AGRICULTURE VICTORIA

Effluent application through centre pivots using a self-cleaning filter

West Gippsland
Catchment Management Authority

Installation of a self cleaning filter on the Gannon farm has enabled effluent water to be utilised through centre pivot irrigation systems.

INTRODUCTION

The Macalister Irrigation District (MID) is a dairy and horticulture dominated irrigation district located in Central Gippsland. The MID is located within the Lake Wellington catchment and outfalls into the Ramsar listed Gippsland Lakes at Lake Wellington.

The Victorian Government's Sustainable Irrigation Program (SIP) is implemented in the MID by Agriculture Victoria in partnership with the West Gippsland Catchment Management Authority. These organisations have been working collaboratively to minimise the environmental impacts of irrigation for over 24 years.

The SIP program has focused on minimising the environmental impacts of irrigation by retaining nutrients on farm and increasing irrigation water use efficiency. A vast amount of on-farm investment by farmers, as well as a sustained effort by the partner agencies, has seen a significant reduction in irrigation drainage water and nutrients leaving the district.

Despite the environmental gains made, there is still significant social pressure on dairy farmers in the MID to minimise their environmental impact. There is a particular focus on effluent storages and their potential to overflow in high rainfall events, contributing a point source of nutrient into waterways that ultimately impacts upon the Gippsland Lakes. Keeping effluent storages as low as possible and providing sufficient disposal area so that effluent is applied to soil at low rates is crucial to reducing the impact of nutrient losses and potential impacts on the Gippsland Lakes.

With this outcome in mind, a demonstration project was set up at Tom Gannon's farm in Tinamba in 2023-24 to evaluate a self-cleaning filter for the application of dairy effluent through a centre pivot irrigator. Tom's farm backs onto the Macalister River and is on an active flood plain. This makes regular and effective effluent disposal a priority to avoid nutrient losses in high rainfall events.

Farm development and effluent disposal

Tom's farm at Tinamba was recently part of the Southern Tinamba Pipeline Project, in which Southern Rural Water (SRW) replaced their open channel delivery system with a pressurised pipeline. Tom and his father Francis matched the upgrade of the delivery system with significant irrigation upgrades on farm, including the conversion of most of the home farm from surface (flood) irrigation to centre pivot irrigation.

Figure 1, Tom's two pond effluent system.

This had enormous benefits on farm for irrigation efficiency, but it also created a problem of how to dispose of the dairy effluent kept in the two pond system on farm (Figure 1).

Tom found that very fine grass particles in the effluent constantly blocked the filtration system on the effluent pump. This caused a pressure drop at the pump, which then lowered the supply pressure for the centre pivots. This caused the pivots to run at lower pressures than they were designed for, which greatly affected irrigation uniformity, or in the worst cases, caused the pivots to stop running altogether. The grass particles would also block the sprinkler heads on the centre pivots, depicted in Figure 2, which further affected uniformity.

'The sticking point was the filtration; it would actually block up a lot.'
– Tom Gannon

Figure 2, One of the nozzles on Tom's pivot showing blockage by effluent particles.

The ineffective filtering was such that Tom had stopped trying to irrigate effluent through any pivot irrigators.

This is a common problem echoed around the district by other irrigators when they convert from surface (flood) to spray irrigation and attempt to apply effluent through the new systems.

The solution – self cleaning filter

The aim of this project was to evaluate the effectiveness of new filtering systems on the ability to distribute effluent through a centre pivot.

The focus of the project was a self-cleaning pontoon filter on the suction line of the existing effluent pump. The barrel has very fine mesh to stop grass particles entering the suction line, and a rotating self-cleaning mechanism to ensure that any solids adhering to the mesh are deposited back into the pond. The filter was installed in November 2023 by a local supplier at a cost of $28,000 (Figure 3).

Figure 3, Tom's pontoon filter ready for installation in November 2023.

An inline filter (Figure 4) was also installed by a local supplier, in May 2023, at a cost of $10,500. This automatically filters, brushes and backflushes as grass particles build up. This was intended as a failsafe mechanism to complement the pontoon filter.

