SLUDGE MANAGEMENT IN SMALL RURAL PLANTS USING A MOBILE VOLUTE DEHYDRATOR

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ABSTRACT

At Tumut Shire Council we have five activated sludge sewer treatment plants ranging from 150 EP to 12,000 EP. Each of these plants produces waste activated sludge that had to be dewatered and disposed of. Having multiple plants that are up to 40 kilometres apart complicated the logistics of sludge management, potentially proving a difficult and costly problem. The largest plant is Tumut (12,000 EP) located on the Tumut River flood plain, and which has little space to construct sludge management facilities. Previously we utilised sludge bags and sludge drying lagoons to dewatering/drying of sludge.

As there were not many dehydrators out there in use, we opted to purchase the base unit and adapt it to suit our particular needs. The unit we opted for was an ES 202 ST Volute Dehydrator purchased from VOR Environmental.

1.0 INTRODUCTION

Historically Council operated trickling filter plants in Tumut and Batlow, and an activated sludge Pasveer plant at Adelong. The township of Talbingo was managed by the Snowy Mountains Hydro Electricity Authority and the village of Brungle was serviced by on-site sewerage systems. The two sludge management systems used were:

- Sludge bags which proved slow and took up precious space for long periods.
- We then pumped the spent sludge to a drying lagoon. After a period a contractor with a long reach excavator was engaged to clean out the sludge drying lagoon. This although successful was very time consuming and costly.

Since 1995 Tumut Shire Council has:

- Taken control of an activated sludge sewer plant in Talbingo and constructed new plants in Brungle (2007) Tumut (2007) and Batlow (2012). They also upgraded the Pasveer at Adelong to accommodate chemical dosing for phosphorus removal and disinfection.

The direct result of this is the increased amount of Waste Activated Sludge (WAS) we have to process. Going on an average concentration of Mixed Liquor Suspended Solids (MLSS) of around 3500 mg/L we are producing about 225kg of dried bio-solids per megalitre of raw sewerage treated.

The problems we faced were:

- We had five sewer plants ranging from very small to medium size to manage the sludge produced.
- The current methods of sludge management no longer suited our needs.
- The logistics of attracting commercial contractors to dewater the sludge was problematic and costly.

This prompted us to research sludge management systems that we could manage in-house with the flexibility to be used at multiple sites by means of a transportable dewatering machine.

2.0 DISCUSSION

In March 2008 we invited VOR Environmental to carry out an onsite demonstration of the volute dehydrator they were promoting. During the trial we used the dehydrator to:

1. Dewater the WAS straight from the Extended Aeration Tank (EAT). Whilst we achieved a satisfactory result we rejected it because we were left with a volatile product that had the potential to create odour issues.
2. Dewater the spent sludge from the sludge lagoons. This proved a more positive path as we could guarantee a consistent product to process.

__**Figure 1:**__ ***The Trial***

We subsequently purchased an ES 202 ST Volute Dehydrator which was sized to process the sludge in 6 to 8 months operating on an 8 hour day. The design capacity for the unit was 35kg of dry biosolids per hour.

The main stages of the process are:

- Mixing of the aged sludge in the sludge lagoon
- Pumping the mixed sludge to the dehydrator
- Polymer dosing into the dehydrator feed tank
- Flocculation/Coagulation
- Volute dehydration
- Collection and disposal of the dried sludge

This process is demonstrated in the schematic in Figure 2.

