SOUTH TARANAKI DISTRICT COUNCIL'S ADVANCED MICROBIAL DIGESTION TRIAL

Paul Senior, Parklink Ltd
Viv Eyberg, South Taranaki District Council
Brent Manning, South Taranaki District Council

ABSTRACT

South Taranaki District Council (STDC) in association with Parklink Ltd in March 2012 commenced trialing an innovative solution to remove sludge from the Hawera wastewater treatment ponds using high rate microbial digestion to break down the organic solids (sludge). To date the trial has shown excellent results with up to 22% of sludge volume reduced in 9 months. The council has now committed to continuation of the trial and its use in other council wastewater treatment ponds. While this practice is currently being used successfully in industrial pond systems, to our knowledge this is the first use in municipal wastewater ponds in New Zealand. We believe the experience of STDC could be replicated in other municipal ponds throughout New Zealand, providing a natural, environmentally sustainable and cheaper alternative to mechanical removal and dumping of bio-solids in landfills.

We will describe the challenges of trialing a new innovation in a dynamic environment where sludge is being removed biologically but also being introduced daily by the flows and loads entering the WWTP. It is demanding to calculate rates of removal in a dynamic environment where the sludge is being hydrated and rising vertically while being carried horizontally by winds and currents.

KEYWORDS:

Microbial sludge digestion, sludge removal, oxidation ponds, bio solids

NOMENCLATURE:

TDS (total dry solids), TSS (total suspended solids), STDC (South Taranaki District Council)

1 INTRODUCTION

This paper outlines the background and experiences resulting from the STDC being invited to a presentation held at the Horizons Regional Council in June 2011. The presentation was focused on the benefits of engaging nature's forces for environmental harmony and was delivered by Parklink. The technology had previously been proven to reduce the volume of sludge within large anaerobic lagoons treating effluent from meat processing plants in New Zealand.

STDC then questioned if domestic wastewater sludge produced in WWTP lagoons could be reduced utilizing this technology. This led to a combined effort to trial the process through a proof of concept field trial.

The concept of an "advanced microbial digestion" trial was developed and the partnership initiated a trial on a STDC wastewater pond where mechanical desludging was identified to be a high cost and environmentally unfriendly alternative.

1.1 WHO IS PARKLINK LIMITED?

Parklink is an entity that has grown from innovative and scientific research and field experience in USA and New Zealand. Parklink staff have used this biological remediation work and combined it with advanced systems to map and monitor the pond and introduce natural indigenous bacterial cultures produced on site to convert sludge.

Some of the Parklink team have been commercially involved in utilising microbiological treatment systems successfully prior to the formation of Parklink on several projects of significance between 1996 and 2008. These included the desludging of a large anaerobic lagoon for a Meat Processing Company in Oringi southern Hawkes Bay and the remediation of a 45 acre wildlife reserve in Napier Hawkes bay. These successes provided the impetus and confirmation to form a new company specialising in bioremediation techniques. The new company Parklink was registered as a company in October 2009. With a clear goal to invest in and develop the Advanced Microbial Digestion technology (AMD).

During 2011 Parklink ran a series of presentations on AMD at several venues to introduce people to this new concept, assist their understanding the process from a microbiological perspective, and communicate to potential clients what this technology could achieve. These presentations were held at the offices of Bay of Plenty Regional Council, Hawkes Bay Regional Council, Horizons Regional Council and Hutt City Council.

Following the presentations at the Horizons regional Council Parklink was approached by the South Taranaki District Council and invited to submit a proposal for removing the accumulated sludge in the Hawera WWTP number one waste water pond.

1.2 THE STDC SITUATION

The Hawera number one wastewater pond has accumulated 85,300 cubic metres of sludge over the last 20 plus years which has significantly reduced the effluent design volume and retention time for effective treatment.

Budgets of several million dollars were allocated for mechanical removal, transport, and landfilling of this sludge. Council officers proposed trialing a biological process which was approved by council and commenced in March 2012, using the specialist services of Parklink at a fraction of the cost of mechanical removal.

The objective of STDC in undertaking this project was simply to identify a more cost effective and more environmentally friendly method to remove the sludge in the Hawera WWTP oxidation pond 1. Further the Council identified the need for an ongoing cost effective programme of maintenance in order to maintain the working life and efficacy of the pond to ensure its operation met the resource consent discharge requirements.

