Disconnected Impervious as a Stormwater Control Measure and Nutrient Reduction Technique

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Working Definition

Disconnected Impervious: Any impervious surface (ex: roof or paved pedestrian/ vehicular surface) which has runoff directed to flow over vegetated surface that has been graded to encourage diffuse flow and meets required parameters.

**for areas to receive stormwater credit as Disconnected Impervious they must meet or exceed the design parameters discussed herein.

Scenarios

1. Vegetated pervious area receives sheet flow from impervious surface and maintains diffuse flow pattern. **(VFS)**
2. Impervious surface runoff is channelized and routed through a level spreader system before being released over evenly graded vegetated pervious area. **(LS-VFS)**
3. Impervious surface runoff is routed through a pipe or gutter system that is released at point(s) on vegetated surface graded to encourage diffuse flow. (Downspout Disconnection **(DSD)**)

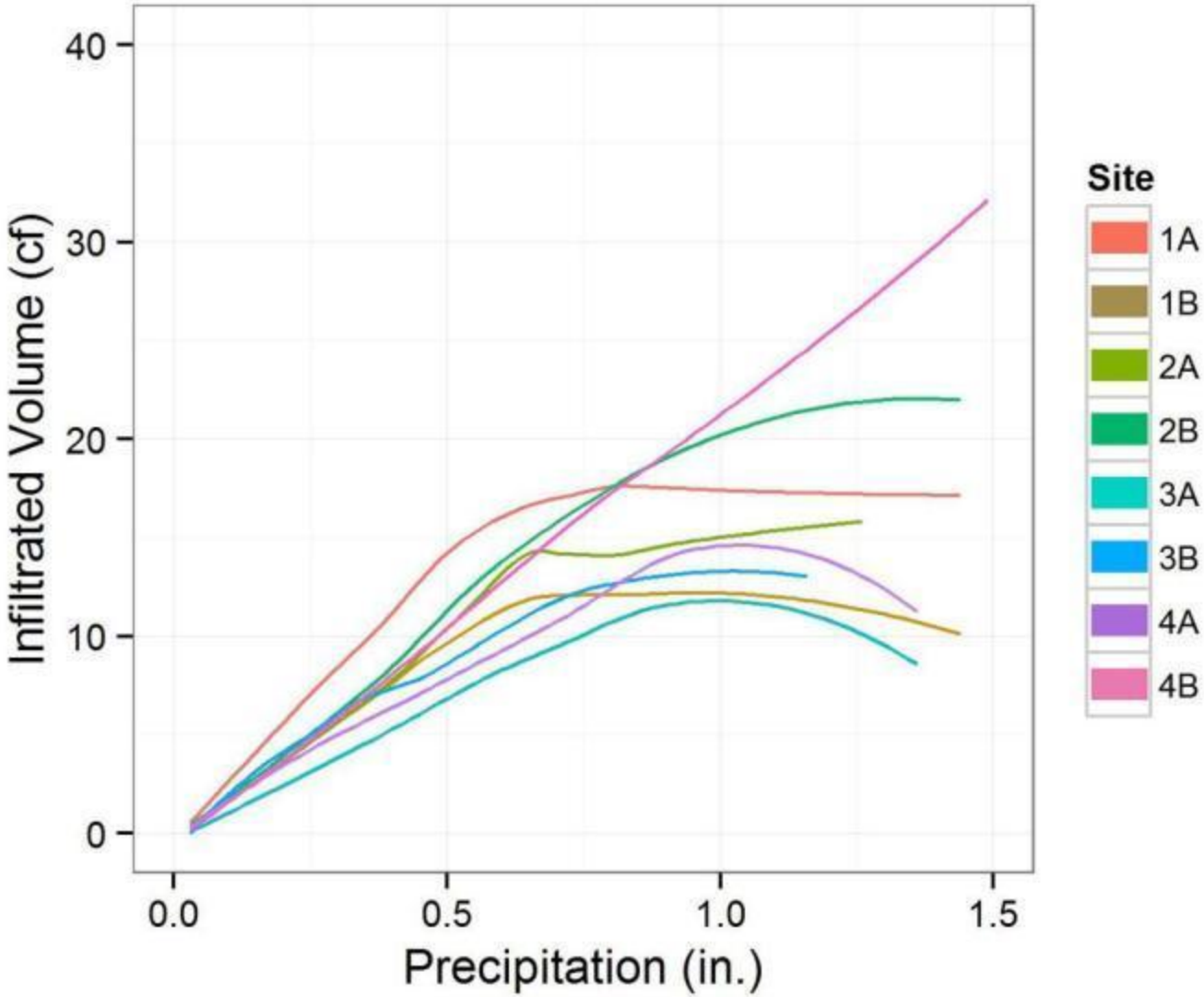
LS and LS/VFS Studies

- Deletic and Fletcher (2006)
- Line and Hunt (2009)
- Hunt et al. (2010)
- Winston (2011)
- Knight et al. (2013)

