

Technical Memorandum



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From: Scott Ferre
Copies:
Date: November 13, 2007
Subject: HSPF INFILT Parameter Study
Project No.: 14505

Introduction

The HSPF INFILT parameter is used in PERLNDS to define the infiltration rate of soils. This parameter was adjusted to several values for a single family residential development to determine the affects on detention pond sizes designed in accordance with Ecology's Manual.

The development modeled is 11.39 acres and is located in Clark County with HSG C soils and flat slopes. Pre-development conditions were modeled with HSG C soils, forest cover, and flat slopes.

Post-development conditions were modeled with 5.39 acres of HSG C soils, lawn cover, and flat slopes, and 6.00 acres of impervious area with flat slopes. The INFILT parameter was adjusted for each run of the model from 0.01 in/hr to 2.0 in/hr. The default setting for the INFILT parameter for HSG C soils, lawn cover, and flat slopes is 0.03 in/hr. The default setting is from the HSPF model calibrated for the Puget Sound area.

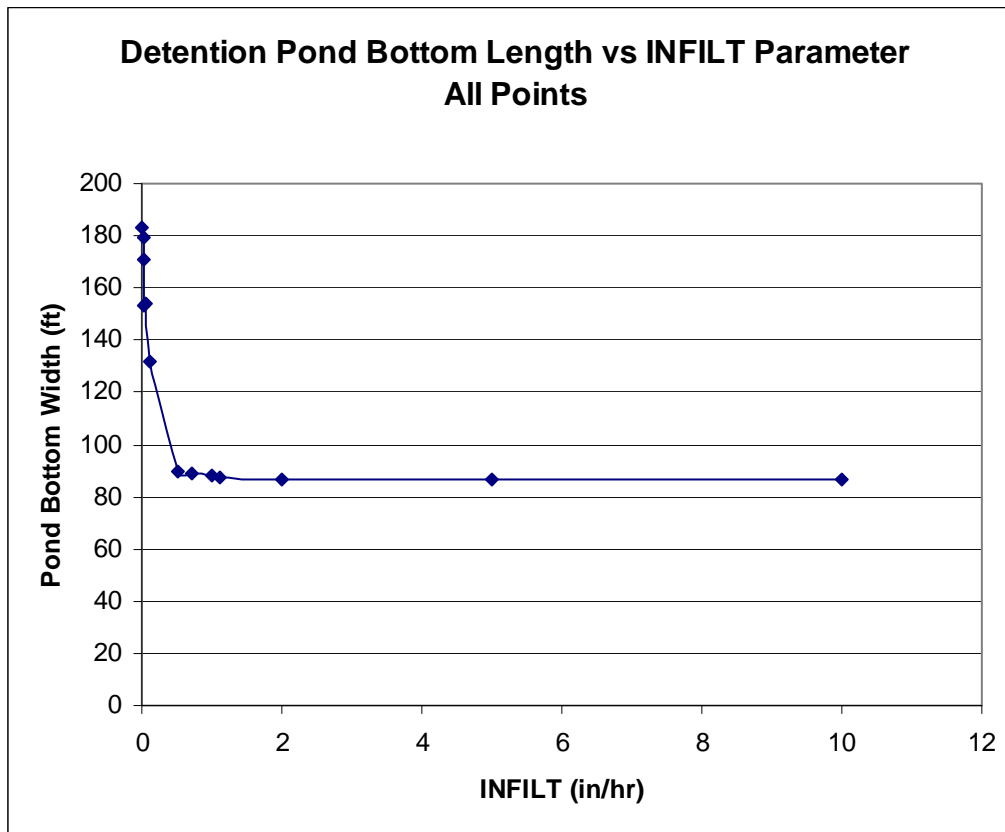
WWHM3 was used for modeling and the Autopond feature was programmed to create a pond at the highest setting (10-minutes) to ensure design of the most efficient flow control structure and pond size for each value of the INFILT parameter modeled.

