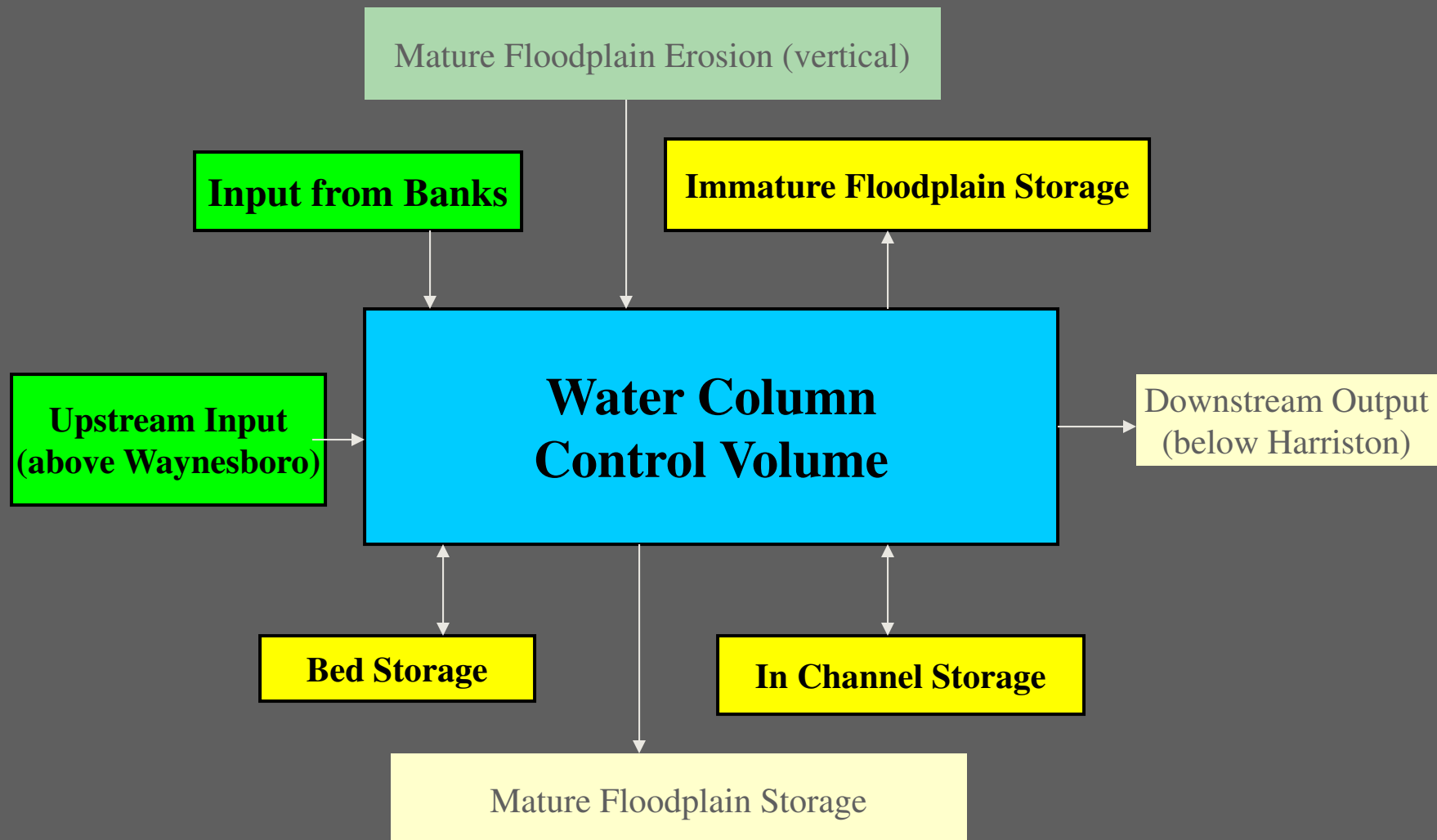


Geomorphology Progress: Updated Sediment Budget and Mud Mapping

Jim Pizzuto

Katie Skalak

Sediment Budget



Upstream Inputs

- ➡ Constructed a dimensionless sediment rating curve using data from nearby watersheds
- ➡ Fit a power function to the data
- ➡ Used 2 years of discharge data for South River at Waynesboro as input to the empirical rating curve to estimate sediment annual sediment inputs.

