WHERE HAVE MY DRYING BEDS GONE?

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ABSTRACT

Gympie Regional Council is replacing its existing sewerage treatment plant with a new BNR plant. The plant is under construction adjacent to the existing plant. In the early stages of this project it was necessary to demolish the existing sludge drying beds, to allow for construction of the new plant.

As a result the plant had to find an effective means of removal of sludge for a period of up to 2 years. A temporary method of sludge removal was developed by the use of geotextile bags.

This paper describes the establishment of a low capital cost dewatering system using geotextile bags. It outlines the methods used, and difficulties that arose. Development of this temporary dewatering system has allowed Council to remove sludge at a significantly reduced cost.

1.0 INTRODUCTION

Gympie Sewerage Treatment Plant is a forty five year old trickle bed filter plant, with primary sedimentation and anaerobic sludge digestion. The growth of Gympie and changes to effluent discharge regulatory requirements have resulted in the construction of a Biological Nutrient Removal (BNR) plant. Construction of this plant commenced in mid 2009, and the plant is expected to be on line in July 2011 and fully operational by December 2011. This plant is designed for a capacity of 30,000 EP.

The existing plant had a series of drying beds, and a drying lagoon. Up to 100,000 litres of sludge was discharged weekly from the anaerobic digestors. The drying beds and lagoons were demolished within 2 weeks of construction commencing.

It was therefore necessary to develop, on short notice, a system of temporary sludge removal for a period of two years.

A number of options were considered, as outlined below;

- Construction of new drying beds. This would be a major capital cost, involving the construction of new infrastructure that would be redundant in two years. The other issue was land availability. There was not suitable land available for the drying area required.
- Early construction of the new sludge dewatering facility, a belt press. The new belt press would be constructed a considerable distance from the sludge digestors. The project program and site made this a difficult and expensive option. Furthermore, return of supernatant back to the inlet works would have presented many difficulties.
- Remove digested sludge. This material could be transported to the nearest waste removal facility. This requires no capital costs. However, at 3% solids transport costs would be exorbitant with most of the material water. The nearest regulated waste facility is 1.5 hours driving away.
- Allow sludge to settle in tanks. This also involved considerable capital cost, and the amount of dewatering that would occur was unknown. Once again the infrastructure would be redundant once the new plant is commissioned.

- Construct a cheap dewatering facility. This facility would need to be a low capital cost, with effective dewatering.

The preferred option was a low cost dewatering facility, that could be easily removed once the new plant was operational. Geotextile bags were considered as an effective dewatering option, that did not involve a major capital outlay.

Investigations were performed on sample bags to determine if the sludge could be effectively dewatered without any filter aid. Results are shown in Chart 1. Whilst the sample bags are not completely representative of dewatering on a large scale it can be seen that this sludge would easily dewater through the geotextile bag in an acceptable time frame.

