Upper Nemahbin Lake Management District

Bark River Physical Characteristics: Summary and Potential Approaches to Roller Mill Dam Issues

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Southeastern Wisconsin Regional Planning Commission

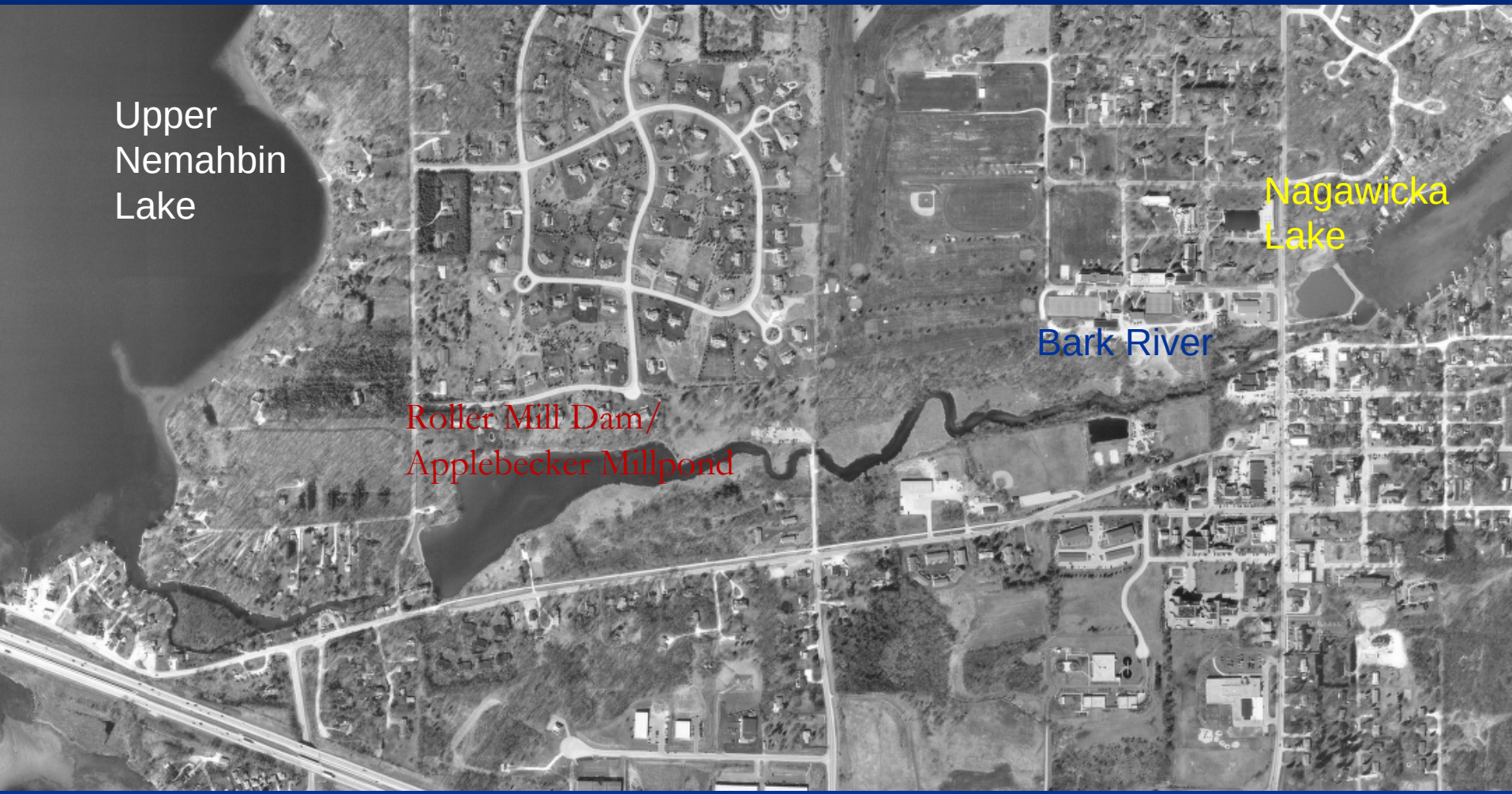
Outline of Presentation

- Watershed Tour: Character and Constraints
- Biology of the Middle Bark River
  - Fishes above and below the Dam
  - Mussels above and below the Dam
- Physical attributes of the Middle Bark River
- Issues and Concerns
- Alternative Considered
- Operational Considerations associated with Recommended Alternative

The Middle Bark River

- Upper Nemahbin Lake to the Nagawicka Lake Dam

The Middle Bark River



Biological Considerations

- Fish
  - Least Darter – State Species of Special Concern*
  - Slender Madtom – State Endangered Species*
  - Banded Darter – Intolerant Species*
  - Fantail Darter*
  - Weed Shiner – State Species of Special Concern
- Mussels
  - Ellipse – State Threatened Species
    - Note: The Fantail Darter is a host to this mussel

*These fish were recorded only downstream of Roller Mill Dam

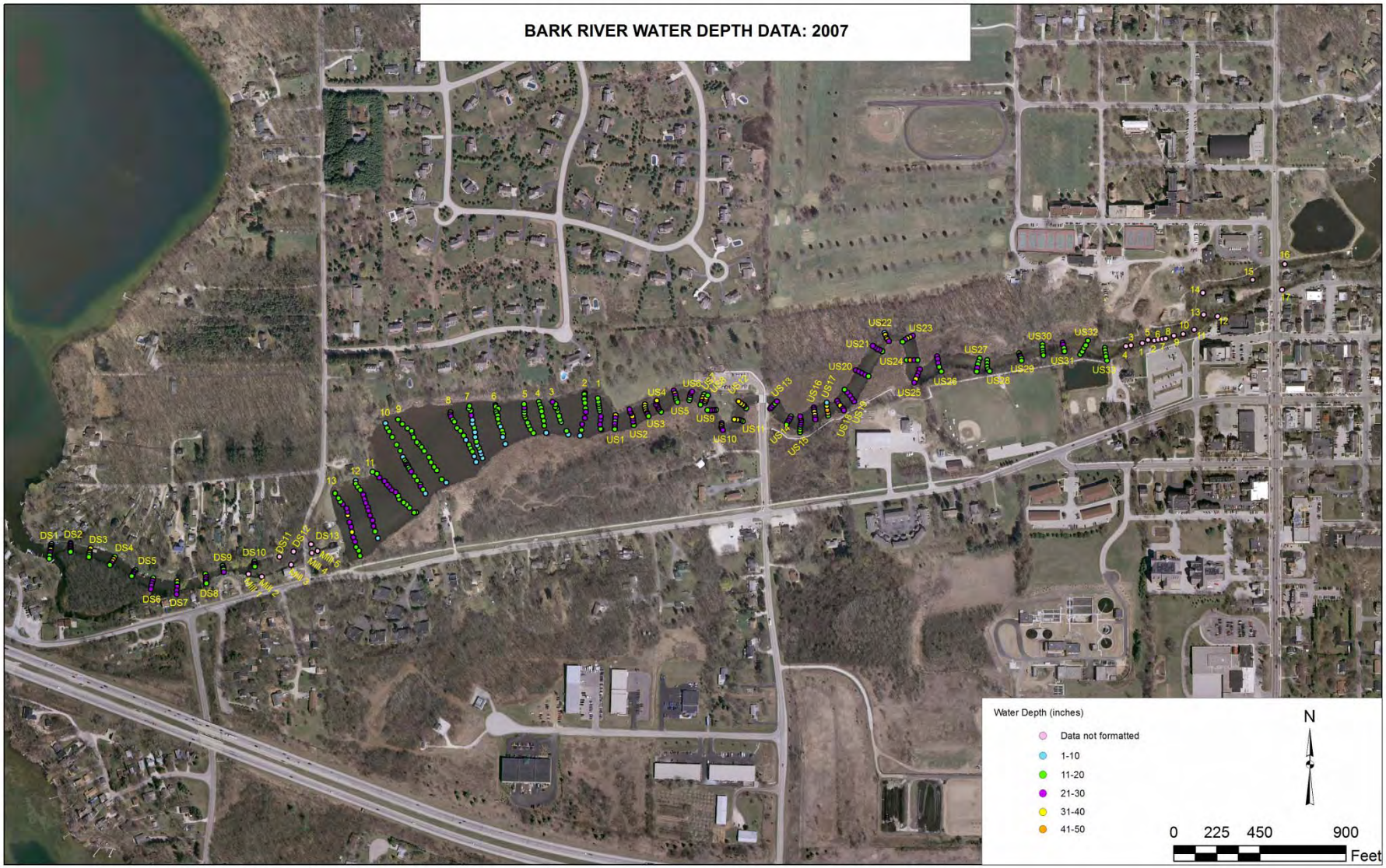
Fishes

Mussels

Physical Attributes

- Historic meanders
- Gradient changes
- Substrate changes

- Effects of impoundment
  - Accumulated sediments
  - Alteration of lotic ecosystem
  - Creation of a lentic ecosystem