2 BACKGROUND

2.1 HAWERA OXIDATION POND 1

The Hawera wastewater treatment plant consists of a large anaerobic lagoon receiving effluent from a local meat works and two oxidation ponds receiving all the industrial and domestic effluent from the townships of Hawera and Eltham, including the effluent from the anaerobic lagoon. These two ponds now operate in parallel but previously operated in series for a number of years. As a consequence of pond 1 previously being used as the primary treatment pond it contains considerably more sludge than pond 2. The effluent from the two ponds flows to four maturation cells before being pumped out to the Tasman Sea via an outfall.

A survey of the accumulation of sludge in pond 1 was undertaken in June 2011 utilizing a remote controlled boat with GPS, and sonar measuring equipment, calculated t there was 85,300m^3 of sludge in pond 1. This represents 59% of the total volumetric capacity of the pond. STDC decided that desludging of the pond was necessary and this was subsequently budgeted for in the STDC long term plan. In comparison Pond 2 contained 35,500m^3 of sludge representing 24% of the total volumetric capacity of the pond.

The budget for desludging pond 1 was based on mechanical removal and transporting dewatered sludge to the nearest landfill which is 70km from the Hawera WWTP. The estimated cost of $4 million was budgeted for this desludging project.

Agreement was reached with Parklink to initiate an advanced microbial digestion trial of accumulated sludge within the Hawera oxidation pond #1 in February 2012. The bioreactor was set up and dosing began at the end of March 2012.

2.2 ADVANCED MICROBIAL DIGESTION – WHAT IS IT?

Advanced microbial digestion is not a product but an entire process that has been developed to biologically remove accumulated organic sludge in waste water ponds. Over the last decade thousands of trials have been conducted using all sorts of shelf stable bacterial products to assist the digestion of sewerage sludge. In most cases trials have been abandoned due to no noticeable difference in either pond performance or no appreciable reduction of sludge within ponds. In comparison laboratory evaluations have categorically proven that sewage sludges can be biodegraded by using selected bacteria and enzymatic catalysts that assist the breakdown and stabilization of the organic components of sewage sludges.

P

Photograph 1: Hawera Ponds 1 and 2

2.2.1 HOW DOES IT WORK ON SITE?

The advanced microbial digestion process involves setting up a manufacturing facility on site to continuously produce the required components necessary to sustain a continuous cycling reaction on the accumulated sludge's.

The extracellular enzymes manufactured on site react with the settled sludge and suspended colloidal materials causing them to be solubilized and converted into simple food sources for aerobic microbes to consume. The manufacturing process uses selected strains of earth derived bacteria. These are classified by American type culture collection as bio safety level 1. This means that they are nonpathogenic microbes and are grown from seed cultures under sterile conditions and imported into New Zealand by Parklink Ltd.

The key difference with this advanced microbial process is that these selected microbes are grown on site, concentrated using specialist culturing methods and are conditioned to specific stages of exoenzyme production using specialist culturing techniques.

When correctly introduced into effluent ponds this mixture of enzyme producing micro organisms system has the capability of solubilizing larger particulates of sludge. The sludge is continuously exposed to the solubilizing activity of these concentrated exoenzymes.

In order to balance the effect of the continual introduction of exoenzymes when necessary, high volumes of live support microbes are produced to digest the freshly solubilized sludges. This means that the complexities surrounding effluent flow rates, retention times, toxicity levels, fluctuating effluent concentration levels and fluctuating environmental/climatic conditions such as temperatures, sunlight hours, rain fall and wind strengths can be taken into consideration with this system.

The microbial solutions produced by this process are pumped directly into the pond via a network of pipes established in the pond. Each pipe line is fitted with injector assemblies that optimize contact of the introduced solution at the sediment interface and at a depth that will support aerobic digestion of the freshly solubilized material. As the treatment progresses the position of the injectors is adjusted to ensure the pumped materials are maintained in the best active zones in the pond.

The concept is unique as it involves "reading" a ponds needs so it is kept operational while the sludge reduction processes occur. As more ponds are treated this way expertise has been built up and improved.

2.3 CHALLENGES AND SOLUTIONS

2.3.1 BETTER UNDERSTANDING SLUDGE, ITS DENSITIES AND CHARACTERISTICS

When microbial digestion takes place the sludge is broken down into smaller particles that it can be digested. In the process of being broken down and hydrated the sludge fluffs up and the volume increases but the density decreases.

Parklink have found through extensive monitoring and research that sludge densities change with increasing depth in waste ponds and lagoons. This particularly applies to Ministry of Works pond designs that are operational in many regions throughout New Zealand. The ponds have definite and different settling zones that are created by specific currents within the pond and are influenced by prevailing winds. Ponds in areas that experience frequent high wind events tend to contain compacted sludge in the deeper zones. This is a result of the settled lighter sediments being mixed into the upper freeboard during high wind events and being re distributed and re oxygenated. This concentrates the remaining heavier sludge particulates which over time can reach densities greater than 16% TDS.

