Decision-making and Sustainable Drainage: Design and Scale

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Sustainable Drainage

Fig 1a Traditional drainage

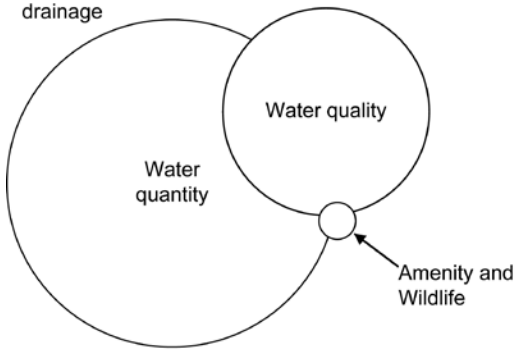


Fig 1b SUDS Triangle

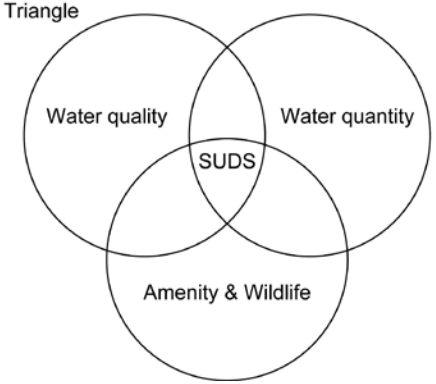
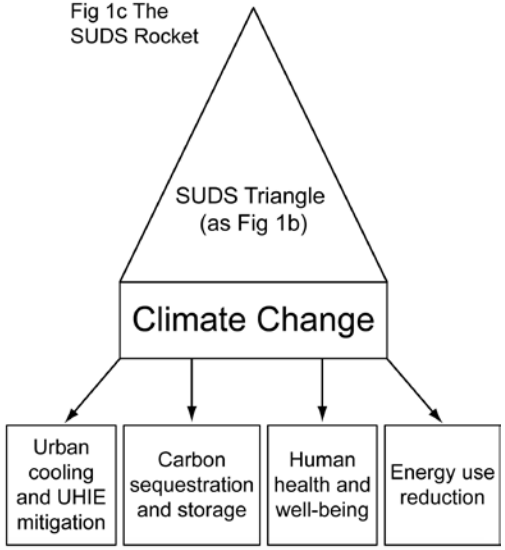


Fig 1c The SUDS Rocket



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Legislation/ policy

National Planning Policy Framework, 2012

Flood and Water Management Act, 2010

- Implementation?
- SUDS Approving Boards
- SUDS Guidance

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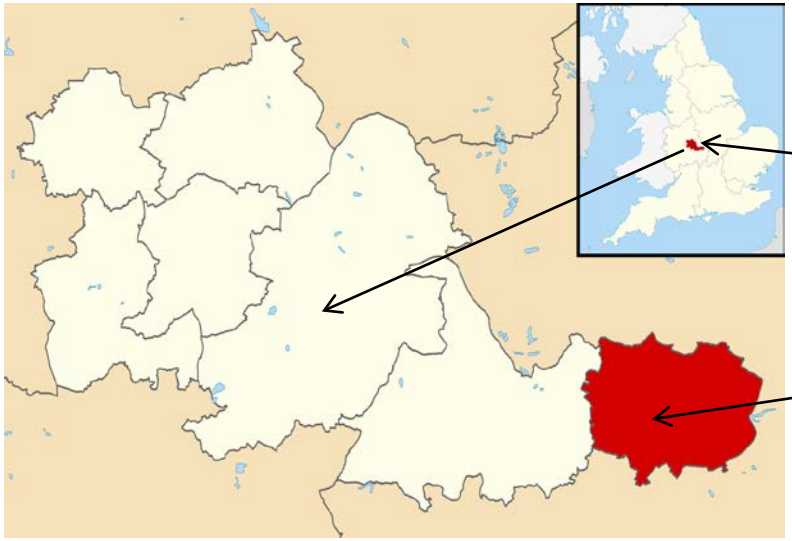
The aims of this paper are:

1. To show how the decision-making process in terms of designing a SUDS management train is scale-related with reference to Coventry City Council, a local government authority in central England
2. To illustrate this with the application of a large scale site-specific model which identifies the individual SUDS devices suitable for the area using geographical information
3. To model at the smaller scale to achieve greenfield runoff.