BARK RIVER WATER DEPTH DATA: 2007
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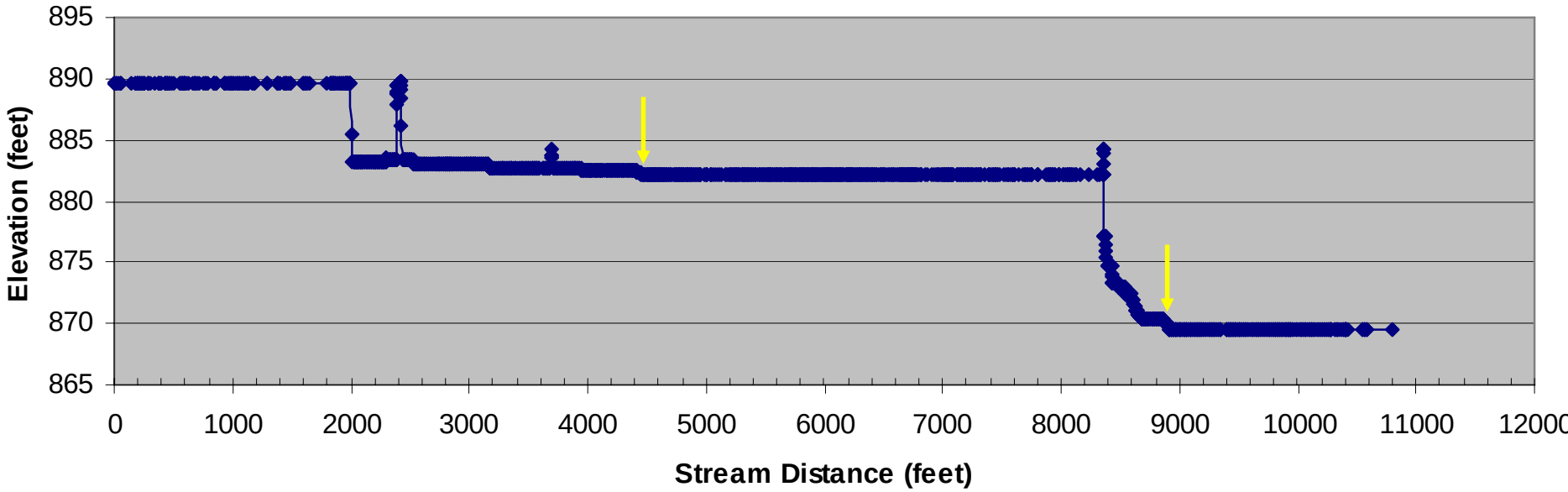
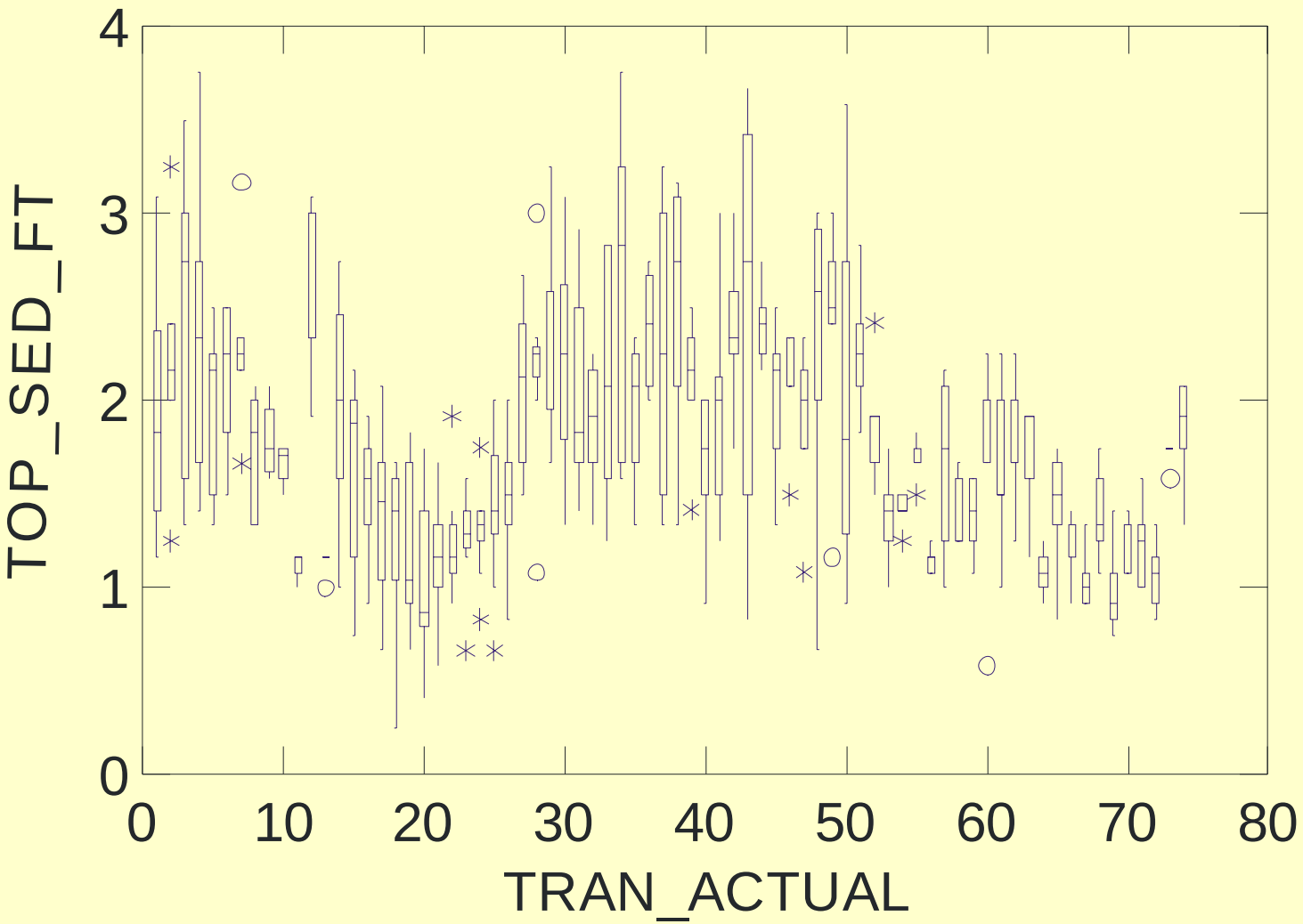
Feet

