

Instream River Training

Fundamentals and Practical Example

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HydroEco 2015, Vienna, Austria





standard solution

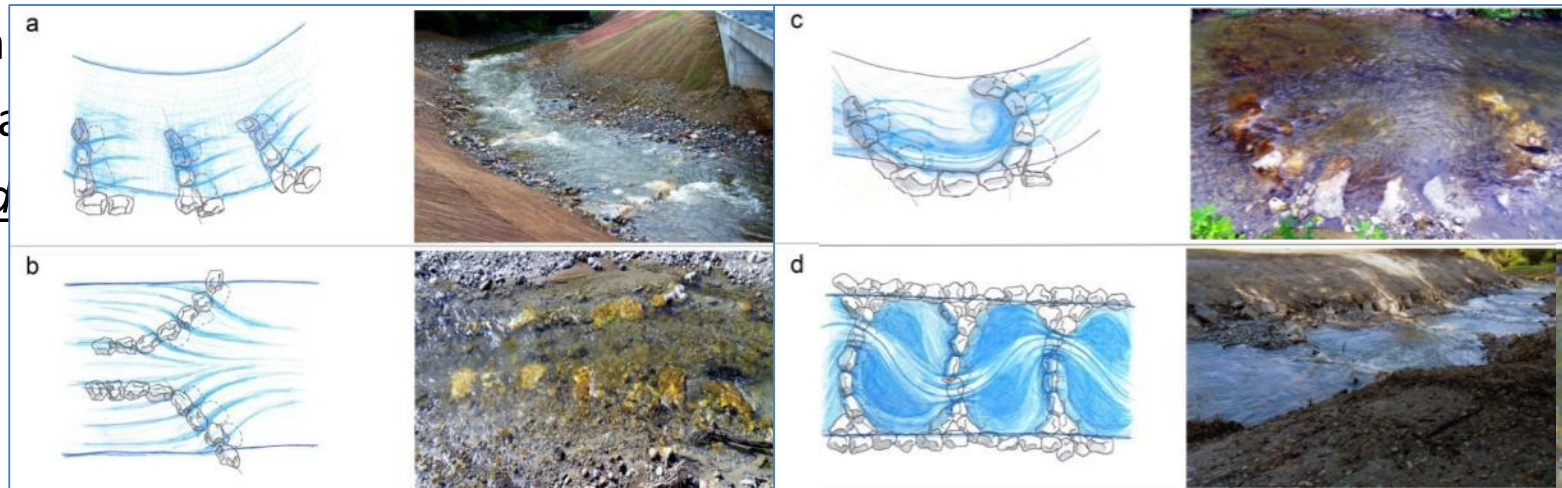
- bank armoring = bank stability by means of riprap (*expensive, not environment friendly*)
- treatment of symptoms (*instead of treating the cause*)

...Actually the river's flow is causing erosion, not the river bank!

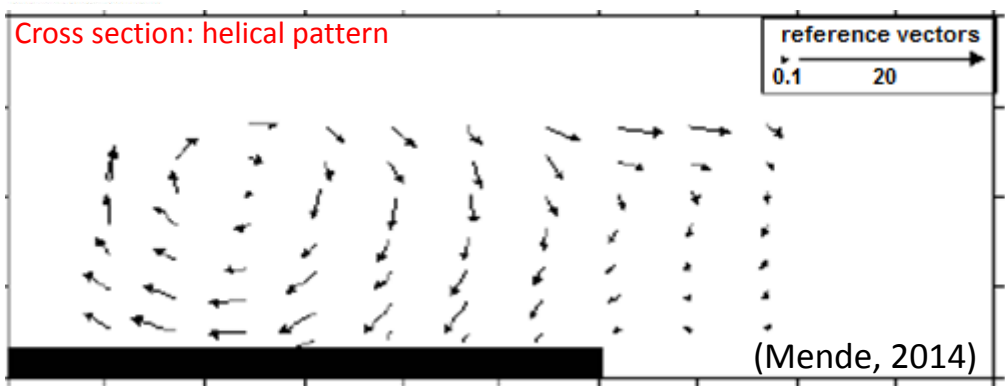
Definition of IRT:

«**modification of flow** with small submerged instream-structures (natural materials)

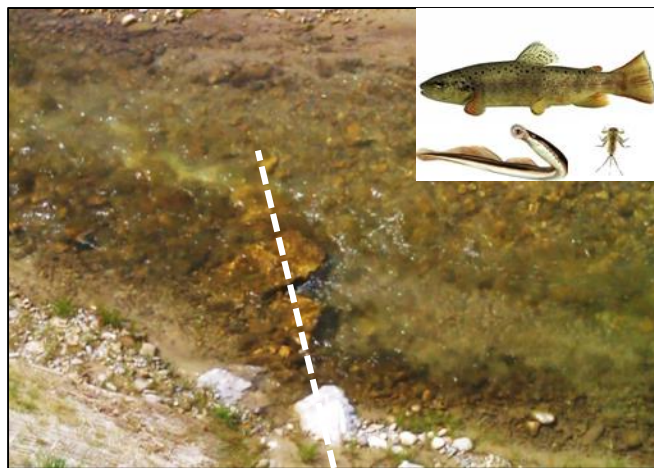
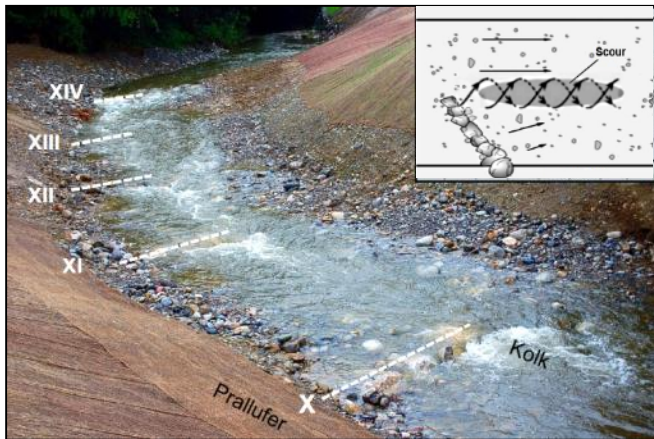
wh
to a
sea



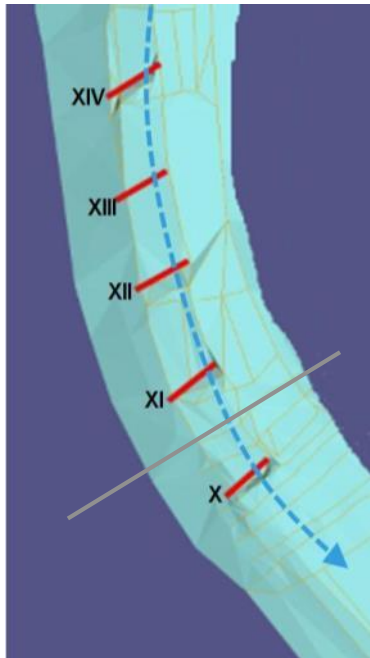
Cross section: helical pattern



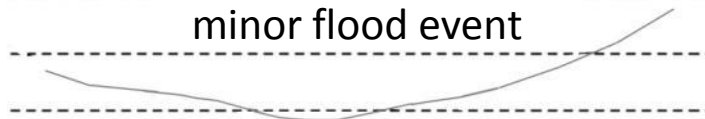
- **Controlling erosion and deposition** (channel stabilization)
- **Creating morphodynamic diversity** (habitats for fish etc.)
- **Saving costs** due to omittment of bank enhancement



