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Water quality monitoring in the Halton Region: assessment of stream health and hyporheic exchange

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The Halton Region in Ontario, Canada lies along the Northwestern shores of Lake Ontario and has one of the fastest growing populations in the Province. In 2022, we assessed water quality in 15 watersheds of the Halton Region at a high resolution (n>500 samples across n>40 streams) to better understand nutrient as well as major and trace element dynamics and underlying controls in streams in this rapidly urbanizing region. This talk presents the application of this surface water quality monitoring data for identifying groundwater discharge on the catchment scale. We compare interpolated groundwater discharge maps produced from >21,000 historic groundwater level measurements across the Region and contrast these to surface- and groundwater surveillance data that was aggregated to assess temperature gradients, hydrochemical (alkalinity, chloride) signatures, as well as stream ecology (water cress, fish taxa). Temperature gradients between air, streams, and groundwater were larger for downstream urban creeks than for upper reaches, and significantly correlated ($p<0.05$) to discharge locations predicted by interpolated groundwater mapping. In contrast, high alkalinity and low chloride levels in Halton Region groundwaters were visibly related to stream hydrochemical signatures in gaining versus loosing stream sections but lacked statistical significance. Finally, strong links between the abundance of cold-water biota, thermal gradients and interpolated gaining stream sections ($p<0.05$) were observed, reflective of the upscaled spatiotemporal resolution presented by ecological parameters. Combined, these correlations help identify sites of infiltration or exfiltration across the watershed. This work shows that high-resolution stream monitoring data may be used to improve our understanding of spatiotemporal water quality variability and hyporheic exchange patterns at the watershed scale and optimize regional management of vulnerable streams and natural heritage systems.