

Overview of Performance by BMP Category and Common Pollutant Type

International Stormwater Best Management Practices (BMP) Database
[1999-2008]



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Analysis of Treatment System Performance Disclaimer

The BMP Database (“Database”) was developed as an account of work sponsored by the Water Environment Research Foundation (WERF), the American Society of Civil Engineers (ASCE) / Environmental and Water Resources Institute (EWRI), the American Public Works Association (APWA), the Federal Highway Administration (FHWA), and U.S. Environmental Protection Agency (EPA)(collectively, the “Sponsors”). The Database is intended to provide a consistent and scientifically defensible set of data on Best Management Practice (“BMP”) designs and related performance. Although the individuals who completed the work on behalf of the Sponsors (“Project Team”) made an extensive effort to assess the quality of the data entered for consistency and accuracy, the Database information and/or any analysis results are provided on an “AS-IS” basis and use of the Database, the data information, or any apparatus, method, or process disclosed in the Database is at the user’s sole risk. The Sponsors and the Project Team disclaim all warranties and/or conditions of any kind, express or implied, including, but not limited to any warranties or conditions of title, non-infringement of a third party’s intellectual property, merchantability, satisfactory quality, or fitness for a particular purpose. The Project Team does not warrant that the functions contained in the Database will meet the user’s requirements or that the operation of the Database will be uninterrupted or error-free, or that any defects in the Database will be corrected.

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The Project Team’s tasks have not included, and will not include in the future, recommendations of one BMP type over another. However, the Project Team's tasks have included reporting on the performance characteristics of BMPs based upon the entered data and information in the Database, including peer reviewed performance assessment techniques. Use of this information by the public or private sector is beyond the Project Team’s influence or control. The intended purpose of the Database is to provide a data exchange tool that permits characterization of BMPs solely upon their measured performance using consistent protocols for measurements and reporting information.

The Project Team does not endorse any BMP over another and any assessments of performance by others should not be interpreted or reported as the recommendations of the Project Team or the Sponsors.

Analysis of Treatment System Performance Overview of Performance by BMP Category and Common Pollutant Type

The following one-page tabular summary provides analysis results from available monitoring data drawn from the International Stormwater Best Management Practices (BMP) Database as of October 2007 to determine whether any differences in treatment performance may be determined based on BMP category (e.g. detention basin, media filter, wetland basin, etc). Summary statistics are provided for the median and upper and lower 95th percentile confidence limits for the median for each BMP study's average influent and effluent event mean concentrations (EMCs) over the entire respective monitoring period, grouped by BMP category. For each water quality constituent examined, only those BMP studies reporting at least three influent and effluent EMCs were included in the analysis data set. Additionally, the Database may contain additional studies not included in these analysis results due to unique site features or monitoring designs that may also be useful in assessing BMP performance.

Note on Hydrodynamic Devices:

For this overview-level analysis, BMPs have been grouped into broad categories. These categories may mask distinctive differences in design and performance in subcategories for multiple BMP types. This is particularly true for the Hydrodynamic Device (HD) category, which represents a wide range of various proprietary and non-proprietary device types. Each of the BMPs categorized as HD device types incorporates or emphasizes a number of different unit processes and design elements (e.g., storage versus flow-through designs, inclusion of media filtration, etc.) that vary significantly throughout the category. These design features likely have significant effects on BMP performance and the underlying detailed data analysis for each HD device (available from www.bmpdatabase.org) should be referenced before drawing conclusions on the performance of Hydrodynamic Devices (and to some extent other BMP types.) At this time it is not possible to identify which unit processes or design elements represent key differentiators in performance, nor to further subdivide this category. Any interpretation or use of the results presented herein should fully acknowledge the widely varied nature of Hydrodynamic Devices, as well as other BMP categories. We recommend that for HD devices in particular that more attention be paid to the observed ranges in performance than median or mean effluent values. The Project Team's future plans include developing additional BMP categories (and subcategories) as more studies become available.