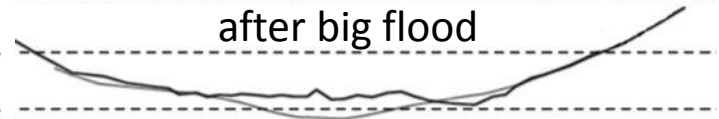
Channel **with** micro groins



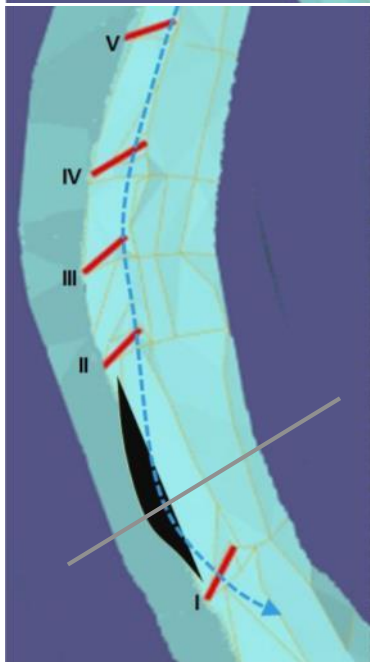
minor flood event



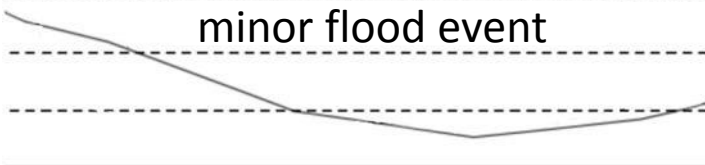
after big flood



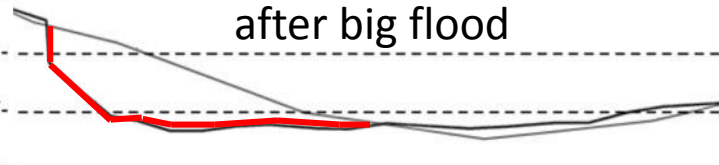
Control **without** micro groins



minor flood event



after big flood

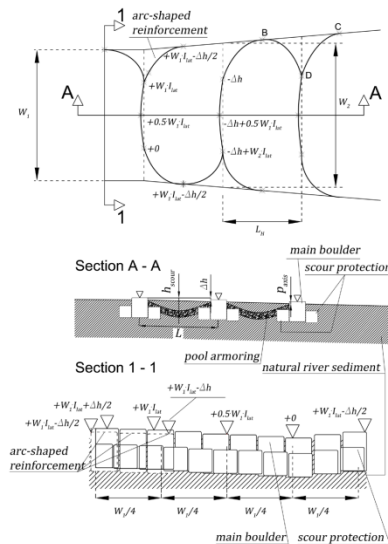


- **Fish migration - establishing continuity** (replacing vertical drops etc.)
- **Controlling erosion and deposition** (channel stabilization)
- **Creating morphologic diversity** (habitats for fish etc.)



Design rules meandering ramps

- river width: ≤ 10 m
- substrate: $d_{90} \geq 140$ mm
- ramp slope: $\leq 3\%$
- step spacing: 5-7 m
- design q : $q \leq 10$ m³/sm



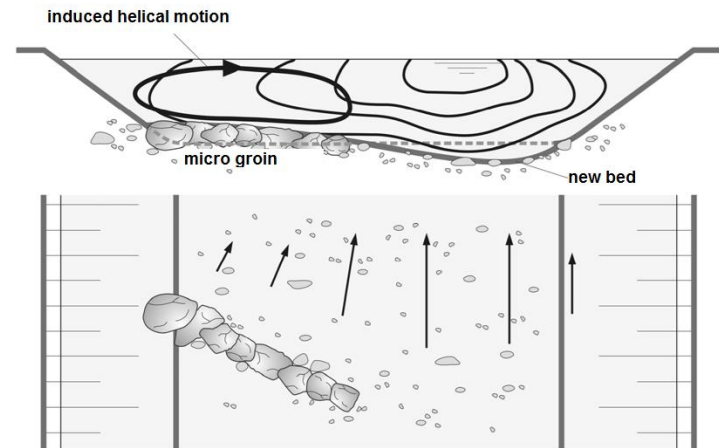
Sindelar (2011): *Design of a Meandering Ramp*, PhD Thesis, University of Technology Graz.

