

# AN INTEGRATED DECISION SUPPORT APPROACH TO THE SELECTION OF SUSTAINABLE URBAN DRAINAGE SYSTEMS (SUDS).

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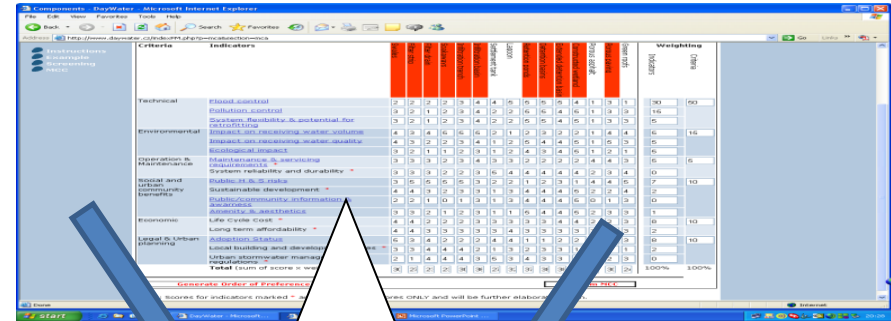
# **A SUDS DECISION SUPPORT SYSTEM (DSS)**

- Increasing interest in the application of SUDS for stormwater control and management; SUDS controls now being incorporated into legislative requirements for urban drainage infrastructure**
- Lack of familiarity/experience of SUDS (design, performance, O&M, costs etc..)**
- Need for public communication and engagement in the decision making process on sustainable drainage for new and retrofit developments**
- Help overcome the “wicked” problem presented by the complexity of urban stormwater drainage controls and management**

## GIS LandUse

## SUDS OPTION MCA MATRIX

## GIS sewer network



# DSS AND SUDSLOC TOOL STRUCTURE

Storm Event Rainfall Profiles  
Landuse Runoff Coefficients  
Surface and Soil Type/Character  
Groundwater Profiles

## MODULES

LandUse

SUDS

SUDS Catalogue

MCA

LiDAR

Decision Support

FRAMEWORK MANAGER

Output Processor

External Inputs  
e.g STORM  
MIKE11  
Infoworks CS  
FloodArea  
Eco.SWM  
Depth-Damage curves

2D Flood maps  
SUDS types and location  
Flood damage maps

# Stormwater SUDS Decision Support System (DSS)

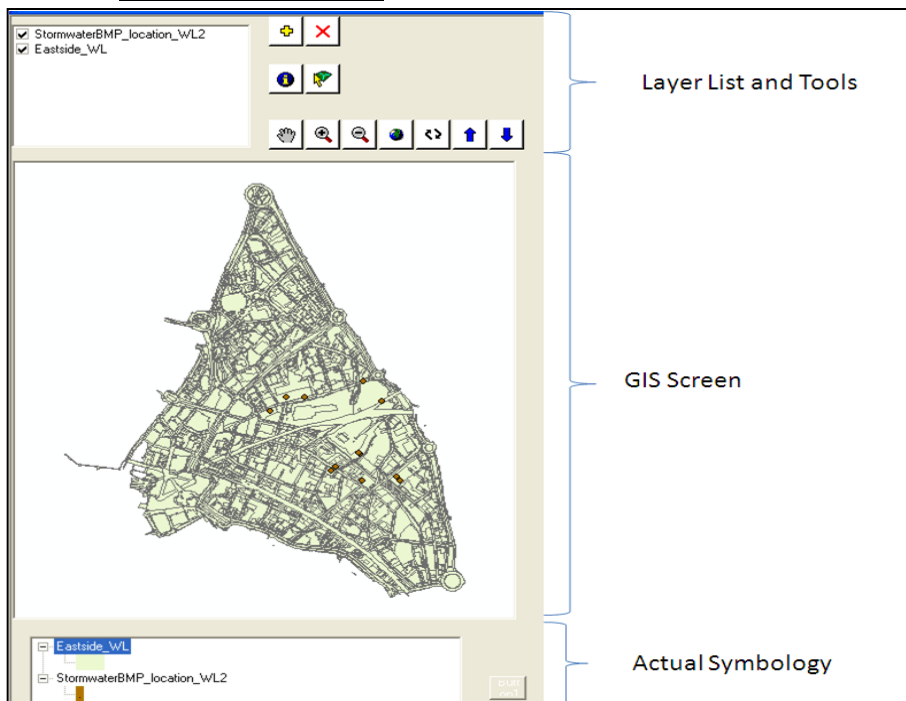
- Interactive tool to support users in the selection and location of SUDs
- Integrate wider considerations involved in the urban development process
- Communication of information in user-friendly format