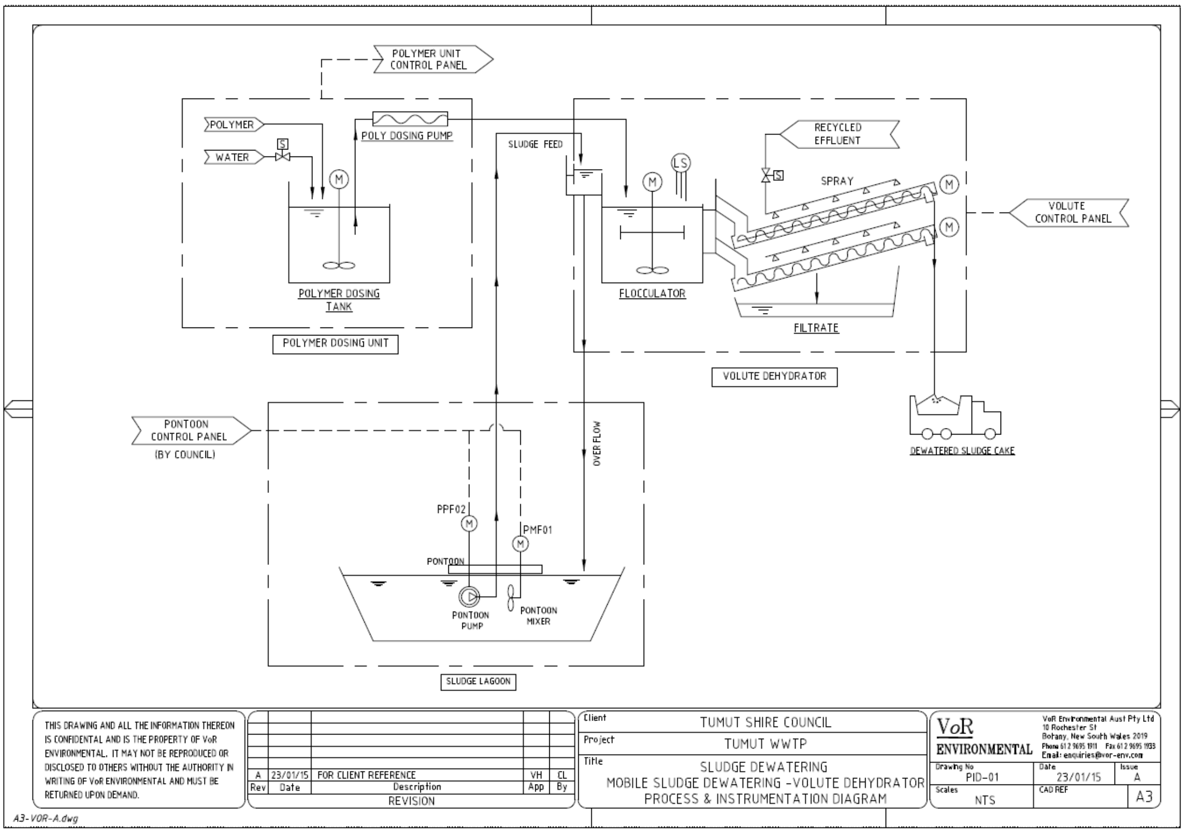

Figure 2: *Volute Dehydrator Schematic*

2.1 The Unit

As stated earlier we chose to purchase the base unit and adopt it to our particular needs. The end result was a trailer mounted unit with associated polymer dosing pumps and batching tanks with storage adequate for longer run times. In addition to the trailer we also constructed a pontoon mounted submersible grinder pump to deliver the sludge to the dehydrator. The photo gallery below clearly shows the finished product and it's components.

Figure 3: *Volute Dehydrator & Polymer System Mounted on Trailer System*

Figure 4: *1000 litre Polymer Batching and Storage Tank*

Figure 5: *Polymer Dosing Pumps*

Figure 6: ***Inlet Tank with Adjustable Overflow Pipe and Measuring Weir***

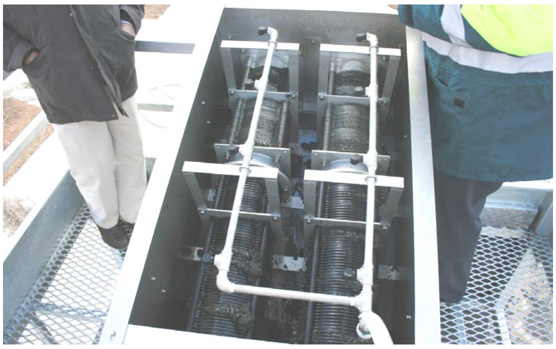

Figure 7: ***Dewatering drums of Volute Dehydrator ES202***

Figure 8: ***Sludge Storage Lagoon with Mixer and Feed Sludge Pump***

The cost of the components of the system are outlined in Table 1 below.