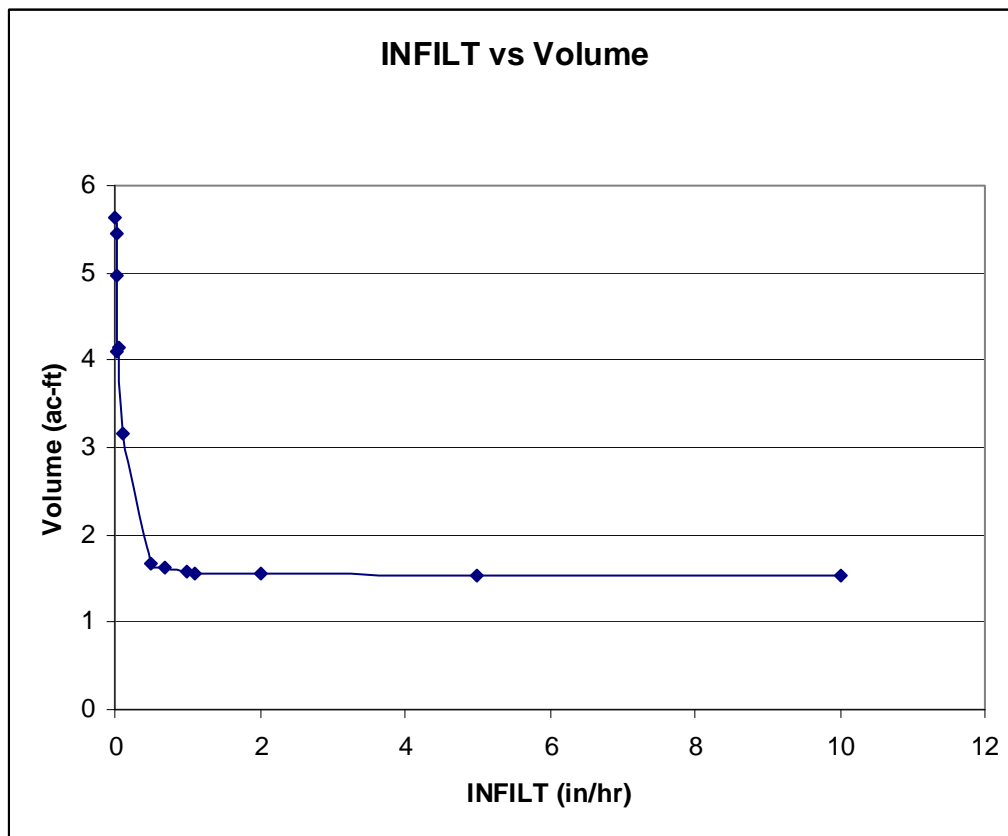
Results

The table on the next page lists the values for the INFILT parameters used and the resulting bottom lengths of the ponds and volumes designed by Autopond. The ponds are 7 feet deep with 1:1 length to width ratios and 3:1 horizontal to vertical side slopes.

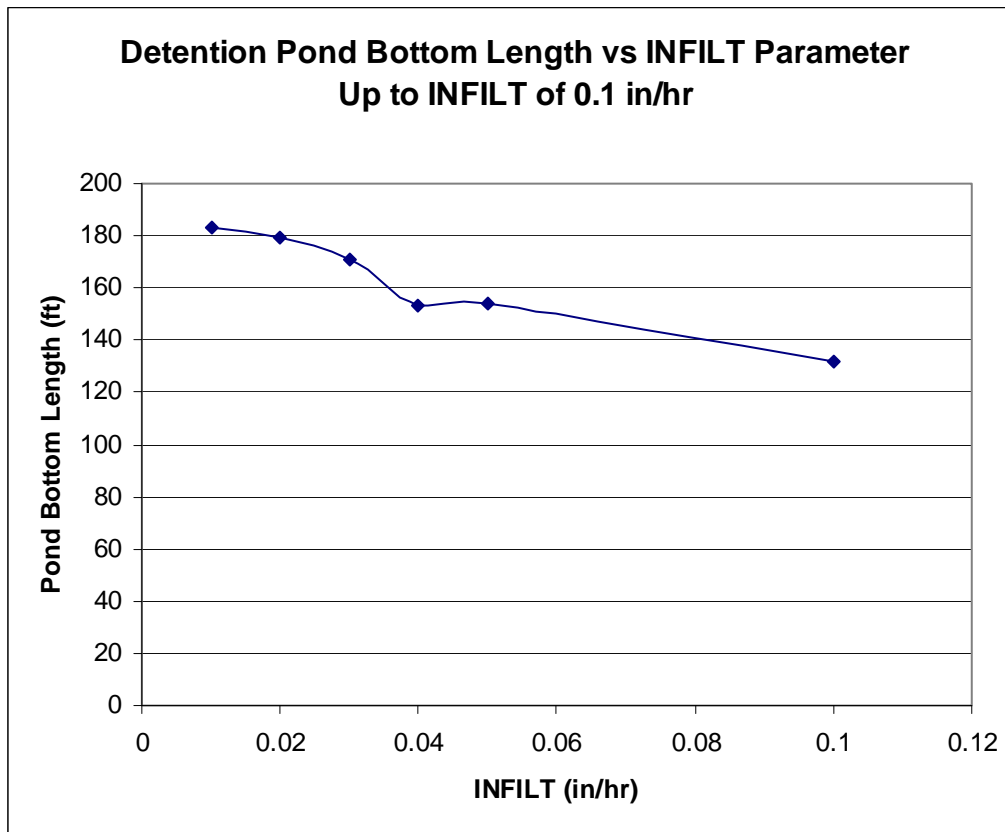
INFILT Parameter Value and Resulting Pond Bottom Length and Volume		
INFILT (in/hr)	Bottom Length Feet (1:1 length to width ratio)	Volume (acre-feet)
0.01	182.8	5.64
0.02	179.5	5.46
0.03 (HSPF default for Puget Sound PERLND modeled)	171.0	4.98
0.04	153.0	4.10
0.05	153.9	4.14
0.10	132.0	3.16
0.50	90.0	1.67
0.70	89.2	1.62
1.00	87.9	1.59
1.10	87.3	1.56
2.00	86.8	1.56
5.00	86.5	1.54
10.00	86.5	1.54

