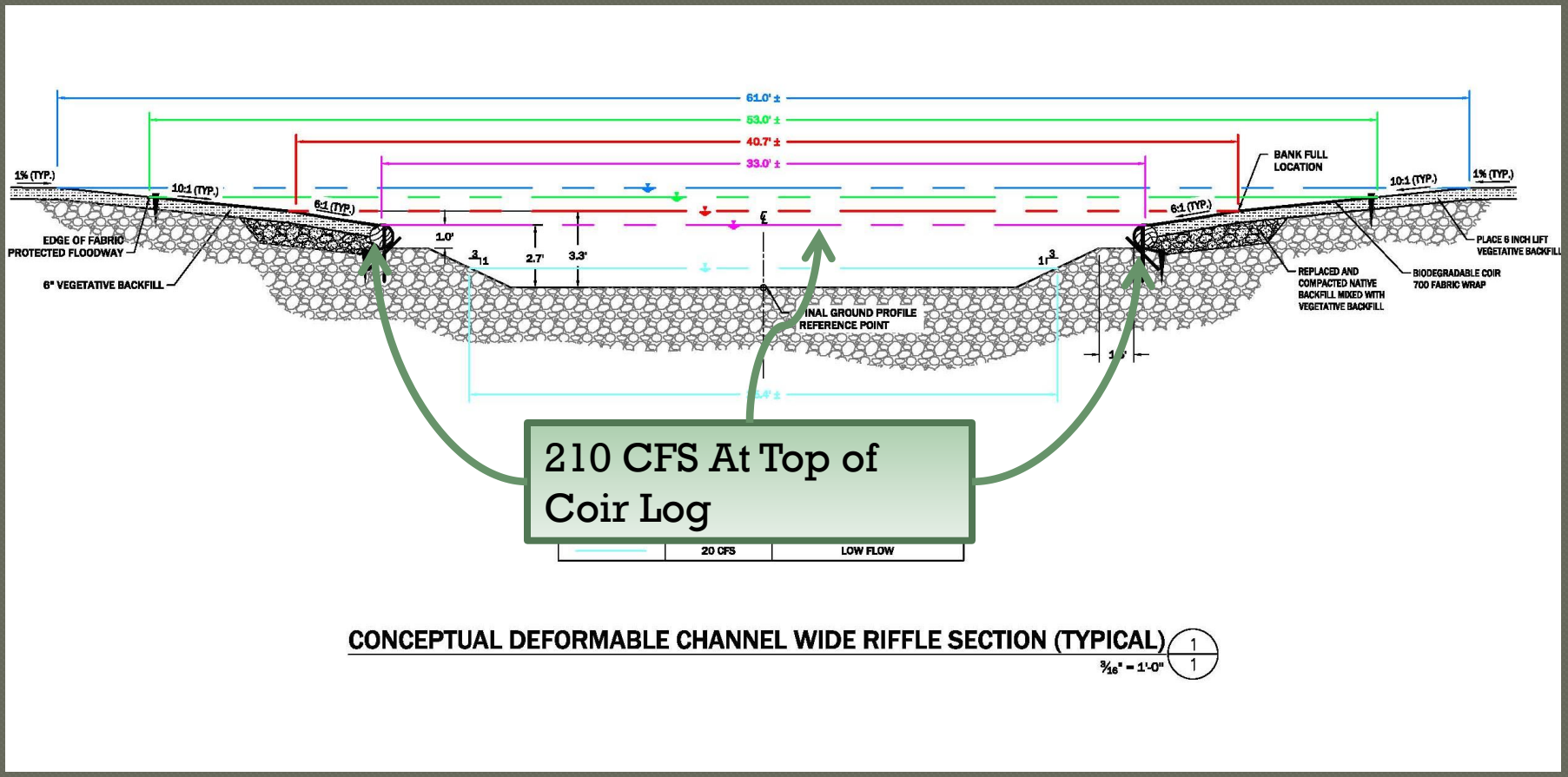
