Verifying (testing) a stormwater biofiltration hydrologic model

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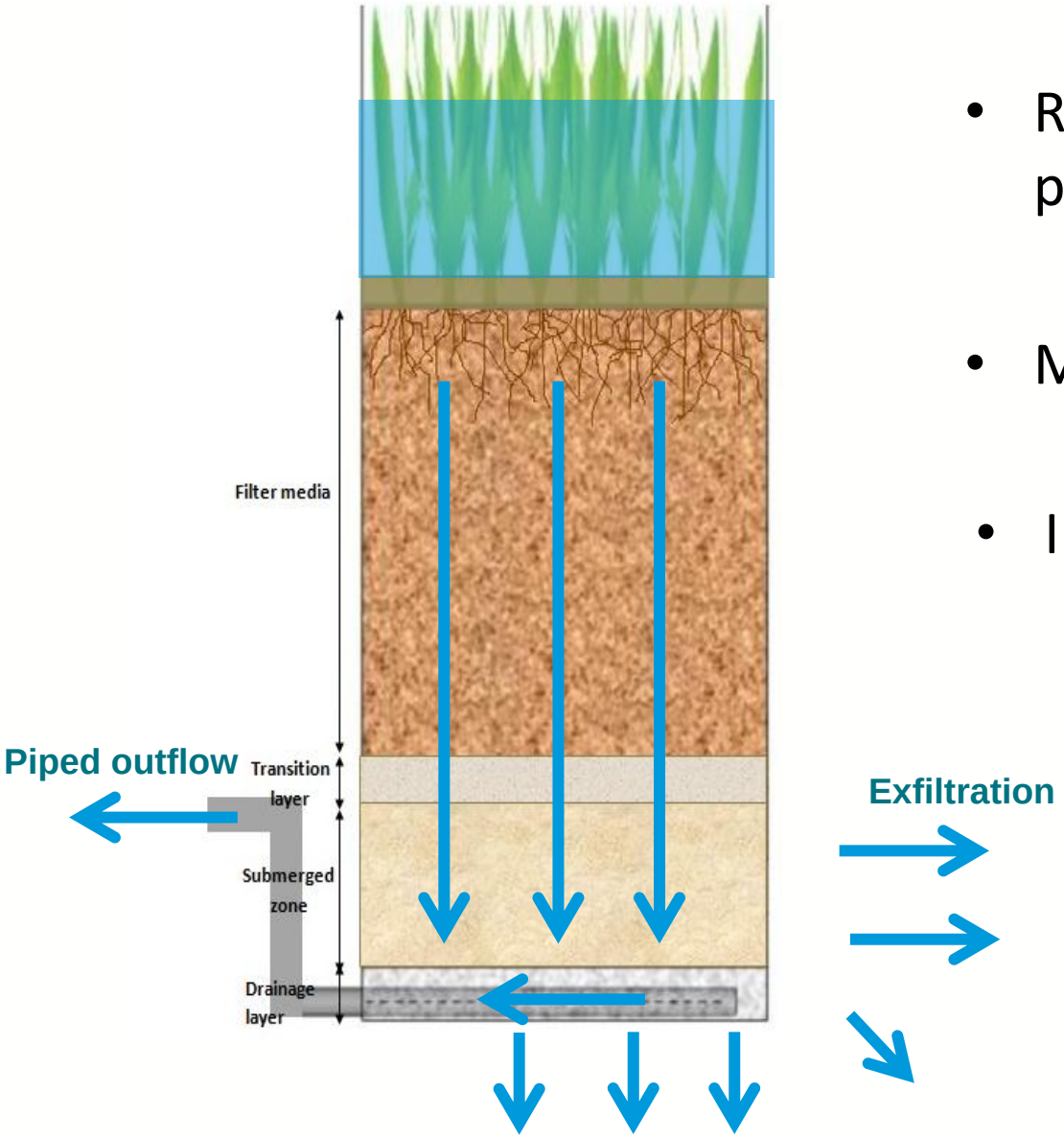
Background:

- Management of stormwater is a problem

- One solution = biofiltration systems

Background:



- Restores hydrology of pre-urbanised catchment
- Models are invaluable
- Incorporated in software

music BY eWater

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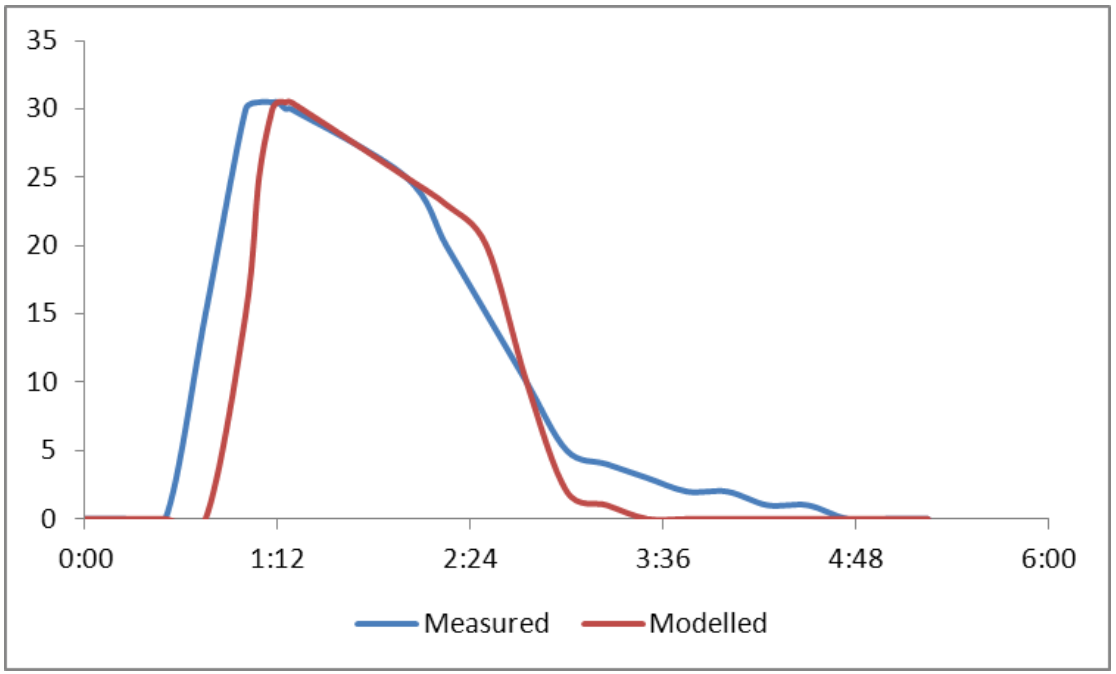
Objective of project

To test a stormwater biofilter hydrologic model using an operating field system.



