



The Yellow River Initiative: The Birth of a System Approach to Challenges Facing the Everglades of the North

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2016 INAFSM Annual Conference
 Belterra Conference Center, Indiana
 September 7, 2016

Federal and National Partners

State, Local, and Educational Partners

Many Agencies | One Solution

Indiana
 SILVER JACKETS
 DATA & DECISIONS | ONE SOLUTION
 Be Risk Aware!

USGS science for a changing world

FEDERAL EMERGENCY MANAGEMENT AGENCY FEMA

NOAA

NATIONAL RESTORATION SERVICE

NRCS

USDA United States Department of Agriculture

INDIANA DNR INDIANA DEPARTMENT OF NATURAL RESOURCES

IDEM

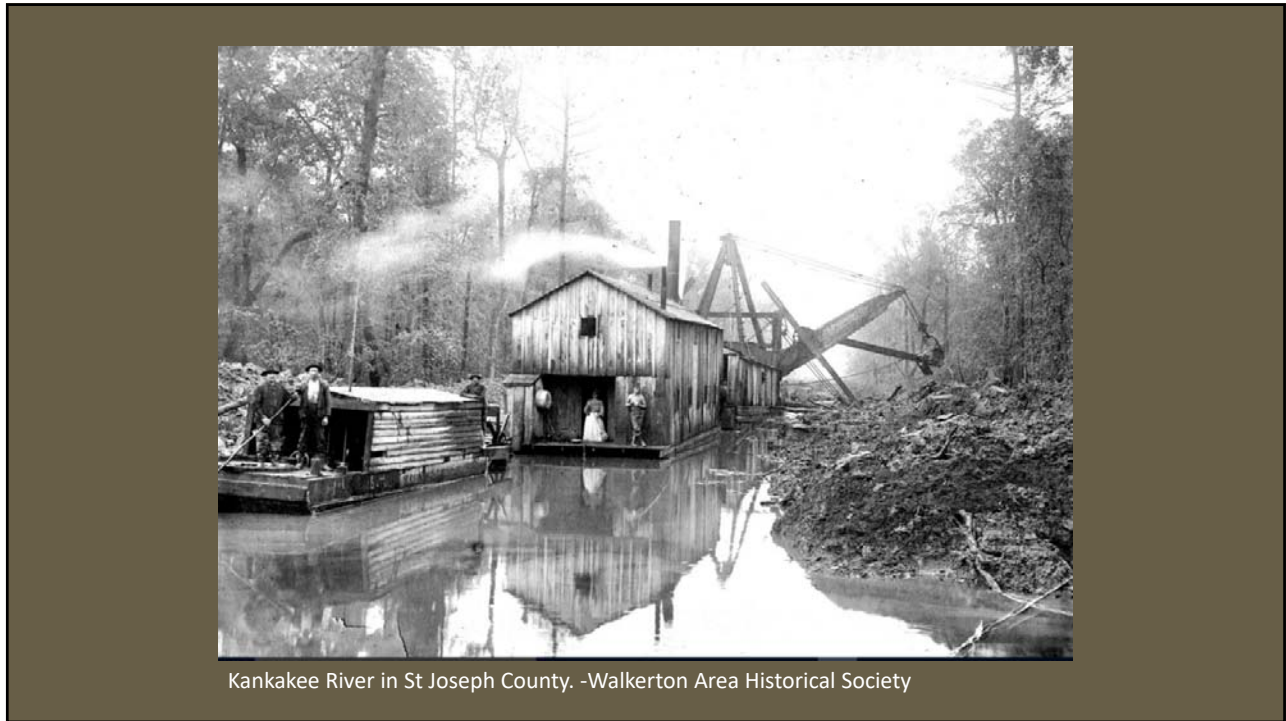
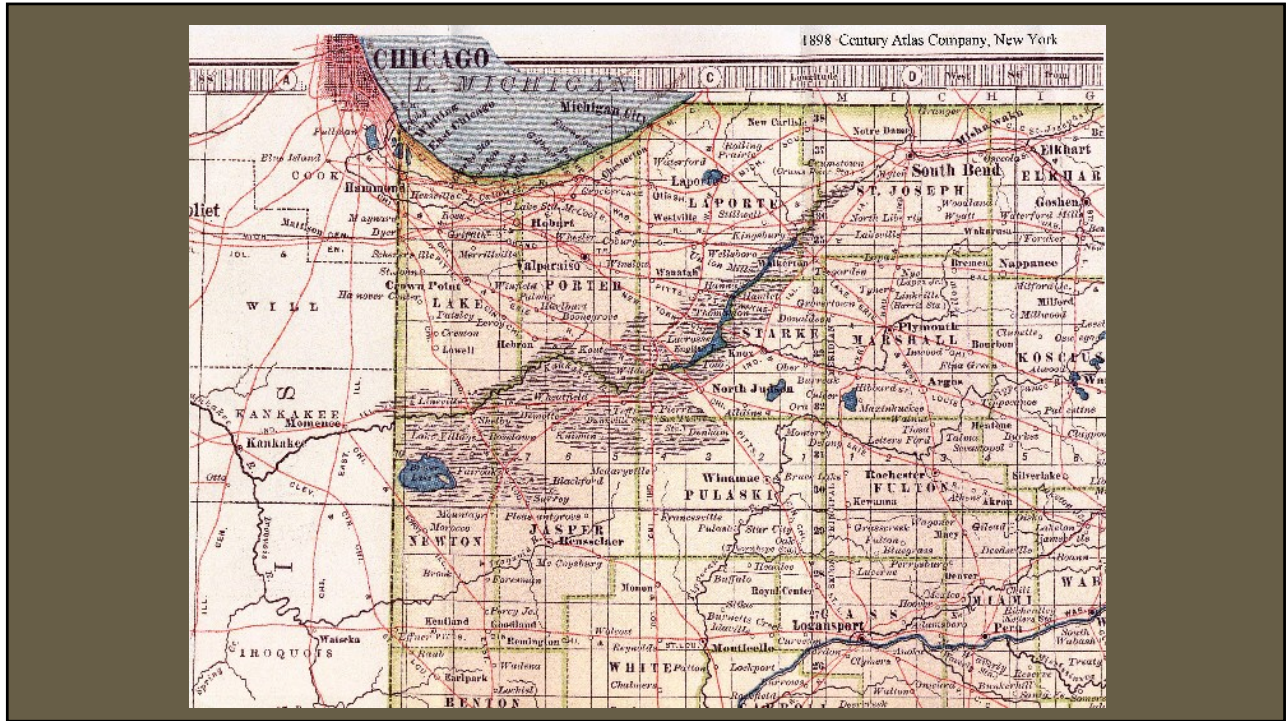
INDIANA OFFICE OF COMMUNITY & RURAL AFFAIRS

