2009

David Saxby

Chris Carlton

September 2009

Introduction

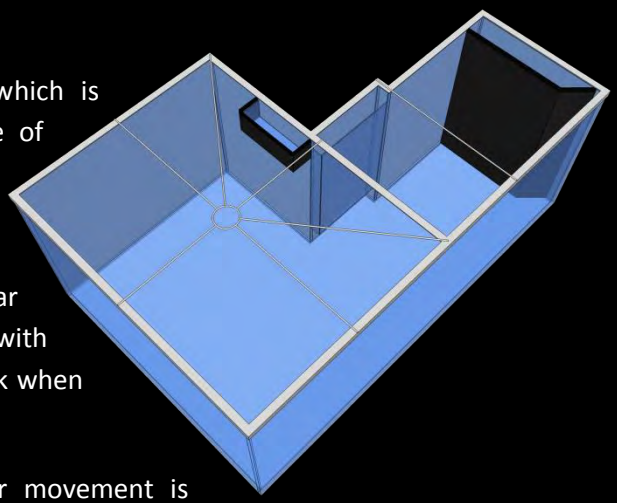
Much has been made of David Saxby's tank over the years and whenever it is mentioned or featured it always attracts comments. Unfortunately, you will occasionally read or hear comments like "You don't think he actually looks after that himself", "He has people come in and do it for him" or "It is amazing what money can do". Strangely for one reason or other this tank for some is a very emotive subject. Everyone is entitled to their opinions irrespective of these views being born out of sheer ignorance and/or envy! As for me, I'm fortunate enough to have known David for a while now and I've had the pleasure of seeing David and His Tank! Believe me when I say this is David's tank and David's alone!! Yes, he's not as spritely as he once was and coupled with being a frequent business traveller it's understandable that he has to accept help every now and then.

Help or not, David is still very much hands on – there is not much that stops him clambering up a set of ladders to reach into the tank. I remember a night watching him build something to stop a troublesome tri-colour tang nibbling on a gargantuous clam. It's quite a thing to duck out the way of hot acrylic pinging across the kitchen whilst he's fashioning some huge cover right there on the kitchen worktop, using a kitchen knife from the top drawer! And, let's not forget the drill bit that was sitting on the gas hob glowing red because we couldn't find the drill! Make no mistake... this man is reefing-mad just like the rest of us! There are plenty of stories that could be recalled and shared but those are for another day.

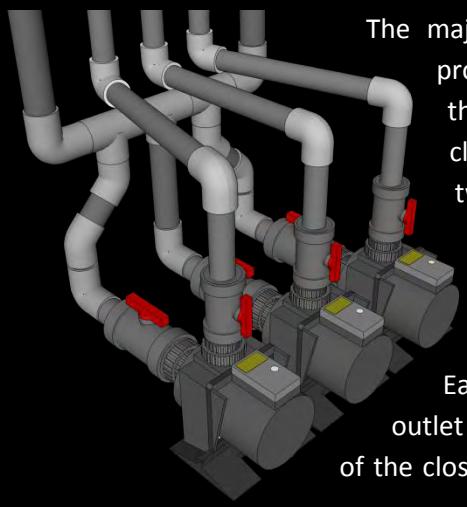
Past articles and features on David's tank, even our very own Tank of the Month, have been hung up on the beauty and the vastness of it. There is nothing wrong with this but it does not really go into any great detail about how it works and why it works. There is a lot to be learnt from this system and this is my attempt of learning, understanding and documenting the 'guts' of this awe-inspiring system. One thing to consider here is that even grand as it is, this system is just like any other – it is not safe from being tinkered with, adjusted here and there, or being overhauled! Like any other reefer David is not one for resting on his laurels and between drawing the images you'll see a little later on and writing this introduction David has yet again tweaked the system resulting in a redraw!

The Display Tank

Many years back during the planning phase of my own system Martin Lakin told me “whatever you do, build the biggest possible box of glass that you can – you can deal with the equipment later – once glass is there it’s there!” The tank, or at least the glass, is one of the few things to have remained constant throughout the life of this system.

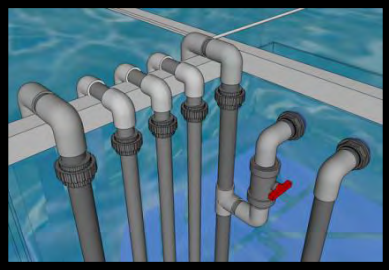


The tank was constructed with a floating base which is paramount in sizeable tanks as it allows a degree of flexibility in each pane of glass without putting any additional stress on the bottom panes. Supporting the top of the 4’ tall glass panels is a metal collar which slips over and around the entire tank. The collar is braced across from side to side and front to back with the metal rods which allow greater access to the tank when compared to traditional glass bracing.

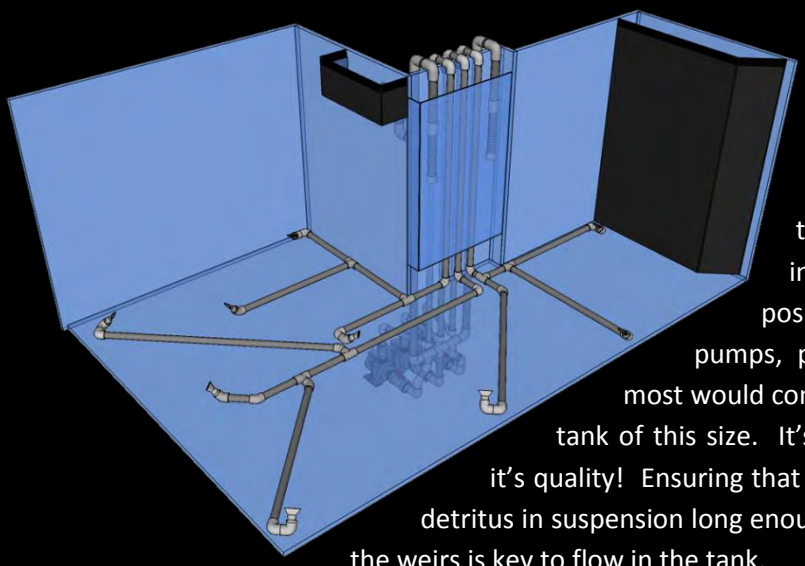


The majority of water movement is provided by a three pump closed loop system that is controlled by the wave function on the IKS computer system. Water for the closed loop pumps is drawn from a 40mm pipe manifold that has two inlet pipes positioned behind a false weir within the tank. The pipe work for the closed loops goes up and over the top of the tank rather than through the bottom or side of the tank. The only holes drilled in the tank are within the weir boxes.

