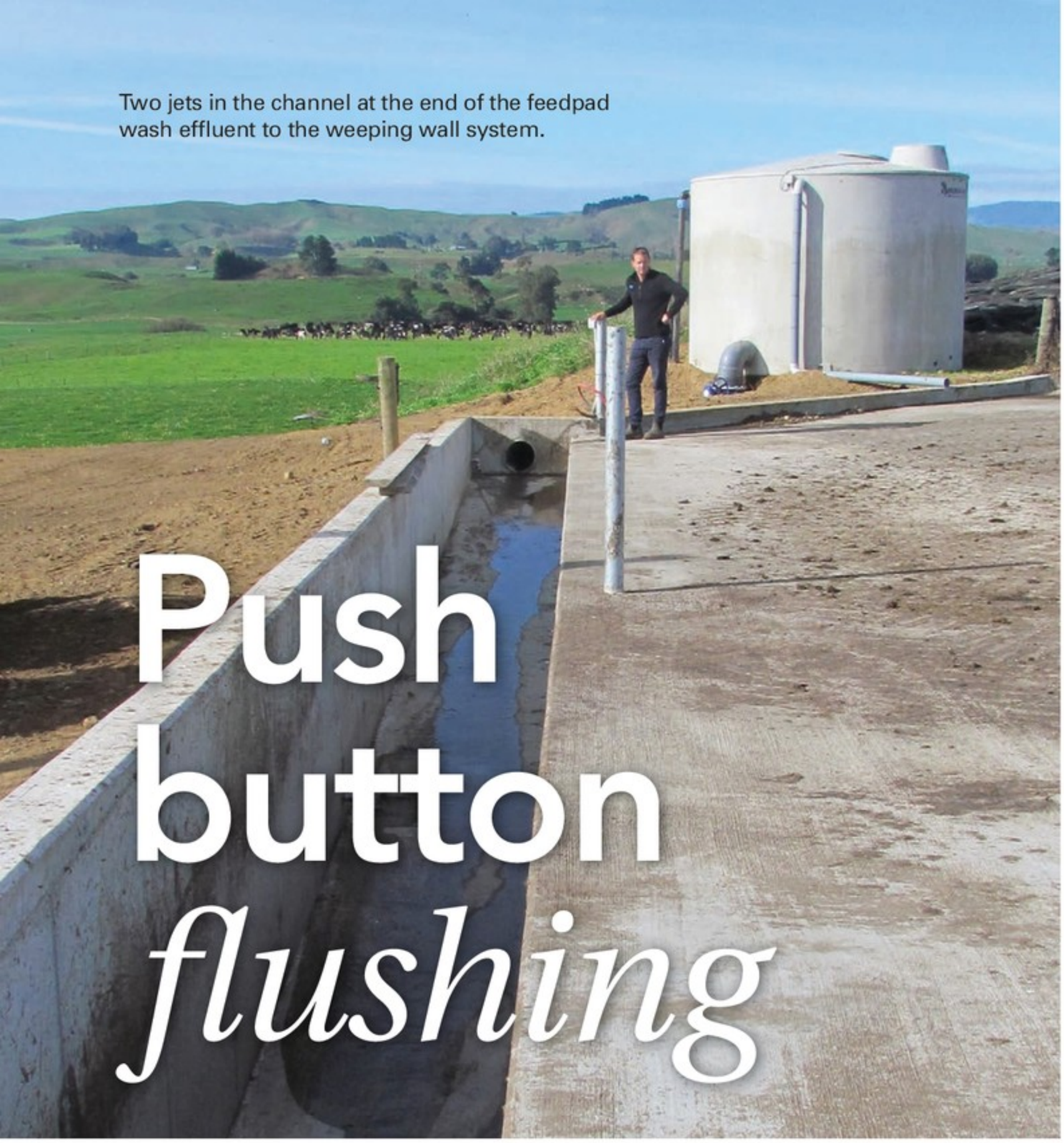

Two jets in the channel at the end of the feedpad wash effluent to the weeping wall system.

Push button *flushing*

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The most advanced weeping wall effluent system in the country has just gone in on a dairy farm south of Te Awamutu, after three years of planning, and every effort has been made to future-proof it as much as possible.

The Haerepo Trust farm has an effective area of 290ha and peak-milks 950 cows in spring through a 50-bail rotary dairy. It runs a split-calving Friesian herd that produces about 340,000kg milksolids (MS). 50:50 sharemilkers Mike and Sue Visser have been with the trust for the past 14 years on the DairyNZ System 3 farm that uses about 250-300 tonnes of palm kernel each year.

They grow up to 25ha of maize silage on their effluent paddocks and buy in 7ha from a local contract grower. Their crops yielded more than 26 tonnes drymatter (DM)/ha and, because no extra fertiliser was needed, cost just 11 cents/kg DM in the stack.

The crops are grown either on the farm's effluent area or on paddocks that need regrassing, where dry or liquid effluent will be put on as a one-off application before planting.

Using effluent to grow maize silage crops made good sense, Mike said. As well as the high yields, because they weren't applying additional nutrients they could reduce the level of nitrogen and potassium in the soil. And with the new weeping wall system they will be able to better manage organic matter levels.

Recent changes to cow numbers, system efficiency and the upgraded effluent system have resulted in the calculated nitrogen leaching reducing to 33kg N/ha, which Rotorua-based AgFirst consultant Darren McNae said was a great result for a large-scale operation.

The trust first started looking at effluent solutions for the farm in 2012. They then engaged AgFirst Engineering's Davieth Verheij to run some different budgets and look at the options. Two years on, design work got under way and after delays because of wet weather last autumn, the project was completed in April.

