



A Preliminary Model on *E. coli* Removal in Stormwater Biofilters

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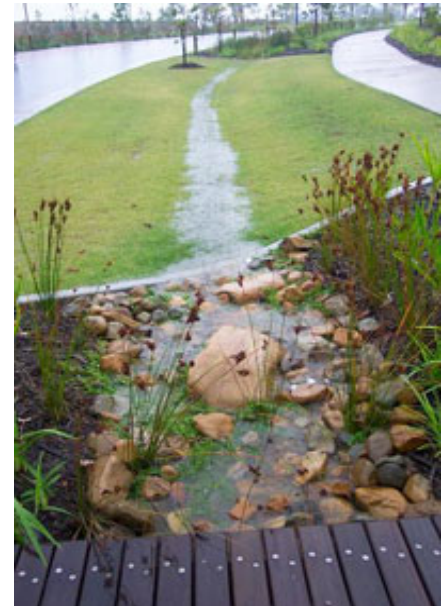
Introduction



Stormwater



Pollutants

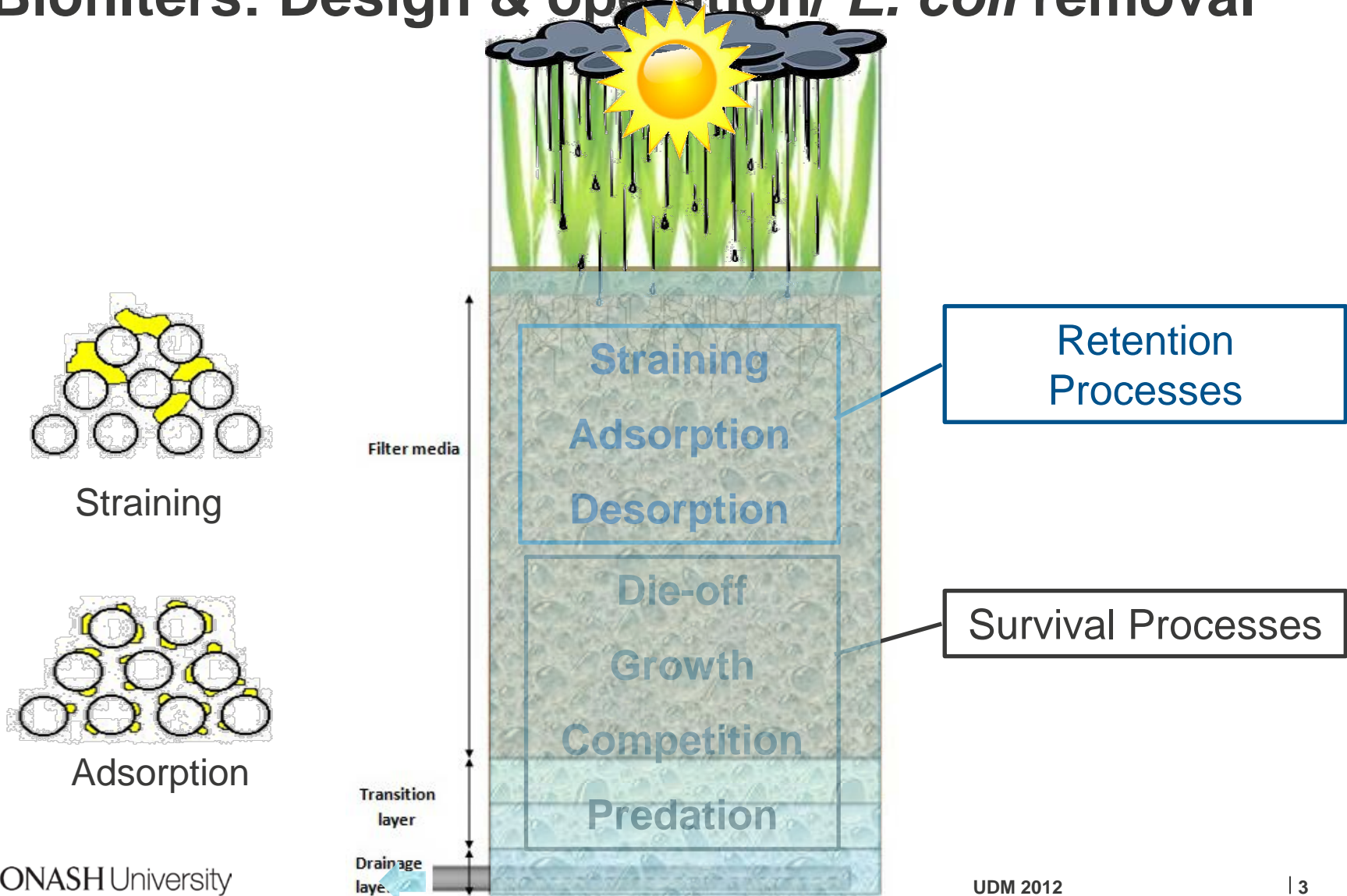


Treatment

Aim of the study

To understand the major process govern <i>E. coli</i> (microbial indicator of faecal pollution) removal in stormwater biofilters and to develop a predictive model	<i>Campylobacter</i> (pathogen)	70/L	Faecal coliforms	69-90%
	<i>Cryptosporidium</i> (pathogen)	55/L	<i>E. coli</i>	(-611)-92%
	<i>Enterovirus</i> (pathogen)	>0/L	<i>Enterococci</i>	(-132)-86%
	<i>E. coli</i> (Indicator)	10^6 /L		

Biofilters: Design & operation/ *E. coli* removal



Methodology

Process Understanding

Using a biofilter column dosing experiment



Model development

Based on results of dosing experiment and literature

Understanding *E. coli* Removal Processes in Biofilters

- Short-term biofilter column dosing experiment

Day	Event number	Concentration (MPN/100mL)
1	Run 1	8.66×10^4
3	Run 2	1.79×10^3
7	Run 3	1.17×10^3
15	Run 4	8.84×10^2
23	Run 5	2.01×10^4
34	Run 6	6.25×10^5
36	Run 7	1.36×10^3
38	Run 8	1.36×10^2

