Storm-event groundwater recharge in a green infrastructure watershed

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Abstract. Novel, distributed, infiltration-focused approaches to stormwater management are being implemented to mitigate the effects of urban development on water resources. One of the goals of this type of stormwater management, sometimes called green infrastructure, is to maintain groundwater recharge and stream base flow at pre-development conditions. However, the connection between infiltration-focused green infrastructure and groundwater recharge is not straightforward. Water infiltrated through stormwater facilities may be stored in soil moisture, taken up by evapotranspiration, or contribute to recharge and eventually local stream base flow. Here, continuous water table fluctuations are used to quantify the movement of infiltrated stormwater. This study focuses on a 1.1 km^2 suburban, green infrastructure watershed in Clarksburg, Maryland, USA which was urbanized with 73 infiltration-focused stormwater facilities. The episodic master recession method of analyzing water table fluctuations was used and time series analysis was performed on the hydrographs of seven wells. Storm properties (precipitation magnitude, duration, and rate), pre-event storage conditions, and spatial location of wells are tested as drivers of storm-event recharge. Persistence in water levels, as measured by the autocorrelation function, was related to depth to water. The recharge to precipitation ratio was inversely related to precipitation magnitude and rate, and positively related to precipitation duration, pre-event storage, and the distance between the well and the stream. The well that had the highest precipitation to recharge ratio also had the fastest recession rate, and was located furthest from the stream, in a riparian buffer adjacent to stormwater dry wells. This work may be used to evaluate the effects of watershed-scale infiltration-focused stormwater management on groundwater flow systems.