

Memorandum

To	Tabitha Manderson
Copy	Jack McConchie
From	Samwell Warren
Office	Wellington Environmental Office
Date	2 May 2018
File	
Subject	Potential losses from the Woodville WWTP pond– a water balance approach

1. Background

An assessment of the net change in the volume of effluent in the two Woodville Wastewater Treatment ponds has been conducted, independently of the work presented in Chapter 5 of *Woodville Water Treatment Plant Flow and Effluence Load Summary* (WSP Opus, 2018). This work has adopted the same water balance approach to determine whether there is any leakage from the ponds. However, the current approach uses the most spatially appropriate empirical rainfall and open water evaporation data to quantify possible external gains or losses of water from the ponds.

2. Data

Data used in this analysis has been obtained from a variety of sources (Table 1). Because of the desktop nature of this study, no detailed quality assurance was carried out on the available data; it was assumed to be accurate. It was noted, however, that raw inflow/ outflow data provided by Tararua District Council was not consistent in its resolution. The concurrent period of record therefore starts on 4 May 2016 and finishes on 1 Jan 2018. The climatic data i.e. rainfall and evaporation, is shown in Figure 1. The inflow and outflow data are shown in Figure 2.

The surface area of the wastewater treatment ponds is assumed to be 30,437m². This has been calculated from GIS data provided by Tararua District Council, and has not been checked independently.

Table 1: Summary of empirical data used in this analysis.

Data	Agency	Site	Record Start	Record Finish
Pond Inflows	Tararua District Council	WWTP	4-May-2016	1-Jan-2018
Pond Outflows	Tararua District Council	WWTP	1-Jan-2015	1-Jan-2018
Rainfall	NIWA	Waipuna at Woodville	31-Dec-2014*	8-Feb-2018
Evaporation	NIWA	Dannevirke	2-Nov-1924	1-Jan-2018

* Record retrieved from this date – full record began in Jan 1986.

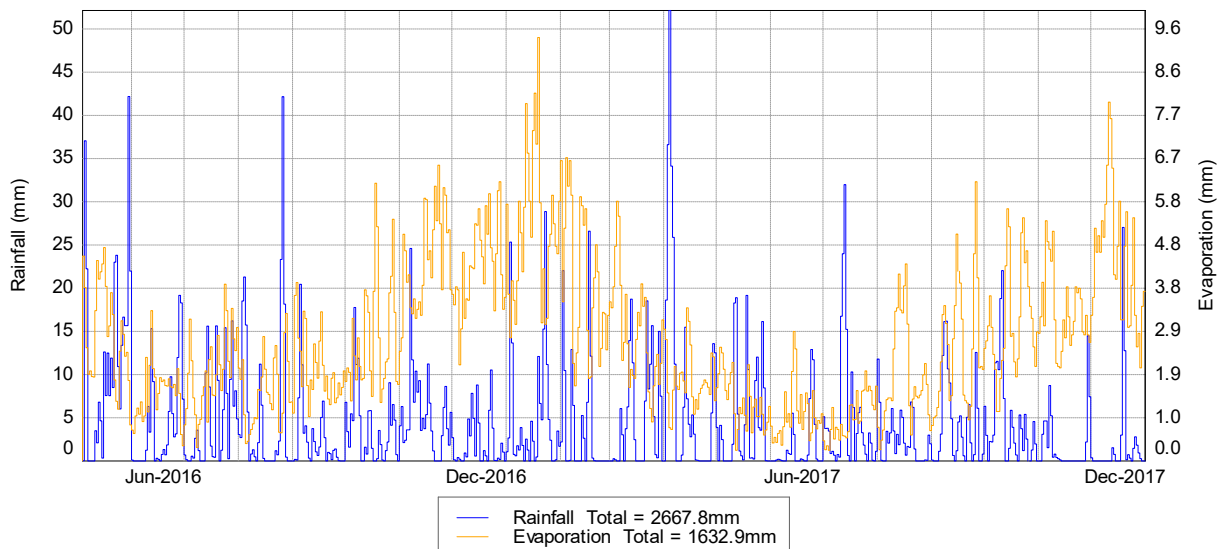


Figure 1: Empirical evaporation and rainfall data used in this analysis (NIWA).