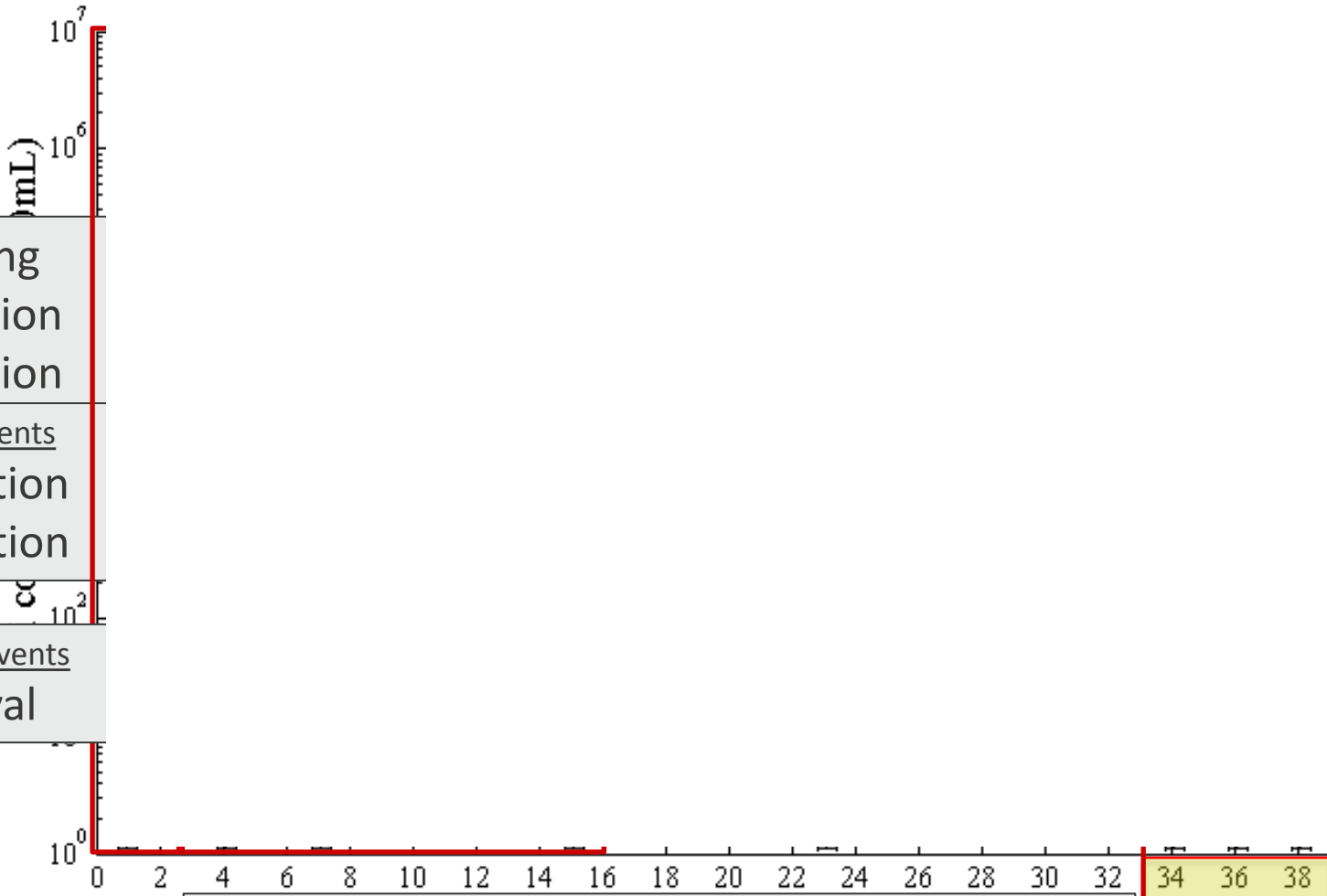


Vegetation

Carex appressa

Lomandra longifolia

Understanding *E. coli* Removal Processes in Biofilters



Within event
Adsorption
Desorption

Straining
Adsorption
Desorption

Within events
Adsorption
Desorption

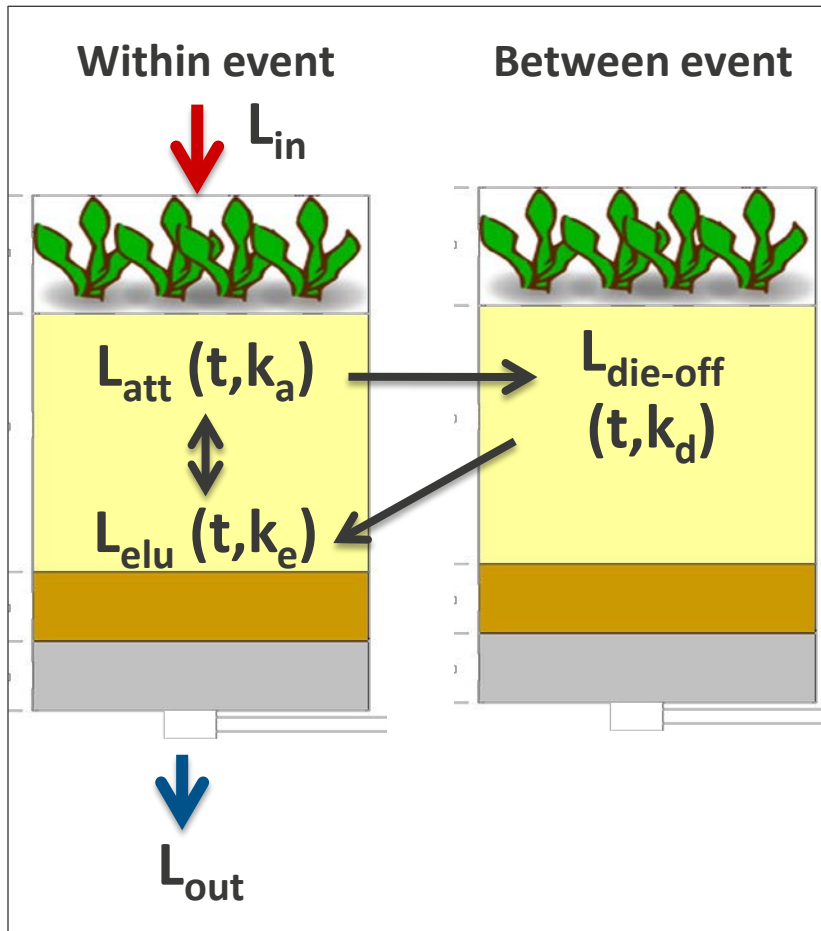
between events
Survival

Removal is governed by,
Adsorption, Desorption and Survival

Modelling Microbial Removal in Stormwater Biofilters

- Very few models on stormwater biofilters (faecal microbial removal)
- Most of the available models are for wastewater/ ground water treatment
 - Limited to single event simulations
 - Overlook importance of survival/ desorption