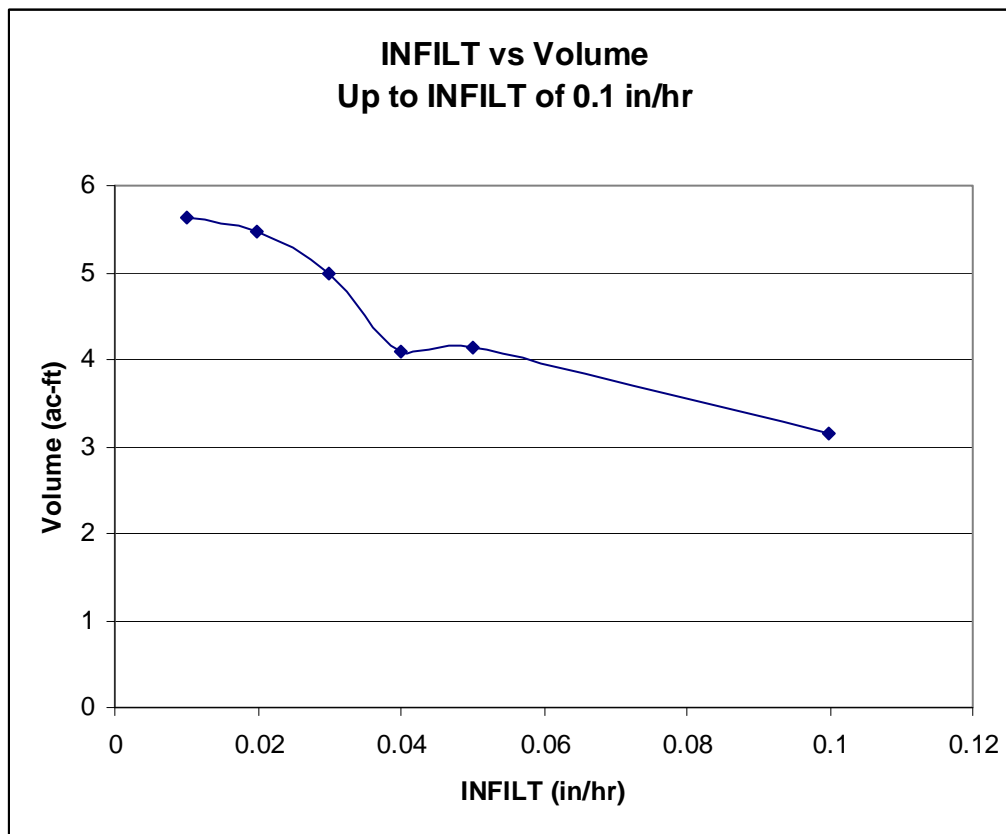
The charts on the next pages show plots of the points from the above table. The first two charts show plots of all the points and the second two charts show plots of the points up to an INFILT parameter value of 0.1. The second two charts allow a better visualization of the pond bottom length and volume increase corresponding to small increases in the INFILT parameter.





The above charts show that when the INFILT parameter reaches approximately 0.5 in/hr the rate of change of decrease in the pond bottom length and volume approaches zero. At an INFILT parameter value of greater than 2.0, the pond bottom length and volume approach constant values. This would indicate that the INFILT parameter cannot be set independently to result in 100% infiltration of runoff from the development and that a pond is still required.





The above two charts show that minimal changes in the INFILT parameter in the range of values near the HSPF Puget Sound default value result in large decreases in pond bottom lengths and volumes. An increase in the INFILT parameter of 0.01 from the HSPF default value (going from INFILT = 0.03 to 0.04) results in the pond bottom length decreasing by 18 ft and the volume decreasing by 0.9 ac-ft.

Summary

This study shows that adjusting the INFILT parameter, which is one of several PERLND parameters, can result in significant pond bottom length and volume changes.

Results indicate there may be a need to develop calibrated PERLNDs for southwest Washington. Depending on site pre-development and post-development conditions, pond sizes designed in southwest Washington using PERLNDs calibrated for the Puget Sound area may be oversized or undersized considerably.

Recommendations

Acceptable differences in pond sizes and volumes resulting from using PERLND parameters calibrated for Puget Sound and using adjusted PERLND parameters should be determined. Then the PERLND parameters in southwest Washington that would most likely differ from those calibrated for the Puget Sound area should be determined. These parameters and combinations of these parameters should then be studied to determine which ones have the greatest impact on pond sizes and if the resulting pond sizes exceed the acceptable differences. If adjusting these parameters or combinations of these parameters results in unacceptable pond size differences, then these parameters should be calibrated for southwest Washington.

- 1) Determine acceptable difference in pond size (i.e. if >5%, then unacceptable).
- 2) Determine which PERLND parameters will differ the most between Puget Sound and SW Wash.
- 3) Play with these parameters and combinations of them to see which ones affect pond sizing the most.
- 4) Find out if playing with these parameters even results in a >5% pond size change.
- 5) If a >5% change in pond size occurs, calibration is needed, if not then calibration isn't needed.