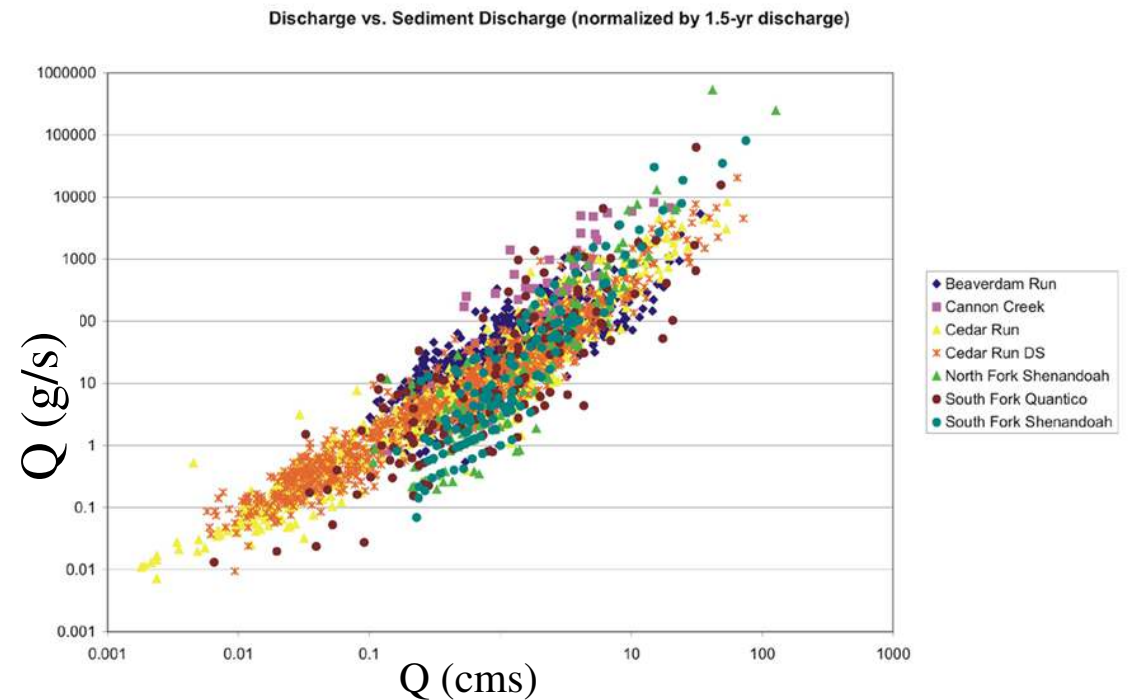
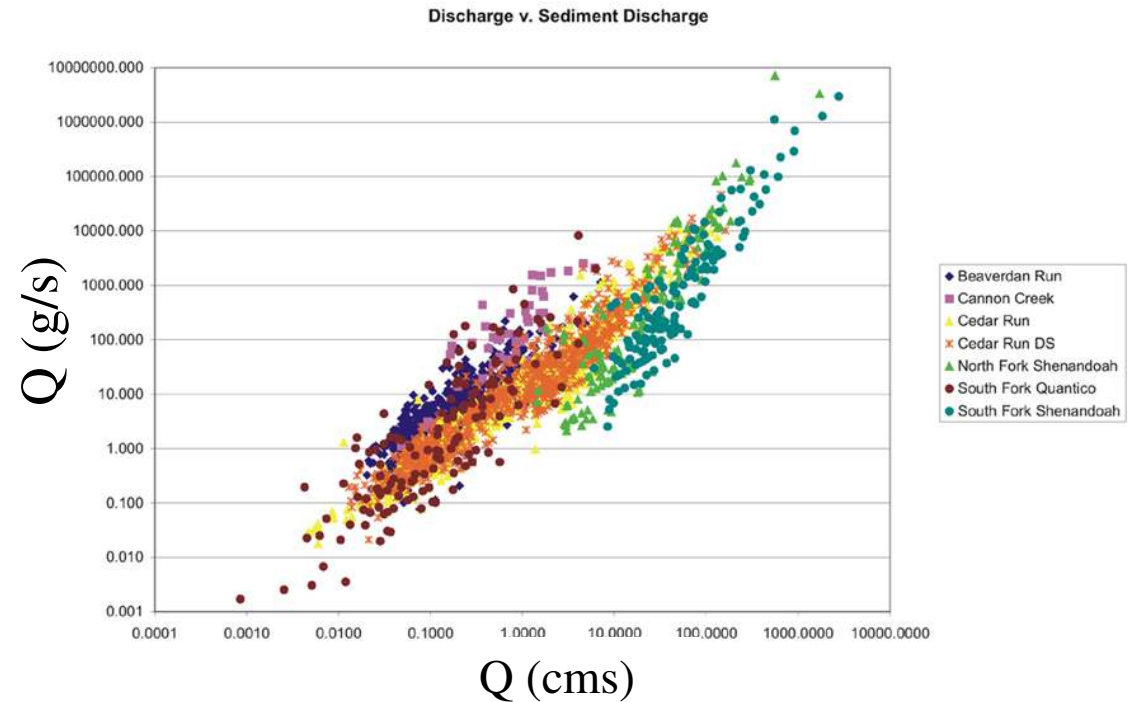
Dimensionless Sediment Rating Curves