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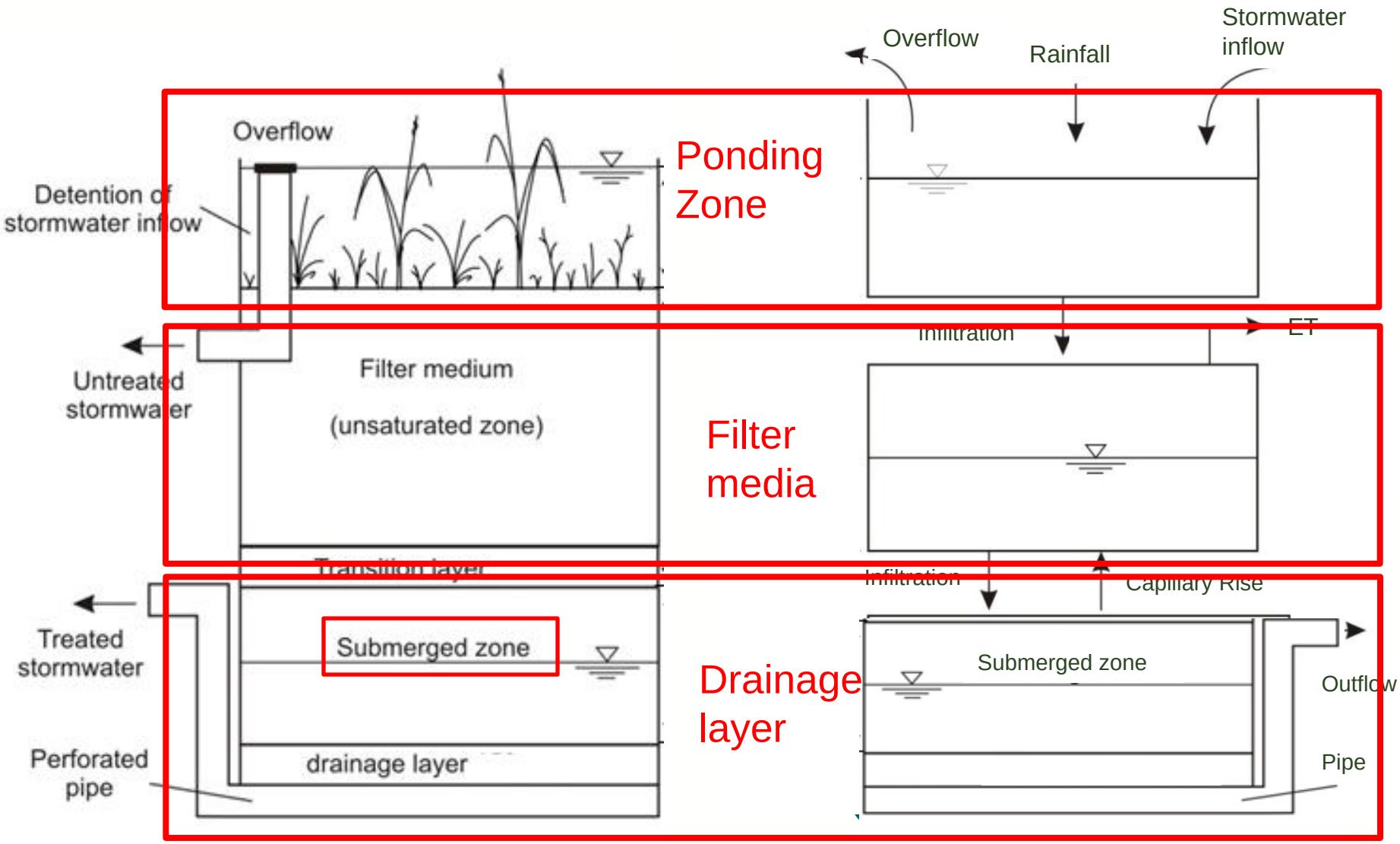
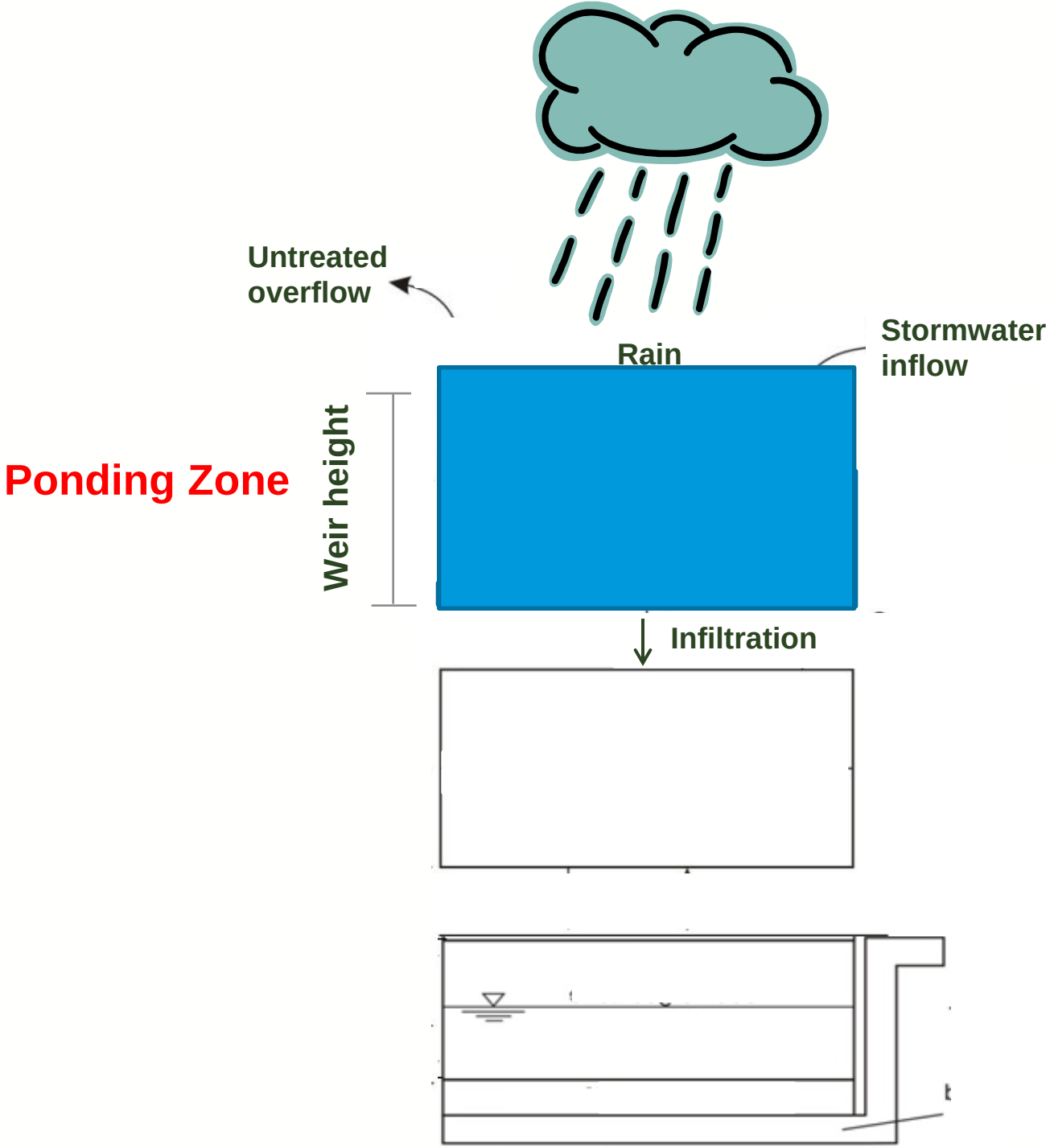
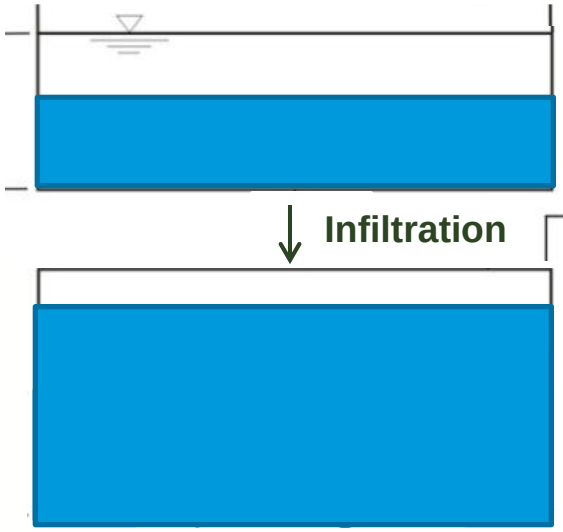
How the model works