From experience Parklink have found most sludge sediment at a depth of 1.5 metres deep, will contain 8-9% Total Dry Solids. Sludges formed at depths of 2.5 to 3.5 metres typically contain 12 to 15% Total Dry Solids. In pond 1 approximately 66.3% of the area of the pond has a depth greater than 1.5 metres. The sludge's in these regions of the pond have concentrated extensively due to high rate settling and frequent high wind events.

2.3.2 SAMPLING SLUDGE

Parklink with the assistance of STDC started a sampling program that involved the use of a vacuum sampler to collect sediment samples so that they could be analyzed for TDS content. The sampler was first constructed as shown below.

Photograph 2: Modified Vacuum Sampler

The sludge in many areas of the pond was only 400-500 mm below the surface of the pond. In order to track progress of the treatment process the solids were sampled at 2 different depths below the water. These depths were initially set at 500mm and 1100mm below the water line. Each time sampling was carried out a laser level was used to guide the operator when lowering the sampler tube to the selected depth at each sampling location. Three positions across the pond were established as way points to which a graduated rope marked in 1 meter increments was set. This rope was used to keep the sampling vessel in the correct position with minimal drifting and enabled the operators to identify the respective sampling locations.

Photograph 3: Sampling rig showing version 2 vacuum sampler and sludge judge

The first sampling round was carried out approximately one month after the Parklink program was initiated with the objective of establishing the percentage solids of the sludge's at these two specific depths. Unfortunately solubilisation of the sludge's had already began so we were unable to collect baseline data that was truly **before** treatment. When subsequently analyzing data from these sampling runs we were able to differentiate two zones within the oxidation pond – a shallow and a deep zone.

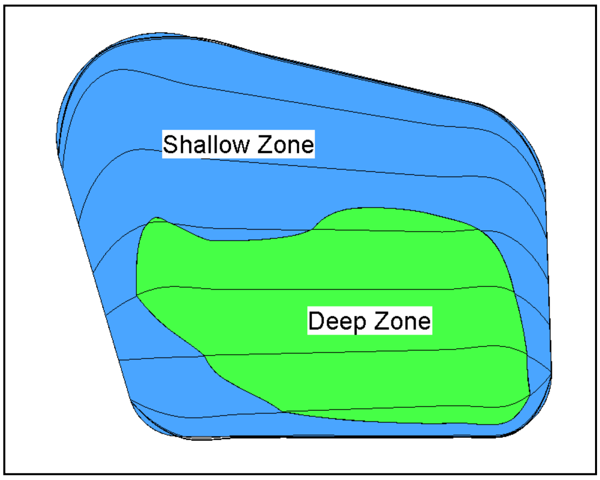


Figure 1: Pond 1 Shallow and deep zone delineation

2.3.3 TOTAL DRY SOLIDS TESTING

The tables below show the results from the first solids testing conducted April and then July 2012:

Pond Area	Depth	Average % TDS	Comments
Shallow areas	500mm	0.52%	8 samples. Highest 0.66%. Lowest 0.056%
Deep areas	500mm	1.00%	7 Samples. Highest 2.6%. Lowest 0.50%
Shallow areas	1100mm	2.37%	8 samples. Highest 4.21%. Lowest 0.77%
Deep areas	1100mm	5.51%	7 Samples. Highest 6.61%. Lowest 3.47%

Table 1: First solids testing results April 2012

Shallow areas	500mm	0.037%	Reduction of 0.48%
Deep areas	500mm	0.043%	Reduction of 0.96%
Shallow areas	1100mm	0.35%	Reduction of 2.02%
Deep areas	1100mm	2.247%	Reduction of 3.26%

Table 2: Solids testing results July 2012

These reductions indicated very good results for the first quarter considering they were achieved during the winter months.

2.3.4 SLUDGE INTERFACE READINGS

In October 2012 Parklink and STDC carried out a survey to determine changes in the sludge interface compared to those obtained in July. Sludge interface readings were completed using a conventional “Sludge Judge”. The device consists of a clear tube fitted with a one way valve in the end. The tube is inserted to a specific depth and when lifted it holds the sample for visual inspection through the clear tube. The operator can measure the clear liquor depth and able to observe the sludge/water interface and calculate the depth it sits in the pond at that point.