-Constructed using USGS data for nearby sites

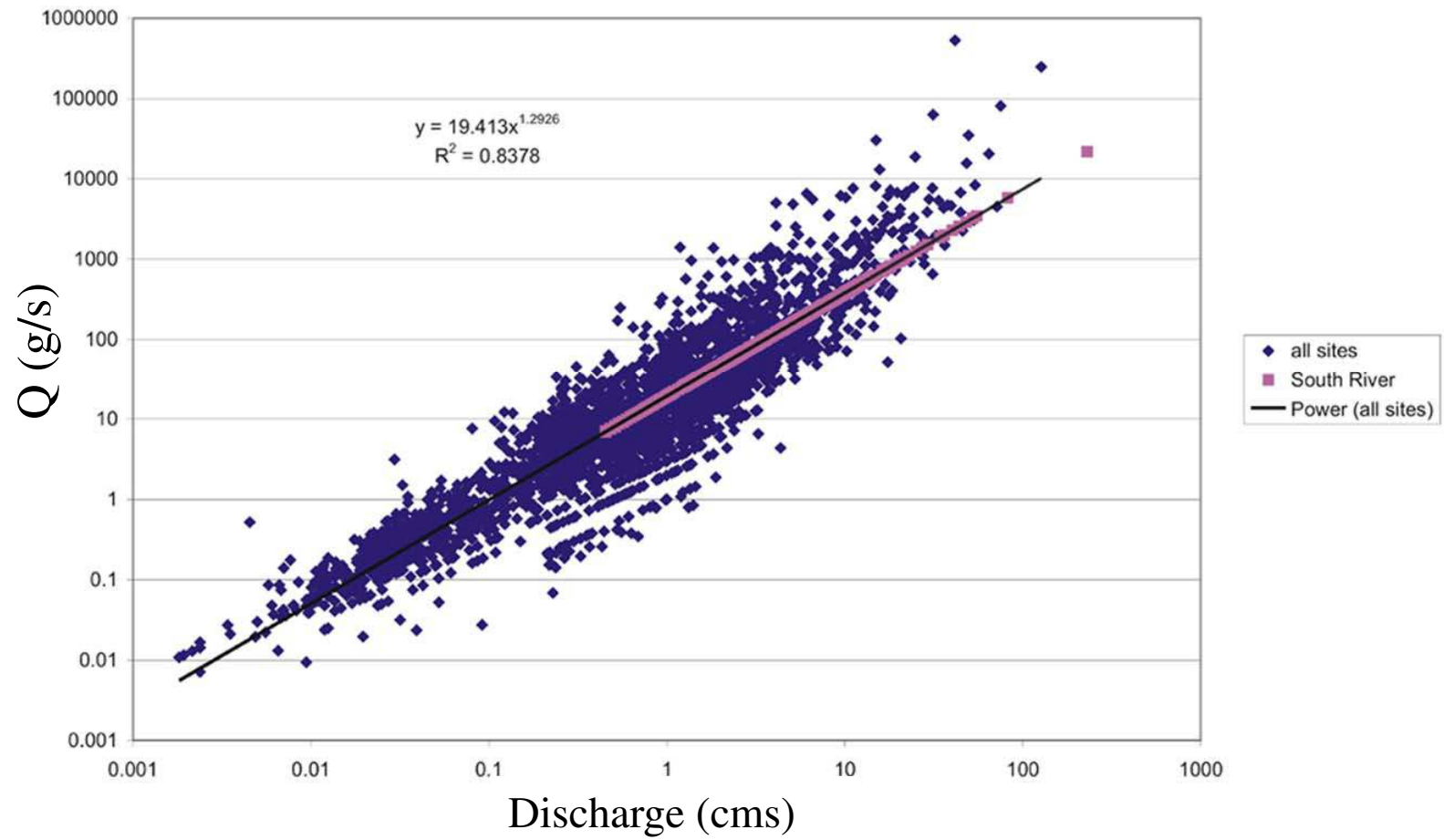
-Suspended Sediment Discharge (g/s) vs Water Discharge (cubic meters/s)

