Phosphorus Mitigation Project

(SFF 404964 – commencing 1st July 2016)

Advancing on-farm phosphorus loss mitigation in conjunction with applied research on a new mitigation tool - the Detainment Bund

Funders:
Sustainable Farming Fund (50%), Co-Funders (50%)
DairyNZ, BOPRC, Beef + Lamb NZ, Ballance Agri-Nutrients, Environment Canterbury, Deer Industry NZ. > $ 400K
In-Kind support > $ 200K

Governance Group of Farmers:
Executive Committee; L McKenzie (Chair), N Saville-Wood (Teasurer), M Birchall, M pacey, B Heard, J Paterson (Project Manager).
Committee; R Moore, Jamie Paterson, Hera Naera, T Cairns, J Ford.

Science Advisory Team:
D Hamilton, C Tanner, L Condron, D Horne, G Lucci, D Clarke, V Fulton, J Peryer-Fursdon

Applied Researcher:
To be confirmed

"….. anthropogenic phosphorus is predominantly particulate…"

"Management of anthropogenic particulate phosphorus loads should be a high priority for reduction as they will be most amenable to management. Sub-catchment particulate phosphorus loads are most appropriately addressed by **land-use best practice** (McDowell 2010), improved **stormwater detention** (Nix et al. 1988) and **erosion control** (Stutter et al. 2008)"

G Tempero et. al 2015 – ERI Report 66

Table 1. Summary of annual phosphorus loading to Lake Rotorua, including estimated percentage range of anthropogenic total phosphorus reduction needed to achieve a TLI target of 4.2 (in parentheses).

	Annual loading t P y^{-1}		
	Total	Anthropogenic	Baseline
Dissolved reactive phosphorus	27.7	6.1	21.6
Particulate phosphorus	21.0	17.3	3.7
Total phosphorus	48.7	23.4 (43-64%)	25.3

A train of P-loss Prevention and Mitigation tools
Cost / Benefit Summary

Table 2. Summary of efficacy and cost of P mitigation strategies

Strategy		Effectiveness (%)	Cost (NZD $/kg P conserved)
Optimum soil test P	management	5-20[1]	highly cost-effective[1]
Low solubility P fertilizer	management	0-20	0-30
Stream fencing	management	10-30	5-65
Greater effluent pond storage	management	10-30	30
Low rate effluent application to land	management	10-30	45
Tile drain amendments	amendment	50	25-100
Restricted grazing of cropland	amendment	30-50	150-250
Alum to pasture	amendment	5-30	150->500
Alum to grazed cropland	amendment	30	160-260
Grass buffer strips	edge of field	0-20	>250
Sorbents in and near streams	edge of field	20	350
Retention dams / water recycling[2]	edge of field	10-80	>500
Constructed wetlands[3]	edge of field	-426-77	>500
Natural seepage wetlands[3]	edge of field	<10%	>500

[1] depends on existing soil test P concentration, but no cost if already in excess of optimum.

[2] upper bound only applicable to retention dams combined with water recycling

[3] potential for wetlands to act as a source of P renders upper estimates for cost infinite.

From AgResearch
R. McDowell, 2010

Accountable structure for GMPs integral with new Phosphorus Mitigation Project

- **GMPs – top of the list for both P-mitigation effectiveness and cost effectiveness**
- **An effective on-farm Environment Management System (EMS) can assure good uptake of GMPs**
- **Two NZ Ag Industry's have EMS type templates for managing the effective uptake of GMPs:**

❖ **DairyNZ – Sustainable Milk Plans (SMP)**

❖ **Beef + Lamb NZ – Land and Environment Plans (LEP) which also covers Deer Farmers**


Sediment and nutrient highway
flow over usually dry paddocks

Ephemeral streams
(overland flow)

The predominant pathway for P and sediment export from pastoral farmland to freshwaters

DBs occupy productive pasture paddocks "they are not a farm dam"

Kaharoa 2012, a DB empty in the LHS pic and still flooding in on the RHS pic


4
3
2
1
2
9
8
7
6

http://researchcommons.waikato.ac.nz/handle/10289/7993

The performance of Detainment Bunds (DBs) for attenuating phosphorus and sediment loss from pastoral farmland

Clarke, Dylan T.