Figure 4, The secondary inline filter in situ in the pump shed.

RESULTS

Filters

The in-line filter was installed first, in May 2023, and provided a big improvement in system operation at that time. Tom was able to irrigate with effluent through the pivots without pressure drops or constant maintenance.

However, after repeated irrigations the filter would still block up, as there were still large quantities of grass particles coming through the suction line and pump into the filter. Tom would then have to manually clean the filter and dump the excess water before he could irrigate again.

> *'It was doing a good job, but then eventually... the sediment would build up... it would overwhelm the dump and motor and it would actually jam up, so that's when we put the filter on the suction line.'*
> *– Tom Gannon*

The pontoon filter was installed in November 2023 and has been a resounding success. Tom has had no blockages or pressure drops since then and has not had to clean the filter on the pump, the pivot, or any pivot sprinklers since it was installed. The inline filter has also hardly run in that time as the water is much cleaner.

Figure 5, Tom's pontoon filter working effectively.

Tom has been irrigating effluent effectively as needed through the three centre pivots on the farm (Figure 6), covering approximately 35 hectares.

Figure 6, One of Tom's pivots spreading effluent.

Pivot assessments

Pivot assessments were undertaken before and after the filters were installed, to compare the effects of improved filtration. These assessments involve measuring water pressure, and sprinkler output using catch cans (Figure 7). The first pivot assessment was completed in February 2023.

Figure 7, Pivot assessment completed by Agriculture Victoria.

Tom ensured that the pump and pivot filters and the sprinkler nozzles were cleaned before the irrigation to give the best representative results. On starting the irrigation with effluent, pressure gauges showed a drop of 20 psi in pump pressure after approximately 10

minutes of irrigation. It was also apparent visually that the pressure drop was affecting the uniformity of the pivot.

When the assessment results were analysed, they showed that the pivot was running at a coefficient of uniformity of 65%. This can be visualised in Figure 8, below.

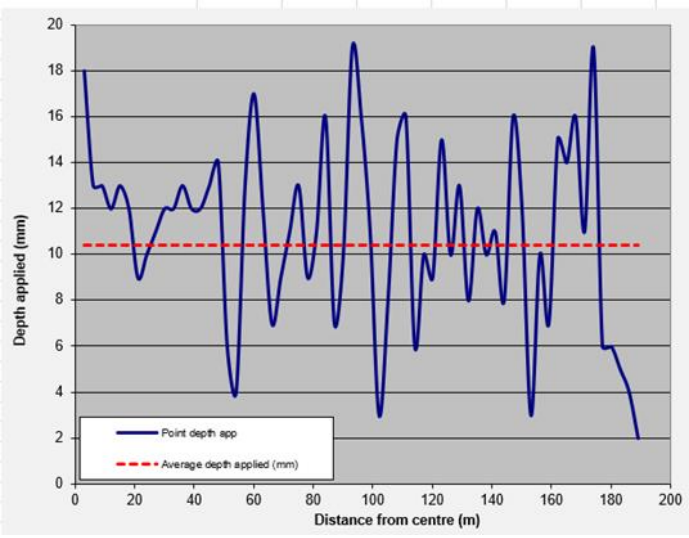

Figure 8, Variability of water and effluent application depth of Tom's pivot without effective filtration.

This value of 65% is well below the industry standard of 80%. The higher the uniformity figure, the more even the application of water which means pasture growth under the whole machine is improved. It is important for efficient irrigation that the pivot operates as close to its maximum uniformity figure as possible.

The second pivot assessment was conducted after both filters were installed, in March 2024. The results of this assessment (Figure 9) showed that the pivot was running at correct pressure due to no blockages, and the uniformity of the machine was much improved, with a coefficient of uniformity of 87%. This is an improvement of 22% uniformity following installation of the filtration system, and well above the industry standard of 80%.