SUDS device groupings

Examples SUDS Devices
Green Roof Rainwater harvesting Permeable paving Sub-surface storage Trees Rain garden Disconnected downpipe
Soakaway Infiltration basin Infiltration trench
Detention basin Retention basin Pond Wetland
Sand filter Filter strip Filter trench Bioretention device
Swale Rill

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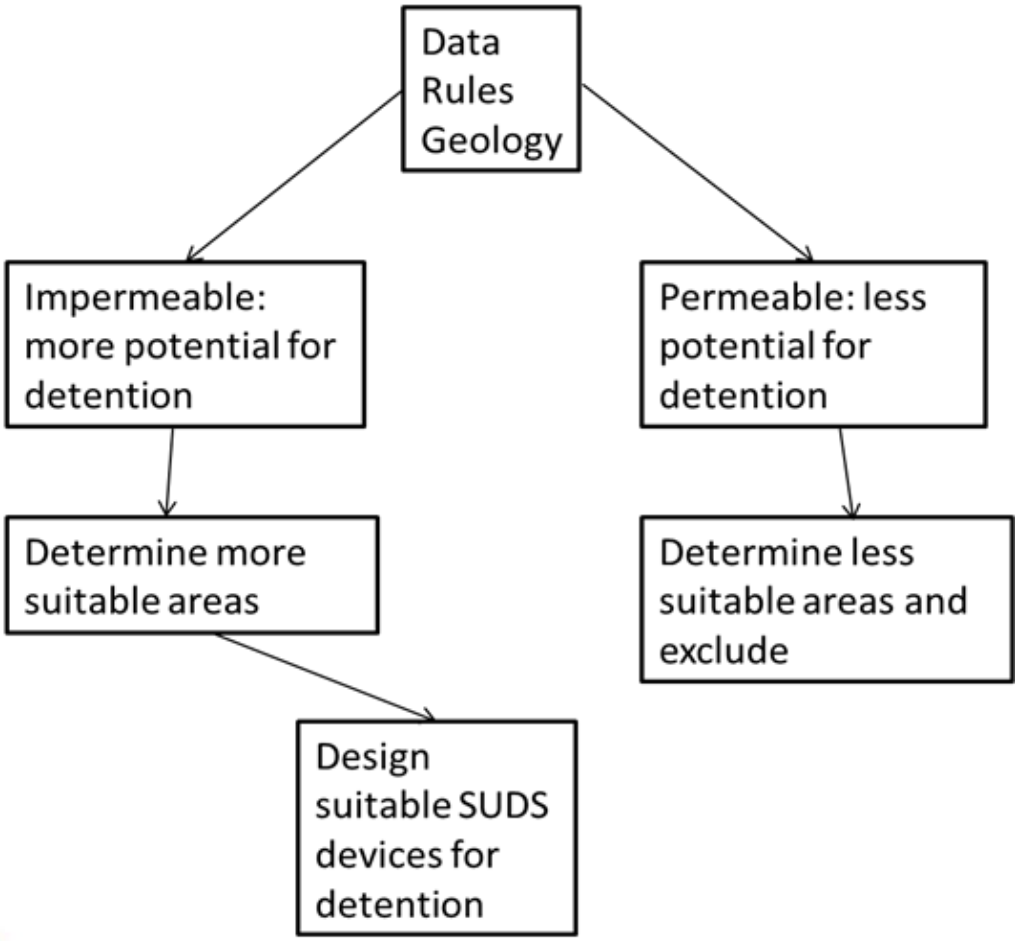
Site specific physical and anthropogenic factors driving SUDS design

	Source Control	Infiltration	Detention	Filtration	Conveyance
Implementation guidelines	First priority	Infiltrate where detention is not possible, detain where infiltration is not possible		These should be used wherever possible	
Factors					
Physical					
Bedrock and surface geology		x	x		
Water bodies	x	x	x	x	x
Fluvial flood zones		x		x	
Soil drainage type		x	x		
Topography		x	x		
Water Table		x	x		
Anthropogenic					
Waste and landfill sites		x			
Current and former industrial sites		x			
Surface and ground water quality		x	x		
Land cover	x	x	x	x	x
Planning constraints	x				x