Bark River Elevation Profile

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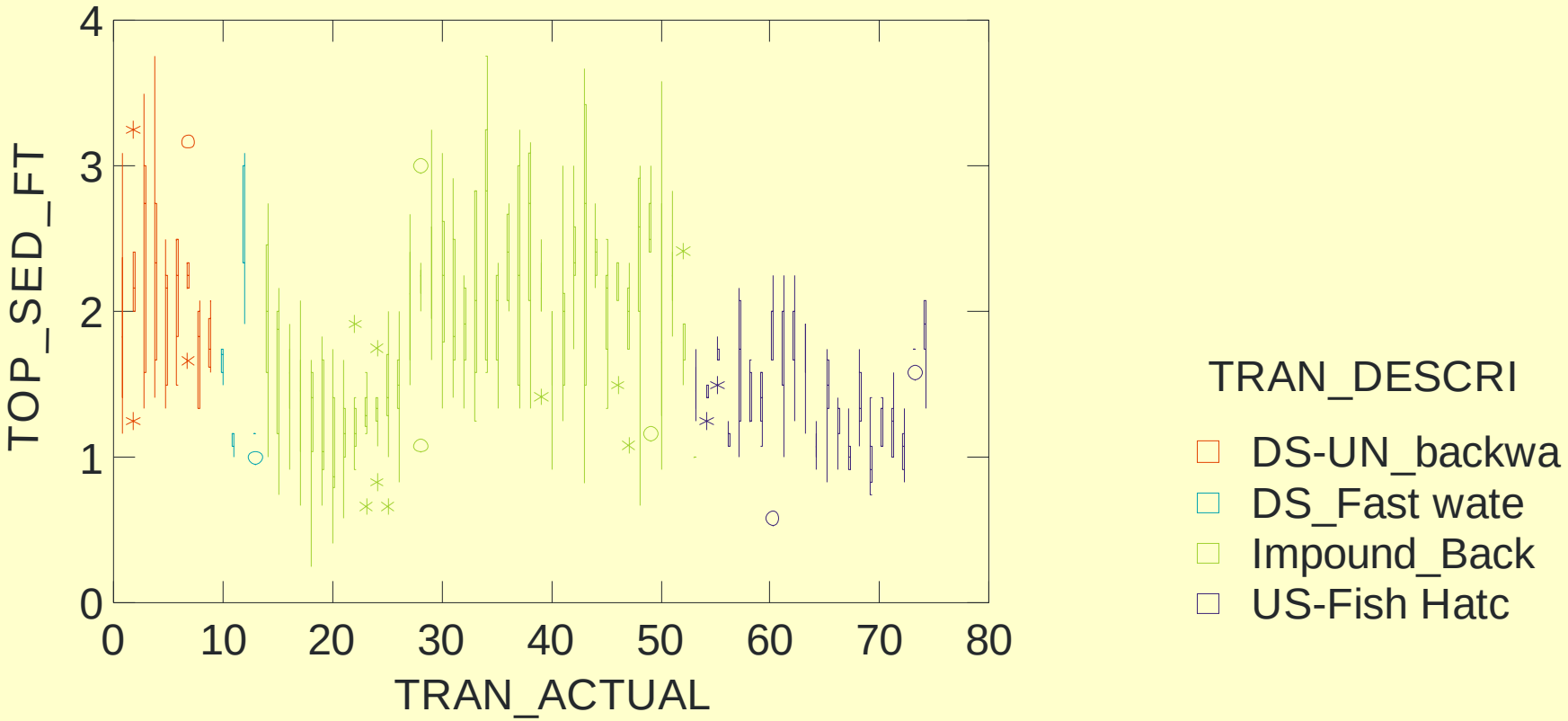
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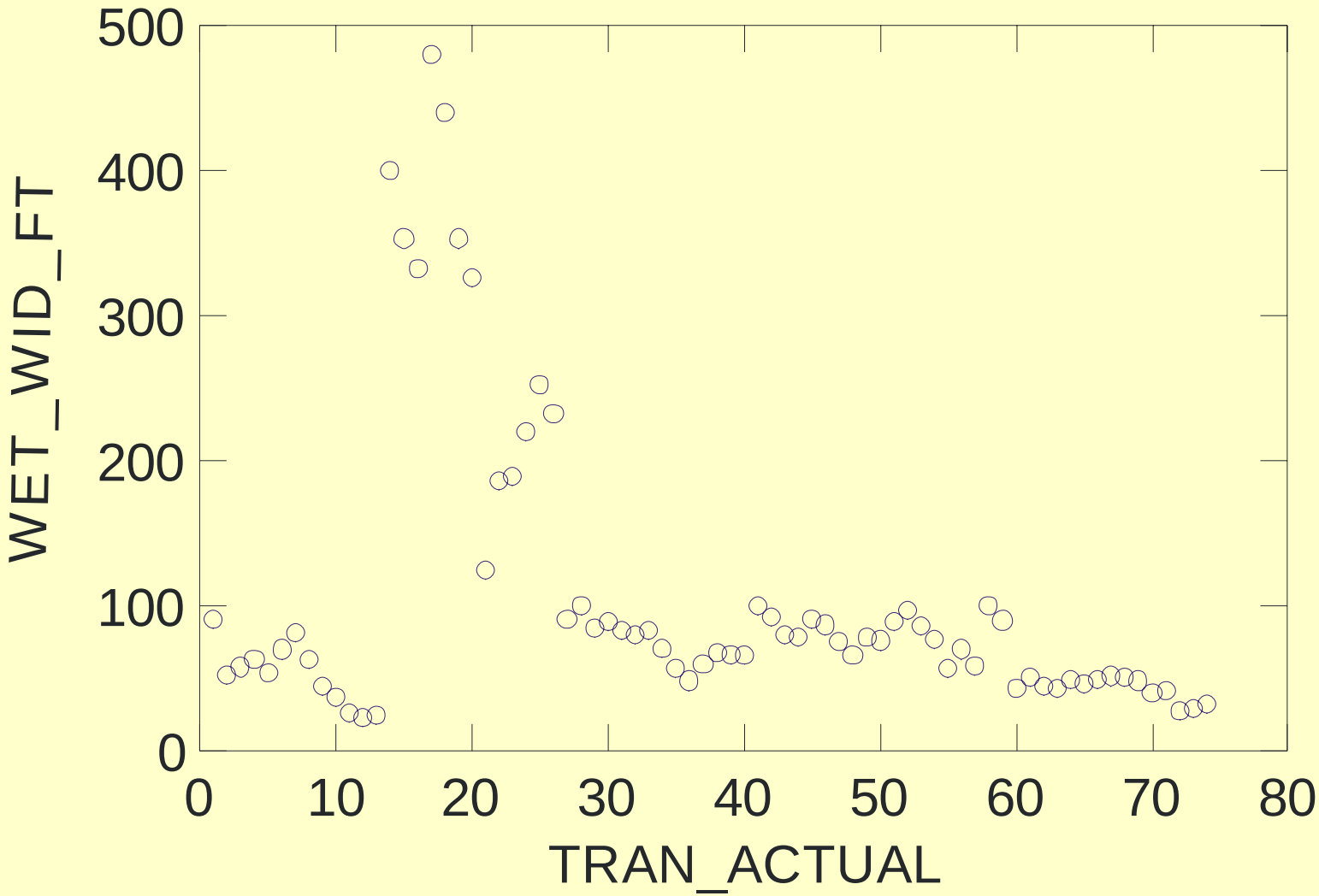
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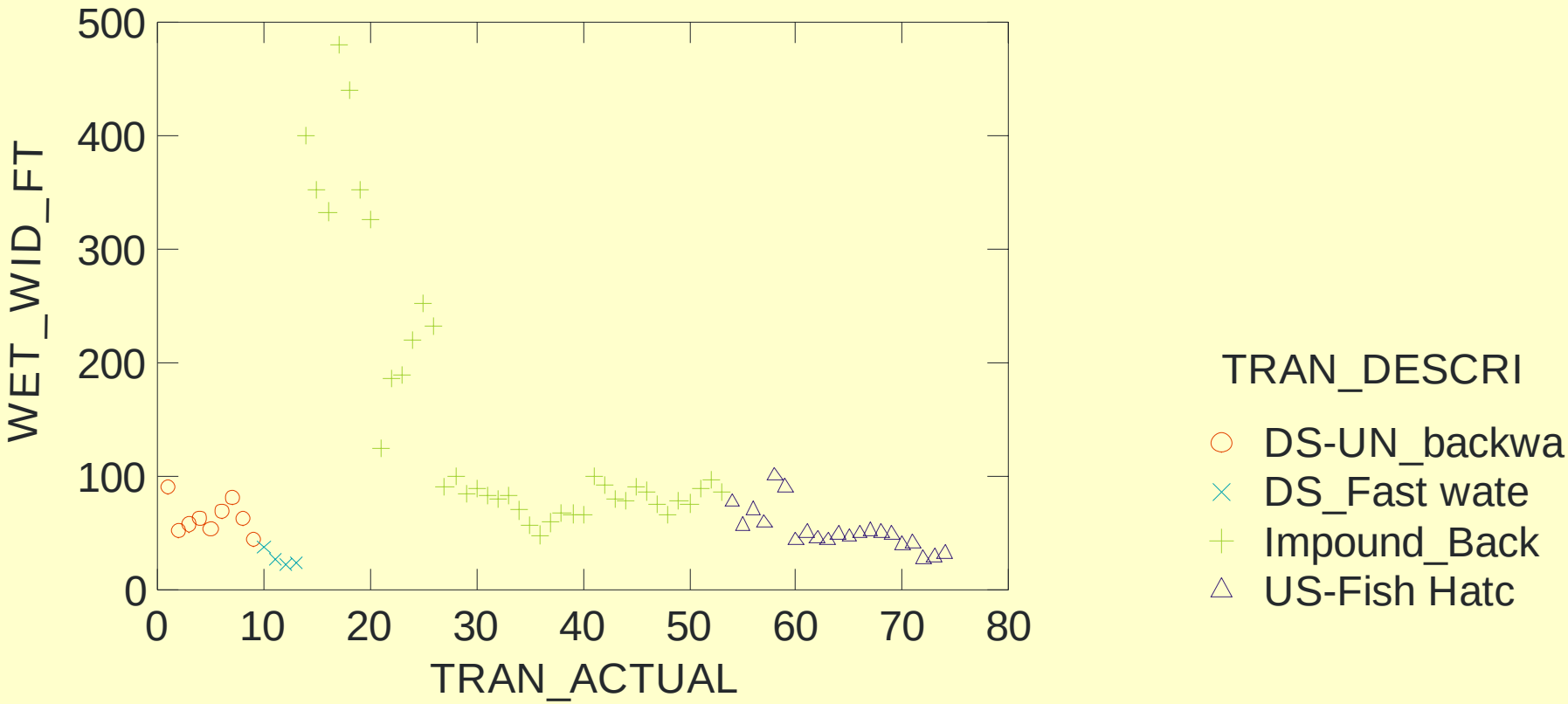
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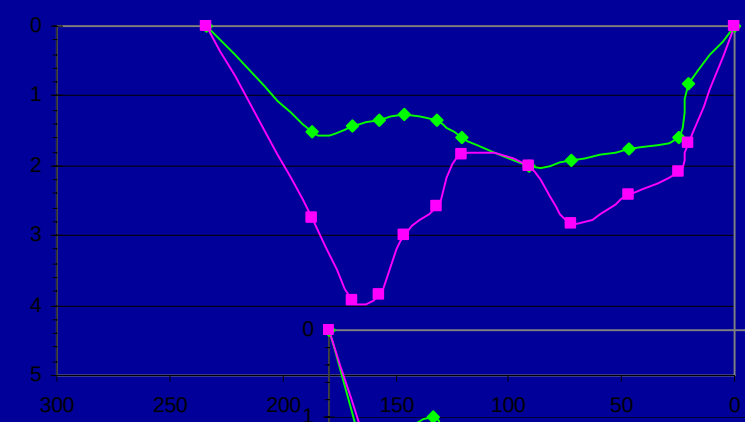
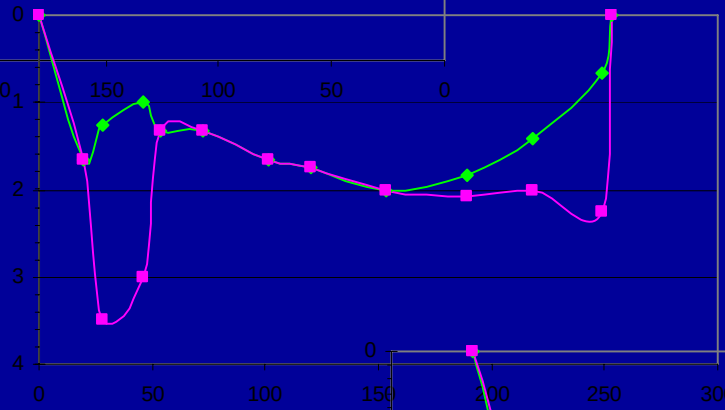
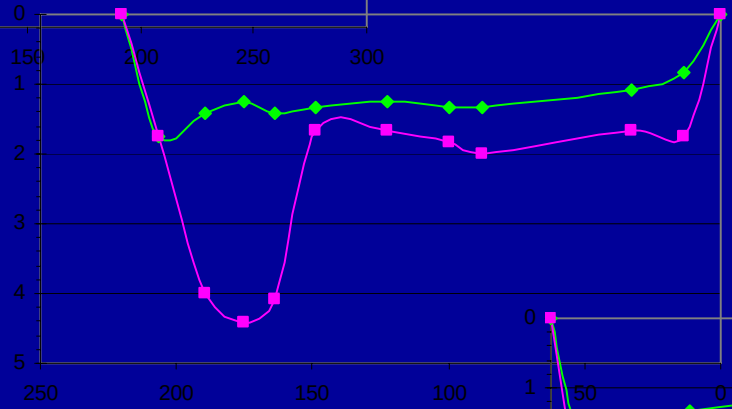
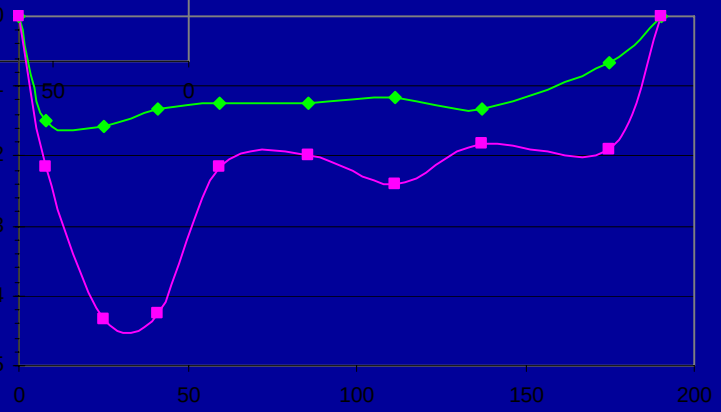
Cross Sections









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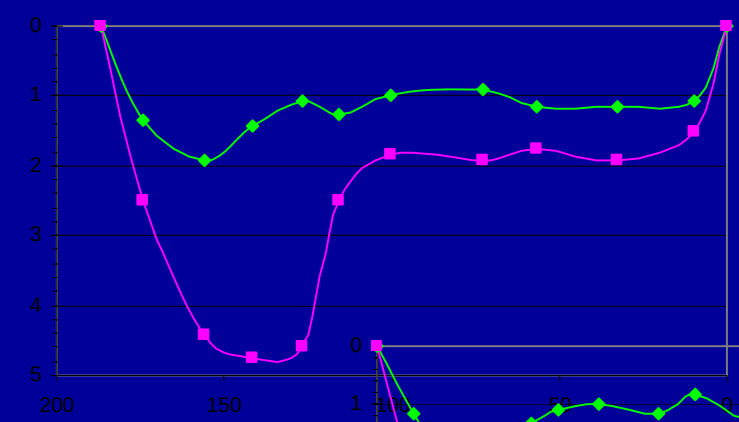

