

NATURE CLOSE TORRENT CONTROL IN ORE MOUNTAINS

Case Study Jindrichovicky Brook Restoration



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b. Climate and global changes

iii. Mitigation Measures, their Prerequisites, Cost and Benefits

INTRODUCTION

CAN HYDROLOGIC AND HYDRAULIC MODELS BE USED IN TORRENT RESTORATION?

- ▶ Problems to be solved:
 - Discharge capacities in different stream parts:
 - Design rainfall data ($P_{N,t}$): **DES-RAIN Model**
 - Design discharge data (Q_N incl. urbanised areas): **KINFIL Model**
 - Channel stability, different morphology (in situation, longitudinal and cross-section profiles): **HEC-RAS, SRH-2D**
 - Biodiversity adequate to geomorphological diversity
 - Riparian vegetation to fit to natural site

Hard regulation measures in the 1970's



BOULDER STEP or CHUTE with POOL, 2008



HYDRAULIC MODELS USED

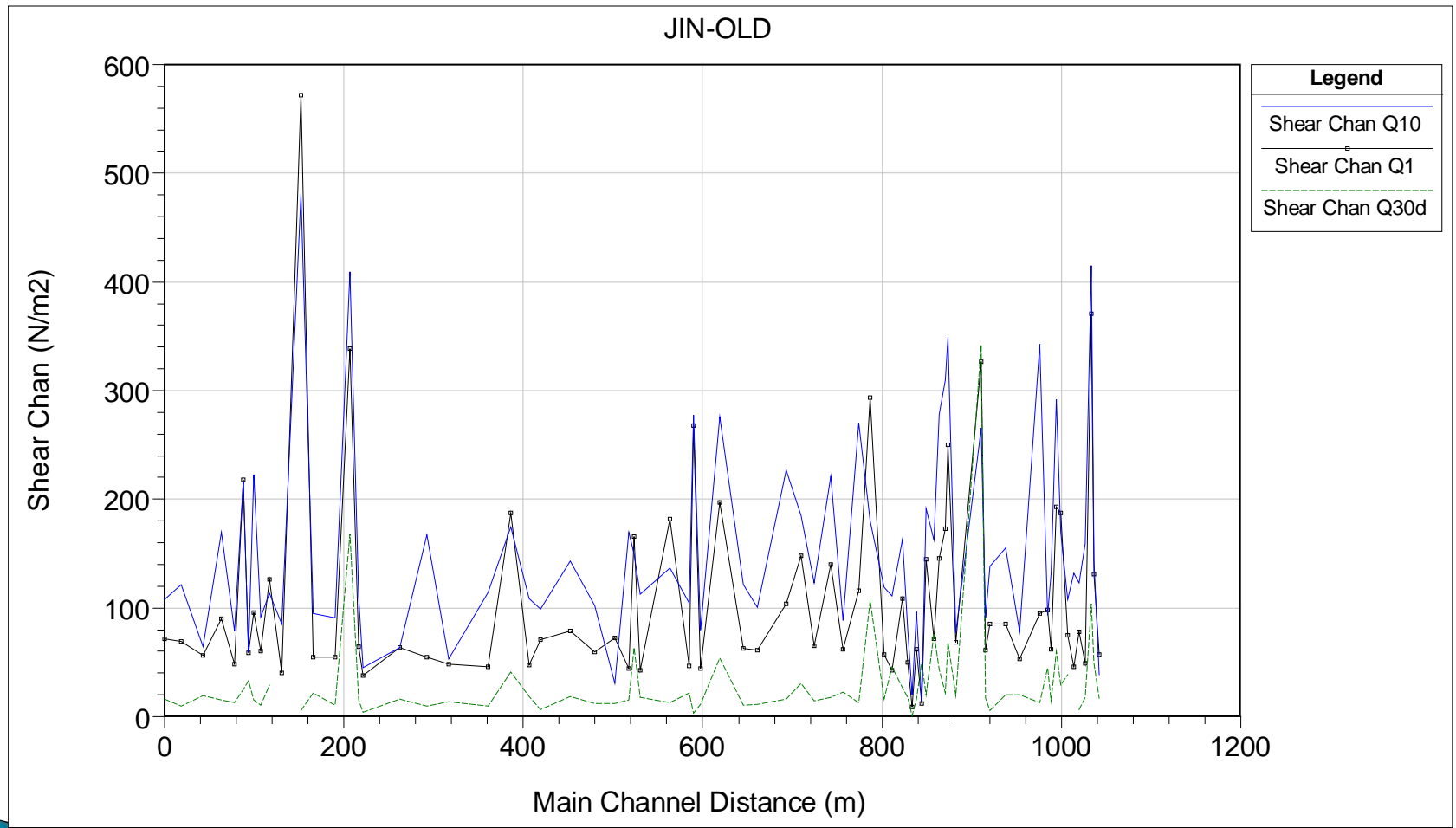
▶ HEC-RAS 1D

- Steady flow,
- non-uniform,
- too many cross-section profiles needed,
- Supercritical flow (unstable solution).