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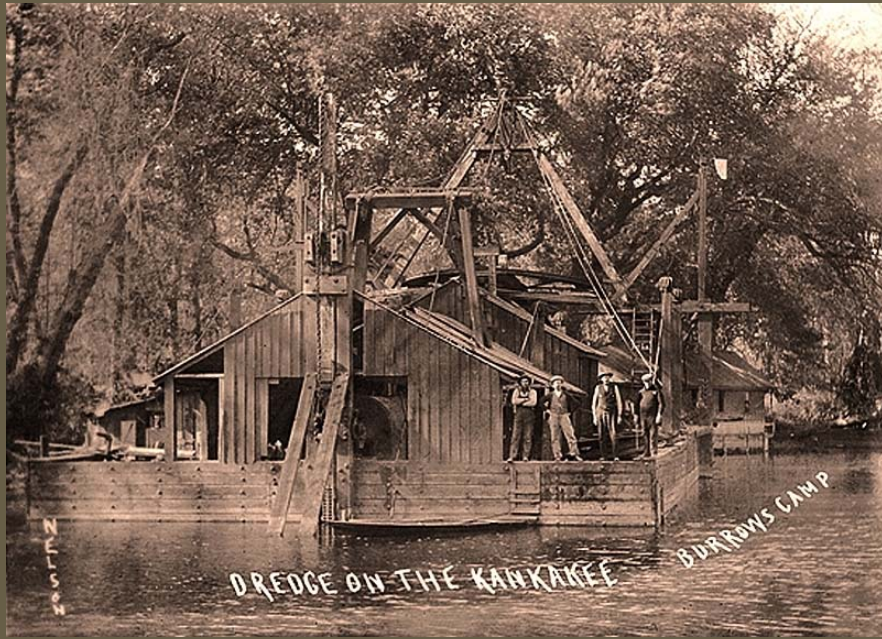
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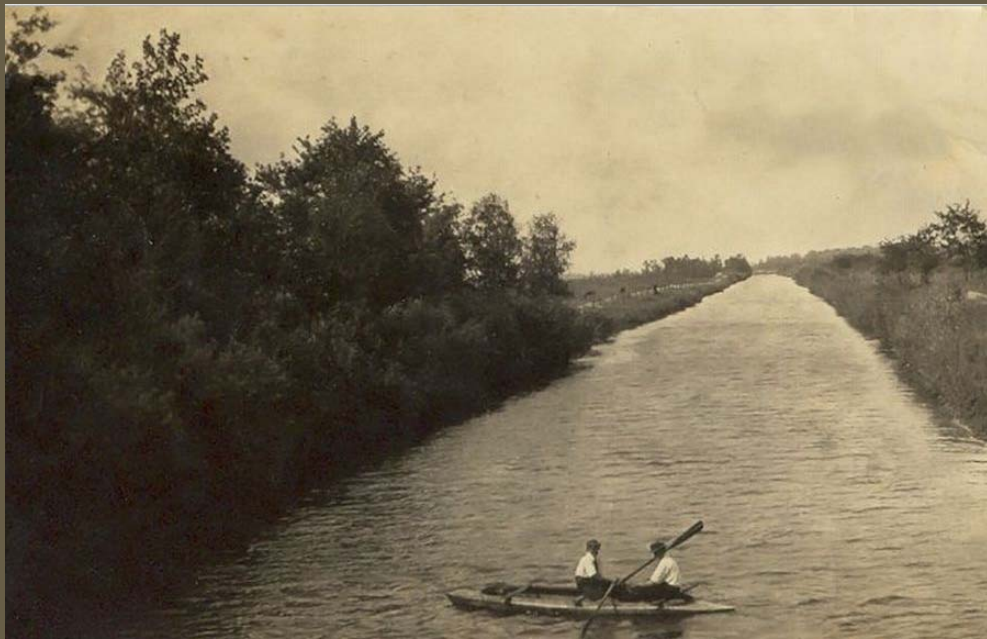
THE NATURE CONSERVANCY



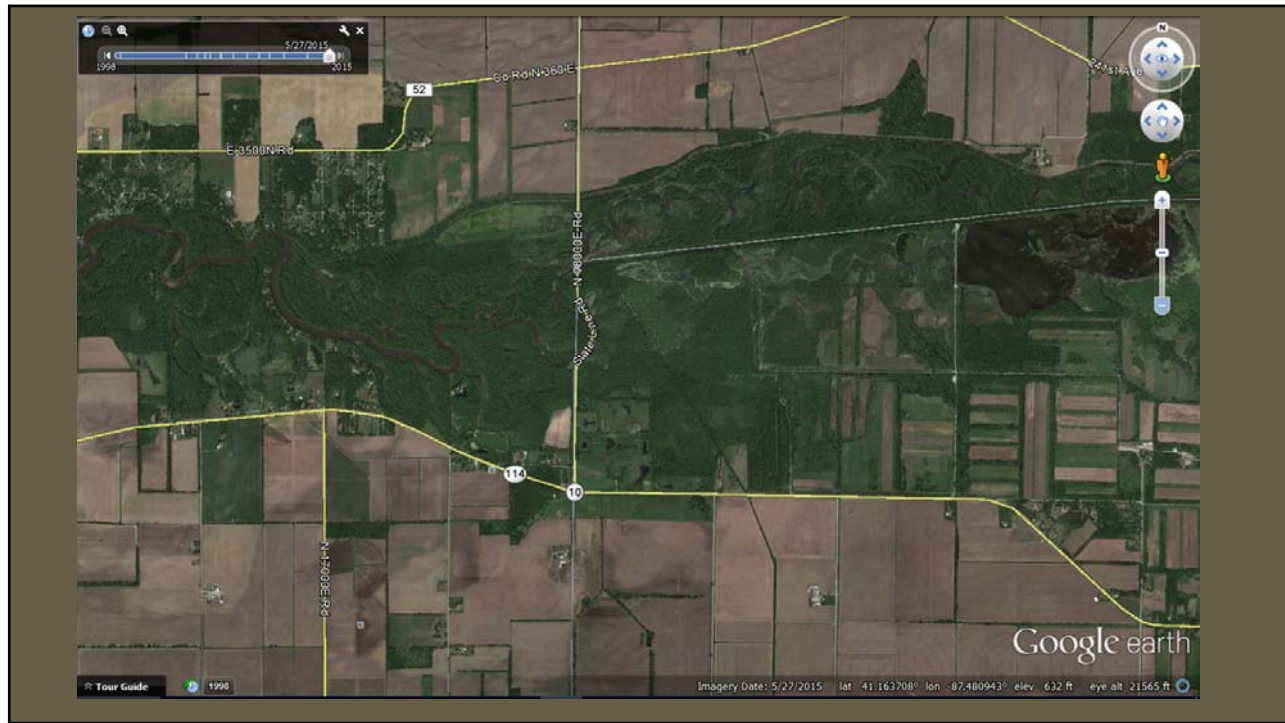
Kankakee River in St Joseph County. -Walkerton Area Historical Society



Burrows Camp near Dunn's Bridge. -Northwest Indiana Genealogical Society Collection



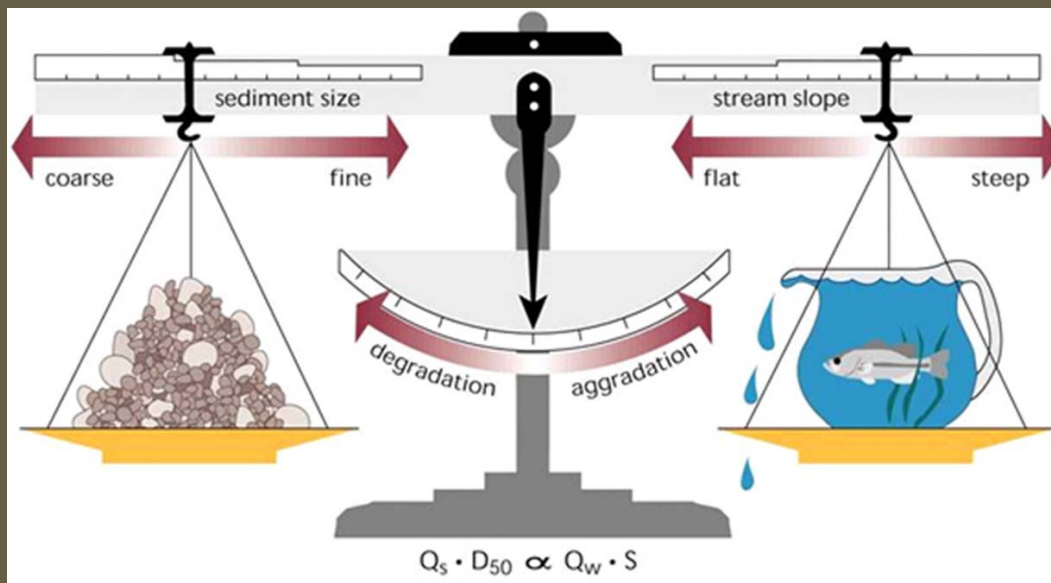
Photo, Northwest Indiana Genealogical Society Collection