Median of Average Influent and Effluent Concentrations of Best Management Practices

Constituents	Sample Location	Detention Pond (n=25) ¹	Wet Pond (n=46) ¹	Wetland Basin (n=19) ¹	Biofilter (n=57) ¹	Media Filter (n=38) ¹	Hydrodynamic Devices (n=32) ¹	Porous Pavement (n=6) ¹
Suspended Solids (mg/L)	Influent	72.65 (41.70-103.59)	34.13 (19.16-49.10)	37.76 (18.10-53.39)	52.15 (41.41-62.88)	43.27 (27.25-59.58)	39.61 (21.95-76.27)	xx
	Effluent	31.04 (16.07-46.01)	13.37 (7.29-19.45)	17.77 (9.26-26.29)	23.92 (15.07-32.78)	15.86 (9.74-21.98)	37.67 (21.28-54.02)	16.96 (5.90-48.72)
Total Cadmium (µg/L)	Influent	0.71 (0.45-1.28)	0.49 (0.20-0.79)	0.36 (0.11-0.60)	0.54 (0.40-0.67)	0.25 (0.12-0.49)	0.74 (0.37-1.11)	xx
	Effluent	0.47 (0.25-0.87)	0.27 (0.12-0.61)	0.24 (0.11-0.55)	0.30 (0.26-0.35)	0.19 (0.1-0.37)	0.57 (0.25-1.33)	xx
Dissolved Cadmium (µg/L)	Influent	0.24 (0.15-0.33)	0.19 (0.10-0.28)	xx	0.25 (0.21-0.28)	0.16 (0.11-0.21)	0.33 (0.11-0.55)	xx
	Effluent	0.25 (0.17-0.36)	0.11 (0.08-0.15)	xx	0.21 (0.19-0.23)	0.13 (0.10-0.18)	0.31 (0.13-0.71)	xx
Total Copper (µg/L)	Influent	20.14 (8.41-31.79)	8.91 (5.29-12.52)	5.65 (2.67-38.61)	31.93 (25.25-38.61)	14.57 (10.87-18.27)	15.42 (9.20-21.63)	xx
	Effluent	12.10 (5.41-18.80)	6.36 (4.70-8.01)	4.23 (0.62-7.83)	10.66 (7.68-13.68)	10.25 (8.21-12.29)	14.17 (8.33-20.01)	2.78 (0.88-8.78)
Dissolved Copper (µg/L)	Influent	6.66 (0.73-12.59)	7.33 (5.40-9.26)	xx	14.15 (10.14-18.16)	7.75 (4.55-10.96)	13.59 (9.82-17.36)	xx
	Effluent	7.37 (3.28-11.45)	4.37 (3.73-5.73)	xx	8.40 (5.65-11.45)	9.00 (7.28-10.72)	13.92 (4.40-23.44)	xx
Total Chromium (µg/L)	Influent	7.36 (5.49-9.88)	6.00 (3.58-10.08)	xx	5.63 (4.49-7.05)	2.18 (1.66-2.86)	4.07 (2.39-6.91)	xx
	Effluent	3.18 (2.10-4.84)	1.44 (0.79-2.66)	xx	4.64 (3.08-6.98)	1.48 (0.82-2.70)	3.52 (2.14-5.80)	xx
Total Lead (µg/L)	Influent	25.01 (12.06-37.95)	14.36 (8.32-20.40)	4.62 (1.43-11.89)	19.53 (10.11-28.95)	11.32 (6.09-16.55)	18.12 (5.70-30.53)	xx
	Effluent	15.77 (4.67-26.87)	5.32 (1.63-9.01)	3.26 (2.31-4.22)	6.70 (2.81-10.59)	3.76 (1.08-6.44)	10.56 (4.27-16.85)	7.88 (1.64-37.96)
Dissolved Lead (µg/L)	Influent	1.25 (0.33-2.17)	3.40 (1.12-5.68)	0.50 (0.33-0.67)	2.25 (0.77-3.74)	1.44 (1.05-1.82)	1.89 (0.83-2.95)	xx
	Effluent	2.06 (0.93-3.19)	2.48 (0.98-5.36)	0.87 (0.85-0.89)	1.96 (1.26-2.67)	1.18 (0.77-1.60)	3.34 (2.22-4.47)	xx
Total Zinc (µg/L)	Influent	111.56 (51.50-171.63)	60.75 (45.23-76.27)	47.07 (24.47-90.51)	176.71 (128.28-225.15)	92.34 (52.29-132.40)	119.08 (73.50-164.67)	xx