-top curve is data for all sites

-bottom curve is data normalized by the 1.5-year discharge

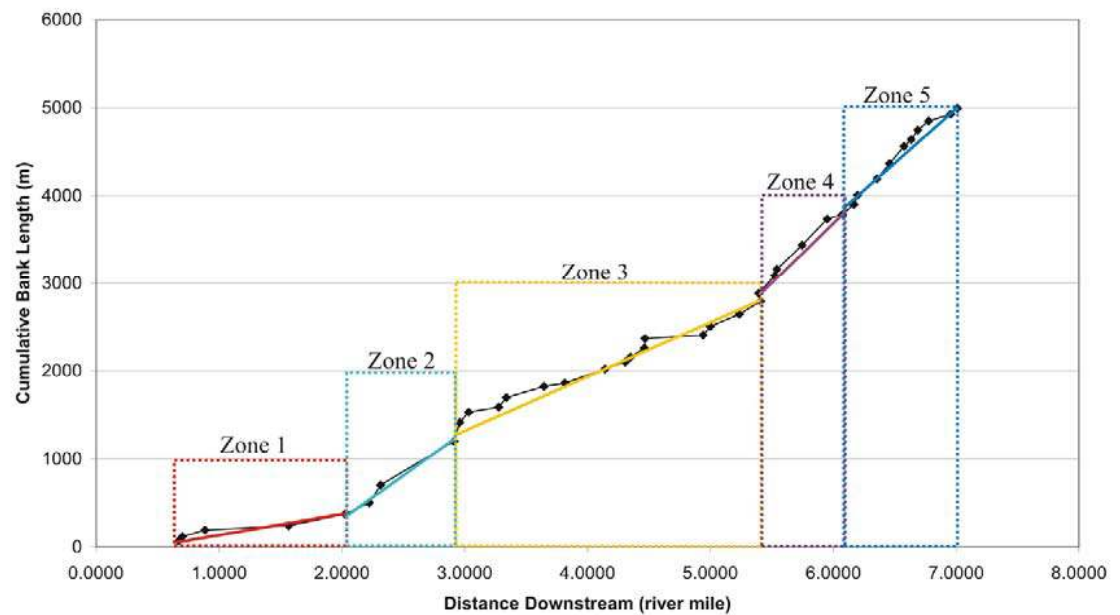


Dimensionless Sediment Rating Curve

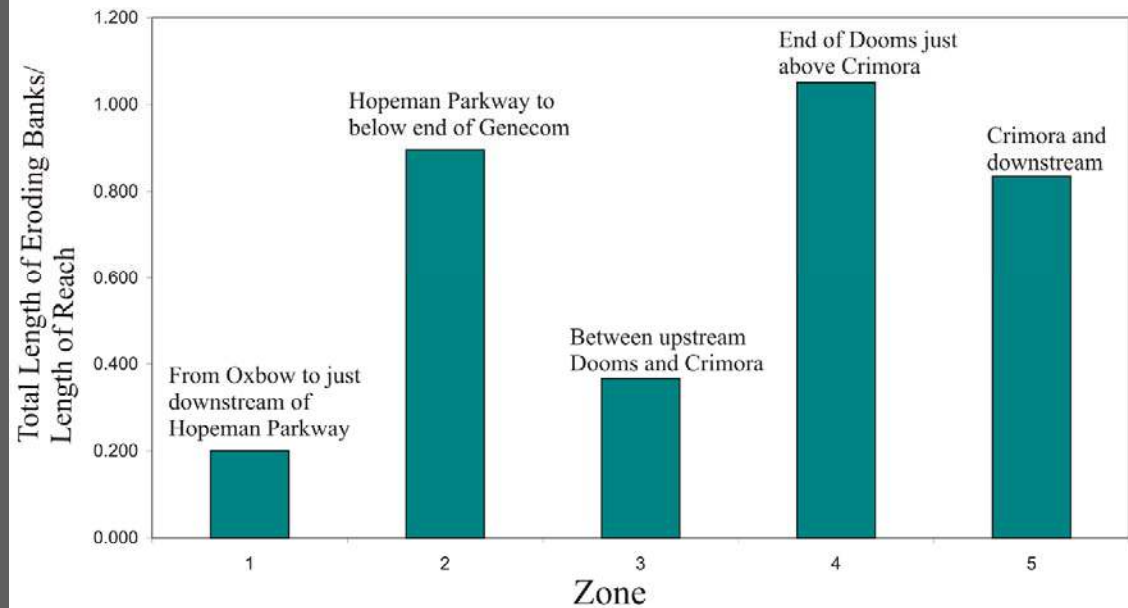


Bank Erosion Inputs

Cumulative Bank Length vs. Distance Downstream



Fraction of Eroding Bank in River Zone



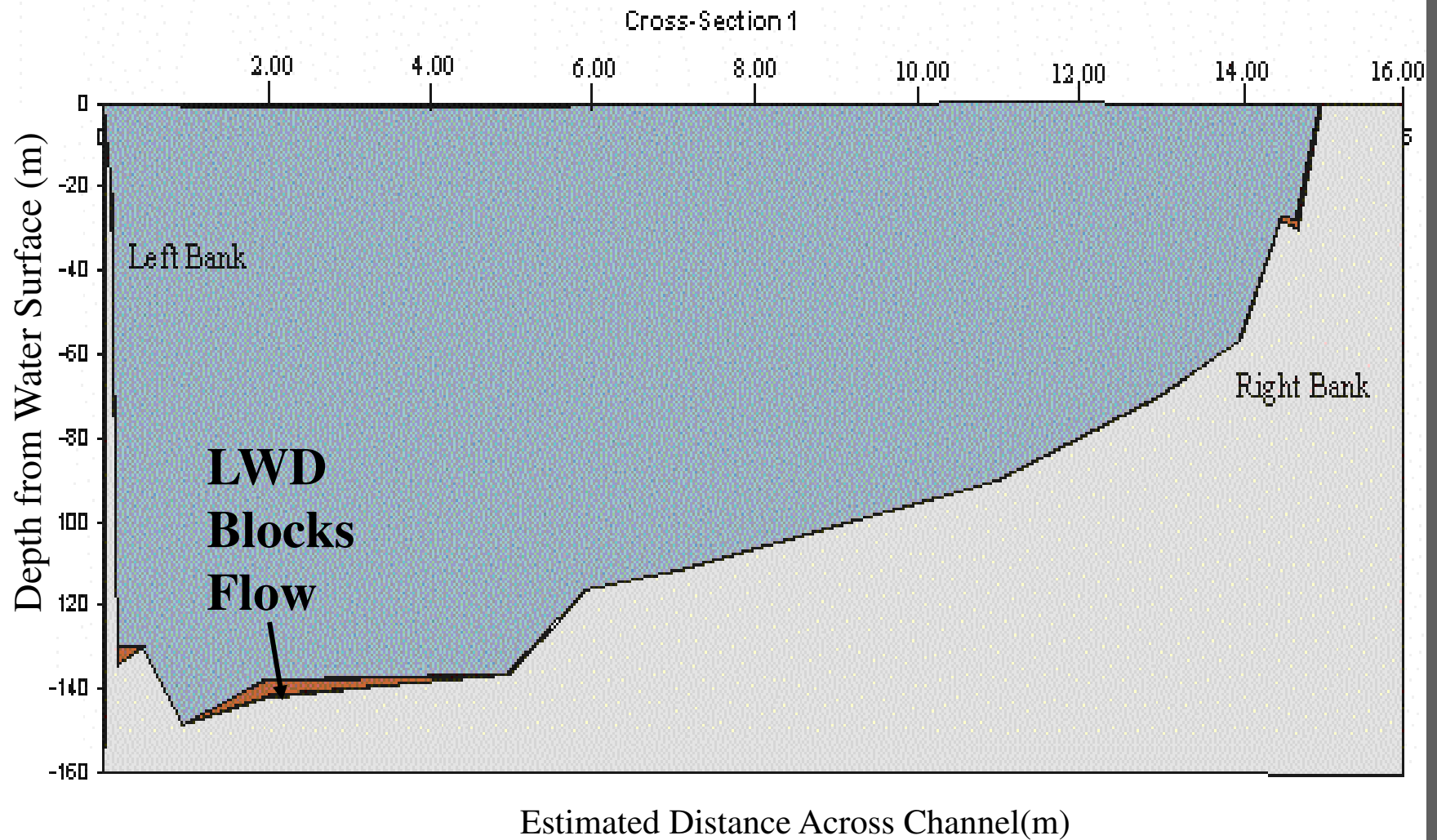
Bank Erosion

- ➔ Rates obtained from 1937 and 1994 aerial photos at 4 locations near Crimora (a first crude estimate)
- ➔ Multiplied by fraction of reach with eroding banks
- ➔ Assumed height of 2 m, reach length of geomorphic maps
- ➔ Assumed 50% silt-clay

Bed Storage

- ➡ Assumed an active layer thickness of 0.2 m
- ➡ Assumed a fraction of silt and clay of 5%
- ➡ Channel width 20 m
- ➡ Bed storage was assumed to have a residence time of one year, therefore is neglected in an annual sediment budget
- ➡ Refers to interstitial fine-grained storage

