The Hungry Canyons Alliance: Stream Stabilization in Western Iowa

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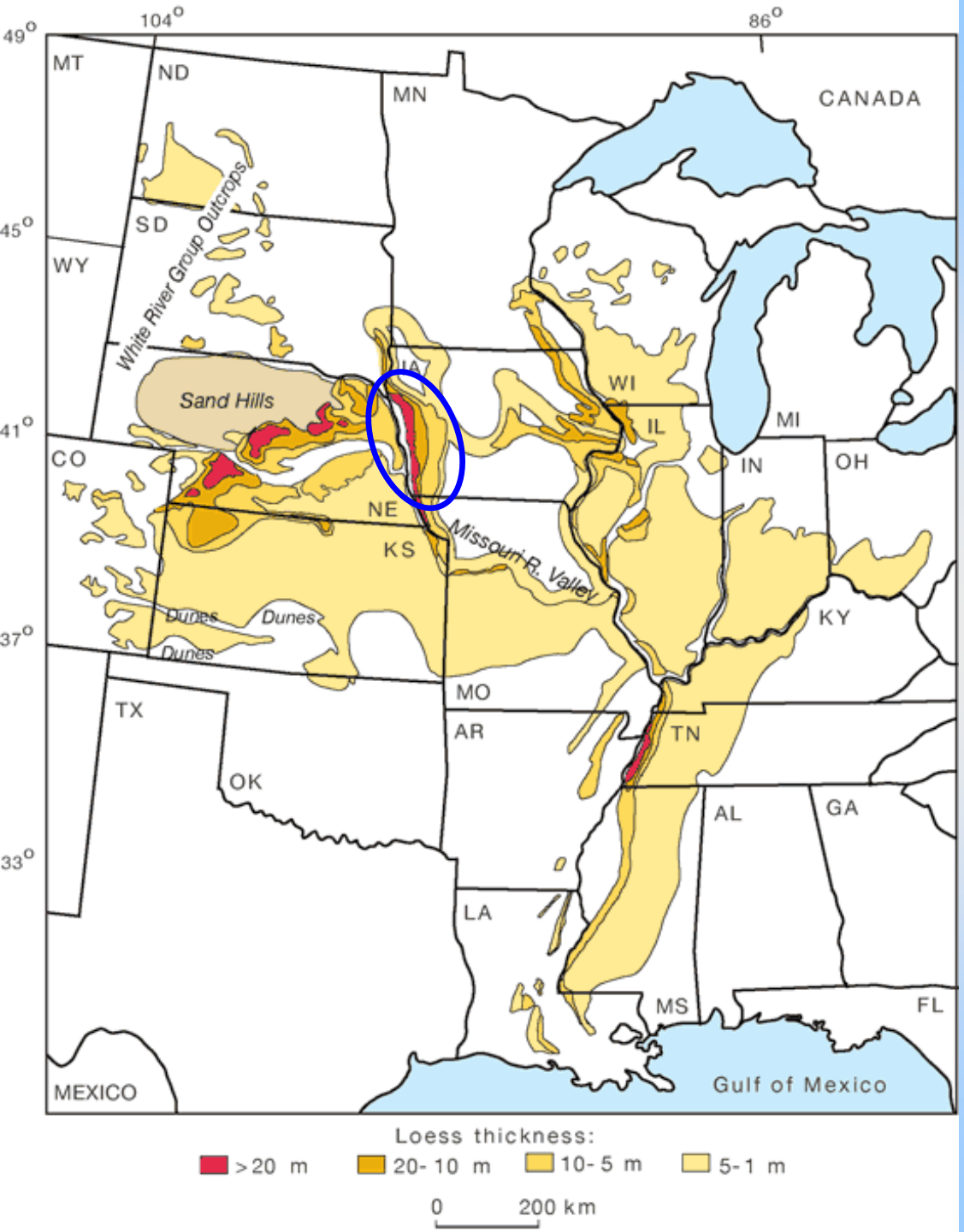
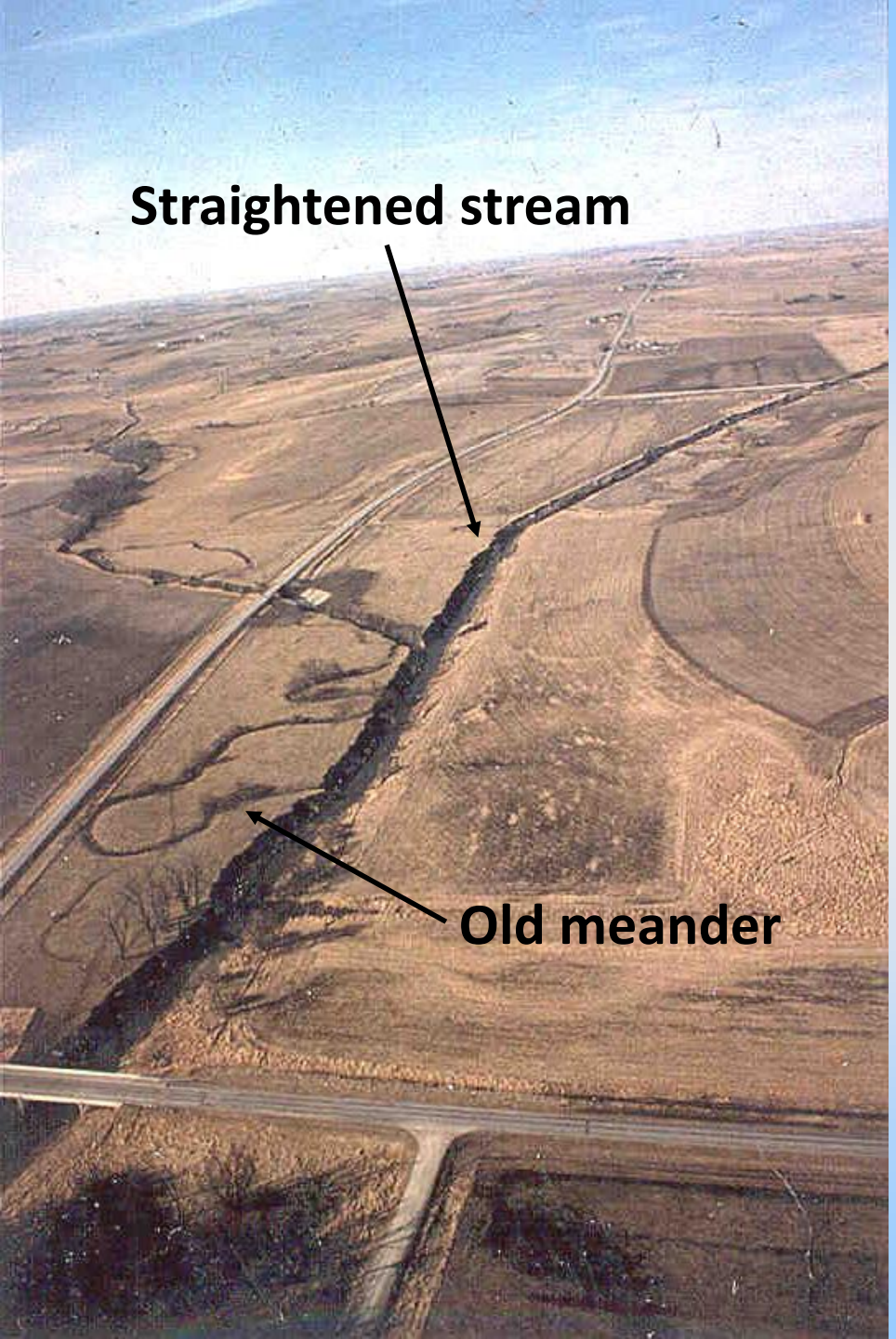