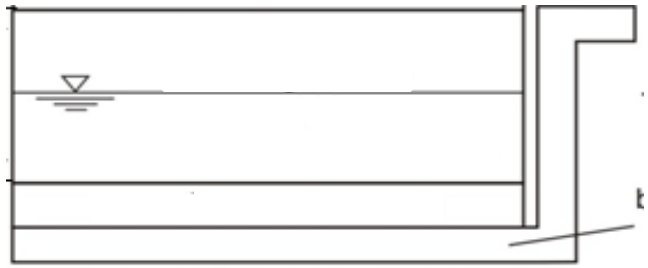

Untreated
overflow
Rain
Stormwater
inflow
Ponding Zone
Weir height
Infiltration

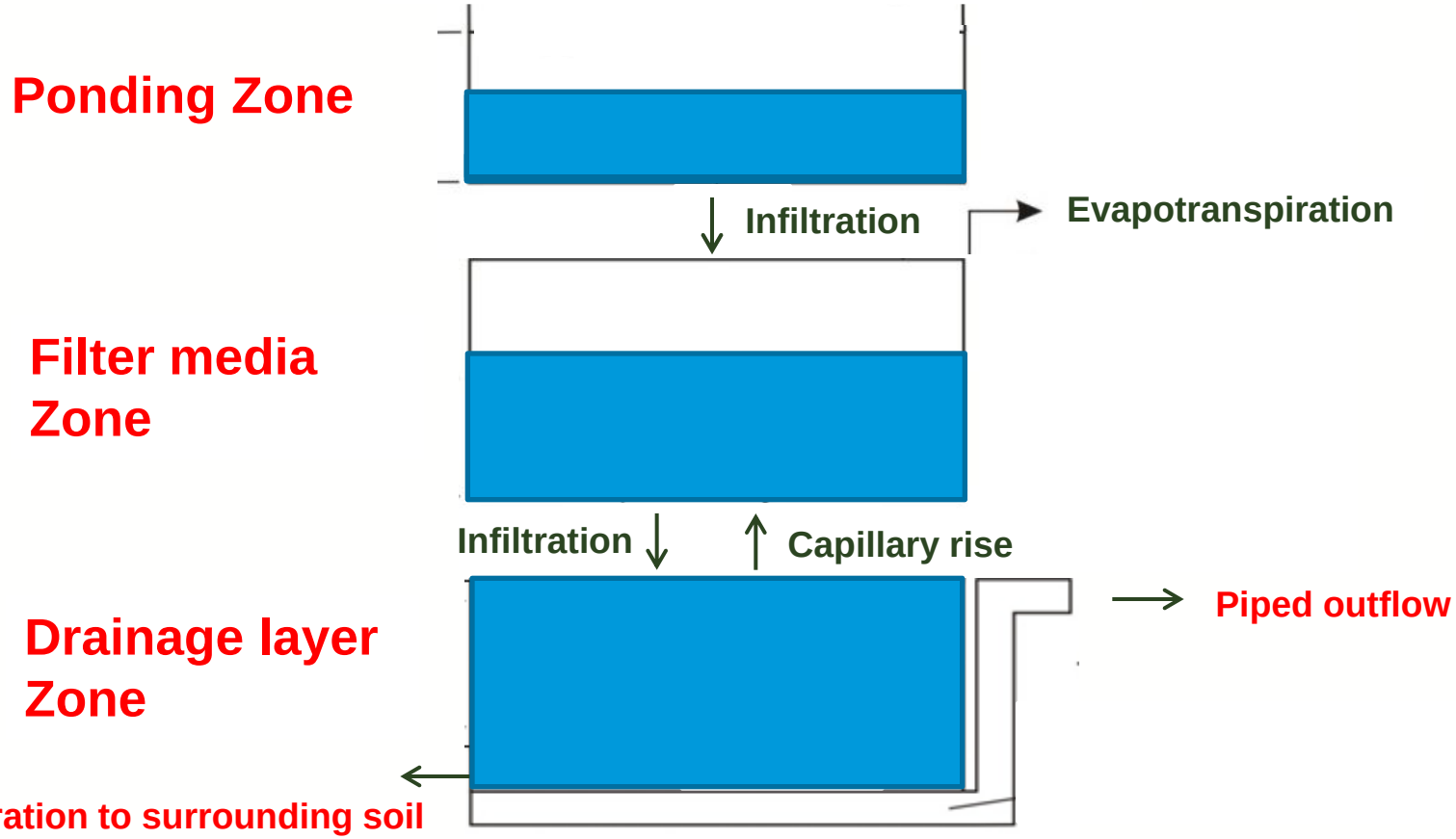
Ponding Zone



Filter media Zone

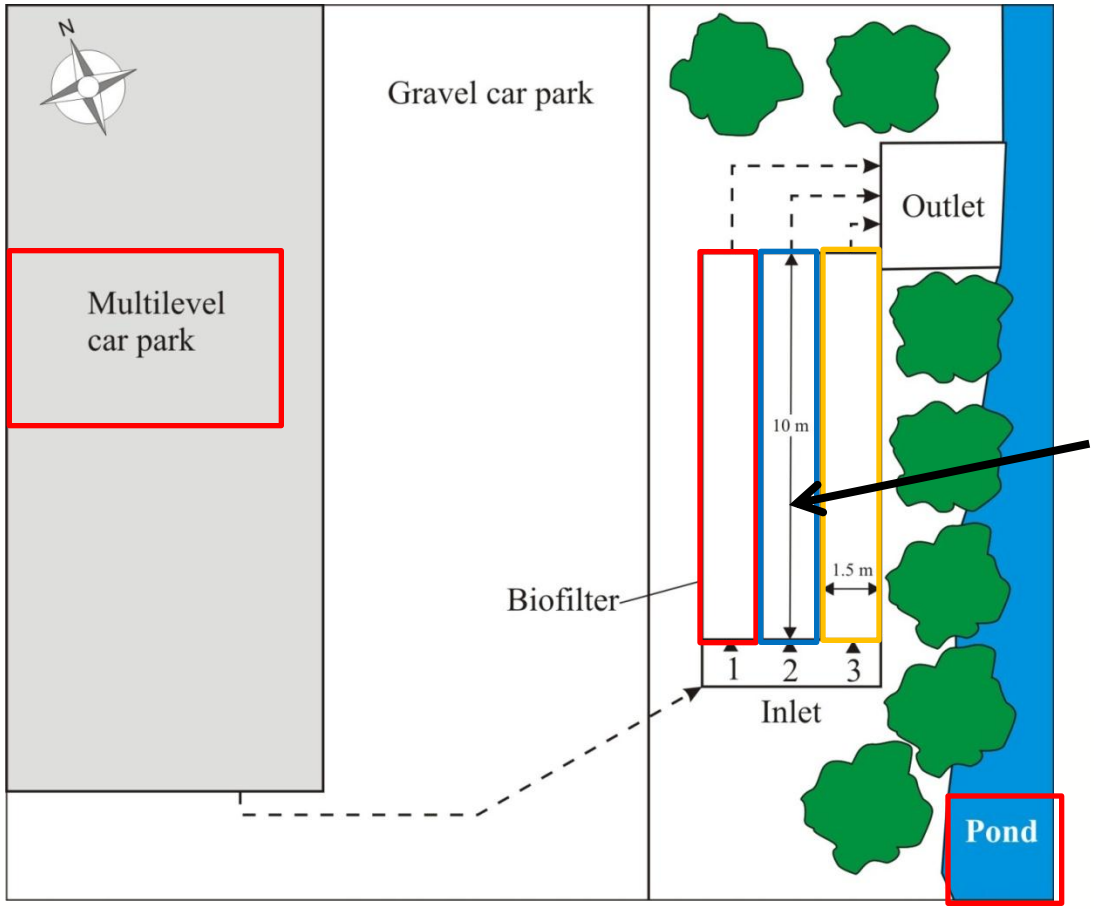
- Hydraulic conductivity of the filter media, *k*
- Soil moisture

