



Undergraduate PIRE Program Down Under

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NSF PIRE PI Meeting

Background

- The Millennium Drought threatened water security in Melbourne, Australia
- Stormwater capture, treatment, and harvesting provide a new source of water for Melbourne, and reduce nitrogen input to Port Phillip Bay





Melbourne

Blackburn

Malvern East

Werribee

Clayton

Fernt

Dandenong South

Berwick

Lara

Bannockburn

Port Phillip Bay

Cranbourne

Frankston

Geelong

Drysdale

St Leonards

Mornington

Hastings

Ocean Grove

Dromana

Torquay

Rye

Anglesea

Cowes

Introduction

- Two treatment approaches are evaluated in this study -- biofilters and constructed wetlands
- Stormwater treatment is affected by flow path, vegetation, and filter media
- The fate of nitrate and phosphate in wetlands and biofilters is evaluated using multiple linear regression (MLR)



THE TEAM

- *12 undergraduates (US)*
- *various grad students, post-docs, and professors (US and Australia)*



Methods

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- Two constructed wetlands: Royal Gardens and Hampton Park



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- One natural wetland system: Edithvale-Seafood Wetlands



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- Temperature (T), dissolved oxygen (DO), and pH measurements were recorded ten times per location using portable instruments
- Water samples taken in triplicate were analyzed for chlorophyll (CHL), pheophytin (PHEO), nitrate, and phosphate (spectrophotometry), and total suspended solids (TSS; weight measurements) as outlined in *Standard Methods for the Examination of Water and Wastewater*