Land ownership, sewer and historical flood locations will also be involved later in the process

Cascade of decision-making: detention



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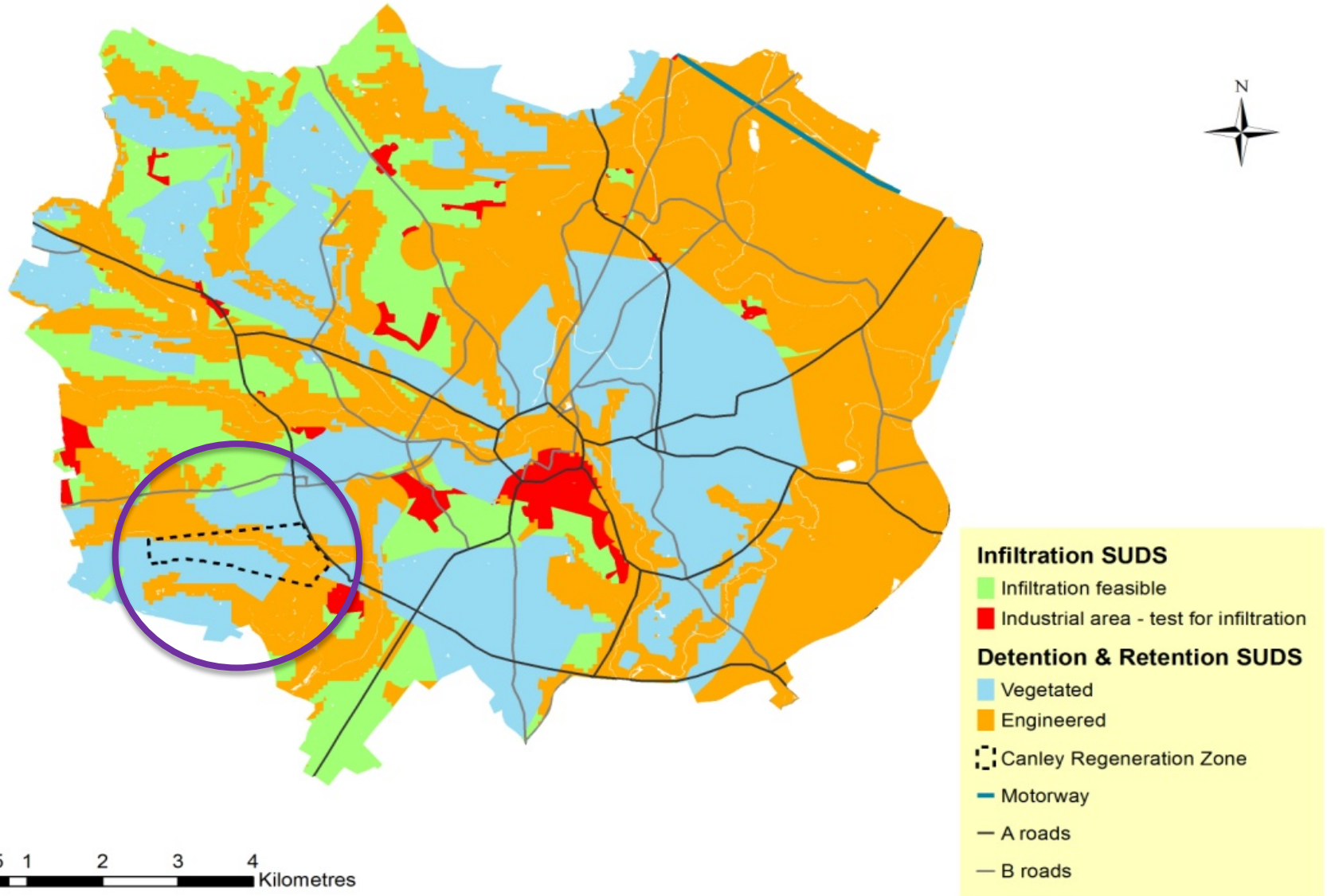
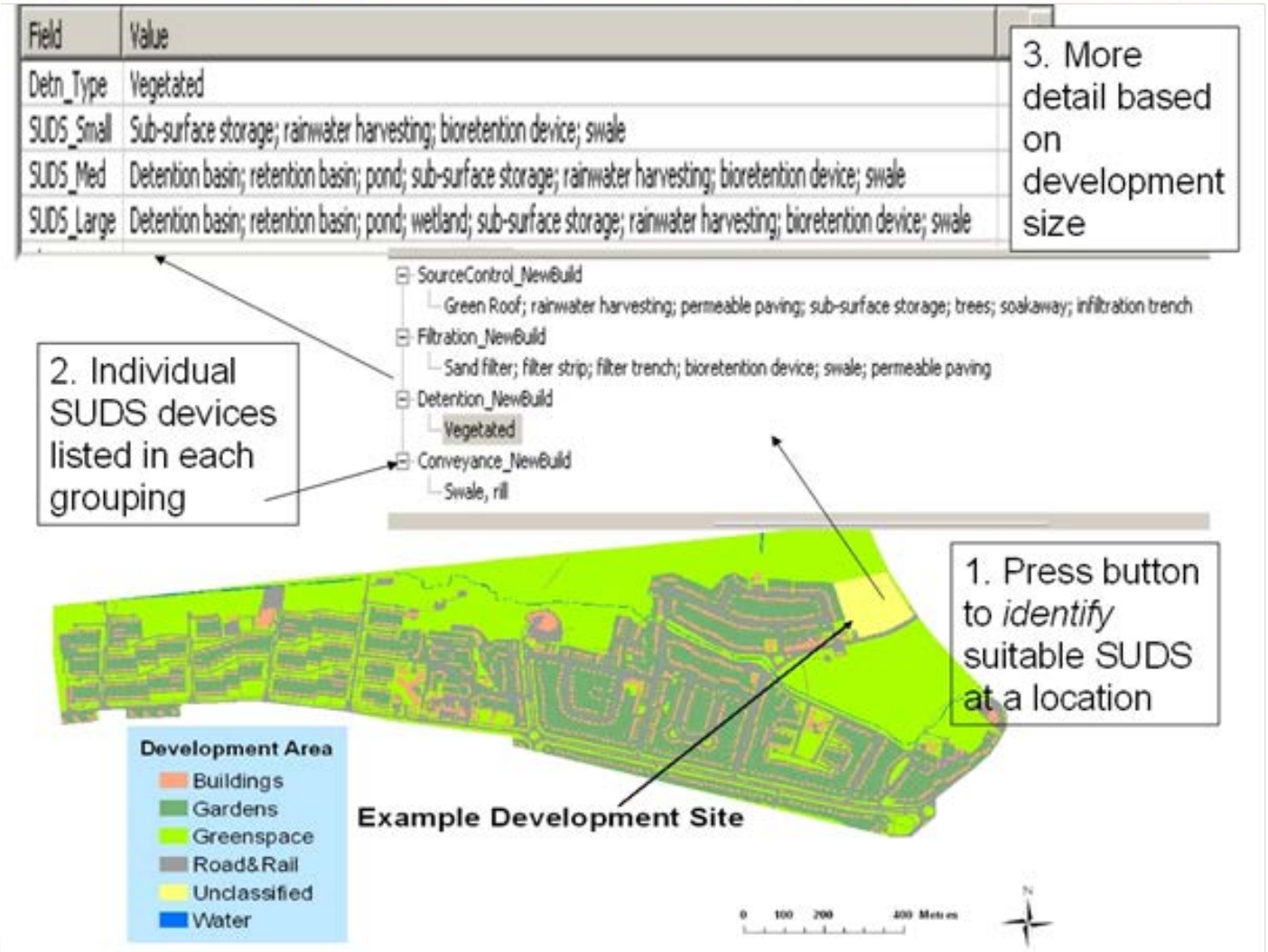
Coventry, West Midlands, Infiltration SUDS