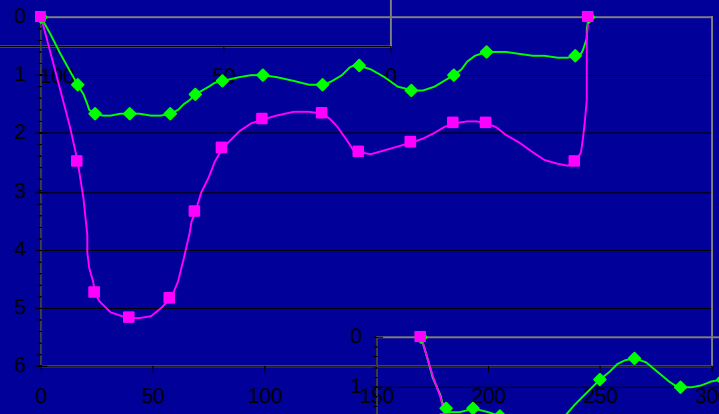

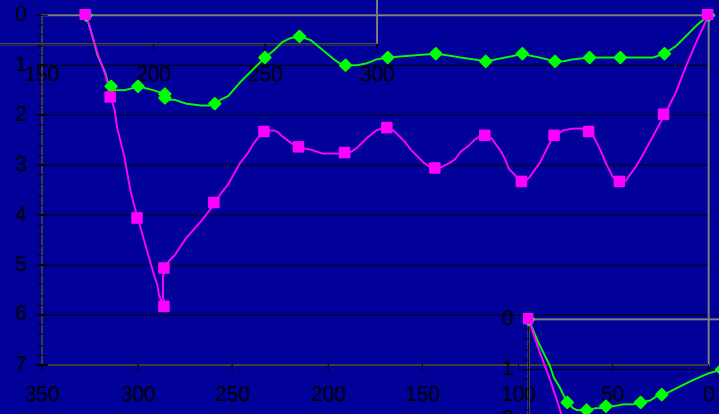

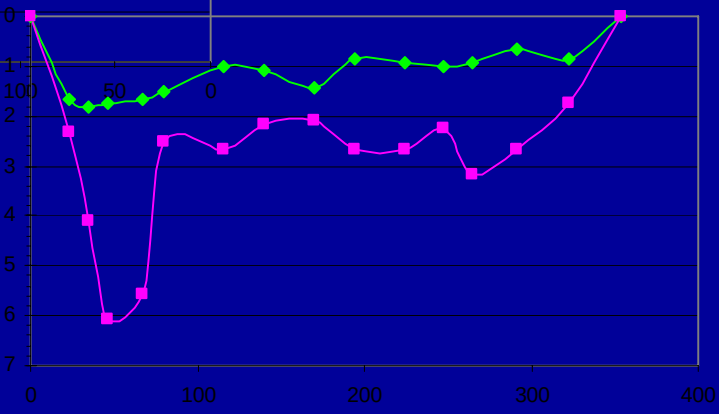

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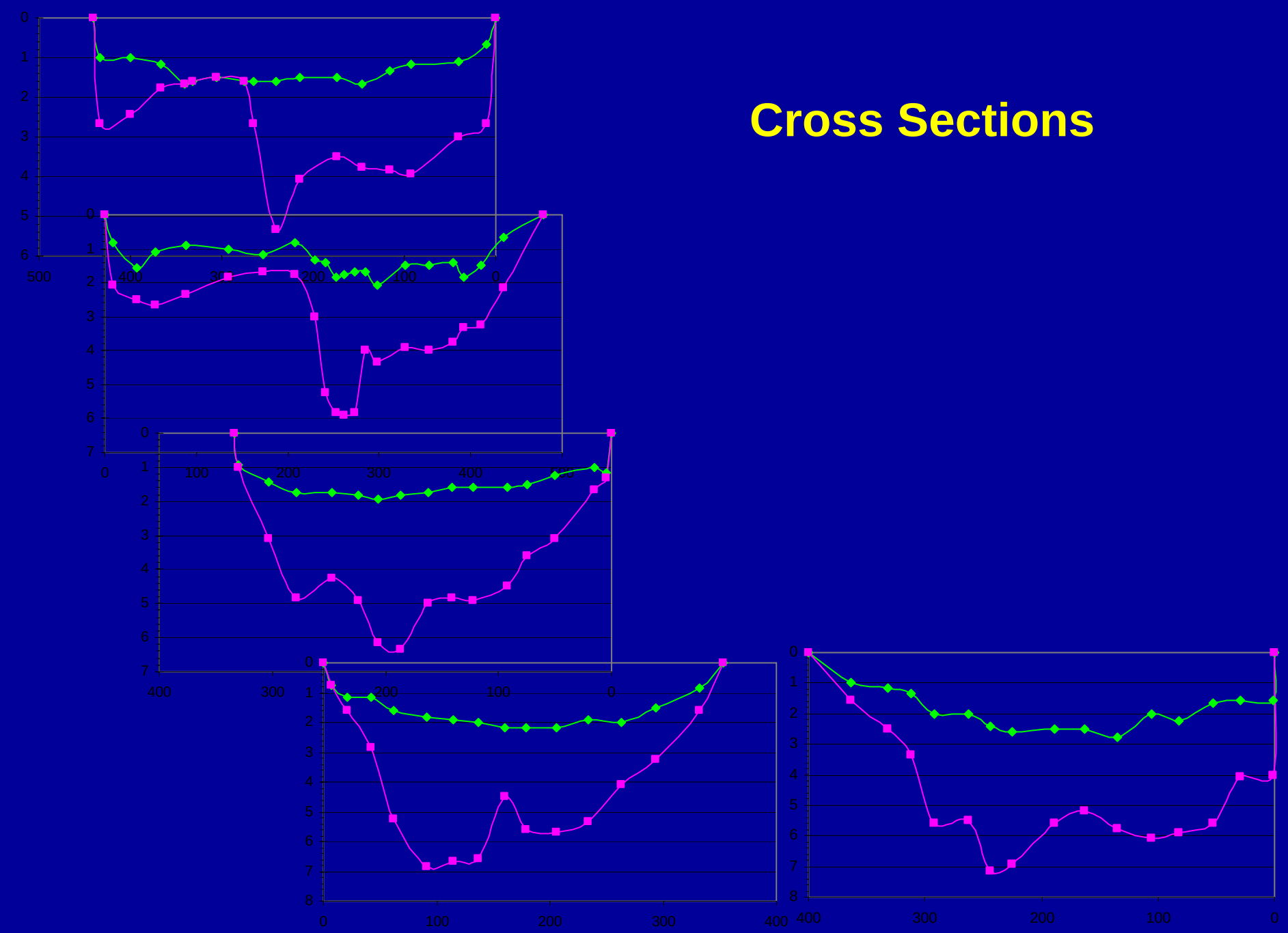
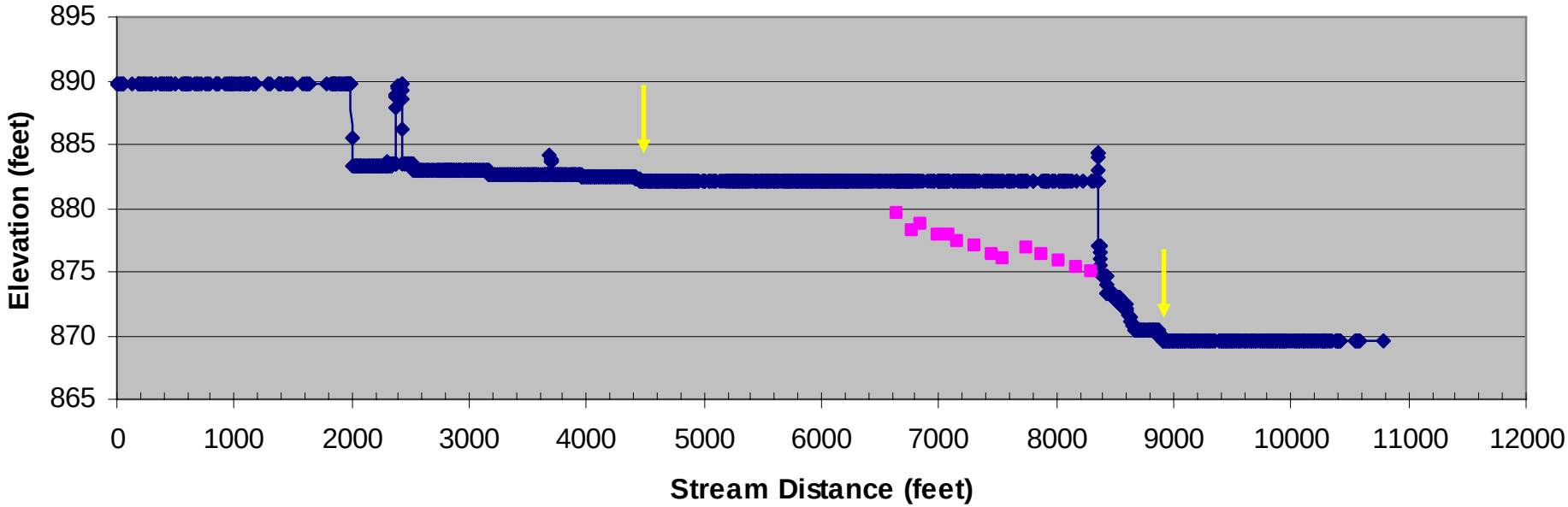


Bark River Elevation Profile

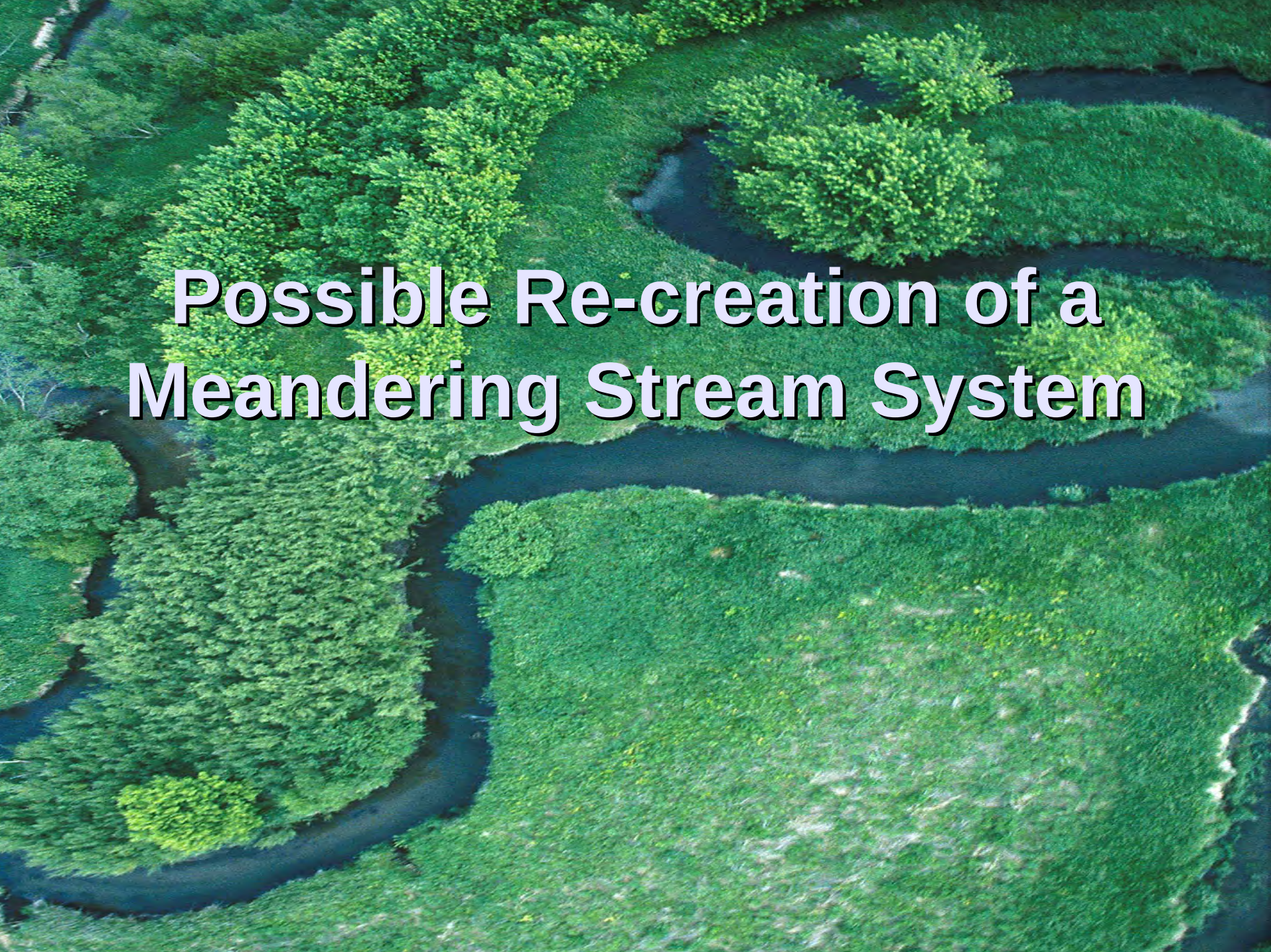


Issues and Concerns

- Physical and chemical aspects of the Middle Bark River
- Establishment a dynamic equilibrium in the new stream ecosystem
- Managing channel adjustments following dam removal