2013

Master of Science (MSc)

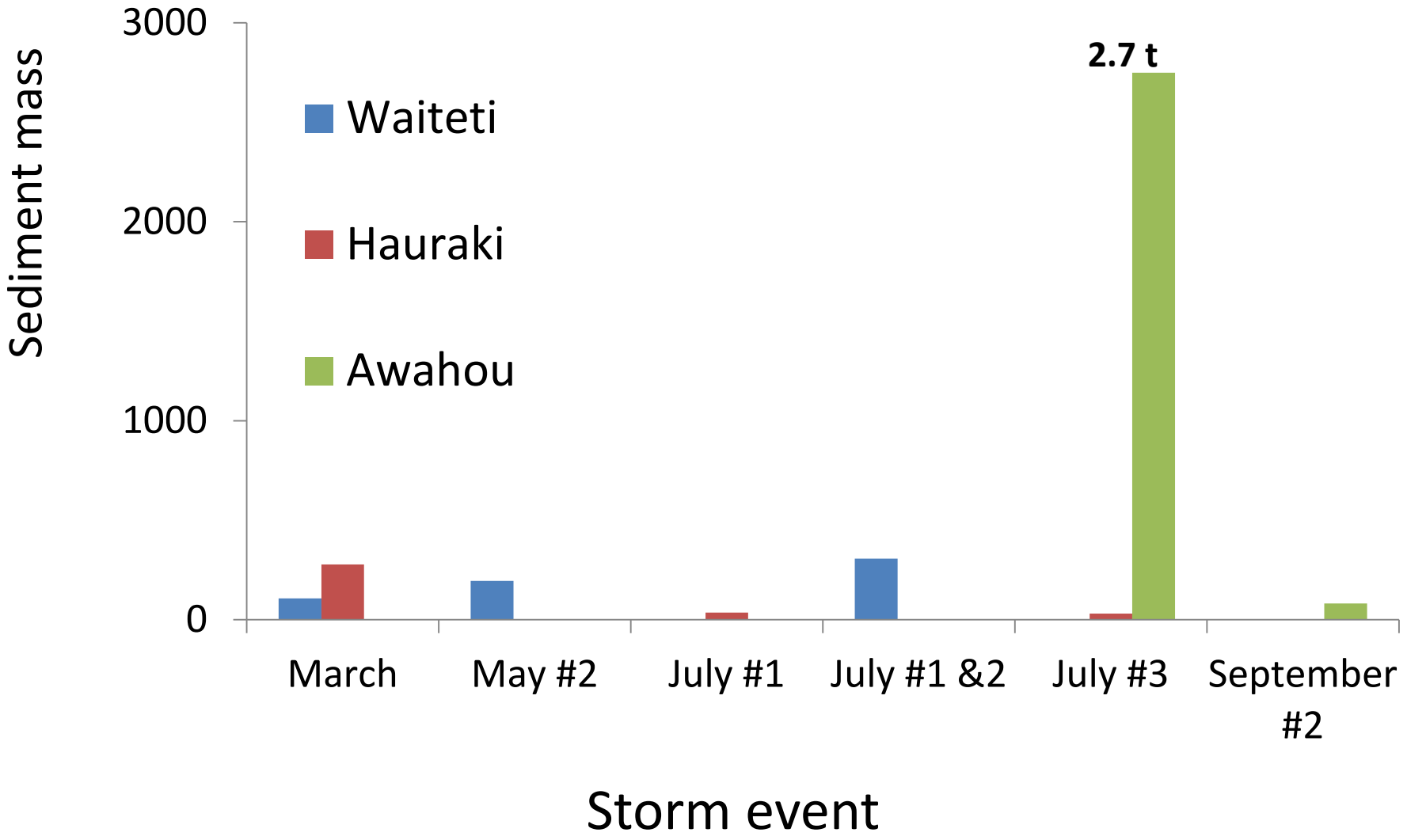
University of Waikato

- Provided proof of concept
- “not sufficient for reporting purposes”

