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Optimizing Water Resources for Enhanced Electricity Production: A Case Study in Croatia's Karst Region

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INTRODUCTION & AIM

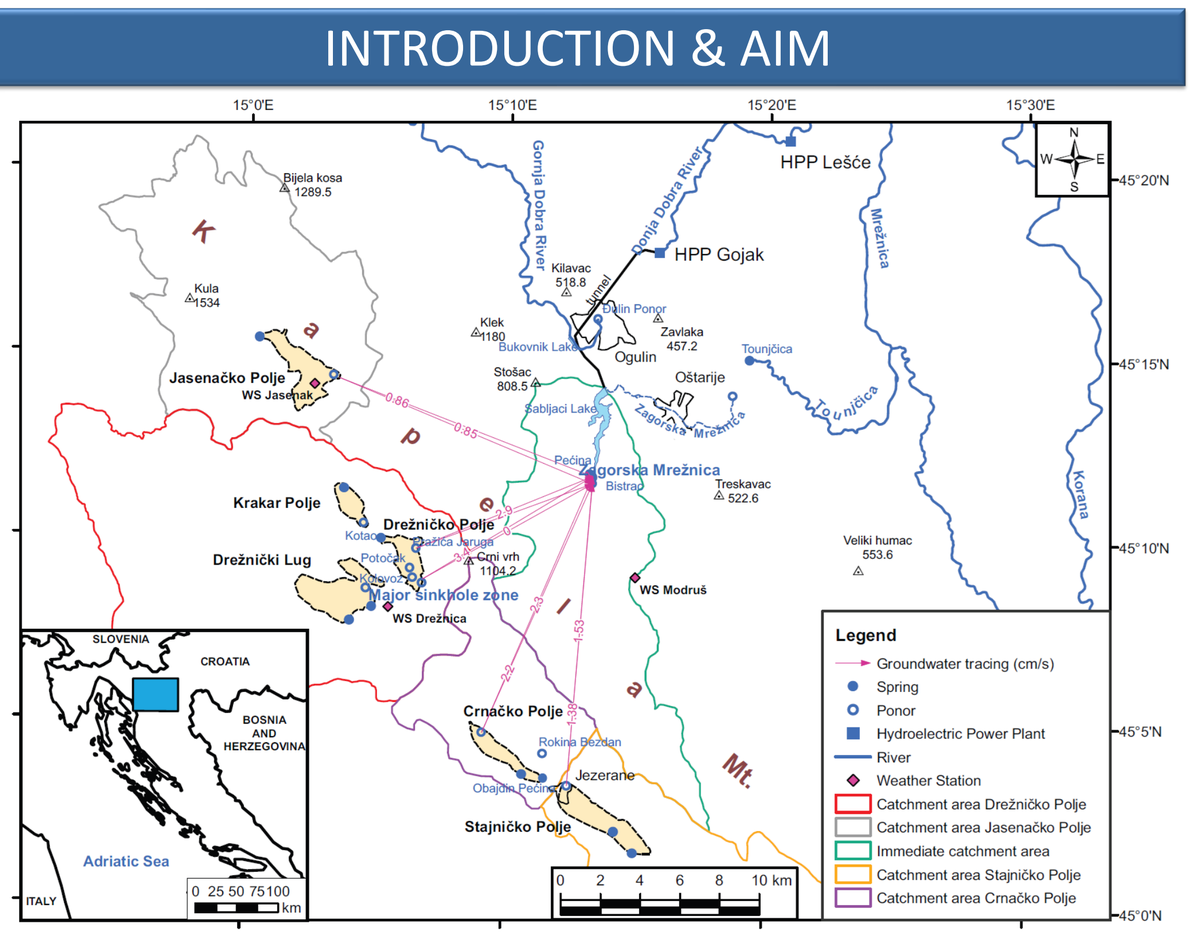

Figure 1: Location of Drežničko polje in Croatian karst (Buljan et al., 2019)