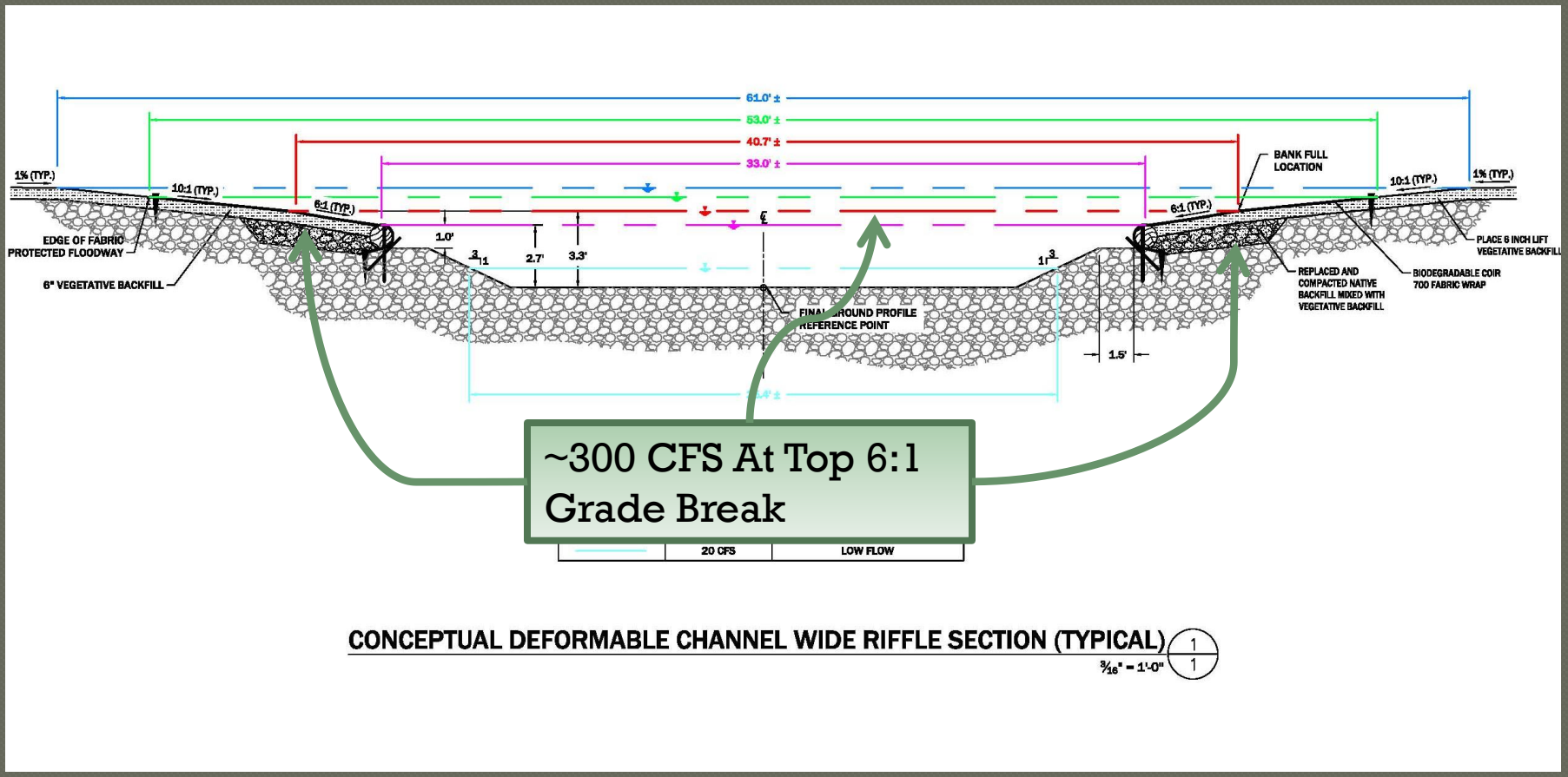