Integrates three stormwater SUDS assessment components:

- Site characteristics
- BMP pollutant removal
- End-user preferences (multi-criteria analysis; MCA)

GIS-based platform: VisialStudio.net 2003® supported by ESRI® ArcGIS library 9.1®

## GIS Interface



## User-Friendly Interface

Parameters | Potential Areas | SitebySite | ADDStormwaterBMP | Project properties | Symbology |

**Working shapefile**

**Site Characteristics** C:\BMP\_DSS\_Tool\data\layer Eastside

**BMP location** C:\BMP\_DSS\_Tool\data\layer StormwaterBMP\_location

**Criteria and Fields relations**

Criteria	Fieldname	FieldPositi
Landuse	Landuse	7
Soil Type	soil	4
Area	area	9
Slope	Slope	3
Watertable	watertable	5
Drainage Are	Drainarea	9
Pollutant	Pollutant	6
Flat	Roof	8

\*



- Land use, soil type, slope, depth to groundwater, drainage area, presence of 'flat' roofs etc.
- Default values relate SUDS type to the above site factors
- Set of 'rules' which determine which BMP can be located at a particular site
- User able to change default settings

## MCC APPROACH

### Site screening characteristics

Prior to using DayWater MCC it is essential to complete this site screening characteristics section. This is to ensure that the default values are not appropriate for your catchment area due to site specific conditions are not evaluated within the MCC.

If this section is not completed the results of the MCC will NOT BE VALID!

#### Indicators

#### Site specific value

Contributing drainage area (KT17)  (m<sup>2</sup>)

Water table level (KT18)  (m)

Soil hydraulic conductivity (KT19)  (m/s)

OR

Soil type (KT20)

OR

Infiltration rate (KT21)

**-Rf values derived from GLUD  
Mastermap  
- Runoff volumes/depths  
derived from storm profile**

**Save my Site characteristics**

If you have saved your site characteristics values you can continue to the [MCC](#).

