

## Optimization of Distributed Retention for Peak Runoff Control

Paul Koch, Ph.D., P.E.

Low Impact Development Center

Retention, as used here, refers to the capture of runoff on-site so that it does not reach the drainage area outlet during a storm event. Instead, the water will be infiltrated, evaporated, absorbed by vegetation, or withdrawn later by some other means.

A straightforward application of Rational Method assumptions indicates how optimizing the placement of retention for peak control will involve capturing runoff from the uppermost part of the drainage area. Optimal placement will minimize the amount of retention necessary to achieve any given peak flow reduction target.

Optimal placement of retention will consistently require less total storage capacity than what would be required in a conventional detention pond. If a triangular hydrograph based on the Rational Method is used for the analysis, then to achieve a peak reduction of  $r\%$ , the theoretical minimum amount of retention required will be  $r\%$  of the capacity of the detention that would otherwise be required at the outlet. Achieving the theoretical minimum requires that the retention is placed in the upper  $r\%$  of the drainage area. This minimum will be approached as the number of retention units increases and their size decreases.

The use of unit hydrograph methods, rather than the Rational Method, will add a significant level of complexity to the optimization analysis. Nevertheless, the analysis will lead to similar results.