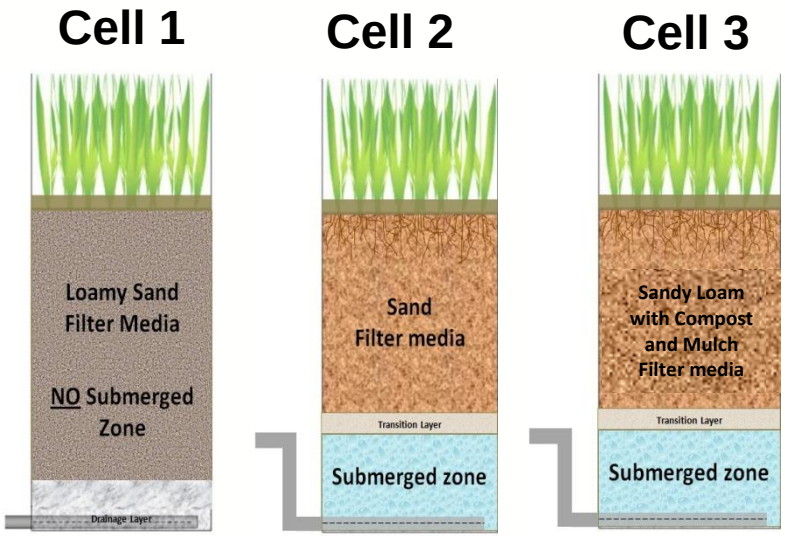



Ponding Zone
Infiltration
Evapotranspiration
Filter media Zone
Infiltration
Capillary rise
Drainage layer Zone
Piped outflow
Exfiltration to surrounding soil

Methodology

Monash University Carpark biofilter





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Methodology

- Available data:
  - Continuous inflow and outflows at 1 minute timesteps
    - 8 months

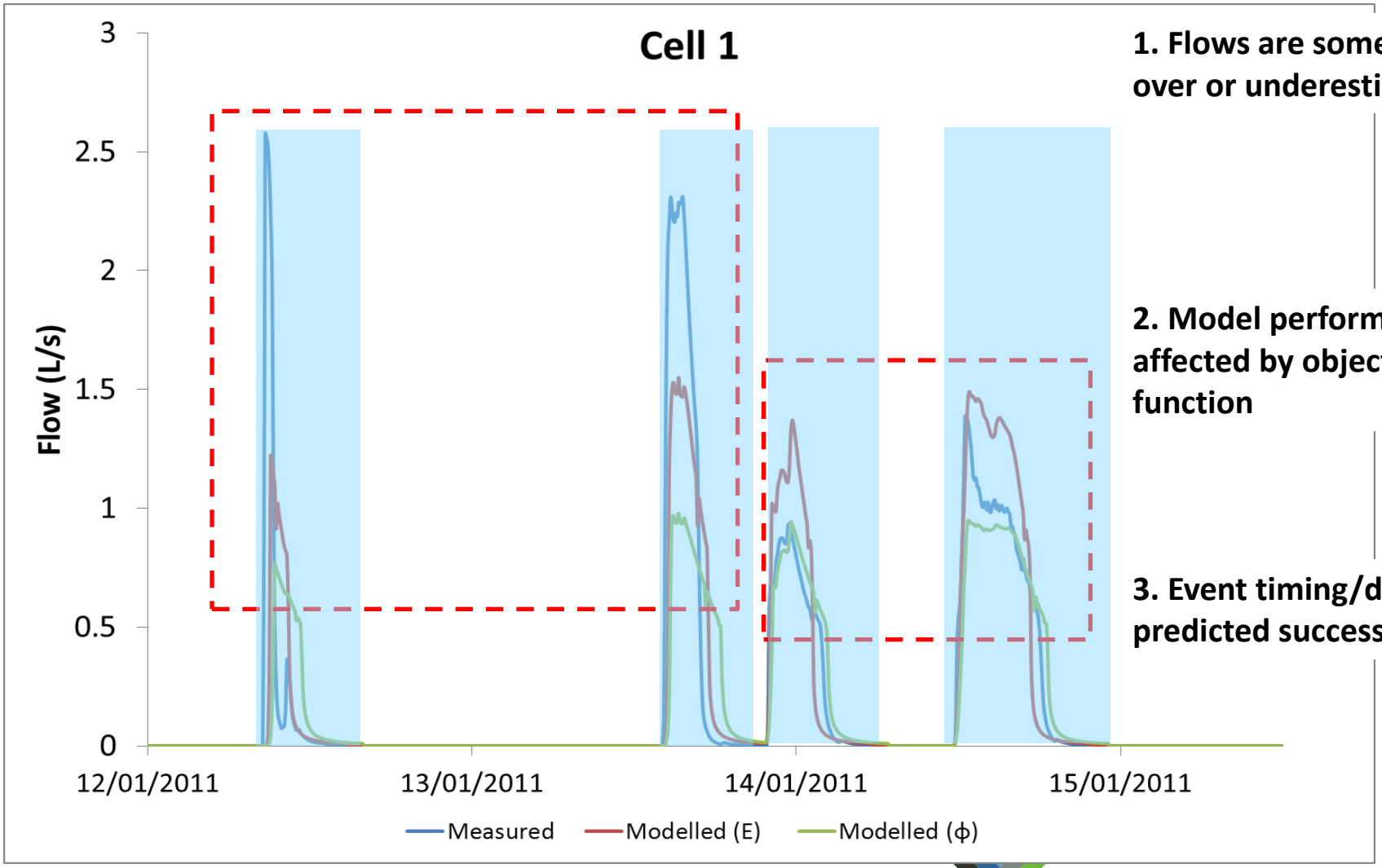
Results:

- All results use corrected input data

Results: Hydraulic Conductivity

	Measured k	Coefficient of efficiency		Unbiased function	
		k	E	k	ϕ
Cell 1	123 mm/hr	190 mm/hr	0.59	120 mm/hr	4.08
Cell 2	144 mm/hr	180 mm/hr	0.91	170 mm/hr	0.24
Cell 3	77 mm/hr	50 mm/hr	0.68	60 mm/hr	0.4