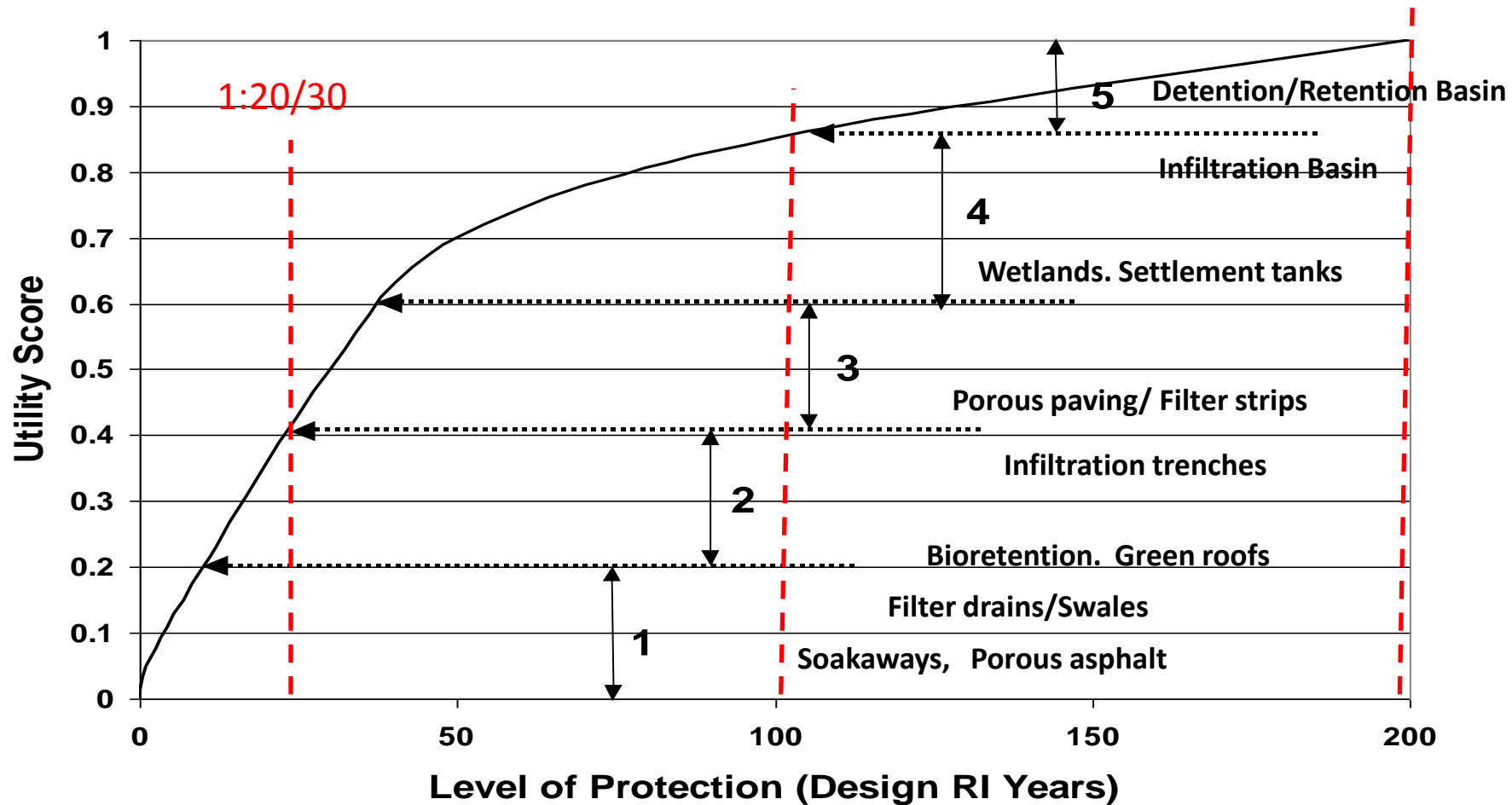
# GENERIC SUDS SUSTAINABILITY INDICES

## (Water quantity, water quality, amenity/ecology)

- ***Criteria***: major established and influencing factors on which the final judgement, evaluation or decision is made
- ***Indicators***: diagnostic states or conditions which describe relevant and appropriate properties of the given criteria
- ***Benchmark***: threshold value or condition (qualitative or quantitative) which can comprise a point of reference for stakeholder decision-making and indicate an acceptable level of performance
  - need to be satisfied for the specific development site

CRITERIA (AoC)	INDICATORS
<b>Technical</b>	Flood Control
	Pollution Control
	System Adaptability
<b>Environmental</b>	Receiving Water Volume Impact
	Receiving Water Quality Impact
	Ecological Impact
<b>Operation and Maintenance</b>	Maintenance and Servicing Requirements
	System Reliability and Durability
<b>Social and Urban Community Benefits</b>	Public Health and Safety Risks
	Sustainable Development
	Public/Community Information and Awareness
	Amenity and Aesthetics
<b>Economic</b>	Life Cycle Costs
	Financial Risk/Exposure
	Long Term Affordability
<b>Legal and Urban Planning</b>	Adoption Status
	Local Building and Development Issues
	Urban Stormwater Management Regulations

Criteria	Indicator	Benchmark	Units
<b>Technical</b>	Flood control	Overflow frequency	1...n
		Design storm return interval	RI yrs
		Extreme event control	H/M/L
	Pollution control	Dissolved pollutant capture	%; H/M/L
		Solid(s) pollutant capture	%; H/M/L
	System Adaptability	Ease of retrofitting	H/M/L
		Design freeboard	% ; Volume, m <sup>3</sup>
<b>Environmental</b>	Receiving Water Volume Impact	Downstream erosion	H/M/L
		Thermal effects	C°
		Groundwater levels	Depth; m
	Receiving Water Quality Impact	Compliance with RWQ standards	%; mg/l
		Threshold pollutant concentrations	mg/l
	Ecological Impact	Biotic diversity	Biotic scores



