Baseflow chemistry of incised urban forest streams: Tracing ion contributions prior to whole-watershed stream restoration

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While the effects of urbanization on stream ion chemistry are well documented [1-3], potential effects of stream restoration as an urban modification that might affect baseflow chemistry are less known. Pre- vs. post-restoration subsurface processes could have implications for nutrient processing or other aspects of urban stream function. Major ion chemistry and isotopes (δD, $\delta^{18}O$, $\delta^{13}C$-DIC) were analyzed for 15 months (2016-17) from subwatersheds in a 6 km^2 urban forest watershed in Charlotte, NC (USA) prior to stream restoration. Channels are observed to be incised into saprolite (weathered quartz diorite) in much of the study area.

Inter-site trends and temporal trends in baseflow chemistry were observed. The forested control (C) stream exhibited the lowest median ion and DIC concentrations (Ca 0.10 mM, Na 0.26 mM, and DIC 0.56 mM, respectively). Most concentrations were higher in developed and agricultural subwatersheds. In the C stream, NO_3^- peaked in ~Jul, and Ca, Na, and DIC were highest in ~Oct. $\delta^{13}C$-DIC was 2-4‰ higher in Jan-Apr, suggesting the atmospheric effect imparted on $\delta^{13}C$-DIC was largest while DIC concentrations were lowest [1]. Some seasonal variations in C stream were also seen in developed subwatersheds. While the more developed streams exhibited summer δD enrichment, C stream exhibited no δD trend, suggesting baseflow consists of subsurface flows of varied residence time.

Comparison of surface water (SW) to shallow groundwater (GW) indicates similar Ca and Na, but GW has higher median DIC (SW 1.0 mM, GW 1.4 mM) and more negative median $\delta^{13}C$-DIC (SW -15.2‰, GW -18.6‰), corresponding to lower median pH (SW 7.1, GW 6.3) and alkalinity (SW 0.81 meq/L, GW 0.58 meq/L).

Overall, the importance of land use or shallow vs. deep subsurface pathways for baseflow chemistry have not been identified with certainty. This system will be examined post-restoration, in which the relative importance of deep vs. shallow pathways might be modified (e.g water table shifted).

[1] Barnes & Raymond (2009) *Chem. Geol.* **266**, 318-327. [2] Moore *et al.* (2017) *Environ. Sci. Technol. Lett.* **4**, 198-204. [3] Kaushal *et al.* (2017) *Appl. Geochem.* **83**, 121-135.