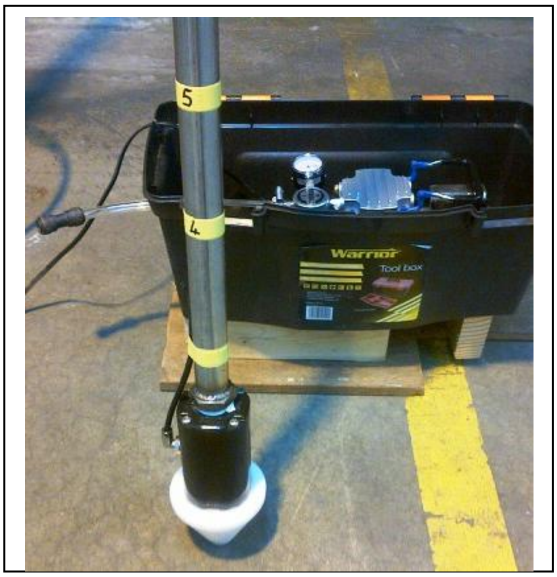
The October readings indicated the deeper and heavier sludge was beginning to hydrate. The hydration of the deeper sediment blanket meant that it was rising into the water column as its density reduced. Parklink concluded that due to the sediment activity levels it was advisable to cease top-down testing and implement testing from the base up. To test from the base up, the actual profile of the base of the pond had to be determined accurately. This would generate a clear picture of the volumes and dry mass of sedimentary sludge in the pond through the measurement of the density of the sludge throughout the pond. This in turn provides a better understanding of the mass of dry matter requiring digestion within the pond. It was critical that the density of the sludge in the deeper zones of the pond was measured so that monitoring of sediment hydration was possible, and the potential for this denser sludge to occupy freeboard area when hydrated could be assessed.

2.3.5 IMPROVED SAMPLER DEVELOPMENT

Parklink expressed concern about the accuracy of the vacuum sampler. It was constructed with a small sediment chamber that relied on the sludge being drawn down from the top of the chamber opening via a 6mm suction opening. At times the sediment densities were known to be higher than 10% TDS however the samples taken with this machine were only showing readings of around 5-6%. It was concluded that the pathway that the sample had to take to reach the sampling chamber was too restrictive and the solids were preferentially separating with the result more water was ending up in the sampling chamber than actual sludge.

The unit was rebuilt so that there was no restriction and the sludge was able to flow into a sampling tube under a vacuum caused by the differential in atmospheric pressure and the water depth. This is also assisted by the additional vacuum from the vacuum pump. This new unit is capable of ‘grab’ sampling sediment densities well over 20% TDS at depths of over 8 m and the only restriction is the force it takes to push the sampler end into heavy untreated sediment.

Photograph 4: Improved sampler



2.3.6 SONAR SURVEY

The STDC undertook another Sonar Survey in November 2012 to see if there had been any appreciable reduction in the overall volume that the sludge was occupying in the pond.

The STDC was keen to use the Sonar measuring system to monitor the solids inventory within the pond. This works well in situations where the sludge blanket remains stable and somewhat immobile. The excellent results that were seen in the first few months of treatment resulted from the colloidal biomass being removed by the treatment. During the initial stages of AMD the colloidal material in the freeboard of treatment ponds is primarily converted as it is situated in the relative aerobic zone where the best oxygen source is available and the molecular size of this food source is the fastest to convert into a microbial digestible form.

Therefore what had been experienced in the first six months following the beginning of AMD was the conversion of colloidal material and some of the lower density sludge's in the shallower regions of the pond. This progress provided an excellent platform to continue the program of solubilisation through the coming summer months without any adverse effect on the discharge quality.

The STDC was also keen to establish a costing for the rate of removal of the pond sludge. They initially planned on using the November survey to provide them with data for calculating the volume differences and from this, establish a cost per cubic meter of sludge removed.

The sludge reduction calculations for the November sonar survey cannot be verified because of the problems associated with the density characteristics of the sludge which are constantly changing. This does not mean that there has not been any reduction but only that the initial calculations used were incorrect due to the lack of knowledge regarding the sludge densities. The initial survey data comprised of 5,200 paired depth soundings. This data was integrated into a graphical representation of the pond depth and sludge build up using the mapping software "global mapper". This survey showed that there had been an increase in sludge volumes of 300m³ from 85,300m³ to 85,600m³.

However when applying this data to the density data derived from the sludge samples obtained during the second survey it was found the mass of dry solids had decreased by 11%. The third sampling round has indicated a decrease in the mass of dry solids of approximately 44%. STDC is keen to use the sonar system again in the near future to once more assess the change in sludge volume. The data from this survey will be paired with the 3D modeling work done by Parklink to define the dry volume of sludge remaining for removal. The sludge interface data is proving he;pful for monitoring the movement of sludge within the pond. The two factors that are working to lift the sludge's are the solubilisation caused by the treatment and the changes in seasonal temperatures within the pond.