- First, why we have a unique situation in W IA
- Loess is a wind blown silt deposit often formed near large rivers.
- Loess is a highly erodible streambed material
- Thicker loess deposits = ↑ potential erosion
- Mississippi and Missouri River Valley loess deposits reach great enough depth (> 5 m) to allow widespread stream channel downcutting and erosion

Excavating a large ditch using steam power, circa 1910.



Stream straightening and land use changes

=

Higher water velocities

+

Highly erodible loess soils

=

Increased channel erosion

Channel downcutting

Higher sediment loads

=

Altered flow regimes

Lost fish habitat

No pool-riffle sequences

Lost lateral connectivity w/ floodplain

Decreased biodiversity

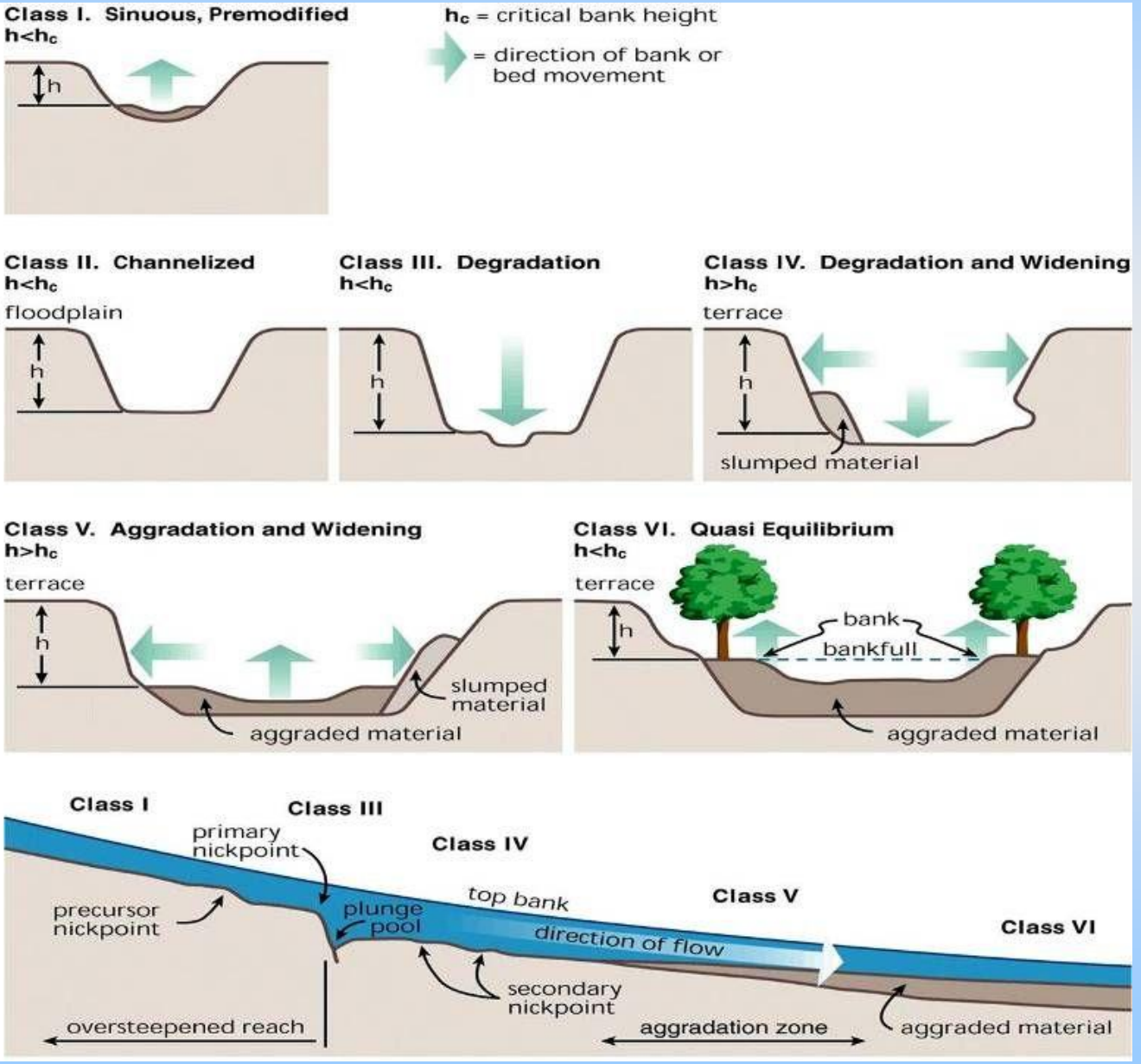
Streambed Degradation - Knickpoints

Streambed Degradation – Knickpoints, Bank Failure, and Stream Widening

Gully Growth Rates

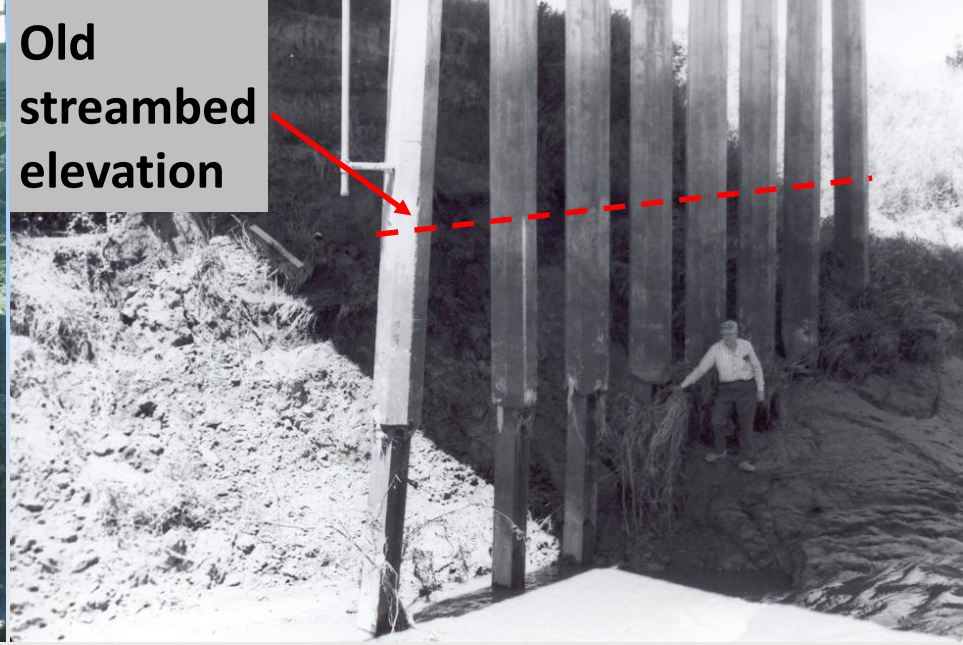
Channel Evolution Model

Simon Channel Evolution Model



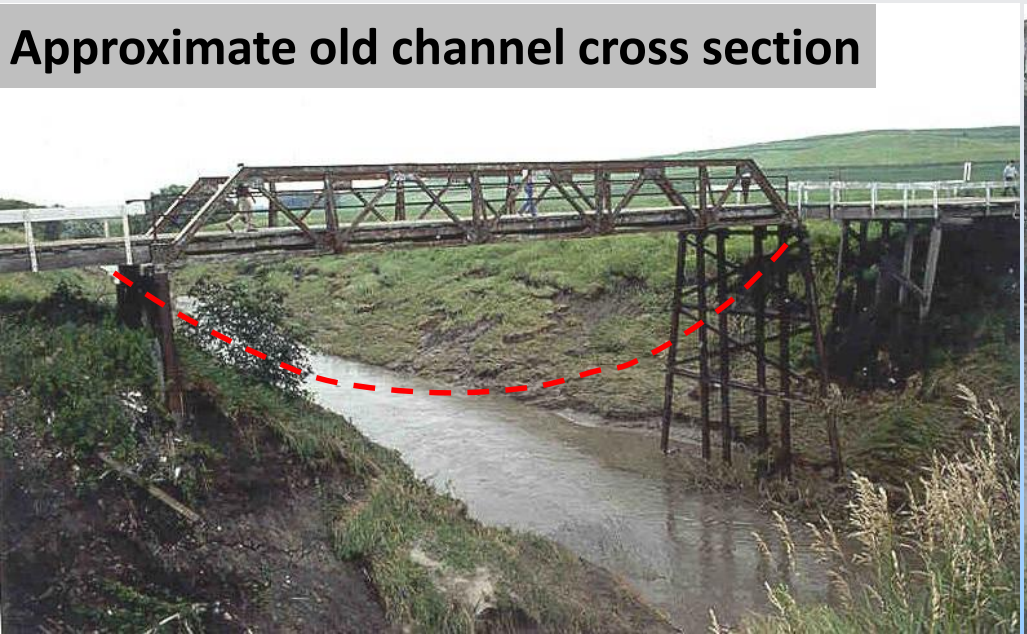
Source:

Simon, 1989, USACE 1990

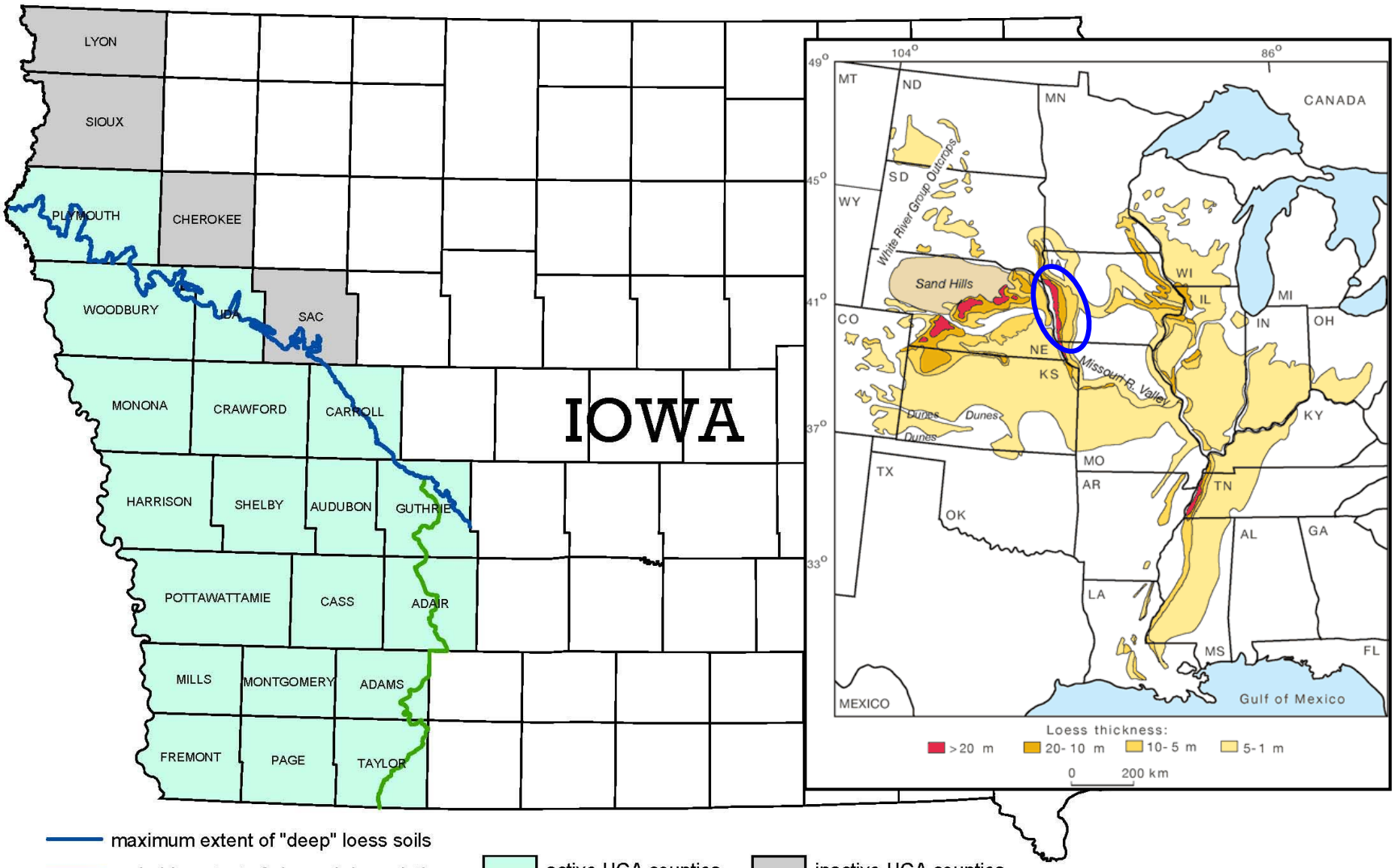


Bridge damage due to streambed degradation

Approximate old channel cross section

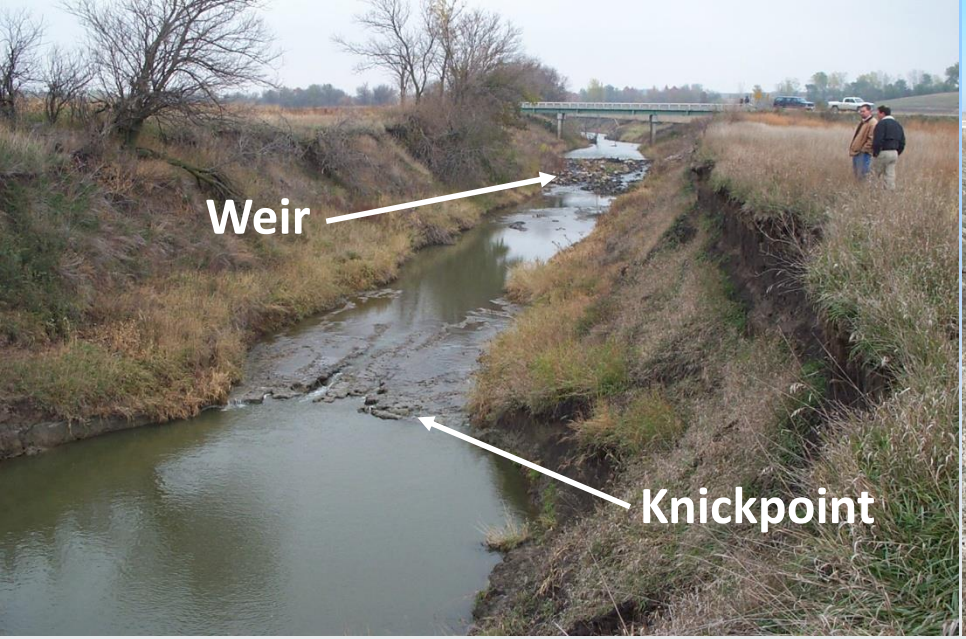


Counties in the Hungry Canyons Alliance



Streambed Stabilization and Grade Control Structures

- Streambed stabilization key to preventing erosion & protecting infrastructure
- Knickpoints affect entire watershed as erode upstream
- Structures at regular intervals change stream profile from erosive steep incline to stable stair-steps
- Grade control structures prevent further downcutting, create an upstream backwater condition, cause sediment to settle out upstream, reduce sediment loads, and protect infrastructure upstream