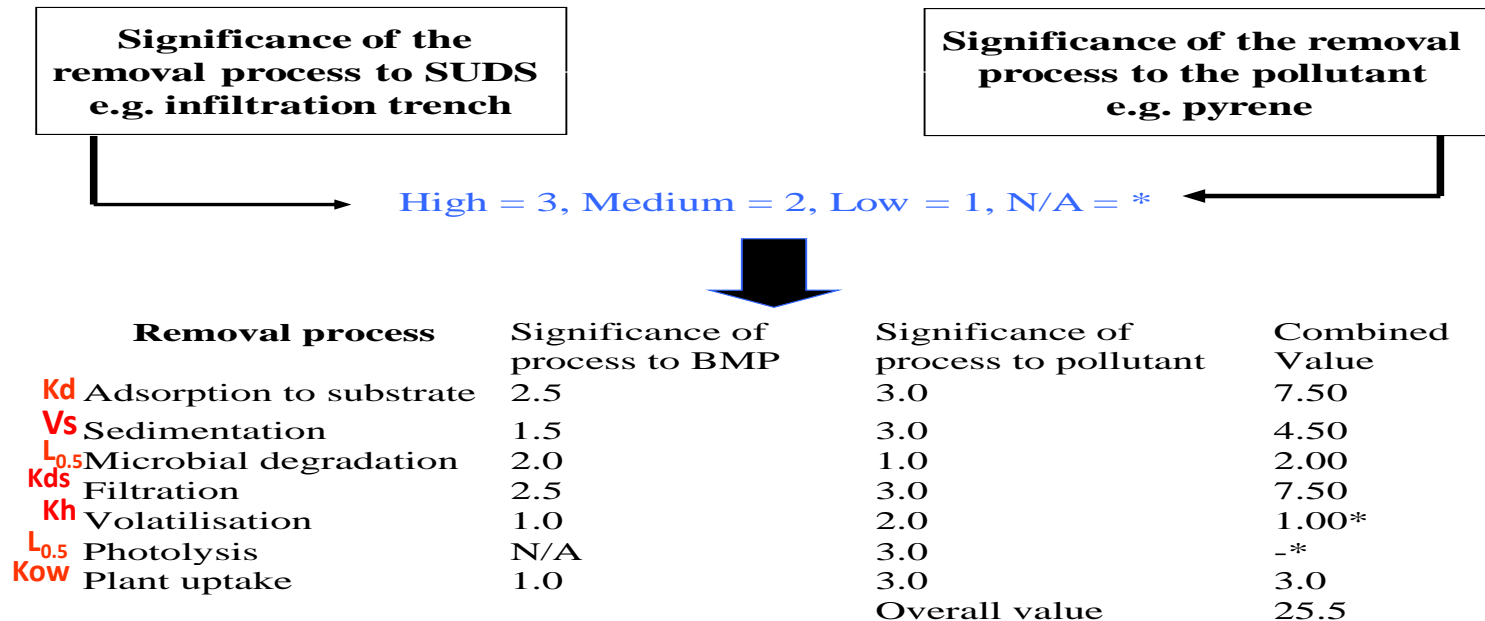
**Derivation of MCA Utility Scores and Ranking Value  
for the Flood Control Indicator**