As the temperatures decreases during the winter, the hydrated material is pulled up into the freeboard zone simply by the difference in temperatures within the pond. The residual heat in the sludge blanket is dissipated quite quickly causing a massive release of upward energy as the heat rises by the convection to the cooler surface of the pond. During the summer of 2013 the pond temperatures approached 24-27 Degrees Celsius. In the space of about two months the temperatures within the pond plummeted to below 10 degrees and reached as low as 6-8 Degrees Celsius in July. As a result the solubilized sludge's was pulled up into the lower clear zone which temporarily reduced the total available free board. Once the temperatures begin rising in spring this uplifted material will be rapidly converted by the AMD treatment.

2.3.7 POND PATTERNING

The pond was divided into transects using GPS way points around the outside perimeter of the pond. Once these points were established the system using the measuring rope was used to traverse the pond to collect the base profile measurements and sludge densities at various depths. Thirty Six measuring points were established for ongoing analysis of the hydration activities in the pond as set out in the drawing below.

The first sets of base-up measurements were made in February 2013 and the following data shows the volumes and different densities of the pond sludge.

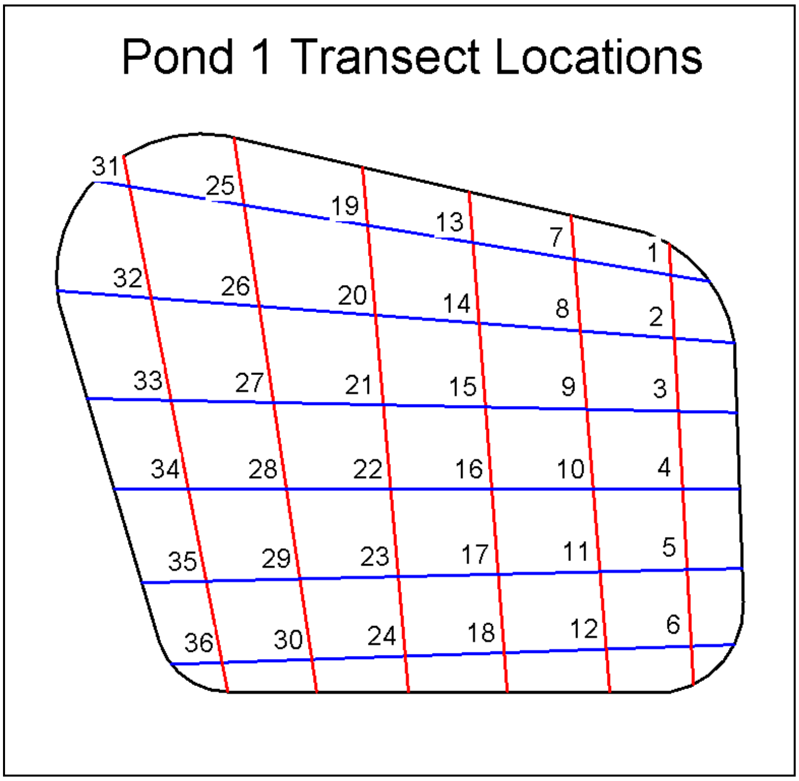


Figure 2: Transect Locations

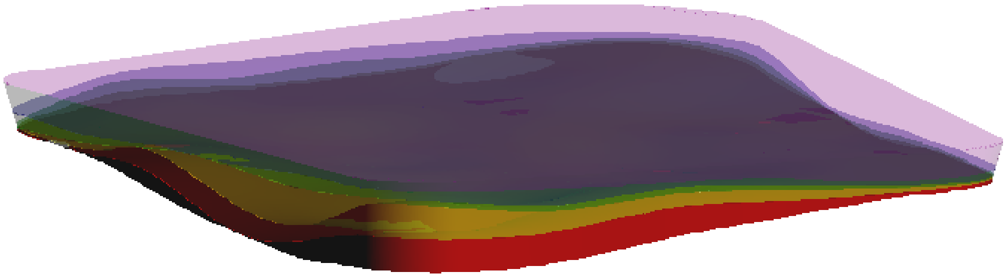
The following calculations were taken from the original sonar survey conducted 12 months before treatment began. The water volume measurements were plotted using 3D CAD software and density zones were modeled using the readings obtained in the February mapping. However to make allowance for margins of error, lower densities have been used than what was actually present before treatment. As a result these figures are very conservative with regards to the actual dry mass weights of sludge. We have used the zoning from the February readings to create the before treatment sludge volumes in the following table.