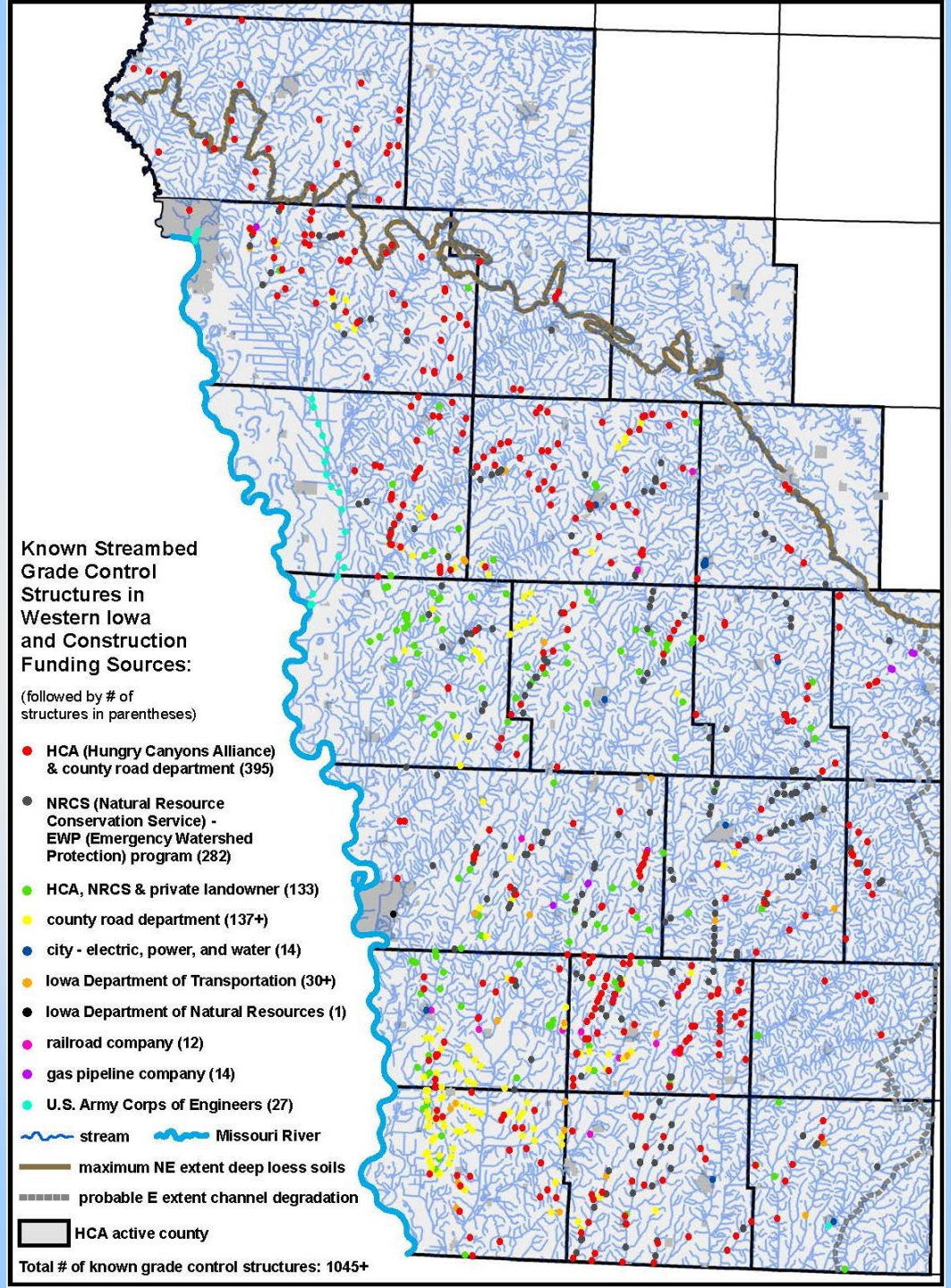


Triage on a grand scale: 1,500+ grade control structures in Western Iowa

Hungry Canyons Alliance Weir Structures

Other Types of Grade Control Structures

Other Types of Grade Control Structures


Known Streambed Grade Control Structures in Western Iowa and Construction Funding Sources:
(followed by # of structures in parentheses)
HCA (Hungry Canyons Alliance) & county road department (395)
NRCS (Natural Resource Conservation Service) - EWP (Emergency Watershed Protection) program (282)
HCA, NRCS & private landowner (133)
county road department (137+)
city - electric, power, and water (14)
Iowa Department of Transportation (30+)
Iowa Department of Natural Resources (1)
railroad company (12)
gas pipeline company (14)
U.S. Army Corps of Engineers (27)
stream
Missouri River
maximum NE extent deep loess soils
probable E extent channel degradation
HCA active county
Total # of known grade control structures: 1045+

Other Activities/Projects