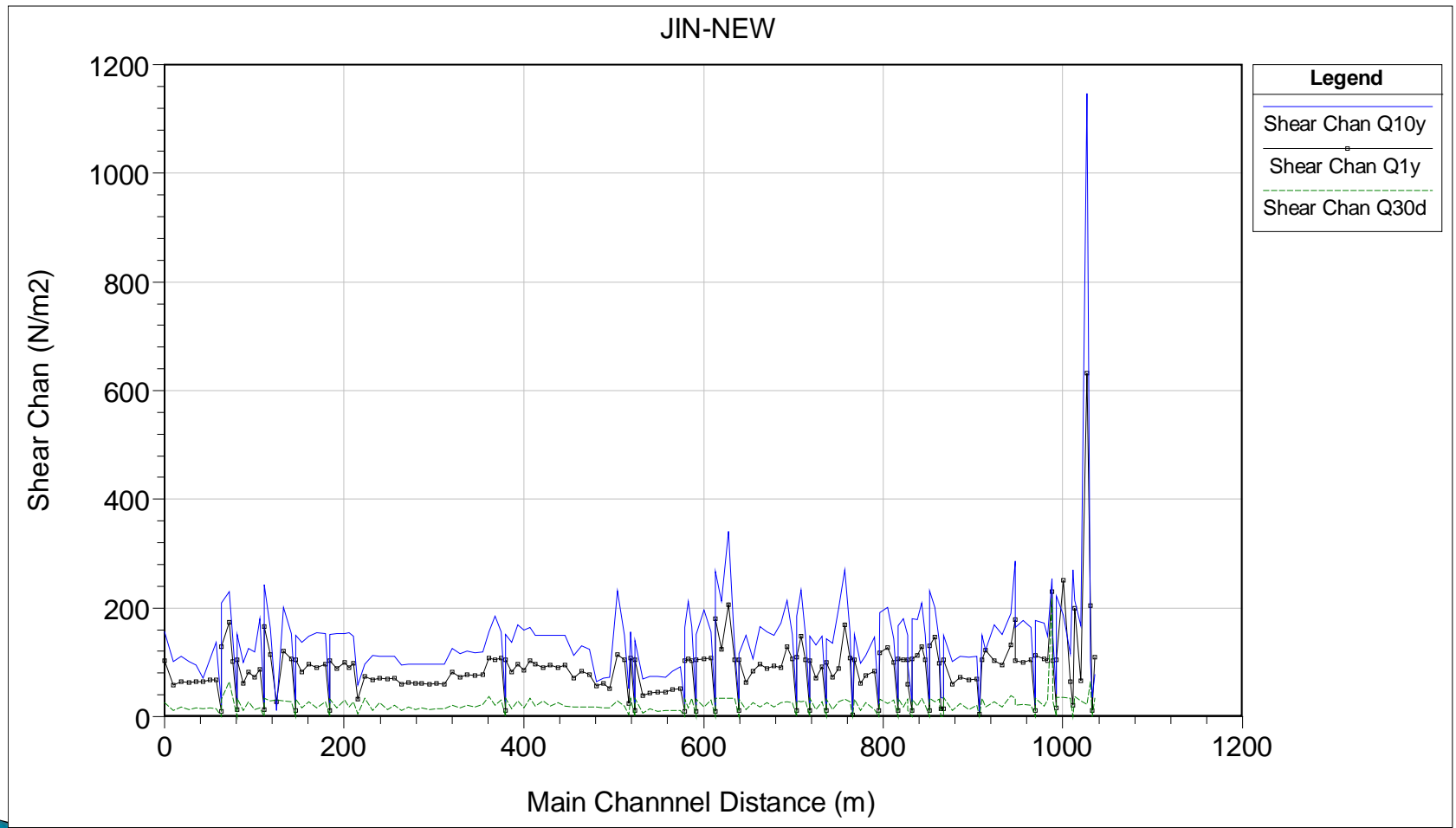
▶ SRH 2D

- Unsteady flow
- less number of profiles:
 - Depth,
 - Velocity,
 - Froude number,
 - Shear stress
- Better possibility to describe morphologic profile situation when needed.