Current Residential DSD Research

Part of **Rain Catchers** program developed by the City of Durham to introduce 250 site-scale stormwater retrofits to improve the South Ellerbee Creek watershed (467 acres, 44% impervious

DSD Abstraction Volume Thresholds



Summary of DSD Data

Site	Mean Percent Reduction	Cumulative Percent Reduction	Watershed Ratio (contributing: receiving)	Length of Run (ft)	Slope (%)
1A	54.7	42.3	17	15	6.6
1B	79.7	54.2	3.9	30	5.2
2A	86.7	75.7	25.6	5	6.0
2B	88.2	80.9	13.6	10	5.5
3A	94.2	84.8	6.4	12	6.6
3B	66.9	36.5	11.6	12	6.6
4A	69.6	43.4	9.6	12	27.0
4B	99.0	97.8	9.6	12	4.8
Mean/ Median	**79.9/ 83.2**	**64.5/ 65**	**12.2/ 10.6**	**13.5/ 12**	**8.5/ 6.3**

Research Synthesis

Parameter	Line and Hunt (2009)	Hunt et al. (2010)	Winston (2009)		Knight et al (2013)				Carmen, unpublished (2013)							
Location	NC 42 and I-40	Charlotte, NC	Louisburg, NC		Wilson, NC				Durham, NC							
Loading Ratio (_:1)	28	9	45	20.2	23	12	32	19	17.0	3.9	25.6	13.6	6.4	11.6	9.6	9.6
slope (%)	5.2	1.25	4.9	7	1	1	1	1	6.6	5.2	6	5.5	6.6	6.6	27	4.8
Amendment	None	SL	N	N	N	N	YES	YES	N	N	N	N	N	N	N	N
Underlying Soil type	S	SL	L/SL	L/SL	SL/CL	SL/CL	SL/SCL	SL/SCL	SCL	SCL	CL	CL	CL	CL	C	CL
Blind Swale Length (m)	7.3	19.4	4	4	8	20	8	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
VFS width (m)	17.1	46	7.6	15.2	6.1	6.1	6.1	6.1	4.6	9.1	1.5	3.0	3.7	3.7	3.7	3.7
Hydraulic Conductivity (cm/h)	not reported	6 to 16.5	5.5	4.8	0.1	0.1	14.2	14.2	1.73	1.73	1.23	1.07	35.31	35.31	0.75	6.75
CEC* (meq/100cm3)					3.5	3.5	65.3	65.3	9.7	9.7	13.1	12.4	14.8	14.8	17.4	8.0
P index					85	85	20	20	312.5	312.5	45.8	117.0	320.8	320.8	20.0	31.7
volume reduction (%)	49	85	48	41	36	59	42	57	42.3	54.2	75.7	80.9	84.8	36.5	43.4	97.8

Recommendations by Soil Type

Soil Group	A	B	C	D
Hydrologic Soil Conductivity (in/hr)	> 0.30	0.15 – 0.30	0.05 - 0.15	0-0.05
Minimum Length of Run (ft)	12	12	20	30
Maximum slope (%)	15	7	5	3
Soil Amendment/ tilling	No	No	Yes	Yes

$$\%\,removal\ credit = \left(-\frac{5}{8}\right) * (loading\ ratio) + 63.125$$

Conclusions

Disconnected Impervious:

- Results in substantial volume reduction
- Is an inexpensive LID measure - $40 conservatively
- Potential for widespread on-site stormwater treatment
- Reasonable to assign stormwater credits

Looking Forward – soil amendments

Our Draft Plan

- Remove existing vegetation
- Till soil to depth of 6-8 inches
- Apply lime and fertilizer to maintain ideal levels as recommended by NC Agronomic Division
- Amend with plant based compost
- "Spectrum" seed from local seed distributor