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Pollutant	Benchmark or Water Quality Criteria	Proprietary Technologies		
		Hydrodynamic Devices	Filtration	Other
Total Suspended Solids (mg/L)	100 (EPA); 130 (1200-Z); 50 (1200-COLS)	<u>37.67</u> median (LCL 21.28, UCL 54.02) of mean effluents from 30 BMP's; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>75</u> median (Q1 52, Q3 700) of mean effluents from 4 BMPs; ETV _b	9.0 median (min <0.5, max 58.0) of 10 composite samples from 4 storm events for 1 BMP; electro-coagulation; TAI _e
		<u>80</u> median (Q1 49, Q3 162) of mean effluents from 5 BMPs; ETV _b	<u>23</u> median (Q1 17, Q3 28) of average effluents from 4 BMPs; WA DOE TAPE _c	<0.5 median (min <0.5, max 3.0) of 20 composite samples from 7 storm events for 1 BMP; ion exchange; TAI _e
		11 median (Q1 6, Q3 18) effluent from 33 events for 1 BMP; NJCAT _d	14 median (Q1 4.0, Q3 20) effluent from 14 events for 1 BMP; NJCAT _d	
Copper, Total (ug/L)	18 (acute, hardness 100 mg/L); 5.6 (EPA, example hardness 25-50mg/L); 100 (1200-Z); 36 (1200-COLS); WA DOE ISGP: 14 Western WA, 32 Eastern WA	<u>14.17</u> median (LCL 8.33, UCL 20.01) of mean effluents from 12 BMPs; <i>no</i> significant difference between influent and effluent EMCs; Int BMP DB _a	7, 23, 57 median effluents from 3 BMPs; ETV _b	92.5 median (min 11.4, max 403.0) of 10 composite samples from 4 storm events for 1 BMP; electro-coagulation; TAI _e
		20, 41 median effluents from 2 BMPs; ETV _b	7.6 median (min 4.0, max 21.0) of 19 composite samples from 7 storm events for 1 BMP; TAI _e	7.5 median (min 2.0, max 18.7) of 20 composite samples from 7 storm events from 1 BMP; ion exchange; TAI _e
Iron, Total (ug/L)	1000 (chronic); 1000 (EPA)	--	--	--

Concentrations in bold and underlined represent medians or averages of multiple BMPs.

< concentraion values represent non-detect limits

Pollutant	Benchmark or Water Quality Criteria	Proprietary Technologies		
		Hydrodynamic Devices	Filtration	Other
Lead, Total (ug/L)	23 (EPA, example hardness 25-50); EPA BM equals acute criteria; 400 (1200-Z); 60 (1200-COLS); 81.6(WA DOE ISGP-industry specific)	<u>10.56</u> median (LCL 4.27, UCL 16.85) of mean effluents from 9 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	20, 16, 88 median effluents from 3 BMPs; ETV _b	3.4 median (min <2.0, max 21.5) of 10 composite samples from 4 storm events for 1 BMP; electro-coagulation; TAI _e
		90 median (Q1 35, Q2 100) effluent of 15 events from 1 BMP; ETV _b	<2.0 effluent concentration of 19 composite samples from 7 storm events for 1 BMP; TAI _e	<2.0 effluent concentration of 20 composite samples from 7 storm events for 1 BMP; ion exchange; TAI _e
Manganese, Total (ug/L)	50 (HH W,O), 100 (HH O)	--	--	--
Mercury, Total (ug/L)	2.4 (acute); 1.4 (EPA)	--	--	<0.1 outflow conc. for all 9 samples from an oil/water separator; Int BMP DB _f
Zinc, Total (ug/L)	50 (EPA, hardness 25-50); EPA BM equals acute criteria; 600 (1200-Z); 240 (1200-COLS); 117 (WA DOE ISGP)	<u>80.17</u> median (LCL 52.72, UCL 107.61) of mean effluents from 18 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>99</u> median (Q1 54, Q3 190) of mean effluents from 4 BMPs; ETV _b	63.5 median (min 7.0, max 168.0) of 10 composite samples from 4 storm events for 1 BMP; electro-coagulation; TAI _e
		90, 170 median effluent from 2 BMPs; ETV _b	70 median (min 46.0, max 153.0) of 19 composite samples from 7 storm events for 1 BMP; TAI _e	10.5 median (min 6.0, max 29.0) of 20 composite samples from 7 storm events for 1 BMP; ion exchange; TAI _e
			<0.5 median (min <0.5, max 2.0) of 19 composite samples from 7 storm events for 1 BMP; TAI _e	