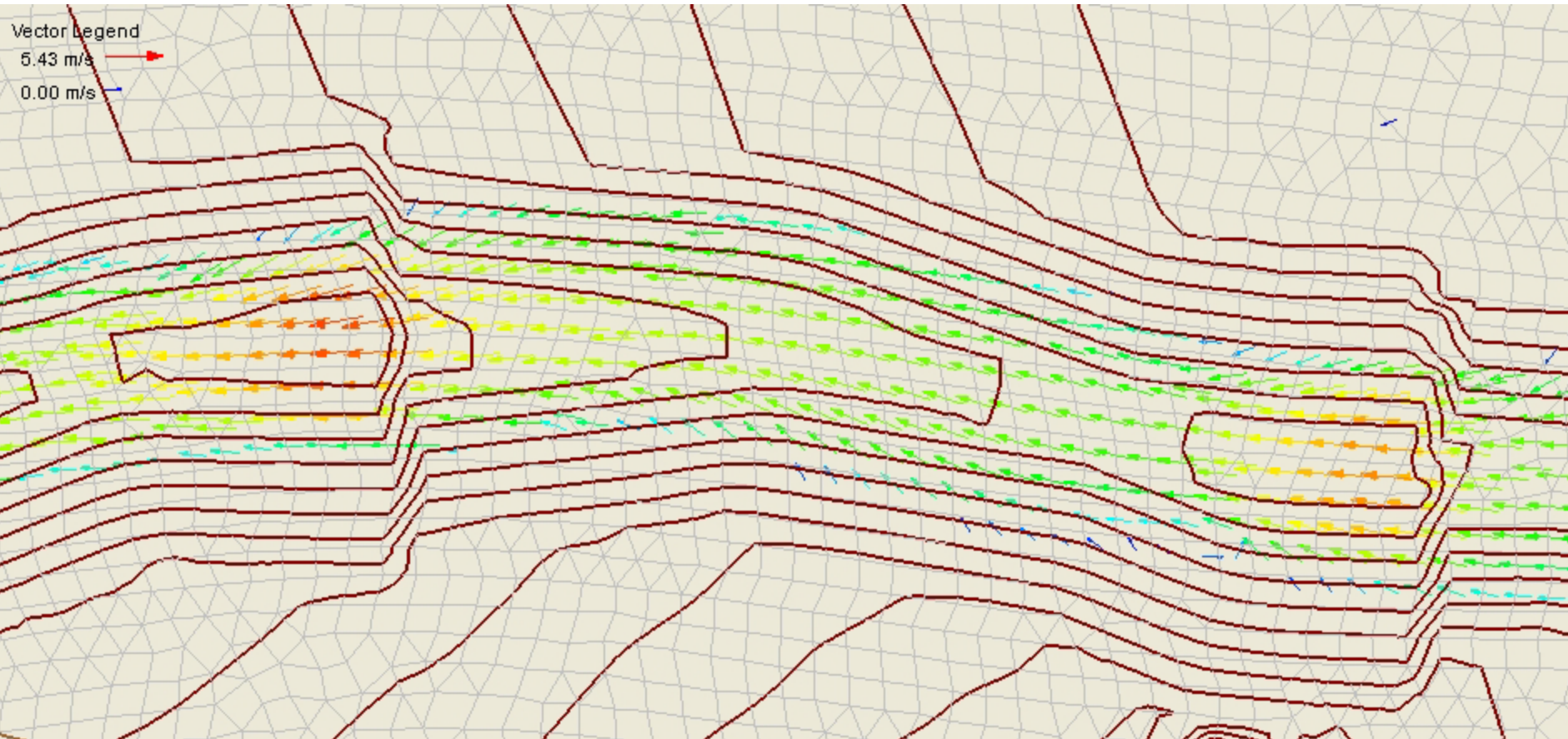
SHEAR STRESS for Q_{30d} , Q_{1y} , Q_{10y} old channel



SHEAR STRESS for Q_{30d} , Q_{1y} , Q_{10y} new channel



VELOCITY VECTORS – Q_{50} (SRH 2D)



COMPARISON OF SELECTED PARAMETERS FOR OLD and **NEW** CHANNELS for various discharges

Selected Data	Hydr.Depth (m)	Velocity (m/s)	Shear Stress (Pa)	Volume (1000 m ³)
Q _{30day}	¹ 0,05 / ² 0,15	0,8 / 0,4	40 / 10	0,04 / 0,1
Q _{1year}	0,25 / 0,35	2,5 / 1,5	140 / 40	0,5 / 0,7
Q _{10years}	0,4 / 0,55	3,8 / 2,0	200 / 80	1,25 / 1,7

¹ OLD

² **NEW**

CONCLUSIONS

- Land use change (conversion of arable land to permanent grassland) mitigated peak discharges on the catchment as it was confirmed by the **KINFIL model** analyses.
 - Implementation of the hydraulic models has provided a good tool for the restoration criteria assessment: depth, velocity, shear stress values (**SRH 2D** better than HEC-RAS models).
 - New nature close hydraulic structures: the **step-pool system** provided good conditions for water **self-purification** and for a **biota migration**.
 - **Improvement in riparian vegetation** fits better to natural sites.
 - Positive **impact on biodiversity**.
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