Each of the closed loop pumps has a ball valve on the inlet and outlet that allow them to be isolated and removed for maintenance. All of the closed loop pipes have a union connector just below the top of the tank before they go up and over into the water. This allows for periodic removal of the pipes for cleaning and/or replacing if necessary.

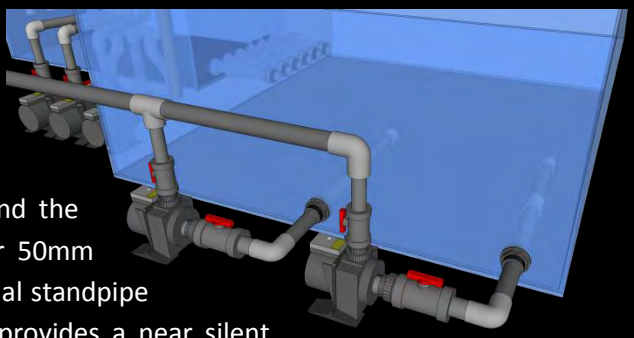


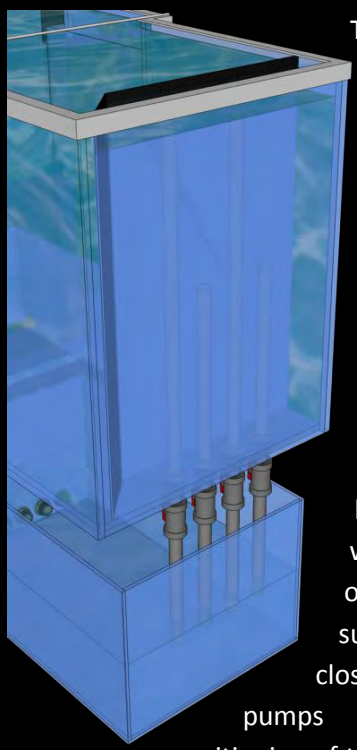
In the weir adjacent to the closed loop intake weir an additional tank connector has been added. This is connected to one of the closed loop intake pipes but isolated by a ball valve so when the pipes and pumps need priming after maintenance it is a simple a matter of opening a valve, flooding the pipes and then closing the valve. Simple, straight-forward and effective!!



Buried within the coarse substrate of the tank is a spiders-web of pipe work that makes up the final part of the closed loop system. Each return pipe, after it reaches the bottom of the tank, is split off to feed three individual outlets that are strategically positioned around the tank. Three pumps, plus the sump returns, is not what most would consider a sufficient amount of flow in a tank of this size. It's not about quantity of flow though, it's quality! Ensuring that there are no dead spots and keeping detritus in suspension long enough for it to make its way up and over the weirs is key to flow in the tank.

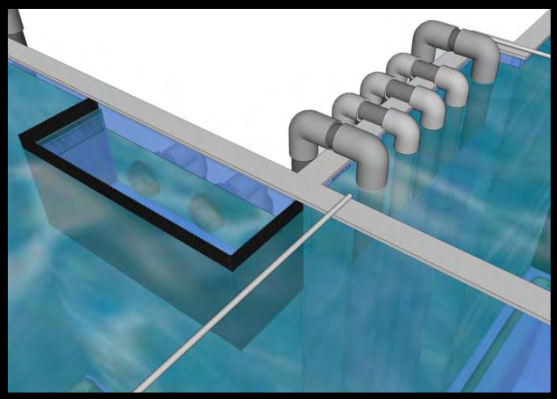
The closed loop pumps are complimented by two Deltec HLP return pumps which return just below the surface of the tanks small side as this is the furthest point from the main weir.





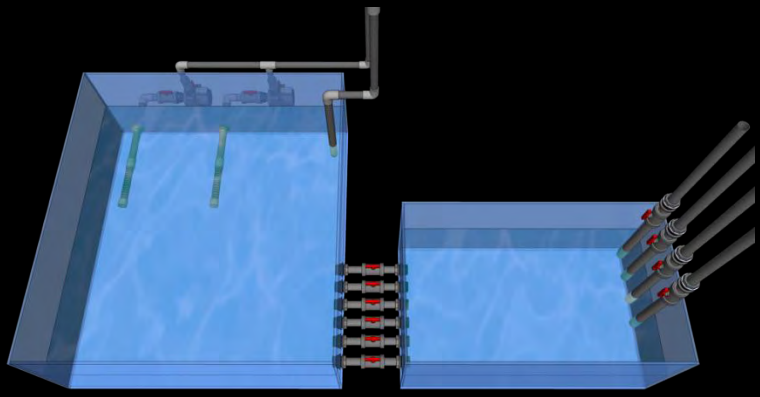
There are two weirs and the largest contains four 50mm pipes setup in the dual standpipe configuration which provides a near silent operation. This larger weir spans 38'' across the tank at the end of the largest viewing side. This weir handles most of the water transition between the tank and the sumps below.

The second weir which is tiny in comparison to the first is located next to the closed loop intakes. Whilst this does not compare to the first weir in terms of water volume it still has an impressive 30'' linear overflow length. This weir has two holes drilled, one leads directly to the sump and the other to the closed loop intake to prime the pumps when necessary. The positioning of this weir, on the inner corner of the L shape, is paramount as it helps take water from this section of this huge tank.