Application: decision support



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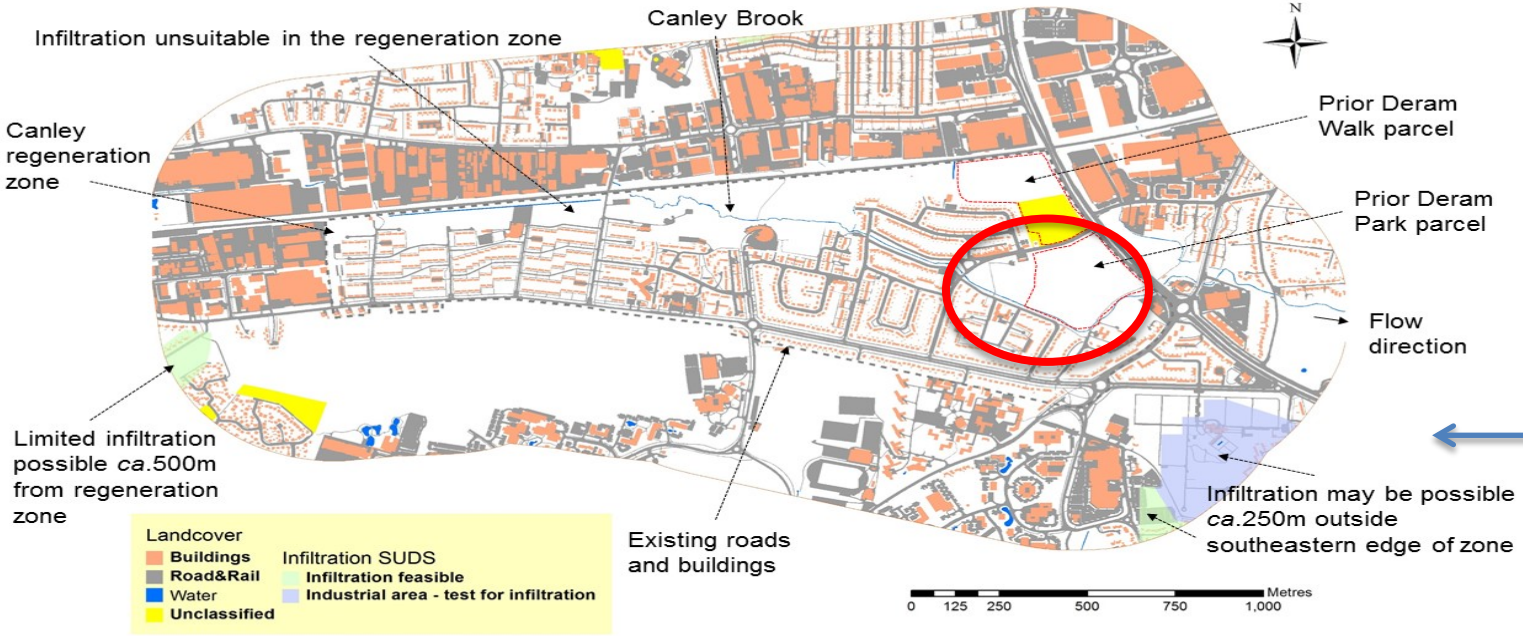
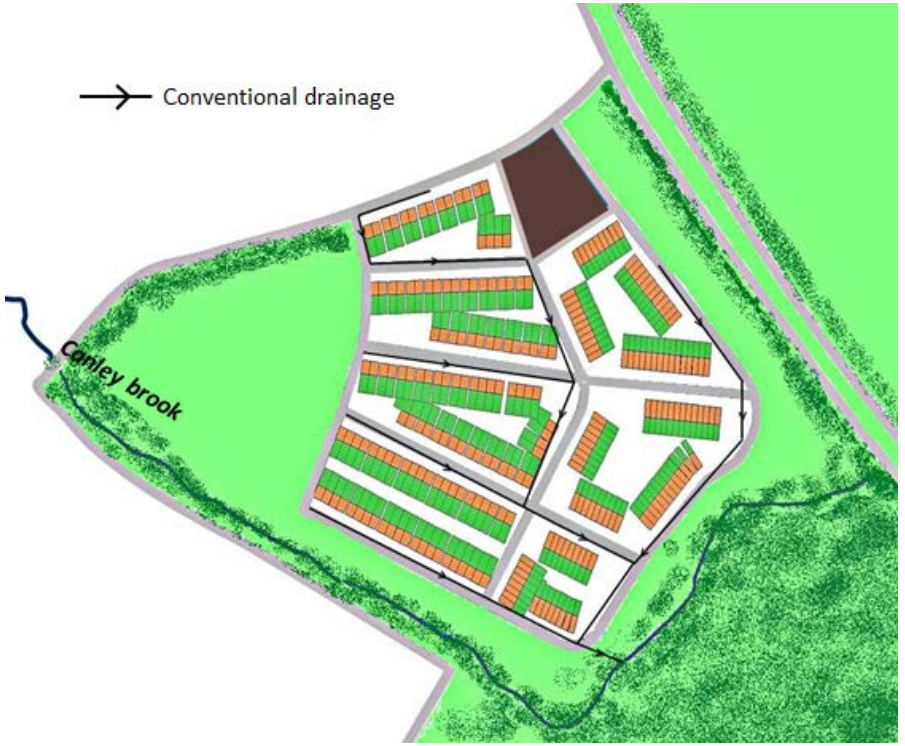
a)



