CASE STUDY

FIXING AN EFFLUENT POND FROM INSIDE THE BIO-CIRCLE.

This 2015 case study was carried out at Wairango Station, an 806 hectare dairy farm on Taharua Road.

THE FEATHER'S STORY CIRCLE

Kay, Roger and Marc Feather own Wairango Station, an 806 hectare dairy farm on Taharua Road. The *Taharua Stream* begins on their farm and because of this, they are closely monitored by the Hawkes Bay Regional Council.

Big pond + vertical stirrer

To meet regulations, the Feathers built a large effluent pond equipped with special pumps and monitoring equipment. Roger recalls: *"Because there wasn't a great power supply to the pond, we were told that a Vertical Stirrer was an adequate way to deal with effluent solids. So we bought one."*

$16,000 for nothing!

After two years, the pond crust was getting out of control. In their concern, the Feathers consulted with the stirrer company. *"They told us that we needed a second stirrer. These stirrers are $8,000 each, but okay, if we have to, we have to. So we bought another one."*

Six months later, no progress had been made. *"That's when the company said* 'You need 4-6 stirrers'. *I was angry about that. I felt they'd misrepresented the whole situation.*

The danger of Overflow

As the pond deteriorated, the Feathers faced a series of problems. *"As more solids built up in the pond, our pump was losing efficiency, sucking up thicker contents. Not only that, our pond was dangerously close to* ***overflowing****. There was the fear of breaching our effluent consent."*

$33,000 for nothing!

To reduce the problem, $9,000 was spent removing the metre thick crust with a *long-reach digger*. That proved to be a temporary fix – the crust returned within a month.

The next move was to bring in a **pumping contractor** with a heavy-duty pump to stir and pump the pond. *"He pumped, but not as much as we wanted"* said Roger. *"He told us,* 'Your pond has deteriorated too far. We'll need to come back in four months.' *That cost us $24,000!"*

Six weeks later, the crust was back thicker than ever.

Slurry Bugs? You're dreaming! It won't work.

In her readings, Kay came across **Slurry Bugs – the bacteria that eat crust**. *"I thought, instead of using more machines, let's try a biological approach."* Roger was less convinced. *"I said to Kay, 'You're dreaming! If two stirrers can't fix the pond, how are bloody bugs gonna solve it?'"*

"I will not pay unless...

After contacting David Law, the Feathers agreed to trial **Slurry Bugs** in their pond. On one clear condition from Roger: *"I told David that I would need to see my face reflected in the pond. We would not pay a cent unless* ***Slurry Bugs*** *worked. He agreed, so we both signed the deal on that basis."*

Wairango Station is an 806 hectare dairy farm on Taharua Road. Because the Taharua Stream begins on this farm, it is closely monitored by the Hawkes Bay Regional Council.

The crust on the effluent pond was 1M thick. Machines were unable to fix the recurring problem.

MARCH 03, 2015: The Feathers contact Slurry Bugs

- **Kay Feather** rings David Law after reading the ***Slurry Bugs advert*** in February edition *The Dairyman*
- Kay explains that they have tried to fix the crusting problem by ***mechanical means.*** Because these measures have been unsuccessful, the Feathers are reluctant to follow the recommendations of their regional Effluent Consultant – the installing of ***large permanent stirrers*** to continuously stir and break the pond crust.
- Aside from issues of *effectiveness*, the major problem with this mechanical approach is the **upfront expense** and the **ongoing cost** of maintenance. And it could prove to be **unsuccessful.**

When the Browns built a new pond, their goal was simply to *keep costs down*. Here is their story...

One crucial question

Shirley and *Tony Brown* own a 550 cow farm out in *Pirongia, Waikato*. When it came time to build a new pond, the question they asked was: *how do we keep the costs down?*

Machines are expensive

The conventional way of managing effluent solids is to use machines: machines that *separate* the solids; machines that *break up* the solids; machines that *stir* the solids.

As every farmer knows, such equipment is very expensive. First there's the initial cost of buying the gear. Then there's the ongoing cost of running it. And, of course, there are the costs of maintaining the machinery.

Hill-top complications...

To make use of *gravity* and to avoid *water table* pressure on the *pond liner*, farm manager **Paul Brown** wanted to construct the holding pond on a hill. But in planning, he foresaw several challenges:

1. Because the proposed hill site was 100M from the shed, the cost of getting electricity up to the pond to run a *stirring* machine would be significant.
2. Paul was also concerned with *potential repair costs* in the event that a *stirring machine* ripped the liner.