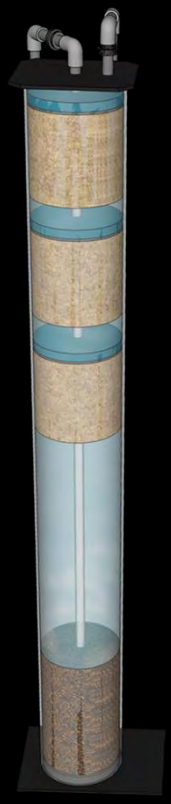
As a spectator of the tank you are completely unaware of the weirs presence due to the natural looking rockwork and extensive coral growth. If you look close enough you can see the teeth of the weir combs but you've got to know they are there and you have to be looking for them!

The sumps

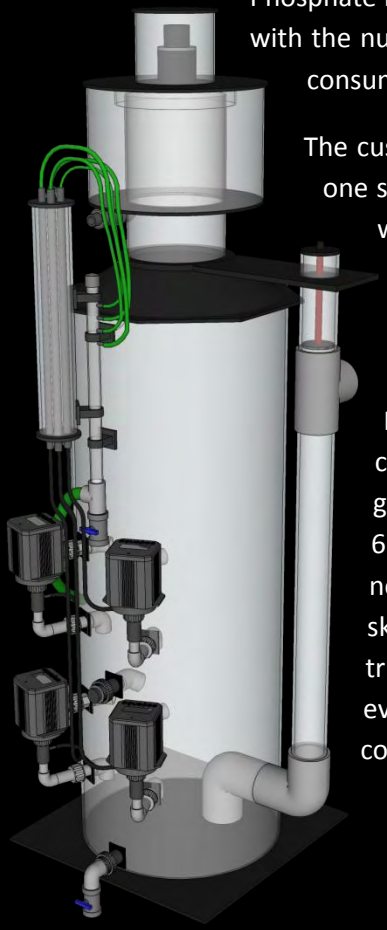


Underneath the tank are two separate sumps which are joined together by six 50mm pipes, each with ball valve to allow isolation of the sumps for periodic cleaning. The smaller of the two sumps is just over 4' by 2 $^{1/2}$' by 2' deep would be able to hold 130 gallons if full. The larger sump is almost a 5 1/2' by 5' by 2' and capable of holding over 300 gallons. During normal operation the sumps run with a maximum water height of 12'' despite there only being approximately 20 gallons of water draining down from the tank in the event of power failure or switching off the return pumps.

The cupboard



The cupboard that resides next to the tank is overflowing with equipment and electrics. They are packed in here tighter than sardines in a tin. In this cupboard, not that you can see all of it, are the closed loop pumps, a custom built skimmer and a custom built Phosphate Reactor, as well as an Ozone Generator, an IKS system along with the numerous plug bars and finally all the other plug sockets and consumer units.



The custom Phosphate Reactor is not for your average tank! This one stands at just over 5' tall, takes 5ltrs of ROWAphos every six weeks and holds an impressive 12 gallons! Not only is it custom in height but there are three sections in the top half of the reactor for placing filter mesh and floss to stop any unwanted particles making their way into the system.

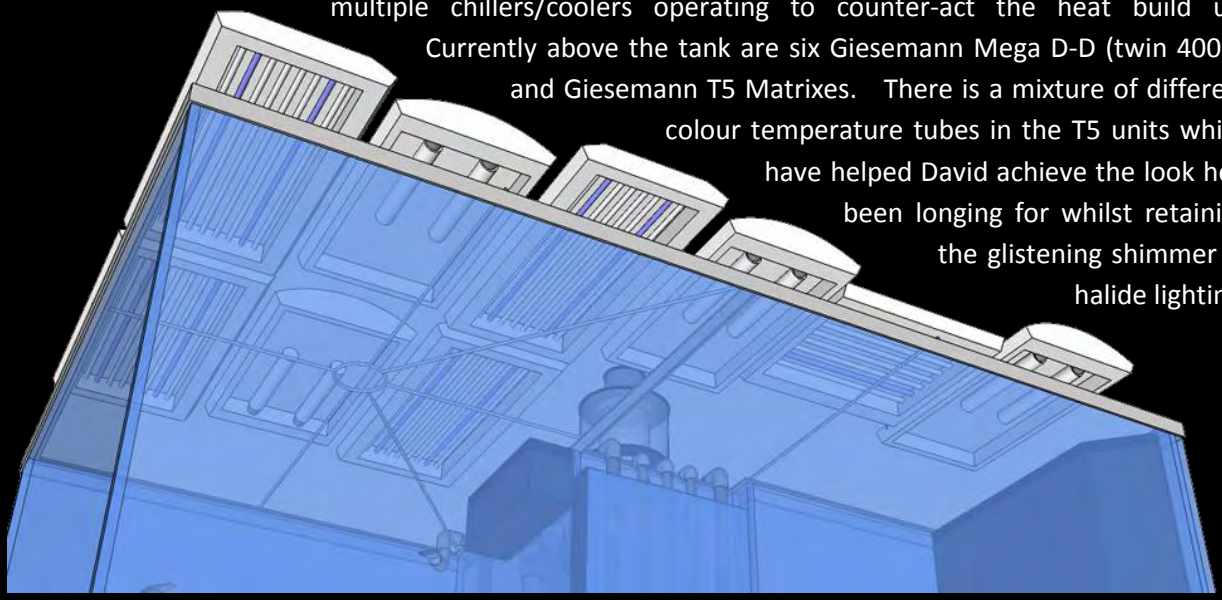
Having been designed specifically for this cupboard the custom skimmer is in a league of its own. Holding over 35 gallons of water this behemoth of a skimmer stands just over 6' tall with the main chamber being almost 4' in height and nearly 5' in circumference. Make no mistake - once this skimmer was in the cupboard it was never coming out! That's not entirely true - it does come out but it has to go up over the tank! With that in mind everything has been positioned on the front of the skimmer to ensure it's completely accessible for maintenance. An Aquabee pump feeds the