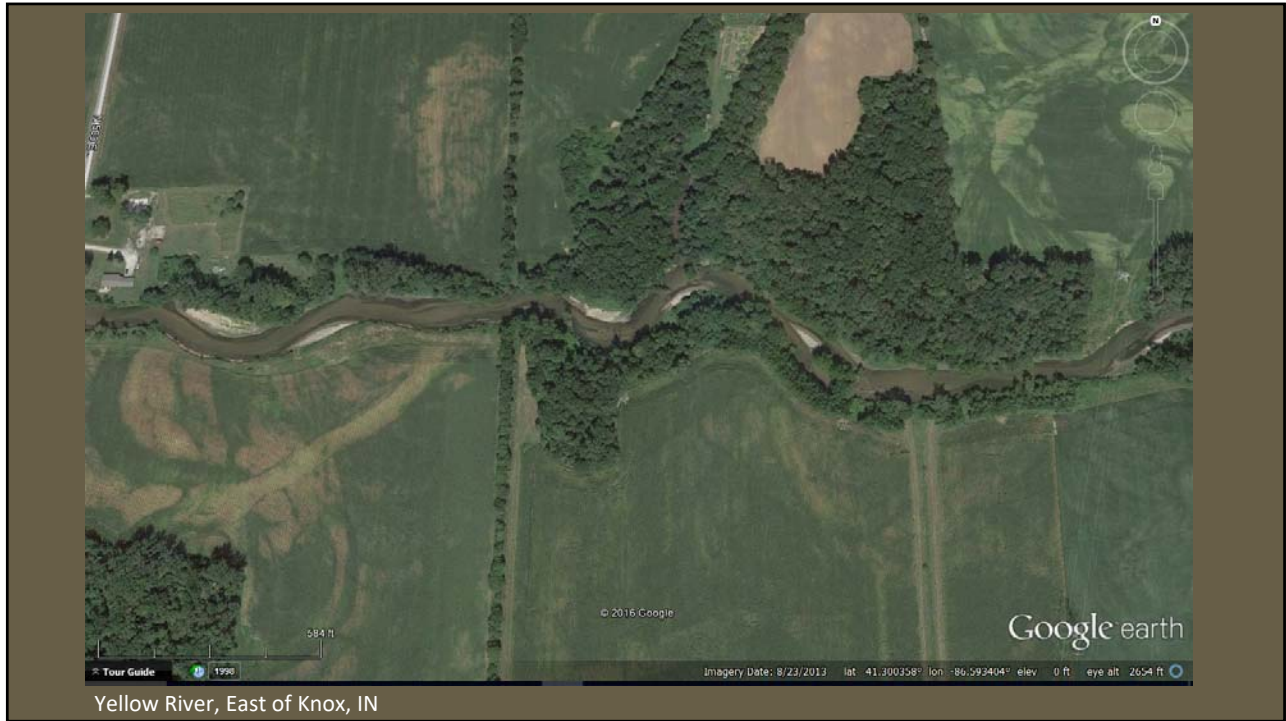
Traditional Restoration Example, Kankakee River , Indiana, June 2015 - reach was "restored" in 2013

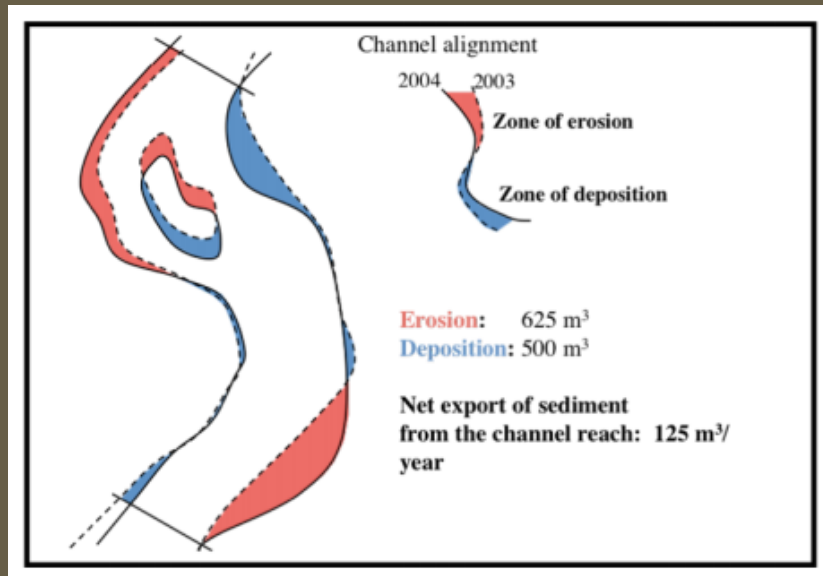


Traditional Maintenance Example, Bank "maintenance" on a tributary channel,
Kankakee River, Indiana 2015