These complications led the Browns to look for alternatives. *Could crusting and effluent odour be managed without machines?*

A chance meeting

At the *2012 Agricultural Bio Technology* conference in Rotorua, Sheryl Brown (Tony and Shirley's daughter) met *Liz Russell*, the founder of *EnviroSystems* in the UK.

For 10 years, *EnviroSystems* had been addressing the cause of effluent crusting and odour. Scientists had discovered that crust and sludge were merely the symptoms of the real problem and that the cause of pond solids were ***microscopic creatures*** living below the surface – **anaerobic bacteria.**

These **anaerobic bacteria** would separate the effluent fibres and send them to the surface. Once reaching the surface, these fibres would combine to form *the crust.*

Scientists realised that the way to beat crust bacteria was relatively simple: put *counteractive bugs* into the effluent pond. These corrective micro-organisms are called ***Aerobic Bacteria*** – **SLURRY BUGS.**

Can crust be prevented?

The Browns learned that **Slurry Bugs** digest *effluent fibre*. It's their food. And if sufficient numbers of **Slurry Bugs** are in a pond eating the effluent fibre, the raw materials needed to make the crust are removed.

That means no crust can develop.

Researching Slurry Bugs

Because Shirley, Tony and Paul were open to biological solutions, they decided to investigate **Slurry Bugs** further.

Over the next two years they had further talks with *Liz Russell*, viewed video footage of **Slurry Bugs** in action in UK ponds and read independent research that drilled deeper into the biology behind it all.

Trialling Slurry Bugs

After weighing up the two approaches – *Machines (symptoms) vs Biology (causes)* – the Browns decided to build their hill-top pond and to dominate it with **Slurry Bugs** from the beginning. *Their rationale:* if **Slurry Bugs** prevent crusting, we save a lot of money and get *better fertliser* in the process. If **Slurry Bugs** fail, we've spent very little to discover that fact and can then proceed with a *machine-based* approach.

The Results

After 5 months, the Brown's effluent pond looked like this:

As impressive as that was, one further question remained: *had* **Slurry Bugs** *dealt with the problem of sludging on the bottom of the pond?* In December 2014 that question was answered when Paul siphoned out the effluent.

The bottom was clear.

Where to from here?

For the Browns, the ongoing task is simply to keep **Slurry Bugs** dominant in the pond. They do that by adding a small amount of **Slurry Bug** powder into the pond every week. Easy.

Before you buy machines:

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www.slurrybugs.co.nz
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they prevent crusting

MARCH 11, 2015: Assessing the Feather's pond

- **The Pond Capacity:** At 48M x 46M, the pond's full capacity was 6,000m^3 = 6,000,000 litres
- **Jamie Ryane,** Slurry Bugs *Technical Manager*, had previously worked as a *pumping contractor.* Upon the Feather's pond, Jamie's comment was *"I've seen worse, but a 1 metre crust is pretty bad."*
- **Managing Director David Law made the following assessment:** *"Slurry Bugs can fix this, but it will cost $20,000 in product."* Roger and Kay agreed to the charge but only on the condition that *if Slurry Bugs doesn't work, no cost will be incurred.* David agreed and they signed off on the contract.

Instructions to the Feathers:

In order for *Slurry Bugs* to gain bacterial dominance over the anaerobic bacteria causing the crust, the following procedures were to carried out.

1. **Pump pond down as much as possible.** This was to reduce the initial work load on the *Slurry Bugs* and speed up the digestion process. Less liquid in the pond also reduces the amount of good bacteria needed which significantly lowers costs.
2. **Set up a hose system to soften the crust**. This would enable more light and oxygen into the pond – conditions that the ***aerobic*** *Slurry Bugs* need in order to thrive and establish dominance.