skimmer from the sump below and is then returned to that same sump. There are four Aquabee recirculation pumps, each fitted with the Deltec pinwheel to guarantee the maximum amount of air possible is fed into the skimmer chamber. Each of these pumps provides 1,500 litres of air every hour into the chamber. David has built a custom ozone chamber which is fixed to the side of the skimmer chamber. There is one feed pipe in from the ozone generator that currently splits off to feed each of the pumps. I say currently because knowing David he'll build something else before I've finished writing this! Another customisation, which is now a feature of the new Deltec Skimmer range, is the micro adjustable gate that sits upon the top of the return pipe. This replaced the traditional ball valve on the skimmer outlet and guarantees that you can get the precise optimum height of water in the chamber to ensure the skimmer is working at its most efficient. Access to the skimmer cup isn't that straight forward considering the space to work in and the height at which the cup sits. The skimmer cup is fitted with a self-cleaning head and is connected directly to waste. It's flushed so often that you never get the build up of what can be a nasty skimmer cup smell!

The IKS computer system and the plug-bars have been mounted on the back of the door to maximise the space within the cupboard. The Giesemann HQI lights are not controlled by the IKS system, these are still connected using the traditional method of contactors and digital timers. The Giesemann T5 Matrix units are connected to the IKS system, as are the closed loop pumps.

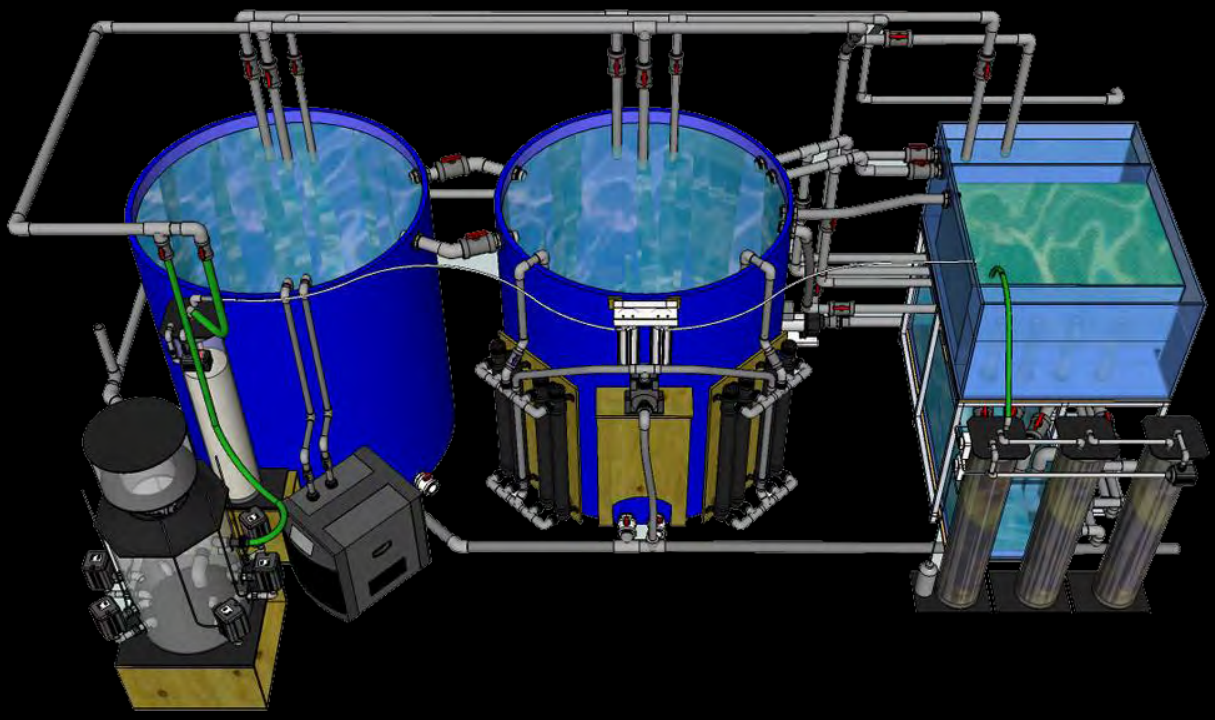
Illumination

David is a great believer in T5 lighting but despite this you cannot avoid needing stronger lighting on tank of this depth. T5 lighting wouldn't punch enough light down to corals lower in the tank and those on the substrate. They may survive but they would not thrive like we want them to. There have been many variations of light and units above the tank including numerous 1000 watt pendants and twelve twin 400 watt Giesemann Mega D-D coupled with D-D razor units. These certainly put enough light into the tank but they also added to the electricity bill given the costs of running them and then needing multiple chillers/coolers operating to counter-act the heat build up. Currently above the tank are six Giesemann Mega D-D (twin 400w) and Giesemann T5 Matrixes. There is a mixture of different colour temperature tubes in the T5 units which have helped David achieve the look he's been longing for whilst retaining the glistening shimmer of halide lighting.

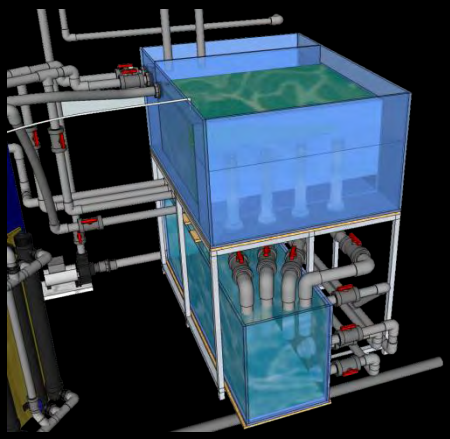


Sump Room One

This is where the vast majority of equipment and water filtration takes place. Water is pumped here from the sump beneath the display tank via a 40 metre long 40mm flexi-pipe which journeys its way up over the tank, through the ceilings of bedrooms, the kitchen and the hall way before it reaches daylight. It then winds its way around the courtyard into the sump rooms and directly into the two BIG blue VATs. Each VAT holds approximately 350 gallons of water and excluding the display tank these are the biggest water containers in the system. They stand an impressive 5ft tall and would need at least three people to join hands to reach around them!