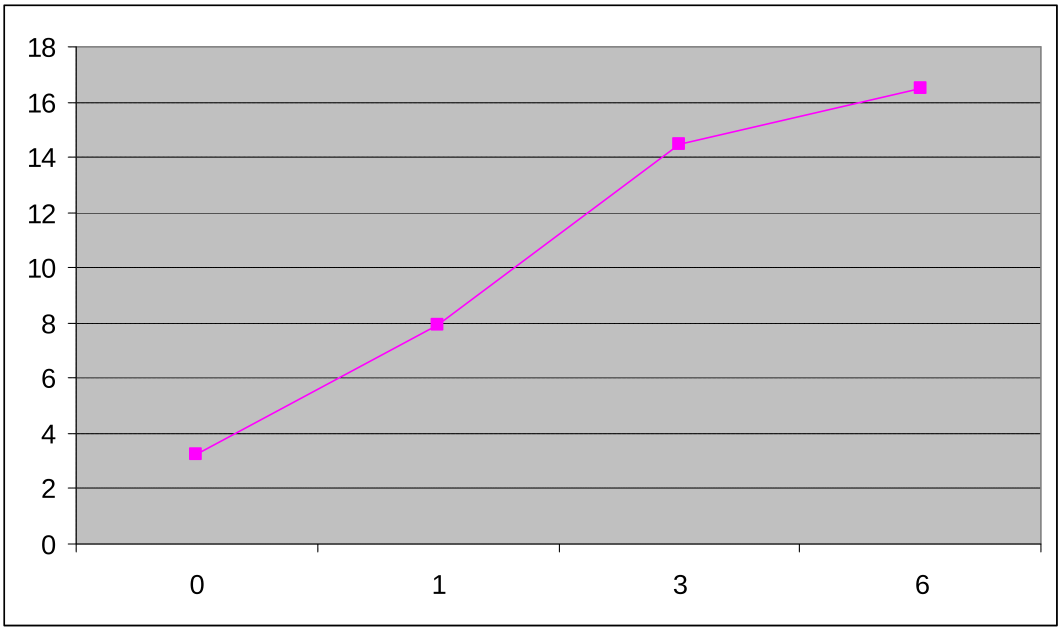

Figure 1: ***Percent solids over time, sample bag***

2.0 DISCUSSION

2.1 Construction

The size of the Geotextile Bags was 15-20m long by 3-4.5m wide. An area was found that would not impede with any construction works of the new plant. This area was graded, to ensure it was flat across the width, with a very slight slope down the length. The area was bunded, and lined with polyethylene sheet. At the low point a pit was constructed, using a 1000L container.

This contained a sump pump with float switches. Flexible hose was run back to the digestor supernatant pit. The geotextile bags were laid upon porous panels, which improved dewatering. In the final version there were four bags in service, with provision for a fifth. Figure 1 shows the arrangement of the bags. Cost of construction was minor, with temporary materials used. The largest cost was the geotextile bags themselves.

Figure 2: ***Geotextile bags configuration***

2.2 Operation

There were two possible ways to operate the bags. Option one was to keep topping the bag up until it was full, and then allow the material to dry over time. This would result in a very dry material, that would have the minimum transport cost. The disadvantage of this is that the material takes many months to fully dry out, and there was not enough room to have a large number of bags at any time. It is possible to stack the bags, but this was considered to be unsafe. The amount of bags required depends on the final sludge solids. Figure 2 shows that a minimum of 12 bags would be required if the sludge was dewatered to 15% solids.

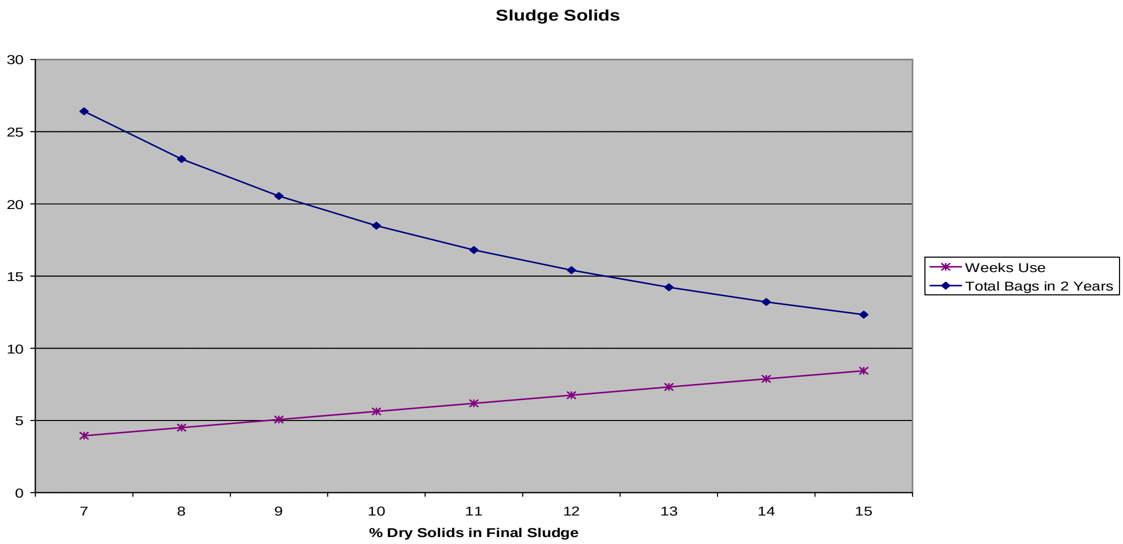

Figure 3: ***Bags Required vs Percentage Dry Solids***

The second option was to dewater the sludge to a level, such that it is still liquid and able to be removed from the bag easily. Then this sludge can be removed, and the bags can be continuously recycled. Whilst this is an increase in transport costs, the capital costs are significantly less than purchasing multiple bags, and the footprint is much smaller.

The key to the second option is running at the highest possible sludge solids whilst still producing a dewatered sludge that can be removed from the bag by a sucker truck. Digested sludge has a solids content of approximately 3%. The goal was to dewater to a minimum of 6% solids, thus halving transport costs. Figure 3 shows how costs diminish with increasing solids content.

