

Water Quality Event Monitoring



Regional Natural Resource Management in Queensland

ID: WQEM 0629

EVENT SUMMARY LOAD CALCULATION

Lower Burnett (DPI Research Station, Kalkie) April 2006

Introduction

This fact sheet presents Event Mean Concentration (EMC), sediment and nutrient to discharge relationships and load estimates for samples collected following a storm event (05/04/2006 – 06/04/2006) at the DPI research station at Kalkie in the lower Burnett River (Figure 1).

Methodology

Eight samples (table 1) were collected from a culvert transporting runoff from the DPI Station at Kalkie (figure 1), during and after 11.8 mm of rainfall (figures 2 & 3). Discharge (m^3/s) was measured using float gauge and stage-height measurements (mm), simultaneously with water sampling (fig. 2). Quality controls indicated variations in flow measurements of 1-9% r.s.d., that background nutrient concentrations associated with sampling equipment were less than in-stream concentrations, and that nutrient concentrations were measured with a precision of 15% r.s.d. (for TSS) or below (table 1).

Hourly discharge (m^3/s) on the rising limb was modelled on hourly rainfall (mm) lagged by 1 hour, and discharge on the falling limb was measured in 0.5 – 1 hour increments (table 2). Rainfall data was sourced from the Bundaberg Automatic Weather Station, from National Climate Centre archives (webclim@bom.gov.au).

To calculate the event load, the average concentration

from the eight measurements was assumed across the hydrograph. Error margins were 2 standard errors around the average concentration, which were propagated across the hydrograph together with the median variation in flow (7%). The event load was the sum of the products of hourly discharge and concentrations (Table 3). The EMC was calculated by dividing the event load by the event volume (Table 3).



Figure 1. DPI Research Station sampling location in the Lower Burnett.

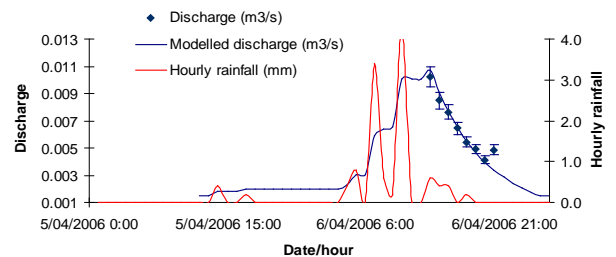


Figure 2. Rainfall, discharge and sample times collected at Kalkie.

Flow Event Description

Localised rainfall occurred between Bundaberg and Bargara, during the afternoon of the 5th April 2006, with more intense follow-up rain on the morning of the 6th April 2006. This was a light, late wet-season flush (figure 2) of a small coastal sub-catchment, with an underlying geology of basalt, highly fertile and permeable soils (ferrosols with minor hydrosols), low relief topography with gentle slope ($<10^\circ$), and high rainfall relative to the region (1080mm/year). The predominant landuse is sugar cane horticulture, with some citrus, and the farm's drainage has been modified to efficiently capture and reuse water and nutrient runoff.

Catchment: Kalkie Research Station; Burnett Catchment.
 Location: $24^\circ 50' 45'' S, 152^\circ 24' 08'' E$
 Catchment Area: 2.5 km^2
 Dominant Land Use: The experimental farm grows sugar cane and citrus, and has 3 dams (12ML, 4ML, 0.5ML). The upper part of the sub-catchment drains an asphalt go-cart track. (upstream of gauge)
 Event Duration: 07/12/2004 - 21/12/2004

Cumulative Rainfall (mm)

06/04/06 - 06/04/06

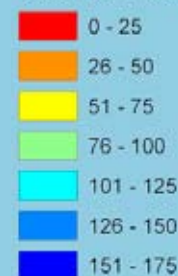


Figure 3. Cumulative rainfall during the event.

Results

Concentrations of N and P on the falling limb of this small event (0.54 ML) were much lower than during a larger event (5 ML), that occurred in October 2005. During the October flush it was observed that most nutrients were carried on the rising limb, so interpretations of this April event are inconclusive because the rising limb was not captured. This event might have been too small to effectively transport nutrients and sediment from the farm. This interpretation is supported by associated observations (conductivity, pH, hardness, salts and metals), because breakthrough of groundwater into the drainage was not observed (which happened during the October 2005 event). Furthermore there had been substantial growth of macrophytes in the drain since October 2005, when the recently modified drain still contained disturbed soil, so the lower nutrient load might reflect improved farm practice. However, since the rising limb was not monitored, the main flush of nutrients could have been missed.

Table 1. Quality Control Samples

	TSS mg/L	TP mg/L as P	TN mg/L as N	TKN mg/L as N	FRP mg/L as P	NOx mg/L as N	NH3 mg/L as N	TOC mg/L as C
Precision of a field replicate	% r.s.d.	% r.s.d.	% r.s.d.	% r.s.d.	% r.s.d.	% r.s.d.	% r.s.d.	% r.s.d.
	15	6	7	10	3	2	0	0

Table 2. Discharge, rainfall, and nutrient data for April 2006 event at Kalkie Station.

Date/Time	Gauge Height (m)	Q	TSS (mg/l)	TP (mg/l)	FRP (mg/l)	TN (mg/l)	TKN (mg/l)	NOx (mg/l)	NH3 (mg/l)	TOC (mg/l)	Turbidity (NTU)	Electrical Conductivity (μ S/cm at 25°C)
6/04/2006 13:00	0.29	0.010	20	0.50	0.38	1.20	0.98	0.38	0.017	14	33	352
06/04/2006 14:30	0.26	0.008	18	0.41	0.28	1.10	0.96	0.26	0.015	14	41	356
06/04/2006 15:15	0.25	0.008	19	0.35	0.26	1.00	0.87	0.22	0.014	13	40	370
06/04/2006 16:00	0.24	0.006	21	0.41	0.3	1.10	0.92	0.27	0.017	14	41	381
06/04/2006 17:15	0.22	0.005	22	0.41	0.34	1.10	0.92	0.28	0.021	13	45	392
06/04/2006 17:45	0.21	0.005	16	0.35	0.24	0.99	0.84	0.21	0.019	13	44	392

Table 3. Estimated load and event EMC for April 2006 event at Kalkie Station

Site Name	Kalkie	Upper bound	Lower bound
Total Event Discharge (ML)	0.54		
Number of samples	8		
TSS Load (Tonnes)	0.010	0.012	0.009
TP Load (Tonnes)	0.00022	0.00025	0.00019
FRP Load (Tonnes)	0.00016	0.00019	0.00013
TN Load (Tonnes)	0.00058	0.00065	0.00052
TKN Load (Tonnes)	0.00050	0.00056	0.00044
NOx Load (Tonnes)	0.00014	0.00017	0.00011
NH3 Load (Tonnes)	0.00001	0.00006	0.00000
TOC Load (Tonnes)	0.0073	0.0080	0.0066
TSS EMC (mg/L)	19	22	17
TP EMC (mg/L)	0.40	0.46	0.34
FRP EMC (mg/L)	0.29	0.35	0.24
TN EMC (mg/L)	1.07	1.20	0.95
TKN EMC (mg/L)	0.92	1.03	0.82
NOx EMC (mg/L)	0.26	0.32	0.21
NH3 EMC (mg/L)	0.02	0.11	0.00
TOC Load (mg/L)	13	15	12
Max Event Discharge (m3/s)	0.011		
Period of record (yrs)	117		
% of times that rainfall is exceeded	7		

To reference this information sheet:

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