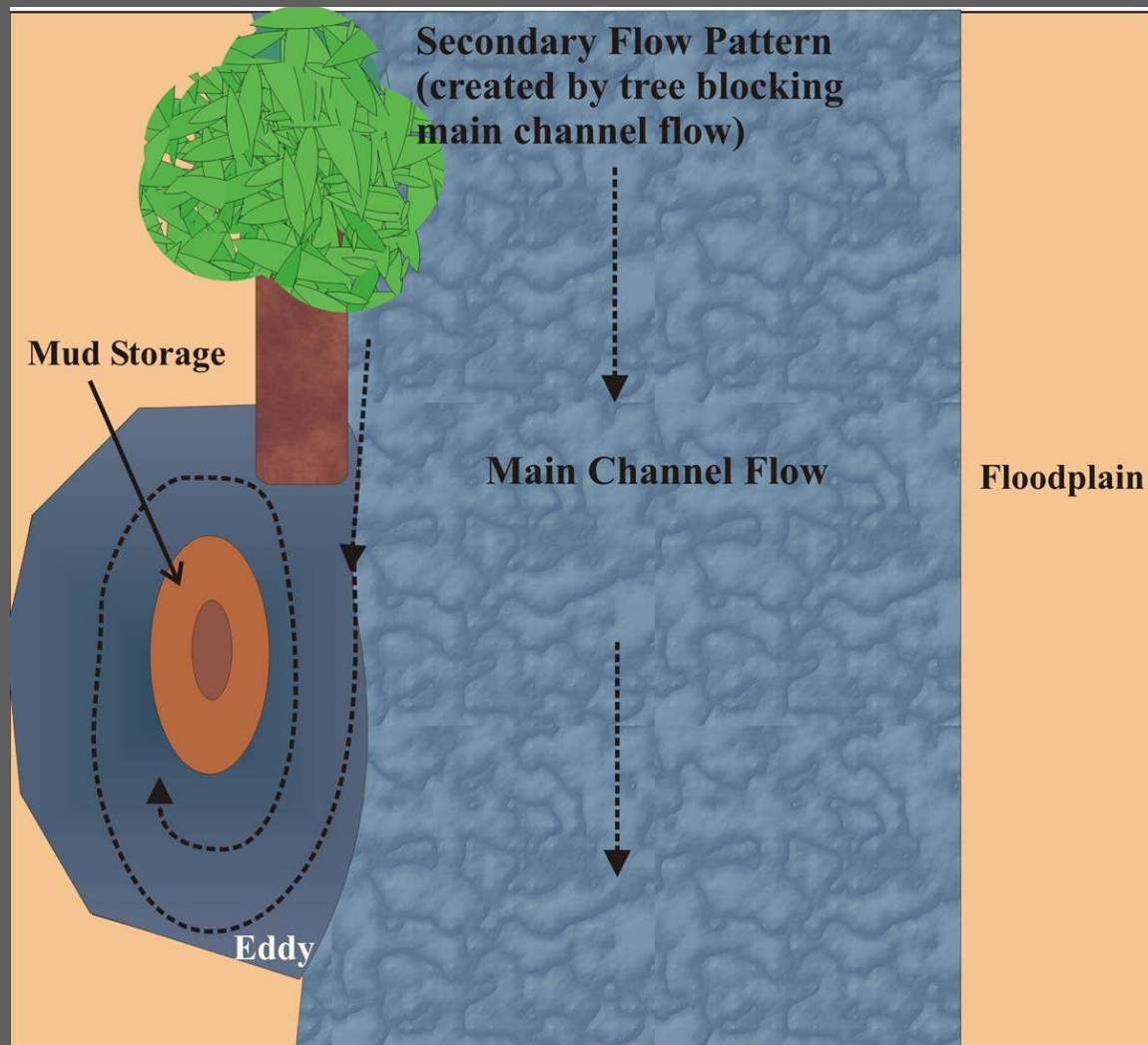
In Channel Storage



In Channel storage

- ➡ Refers to all storage in channel except interstitial bed storage
- ➡ Estimated area from the 7 cross-sections
- ➡ NOTE: cannot assign a residence time for most of this, need a tracer (i.e. cosmogenic radionuclide)!!