Data Analysis

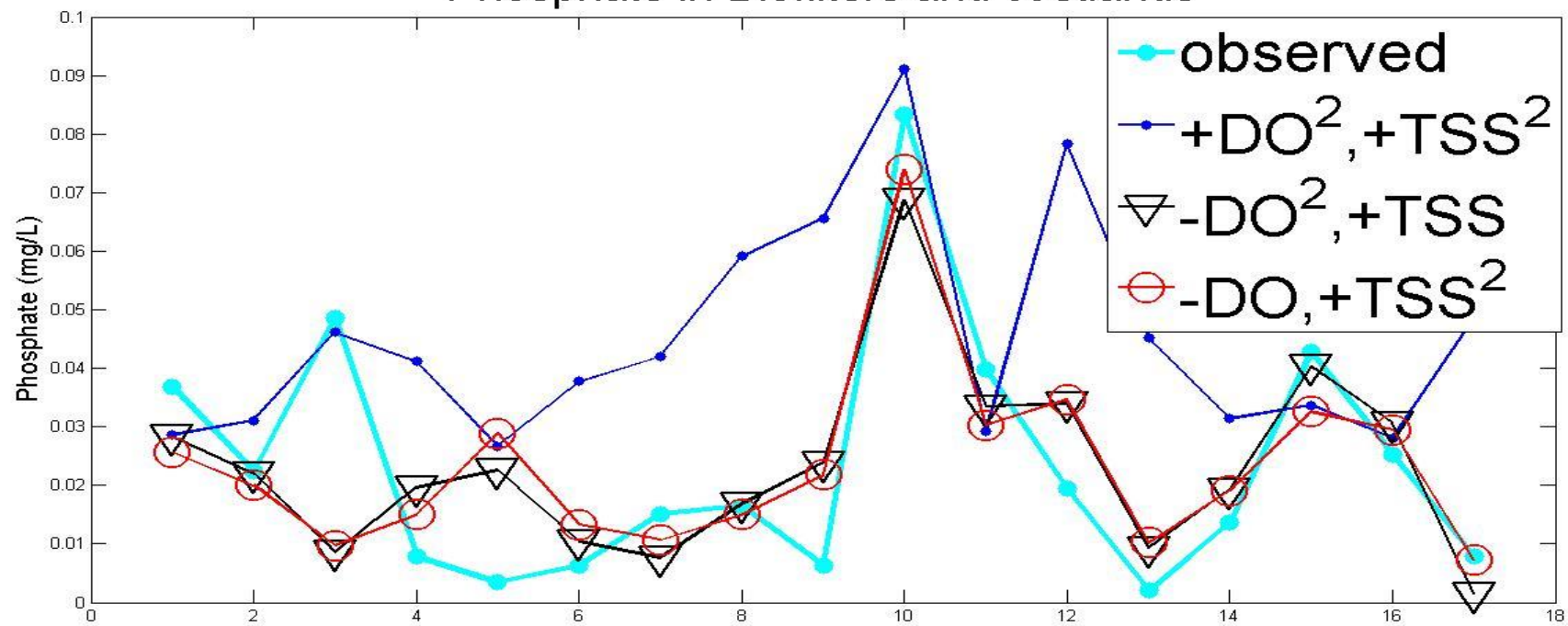


MLR models were developed using Virtual Beach 2.3 with:

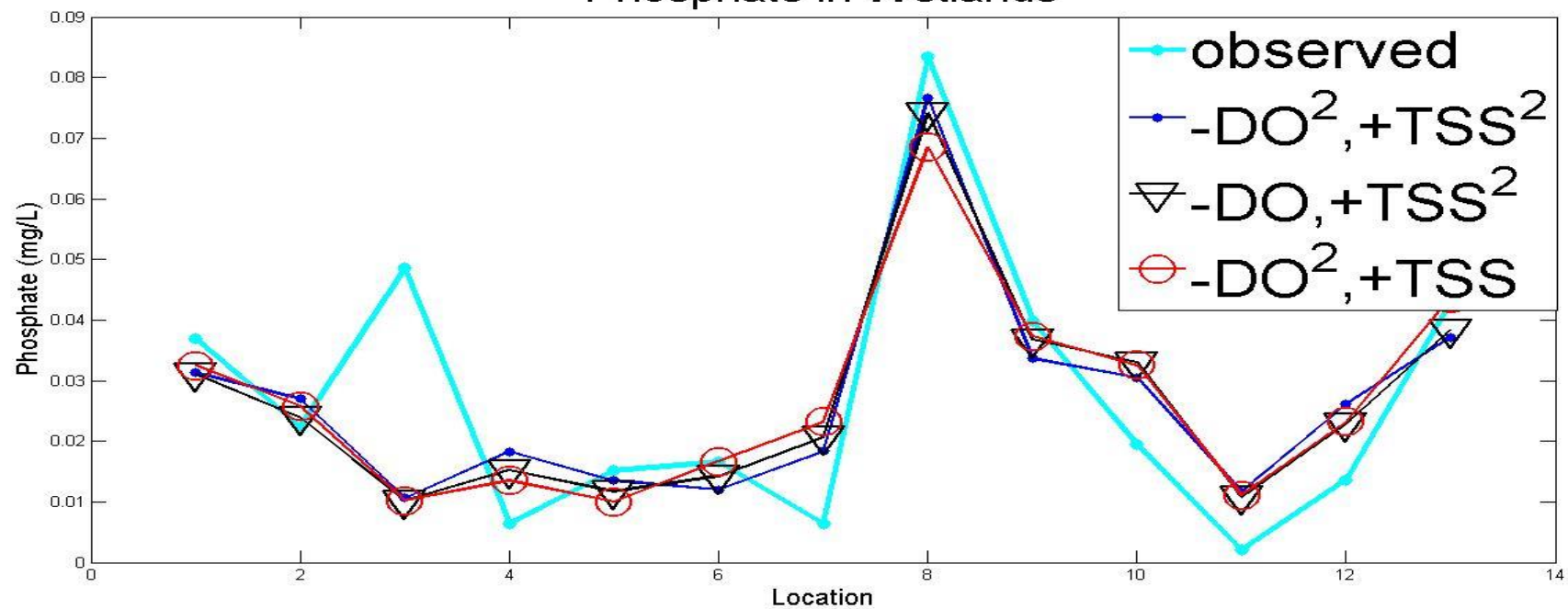
- nitrate or phosphate as the dependent variable
- T, DO, pH, CHL, PHEO, and TSS as independent variables