Table 1: *Cost of the components*

Component	Cost
Volute Dehydrator ES202	$125,200
Trailer	$11,190
Batching Tank	$3,288
Dosing Skid	$5,640
Dosing Pumps	$11,350
Sludge Pump	$3,540
Total Cost	$157,208

Original Unit Specifications
A1.2 Volute Dehydrator – 14 hour Operation
Volume: 48 m3/day
Operation: 7 days
8 hr/day: 201.6kg/day
14.40 kg/hr
Sludge Conc. 0.4% to 0.45% DS from Sludge Holding Tank
Sludge Feed 3.4 m3/hr

One (1) number Model ES-202ST:

- Total width 935 mm
- Total Length 2500 mm
- Total Height 1275 mm
- Throughput kg DS /hr (per unit) ~ 22.8 kg DS/hr
- Volute drum 2 x Dia. 200
- Gear motor 415V, 3 ph, 2 x 0.4 kW, IP 56.
- Agitator motor 0.4 kW, IP65
- Level switch conductive
- Solenoid valve 24V DC
- Material 304

2.2 Chemicals

When commissioned we were dosing with 0.5% solution of Coreshell 303 Cationic Polymer with a mixed sludge through put of 3kL/hr. We were able to achieve a dry solids output of 28 to 35 kg/hr.

We then began to experiment with different polymers and flocculation chemicals to try to improve the output of the unit. We tried them by themselves and in conjunction with others. The chemicals we experimented with are listed in Table 2.

Table 2: ***Chemicals Used in Experiments***

Primary Polymer	Secondary Chemical Dosing
Coreshell 303 - Cationic	
Coreshell 301- Cationic	
Coreshell 301- Cationic	Alum (61%)
Coreshell 301- Cationic	Multifloc SE 287 (Silica)
Coreshell 301- Cationic	Poly Aluminium Chlorohydrate (PACL)
Coreshell 301- Cationic	Multifloc LT20 (Non Ionic)

2.3 Today

After trailing different chemicals, we have settled on Coreshell 301 Cationic polymer in combination with Multifloc LT 20. Table 3 below outlines the dosing data of the two chemicals. As demonstrated, the dry sludge output is double the original levels achieved. The daily cost of chemicals is in the region of $330 per 24 hour run time. The polymer batching system is designed to allow for continuous operation 24/7. All components are controlled by the control panel. Should any component experience problems then the whole unit shuts down.

Table 3: ***Dosing data of the two chemicals***

Flow rate kl/h	Primary Polymer dosing rate (L/min) Coreshell 301	L/Hr	polymer strength %	Dosage mg/l	secondary polymer Dosing rate (mLs/min) Multifloc LT 20	L/Hr	Polymer strength %	Dosage mg/l	Wet Sludge Kg/hr	% of dry sludge	Est Dry kg/h
2	3.64	218.4	0.4	417	428.5	25.7	0.2	26	420	18	75.6
2.5	3.64	218.4	0.4	334	428.5	25.7	0.2	20.5	540	15	81

3.0 CONCLUSION

To sum up we are very happy with the outcome of choosing to develop an onsite sludge drying facility at Tumut Shire, and we believe it is cost effective and versatile in terms of time management and adaptability to different sites.

4.0 ACKNOWLEDGEMENTS

In closing I would like to thank the team from VOR Environmental for their assistance in setting up the trial and technical help along the way.

I would also like to thank my colleague and plant operator Steve Signor for his commitment to continuous improvement with this project and all aspects of the sewer treatment operations in Tumut Shire.