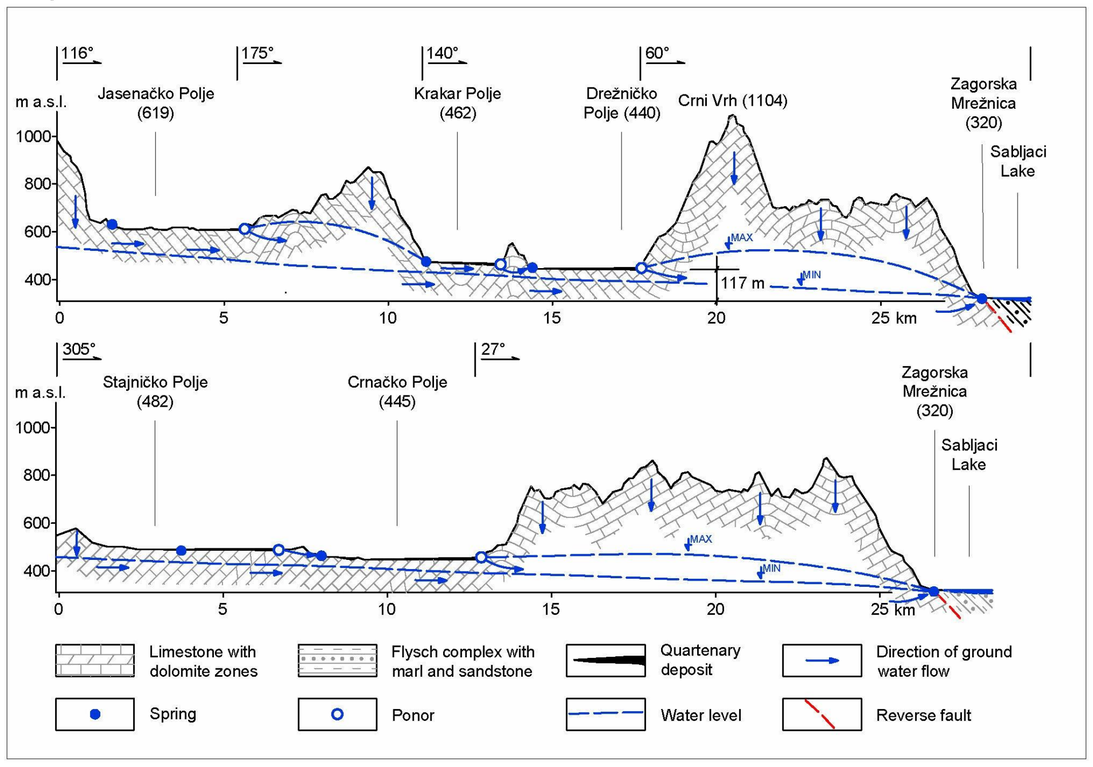

Figure 2: Cross-section profiles through the research area with schematized hydrogeological relations (Buljan et al., 2019)

METHOD

Management of water runoff from Drežnica polje (field):

- passively by sealing the abyssal zone via grout curtain
  - maximum flow from abyssal zone reduced from 35 m^3/s in natural state to 25 m^3/s
- actively by building retention and sluice gates
  - three variants with losses when the sluice gate is completely closed (Q_{l1}=6.0 m^3/s, Q_{l2}=10.0 m^3/s and Q_{l3}=15.0 m^3/s) during the non-vegetation period during the year (from October 15th to April 15th).

Mathematical modeling of the natural and built state was carried out using HEC-ResSim software