Particulate **N**

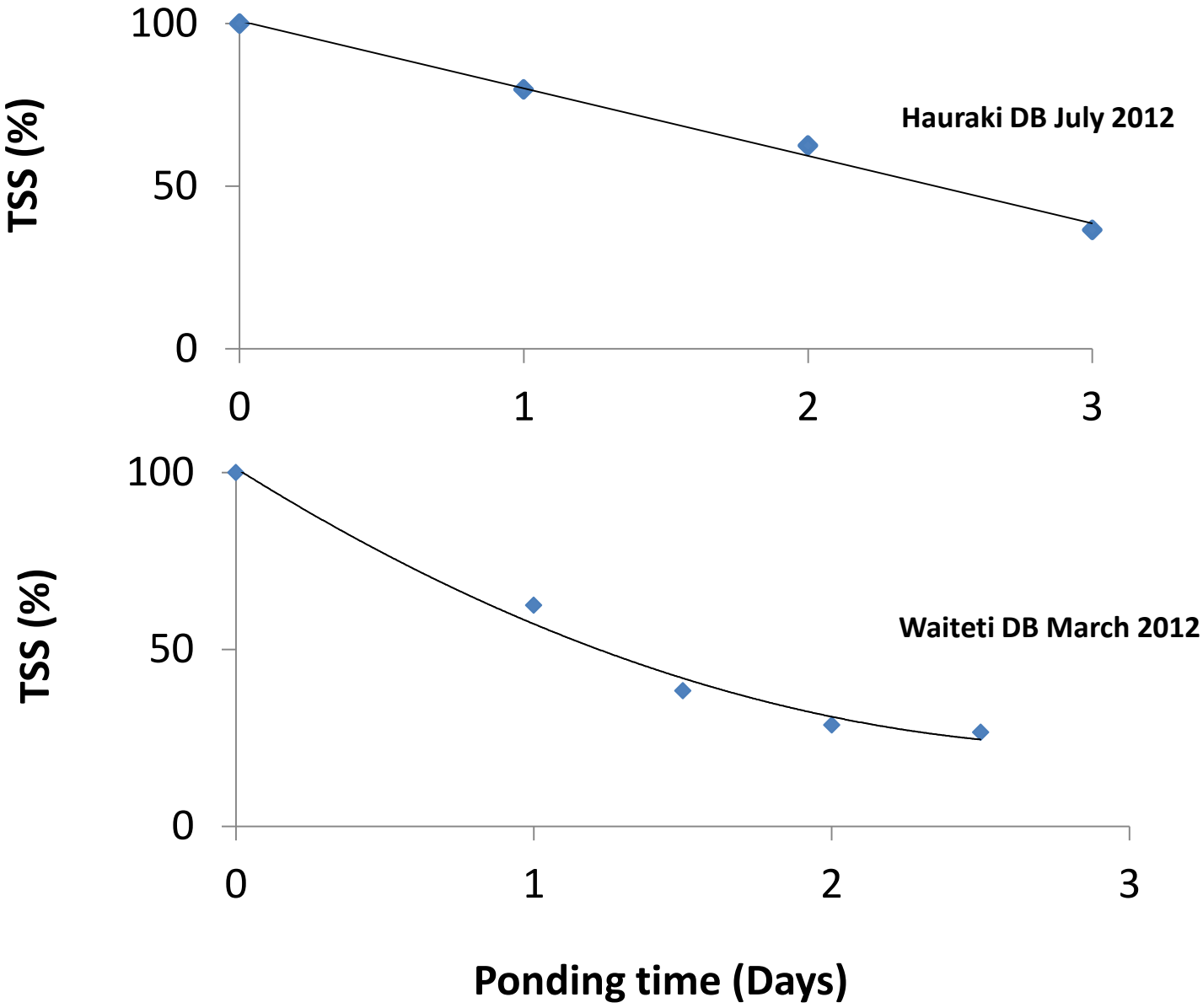
- In some cases, reductions in Particulate Nitrogen concentrations of outflow water were observed
- E.g. a 42% reduction in PN concentration over 20 hours
- Attributed to a recently grazed winter forage crop