Zones before Treatment	Cubic Meter Volume of Zone	Actual Total Dry Solids	Total Dry Solids before Treatment
Zone 1 Freeboard	35,497m3	Water	
Zone 2 @ 5.0% TDS	38,655m3	1,932.7kg	
Zone 3 @ 6.5% TDS	30,228m3	1,964.8kg	

Zone 4 @ 9.0% TDS	33,048m3	2,974.3kg	6,871kg

Table 3: Dry Solids volumes at start

The following 3D rendering showing water zone and three separate density zones based on data taken from sludge survey completed in February 2013 has a depth scale multiplied 10 times to help visualize the differences.



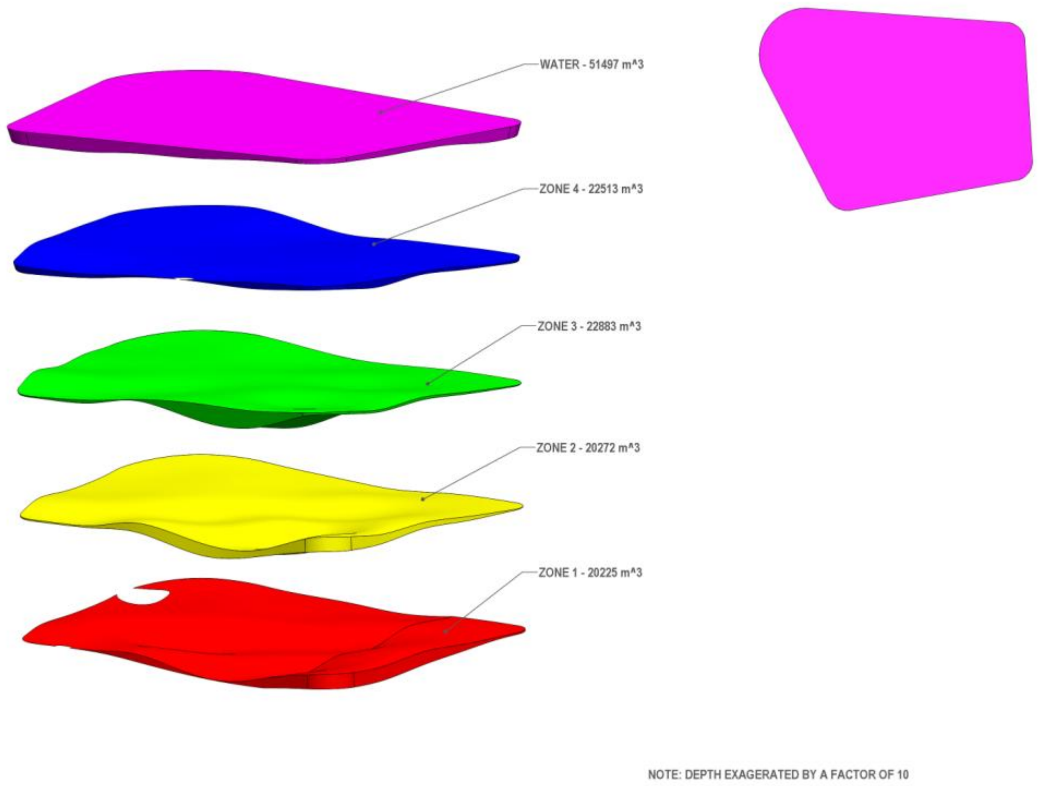
The survey data included total dry solids tests taken at 100 mm above the base of the pond and at selected heights above this and includes a full set of sludge interface readings at each transect.

Zones @ February 2013	Cubic Meter Volume of Zone	Actual Total Dry Solids	Total Dry Solids @ February 2013
Zone1 Freeboard	51,497m3	Water	
Zone 2 @ 1.5% TDS	22,513m3	337.7kg	
Zone 3 @ 3.0% TDS	22,883m3	686.5kg	
Zone 4 @ 5.0% TDS	20,272m3	1,013.6kg	
Zone 5 @ 7.5% TDS	20,225m3	1,516.8kg	3,554.6kg

Table 4: Dry Solids volumes as determined

2.3.8 FEBRUARY 2013 3D MODELING OF THE INDIVIDUAL DENSITY ZONES

The depths in this diagram have been multiplied by a factor of ten also to help with visual perspective:



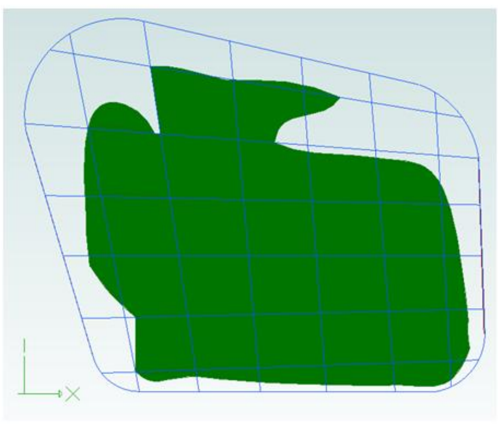
The net result of this modeling demonstrates a reduction in total dry solids of over 50% and was achieved over the eleven month time treatment period.

