**Table 1a: Watershed-level effects of stormwater management practices - Hydrologic effects**

| Study Name | Location | Study Design | Stormwater Management Approach | Storm Event Runoff (mm) | Peak discharge ($m^3/s$) | Lag-to-peak (min)[1] |
|---|---|---|---|---|---|---|
| Hood et al. (2007) | Waterford, CT | • Paired watersheds<br>• Observed data<br>• Average of 82 to 97 storm events depending on statistic | Conventional | 1.7 | 0.022 | 111 |
| | | | Low Impact Development | 0.2 | 0.0017 | 153 |
| | | | **% Change** | **88%** | **92%** | **-38%** |
| Bedan & Clausen (2009) | Waterford, CT | • Paired watersheds<br>• Observed data<br>• Average of three years of data | Conventional Developed in 1988[2] | 3.5 | 0.0246 | -- |
| | | | Conventional Developed in 2003 | 3.3 | 0.0152 | -- |
| | | | **% Change** | **6%** | **38%** | **--** |
| | | | Conventional Developed in 1988[2] | 4.0 | 0.0262 | -- |
| | | | Low Impact Development | 1.3 | 0.0030 | -- |
| | | | **% Change** | **68%** | **89%** | -- |
| | | | Conventional Developed in 2003[3] | 3.3 | 0.0152 | -- |
| | | | Low Impact Development[3] | 1.3 | 0.0030 | -- |
| | | | **% Change** | **61%** | **80%** | -- |
| Selbig & Bannerman (2008) | Cross Plains, WI | • Paired watersheds<br>• Observed data<br>• Annual average values for seven years | Conventional | 0.762 to 1.27 | 0.147 to 0.288 | -- |
| | | | Low Impact Development | <0.254 to 0.762 | 0.010 to 0.115 | -- |
| | | | **% Change** | **40% to 67%** | **60% to 93%** | -- |
| Lloyd et al. (2002)[5] | Lynnebrook, Australia | • Paired watersheds<br>• Observed data<br>• Average of one-month or smaller rainfall events[4] | Conventional | 1.5 | -- | -- |
| | | | Low Impact Development | 5.95 | -- | -- |
| | | | **% Change** | **75%** | **--** | -- |
| Cheng et al. (2003)[5] | Prince George's County, MD | • Paired watersheds<br>• Observed data<br>• Average of two years of data | Conventional | -- | -- | -- |
| | | | Low Impact Development | -- | -- | -- |
| | | | **% Change** | **60%** | **56%** | -- |
| Carter & Jackson (2007) | Athens, GA | • One watershed<br>• Modeled data<br>• Rain events ranging in size from 1.27 cm - 19.51 cm | Conventional | 2.03 to 169.3 | -- | -- |
| | | | Conventional with green roofs | 1.28 to 163.6 | -- | -- |
| | | | **% Change** | **3% to 37%** | -- | -- |
| Williams & Wise (2006) | Alachua County, FL | • One watershed<br>• Modeled data<br>• 2-year & 25-year storm events[6] | Conventional | 47.2, 118.8 | 8.6, 23.3 | -- |
| | | | Low Impact Development | 41.0, 111.3 | 5.7, 16.1 | -- |
| | | | **% Change** | **13%, 6%** | **34%, 31%** | -- |
| | | | Conventional (with ponds) | 31.4, 101.9 | 2.8, 9.8 | |
| | | | Low Impact Development (with ponds) | 30.2, 98.8 | 3.3, 10.6 | |
| | | | **% Change** | **4%, 3%** | **-18%, -8%** | |
| Gilroy & McCuen (2009) | Theoretical lot with rainfall data for Baltimore, MD | • One lot sized watershed<br>• Modeled data<br>• 2-year storm event<br>• Data range are for three different land uses (single family, townhome, commercial) | No BMPs | 1.69 to 2.675 | 0.010 to 0.013 | -- |
| | | | **Cisterns only** | **6% to 10%** | **0% to 6%** | **--** |
| | | | **Bioretention cells near lot outlet[7]** | **20% to 27%** | **3% to 8%** | **--** |
| | | | **Bioretention cells for cistern overflow** | **19% to 28%** | **14% to 31%** | **--** |
| | | | **Bioretention cells for impervious runoff** | **19% to 30%** | **0% to 8%** | **--** |
| | | | **Bioretention cells near cistern & impervious area** | **20% to 28%** | **3% to 16%** | **--** |

Notes:
Conventional watershed refers to a watershed with traditional stormwater management techniques (i.e. pipes and conveyance systems)
Low Impact Development watershed refers to a watershed with LID techniques, including but not limited to swales, filter strips, porous pavement, and bioretention.
Holman-Dodds et al. (2003) is another relevant study but values could not be read from the presented graphs. Authors can be contacted for original data.
[1] "Lag-to-peak" measures the time from the start of the rainfall event to the peak discharge.
[2] Stormwater management practices in this watershed were not described other than noting that it was developed in 1988.
[3] Conventional and LID data are collected for two different time periods, therefore, the Control watershed has two different range of values that match the Conventional and LID time periods (Conventional collected from 06/2003 - 06/2005; traditional collected from 8/2002 - 6/2005).
[4] Each rainfall event used was less than or equal to the one month average recurrence interval storm event.
[5] Papers are not peer-reviewed literature. Cheng et al. (2003) is a symposium paper. Lloyd et al. (2002) is project report.
[6] Data also available for the effect of site design on runoff. Low Impact Development presented here corresponds to "Partial LID" in the study; "Full LID" in the study includes bioretention *and* cluster housing design.
[7] Each scenario (except "cisterns only") has five bioretention cells located in different areas of the lot. All data are presented as percent change from the developed watershed without BMPs