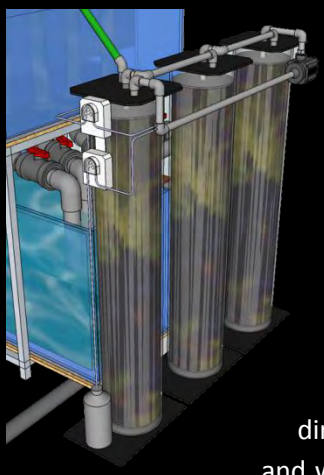


These two vats are connected to each other via three 40mm pipes to allow water to pass between them. The left VAT (Blue VAT 1) directly feeds a D-D Chiller that helps maintain the temperature in this part of this vast system. A Deltec HLP Pump takes a feed from one of the connecting pipes between the two vats and supplies water to two D-D 4x39w UV Units which return to the right VAT (Blue VAT 2). The vats also directly feed the two glass sumps in the room as well as having a pipe linking straight to the drain when they need to emptied and cleaned.



The two glass sumps are positioned one above the other flowing end to end and top to bottom. The top sump holds approximately 110 gallons (500 litres) of water and contains a substantial caulerpa bed which is lit 24x7 by a T5 unit. The caulerpa is harvested periodically to remove nutrients and to encourage further growth. The water leaves via four

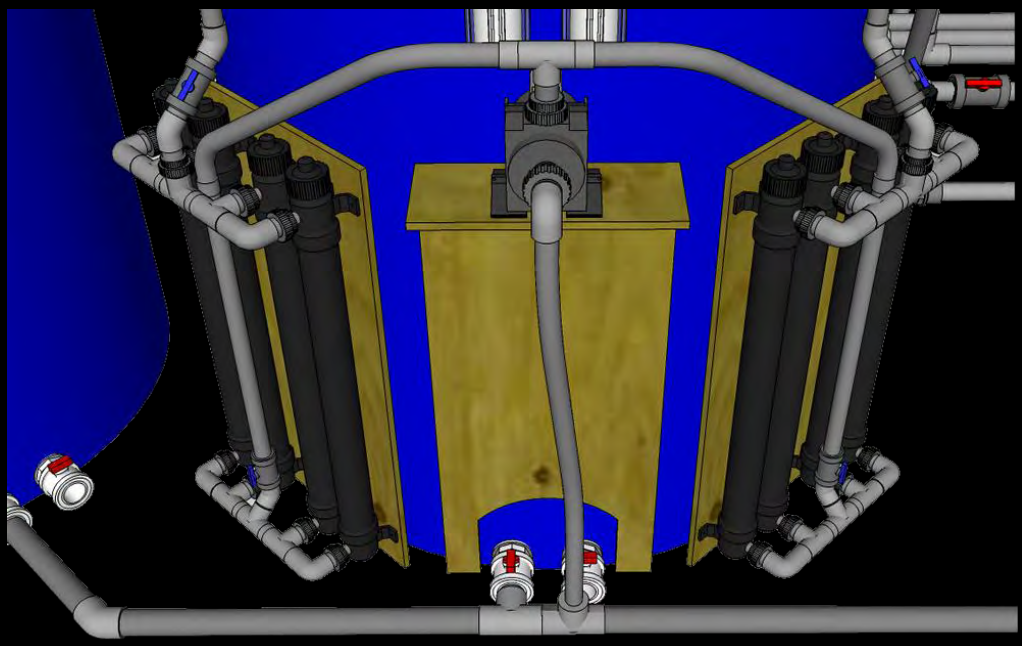
standpipes to the bottom sump. The bottom sump contains a heater matrix which is made up of several 500w titanium heaters. There are also heaters placed within each of the vats to allow for independent control when the vats are isolated as well as ensuring a balanced temperature throughout the system. Monitoring and control for all the equipment in this room is provided by an IKS system.



Water from the bottom sump is circulated to the other equipment in the room as well as feeding a sump in the second sump room. Water is pumped to equipment in the room by an external Sequence Pump that feeds a 40mm pipe ring that runs around the ceiling of the room. With the pipe ring above your head and out of the way, it is very accessible which makes it very easy is adjust the flow to the equipment and even add new equipment where necessary. Water from the ceiling ring is supplied to a Deltec 1006 skimmer, a Deltec PF1001 Calcium Reactor as well as feeding water to the blue vats. Until recently it also served water to the three Deltec NFP1020 Nitrate Filters but this has been changed as they are now directly fed by a Bellows pump. All three Nitrate filters are linked to each other and water is pumped from one to the other in a continuous loop. The adjustable Bellows Pump takes water from the bottom sump and returns it via the filters to the top sump.