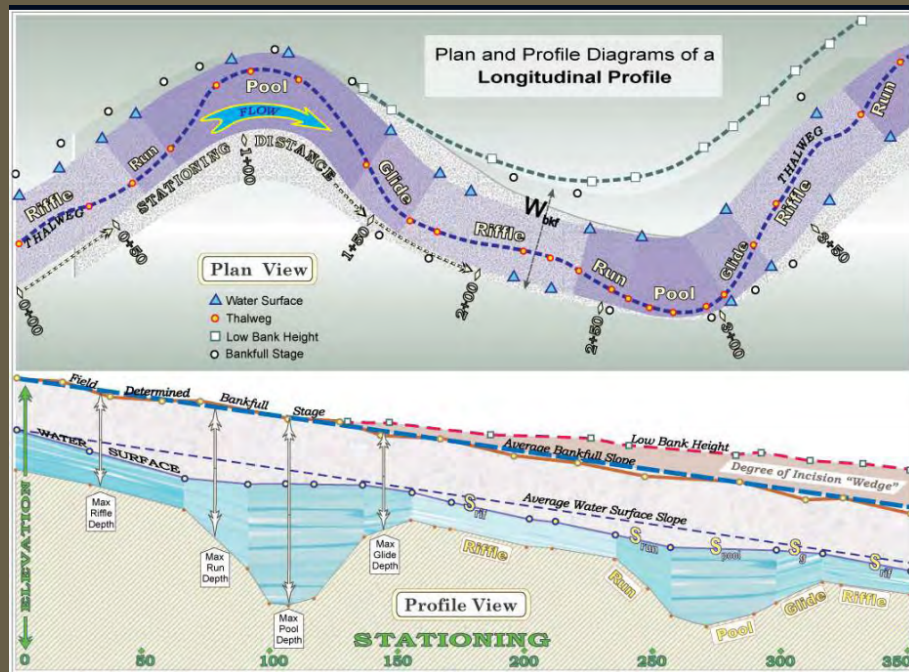


Wildland Hydrology, after Lane, 1955

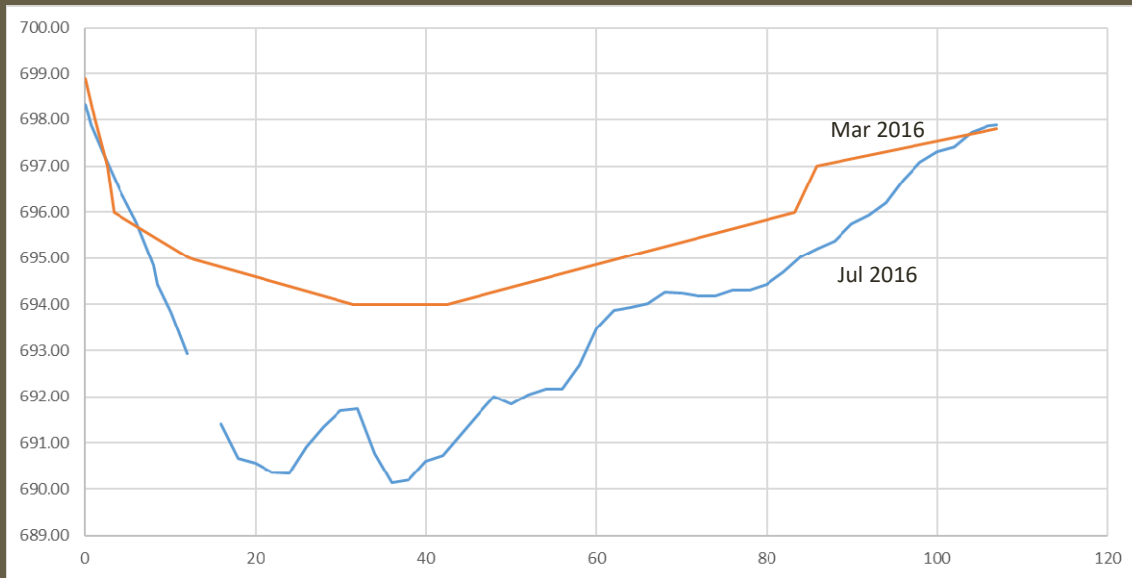




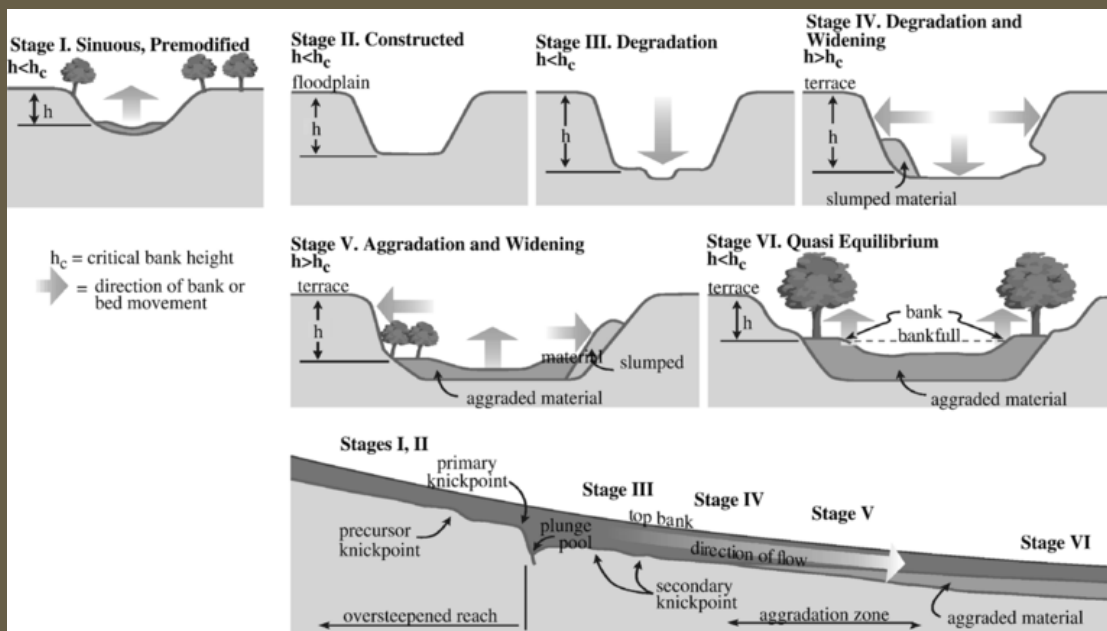
Hickin, 2010



Wildland Hydrology



Change in pool cross-section, Yellow River at Trigg Farms

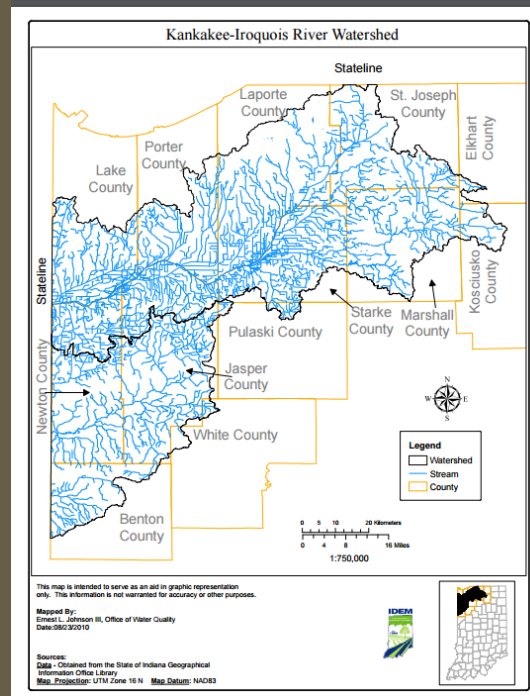


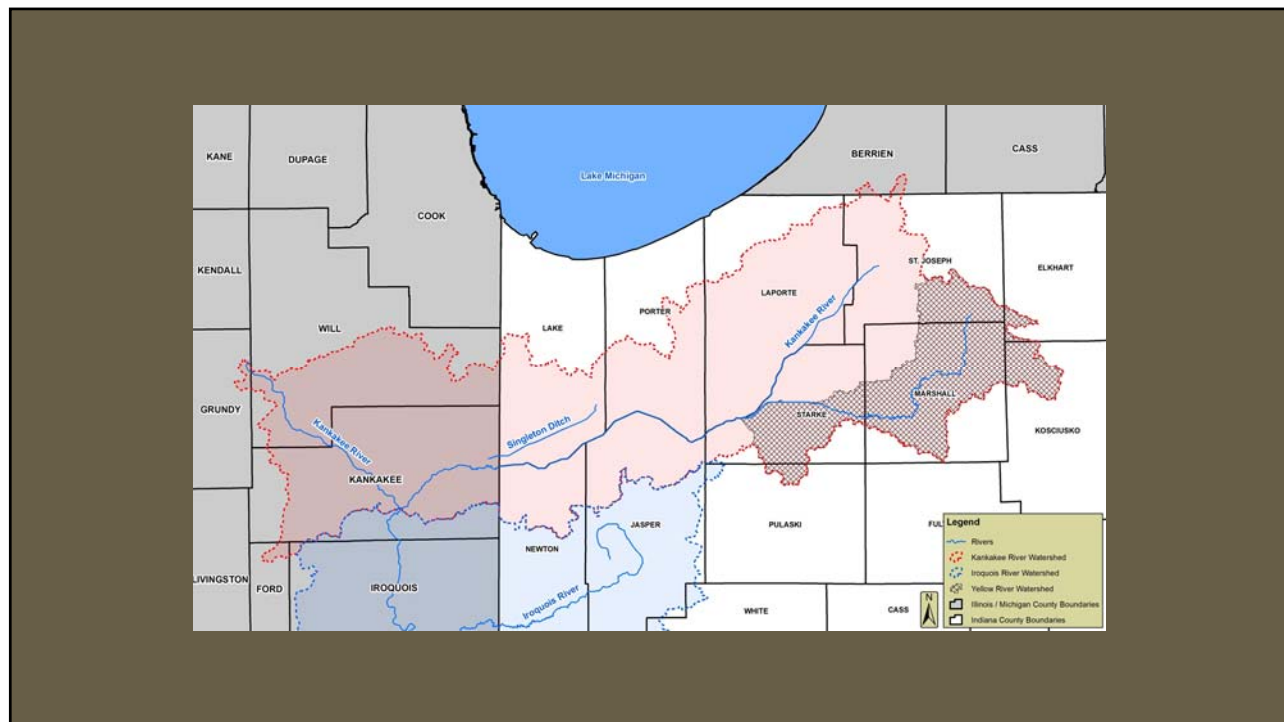
Channel Evolution Model Stages

(Schumm, from Simon and Rinaldi (2006))

Introduction

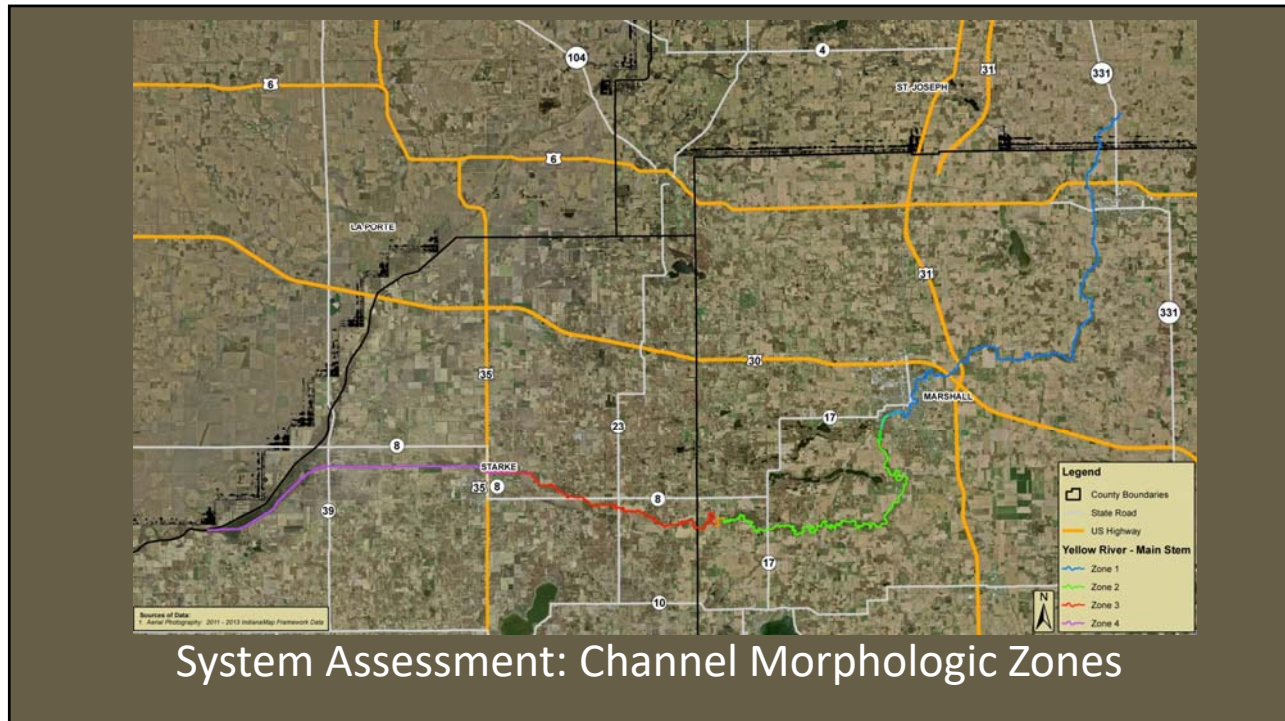
- Study initiated and funded by KRBC
- Problem Statement
 - Too much, repeated maintenance expenditures needed to deal with significant bank failures, erosion, and sediment aggradation
 - Too much sediment is going to Illinois
 - Yellow River cited as a major sediment source
 - Degraded habitat and quality in Yellow River and Kankakee
- Our Charge
 - Pinpoint the root causes
 - Recommend sustainable solutions (where to do what)