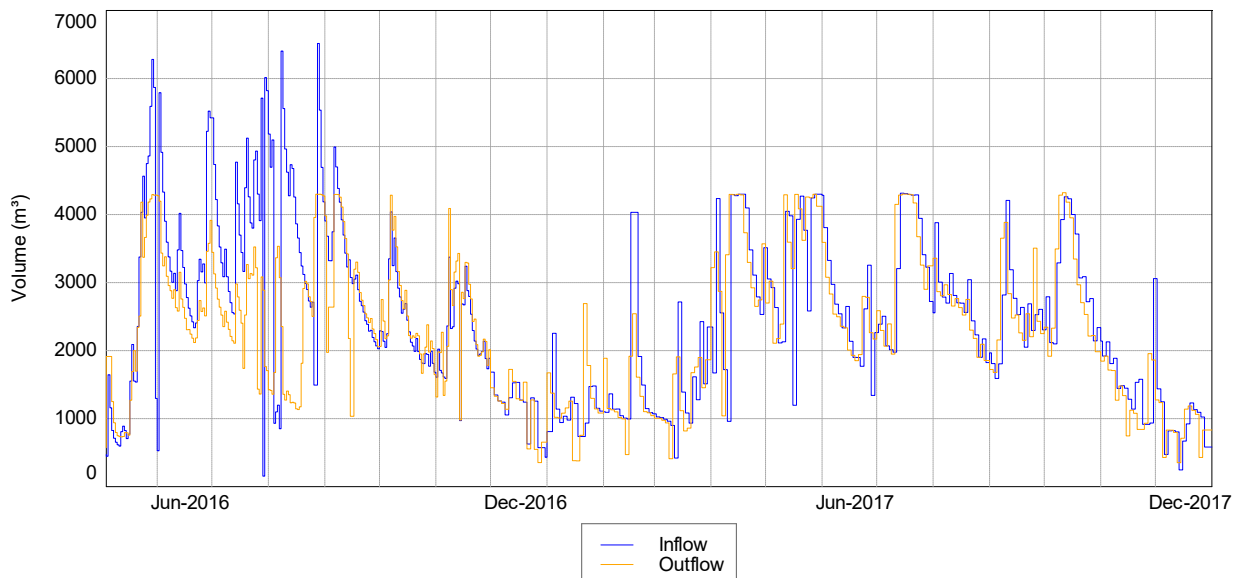


Figure 2: Treatment pond inflow and outflow data provided by Tararua District Council.

3. Results

Initial water balance results were calculated from May 2016 to Jan 2018 (Figure 3 & Figure 4). These results were then converted to a cumulative change in volume, which was subsequently converted to an effective change in water level based on the surface area of the ponds (Figure 5).

Significant rainfall which occurred over the June - September 2016 period biases the results significantly. The period of analysis was therefore reduced to Sep-2016 to Jan 2018 (Figure 6). Again, a cumulative plot of the gain in water volume over this period has been converted to water level to provide context regarding the significance of any change. This is important when considering measurement accuracy, and alternative methods of determining the potential loss of effluent from the ponds.

These results show that over a 14-month period, there was a net cumulative surplus of water entering the treatment pond. This surplus was equivalent to a total level change of 530mm; with a maximum single daily change in water level being an effective loss of 111mm.