Sediment deposited

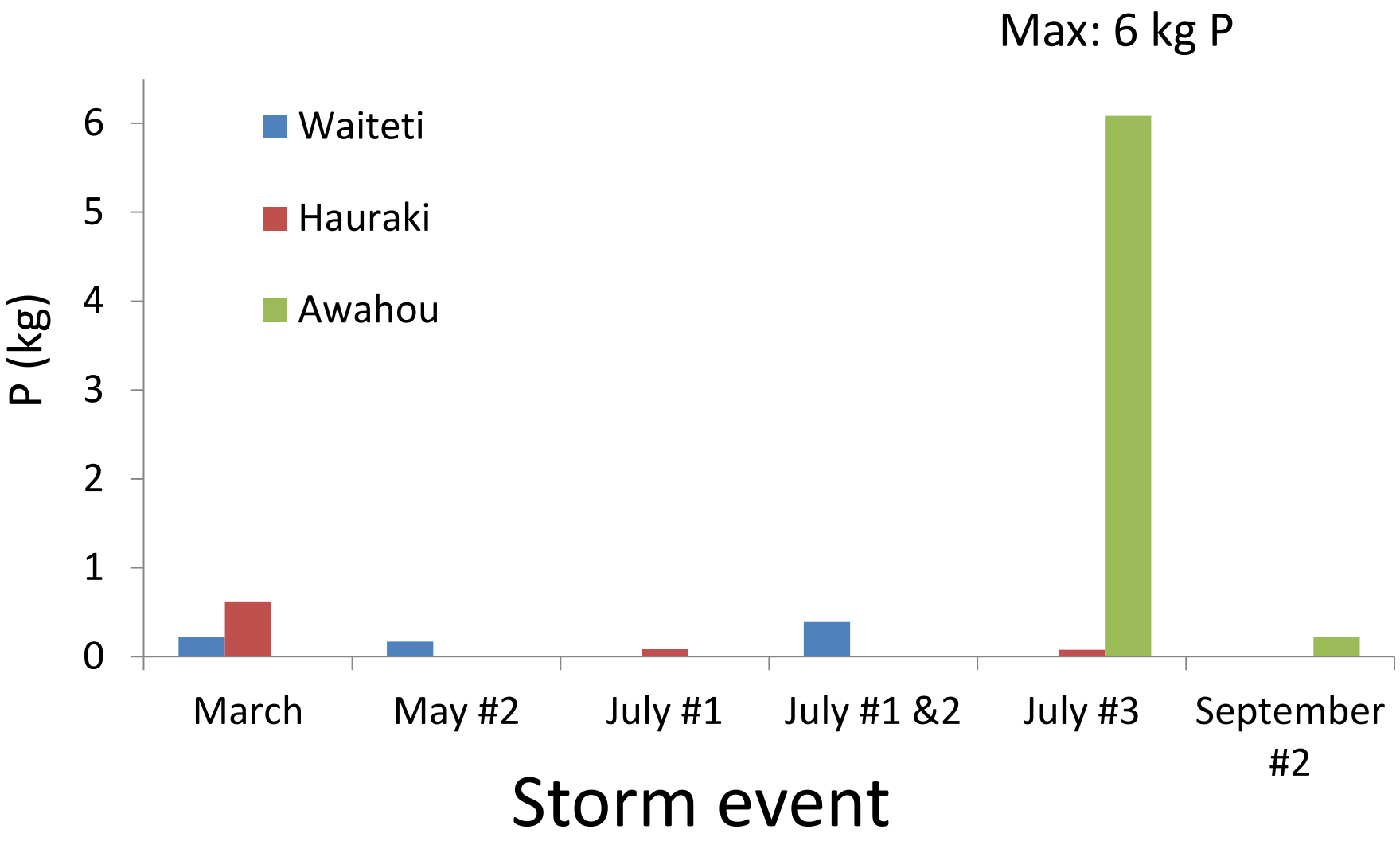


2.7 t sediment deposited extreme case

Total Suspended Sediment (TSS)



P retained


Max: 6 kg P
Waiteti
Hauraki
Awahou
P (kg)
0
1
2
3
4
5
6
March
May #2
July #1
July #1 &2
July #3
September #2
Storm event

Integrating DBs into farm systems

Aim to maintain the productive potential of ponding area

Optimal ponding time is a compromise between:

- maximising water treatment
- maintaining pasture quality

- 3 days inundation has been tolerated by the Land Owner participants

The new P-Project

Phosphorus Mitigation Project

- Aims to shift the knowledge from ‘qualitative’ to ‘quantitative’ – credible for reporting.
- Learn how to best drive DBs (pre storm plugging, 120:1, 3 days ponding, post storm care, etc.)
- Emphasis on catchment BMPs (monitored via EMS’s)
- MSc - 5 data sets (1yr x 5 events x 3 sites)
- PhD – 90 data sets (3yr x 5 events x 6 sites)
- Trial sites in 3 different catchments (select 6 from 20)
- Different farm types – Dairy, drystock, Deer ? tbc.

The new P-Project

Phosphorus Mitigation Project

- Full hydrological analysis of events at DBs
- Science Advisory Team – finalizing methodology
- More automated monitoring / sampling
- Land owner practices / status of covers - also monitored per event
- Near source dosing of flocculants (2 options)
- Additional features:

  - monitoring of e-coli (tbc)
  - subject to SAT and $

Thanks again to the researchers and particularly the farmers for rising to the challenge of integrating DBs into their farming systems

Funding for the Phosphorus Mitigation Project approved by SFF 14/04/2016

Co-funders confirmed (others pending):

- **Bay of Plenty Regional Council**
- **DairyNZ**
- **Ballance Agri-Nutrients**
- **Beef + Lamb**
- **DINZ**
- **Ecan**

Start date 1st July 2016

2 4 4

Bay of Plenty REGIONAL COUNCIL

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

DairyNZ
Profitability. Sustainability. Competitiveness.