Bark River: 2000

- Water quality is generally good and has improved since the establishment of the Delafield-Hartland Water Pollution Control Commission in the 1970s
- Sediment quality is questionable with records of excessive oil and grease and other potential metals contamination
- Habitat quality and fishery is good except within the impoundment, which is dominated by carp


Possible Re-creation of a
Meandering Stream System

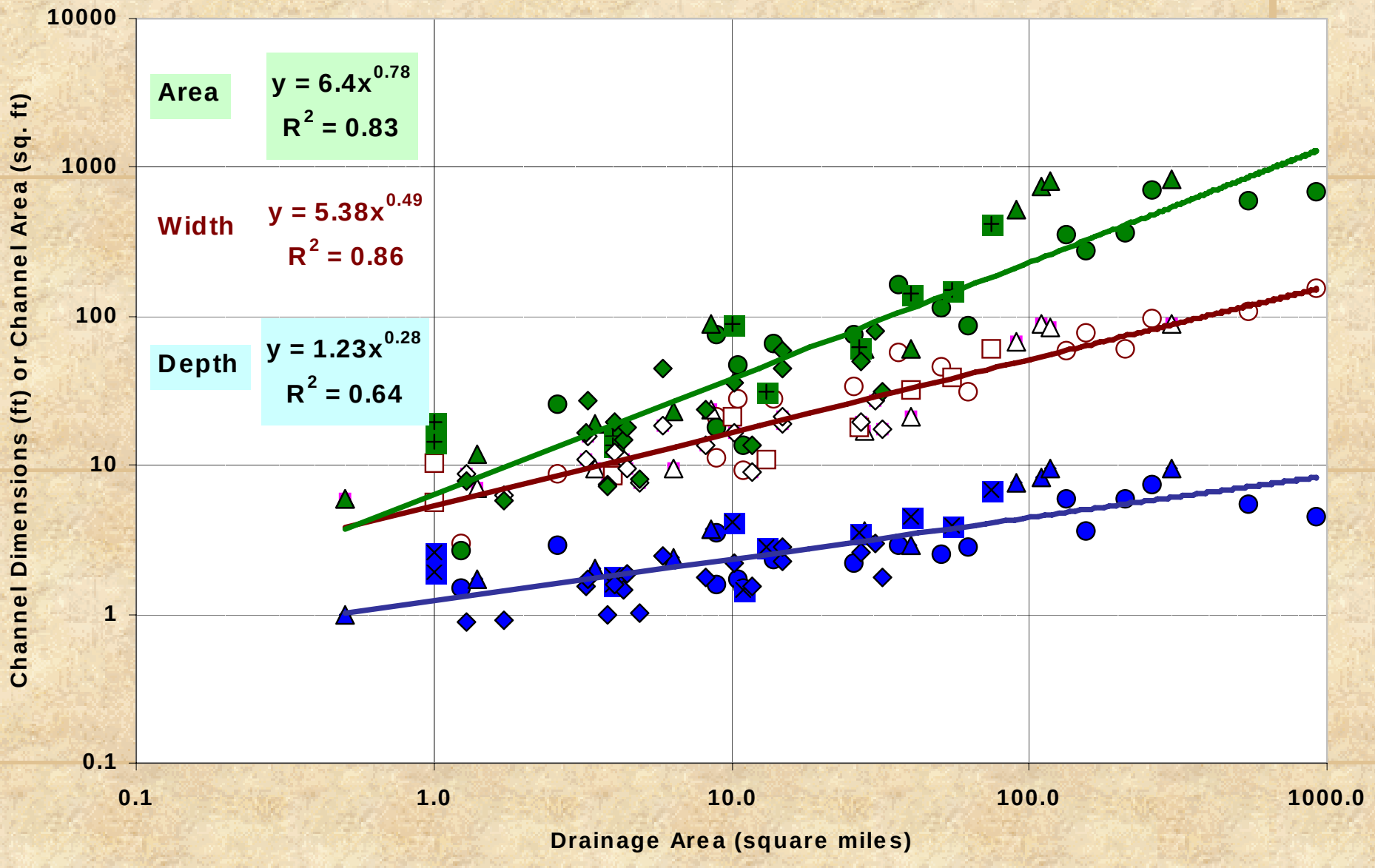
Stream Behavior Is Predictable

- Streams seek a state of dynamic equilibrium
- Equilibrium is a function of the flow and sediment
- Equilibrium is naturally associated with a main channel and a flood-prone area
- Effective (“bankfull”) discharge forms the main channel
- Streams meander in a predictable manner

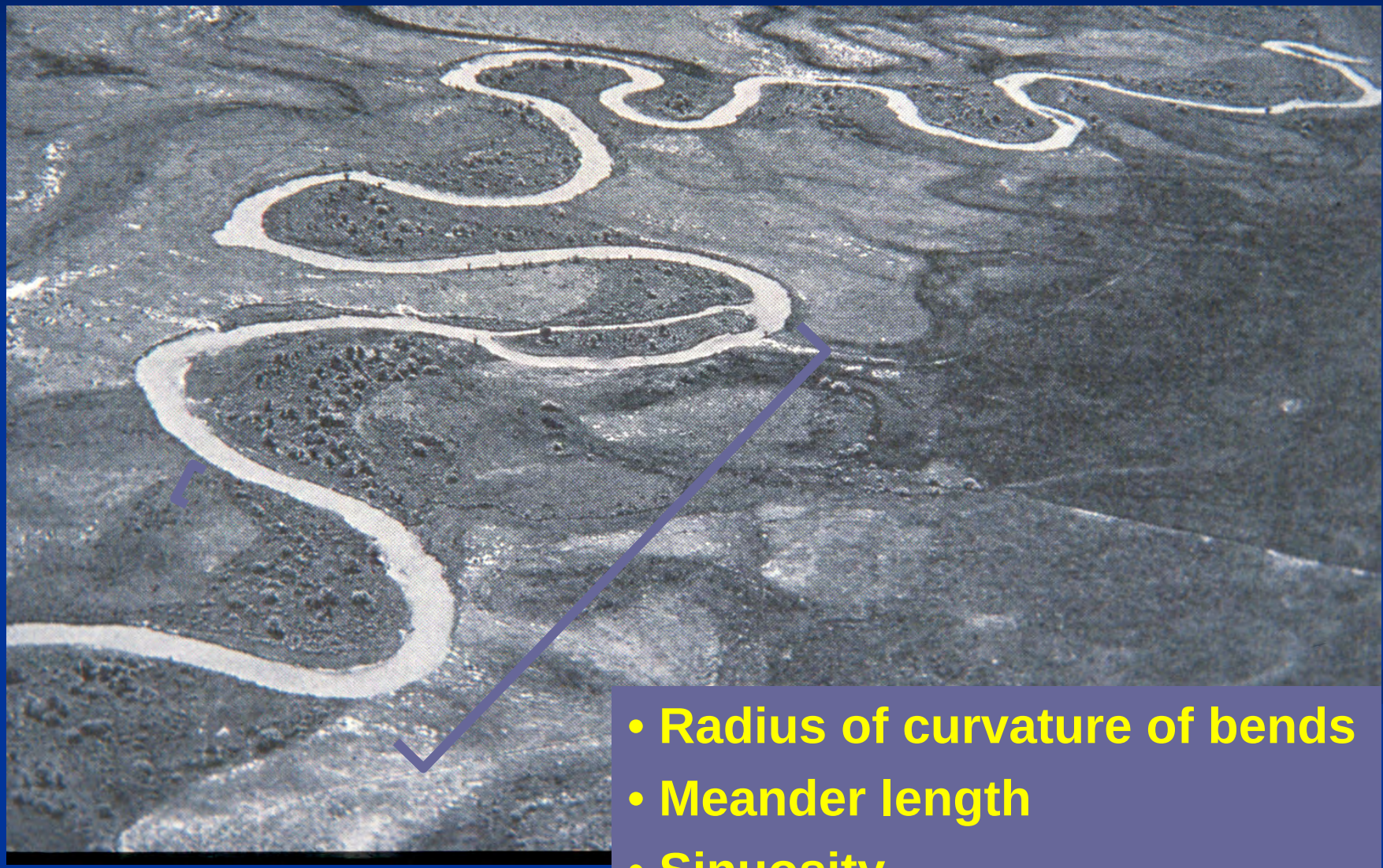
Stream Stability

- Natural stream channel stability is achieved by allowing the river to develop a stable *dimension, pattern and profile* such that channel features are maintained and the stream system neither aggrades nor degrades (Leopold)