Results: Flow Rates

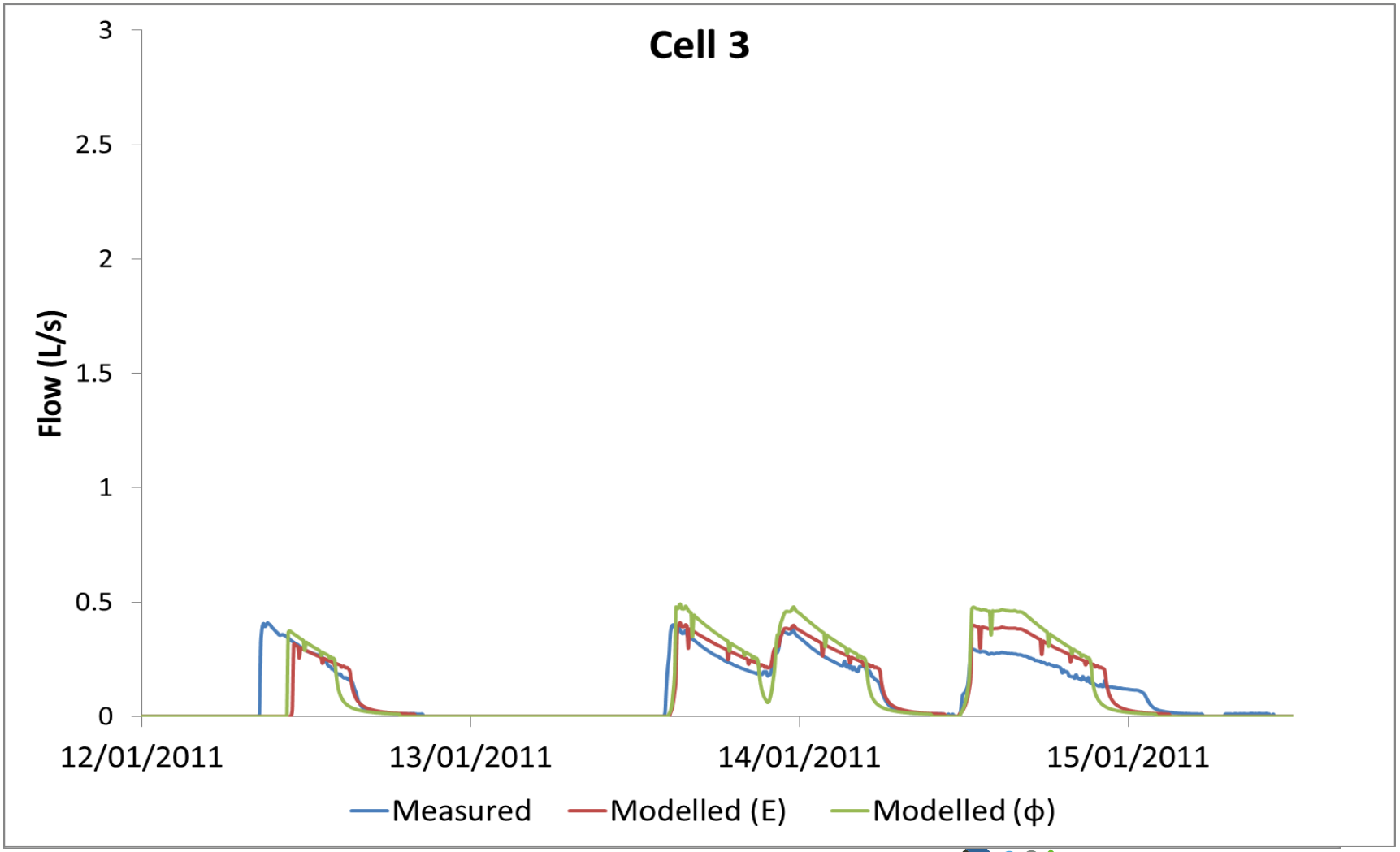


1. Flows are sometimes over or underestimated

2. Model performance affected by objective function