Selected Previous Studies

- CBBEL, 1992
- Holmes (USGS), 1997
- Bhowmik and Demissie, 2001
- USACE, 2007 (Illinois Basin Comprehensive Plan)
- CBBEL, 2012
- USACE, Kankakee River Basin Evaluation of Sediment Management Strategies, Little and Jonas, 2013
- USACE, Kankakee River Mainstem Critical Restoration Project Summary Report, 2014





Yellow River near Armev Ditch, Marshall County



Yellow River at Marshall – Starke County Line



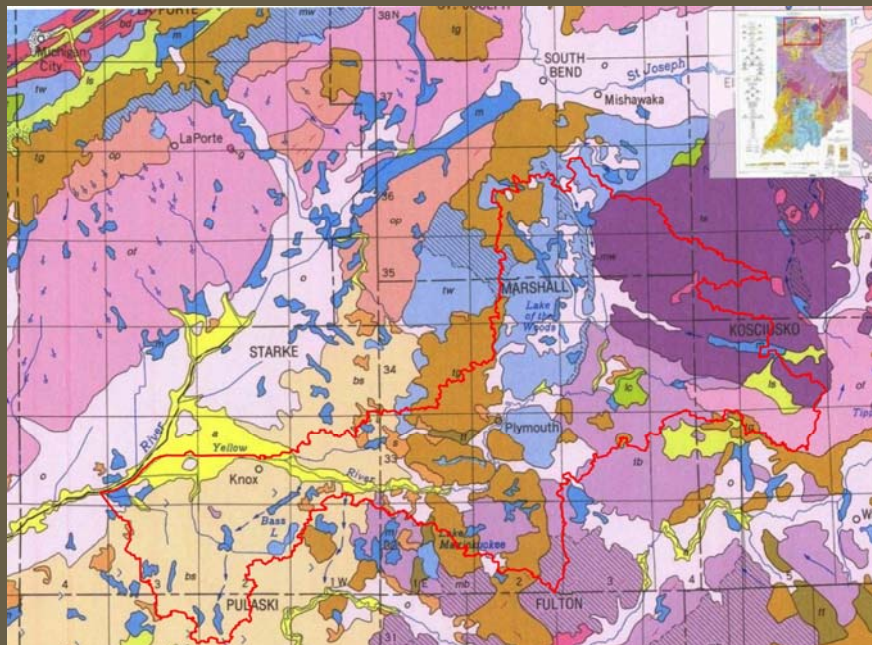
Yellow River, Starke County



Yellow River, Starke County

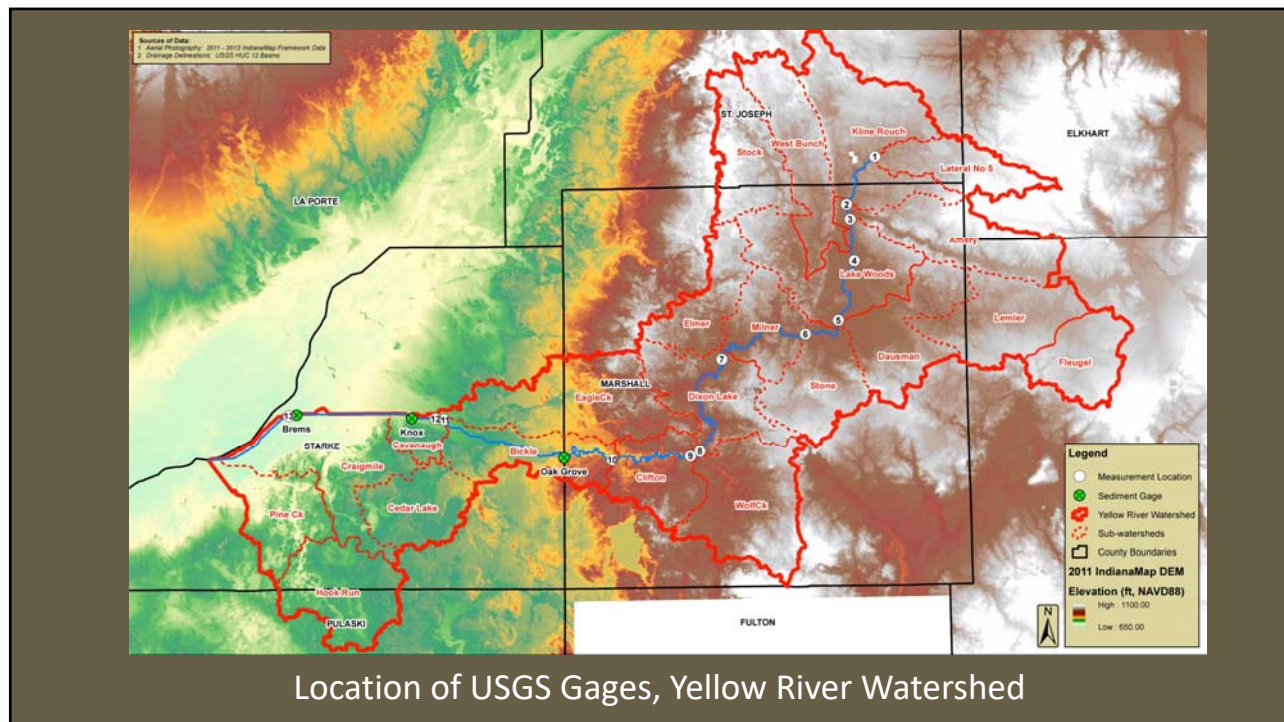


Yellow River West of Knox



Detail from Quaternary Geologic Map of Indiana

(Gray, 1989)



Data Analysis

- Drainage modification
- Soils & land management
- Sediment gage data
- Sediment source analysis
- Channel geometry
- Channel processes
- Bank Failures