Preliminary modelling



L_{in}	: Number of <i>E. coli</i> in inflow
L_{out}	: Number of <i>E. coli</i> in outflow
L_{att}	: Number of <i>E. coli</i> attached
L_{elu}	: Number of <i>E. coli</i> eluted
$L_{die-off}$: Number of <i>E. coli</i> die-off
k_a	: Attachment rate coefficient
k_d	: Die-off rate coefficient
k_e	: Elution rate coefficient

Simplified modelling approach

Adsorption

f (inflow concentration, pore water velocity)

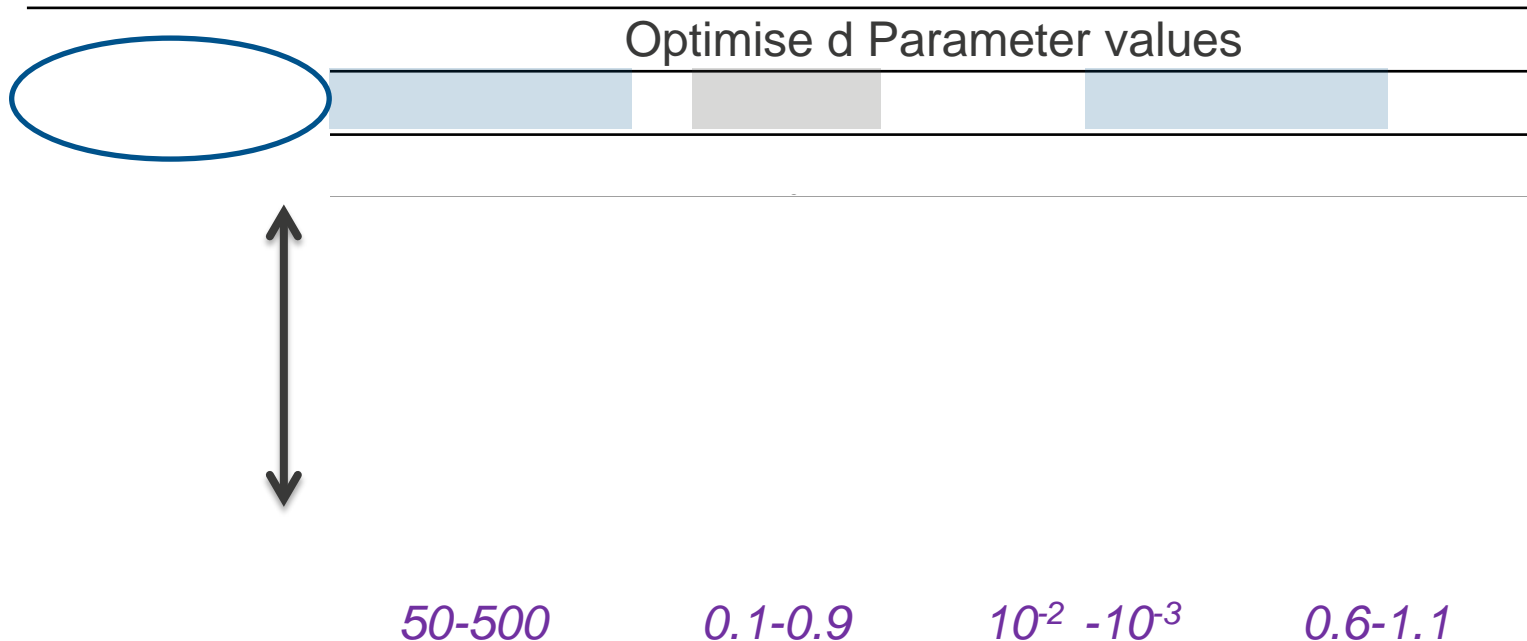
Desorption

f (amount attached to media, pore water velocity)