Fish Monitoring Große Tulln River (2012-2013)

- Complete migratory continuity

Design rules micro groins

- relative submergence
- groin inclination
- groin spacing
- groin length
- required boulder size



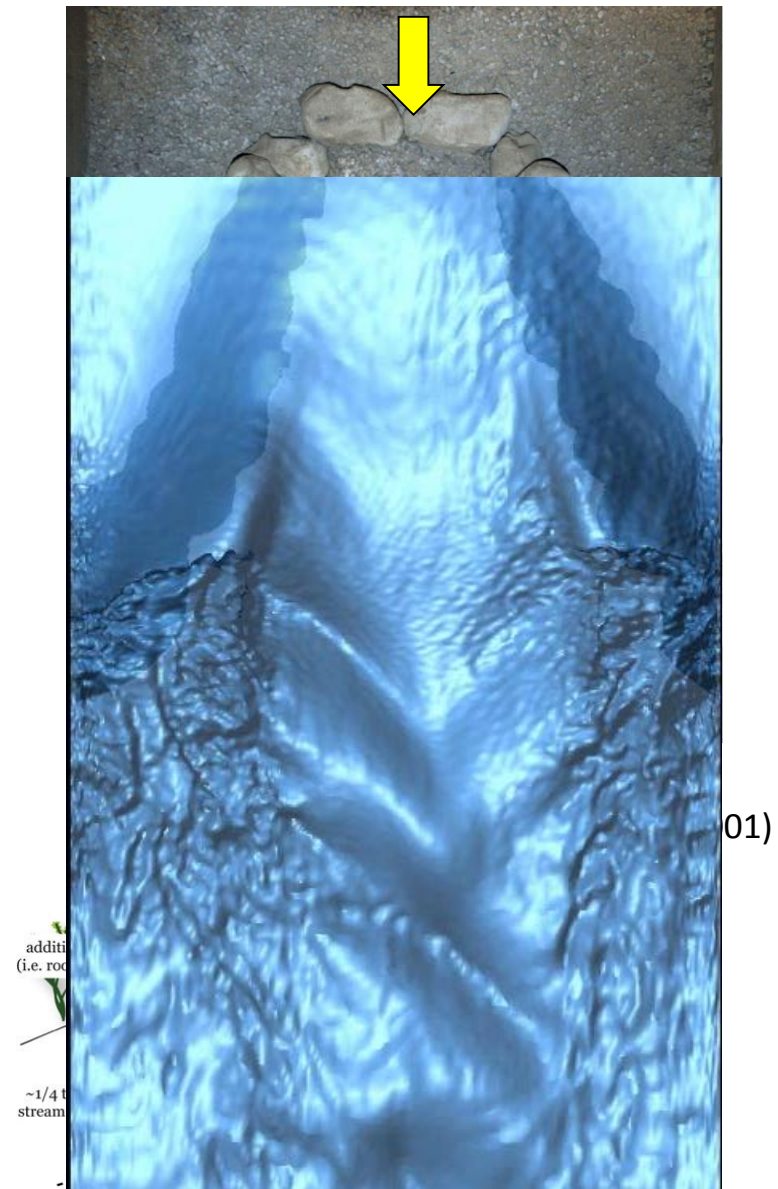
Mende (2014): *Naturnaher Uferschutz mit Lenkbuhnen - Grundlagen, Analytik und Bemessung*, PhD Thesis, Technische Universität Braunschweig

Monitoring Taverna River (2012 - 2017)

- Ongoing ecological monitoring

Stream barbs & rock vanes

- Modification of flow by means of instream structures
- Only partly submerged, groin root level with top of bank
- transition to fully submerged state critical for banks
- Stream Barbs (USDA)
- Rock Vanes (Dave Rosgen)



Courtesy of: University of Minnesota
St. Anthony Falls Laboratory (2014) 13)

Outlook - Research

- Interaction of micro groins with river morphodynamics
- Effect of vortical structures on fish and macro invertebrate
- Hybrid modeling (combined physical and numerical modeling)
- Meandering ramps for higher specific discharges and smaller substrate

Outlook – Application

- Installation of micro groins in a sharp bend in Thur River, Switzerland
- Continuation of monitoring program at Taverna River, Switzerland

Thank you for your attention

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