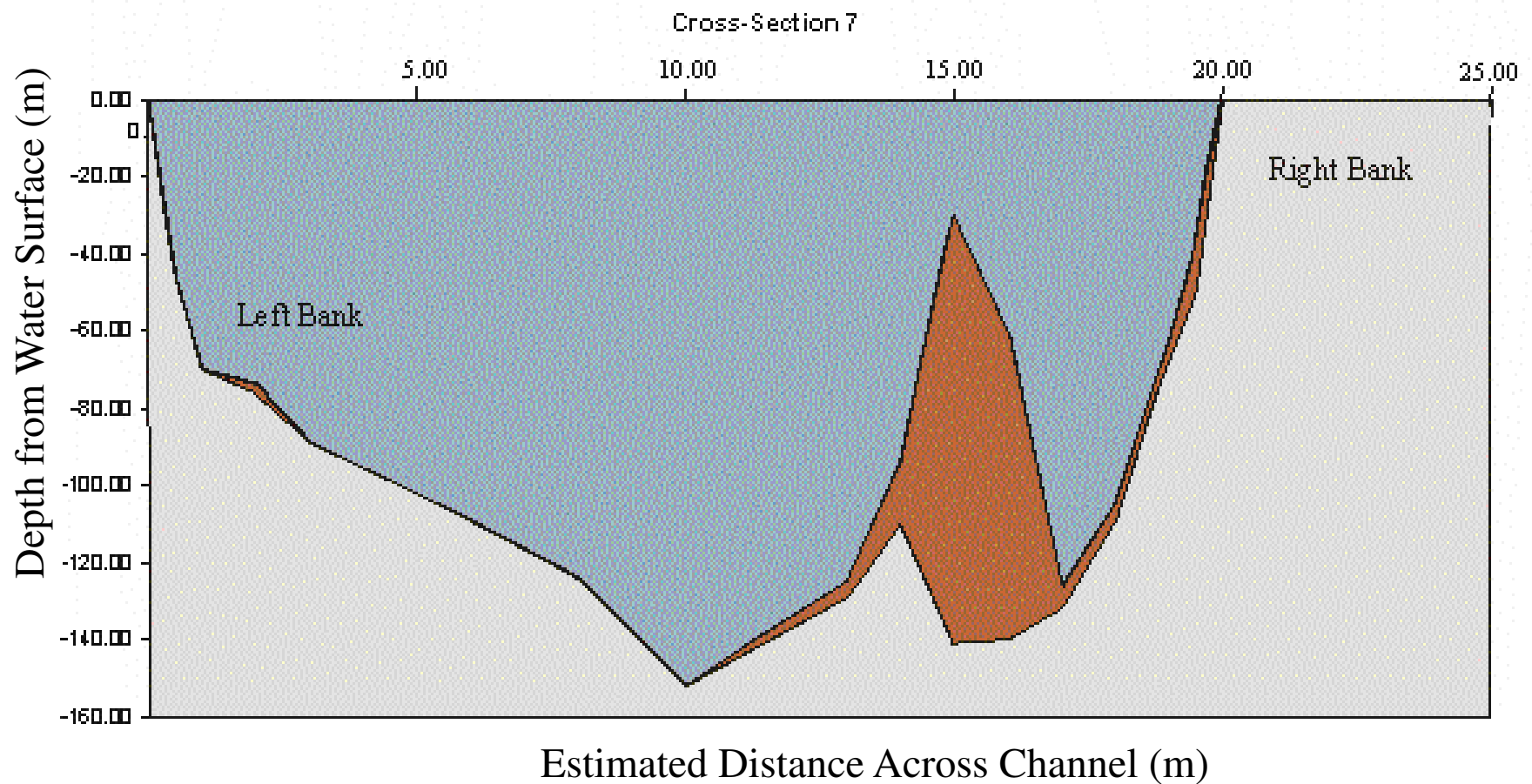
Cartoon of an Eddy



In Channel Storage (Eddies only)

- ➡ Determined volume from cross-sections (assuming cone-shaped)
- ➡ Assumed continuous distribution of eddies
- ➡ Randomly generated volumes
- ➡ Assumed 10-yr residence time (previous studies)

In Channel Storage

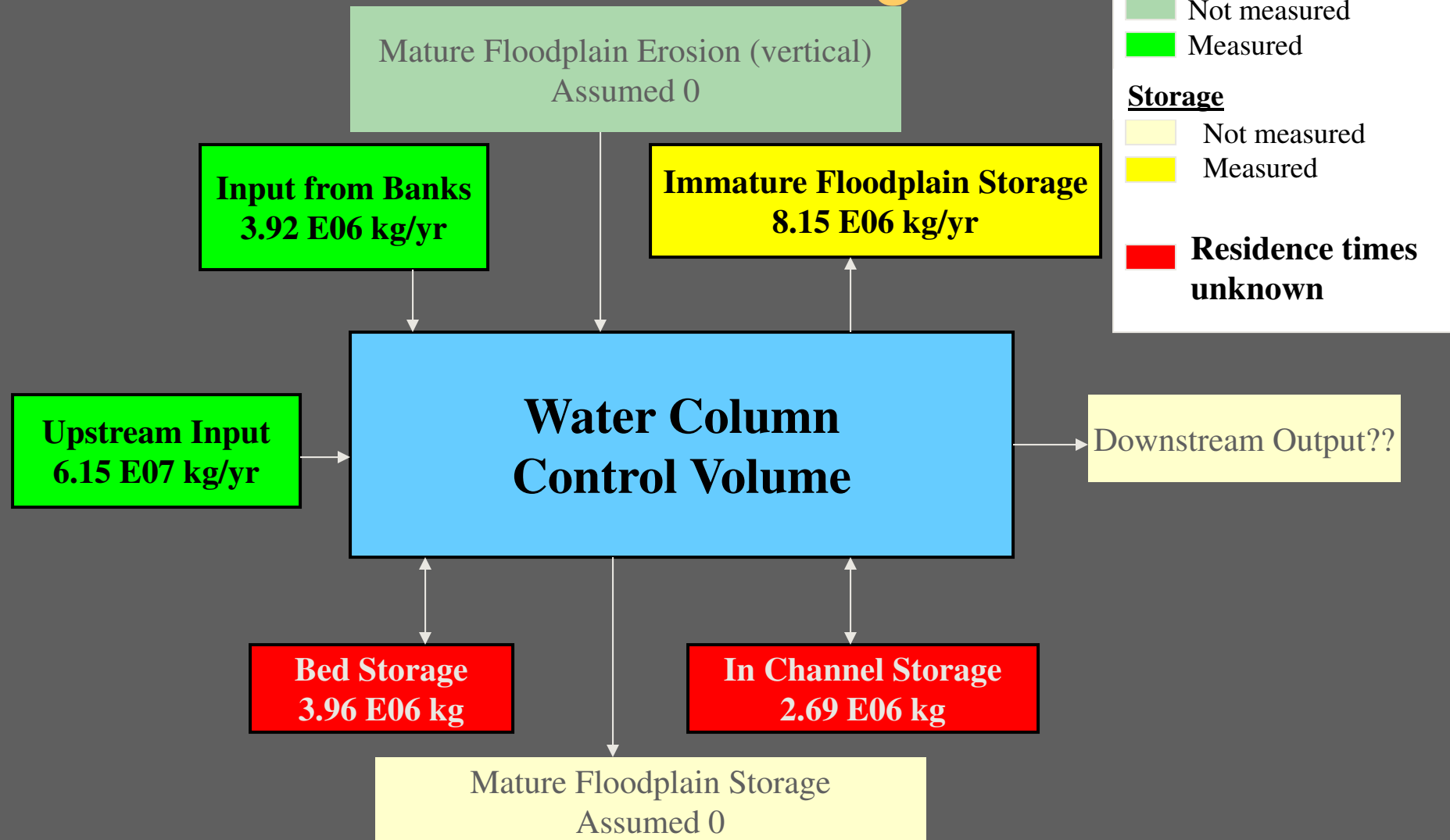




Immature Floodplain Storage

1. Accretion rate = bank erosion rate
2. Height above bed is 1.5 m
3. Percent silt and clay is 10
4. Quantified from geomorphic maps
5. Mature floodplain storage (and erosion)
assumed to be 0