CONCEPTUAL DEFORMABLE CHANNEL WIDE RIFFLE SECTION (TYPICAL) 1/1

3/16" = 1'-0"

REVISED CHANNEL



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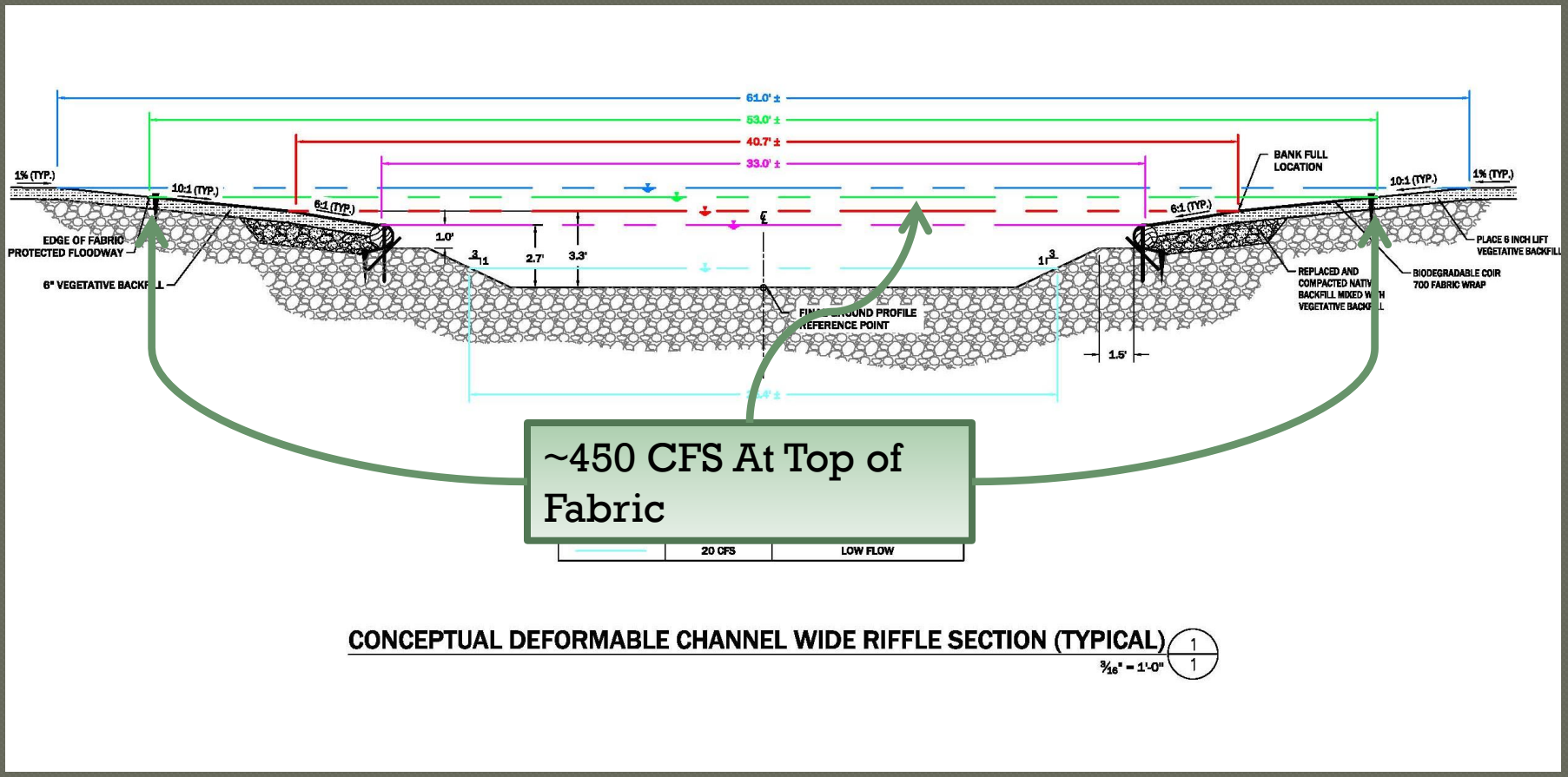