3. Event timing/duration predicted successfully

Results: Flow Rates



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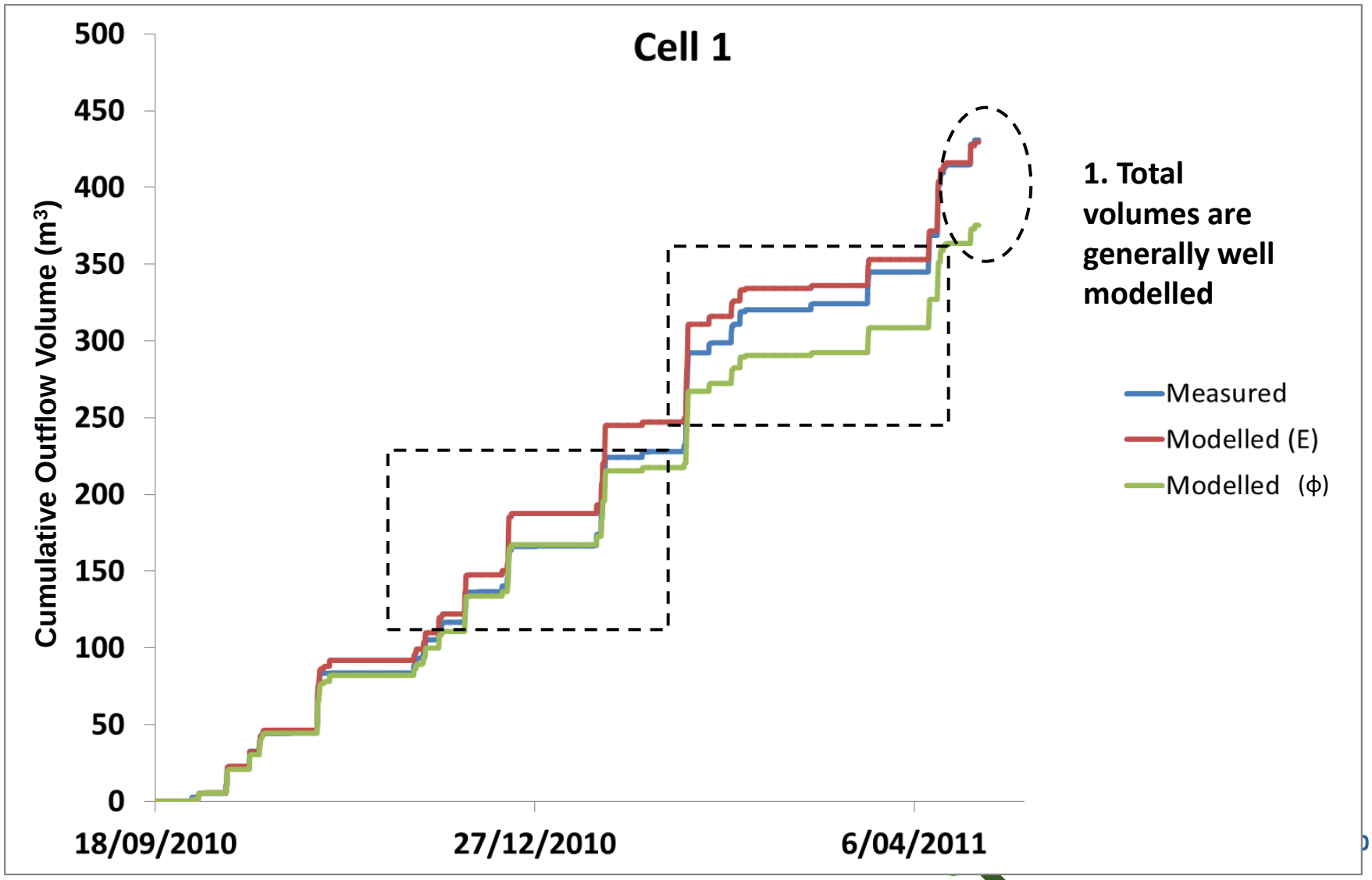
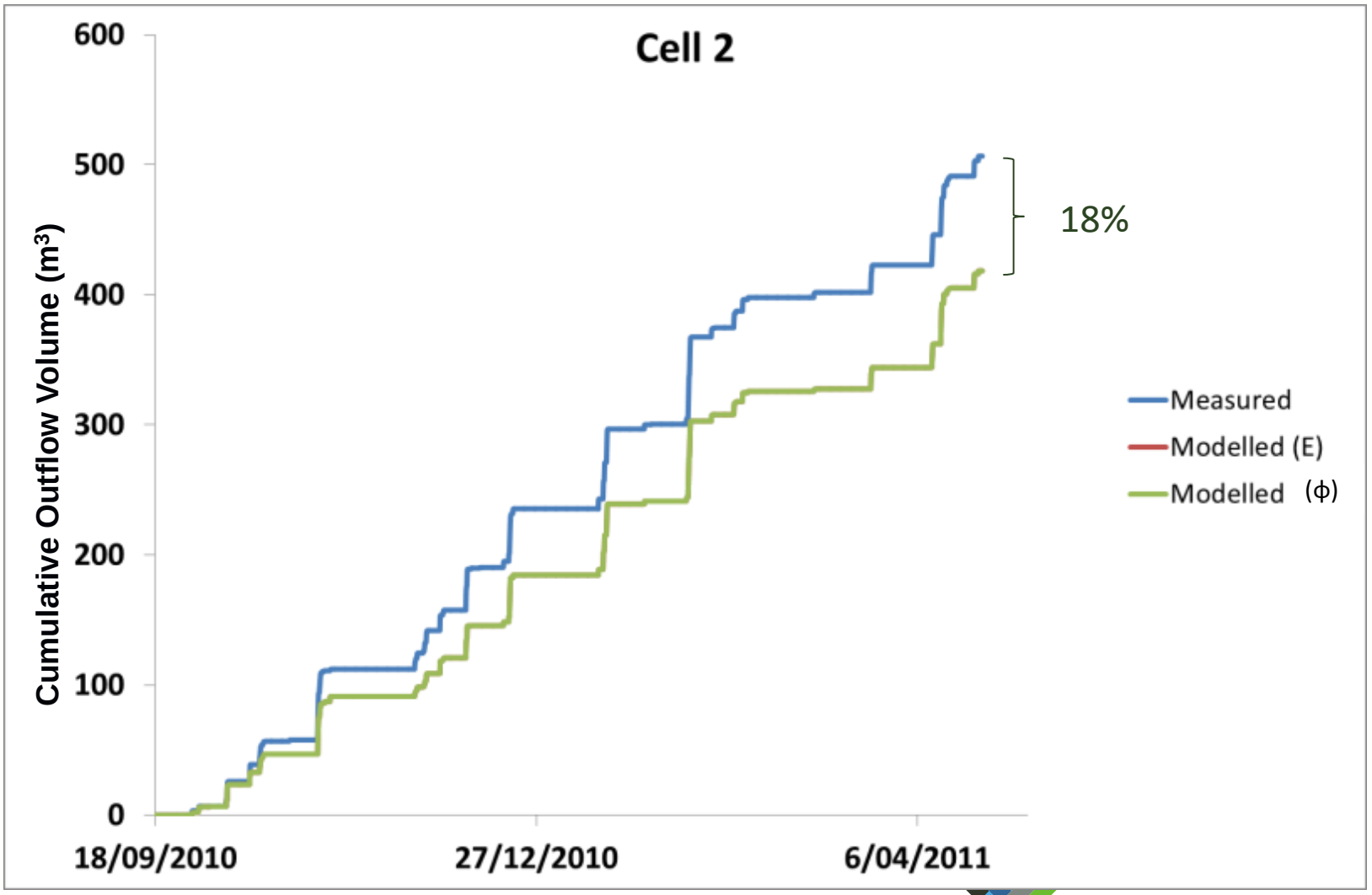
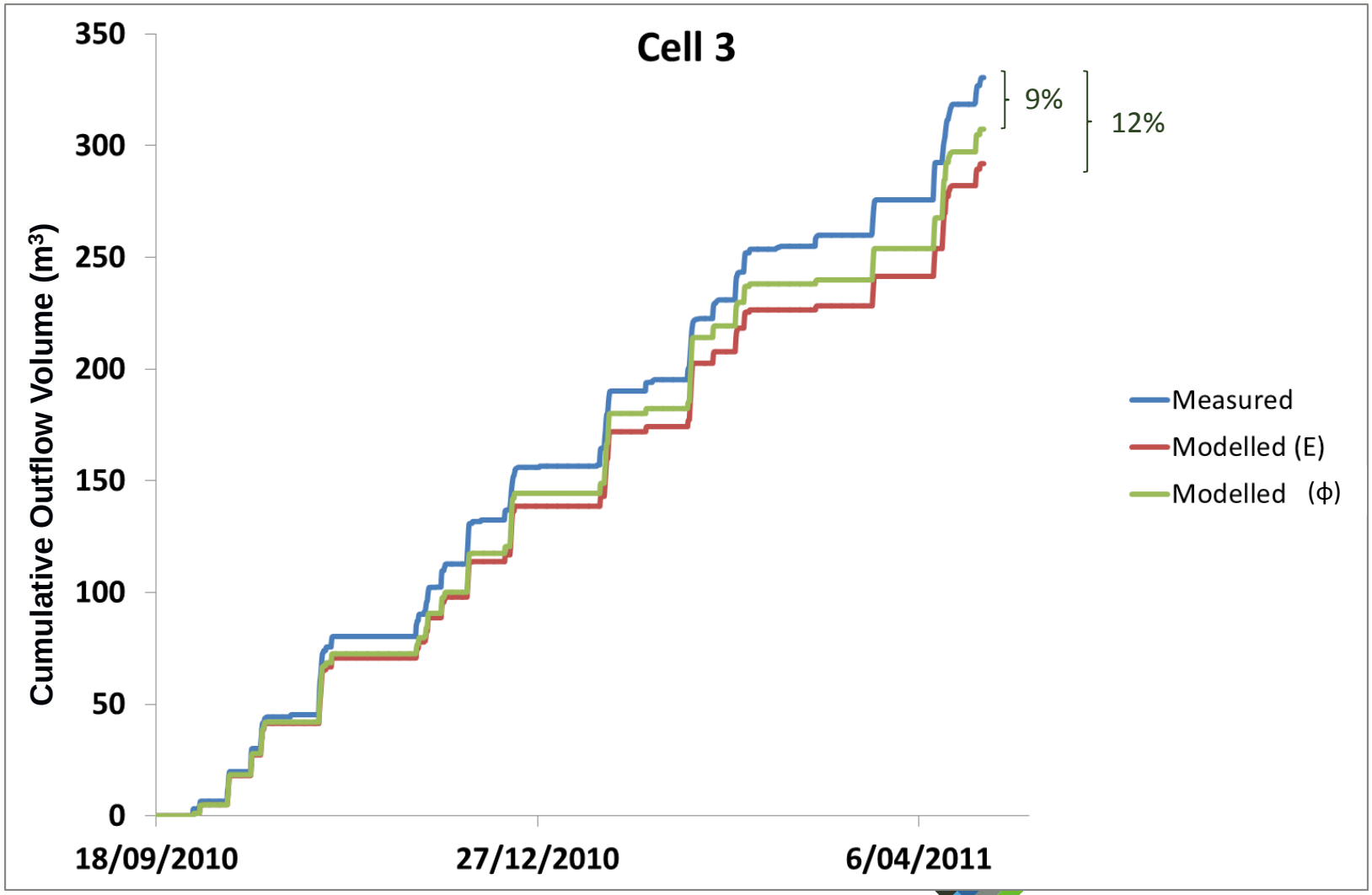
Results: Volumes