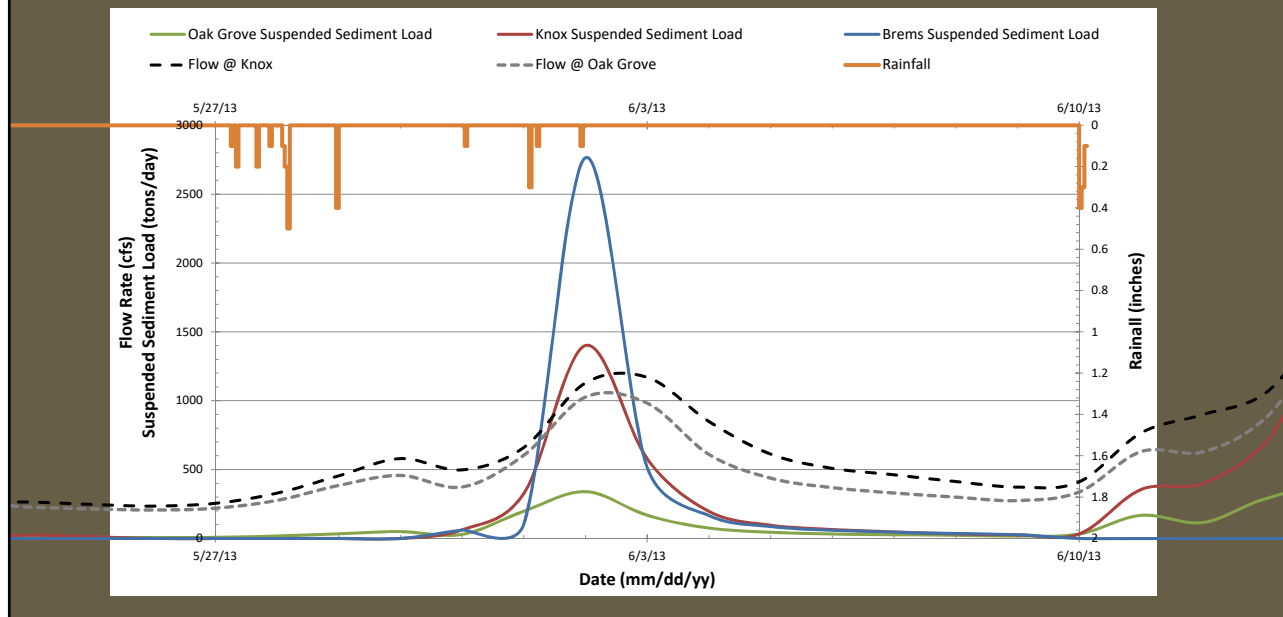
Sediment Gage Data

- Variability from year-to-year
- Sharp increase in sediment between Oak Grove & Knox
- Knox sediment load \approx Brems sediment load



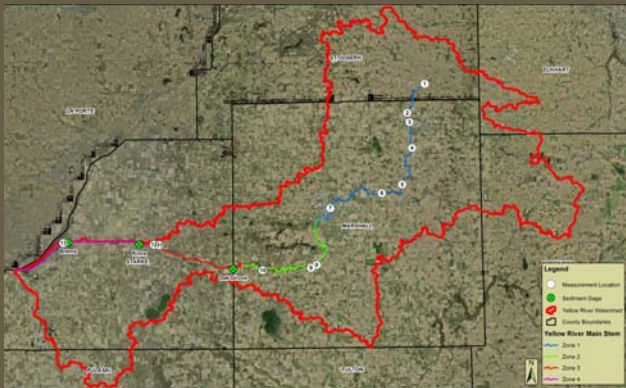
Location	Contributing Drainage Area (sq. mi.)	Adjusted Annual Suspended Sediment Load (tons)			
		2013	2014	2015	Average Annual
Oak Grove	377	20,340	12,682	20,324	17,782
Knox	435	61,179	29,028	57,023	49,077
Brems	438	70,232	19,392	49,353	46,325

Sediment Gage Data

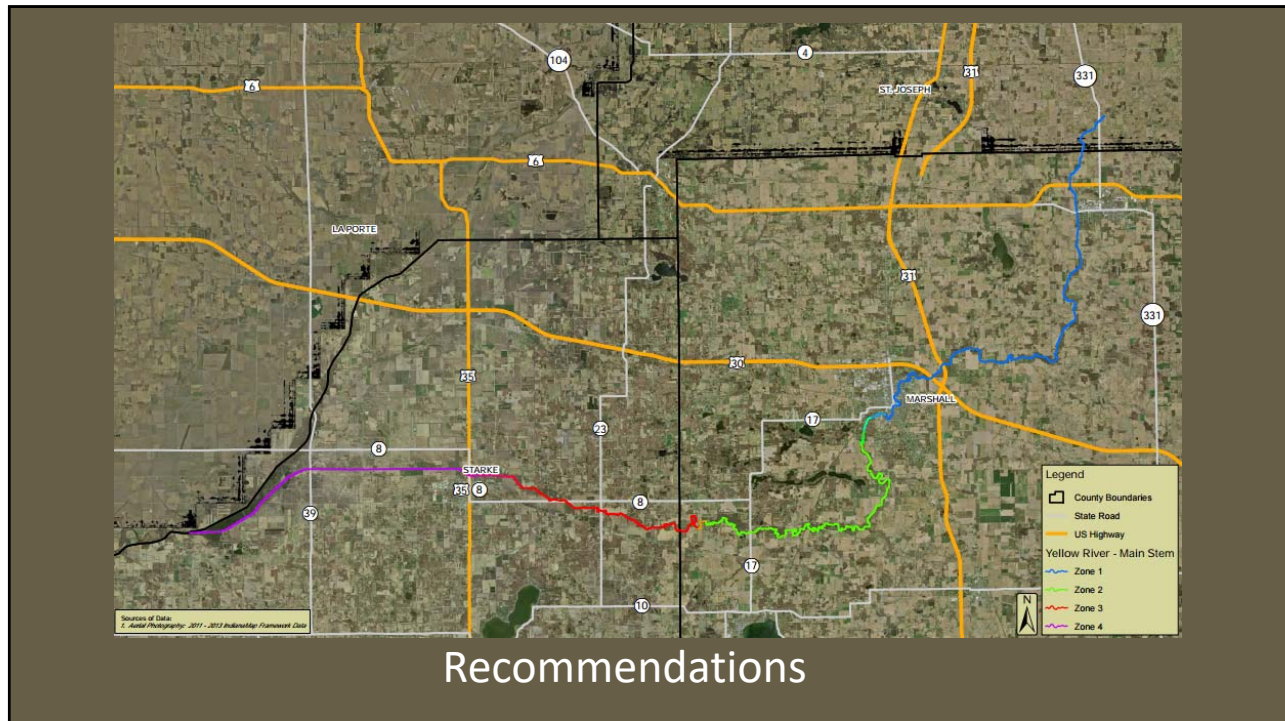


Channel Geometry

- Channel dimensions are what we expect in natural channel reach
- Difference from 'stable' channel dimensions is greatest downstream of Knox



Location	Approx. Bankfull Width (ft)	Regional Equation Bankfull Width (ft)	Description of Measurement Location
1	22	33	Man-made ditch
2	30	48	Man-made ditch
3	45	54	Man-made ditch
4	49	63	Man-made ditch
5	54	68	Man-made ditch
6	70	78	Natural channel
7	84	82	Natural channel
8	89	84	Natural channel
9	96	87	Natural channel
10	88	88	Natural channel
11	101	90	Channelized stream
12	102	92	Channelized stream
13	129	93	Man-made ditch



Recommendations

Recommendations, Basin-Wide

- In partnership with the County SWCDs, NRCS, and ISDA, promote soil health practices on all agricultural areas
- Reduce bank slopes as maintenance is done
- Utilize multi-stage ditch where possible and beneficial



Recommendations, Zones 1 and all headwater Laterals

- Zone 1
 - Establish/maintain riparian corridor
 - Reduce bank slopes as maintenance is done
 - Utilize multi-stage ditch where possible and beneficial



Recommendations, Zone 2

- Zone 2
 - Monitor
 - Maintain riparian corridor

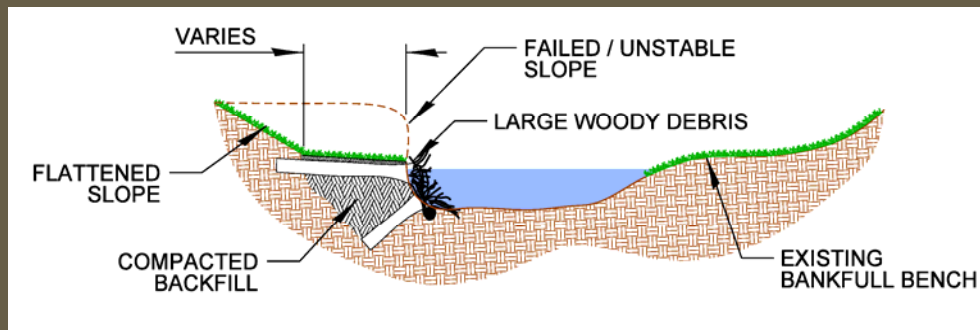


Recommendations, Zone 3

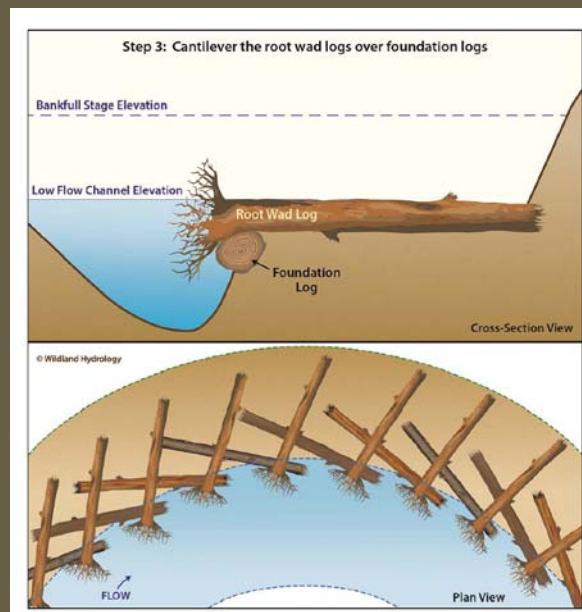


Recommendations, Zone 3

- Stabilize banks - Use “Toe wood” technique for bank stabilization
- Develop typical cross sections for bank reconstruction
- Develop cost estimates for reach
- Initiate pilot projects to refine model