Once these conditions were established, David and Jamie agreed to return to put *Slurry Bugs* into the pond to establish an *aerobic environment.*

28 MARCH, 2015: Putting Slurry Bugs into the pond

- **The large pond** had been pumped as requested and was now half full – approx 3,000,000 m3 litres.
- The Feathers had created 10M^2 hole in the 1M thick crust in the corner of the pond.
- To treat the half-full pond, **seven pots of Slurry Bugs** was administered with **another treatment of seven pots scheduled for Monday 30th.**

Sand Trap instructions:

1. To avoid adding more *anaerobic (bad) bacteria* into the main pond, we asked farm employees to pump effluent **straight from the *Sand Trap* to the farm <u>for one month</u>**. This would give the *Slurry Bugs* a better chance at gaining dominance in the pond. Colin Murray, the farm manager, agreed to do this.
2. We also instructed farm employees **not to put chlorine, antibiotics or penicillin milk in the pond.** These chemicals kill bacteria, including *Slurry Bugs*. If chlorine, alkaline or antibiotics were to enter the pond, the pond would need to be pumped out and the *Slurry Bug* treatment started again.
3. **The Sand Trap was to be treated with 200 gms of *Slurry Bugs* every morning** at 8am after milking. This would break up the sludge and keep the effluent liquefied, making it easier to pump onto the farm.

2 APRIL: Instructions not followed, but progress made

- **We returned to find that the main pond had risen 200mm with an extra 441,600 litres of effluent.** Farm employees had failed to pump out effluent from the Sand-Trap and had continued transferring its overflow contents into the main pond. This additional effluent meant that more bad bacteria needed to be negated and more *Slurry Bugs* needed to be added.
- After to speaking to Colin about the failure to comply with instructions, we learned that the reason was a communication breakdown with Filipino employees.
- To compensate for the extra 441,600 litres, **one pot of Slurry Bugs was added.**

Chemicals in the pond

- We noticed a green discolouration in the pond around the inlet pipes. This discolouration occurs when chlorine-based chemicals have killed bacteria – *Slurry Bugs*. That same day, we witnessed a farm worker scrubbing the huge shed cafeteria area with the *Mr Muscle* all purpose cleaner. The run-off from this cleaning activity overflows into main pond.
- We spoke to the *farm manager* about the chemical setback. He agreed to enforce the chemical instructions with his staff – to pump from the Sand Trap to prevent chemical and effluent overflow into main pond.
- In spite of the obstacles, there is **evidence of good Slurry Bug activity.** David and Jamie are happy with the progress and will return on Wednesday.
- **Seven Pots are added** to maintain the progress in eating up the crust.

8 APRIL: 35% of the pond has softened

- Approx 35% of the pond now has soft crust
- Very happy with progress
- With Roger and Colin present, we agree that approximately 35% of the pond now has a soft crust. David and Jamie are happy with the progress and Roger is happy to continue with the current treatment.
- To date we have used 25 pots plus another eight more added today
  - 28/3/2015 9 pots
  - 30/3/2015 7 pots
  - 2/4/2015 9 pots
  - 8/4/2015 8 pots

Instructions still being ignored

- **Current pond volume is now 4 million litres.** Farm employees are still allowing fresh effluent from the Sand-Trap (and chemicals) to overflow into the main pond. This ignoring of instructions **slows down** and **frustrates** the work of the *Slurry Bugs*.
- **Good news:** Colin has been **softening the crust regularly** which is having a great effect. The extra light and oxygen helps the *Slurry Bugs* get established. Colin has also worked hard to separate chemicals to avoid contaminating the Sand Trap.
- In spite of Colin's efforts, **a senior worker had countered every previous instruction:**
  - *He refuses to separate the chemicals* on the basis that *"It's too much work"*
  - *He stopped the daily 200gms Slurry Bug treatment* to the Sand-Trap because **"It's a waste of time."**
  - He allowed the Sand-Trap to overflow into the main pond.

16 APRIL: Obstacles continue, but so does the progress

- Dave and Jamie went to assess the pond. **It had risen a further 1.5 metres** from the effluent overflow from the Sand-Trap. **The obstacles and resistance are entrenched.**
- To compensate for the resistance, four more pots of *Slurry Bugs* are added.
- **77% of crust has softened.**

21 APRIL: Aerating the pond

- There is plenty of *Slurry Bug* activity.
- Jamie has brought in a **Pearson pond stirrer to break up the remaining crust.** This will help create the necessary aerobic conditions that *Slurry Bugs* thrive in. **A further eight pots are added.**

30 APRIL: One more stir

- With the additional 1 million litres of fresh effluent now in the pond, the *Slurry Bugs* needed extra help to establish their dominance. So Jamie **uses the stirrer for the second time to oxygenate the pond.**

8 JUNE: Ready to pull the pin?

- **Roger is frustrated.** The pond hasn't cleared as he'd hoped and he believes the current progress is mainly due to the stirring, not the *Slurry Bug* activity.
- Roger calls a farm meeting to discuss whether or not to continue with the *Slurry Bug* treatment. Roger wishes to "pull the pin" but is out-voted by Kay, his son Marc, and their farm manager Colin Murray. They all agree to persist with *Slurry Bugs* for a few more weeks.
- Colin informed Jamie of these developments.