Results: Volumes



Results: Volumes



Although the model works quite well, there are some limitations:

1. Model limitations:

   a. Outflows are sometimes over- or under- estimated

2. Assumptions:

   a.

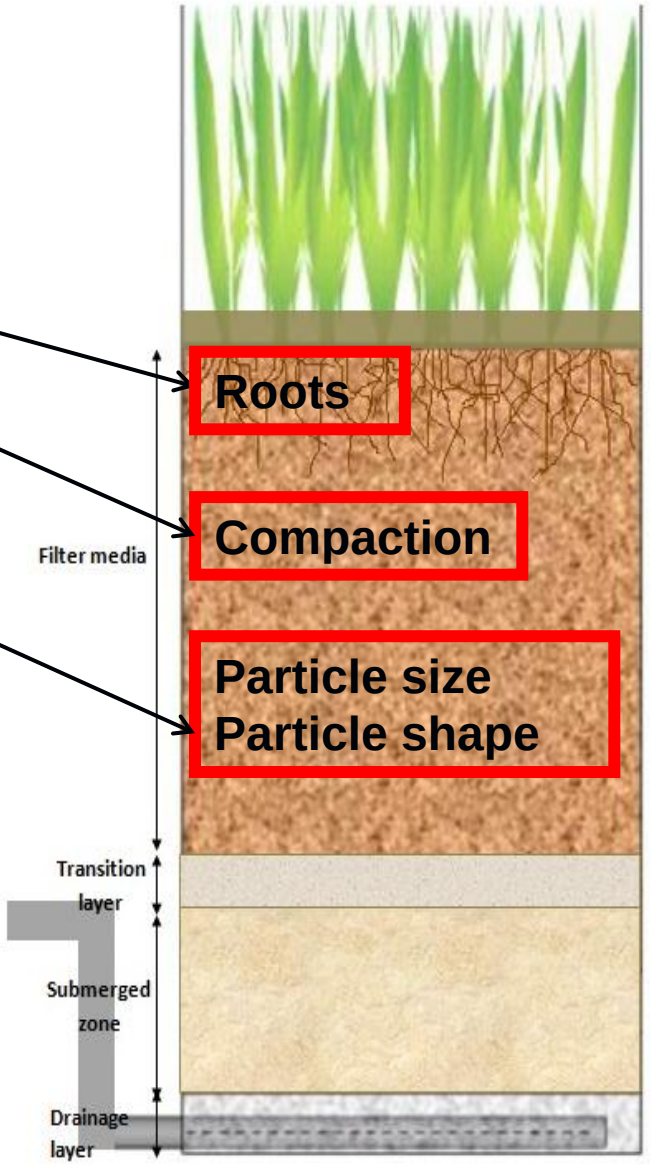
   b

Model limitations and assumptions

Hydraulic conductivity affected by:

1)Macropores

2) Soil porosity



Conclusions

1. A hydrologic model of a stormwater biofilter was tested

2. Main conclusions about model performance:
    a. Model is working well
        i. Appropriate for conceptual design stage
        ii. Appropriate for modelling pollutant loads
    b. Model performance dependent on objective function choice
    c. Model is not perfect

3. Further work:
    a. Calibrated model should be verified on an independent data set
    b. Uncertainty should be assessed

Thank you