- Completed HCA research projects:
  - design of GCS to provide fish passage
  - use of scrap tires in GCS
  - aerial stream video and classification of western Iowa streams
  - factors controlling knickpoint migration
  - **the use of directional drilling in small watershed GCS projects**
- Ongoing HCA research projects:
  - measuring nutrient loads from eroding streambanks to quantify the impact of channel stabilization projects
  - **experimenting with new bank stabilization techniques and materials (broken concrete and wood)**

Gully Erosion in the Loess Hills

Gully Erosion in the Loess Hills

Bored Headcut Basin Projects

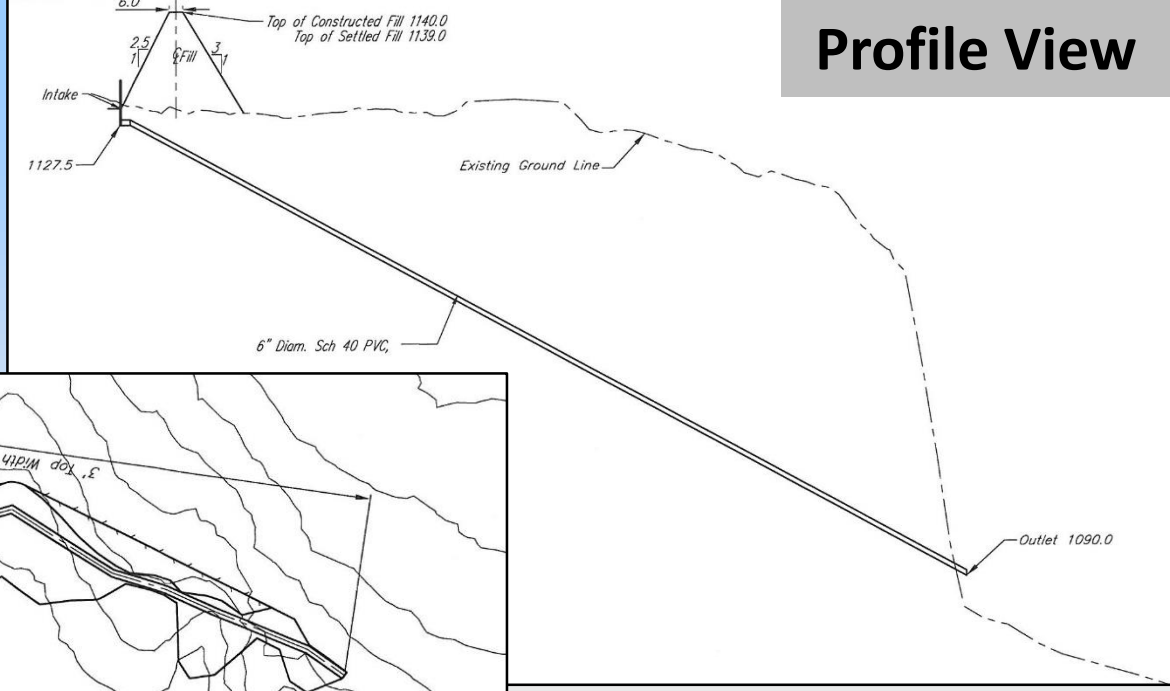
Project Goals

- Control headcut growth for large gullies with small drainage areas
- Limit the potential for runoff infiltration
- Disturb as little ground as possible
- Eliminate long backslope
- Limit the amount of work done in-gully
- Use the dry, vertical stability of loess to our advantage