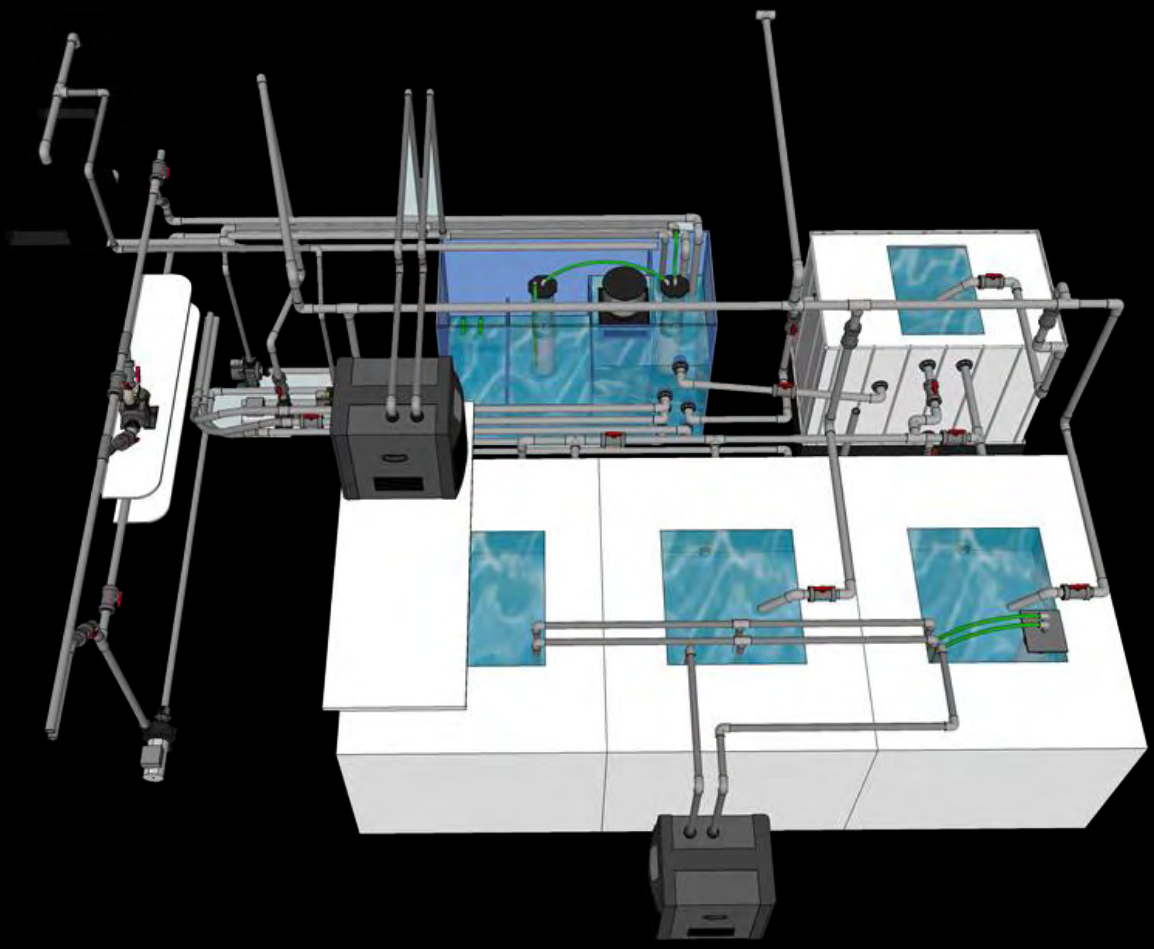
Even though it is connected to the ceiling ring, the Calcium Reactor is supplied water by two adjustable dosing pumps placed between the ring and the reactor. Such equipment requires exact measure and control and ball valves alone would not provide this. The return from the Calcium Reactor passes through a DIY degassing chamber which helps raise the pH level before it's returned to the caulerpa section of the top sump.

To help maintain the air temperature in the room David has installed a wall mounted air conditioning unit. With lots of equipment operating and warm water passing through the room it is naturally a very warm, and sometimes uncomfortable, place to be for any great length of time.



Sump Room Two

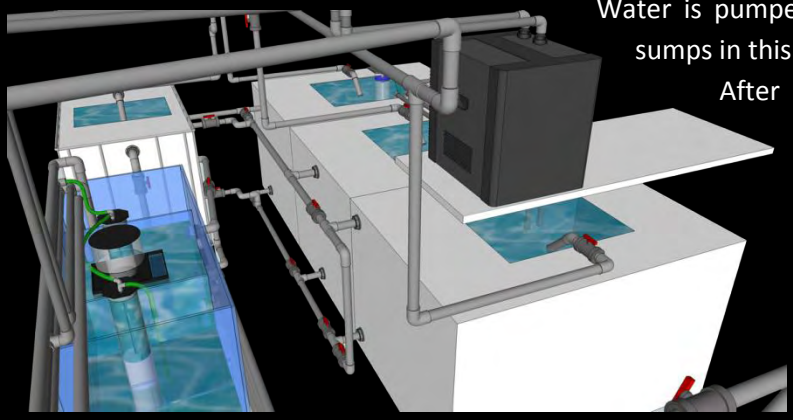
If you thought the plumbing looked complex in the first sump room then another layer of complexity is added in here. There are no less than 19 tank connectors joining five sumps together and over 40 ball valves controlling the flow and isolation of the equipment and sumps.



All the water from the first sump room flows into the glass sump via three 40mm pipes and from here it is distributed around the room to further sumps and equipment. Water from this glass sump is returned to the tank via a Spec pump that is hidden behind the door as you enter the room. It is impossible to get an equal flow rate in opposite directions despite having two identical pumps at either end. With this in mind the flow between the sump rooms and the tank is controlled precisely by float switches in the sumps. The Spec Pumps are on their own electrical ring main and the float switches decide which pump is turned on and which is turned off by controlling the flow of electricity. They are constantly monitoring and switching the pumps to ensure a balanced flow of water is achieved between these two locations. Given the huge volumes of water being moved between the sump rooms and the tank there is a third float switch in each sump which acts as a dead mans switch. Should the either of the float switch pairs fail the third switch kills the ring main thus stopping the pumps and flow until the problem is located and repaired. The ring main has to be reinstated manually to restart the pumps. There is no computer control or intervention for the operation of these pumps.

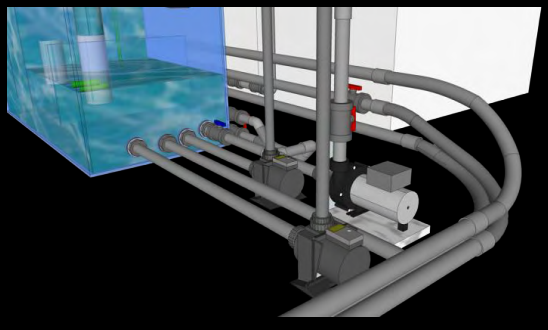
The last chamber of this glass sump is the lowest point in the system and this is where the float switches for the top up system reside. The excitement and anticipation of entering the heart of the system makes most visitors completely unaware that they have stepped down into this sump room!