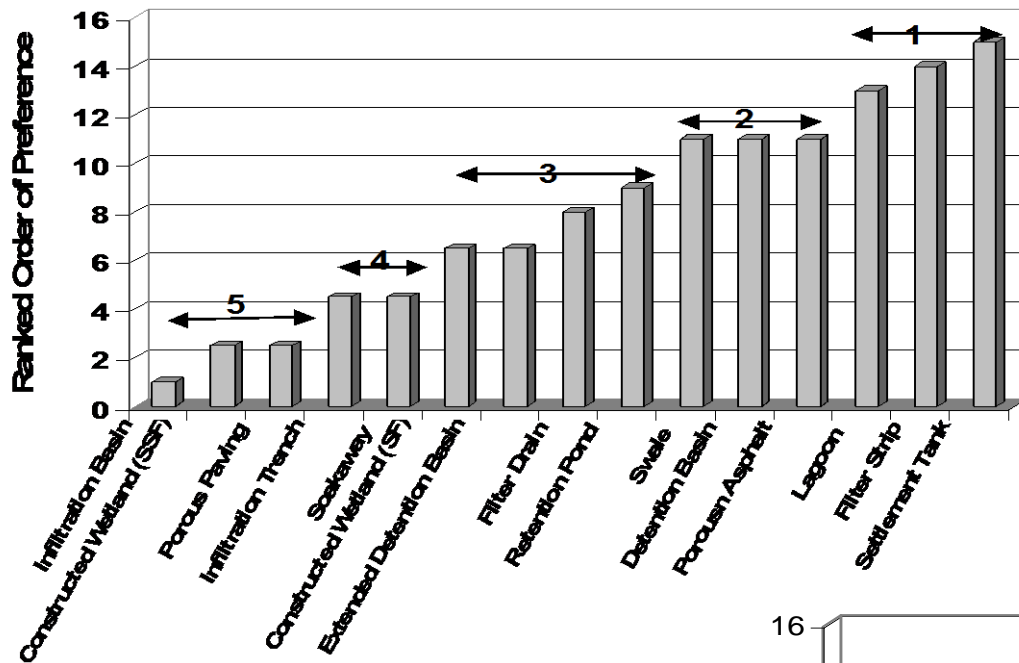
# Pollutant Removal Potential

- Combination of field data and expert judgement
- Assess potential for 7 pollutant removal process to occur in range of SUDS
- Assess the potential for specific pollutants to be removed by these 7 pollutant removal processes
- Information combined to develop single unit value describing the relative potential for a particular pollutant to be removed by specific SUDS Ranking values enables a SUDS pollutant-specific order of preference to be developed

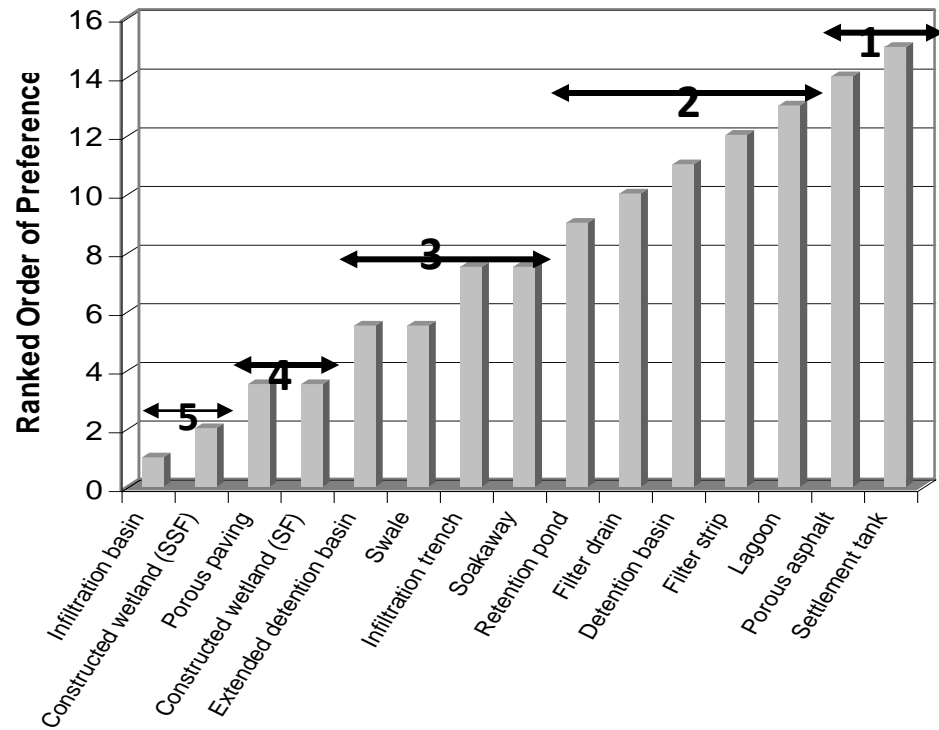
## Derivation of SUDS Scores for Pollutant Capture Benchmark