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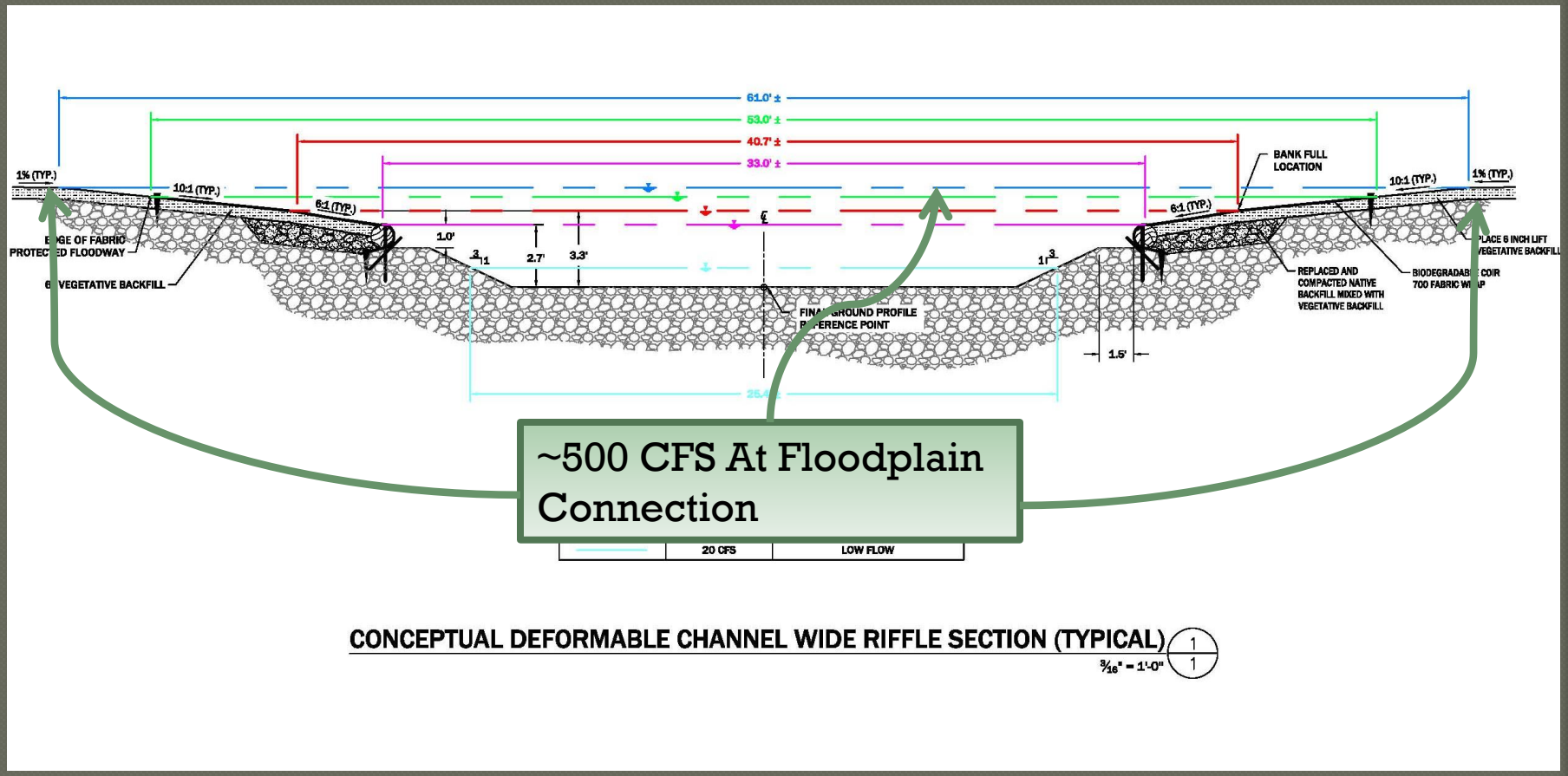