infiltration

SUDS management train designed for Prior Deram Park, CRZ, Coventry



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Comparison of SUDS feasibility map proposals for CRZ at PDP

Device grouping	**Detailed assessment for Prior Deram Park**	**Broad-scale feasibility map options for CRZ**
Options in **bold** show agreement between the two methods across different scales		Proposals that could be considered for this site.
Source Control	**Permeable paving; green roofs; sub-surface storage; trees**	Green roof; rainwater harvesting; permeable paving; sub-surface storage; trees; rain garden; disconnected downpipe; soakaway; infiltration trench; bioretention device
Infiltration	none	none
Detention & retention	**Detention ponds**, Hydrobrake	Engineered: detention basin; retention basin; pond; sub-surface storage; rainwater harvesting; bioretention device; swale
Conveyance	**Swales**	Swale, rill
Filtration	**Sand filter**	Sand filter; filter strip; filter trench; bioretention device; detention basin; retention basin; pond; swale; permeable paving

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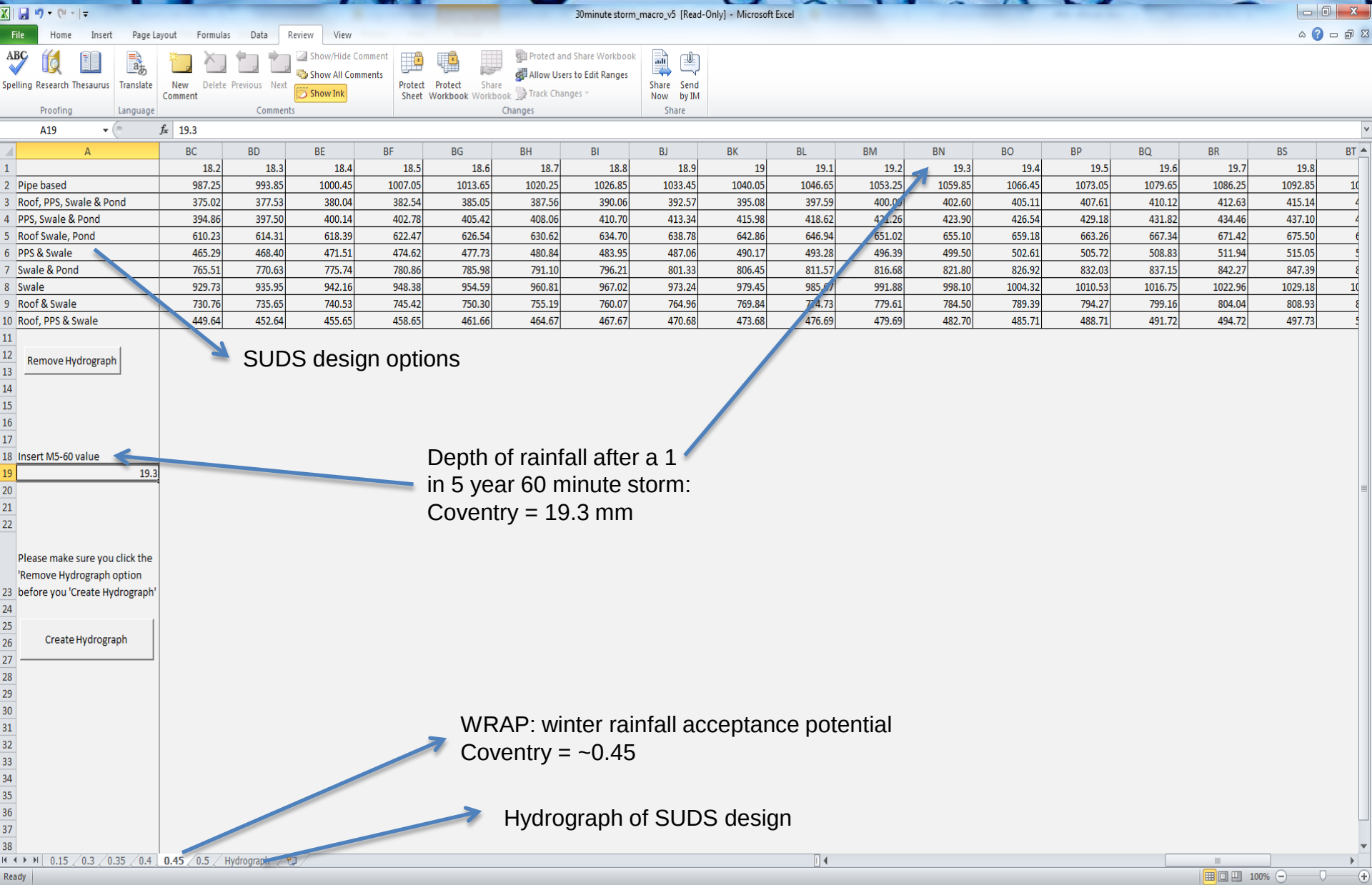
Application: decision support