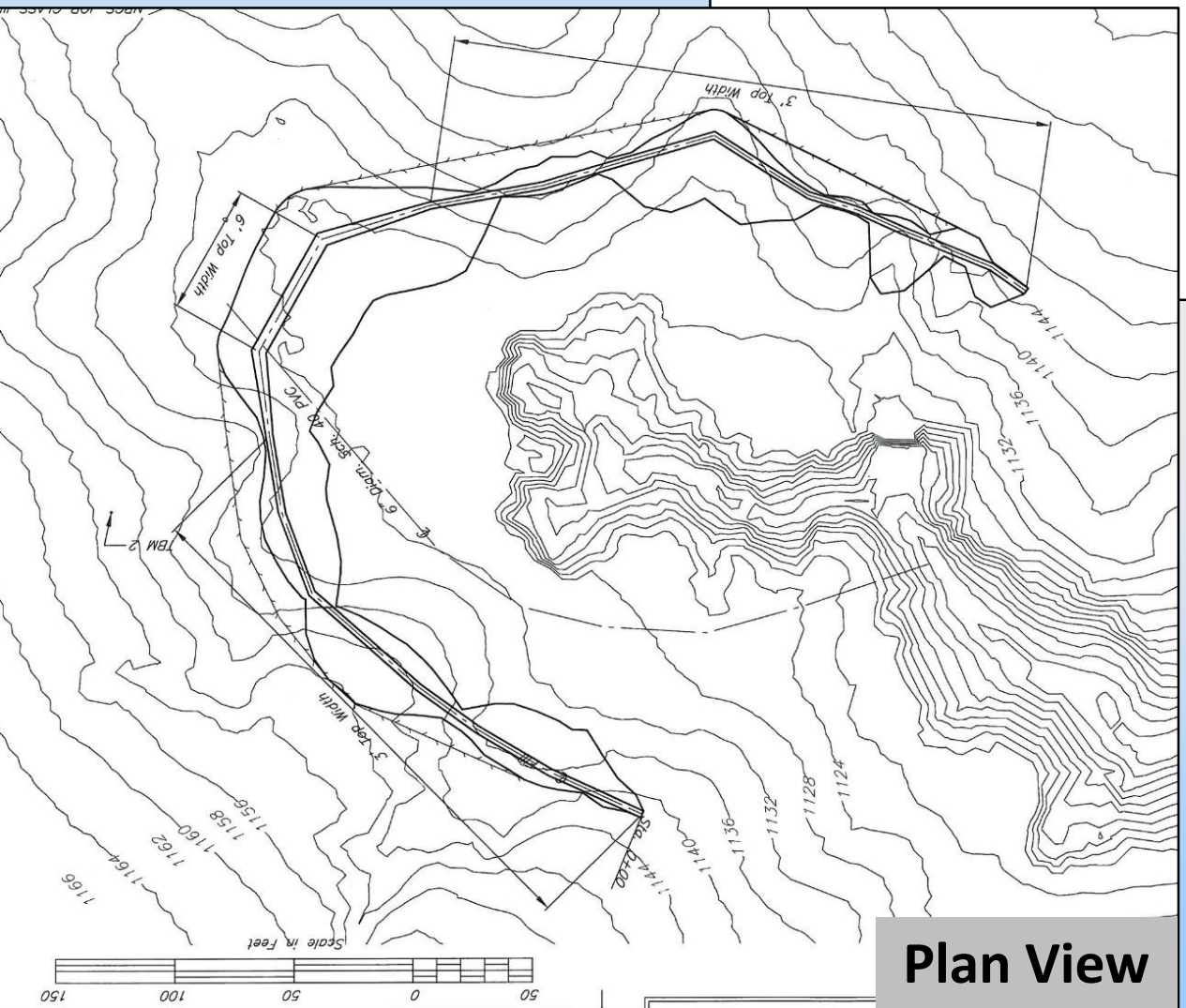
Results

- Success by pioneering use of directional drilling technology
- Pull back thick, continuous black polyethylene pipe after one pass of drill bit
- 12 projects completed – built July 2007 – Dec 2017
  - 6 to 24 meters of grade controlled
  - 0.2 to 15 hectares of drainage area
  - average cost of projects: $10,114
  - max cost: $17,085 – min cost: $7,202

Directional Drilling Technology



Profile View



Plan View

Bored Headcut Basin Example Plans


2014/12/10

Bank Stabilization using Broken Concrete

$35,000 for 230 m of stabilized bank and 11 bendway weirs

Bank Stabilization using Low-Floodplain Benches

Contact Information

- For questions or comments about the information presented in this presentation, contact John Thomas, Hungry Canyons Alliance Project Director
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