There is no top up reservoir for this system as the twin pumped RO units produce water quickly enough to keep on top of the huge evaporation rates. The IKS controls the RO Units so that they are only operational for a maximum of 90 minutes each morning. This is enough time for them to refill the system and return the water level back to it's intended volume. Should a float switch failure occur then after 90 minutes the IKS turns off the RO units and their flow of water which prevents a flood. Running the units like this helps preserve the pre-filters and membrane longer and it also dilutes the high TDS water that is produced in the first few moments of switching on an RO unit.



Water is pumped from the glass sump to the other sumps in this room via an external Sequence Pump. After teeing off to feed each of these sumps, the pipe extends through the wall back to the first sump room where it also feeds the two blue vats and the top glass sump. Three of the sumps in this second room are 220 gallon (1000 litre) containers and when isolated these are used for the four weekly water change regime. The water change process is very slow and very deliberate, and usually completed in 4 - 5 days. The vats are isolated, drained and given a thorough clean before being refilled by the two pump driven RO units. The salt is added to the vats and given a thorough mixing before being raised to the temperature of the tank (25 degrees Celsius). After the mixing process is complete the valves are opened to slowly release the newly made water to the rest of the system. As you'd expect David uses his own salt on his system and in recent polls it's been voted the no. 1 used salt by UK reefers. What may come as a surprise is that having tested numerous formulas of salt David then guinea-pigged his own tank as the test bed to prove the salt prior to its release. Proving an unknown on one of the most famous privately owned tanks in the world is a little bit scary.

Within two of the three water change vats is an Aquabee Pump that circulates water to the other two vats as well as within its own VAT. The third vat also contains an Aquabee Pump but this feeds a custom built Phosphate Reactor and a D-D Chiller. You may not think it but David is quite a dab hand at DIY! He built the Phosphate Reactor from various components of old equipment and standing at nearly 4' tall it's quite an impressive piece of work!

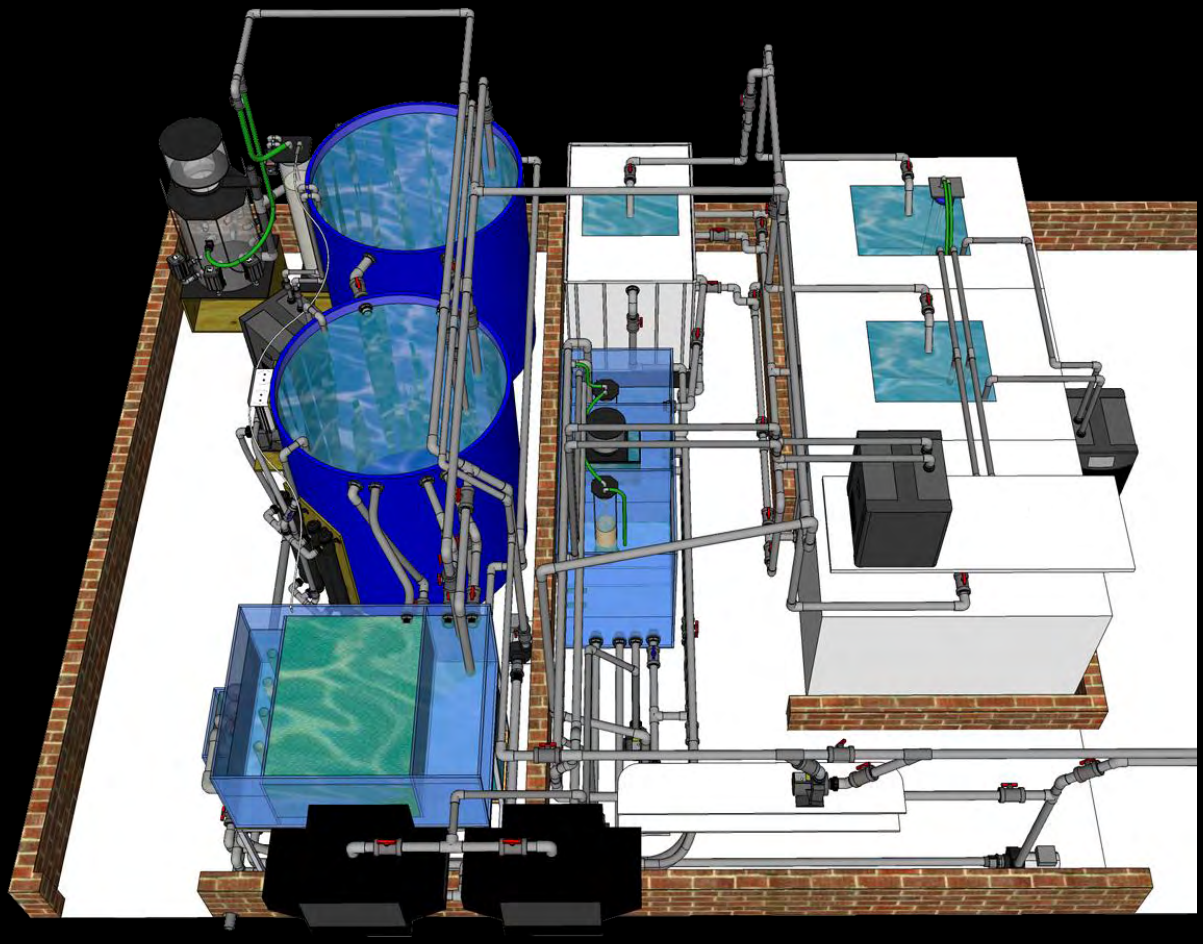


In addition to the connectors for the Sequence Pump and the Spec Pump in the last chamber of the sump there are also two connectors for two Deltec HLP Pumps. One of the pumps supplies water to two Deltec Eco-