Die-off

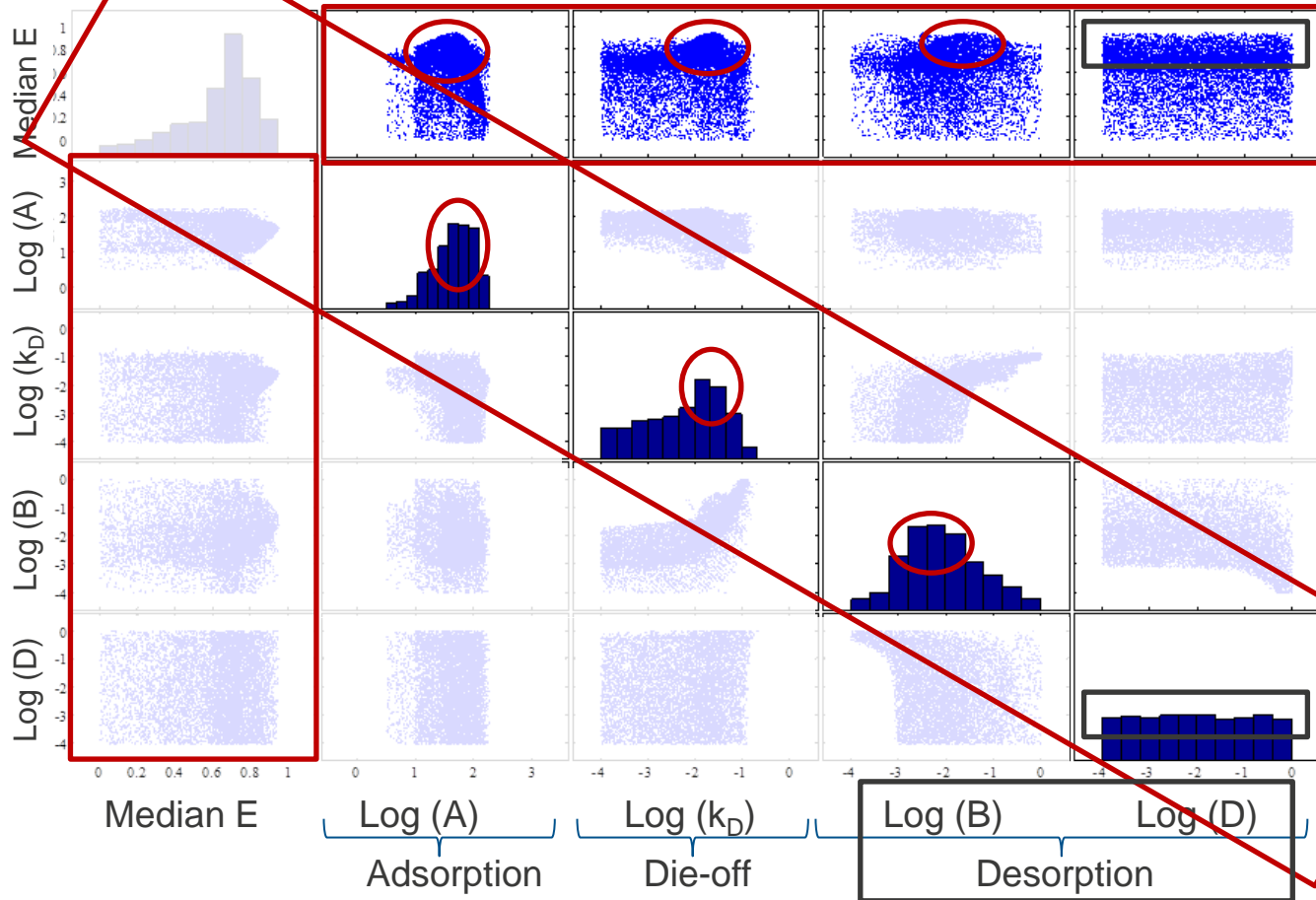
First order die-off kinetics

Preliminary Modelling Results - Calibration



- Good agreement between modelled and observed performances
- Optimised process rate constants are comparable with literature
- Vegetation affects wet weather processes

Preliminary Modelling Results–Sensitivity Analysis



- Model Sensitivity is highest towards adsorption parameter
 - Adsorption is the governing process in the model

Conclusions and Future Work

- *E. coli* removal in stormwater biofilters can be simulated using the selected wet weather (adsorption/ desorption) and dry weather (die-off) processes
- Adsorption is the governing process of the model
- Biofilter vegetation affects the wet weather processes

- The model needs to be calibrated and validated using field data
- Other effects of biofilter design and operational characteristics need to be incorporated into the model

Thank you