	A	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT
1		18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	19	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	
2	Pipe based	987.25	993.85	1000.45	1007.05	1013.65	1020.25	1026.85	1033.45	1040.05	1046.65	1053.25	1059.85	1066.45	1073.05	1079.65	1086.25	1092.85	10
3	Roof, PPS, Swale & Pond	375.02	377.53	380.04	382.54	385.05	387.56	390.06	392.57	395.08	397.59	400.09	402.60	405.11	407.61	410.12	412.63	415.14	4
4	PPS, Swale & Pond	394.86	397.50	400.14	402.78	405.42	408.06	410.70	413.34	415.98	418.62	421.26	423.90	426.54	429.18	431.82	434.46	437.10	4
5	Roof Swale, Pond	610.23	614.31	618.39	622.47	626.54	630.62	634.70	638.78	642.86	646.94	651.02	655.10	659.18	663.26	667.34	671.42	675.50	6
6	PPS & Swale	465.29	468.40	471.51	474.62	477.73	480.84	483.95	487.06	490.17	493.28	496.39	499.50	502.61	505.72	508.83	511.94	515.05	5
7	Swale & Pond	765.51	770.63	775.74	780.86	785.98	791.10	796.21	801.33	806.45	811.57	816.68	821.80	826.92	832.03	837.15	842.27	847.39	8
8	Swale	929.73	935.95	942.16	948.38	954.59	960.81	967.02	973.24	979.45	985.67	991.88	998.10	1004.32	1010.53	1016.75	1022.96	1029.18	10
9	Roof & Swale	730.76	735.65	740.53	745.42	750.30	755.19	760.07	764.96	769.84	774.73	779.61	784.50	789.39	794.27	799.16	804.04	808.93	8
10	Roof, PPS & Swale	449.64	452.64	455.65	458.65	461.66	464.67	467.67	470.68	473.68	476.69	479.69	482.70	485.71	488.71	491.72	494.72	497.73	5