\* = weighted 0.5



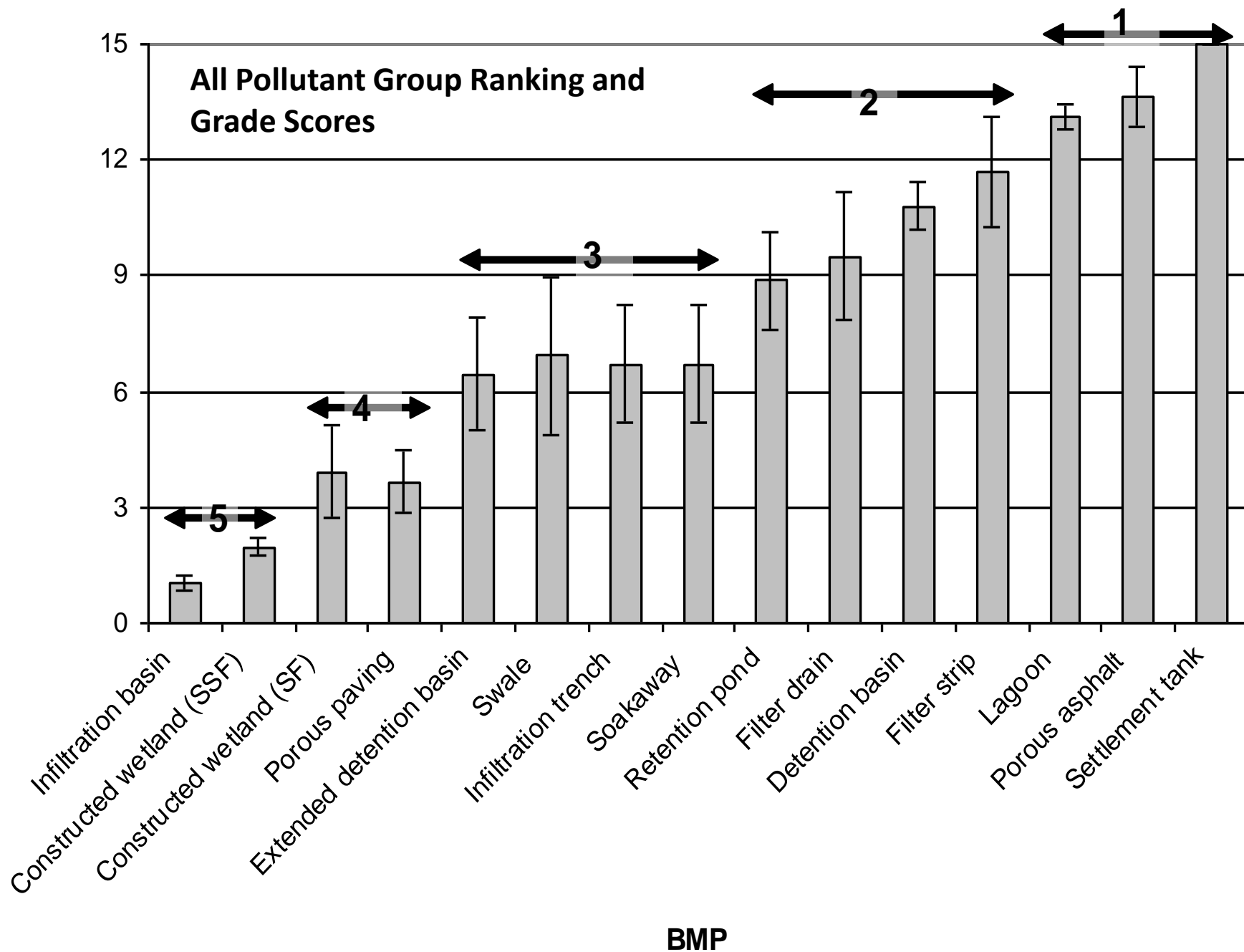
## BOD AND ORGANICS REMOVAL



**BMP**

Average ranked order of preference

## All Pollutant Group Ranking and Grade Scores



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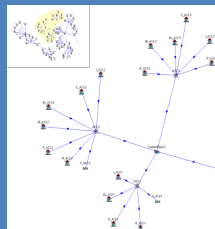
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- Instructions
- Example
- Screening
- MCC