Low Gradient Agricultural Watersheds

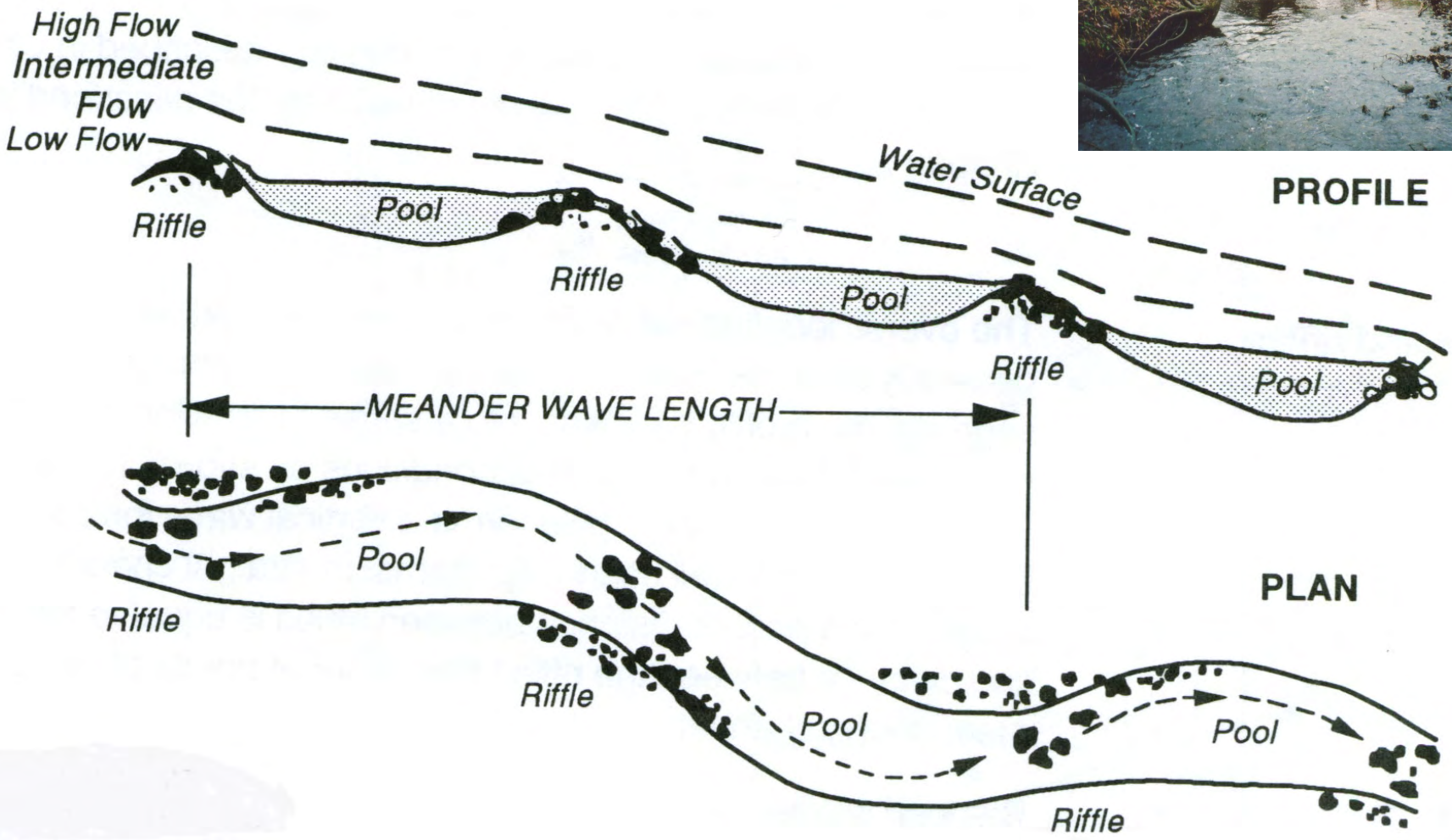


Pattern (Meandering or Sinuosity)



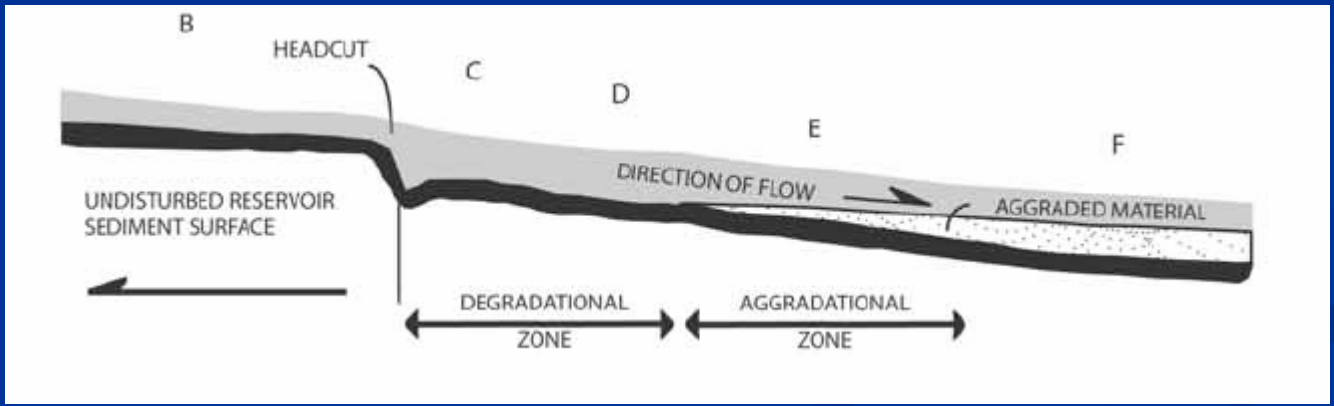
- Radius of curvature of bends
- Meander length
- Sinuosity

Riffle-Pools Features
(Spaced at 5-7 Bankfull Widths)



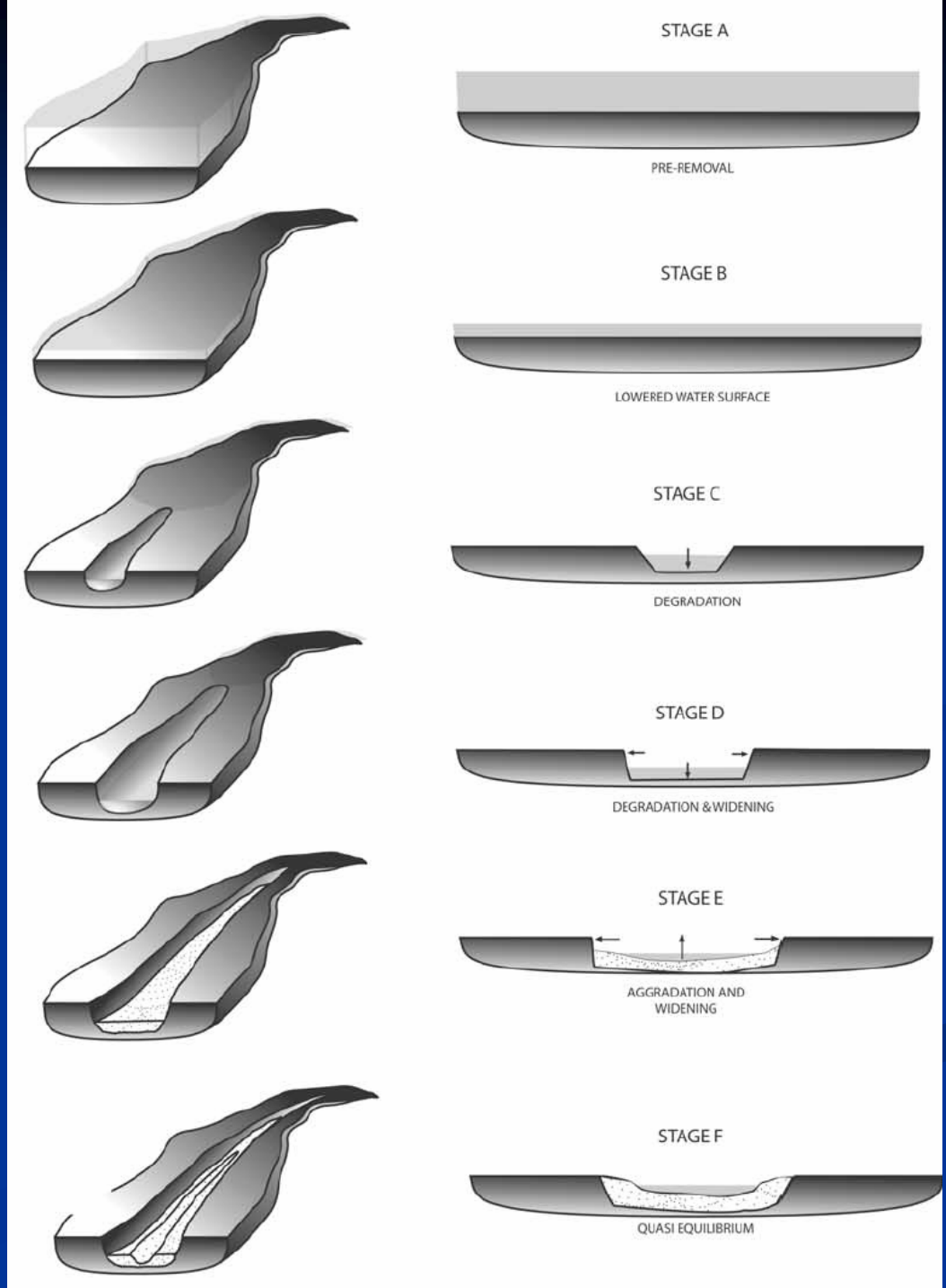
Lakes *versus* Streams: Managing Channel Adjustments

Anticipated Lake Bed Erosion Following Dam Removal (1)



M.W. Doyle, E.H. Stanley, J.M. Harbor, Channel adjustments following two dam removals in Wisconsin, Water Resources Research, Vol. 39, No. 1, 2003.

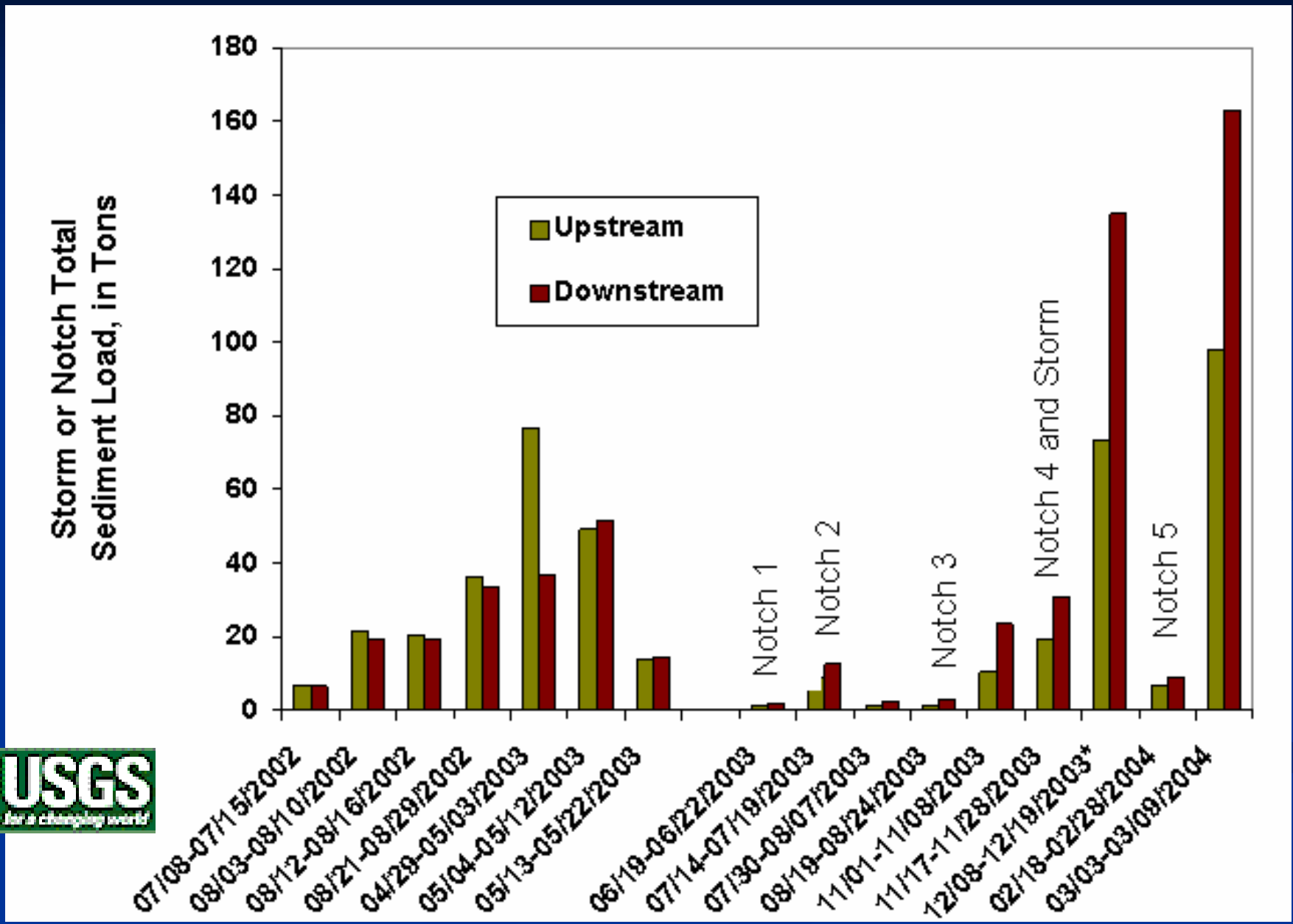
Anticipated Lake Bed Erosion Following Dam Removal (2)