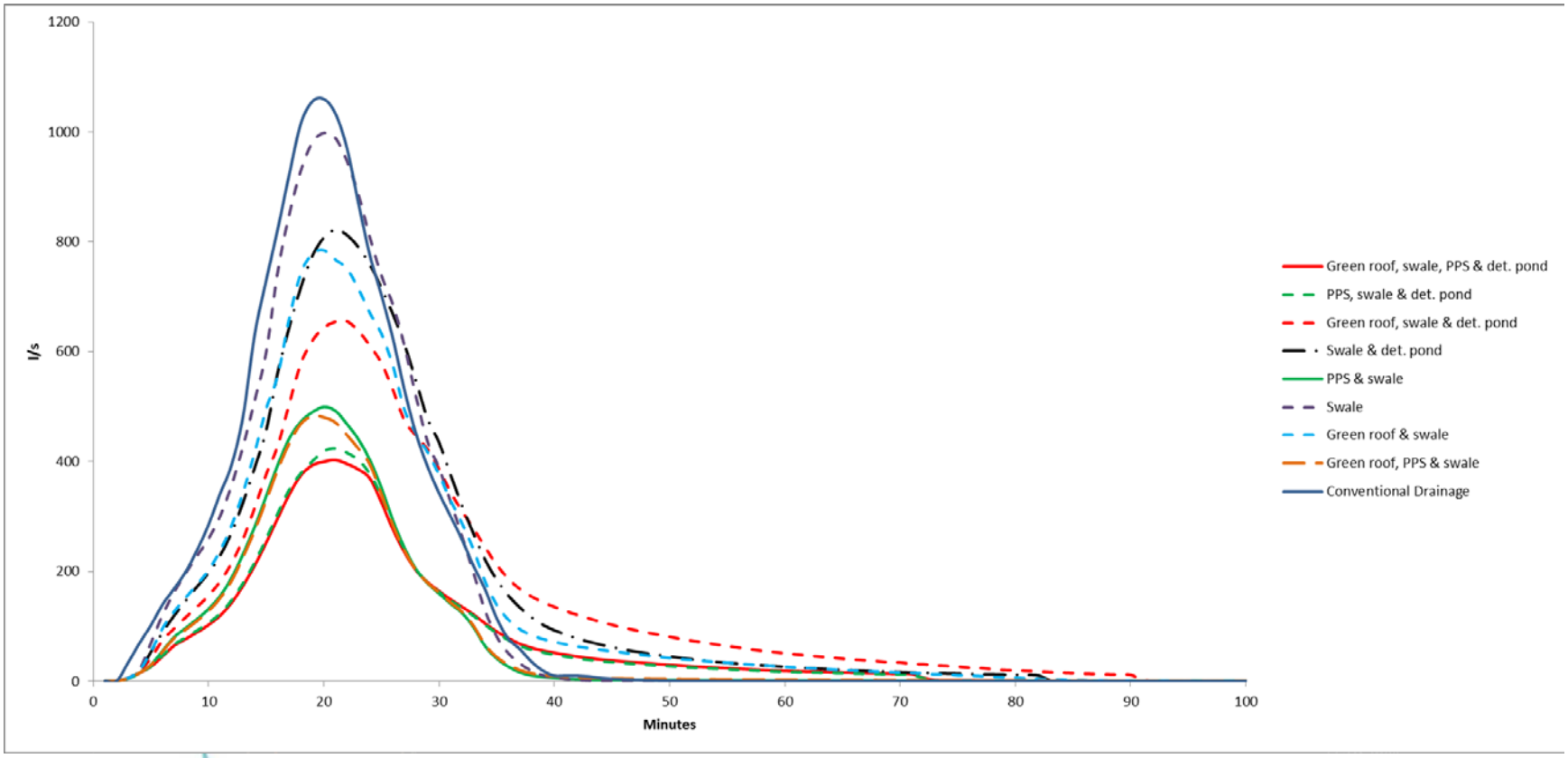
SUDS design options

Depth of rainfall after a 1 in 5 year 60 minute storm:
Coventry = 19.3 mm

WRAP: winter rainfall acceptance potential
Coventry = ~0.45

Hydrograph of SUDS design

Hydrograph of SUDS design and pipe-based system



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Conclusions

1. Large-scale information can be useful early in the decision-making process, but may require more testing for detailed planning.
2. The information required is site-specific
3. The maps are readily understandable, supporting initial discussions at Local Authority level
4. They may contribute to breaking down barriers currently limiting the uptake of sustainable forms of stormwater management
5. At the smaller scale, it is possible to model suggested SUDS designs based on guidance from the coarser resolution maps
6. The pipe-based drainage at PDP would have resulted in 20% of the housing being flooded in a 1 in 100 storm, whereas the SUDS design would have resulted in no flooding.
7. SUDS can provide benefits other than storm attenuation, such as water quality improvements, amenity provision and enhancement of biodiversity

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