Report for 2004WI78B: Design and Evaluation of Rain Gardens for Enhancement of Groundwater Recharge

- Articles in Refereed Scientific Journals:
  - Dussaillant, A. R., C. Wu, and K.W. Potter, Richards equation model of a rain garden, Journal of Hydrologic Engineering, ASCE, 9(3), 219-225, 2004.
  - Brander, K. E., K. E. Owen, and K. W. Potter, Modeled impacts of development type on runoff volume and infiltration performance, Journal of the American Water Resources Association, 40(4), 961-970, 2004.

Report Follows

Design and Evaluation of Rain Gardens for Enhancement of Groundwater Recharge

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Funding Agency: UWS Groundwater Research Program

Project Duration: July 2003–June 2005

In highly urbanized and rapidly urbanizing portions of Wisconsin, groundwater depletion can and has occurred as a result of excessive pumping and reduction of groundwater recharge due to introduction of impervious surfaces. In past and ongoing research we have demonstrated that rain gardens (sunken gardens that receive surface runoff) have the potential of increasing local groundwater recharge rates well above natural rates. We have developed continuous hydrologic models and used them to evaluate the performance of various rain garden designs. We have also constructed an experimental rain garden to provide validation data and improve our understanding of rain garden performance. The objectives of the proposed research are twofold: to develop design charts and other guidelines to facilitate the design of rain gardens; and to operate the recently completed experimental rain garden for the two-year project duration to provide information on the long-term behavior and data for evaluating the ability of our models to simulate long-term performance. The design charts and other information developed in this project will greatly facilitate the use of rain gardens to enhance groundwater recharge in Wisconsin, and hence will contribute to the mitigation of aquifer depletion and groundwater degradation in highly urbanized and rapidly urbanizing portions of the state.

Project Update:

We have made significant improvements to RECARGA, the model we developed for designing and evaluating bioretention facilities. Prior to these improvements, it was necessary to use RECARGA in an iterative fashion to arrive at a facility area that met a specified infiltration requirement. The revised model allows direct calculation of the required area.

We have completed a technical manual for the design of bioretention facilities. This manual explains in detail the role of each design parameter and offers general advise about the application of infiltration practices. It also includes information on the use of RECARGA. The manual is currently undergoing external peer review.

We collected data from the experimental rain garden through the spring of 2005. Late in 2004 the facility developed clogging problems that limited the usefulness of measurements of infiltration amounts. However, operation of the facility during the winter of 2004-5 demonstrated that bioretention facilities can effectively function during winter thaws.