Case Study:
Dam Removal Project-Kane County, IL (1)

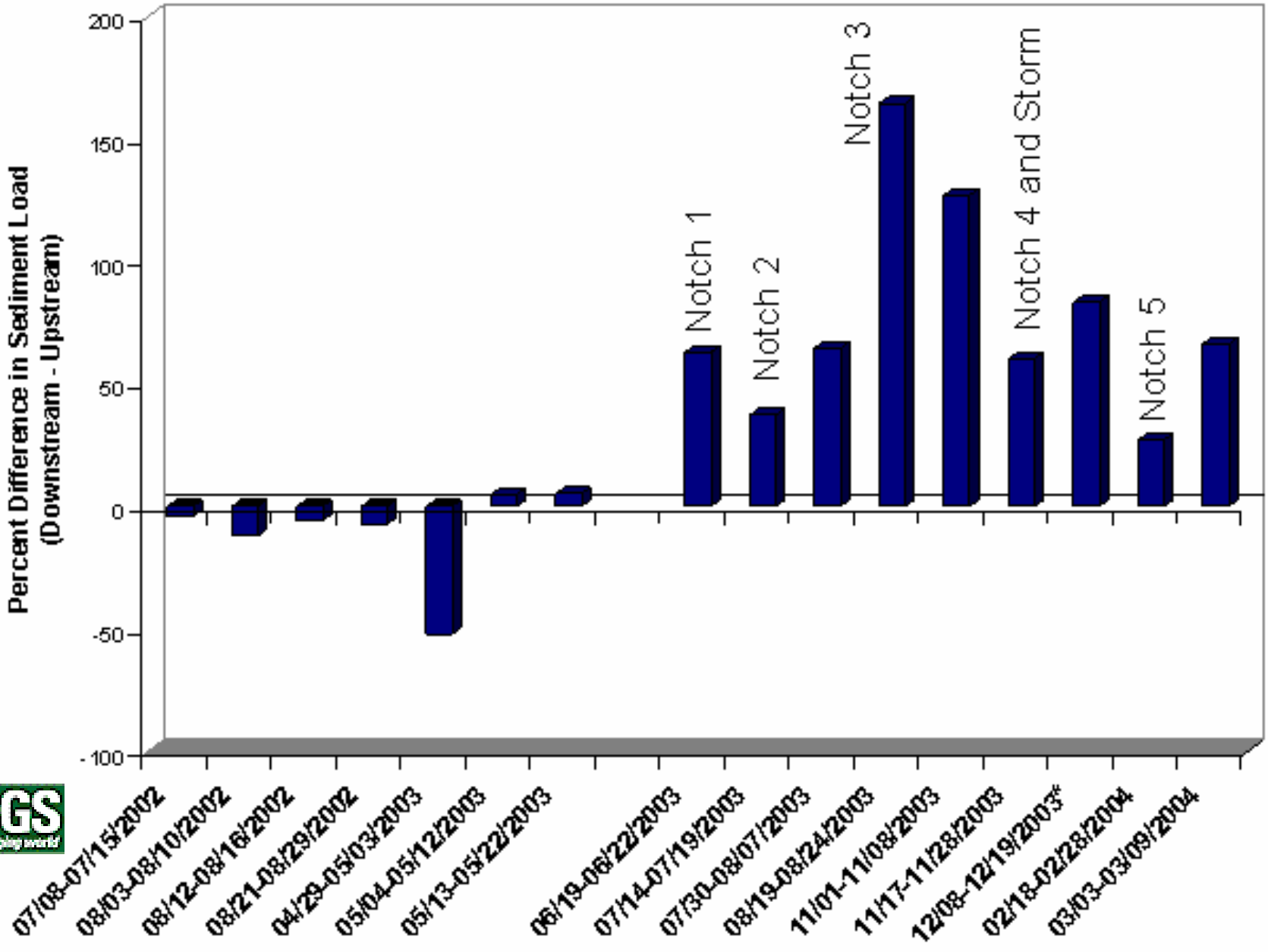
Source: Karen Kosky, Watershed Engineer, Kane County, IL, Brewster Creek Dam Removal and Stream Restoration Project

Dam Removal Project-Kane County, IL (2)



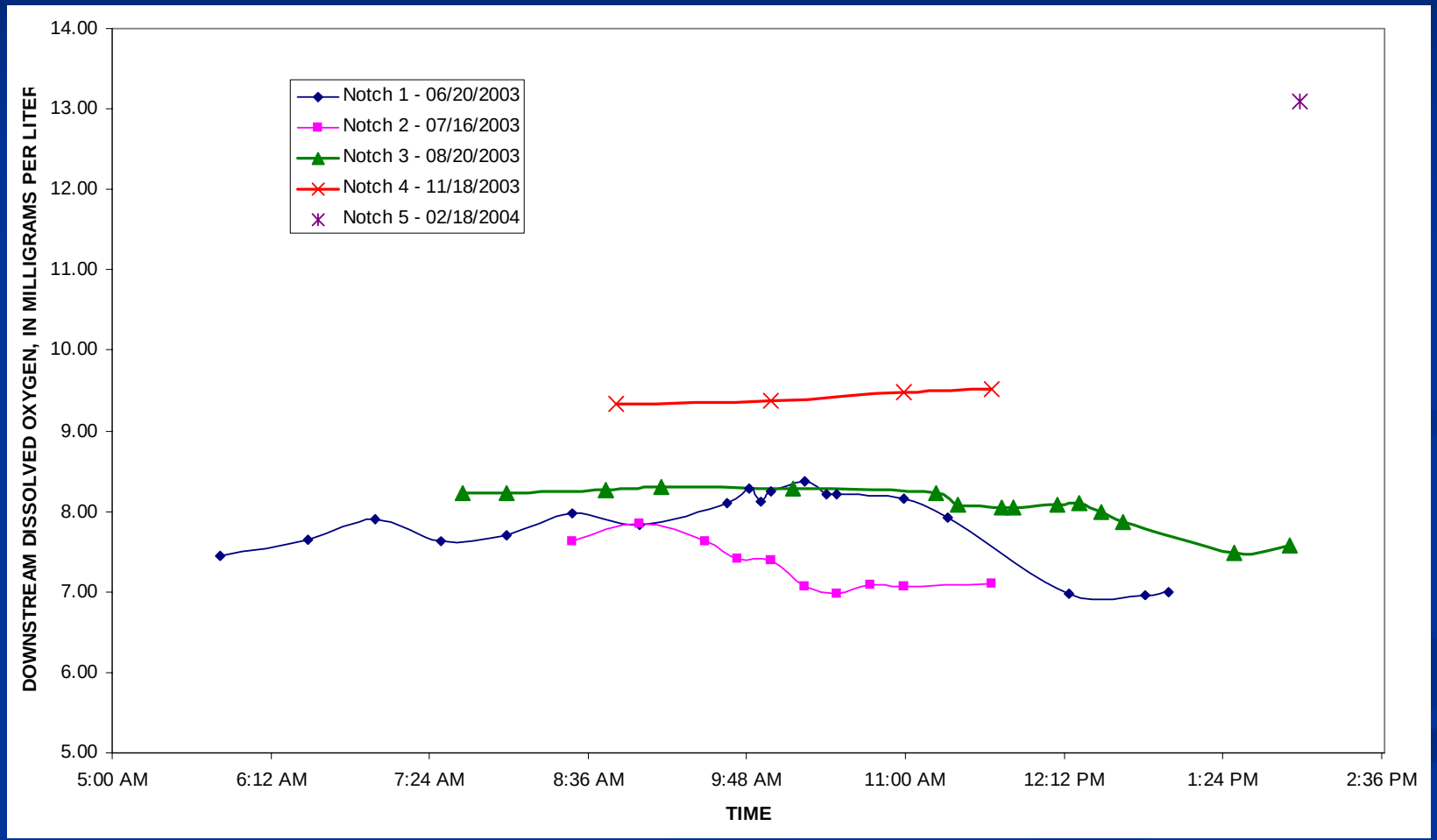
USGS
science for a changing world

Dam Removal Project-Kane County, IL (3)



Dam Removal Project-Kane County, IL (4)

Monitoring Results – Dissolved Oxygen



Genesee Creek Dam Removal Project- Waukesha County, WI

Post-Removal Stabilization Efforts-Genesee Creek Dam Removal Project (1)

Post-Removal Stabilization Efforts-Genesee Creek Dam Removal Project (2)

Alternatives Considered

- Four alternatives considered:
  - Alternative 1: Do nothing-remove dam
  - Alternatives 2, 3A and 3B: Remove dam
  - Alternative 4: Transfer dam permit

Alternative 1

- “Do Nothing”
  - Remove dam boards
  - Notch the structure
  - Allow channel to erode/adjust
  - Remove superstructure-leave foundation of structure in place
- NOT RECOMMENDED
  - Potential for impact to downstream properties and riverine ecosystems (threatened species)

Alternative 2

- Bypass flow through millrace
  - Construct temporary bypass channel through millrace
  - Size for nominal base flow
  - Reconstruct and reconnect historic channel
  - Remove dam structure and appurtances

- NOT RECOMMENDED
  - Likelihood of groundwater inflow within the former lake basin is high
  - Millrace may not be able to accommodate high flows

Alternative 3A

- Create instream sedimentation basin upstream of current dam structure
  - Utilize the “deep hole” behind the dam to capture and retain eroded sediment; remove sediment for offsite disposal
  - Reconstruct and reconnect historic channel
  - Remove dam structure and appurtenances

- NOT RECOMMENDED
  - Cost of sediment removal very high

Alternative 3B

- Create instream sedimentation basin upstream of current dam structure
  - Utilize the “deep hole” behind the dam to capture and retain eroded sediment; reconstruct floodplain within the lake basin using captured sediments
  - Reconstruct and reconnect historic channel
  - Remove dam structure and appurtenances