**Table 1b: Watershed level effects of stormwater management practices - Water quality effects**

| Study Name | Location | Study Design | Stormwater Management Approach | TSS (kg/ha/yr) | TP (kg/ha/yr) | TN (kg/ha/yr) | Nitrate + Nitrite (kg/ha/yr) | TKN (kg/ha/yr) | Cu (g/ha/yr) | Pb (g/ha/yr) | Zn (g/ha/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Bedan & Clausen (2009) | Waterford, CT | • Paired watersheds<br>• Observed data<br>• Average of three years of data | Conventional Developed in 1988[1] | 64 | 0.462 | -- | 3.29 | 3.6 | 15 | 1 | 55 |
| | | | Conventional Developed in 2003 | 65 | 0.412 | -- | 0.83 | 2.4 | 18 | 2 | 17 |
| | | | **% Change** | **-2%** | **11%** | **--** | **75%** | **33%** | **-20%** | **-100%** | **69%** |
| | | | Conventional Developed in 1988[1] | 75 | 0.52 | -- | 4.02 | 3.99 | 21 | 5 | 87 |
| | | | Low Impact Development | 8 | 0.21 | -- | 0.25 | 0.9 | 4 | 0.5 | 10 |
| | | | **% Change** | **89%** | **60%** | **--** | **94%** | **77%** | **81%** | **90%** | **89%** |
| | | | Conventional Developed in 2003[2] | 65 | 0.412 | -- | 0.83 | 2.4 | 18 | 2 | 17 |
| | | | Low Impact Development[2] | 8 | 0.21 | -- | 0.25 | 0.9 | 4 | 0.5 | 10 |
| | | | **% Change** | **88%** | **49%** | **--** | **70%** | **63%** | **78%** | **75%** | **41%** |
| Dietz & Clausen (2007) | Waterford, CT | • Paired watershed<br>• Observed data<br>• Average annual values for nine years | Conventional | -- | 2 | 10 | -- | -- | -- | -- | -- |
| | | | Low Impact Development | -- | 0.4 | 2 | -- | -- | -- | -- | -- |
| | | | **% Change** | **--** | **80%** | **80%** | **--** | **--** | **--** | **--** | **--** |
| Selbig & Bannerman (2008) | Cross Plains, WI | • Paired watersheds<br>• Observed data<br>• Annual average values for seven years | Conventional | 27.9 to 103.3 | 0.07 to 0.15 | -- | -- | -- | -- | -- | -- |
| | | | Low Impact Development[3] | 0.58 to 134.5 | 0.01 to 0.48 | -- | -- | -- | -- | -- | -- |
| | | | **% Change** | **-30% to 98%** | **-220% to 86%** | **--** | **--** | **--** | **--** | **--** | **--** |
| Cheng et al. (2003)[4] | Prince George's County, MD | • Paired watersheds<br>• Observed data<br>• Average of two years of data | Conventional | 136.4 | 1.2 | 7.4 | 1.8 | 5.5 | 0.021 | 0.006 | 0.076 |
| | | | Low Impact Development | 116.9 | 1.7 | 7.1 | 1.2 | 6.0 | 0.013 | 0.005 | 0.048 |
| | | | **% Change** | **14%** | **-40%** | **3%** | **35%** | **-8%** | **36%** | **21%** | **37%** |
| Lloyd et al. (2002)[4] | Lynnebrook, Australia | • Paired watersheds<br>• Observed data<br>• Average of one-month or smaller rainfall events[5] | Conventional[6] | 0.01 | 0.011 | 0.086 | -- | -- | -- | -- | -- |
| | | | Low Impact Development[6] | 0.002 | 0.002 | 0.020 | -- | -- | -- | -- | -- |
| | | | **% Change** | **80%** | **83%** | **76%** | **--** | **--** | **--** | **--** | **--** |

Notes:

Conventional watershed refers to a watershed with traditional stormwater management techniques (i.e. pipes and conveyance systems)

Low Impact Development watershed refers to a watershed with LID techniques, including but not limited to swales, filter strips, porous pavement, and bioretention.

[1] Stormwater management practices in this watershed were not described other than noting that it was developed in 1988.

[2] Conventional and LID data are collected for two different time periods, therefore, the Control watershed has two different range of values that match the Conventional and LID time periods (Conventional collected from 06/2003 - 06/2005; traditional collected from 8/2002 - 6/2005).

[3] The TSS data included a ".0" value. W.R. Selbig clarified via personal communication the value was 0.05 tons.

[4] Papers are not peer-reviewed literature. Cheng et al. (2003) is a symposium paper. Lloyd et al. (2002) is project report.

[5] Each rainfall event used was less than or equal to the one month average recurrence interval storm event.

[6] Values were estimated from a graph.

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