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Pollutant	Benchmark or Water Quality Criteria	Proprietary Technologies		
		Hydrodynamic Devices	Filtration	Other
Arsenic, Total (ug/L)	150 (EPA), 0.0022 (HH W, O), 0.0175 (HH O)	1.0 median outflows from each of two BMPs; Int BMP DB _f	--	<u>2.35</u> median (Q1 2.3, Q3 3.05) of median outflows from 5 catchbasin insterts; Int BMP DB _f
		--	--	2.0 median (Q1 1.77, Q3 2.93) of 9 samples of outflows from an oil/water separator; Int BMP DB _f
Oil and Grease (mg/)	10 (1200-Z, 1200-COLS)	<u><2.5</u> median (Q1 <2.5, Q3 3) of median effluents from 5 BMPs, Int BMP DB _f	<u>3.9</u> median (Q1 <2.5, Q2 5.4) of median effluents from 5 BMPs; Int BMP DB _f	1.0, <2.5, 5.0 median effluent from 3 oil/water separators; Int BMP DB _f
E. Coli (counts per 100/mL); indicator for Fecal Coliform	406 (1200-Z, 1200-COLS)	30255 median of 4 samples from 1 BMP; Int BMP DB _f	--	--
Chemical Oxygen Demand (mg/L)	120 (EPA)	<u>55.5</u> median (Q1 48.25, Q3 65.75) of medians from 4 BMPs; Int BMP DB _f	<u>42</u> median (Q1 38, Q3 78) of median effluent from 5 BMPs; Int BMP DB _f	--
		69 median (Q1 55, Q3 86) effluent of 17 events for 1 BMP; ETV _b	50 median (Q1 34, Q3 78) effluent of 17 events for 1 BMP; ETV _b	
Biological Oxygen Demand (mg/L)	33 (1200-COLS), 30 (EPA)	6, 22 median effluent from 2 BMPs; Int BMP DB _f	<u>10</u> median (Q1 8, Q3 14) of median effluent from 5 BMPs; Int BMP DB _f	--

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Pollutant	Benchmark or Water Quality Criteria	Proprietary Technologies		
		Hydrodynamic Devices	Filtration	Other
Phosphorus, Total (mg/L)	2.0 (EPA); 0.16 (1200-COLS)	<u>0.26</u> median (LCL 0.12, UCL 0.48) of mean effluents from 21 BMPs; <i>no</i> significant difference between influent and effluent EMCs; Int BMP DB _a	0.034, 0.10, 0.11 median effluents for 3 BMPs; ETV _b	--
		0.14, 0.14, 0.15 median effluents for each of 3 BMPs; ETV _b		
Nitrate + Nitrite, Total (mg/L as N)	0.68 (EPA)	<u>0.34</u> median (LCL 0.20, UCL 0.47) of mean effluents from 9 BMPs; <i>no</i> significant difference between influent and effluent EMCs; Int BMP DB _a	0.64, 1.2 median effluents for 2 BMPs; ETV _b	--
		0.26, 0.35 median effluents for 2 BMPs; ETV _b		

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Pollutant	Benchmark or Water Quality Criteria	Public Domain Technologies			
		Detention Basin	Biofilter	Media Filter	Retention Pond
Total Suspended Solids (mg/L)	100 (EPA); 130 (1200-Z); 50 (1200-COLS)	<u>31.04</u> median (LCL 16.07, UCL 46.01) of mean effluents from 22 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>23.92</u> median (LCL 15.07, UCL 32.78) of mean effluents from 56 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>15.86</u> median (LCL 9.74, UCL 21.98) of mean effluents from 33 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>13.37</u> median (LCL 7.29, UCL 19.45) of mean effluents from 43 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a
Copper, Total (ug/L)	18 (acute, hardness 100 mg/L); 5.6 (EPA, example hardness 25-50mg/L); 100 (1200-Z); 36 (1200-COLS); WA DOE ISGP: 14 Western WA, 32 Eastern WA	<u>12.10</u> median (LCL 5.41, UCL 18.80) of mean effluents from 19 BMPs; <i>no</i> significant difference between influent and effluent EMCs; Int BMP DB _a	<u>10.66</u> median (LCL 7.68, UCL 13.68) of mean effluents from 50 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>10.25</u> median (LCL 8.21, UCL 12.29) of mean effluents from 27 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>6.36</u> median (LCL 4.70, UCL 8.01) of mean effluents from 27 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a
Iron, Total (ug/L)	1000 (chronic); 1000 (EPA)	820, 1200, 1600 median effluent from 3 BMPs; Int BMP DB _f	<u>240</u> median (Q1 60, Q3 580) of median outflows from 7 BMPs; Int BMP DB _f	<u>219</u> median (Q1 110, Q3 460) of median outflows from 4 BMPs; Int BMP DB _f	<u>370</u> median (Q1 230, Q3 530) of median outflows from 4 BMPs; Int BMP DB _f