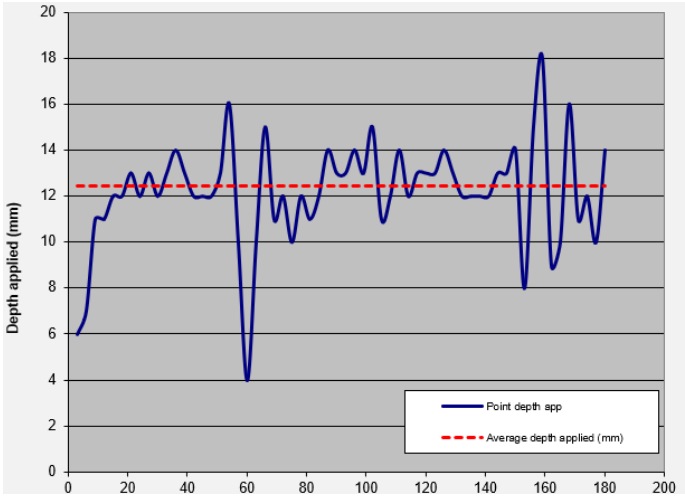

Figure 9, Variability of water and effluent application depth of Tom's pivot with effective filtration

Nutrient tracking

Soil, effluent, and plant tissue tests were taken at the start and end of the project (12 months apart) to compare nutrient status after irrigating with effluent. Tom did not apply any nutrient to the trial area during this time, except for 80 kg of urea after each grazing.

The soil tests showed that the topsoil had no change in organic carbon, a slight increase in salinity, and a slight decrease in most nutrients, though the levels were still mostly in the high range. The subsoil showed a slight increase in pH, and no marked change to salinity or nutrients.

The plant tissue tests yielded similar results. Most major nutrients were at the high end of adequate, and not limiting plant growth, with the exception of calcium, that increased from marginal to adequate over the course of the 6 months of irrigating with effluent. The only nutrient possibly limiting plant production was boron. This may require a separate maintenance application.

Effluent testing, shown in Figure 10, suggested no major change in nutrient levels, with all measuring as adequate or high. The effluent also did measure relatively high in salinity.

Figure 10, Effluent testing being undertaken at Tom's effluent pond.

These results show that effluent application could replace fertiliser for the 12 months of the trial period, with the exception of urea. However, the results also reinforce the importance of soil testing to track nutrient status and monitor any possible impacts on pasture production. If this practice were to continue, some maintenance application rates of certain nutrients may be required.

Tom also had an effluent use report completed by Agriculture Victoria's extension officers in March 2023. This report made some recommendations around the pipe connecting the first and second effluent ponds, which Tom implemented to reduce the flow of fine grass particles into the second pond, where the pump draws supply for the pivot with effluent water.

OUTCOME AND CONCLUSIONS

The new filtration system has been a resounding success. Tom has had no blockages or pressure drops and has not had to clean the filter on the pump or any pivot sprinklers since the pontoon filter was installed.

The filters have saved him a lot of labour, and greatly increased the uniformity of his irrigations, as well as significantly reduced the need for fertiliser applications.

'If money wasn't an object, would I do something different with this project? … I wouldn't change anything.'
– Tom Gannon

Most importantly, the overall outcome of this project is an effective effluent disposal system of 35 hectares of centre pivot irrigation. This allows Tom to apply effluent in small amounts, frequently, matched to pasture nutrient needs. This method of application significantly reduces the risk of over application or overflow of his effluent pond in high rainfall events.

'Since we're only putting small amounts on with the spray irrigation, that also gives us peace of mind that it's not running off the paddocks, it's not getting into our drainage system, and it's not getting into the waterways.'
– Tom Gannon

This demonstration showcases the potential for effluent application through spray irrigation systems, using novel filtration methods. This has enormous potential to increase community awareness of filter technology and the benefits of effective effluent disposal. It is hoped that it will provide a catalyst for spray irrigators to improve their filtration systems so they can effectively apply effluent. This project has the potential to significantly increase the effective effluent disposal area of many other irrigators in the district and further afield into the future.