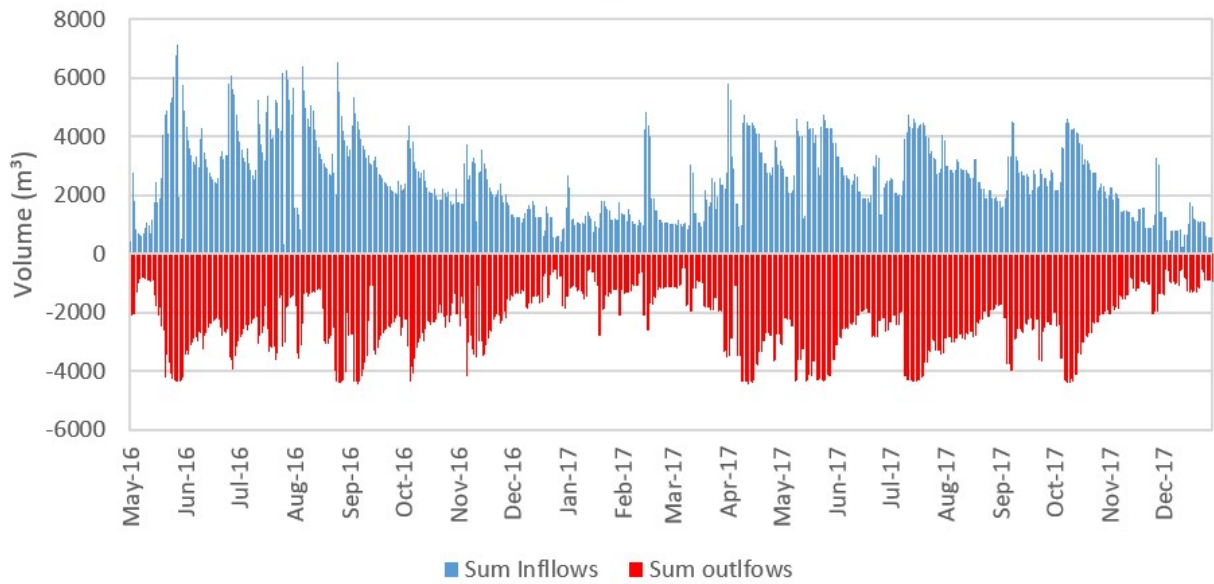


Figure 3: Total daily inflows and outflows from the treatment pond.

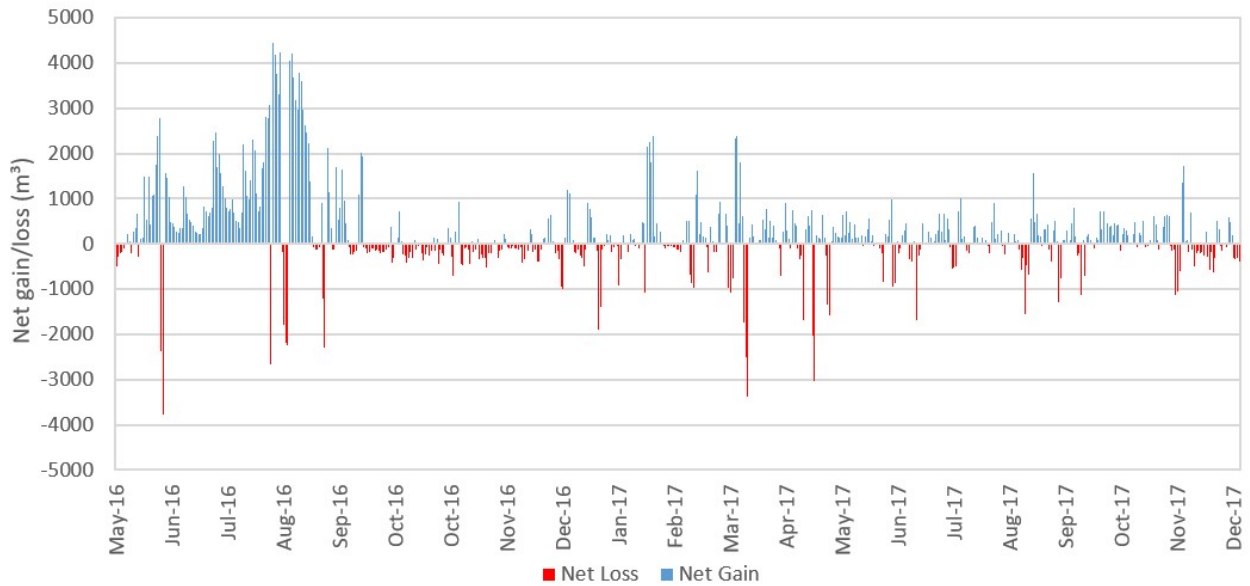


Figure 4: Net daily gain/loss of water from the treatment ponds.