- RECOMMENDED

Alternative 4

- Repair and maintain current dam structure
  - Transfer operating permit to an eligible entity
  - Permitee implements remedial actions to restore the dam to full structural integrity
- NOT RECOMMENDED
  - Eligible municipal sponsor to whom to transfer operating permit is not forthcoming

Operational Considerations

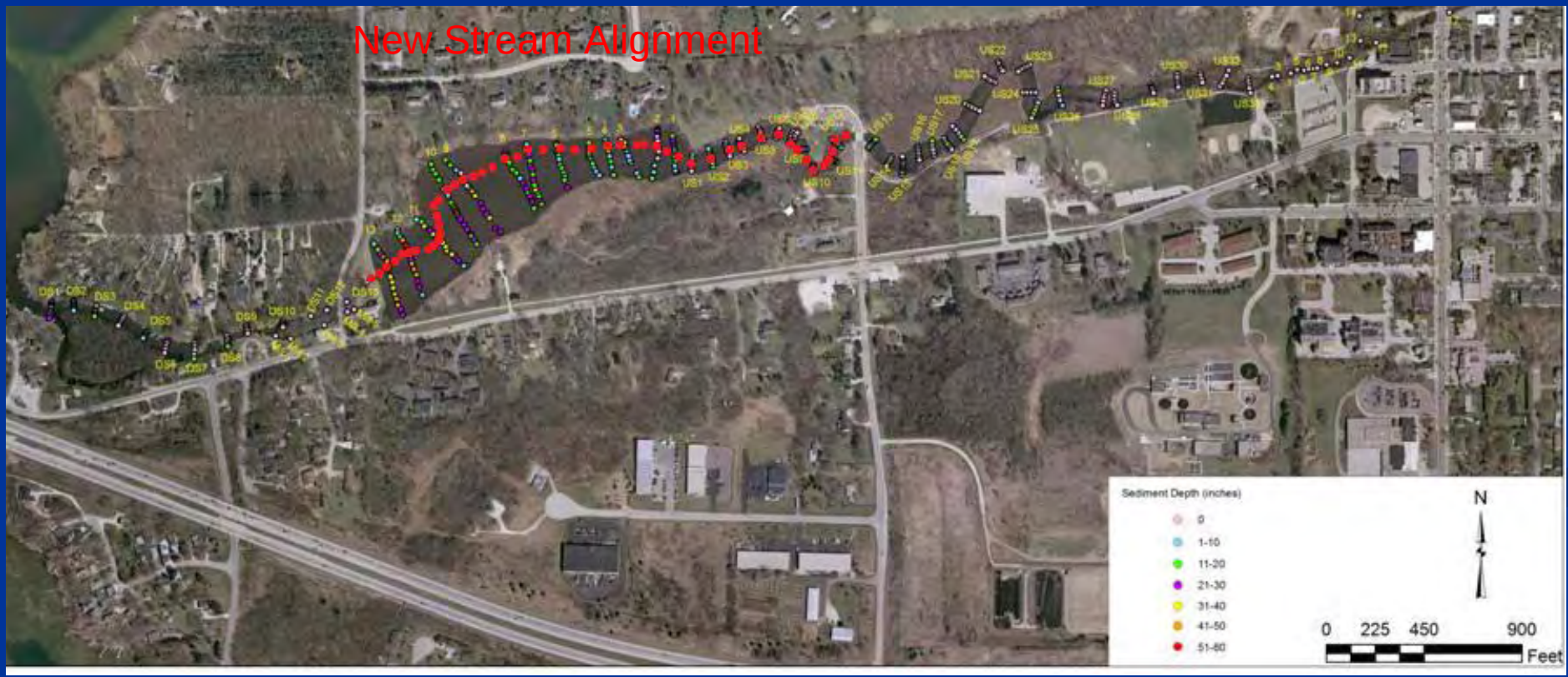
- Objectives
  - Protect the rights and interests of riparian owners both upstream and downstream
  - Protect the integrity of the existing stream ecosystem both upstream and downstream
  - Restore the structure and function of the Middle Bark River, currently impounded by the Roller Mill Dam
  - Minimize downstream impacts by recreating the historic flow channel, controlling erosion, and appropriately staging construction activities

Appropriate Staging

- Complete the outstanding actions identified in the Environmental Assessment (EA)
  - Sediment stabilization plan
  - Erosion control plan
  - Material removal plan
  - Stream bank stabilization plan
  - Planting plan
  - Existing and proposed grades
  - Floodplain analysis
  - Construction sequencing

Plan view of reconstructed stream

- Plan view of new stream—sinuosity and radii of curvatures

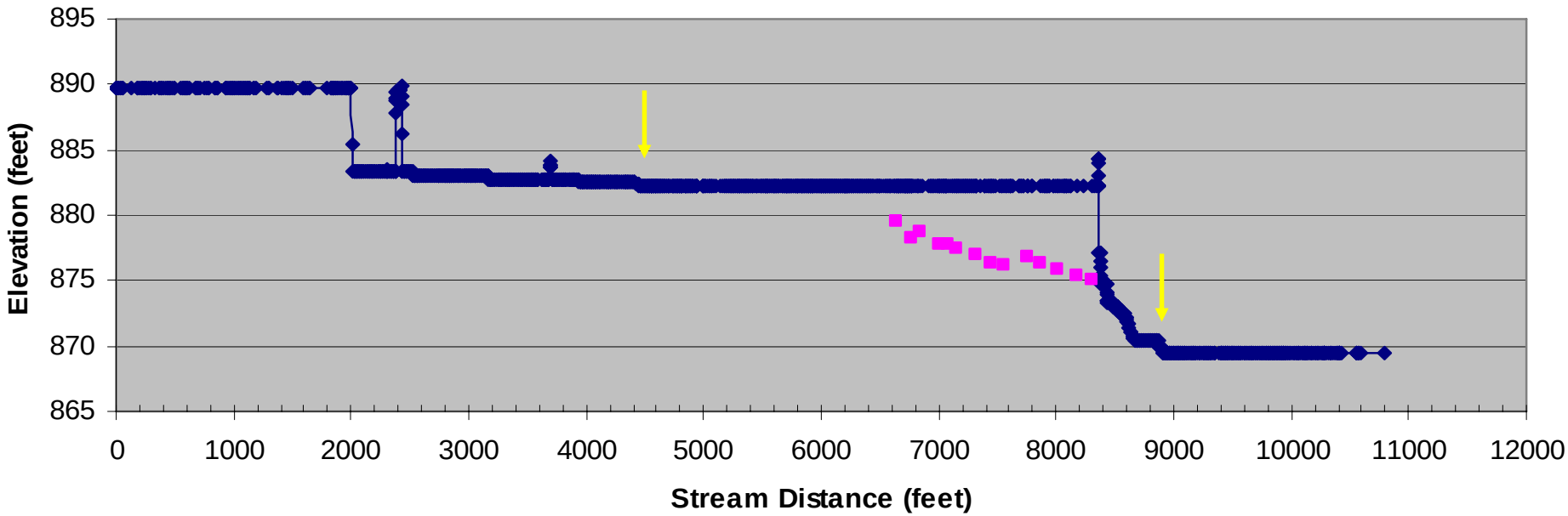


Plan view of reconstructed stream

- Plan view of new stream—sediment management options

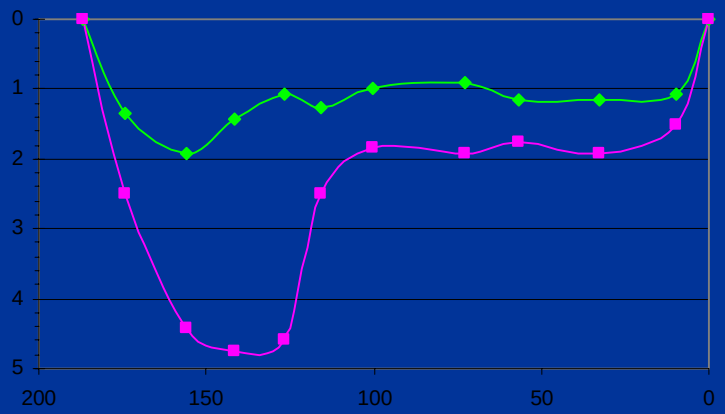
Elevation of reconstructed stream

- Elevations and riffle-pool structure



Cross-section of reconstructed stream

- Cross sections



channel characteristics (feet)

	Avg	Min	Max
Historic channel			
Bankfull Width:	59	34	87
Bankfull Depth	2	1.5	3
Upstream			
Bankfull Width:	54	47	76
Bankfull Depth:	3.0	2.5	3.3
Lowflow Width:	46	40	52
Lowflow Depth:	1.4	1.0	1.7
Downstream			
Lowflow Width:	28	23	38
Lowflow Depth:	1.6	1.4	1.8

Restoration of Shorelands

- Plant species to be planted

Deep Marsh Recommended Rootstock Planting List

Scientific Name	Common Name	Preferred Water Depth (inches)
Pontederia cordata	pickerel weed	4”-18”
Sagittaria latifolia	broad-leaf arrowhead	4”-18”
Sparganium eurycarpum	giant bur reed	1”-18”
Nymphaea tuberosa	American white water-lily	12”-24”
Nuphar luteum	variegated yellow pond-lily	12”-24”
Potamogeton pectinatus	Sago pondweed	24”-96”
Potamogeton amplifolius	large-leaved pondweed	24”-96”

Restoration of Shorelands

- Plant species to be planted

Shallow Marsh Recommended Rootstock Planting List

Scientific Name	Common Name	Preferred Water Depth (inches)
Scirpus americanus	true three square bulrush	4”-18”
Scirpus atrovirens	green bulrush	1”-18”
Scirpus cyperinus	wool grass	1”-18”
Scirpus fluviatilis	river bulrush	1”-18”
Juncus effusus	soft rush	1”-18”
Spartina pectinata	prairie cord grass	Damp to muddy
Alisma subcordatum	water plantain	Damp to muddy
Acorus calamus	sweet flag	Damp to muddy
Carex lacustris	lake sedge	Damp to muddy

Restoration of Shorelands

- Plant species to be planted

Shrub Recommended Planting List

Scientific Name	Common Name
Spirea alba	meadow-sweet
Viburnum trilobum	high bush cranberry
Cornus stolonifera	red osier dogwood

Restoration of Shorelands

- Plant species to be planted

Wet Meadow Recommended Seeding List

Scientific Name	Common Name	Pounds Per Acre
Carex vulpinoidea	fox sedge	1.0
Carex hystricina	porcupine sedge	1.0
Elymus canadensis	Canada wild rye	3.0
Elymus virginicus	Virginia wild rye	2.0
Glyceria striata	fowl manna grass	2.0
Aster simplex	marsh aster	0.75
Helenium autumnale	sneezeweed	0.75
Verbena hastata	blue vervain	0.75
Eupatorium perfoliatum	boneset	0.75

Thank You!