Criteria	Indicators	Weighting																Criteria
		Swales	Filter strip	Filter drain	Soakways	Infiltration trench	Infiltration basin	Settlement tank	Lagoon	Retention ponds	Detention basins	Extended detention basin	Constructed wetland	Porous asphalt	Porous paving	Green roofs	Indicators	
Technical	<a href="#">Flood control</a>	2	2	2	2	3	4	4	5	5	5	5	4	1	3	1	30	50
	<a href="#">Pollution control</a>	3	2	1	2	3	4	2	2	5	5	4	5	1	3	3	15	
	<a href="#">System flexibility &amp; potential for retrofitting</a>	3	2	1	2	3	4	2	2	5	5	4	5	1	3	3	5	
Environmental	<a href="#">Impact on receiving water volume</a>	4	3	4	5	5	5	2	1	2	3	2	2	1	4	4	5	15
	<a href="#">Impact on receiving water quality</a>	4	3	2	2	3	4	1	2	5	4	4	5	1	5	3	5	
	<a href="#">Ecological impact</a>	3	2	1	1	2	3	1	2	4	3	4	5	1	2	1	5	
Operation & Maintenance	<a href="#">Maintenance &amp; servicing requirements</a> *	3	3	3	2	3	4	3	3	2	2	2	2	4	4	3	5	5
	System reliability and durability *	3	3	3	2	2	3	5	4	4	4	4	4	2	3	4	0	
Social and urban community benefits	<a href="#">Public H &amp; S risks</a>	3	5	5	5	5	3	2	2	1	2	3	1	4	4	5	7	10
	Sustainable development *	4	4	3	2	3	3	1	3	4	4	4	5	2	2	4	2	
	<a href="#">Public/community information &amp; awareness</a>	2	2	1	0	1	3	1	3	4	4	4	5	0	1	3	0	
	<a href="#">Amenity &amp; aesthetics</a>	3	3	2	1	2	3	1	1	5	4	4	5	2	3	3	1	
Economic	Life Cycle Cost *	4	4	2	2	2	3	3	3	3	3	4	4	2	2	3	8	10
	Long term affordability *	4	4	3	3	3	3	3	4	3	3	3	3	3	2	3	2	
Legal & Urban planning	<a href="#">Adoption Status</a>	5	3	4	2	2	2	4	4	1	1	2	2	2	2	3	8	10
	Local building and development issues *	3	3	4	4	4	2	1	3	2	3	3	1	3	2	1	2	
	Urban stormwater management regulations *	2	1	4	4	4	3	5	3	4	3	3	4	4	2	3	0	
	Total (sum of score x weight)	30	27	23	23	30	36	27	32	37	36	36	36	16	30	24	100%	100%
Generate Order of Preference		Perform MCC																

NOTE: Scores for indicators marked \* are PRELIMINARY scores ONLY and will be further elaborated soon.

[illegible]

# DSS AND SUDSLOC TOOL

## Decision Support

## FRAMEWORK MANAGER

Eventually you get a comparison of chosen alternatives

Does the solution fit?  
DSS helps with road maps

- Compare
  - cost,
  - impact,
- required actions by others
- water quality, etc.