Toe Wood Illustration



Source: Wildland Hydrology

Recommendations, Zone 3

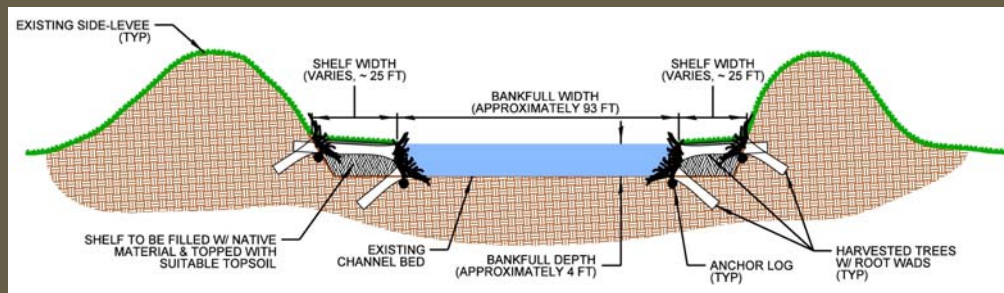


Recommendations, Zone 4



Recommendations, Zone 4

- Narrow bankfull width and create floodplain shelves (within levees)
- Develop typical cross sections for floodplain reconstruction
- Work with contractor to develop cost estimates for reach
- Initiate pilot project

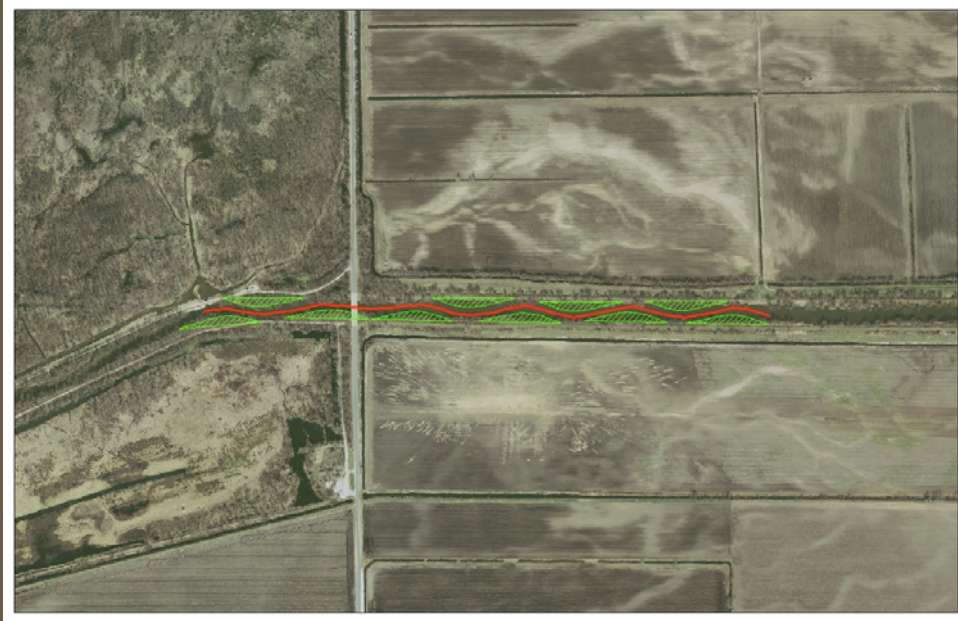


Recommendations, Zone 4

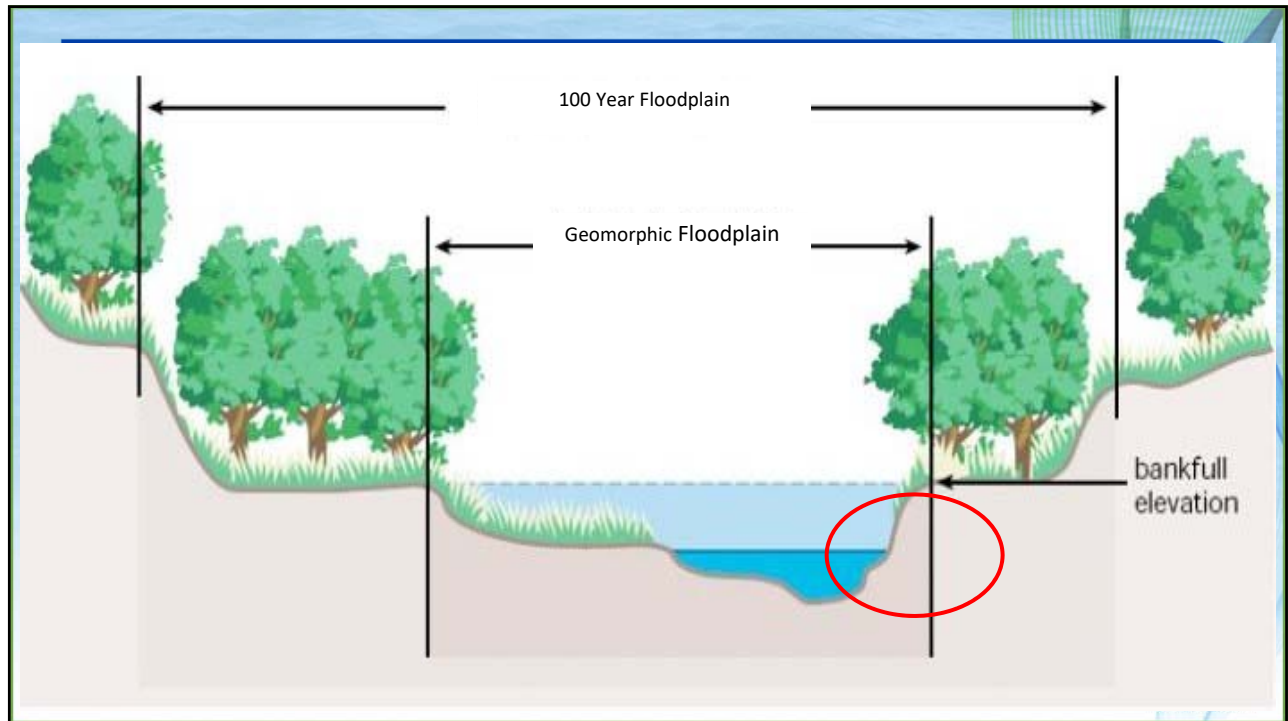


Proposed reference reach, Yellow River near E. Division Road, Starke County, Indiana