2.3.9 UNDERSTANDING SLUDGE LIFTING POTENTIAL

Hydrolyzing and solubilizing high density sludge’s increases the potential for occupying space within the upper freeboard zones. This is a manageable issue but needs to be carefully monitored. Should the program of treatment be too aggressive the deeper sludge’s can lift very quickly as a blanket and limit the oxygen transfer in the freeboard zones.

As can be seen from the modeling below the volumes of deeper sediment that have the potential to rise into freeboard zone are huge.

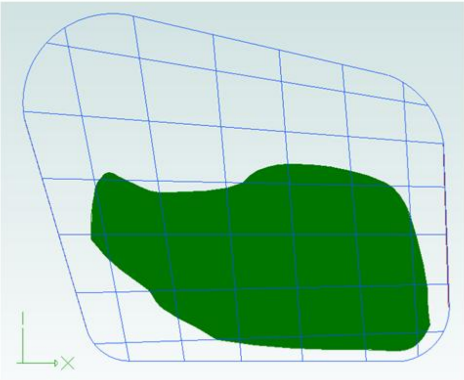
Below 1.5m



Sludge volumes below 1.5 metres measure 33,357m³ or 24.3 % of the total pond volume.

Using this volume and assuming sludge’s are at 6% solids, having hydrated the sludge’s to 2% solids and making no allowance for volatile solids destruction, the volume occupied by this material would increase to potentially over 100,080m³. This would represent 72% of the total pond volume. However the AMD process limits this potential.

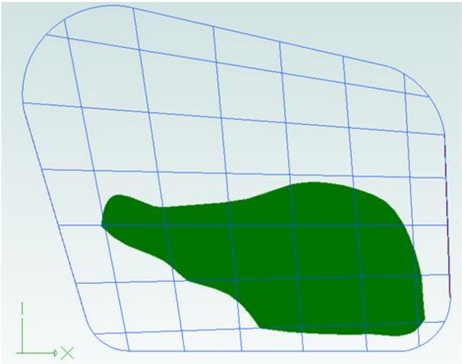
Below 1.9m



Sludge volumes below 1.9 metres measure 18,576m³ or 13.53 % of the total pond volume.

Using this volume and assuming sludge's are at 7% solids, having hydrated the sludge's to 2% solids and making no allowance for volatile solids destruction, the volume occupied by this material would increase to potentially over 65,000m³. This would represent 47% of the total pond volume. However the AMD process limits this potential.

Below 2.3m



Sludge volumes below 2.3 metres measure 8,566m³ or 6.24 % of the total pond volume.

Using this volume and assuming sludge's are at 8% solids, having hydrated the sludge's to 2% solids and making no allowance for volatile solids destruction, the volume occupied by this material would increase to potentially over 34,200m³. This would represent 25% of the total pond volume. However the AMD process limits this potential.

2.3.10 SLUDGE HYDRATION ACTIVITY CONCLUSION

As can be seen by the above data, sludge's over 5% TDS have the ability to temporarily occupy large areas of freeboard within a pond system when being transformed by the remediation process. Until recently little has been understood about the hydration and lifting potential of sludge blankets.

Sludge blankets in untreated ponds remain quite stable despite seasonal temperature fluctuations and where dissolved oxygen values are kept above anoxic levels. Using Sonar testing to measure total sludge inventory is not suitable in treated ponds until the hydration and lifting potentials have been lowered. This would mean that the percentage of sludge's above 4% TDS need to occupy less than 20% of the total pond volume before the potential for lifting has been suitably stabilized to allow Sonar measuring to be used with confidence. This is recommended by Parklink and we continue to refine procedures for this as more data is collected.

2.3.11 POND DISCHARGE RESULTS DURING TREATMENT

The Advanced Microbial Digestion process has proven to assist the quality of discharged pond effluent despite the hydration of the sludge layer. The TSS data compiled below indicates the quality of the treated effluent remained stable during the high temperatures of the recent long summer period.

- Data from July 2005 to March 2012 shows TSS readings from 79 tests.

- The average value over the 79 tests was 69.85mg/L TSS. The highest reading was 335mg/L TSS in November 2008 with 13 tests during the period prior to treatment that were over 100mg/L TSS.