Phosphate in Biofilters and Wetlands



Phosphate in Wetlands



Discussion

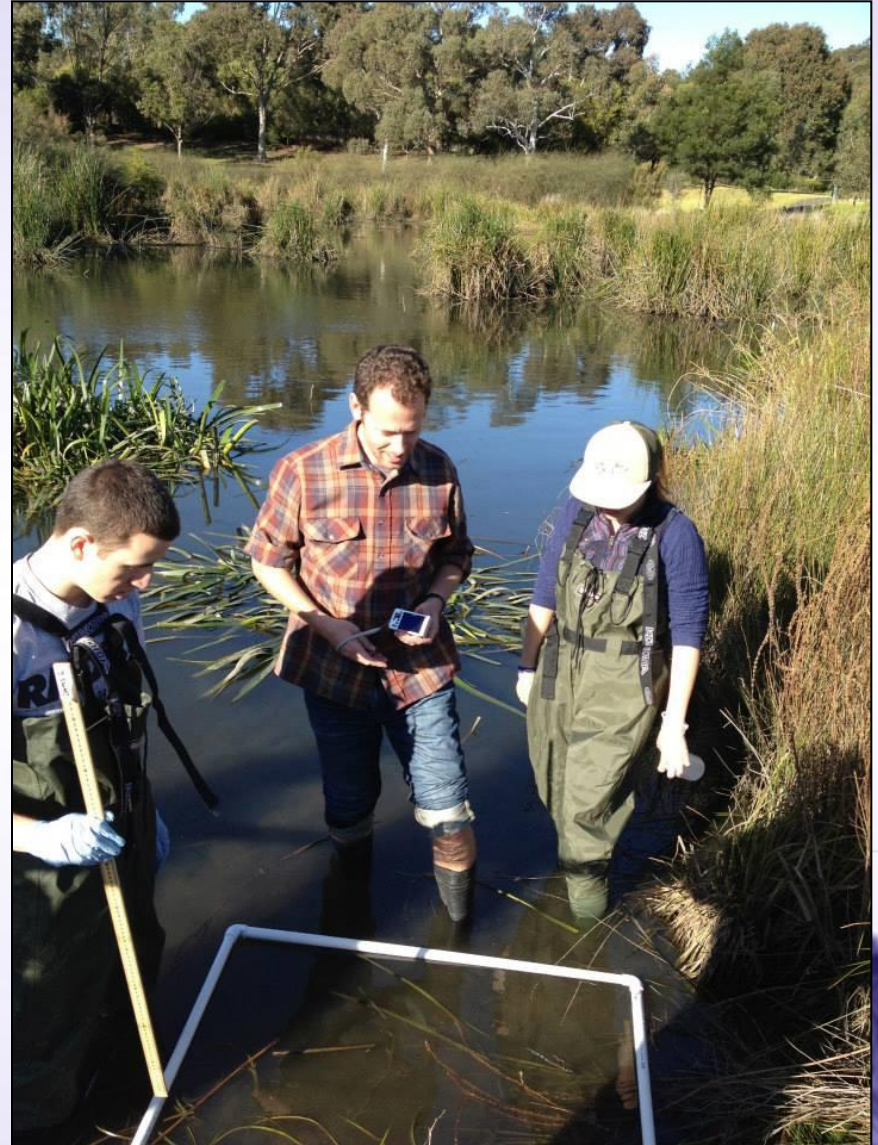
Phosphate

- DO and TSS were the strongest correlates
- Consistent with the fact that phosphate binds to suspended solids
- Highlights the importance of solids removal as a wetland function



Analysis conducted by four teams:

- Plant diversity
- Invertebrate counts
- Pathogens
- Nutrients



Can animals improve the efficiency of water-sensitive urban design?