Recommendations, Zone 4



Proposed pilot project reach, Yellow River at SR 39, Starke County, IN



Recommendations, Zone 4



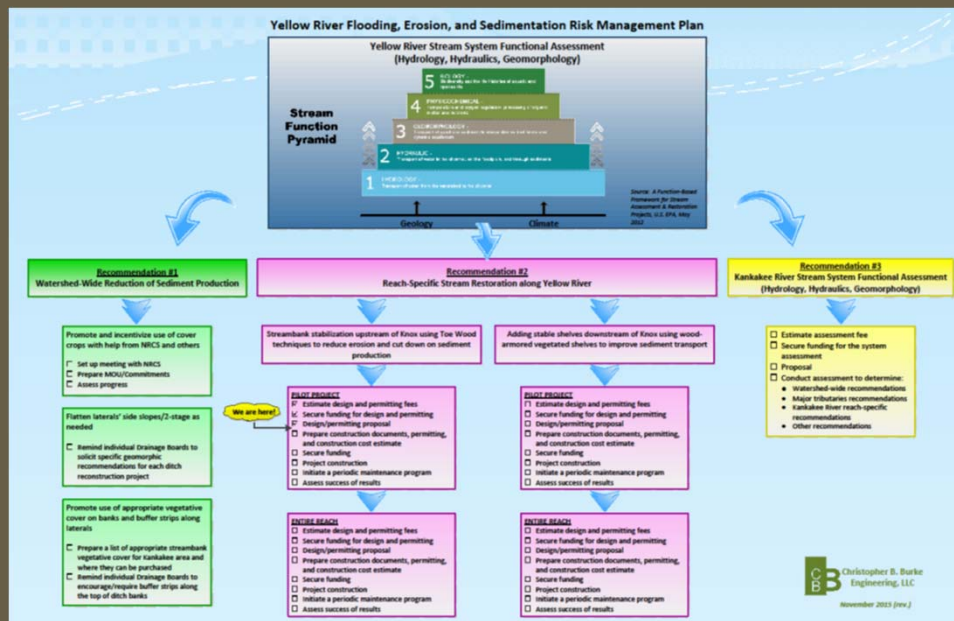
Bottom Line

- Major sources of sediment production:
 - Sand on headwater land surfaces
 - Severe streambank erosion between Knox and Starke-Marshall County line
- Major cause for severe aggradation in lower reaches:
 - Too much incoming sand
 - Lack of an efficient sediment transport mechanism
- Recommended measures:
 - Agricultural conservation practices – watershed-wide
 - Flatter side slopes and appropriate slope cover to minimize sand production
 - Streambank stabilization through use of “Toe Wood” techniques u/s of Knox
 - Creating a 2-stage low flow channel by narrowing the width at bankfull flow depth through addition of stable shelves in the lower reach

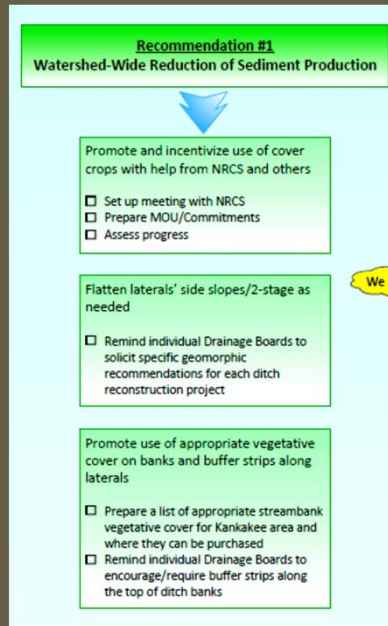
Call for Action

- Incentivize conservation practices on headwaters land surfaces
- Proceed with flattening side slopes/2-stage ditching of select headwaters tributaries (when maintaining ditches)
- Proceed with design and cost estimating of a suitable streambank stabilization measure for the problem area upstream of Knox – **Currently designing a pilot project**
- Proceed with design and cost estimating of creating low flow inset channel in the lower reaches - **Start with a pilot project**
- Continue supporting sediment gages to promote good designs and to make sure improvements are working – **& Add gages along Kankakee**
- Consider expanding this type of assessment to the entire Kankakee (to determine where to do what) – **Include the Momence reach in Illinois**

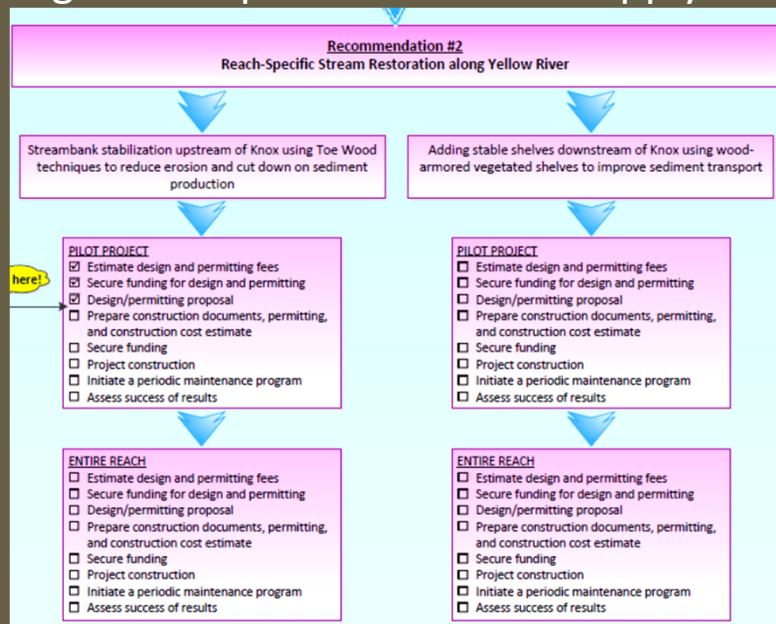
Implementation Roadmap



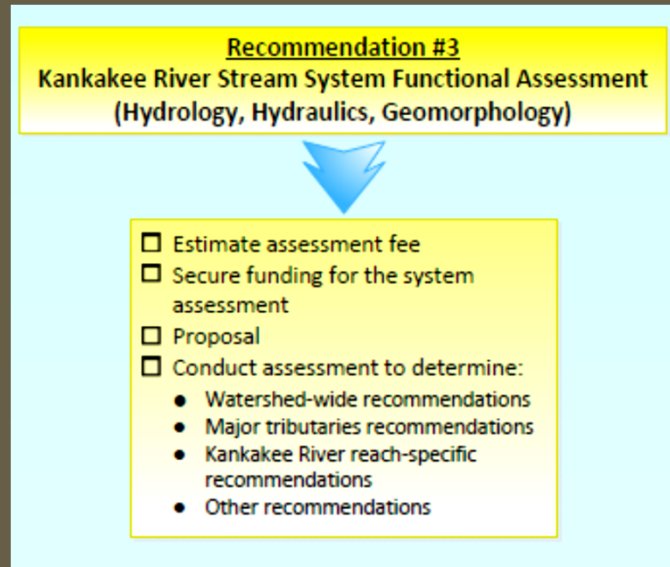
Addressing Watershed-wide Flow and Sediment Supply



Addressing Reach-Specific Sediment Supply and Transport

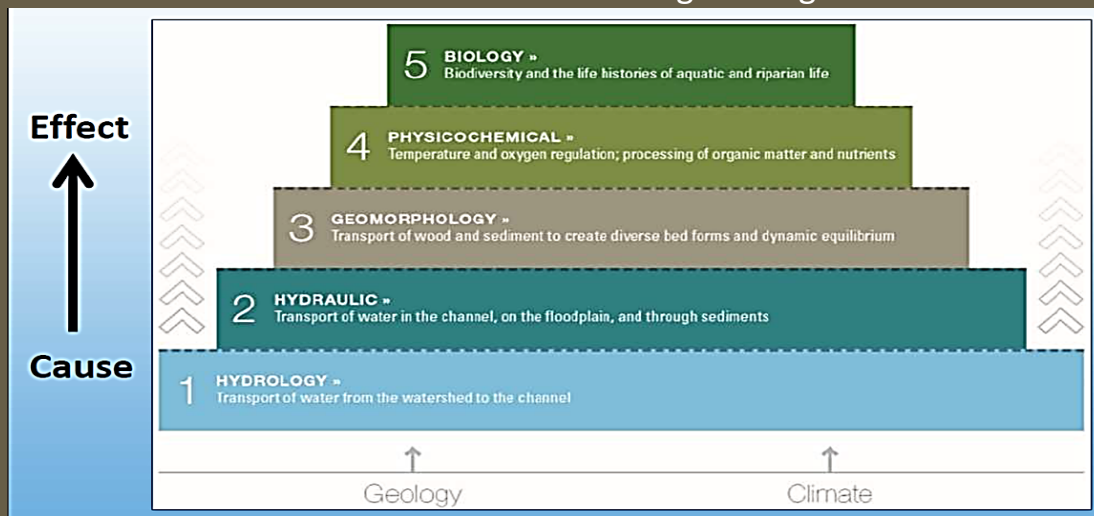


Implementation Prep for the Bigger Kankakee System



Function-based Hierarchy

Function-based approach for addressing a legacy “ecosystem” restoration need & achieving “ecological lift”



Source: A Function-Based Framework for Stream Assessment & Restoration Projects, U.S. EPA, May 2012

QUESTIONS?

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