17 JUNE: The breakthrough

- In an effort to *solve the unsolvable problem*, **Jamie tests the pond's acidity levels.** He discovers that the continued presence of *chemical pollutants* has dropped the pH level to 6.7, a degree of acidity that forces *Slurry Bus* into hibernation. **David then treats the pond with a pH buffer** to negate the acidity.
- **Jamie and David make another breakthrough.** They confirm that the ratio of enzymes to bacteria needs adjusting. Five pots of *enzymes* and three pots of *Slurry Bugs* are added to the pond.

2 JULY: Oh my God! That's unbelievable!

- **Within three weeks, the adjustments had worked.** Roger recalls: *"I hadn't seen the pond for a while, then one day in July I came over the hill and saw it.* ***Good God! That's unbelievable!*** *That what's I said. The pond was back to how it was when we first built it. I could see my reflection in the surface!"*
- The pond is completely liquefied. Roger calls the Effluent Consultant to come and have a look.

Maintenance instructions for Wairango Station:

- Because fresh effluent (and bad bacteria) will continue to flow into the pond every week, a *Slurry Bugs maintenance programme* will need to be followed.
  1. **Put one pot of *Slurry Bugs* into the pond every week.**
  2. **Keep *harmful chemicals* out of the main pond.** The easy way to do this is by using a *Chlorine Dioxide* sanitiser to clean the shed and related areas. *Chlorine Dioxide* oxidises (kills) pathogenic bacteria 2.5 times better than Chlorine *but doesn't harm good bacteria like Slurry Bugs.* A *Chlorine Dioxide* sanitiser can be washed into the pond with no ill effects on *Slurry Bug* activity.

Empty a pot of Slurry Bugs powder into a bucket. Quantity will depend on pond size.

Mix it up with warm water.

Hose the liquid into your effluent pond.

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they prevent crusting

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THEN IT ALL WENT BACKWARDS

In spite of the stunning progress on this pond (from 1M thick crust to 100% liquefied), much of the good work was undone within 3 months. Surface crust reappeared, and while it was not deep and hardened, it was extensive, covering 70% of the pond.

What went wrong with the Slurry Bugs?

In one sense, nothing went wrong with the *Slurry Bugs*. These good bacteria can do only what they're programmed to do – to eat effluent crust and to transform digested nutrients into organic forms.

The fundamental problem is bigger

The cause of pond crust is the *anaerobic bacteria* in the effluent. These *pathogens* prefer an environment that is devoid of light and oxygen. To create these conditions, these bad organisms separate effluent fibres and send them to the surface to form the crust.

Which begs the question: *Why was the pond still dominated by bad bacteria when we were frequently infusing it with Slurry Bugs?*

POND PROBLEM #1: Fresh effluent loaded with pathogens

With every milking event, fresh effluent was being emptied into the pond and this effluent was loaded with pathogenic bacteria. This meant we we were always fighting an uphill battle to keep the ratio of good bugs to bad bugs in our favour.

POND PROBLEM #2: Pond acidity that helps bad bugs grow

Beneficial organisms, like Slurry Bugs, thrive in a pH of 6.3 to 6.4. Pathogens, however, flourish when the pH levels are *lower.*

After testing the Feather's pond, we discovered that the low pH levels were perfect for ***crust-making*** bacteria, but too low for the Slurry Bugs to effectively do their ***crust-eating*** work.

One way to fix that problem is to add lime to the pond to raise the pH. But this measure, like continually adding more Slurry Bugs, would only be a *short term fix*.

Getting to the root of the problems

We now had a better set of questions to answer.
Why were bad bacteria dominating the effluent?
Why was the effluent acidic instead of neutral?