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Pollutant	Benchmark or Water Quality Criteria	Public Domain Technologies			
		Detention Basin	Biofilter	Media Filter	Retention Pond
Lead, Total (ug/L)	23 (EPA, example hardness 25-50); EPA BM equals acute criteria; 400 (1200-Z); 60 (1200-COLS); 81.6(WA DOE ISGP-industry specific)	<u>15.77</u> median (LCL 4.67, UCL 26.87) of mean effluents from 15 BMPs; <i>no</i> significant difference between influent and effluent EMCs; Int BMP DB _a	<u>6.70</u> median (LCL 2.81, UCL 10.59) of mean effluents from 50 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>3.76</u> median (LCL 1.08, UCL 6.44) of mean effluents from 24 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>5.32</u> median (LCL 1.63, UCL 9.01) of mean effluents from 30 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a
Manganese, Total (ug/L)	50 (HH W,O), 100 (HH O)	--	1.6, 3.1, 6.2 median effluent from 3 BMPs; Int BMP DB _f	--	<u>48</u> median (Q1 18, Q3 64) of median outflows from 6 BMPs; Int BMP DB _f
Mercury, Total (ug/L)	2.4 (acute); 1.4 (EPA)	0.02 median (Q1 unspec. non-detect value, Q3 0.10) 10 samples of outflow from 1 BMPs; Int BMP DB _f	0.01 Q3, max conc 0.1; Q1 and median of six samples are non-detects; Int BMP DB _f	<0.2, <0.1 median outflow from two BMPs; max values from the BMPs are 0.3 and 0.15; Int BMP DB _f	--
Zinc, Total (ug/L)	50 (EPA, hardness 25-50); EPA BM equals acute criteria; 600 (1200-Z); 240 (1200-COLS); 117 (WA DOE ISGP)	<u>60.20</u> median (LCL 20.70, UCL 99.70) of mean effluents from 21 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>39.83</u> median (LCL 28.01, UCL 51.65) of mean effluents from 54 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>37.63</u> median (LCL 16.80, UCL 58.46) of mean effluents from 34 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>29.35</u> median (LCL 21.13, UCL 37.56) of mean effluents from 34 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a

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Pollutant	Benchmark or Water Quality Criteria	Public Domain Technologies			
		Detention Basin	Biofilter	Media Filter	Retention Pond
Arsenic, Total (ug/L)	150 (EPA), 0.0022 (HH W, O), 0.0175 (HH O)	<u>1.8</u> median (Q1 0.94, Q3 2.4) of median effluents from 5 BMPs; Int BMP DB _f	0.30, 1.16, 1.25 median effluent from 3 BMPs; Int BMP DB _f	<u>1.35</u> median (Q1 0.84, Q3 1.7) of median outflows from 6 BMPs; Int BMP DB _f	<u>0.90</u> median (Q1 0.76, Q3 1.1) of median effluents from 4 BMPs; Int BMP DB _f
		--	--	--	--
Oil and Grease (mg/)	10 (1200-Z, 1200-COLS)	<u>2.5</u> median (Q1 2.5, Q3 2.9) of median effluents from 3 BMPs; Int BMP DB _f	<u><2.5</u> median (Q1 2.5, Q3 5.1) of median effluent from 6 BMPs _f	<u><1.685</u> median of median effluent values for 4 BMPs; all median values equal non-detects; Int BMP DB _f	<u>2.5</u> median (Q1 1.5, Q2 5.7) of median effluents from 7 BMPs; Int, BMP DB _f
E. Coli (counts per 100/mL); indicator for Fecal Coliform	406 (1200-Z, 1200-COLS)	<u>790</u> median (Q1 298, Q3 1700) of geometric mean outflow from 10 BMPs; Clary et al, 2008 _g	<u>2000</u> median (Q1 400, Q3 460) of geometric mean outflow from 18 BMPs, Clary et al, 2008 _g	98 median (Q1 57, Q3 190) of 5 samples from 1 BMP; Int BMP DB _f	80, 1400 median effluent from 2 BMPs; Int BMP DB _f
Chemical Oxygen Demand (mg/L)	120 (EPA)	--	<u>48</u> median (Q1 47, Q3 59) of median effluent from 5 BMPs; Int BMP DB _f	17, 19.2, 22.5 median outflow from 3 BMPs; Int BMP DB _f	17.3, 31.75. 35 median outflow from 3 BMPs; Int BMP DB _f
Biological Oxygen Demand (mg/L)	33 (1200-COLS), 30 (EPA)	3.8, 7.0 median effluent from 2 BMPs; Int BMP DB _f	4.0, 6.0, 6.5 median effluent from 3 BMPs; Int BMP DB _f	2.0 median effluent from 2 BMPs; Int BMP DB _f	<u>3.9</u> median (Q1 3.4, Q3 4.8) of median effluent from 4 BMPs; Int BMP DB _f