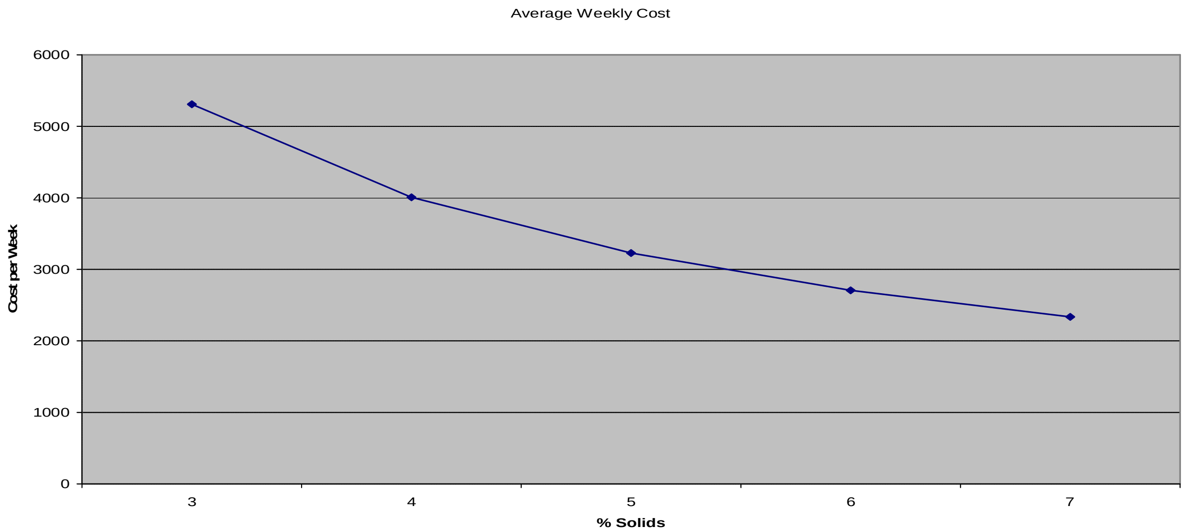

Figure 4: ***Costs of removal vs Percentage Solids***

Table 1 summarises the costs for the two options at various percentage solids. It allows for the increased capital costs for additional bags for the dry solids option.

From a straight cost comparison, drying the sludge fully is the cheapest option. However, there were a number of logistical issues that made this impractical. The primary issue is the turnover time when drying, which means a large footprint is required, or stacking. Given the difficulties of this option, it was decided to use the second option, and remove partially dewatered sludge. The focus was then to ensure that this sludge had been dewatered to a minimum 6%.

Once the system of wet sludge removal was established, the bags were filled and emptied on a rotation system. Each bag was allowed to dewater for up to two weeks prior to being emptied.

Table 1: ***Cost Comparison of Wet Sludge vs Dry Sludge Removal***

Dry Sludge Solids, %	Cost per Week	Wet Sludge Solids	Cost per Week
7	$3042	3	$5,308
8	$2662	4	$4,008
9	$2366	5	$3,228
10	$2130	6	$2,708
11	$1936	7	$2,336
12	$1775		
13	$1638		
14	$1521		
15	$1420		

2.3 Issues

Site level is very important, particularly across the width of the bags. It was found that even with a very small slope the bags rolled, and it was necessary to stake them to avoid them moving. The site had to be level across the width, and only have the slightest fall lengthways.

Over drying was an issue in the hot summer months. At one stage in December 2009 the bags were not able to go more than a week before they became unpumpable. This then meant that the bag then became unusable as it could not be emptied. If this occurred it was necessary to dry the bag out and then remove the dry solids, and put another bag in its place. Drying the bag out took time, and balancing the sludge removal between the other bags then became difficult. It was important to ensure each bag was able to remain in service.

Low solids content was also an issue. The geotextile bags do tend to clog up, and it is very important to monitor solids levels. It was found that the use of a water blaster every second day cleaned the bag surface efficiently and dramatically improved dewatering.

Maintaining the correct solids content was critical to the successful operation of this system. If the solids are too high the material cannot be pumped, and the bag becomes unusable. If the solids are too low the costs blow out, and sludge removal is inefficient, ultimately leading to too high sludge levels in the digestor and sedimentation tanks.

3.0 CONCLUSIONS

The use of Geotextile bags is an effective way to dewater sewerage sludge. It will dewater to up to 15% solids, depending on the time allowed.

Costs of disposal vary with the percentage solids achieved. As this is the critical process parameter it is important to measure this regularly to ensure that the system is working as required.

The bags were filled to 1.5m height, and with efficient dewatering, the height dropped to under 1m. This allowed the bag to be topped up again prior to sludge removal. Alternatively, the remaining material was then removed to allow the bag to be refilled.

Geotextile bags are a low cost method of dewatering, when compared to the capital costs involved in establishing concrete drying beds, and the method used allowed significant cost reductions.

Once this process was established, this dewatering system has worked very well, and will sufficiently remove sludge until the new plant is commissioned. It requires minimal maintenance, a few hours a week water blasting and an hour a week for removal. It is a low labour intensive operation.