	Effluent	60.20 (20.70-99.70)	29.35 (21.13-37.56)	30.71 (12.80-66.69)	39.83 (28.01-51.56)	37.63 (16.80-58.46)	80.17 (52.72-107.61)	16.60 (5.91-46.64)
Dissolved Zinc (µg/L)	Influent	26.11 (5.20-75.10)	47.46 (37.65-57.27)	xx	58.31 (32.46-79.16)	69.27 (37.97-100.58)	35.93 (4.96-66.90)	xx
	Effluent	25.84 (10.75-40.93)	32.86 (17.70-48.01)	xx	25.40 (18.71-32.09)	51.25 (29.04-73.46)	42.46 (10.38-74.55)	xx
Total Phosphorus (mg/L)	Influent	0.19 (0.17-0.22)	0.21 (0.13-0.29)	0.27 (0.11-0.43)	0.25 (0.22-0.28)	0.20 (0.15-0.26)	0.24 (0.01-0.46)	xx
	Effluent	0.19 (0.12-0.27)	0.12 (0.09-0.16)	0.14 (0.04-0.24)	0.34 (0.26-0.41)	0.14 (0.11-0.16)	0.26 (0.12-0.48)	0.09 (0.05-0.15)
Dissolved Phosphorus (mg/L)	Influent	0.09 (0.06-0.13)	0.09 (0.06-0.13)	0.10 (0.04-0.22)	0.09 (0.07-0.11)	0.09 (0.03-0.14)	0.06 (0.01-0.11)	xx
	Effluent	0.12 (0.07-0.18)	0.08 (0.04-0.11)	0.17 (0.03-0.31)	0.44 (0.21-0.67)	0.09 (0.07-0.11)	0.09 (0.04-0.13)	xx
Total Nitrogen (mg/L)	Influent	1.25 (0.83-1.66)	1.64 (1.39-1.94)	2.12 (1.58-2.66)	0.94 (0.94-1.69)	1.31 (1.19-1.42)	1.25 (0.33-2.16)	xx
	Effluent	2.72 (1.81-3.63)	1.43 (1.17-1.68)	1.15 (0.82-1.62)	0.78 (0.53-1.03)	0.76 (0.62-0.89)	2.01 (1.37-2.65)	xx
Nitrate-Nitrogen (mg/L)	Influent	0.70 (0.35-1.05)	0.36 (0.21-0.51)	0.22 (0.01-0.47)	0.59 (0.44-0.73)	0.41 (0.30-0.51)	0.40 (0.06-0.73)	xx
	Effluent	0.58 (0.25-0.91)	0.23 (0.13-0.37)	0.13 (0.07-0.26)	0.60 (0.41-0.79)	0.82 (0.60-1.05)	0.51 (0.08-1.34)	xx
TKN (mg/L)	Influent	1.45 (0.97-1.94)	1.26 (1.03-1.49)	1.15 (0.81-1.48)	1.80 (1.62-1.99)	1.52 (1.07-1.96)	1.09 (0.52-1.67)	xx
	Effluent	1.89 (1.58-2.19)	1.09 (0.87-1.31)	1.05 (0.82-1.34)	1.51 (1.24-1.78)	1.55 (1.22-1.83)	1.48 (0.87-2.47)	1.23 (0.44-3.44)

¹ Actual number of BMPs reporting a particular constituent may be greater or less than the number reported in this table, which was based on number of studies reported in database based on BMP category.

Notes: xx- Lack of sufficient data to report median and confidence interval. Values in parenthesis are the 95% confidence intervals about the median.

Differences in median influent and effluent concentrations does not necessarily indicate that there was a statistically significant difference between influent and effluent. See "Analysis of Treatment System Performance, International Stormwater BMP Database (1997-2007) (Geosyntec and WWE 2007) for more detailed information. Source: International Stormwater BMP Database June 2008 (www.bmpdatabase.org)