Figure 5: Cumulative change in volume in the treatment ponds, converted to water level (mm).

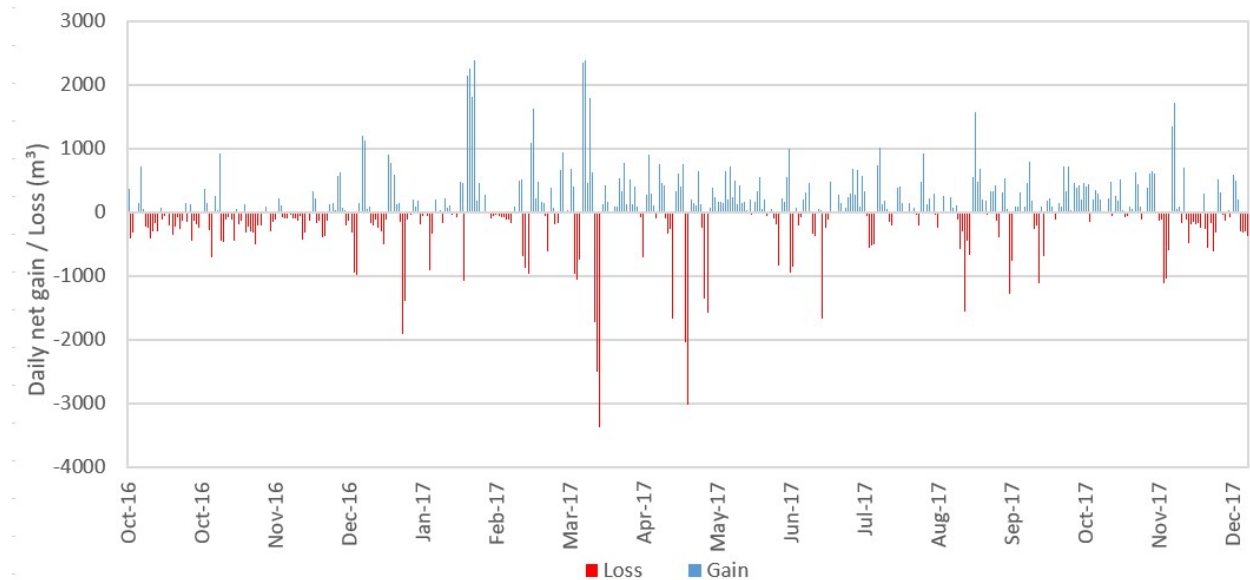


Figure 6: Net daily gain/loss from the treatment ponds for the period since October 2016.



Figure 7: Cumulative change in volume in the treatment ponds, converted to water level (mm) for the period since October 2016.

4. Discussion

This analysis has been conducted at a daily resolution. However, inflows and outflows from the treatment pond are unlikely to balance daily; although they should over the longer term. This is because of the nature of the system (two ponds), retention within the ponds, and losses or gains associated with changes in storage.

The results, which show a net gain and not a net loss of water, indicate that there is no significant loss of effluent through the lining of the ponds i.e. there is no leakage. Any movement of water through the lining must be into, rather than out of, the pond. This is considered unrealistic, **certainly the gains of water of the magnitude indicated in this analysis.**

Alternatively, the evaporation data used may under-estimate evaporation at the site. This, however, is also considered unlikely to be the cause of the pattern observed in the data. Any errors in the measurement, or appropriateness, of the evaporation data are unlikely to explain the significant 'gains' of water within the ponds over 14 months.