Hydrol. Earth Syst. Sci. Discuss., 8, C1011–C1015, 2011
www.hydrol-earth-syst-sci-discuss.net/8/C1011/2011/

Hydrology and Earth System Sciences Discussions

Interactive comment on "The need for complementary hydraulic analysis in post-restoration monitoring of river restoration projects" *by* T. A. Endreny and M. M. Soulman

T. A. Endreny and M. M. Soulman

te@esf.edu

Received and published: 29 June 2011

Reviewer Comments: Endreny and Soulman present results of intensive monitoring of a 1600-m-long channel project on a small (18 km2 watershed) channel in New York state. Although the project is termed "river restoration" throughout the paper, its only stated purpose was to "reduce turbidity entering....a reservoir." This goal was addressed by constructing 60 stone river training (erosion control) structures (an average of 1/27 m), which resulted in four (or 5??–see figure 1) channel avulsions. The authors attribute this response to the small cross-vane arm horizontal angles. Although many

of the as-built cross vane geometries departed from design standards, the authors recommend such adverse channel response be addressed via intensive monitoring and timely hydraulic analyses using computer models and the monitoring data.

Response: We confirm the project design and management team use the term "restoration" in reference to this project. See our manuscript references, where the GCSWCD is the design team and their report is termed "Big Hollow Restoration Project". We agree the number of avulsions looks like 5 from Figure 1 because we show the meander at CV07 in the upper and lower map of the river. This overlap was intended to give the reader a common reference frame in the upper and lower map of the river. We can clarify this overlap in the caption if needed.

GCSWCD (2006), Big Hollow Restoration Project - Batavia Kill Implementation and Monitoring Report., Green County Soil and Water Conservation District, Cairo, NY.

Reviewer Comments: Abundant literature (E.G., Brookes and Shields 1996, FISRWG 1998, Shields et al. 2003) provides guidance on stream restoration which was either absent or undocumented in this project. 1. The purpose of a stream restoration/rehabilitation project should be to return the ecosystem to a pre-disturbance trajectory. This implies some analysis and documentation of the "pre-disturbance" ecological condition, and how project components will interact with natural forces to move the system toward that trajectory. In the case of this project, for example, what are past, present and desired downstream turbidity regimes? What types of organisms and habitats are of concern in the project reach? Instead, the monitoring program focuses entirely on channel stability. The implication is that channel stability and restoration project success are directly proportional, and vice versa.This is false (Shields et al. 2003,Florshiem et al. 2008, Rakovan and Renwick 2011).

Response: The design team cited Simon and Darby (2002, "Effectiveness of Grade Control Structures", Geomorphology, Vol 42) in one of their reports but I am not aware of them citing your work. The organisms and habitats of concern are primarily related

HESSD

8, C1011–C1015, 2011

to macro-invertebrates and fish, as discussed in the GCSWCD reports. The GCSWCD has a fish monitoring program, which is led by Barry Baldigo of the USGS. I can cite this work in the manuscript if needed.

Baldigo, B. P., A. G. Ernst, D. R. Warren, and S. J. Millar (2010), Variable Responses of Fish Assemblages, Habitat, and Stability to Natural-Channel-Design Restoration in Catskill Mountain Streams, Transactions of the American Fisheries Society, 139(2), 449-467.

Response cont'd I do not have data on the historical turbidity levels, but from what I have been told by NYC DEP determined this watershed had the highest contribution to turbidity in the NYC drinking water supply and due to new concerns about color and turbidity in the water supply they wanted to reduce the river's bank erosion. The project team measured Big Hollow erosion at an average of 9649 tons/year for 2 years prior to the restoration. They anticipated this rate would increase by 2 to 3 fold without restoration. After restoration but before the avulsions, the average Big Hollow erosion was 2077 tons/yr for 2002, 2003, and 2004. In 2005 with the avulsions the Big Hollow erosion was 9038 tons/yr. The project team did not state project success was defined by stability, but they certainly had the goal of reducing turbidity and TSS leaving the reach. I can add this erosion data to the manuscript if needed, as well as explain project success was not defined by stability but project goals included reduced erosion.

Reviewer Comments: 2. Project planning should include a geomorphic assessment of the watershed system that includes regions beyond the project reach. Only within the context of such an assessment can the real triggers for post-implementation channel behavior be identified. Simply attributing avulsions to certain aspects of structural design misses the more significant point of channel response to upstream sediment inputs, hydrologic perturbations, bed stability, etc. (Shields et al. 2004 and 2006).

Response: We agree avulsions are also a function of upstream sediment inputs and hydrologic perturbations and bed stability. We can add this to the revised manuscript.

HESSD

8, C1011–C1015, 2011

Reviewer Comments: 3. The project was designed based on characteristics of a reference reach. If the reference reach was appropriately selected, and if the reference reach was stable, why was it necessary to install 60 structures to insure channel stability?

Response: My understanding was the reference reach was forested along the riparian corridor. The structures provided river training and deflection of river scour at the banks without vegetation. The project team recognized vegetation was critical for long term project stability.

Reviewer Comments: 4. What natural channel habitat features were the river training structures designed to emulate?

Response: My understanding is the structures were training river currents to maintain scour pools used by fish.

Reviewer Comments: 5. Would the project have produced a better outcome in terms of its stated objective (reducing downstream turbidity) if the bed and banks had been protected with orthodox erosion controls rather than imposing a "natural channel design"?

Response: What are the orthodox erosion controls? It is difficult to predict what other measures may have done for erosion control, but I am amenable to discussing these scenarios if you provide more guidance.

Reviewer Comments: 6. The intensive monitoring program and complementary hydraulic analysis illustrated by this study are praiseworthy examples of state-of-the-art approaches for physical monitoring of the restored reach. However, such efforts are prohibitively expensive for routine application to all projects. What were the costs for monitoring and analysis and how do they compare to the construction cost?

Response: You are very kind to suggest our analyses were worthy efforts. Our costs were about $5,000, which paid a summer internship for a student. The Big Hollow

HESSD

8, C1011–C1015, 2011

project cost was estimated at $185,000. The GCSWCD project team maintained monumented cross-sections for monitoring within their annual budget and did not charge this to the project cost.

Reviewer Comments: In conclusion, the Batavia Kill river restoration project suffers from the same syndrome as others produced by the Rosgen school of thought (Simon et al. 2007 and reply to subsequent discussion). Post construction monitoring should have highlighted this shortcoming.

Additional References Brookes, A. and Shields, F. D., Jr., editors. 1996. River Channel Restoration. U.K.: John Wiley and Sons, Chichester, 433p. Florsheim, J., J. Mount, and A. Chin. 2008. Bank erosion as a desirable attribute of river. Bioscience 58(6):519-529. Rakovan, M.T. and W.H. Renwick, 2011. The role of sediment supply in channel instability and stream restoration. Journal of Soil and Water Conservation 60: 40-50. Shields, F. D., Jr., Morin, N. and Cooper, C. M. 2004. Large woody debris structures for sand bed channels. Journal of Hydraulic Engineering. 130(3):208-217. Shields, F. D., Jr. and Copeland, R. R. 2006. A comparison of empirical and analytical approaches for stream channel design. Proceedings, Eighth Federal Interagency Sedimentation Conference, April 2-6, Reno, Nevada, Advisory Committee on Water Information, Subcommittee on Sedimentation, Washington, DC, CD-ROM.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 2609, 2011.