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Pollutant	Benchmark or Water Quality Criteria	Public Domain Technologies			
		Detention Basin	Biofilter	Media Filter	Retention Pond
Phosphorus, Total (mg/L)	2.0 (EPA); 0.16 (1200-COLS)	<u>0.19</u> median (LCL 0.12, UCL 0.32) of mean effluents from 19 BMPs; no significant difference between influent and effluent EMCs; Int BMP DB _a	<u>0.34</u> median (LCL 0.26, UCL 0.41) of mean effluents from 55 BMPs; no significant difference between influent and effluent EMCs; Int BMP DB _a	<u>0.14</u> median (LCL 0.11, UCL 0.16) of mean effluents from 28 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>0.12</u> median (LCL 0.09, UCL 0.16) of mean effluents from 40 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a
Nitrate + Nitrite, Total (mg/L as N)	0.68 (EPA)	<u>0.16</u> median (LCL 0.06, UCL 0.30) of mean effluents from 5 BMP; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>0.27</u> median (LCL 0.22, UCL 0.32) of average effluents from 12 BMPs; <i>effluent EMCs significantly greater than influent EMCs</i> ; Int BMP DB _a	<u>0.14</u> median (LCL 0.05, UCL 0.30) of mean effluents from 7 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a	<u>0.12</u> median (LCL 0.08, UCL 0.16) of mean effluents from 22 BMPs; significant difference between influent and effluent EMCs; Int BMP DB _a

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< concentraion values represent non-detect limits

a - Geosytec Consultants and Wright Water Engineers, Inc., 2008. Analysis of Treatment System Performance, International Stormwater Best Management Practices (BMP) Database [1999-2008].

- median of average effluent of individual BMP studies
- LCL = lower 95% confidence limit, UCL = upper 95% confidence limit

<http://www.bmpdatabase.org/Docs/Performance%20Summary%20June%202008.pdf>

b - Environmental Technology Verification (ETV)

http://www.nsf.org/business/water_quality_protection_center/reports.asp?program=WaterQuaProCen

c - Washington Department of Ecology's Technology Assessment Protocol - Ecology (TAPE); 4 proprietary BMPs which received General Use Level Designation (GULD) for Basic (TSS) Treatment; average removals assessed from Findings of Fact

<http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html#construction>

d - Median BMP effluent assessed from data submitted for verification by New Jersey Corporation for Advance technology (NJCAT) Program

<http://www.njstormwater.org/treatment.html>

e - Taylor Associates, Inc. 2008. Final Report Boatyard Stormwater Treatment Technology Study, Final Report. Prepared for Northwest Marine Trade Association, Puget Soundkeeper Alliance, and Washington State Department of Ecology

http://pugetsoundkeeper.org/files/Boatyard%20Stormwater%20Treatment%20Technology%20Report_Final.pdf

f - International Stormwater Database, analysis of compiled database information

<http://www.bmpdatabase.org/retrieveBMPs.asp>

g - Clary, J., J. Jones, B. Urbonas, M. Quigley, E. Strecker, and T. Wagner, 2008. Can Stormwater BMPs Remove Bacteria? New Findings from the International Stormwater Database. Stormwater. May, 2008. Vol. 9, No. 3. Forester Media, Inc.