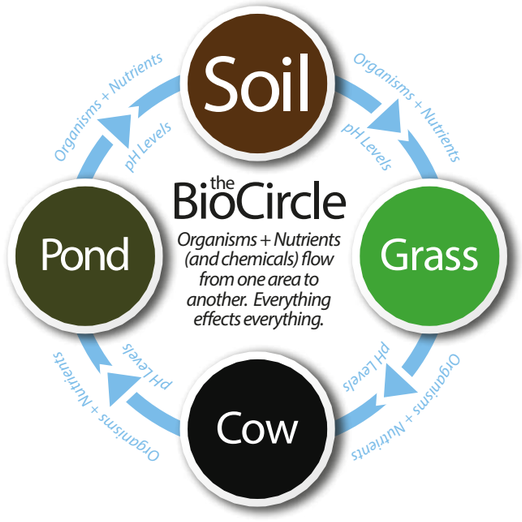
The answer to both these questions was way back in the soil, where everything starts.

The Soil is the Key to Everything

Your farm is a Bio Circle.

That means that every key area flows into and out of other key areas. What's in the **soil** goes into the **grass**. What's in the **grass** goes into the **cow**. What's in the **cow** goes into the **effluent pond**. What's in the **effluent pond** goes into the **soil...**

This transference **is unavoidable.**



Organisms and **Nutrients** are the things that get transferred.

ORGANISMS are the animals, plants, and single-celled life forms. They are the foundation of every ecosystem, including farms. There are good organisms that help farms grow in health, and there are bad organisms that lead to disease and decay and malfunction.

NUTRIENTS are the substances that provides nourishment essential for the maintenance of life and for growth.

Plants absorb nutrients mainly from the soil in the form of minerals and other inorganic compounds. **Animals** obtain nutrients from the foods they eat or take in. And in the case of dairy farms, humans obtain nutrients from the products that dairy farms produce. Like milk.

Soil is the key because...

The soil is the key because it is the primary source of the biology. The soil is where things begin.

If the organisms and nutrients are healthy and in good numbers, they will carry out their beneficial work wherever they are transferred: from the soil to the grass to gut of animals to the milking shed to the effluent pond.

Which is excellent.

Bad things also get transferred

Bit this cycle also occurs when the organisms and nutrients are harmful. **Pathogens** and **inadequate nutrients** will have a negative impact wherever they are transferred: from the soil to the grass to gut of animals to the milking shed to the effluent pond.

The soil and the pond crust

Even though measures were being taken to address the imbalance of bad bacteria in the Feather's pond, the fundamental problem was the pH and nutrient balance of their soil

The soil pH was sitting at around 5.8. As we alluded to earlier, an elevated acidity has *two negative effects.*

1. Good bacteria are killed or hibernated

The beneficial organisms that grow grass and help cows digest feed prefer a pH level of 6.3-6.4. That's when they function effectively. At 5.8, however, many of these good organisms are forced into hibernation while some perish.

That's bad news on a bunch of levels. One activity these good guys perform is to compete with and suppress pathogens in the soil. They keep the population of disease inducing and crust causing bad guys down. If the population of good organisms is reduced, the bad bacteria are allowed to flourish.

But there's another downside to an acidic soil.

2. Pathogenic bacteria flourish

Pathogenic organisms thrive in an acidic environment; a pH level of 5.8 actually helps them reproduce. Coupled with the reduction of the suppressing influence of good bacteria, the Feather's farm soil was primed for an imbalance of bad bacteria.

This harmful organism imbalance was then transferred around the **Bio Circle:**

- From the soil to the grass.
- From the grass to the gut of the cows.
- From the gut of cows to the effluent pond.

And in the effluent pond, these pathogens that prefer darkness and zero oxygen created their ideal environment by forming the pond crust. This, of course, was made easier as the competing Slurry Bugs were destroyed by the presence of the Chlorine was from the shed.

Healthy Soil will give you a Clear Pond

That's the good news. The Bio Circle also works in favour of the farmer. When you see an effluent pond that is clear and liquefied, you will invariable find that the farm's soil has a pH of about 6.3.

Always.

In this pH friendly condition, beneficial bacteria thrive while harmful bacteria are suppressed. This healthy state manifests throughout the whole **Bio Circle**, including the effluent pond.

If farmers takes proper care of the soil biology, that same biology will take care of the farmer's pond.

Guranteed.

3 weeks after the cows were dried off, (with no new pathogen-filled effluent going in) the **Slurry Bugs** were able to catch up and transform the pond back into a liquefied state

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