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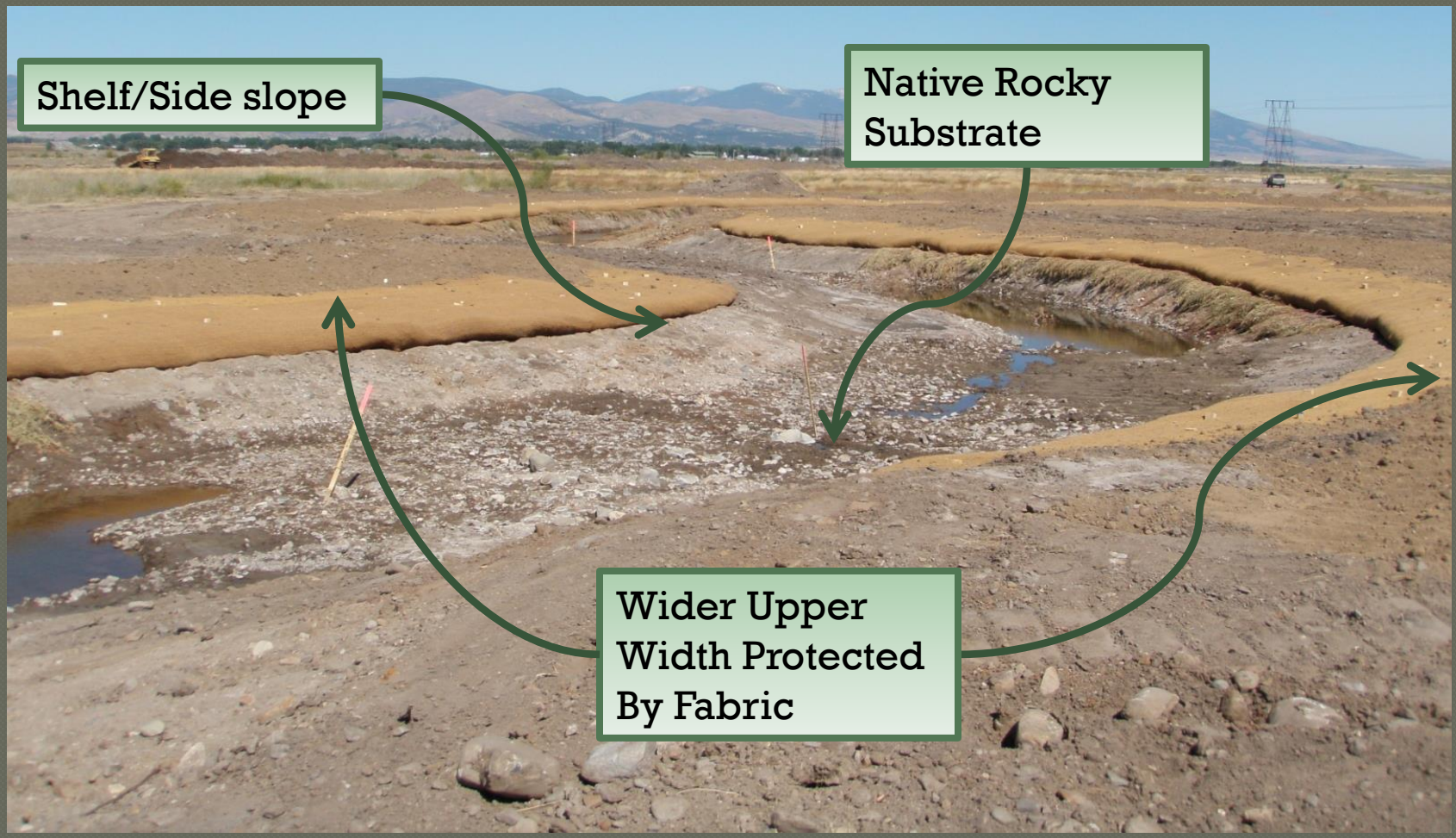

SUMMARY

- Larger Channel Capacity
- Enhanced Initial Stability
- Still Have Some Risk
- Side Channels/Terraces
- QA/QC Is Key
- Ice Jams Remain A Wildcard
- Expect and Budget for Some O&M/Repair

QUESTIONS?

THANKS!