Running title: Animal roles in biofilter function

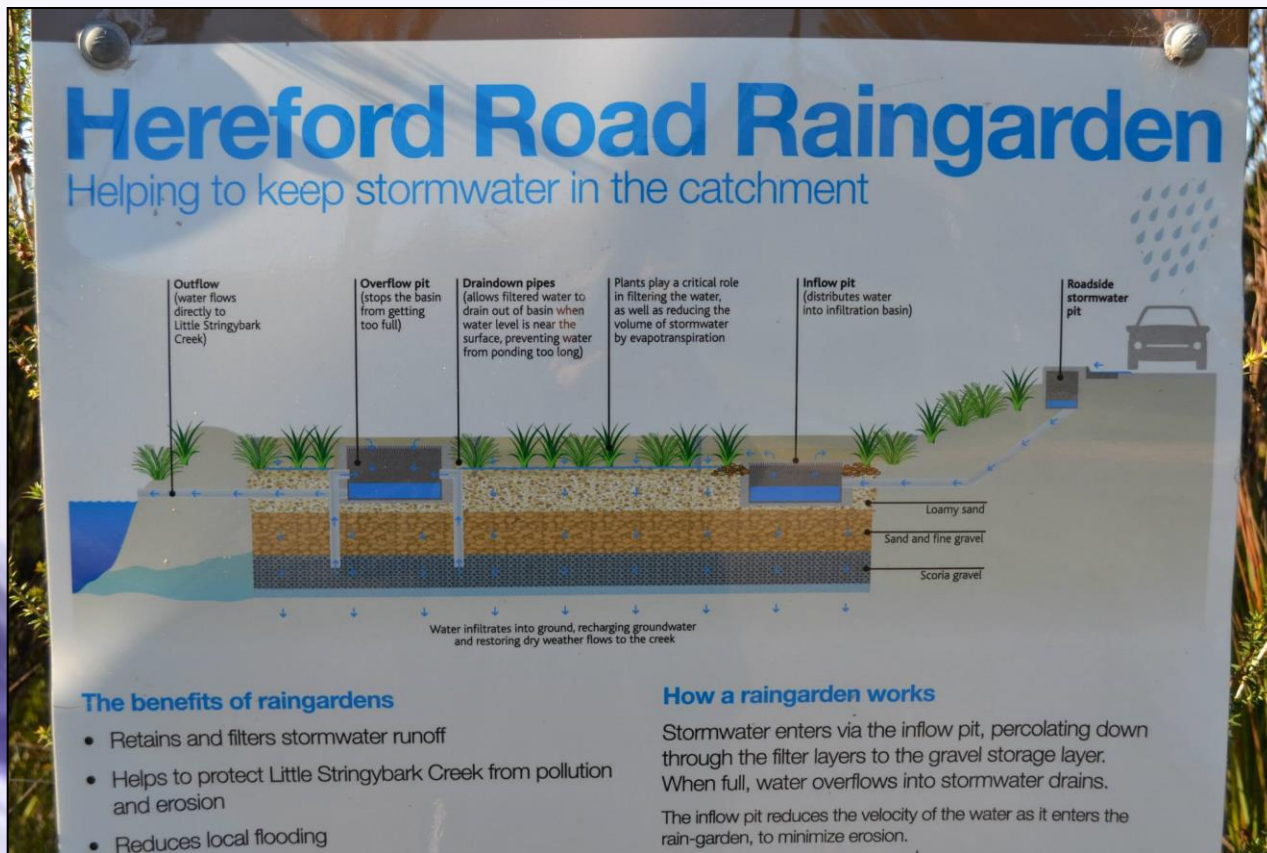
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A Different Mindset

- Recycled rainwater in use at large facilities
- Dual-flush toilets
- Rainwater tanks common





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NUTRITIONAL INFORMATION
Servings per package: 3 Servings Size: 150g
Av. Qty per serving Av. Qty per 100g

Energy	627kJ	418kJ
Protein	32.2g	21.5g
Fat, total	1.8g	1.2g
-saturated	0.6g	0.4g
-trans	0.1g	0.1g
-polyunsaturated	0.6g	0.4g
-monounsaturated	0.4g	0.3g
Carbohydrates	0.7g	0.5g
-sugars	0.7g	0.5g
Sodium	75mg	50mg
Gluten	0mg	0mg
Iron	4.9mg	3.3mg



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