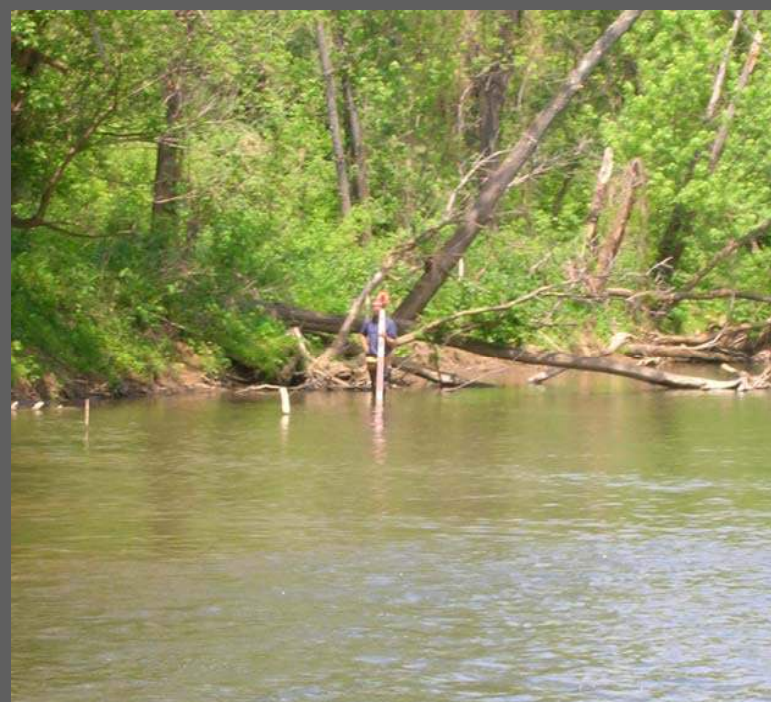
Final Sediment Budget





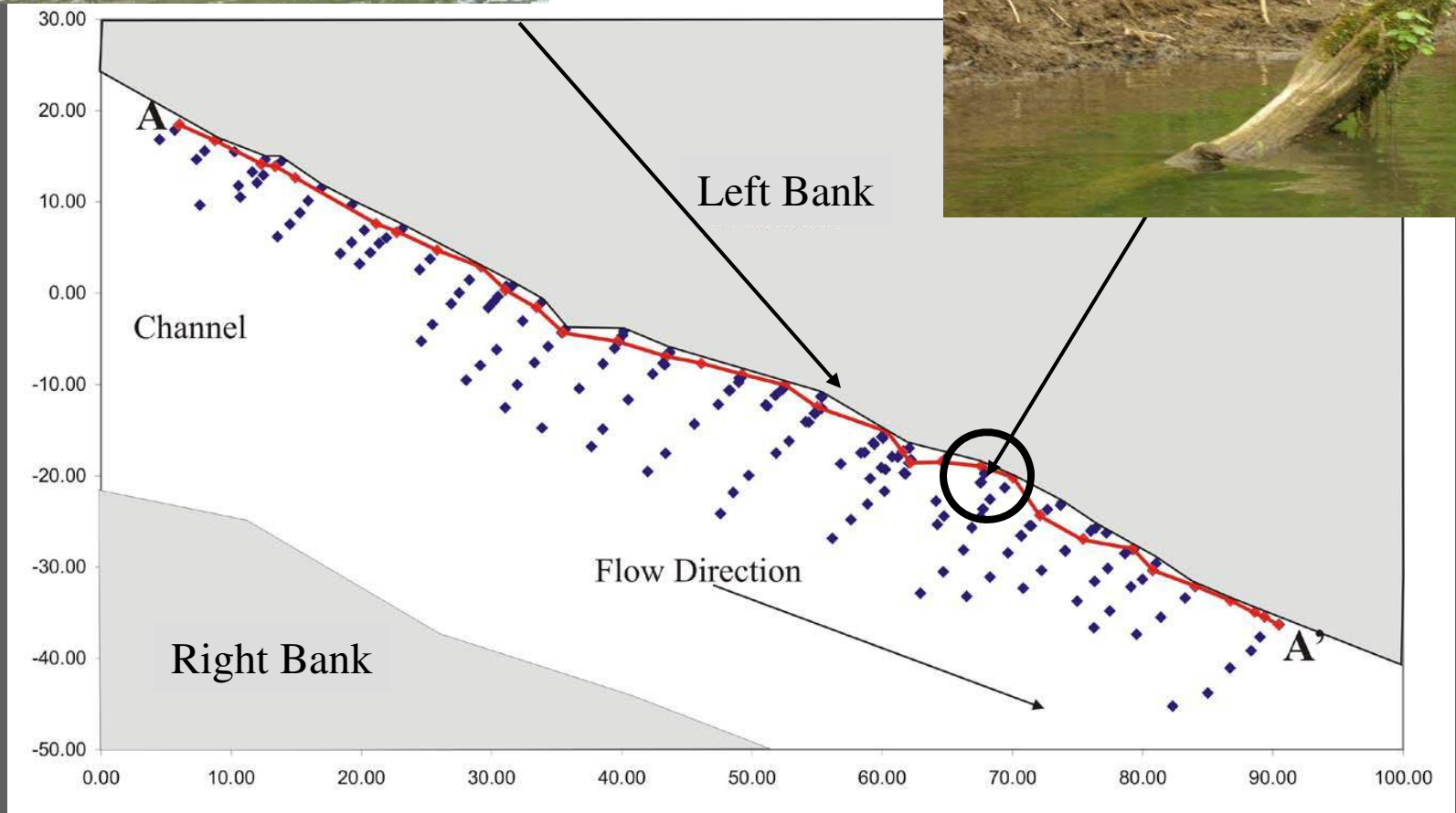
Mud Mapping in South River

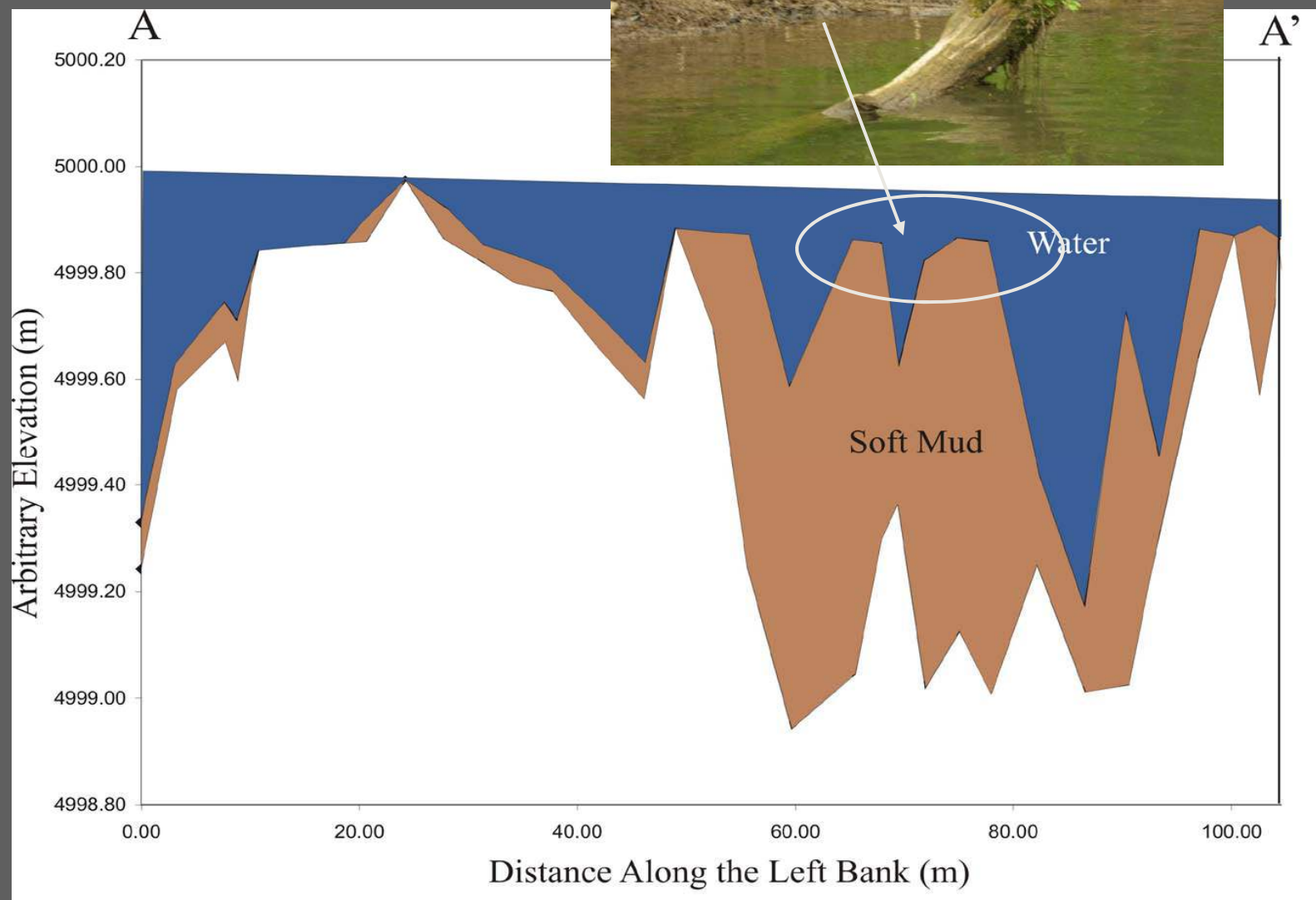
- ➡ Mapped mud deposits just below Hopeman Parkway on both sides of the river
 - used transect tape and laser distance meter
 - used Total Station to create 3-D map (including topography and mud thickness)





Mud Mapping Survey





Future Studies of Channel Mud Deposits

- ➡ Map mud deposits using Total Station at 10 locations
 - Determine controlling variables on mud accumulation and storage in the study area
- ➡ Core: determine grain size, organic content, Hg concentration, primary sedimentary structures
- ➡ Residence times, dynamics of erosion and deposition
 - Determine extent of erosion and deposition caused by individual storms (sediment traps, detailed surveys)
 - Determine Hg concentration profile
 - Isotopic dating
 - Design flume study?

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Other Ongoing Studies

- ⇒ Propose accessible eroding banks for Hg sampling
 - Any new info about sampling banks adjacent to private property???
- ⇒ Refine estimates of bank erosion rates based on new LIDAR data and 1935 aerial photos
- ⇒ Measure mud content of bed sediments
- ⇒ Core sections of the floodplain to test assumptions
- ⇒ Improve dimensionless sediment rating curve and further refine estimate of upstream sediment input
- ⇒ Finish geomorphic mapping of rest of South River

Thank you!!!
Questions? Comments?