Davieth said one challenge was the farm's rolling country, made up of a number of high-risk soils.

"There are big cow numbers with intensive feeding," he said.

"The trust wanted to capture the nutrients in the dairy effluent and saw a big benefit in doing so. Removing the solids made nutrient management and monitoring simple."

The existing uncovered feedpad on the farm fell slightly to one corner and couldn't be floodwashed. Effluent that accumulated had to be scraped by tractor into a big old pond at the end, a sometimes risky business for those operating the machinery. They needed to make a number of moves to and fro and would sometimes drive out on to soil that had built up.

"It was an absolute nightmare because tractors couldn't turn properly at the end," he said.

The solution was to extend its area slightly by adding 200m² more concrete and square it up at the end so there was plenty of room to manoeuvre. A gutter was added at the end, falling from 500mm to two metres deep, with two green water jets inset in the bottom of the walls to move solids on their way.

A 25,000 litre tank that is filled with separated effluent coming from the storage pond has been installed to the side of

AgFirst Engineering's Davieth Verheij in front of the tank used to wash effluent from the feedpad to the weeping wall system.

The Haerepo effluent pond can hold eight million litres of effluent.

the feedpad by the shallow end of the gutter. There's one pump at the bottom so with the push of a button staff can flush the gutter out at a volume of 1000 litres a minute from the jets after effluent is scraped into it. Separate pipelines with valve automation allow automatic tank fill and push-button flushing from the feedpad.

When it came to getting effluent to the new weeping wall system and storage pond they were able to use a paddock across the race from the feedpad, which fortunately sloped away slightly. The fall was only just enough, resulting in an over-excavation of only 300mm.

Work started in February last year to excavate the weeping wall site and start the centre of the storage pond. But that uncovered a series of holes from 50mm to 300mm across.

"There was a storm event and the water disappeared down them," Davieth said.

A geotech engineer identified them as old root casts from a former forest.

"We could have carried on but there was the risk they could have expanded."

Further geotech advice was sought as they looked for the most robust solution to the problem.

"There were many levels of solutions on the table to reduce risk which came at a similar range of costs," he said.

"We decided the best thing was to watch and monitor over winter."

During that time the holes filled with silt and the pond drained up to 48 hours after rain events with no collapse, which was a positive result.

"This gave us confidence that capping of the holes would be sufficient along with geotextile cloth and a good drainage design."

A total of 852 tonnes of a clay and rotten rock mix was bought in from J Swap's quarry for this purpose. Earthworks and site preparation were under way by March last year by Paul Steiner Contracting and Lowe Builders.

"However, we had to pull the pin to ensure there were no future complications."

But when it was completed the new pond foundation exceeded geotech recommendations.

The weeping wall system consists of two beds, each 76m long by 8m wide, which it's estimated will fill up completely within six to nine months.

"It's the most advanced system in New Zealand," Davieth said.

"It gives a huge amount of flexibility. Depending on the time of year one side can be filled for up to six months. But as the effluent's ready to spread in three to four months, if there's a suitable window in the weather or cropping cycle that can happen three or four times a year."

The biggest problem with similar systems can be that with continual floodwashing solids are forced to the end where they block up the weeping walls. The answer is two segregation screens placed in each of the beds, made of hot-dipped, galvanised steel with mesh screen that diminishes in size the further along the bed the effluent travels. The screens have been made at different heights to regulate the amount of effluent moving through them and over their tops, giving a three-stage filtration process.

"This design has been developed over two years of trials and testing," Davieth said. "Everything is sized to suit flow velocity and particle size distribution. The end result is the sludge is significantly drier and there has been up to three months of additional storage capacity."

Davieth Verheij at the controls for the effluent system.

This is because the flow paths through the solids have been kept open through good design.

"The weeping wall is not a filter, the sludge itself is the filter," he said.

"All the weeping wall does is retain the solids and allow the filtered liquid to drain."

The drive-in access means the sludge beds can be wider and achieve greater capacity, and as the sludge is emptied the screen can be easily lifted out.

All the 300m³ of concrete for the beds' floor and sides, made of a series of 1.5m by 900mm shutters, was poured on-site, meaning the system could be built 30% cheaper than if pre-cast concrete had been used. Pre-cast panels are typically only constructed up to 150mm to keep costs down whereas the shutter system provided 200mm thick walls and a lower cost.

The storage pond, which holds 8m litres of effluent, measures 52m by 52m and is 4m deep.

"With the solids removed the liquid portion is simple to irrigate and our results have shown stirring is not necessary," he said.

"In this system that saves $15,000 a year in power consumption."

The pond is lined with VLDPE, a low-density polyethylene imported from the United States by Pondco. It provides additional assurance if there is any movement in the pond foundation.

The VLDPE also comes in wider rolls, meaning fewer seams and less risk of leakage. The seams on the lining were all welded on-site. The lining comes right up the sides of the pond to a number of gas outlets that release any methane trapped underneath.

"If it's present you will see it coming up the liner as a moving bubble," Davieth said.

Another feature is the 600mm drain dug all around the pond to safeguard against any possible overland flow of stormwater from the upper area.

The control centre is a shed housing a 22-kilowatt irrigation pump that can deal with the 70m elevation variation. Installed by Alpha Electrical, it's controlled by a flowmeter that will automatically adjust to the effluent flow rate so there's the same flow of 30,000 litres/hour to every hectare of the effluent area at all times.

It's worked by a touch screen and autoprimes every time it turns on to flush any gas or bubbles out of the pump head. If it senses a problem it will try two more times. If it still doesn't start it will send out an alarm, yet another fail-safe feature.