- The data below shows the TSS tracking down to 50 and below over the winter months as the lighter sediments and colloidal materials are digested. Then the temperatures start to rise and this coincided with the heavier sediments starting to actively hydrate. The result is an increase in the TSS readings.

However the treatment was adjusted to compensate for this extra material arriving in the freeboard zone so that the results were stabilized once it was clear that we were losing freeboard to hydrated sludge.

Date	pH	conductivity	amoniacal-N	total N	diss inorganic N	diss reactive P	CBOD	turbidity	Sus solids
10/04/2012	6.9	738	0.081	39	28	8.3	80	55	110
16/05/2012	7.6	855	56	89	70	13	60	50	68
13/06/2012	7.5	772	53	75	58	9.8	80	40	62
20/06/2012	7.8	761	52	61	55	9.4	60	46	57
11/07/2012	7.5	823	28	51	38	7.1	80	45	55
15/08/2012	7.6	525	22	48	29	7.5	54	40	47
12/09/2012	7.6	502	22	37	27	5.8	26	40	40
16/10/2012	8.1	764	24	39	21	7.1	40	50	72
13/11/2012	7.8	931	43	50	47	10	60	55	74
11/12/2012	7.8	1109	52	60	53	15	80	33	50
15/01/2013	7.9	1,166	61	71	60	12	60	55	88
19/02/2013	7.7	983	65	86	82	17	60	28	69
12/03/2013	7.9	1,439	81	95	86	20	60	40	74
16/04/2013	7.8	876	43	63	60	18	60	55	71
21/05/2013	7.6	852	64	64	68	14	60	70	111
11/06/2013	7.6	711	45	62	40	11	80	60	96
9/07/2013	7.8	608	39	43	42	7.2	60	38	95

Table 5: Total Suspended Solids (TSS) readings

2.3.12 RATE OF REMOVAL

After outlining the problems experienced attempting to accurately measure the sludge volume, it is necessary to point out that accurate measurement of sludge is only necessary to determine the rate of removal. Once we have determined the rate of removal and therefore the cost per m³ of removal, the accurate measurement of the sludge becomes superfluous. As this technology for sludge removal is further proven on wastewater ponds, the cost will be based per unit of time rather than volume.

Using the results above and taking into consideration the costs incurred to date, we estimate a removal cost of approximately $7 per m³ of wet sludge. This is 15% of the equivalent cost for mechanical extraction and land filling of sludge from the Hawera WWTP oxidation pond 1. Because of the difficulty we have had in establishing these quantities we are using these figures as indicative until we can verify the mass of dry solids removed. We estimate the remaining sludge will be totally removed from the pond in the next 12 to 18 months. At that stage we will be able to accurately calculate the cost of removal with greater confidence. If it takes six months longer than anticipated it will be of little consequence as the overall cost savings remain significant.

3 CONCLUSIONS

Biologically removing sludge is a slow process. Where mechanical desludging could remove sludge in a six month period, the period of time required for biological removal will be 2 to 3 years. As a consequence planning needs to be more robust, but the financial and environmental impact gains are such, that it is worth the extra effort to plan for it.

For those that have been through the consenting process to physically remove sludge from treatment ponds and apply or dispose of it will know that it is a time consuming, expensive and frustrating process. These negative experiences are circumvented by biological removal.

Although there are still some unanswered questions regarding advanced microbial digestion it is apparent this technology provides a cost effective alternative for in-situ removal of sludge in typical Council wastewater ponds.

3.1 OTHER CONSIDERATIONS

As further ponds are treated further research will provide data on the fate of contaminants within pond sludges.

For example, we have not established whether heavy metals are accumulating in the bottom of the pond. Generally, sulphide is generated in the anaerobic conditions prevalent in wastewater pond sludges.

Sulphide is a very effective precipitating agent and can cause long term precipitation of heavy metals including Zn, Cu, Cd, etc. Providing the sludge has been exposed to sulphides over a suitable period of time, it is likely a metal precipitation will occur and will immobilize heavy metals. In theory, as you digest the organic component, through bio remediation the insoluble, metal precipitates will tend to concentrate.

3.2 THE STDC VIEW

Based on the results to date STDC have committed to an expansion of the Advanced Microbial process to its 2nd wastewater pond at Hawera, and this began in May 2013, STDC intends to apply the same process at its Waverley pond, beginning in summer 2013/14. The Council considers that based on the reduction rates already achieved at Hawera WWTP, it will save significant amounts of capital for those ponds by removing or significantly deferring the need the need for mechanical removal of sludges.

ACKNOWLEDGEMENTS

Vikki Kuyl, Wastewater Treatment Technician, South Taranaki District Council (photos, fieldwork)