## Output Processor

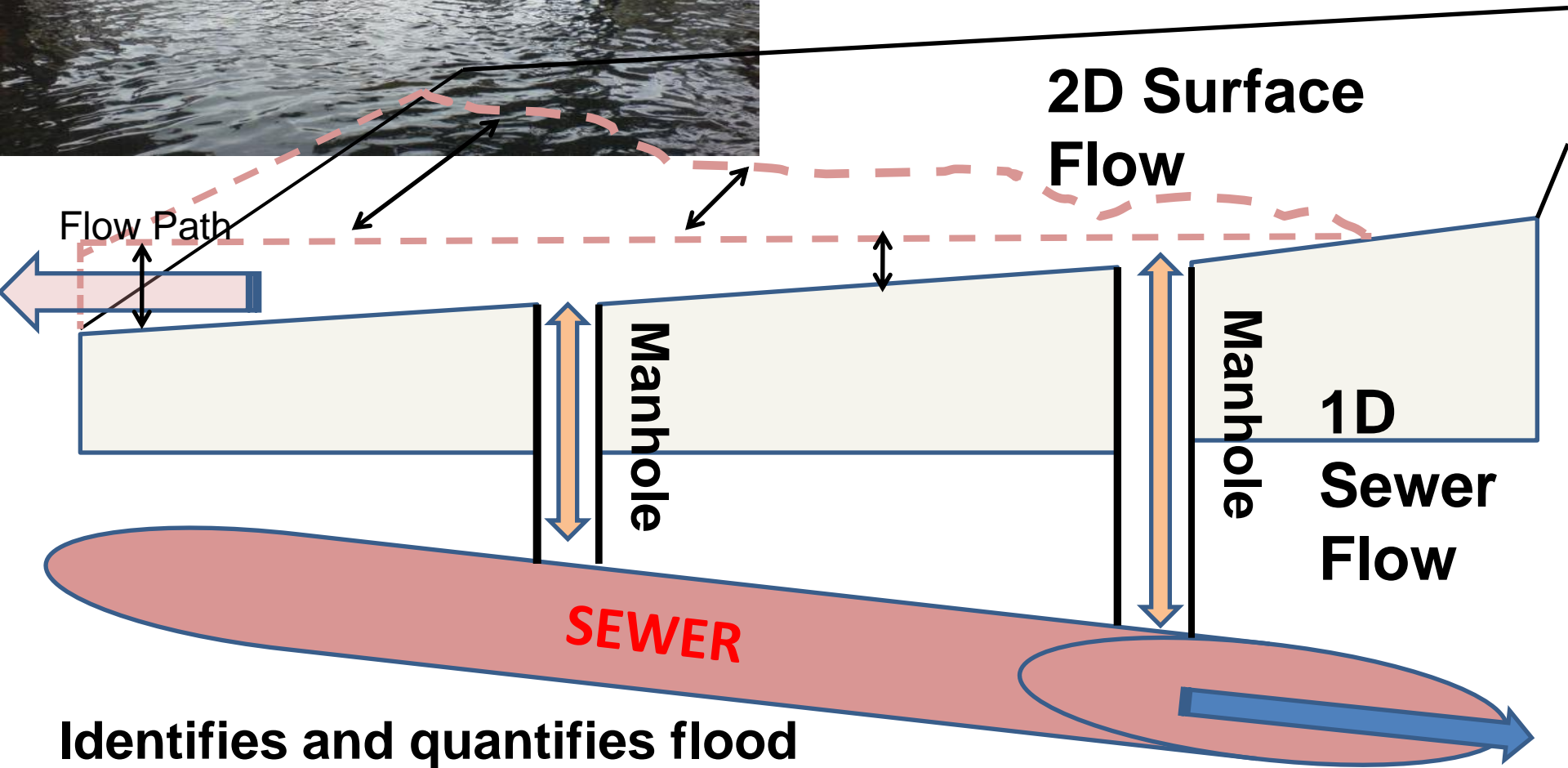
How to:

- inform the public
- work together





# 1D/2D COUPLED MODELLING FOR SURFACE PLUVIAL FLOODING



Identifies and quantifies flood depths and flow paths during extreme storm events







# WHERE DO WE LOCATE SUDS?

Storm water BMPs DSS

Parameters | Potential Areas | SitebySite | ADDStormwaterBMP | SurfaceFlowDestination | Symbology | Project properties

Information (pdf)

BMP name ID: new Constructed wetland

Criteria	Value
Landuse	Building
Soil Type	Loam
Area	733.56999

at you help in making a small

Need help with this add-on?

THE SUDSLOC MODEL

start | Windows Explorer | Untitled - ArcMa... | Inbox - Microsoft... | Capture Fox... A... | BMP\_bssv1 - Mic... | Storm water BMP... | EN | 16:20



19th March 2005

# Community Workshop

## GIS-BASED DSS STORMWATER MANAGEMENT

- GIS-based, user-friendly, web-based screening tool
- Basis for selecting and locating appropriate SUDS drainage controls for the mitigation of surface flooding and pollution impacts
- Provides flexible communication tool for stakeholder and public consultation and information on flood procedures and mitigation measures as well as amenity/ecology benefits of SUDS
- Identifies “critical drainage areas” as specified under WFD SWMP requirements with mapped flood areas, depths, flow paths and velocities on real-time basis
- Assist in emergency planning

