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Impact of river restoration on groundwater – surface water – interactions

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Since the end of the 19th century, flood protection was increasingly based on the construction of impermeable dams and side walls (BWG, 2003). In spite of providing flood protection, these measures also limited the connectivity between the river and the land, restricted the area available for flooding, and hampered the natural flow dynamics of the river. Apart from the debilitating effect on riverine ecosystems due to loss of habitats, these measures also limited bank filtration, inhibited the infiltration of storm water, and affected groundwater-surface water-interactions. This in turn had a profound effect on ecosystem health, as a lack of groundwater-surface water interactions led to decreased cycling of pollutants and nutrients in the hyporheic zone and limited the moderation of the water temperature (EA, 2009). In recent decades, it has become apparent that further damages to riverine ecosystems must be prohibited, as the damages to ecology, economy and society surmount any benefits gained from exploiting them. Nowadays, the restoration of rivers is a globally accepted means to restore ecosystem functioning, protect water resources and amend flood protection (Andrea et al., 2012; Palmer et al., 2005; Wortley et al., 2013). In spite of huge efforts regarding the restoration of rivers over the last 30 years, the question of its effectiveness remains, as river restorations often reconstruct a naturally looking rather than a naturally functioning stream (EA, 2009). We therefore focussed our research on the effectiveness of river restorations, represented by the groundwater-surface water-interactions. Given a sufficiently high groundwater level, a lack of groundwater-surface water-interactions after restoration may indicate that the vertical connectivity in the stream was not fully restored. In order to investigate groundwater-surface water-interactions we determined the thermal signature on the stream bed and in +/- 40 cm depth by using Distributed Temperature Sensing (DTS), a fibre optical method for temperature determination over long distances (Selker et al., 2006). Thermal signatures were determined in a small urban stream before and after restoration and compared to streams in natural and near-natural settings.

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