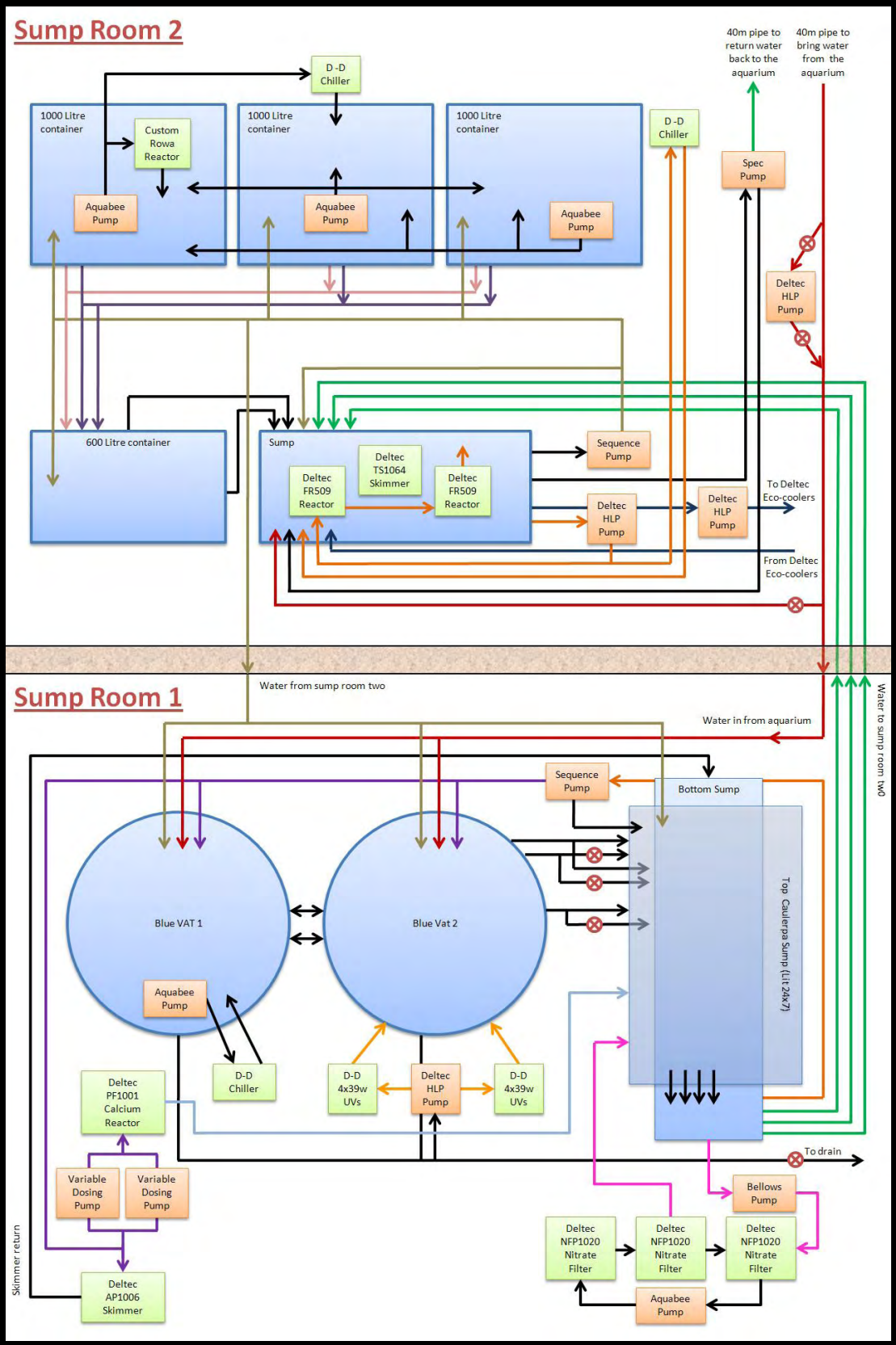
coolers which are housed in an external shed out in the courtyard area. Water returns back from the coolers under gravity to the first chamber of the sump. The second Deltec HLP Pump splits off and feeds another D-D Chiller which sits atop a shelf above the first water change vat. The pump also feeds two Deltec FR509 Reactors which sit in series with each other inside the sump itself. The water returns to the sump where it can then be distributed around the sump rooms or back to the tank. Also sited in this sump is a Deltec TS1064 skimmer which skims the water one last time before returning to the tank.

As you'll have no doubt spotted there are very few single items of equipment. There are three skimmers, three phosphate reactors, three nitrate filters, three chillers as well as two eco-coolers, three water change vats, three closed loop pumps, two return pumps, two RO units, IKS systems… the list goes on.... and this is all very intentional. With a system of this size there has to be redundancy in place. You simply couldn't remove the only skimmer for maintenance and not expect the system to suffer during its absence regardless of that absence being planned or not. Each piece of equipment is backed up by another piece of equipment.

Each and every piece of equipment and sump or VAT is independently controllable, and isolatable, which on a system this size is paramount given the constant maintenance schedule.



Water Flow around the Sump Rooms



Concluding

Throughout time there will always be advances in this wonderful hobby of ours. The tried and tested techniques and methods will always work but that should never stop us from wanting to do better and achieve more. Having seen this system going through various changes it's clear that David will never stop trying to better than what most of us can only dream about coming home to. It's testament to David that time and time again he puts his tank on the front line to test and prove these advances.

The first time I met David and cast my eyes on his system I was accompanied by Martin Lakin. As we made our way down to the sump rooms he turned to me and said "Whatever you do Chris, don't try to understand what you're about to see, and certainly don't try and draw it. Only David knows how it all goes together and works."

No longer is that true! I've seen, I've learnt and I've understood. Hopefully, there are a few more that now do too!