http://www.stormh2o.com/sw_0805_can.html

Pollutant	Benchmark or Water Quality	Proprietary Technologies	
		Hydrodynamic Devices	Filtration
Acenaphthene	670 (HH W,O), 990 (HH O)	<0.02 median (Q1 0.02, Q3 0.06) of 15 sampling events from 1 BMP	<0.01, 0.01, <0.01 median effluent from 3 BMPs
Acenaphthylene			<0.01, 0.01, <0.01 median effluent from 3
Anthracene	8300 (HH W,O), 40000 (HH O)	<0.01 median (Q1 0.01, Q3 0.02) of 14 sampling events from 1 BMP	0.026 median (Q1 0.01, Q3 0.026) of median effluents from 4 BMPs
Benzo(a)Anthracene	0.0038 (HH W,O), 0.018 (HH O)	0.13 median (Q1 0.09, Q3 0.15) of 14 sampling events from 1 BMP	0.030 median (Q1 0.026, Q3 0.12) of median effluents from 4 BMPs
Benzo(a)Pyrene	0.0038 (HH W,O), 0.018 (HH O)	0.3 median (Q1 0.21, Q3 0.38) of 15 sampling events from 1 BMP	0.032 median (Q1 0.027, Q3 0.30) of median effluents from 4 BMPs
Benzo(b)Flouranthene	0.0038 (HH W,O), 0.018 (HH O)	0.5 median (Q1 0.34, Q3 0.55) of 15 sampling events from 1 BMP	2.7 median (Q1 , Q3) of 15 sampling events from 1 BMP
Benzo(g,h,i)Perylene		0.34 median (Q1 0.26, Q3 0.41) of 15 sampling events from 1 BMP	0.057 median (Q1 0.048, Q3 0.55) of median effluents from 4 BMPs
Benzo(k)Fluoranthene		0.22 median (Q1 0.18, Q3 0.25) of 15 sampling events from 1 BMP	0.078 median (Q1 0.063, Q3 0.34) of median effluents from 4 BMPs
Chrysene	0.0038 (HH W,O), 0.018 (HH O)	0.58 median (Q1 0.42, Q3 0.64) of 15 sampling events from 1 BMP	0.054 median (Q1 0.063, Q3 0.62) of median effluents from 4 BMPs
Dibenzo(a,h)Anthracene	0.0038 (HH W,O), 0.018 (HH O)	0.03 median (Q1 0.02, Q3 0.04) of 15 sampling events from 1 BMP	<0.01, 0.01, 0.01 median effluent from 3 BMPs
Fluoranthene	42 (HH W,O), 54 (HH O)	1.2 median (Q1 1.03, Q3 1.49) of 15 sampling events from 1 BMP	0.094 median (Q1 0.077, Q3 1.6) of median effluents from 4 BMPs
Fluorene	1100 (HH W,O), 5300 (HH O)	<0.06 median (Q1 0.06, Q3 0.19) of 15 sampling events from 1 BMP	<0.01, 0.01, 0.011 median effluent from 3 BMPs
Ideno(1,2,3-cd)Pyrene	0.0038 (HH W,O), 0.018 (HH O)	0.32 median (Q1 0.25, Q3 0.37) of 15 sampling events from 1 BMP	0.020 median (Q1 0.026, Q3 0.50) of median effluents from 4 BMPs

Pollutant	Benchmark or Water Quality	Proprietary Technologies	
		Hydrodynamic Devices	Filtration
Naphthalene		<0.03 median (Q1 0.03, Q3 0.05) of 15 sampling events from 1 BMP	<u>0.028</u> median (Q1 0.026, Q3 0.029) of median effluents from 4 BMPs
Phenathrene		0.62 median (Q1 0.32, Q3 0.85) of 15 sampling events from 1 BMP	<u>0.045</u> median (Q1 0.041, Q3 0.68) of median effluents from 4 BMPs
Pyrene	830 (HH W,O), 4000 (HH O)	0.95 median (Q1 0.67, Q3 1.22) of 15 sampling events from 1 BMP	<u>0.12</u> median (Q1 0.10, Q3 1.1) of median effluents from 4 BMPs

Concentrations in bold and underlined represent medians or averages of multiple BMPs.
< concentration values represent non-detection limits

HH W, O - Human health criteria based on consumption of water and aquatic organisms

HH O - Human health criteria based on consumption of aquatic organisms

Data taken from the following sources:

International BMP Database

<http://www.bmpdatabase.org/retrieveBMPs.asp>

City of Tacoma and Taylor Associates, Inc., 2008. EvTEC Ultra-Urban Stormwater Technology Evaluation Stormwater Management StormFilter.

<http://www.cityoftacoma.org/File.ashx?cid=9644>

<http://www.cityoftacoma.org/File.ashx?cid=9645>

Horwath, J.A., and Bannerman, R.T., 2010, Parking lot runoff quality and treatment efficiency of a stormwater-filtration device, Madison, Wisconsin, 2005–07: U.S. Geological Survey Scientific Investigations Report 2009–5196, 50 p.

http://pubs.usgs.gov/sir/2009/5196/pdf/sir2009-5196_web.pdf