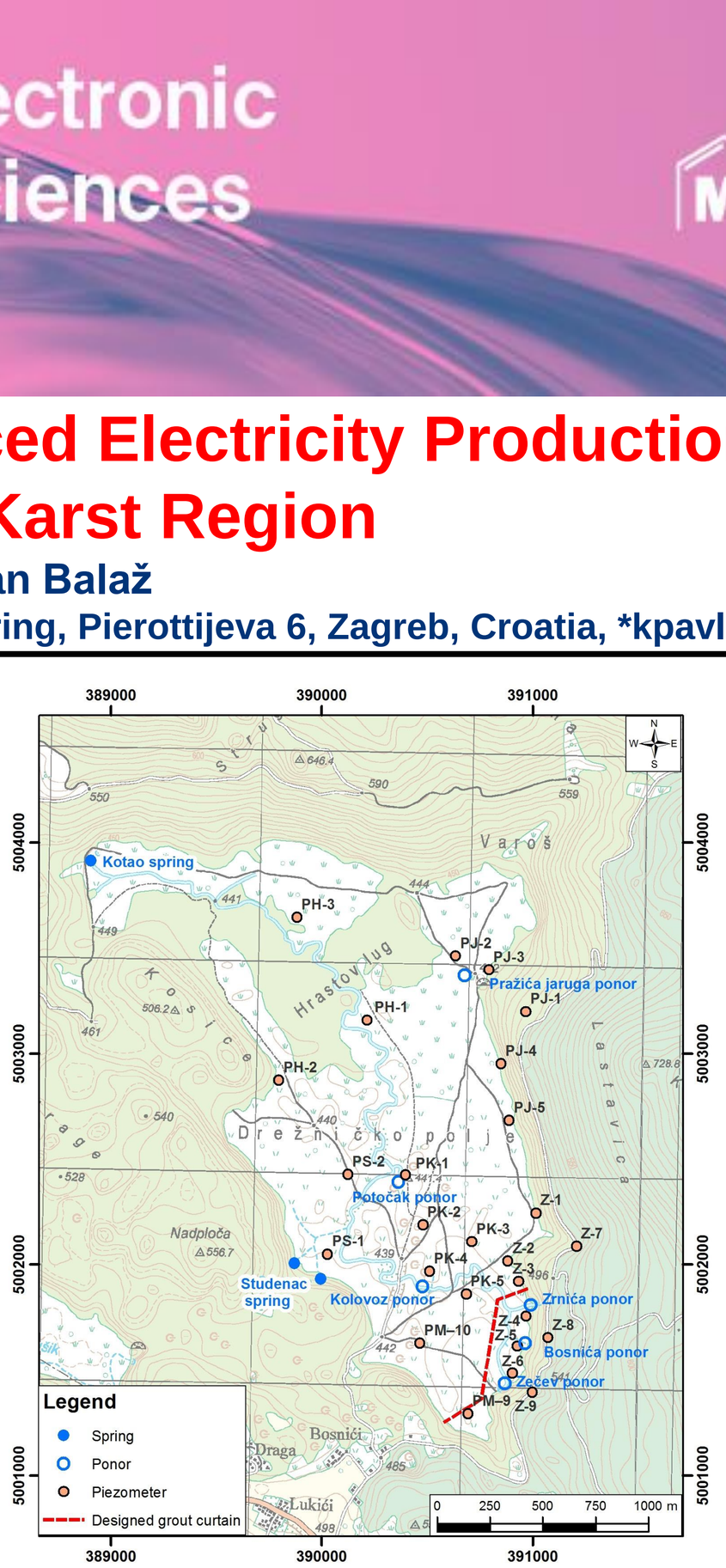

Figure 3: Location of Drežničko karst polje with existing hydrogeological objects, piezometers and designated grout curtain (Buljan et al., 2019)

RESULTS & DISCUSSION

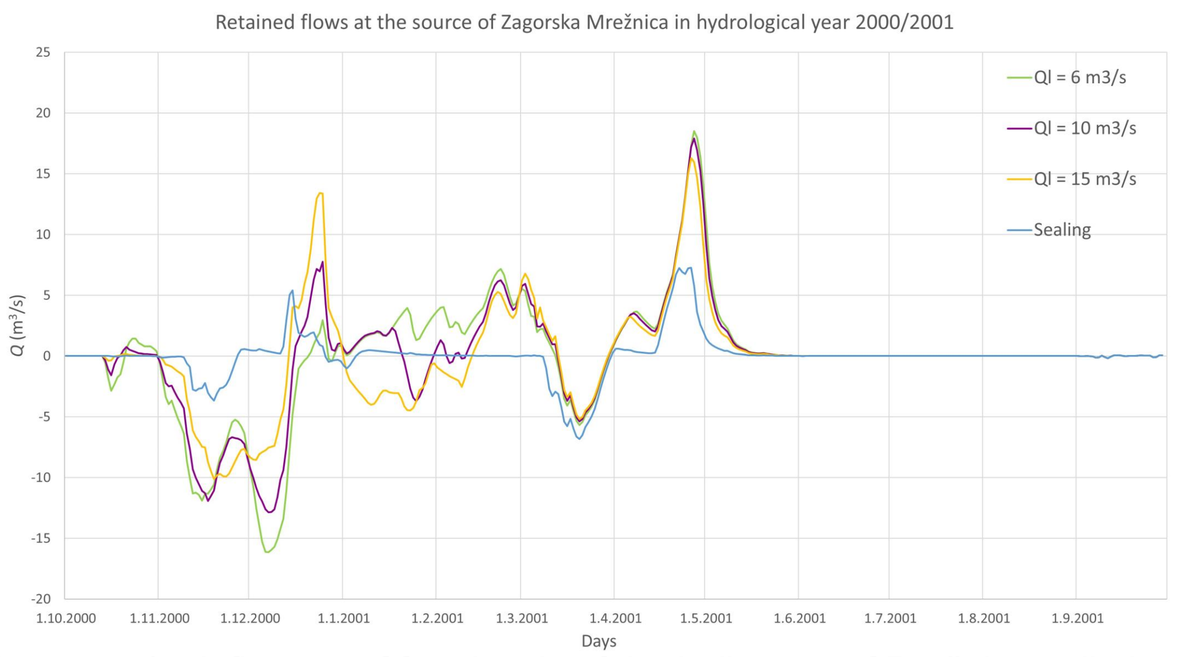

Figure 4: The influence of four levels of the built state of Drežnica polje is shown in the hydrological year 2000/2001

CONCLUSION

- With the passive and active management od water runoff from Drežnica polje, overflows can be reduced on average by: 23%, 42%, 36% and 33% respectively.
- A drastic reduction in the overflow is already visible when the abyssal zone is sealed.
- The exact losses of the hydrotechnical structure, and thus the actual reduction of overflow, will only be known after the construction of the retention and sluice.

REFERENCES

Buljan, R.; Pavlić, K.; Terzić, J.; Perković, D. A Conceptual Model of Groundwater Dynamics in the Catchment Area of the Zagorska Mrežnica Spring, the Karst Massif of Kapela Mountain. Water 2019, 11, 1983. https://doi.org/10.3390/w11101983
HEC-ResSim Reservoir System Simulation, User's Manual, US Army Corps of Engineering, Institute for Water Resources, Hydrologic Engineering Center, Davis, California, 2013.