Bluepools Clear Clean Water

Proposed Upgrade of the Swimming Pool
at The xxxxxxxxxxxx School, XXX XXX

Report on the Inspection of Indoor Swimming Pool and the Identification of the Development Options

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1 Introduction

1.1 Background

Bluepools Ltd is a swimming pool consultant and was commissioned by Mr Richard Beeson, the Estates and Facilities Manager at Merchant Taylors School Crosby to carry out an inspection and provide a report on the Development Options for the swimming pool at the xxxxxxxxxxxx School

The Report on the Development Options will be used by the School as the basis of a project to upgrade and modernise the facility.

The Inspection was carried out by Mr Will Witt B.Eng. C.Eng. M.I.C.E, assisted by Ms Rebecca Witt on Tuesday 26th November 2019.

1.2 The Brief by the xxxxxxxxxxxx School

This proposal has been prepared in response to the Email brief to Bluepools as follows:- "

As discussed over the phone, I need to get a structural survey done of the pool and I am hoping you can give me a quote for the comprehensive survey we discussed over the phone.

As you will see from the photos there is obvious movement in the walls and I need to be able to present to the directors and health and safety committee a comprehensive survey and plan of action moving forward. I have managed to gain some costs to run the pool for the last 3 years , however they do not include heating. This weekend we nearly had a fire due to the gas heating system overheating so this survey is critical now.

I am here to answer any questions you may have and I would be grateful for a breakdown of the survey you would be able to provide the school and the costs associated. Apologies for the quality of the photos I will try and improve them and send them over again."

1.3 Response to the Brief by Bluepools Ltd

1.3.1 Response to Brief

"I refer to our telephone conversation and am pleased to provide this proposal to assist and advise you on the renovation of the swimming pool at Xxxxxxxxx School, XXX

I am a Chartered Civil Engineer myself and have specialized in the Swimming Pool Industry for the past 15 years. I will be able to tell whether there are any fundamental problems with the pool tank from a visual inspection without emptying the pool. From the photographs it looks as though the installation of a modern Alkorplan type liner will cure the structural problems and a liner will also be a lot less costly to install than re-tiling.

With a pool of this age it is highly probable that that are other issues that need urgent attention, especially as Health and Safety standards nowadays are far more stringent then they were when the pool was built.

To provide the best advice we will need to both inspect the pool and discuss the problems with yourself and the operational staff in detail so that we can tailor our report to meet all your requirements.

We would carry out the inspection and provide the report on the basis described below.

The main principle underlying the report would be to identify any aspect of the current pool operation and maintenance procedures that do not comply with modern commercial pool standards. These include HSG 179 - Managing Health and Safety in Swimming Pools and the Code of Practice issued by PWTAG - The Management And Treatment of Swimming Pool Water.

Energy conservation has become dominantly important in the commercial pool industry and modern equipment can often recover the capital cost in a few years of operation.

Hence the purpose of the inspection and report will be:

• To inspect the pool and report on its current condition and fitness for use.

• To identify any pool plant and equipment that does not comply with modern industry standards and provide an estimate of the cost of replacement.

• To identify the pool plant and equipment that could be be replaced by more economical equipment and provide an estimate of the cost.

• To identify any Health and Safety issues and/or non-compliance with HSE legislation (A new Operations Manual with detailed maintenance procedures will need to be produced during the Project Design Stage and so will not be included in the report).

• To identify the best approach for the renovation and updating of the pool and provide a preliminary cost estimate of so doing.

Bluepools is familiar with the typical electrical control panels and cabling systems in pool plant rooms but is not professionally qualified to report on their adequacy. And so Bluepools will comment on the electrical system where there are any obvious issues but will not attempt to identify where the installation does not comply with the Current Electrical Regulations.

The survey is restricted to the matters described in the Report Brief but where there are any obvious breaches of statutory requirements such as the Building Regulations they will also be noted in the Report.

1.3.2 Qualifications

The Inspection and Report will be undertaken for the purpose of identifying the current issues that need to be dealt with during the Upgrading of the facility and will not provide advice on any operational deficiencies that may not comply with the Standards referred to in Section 1.4 below.

1.3.3 Project Stages

This Report should be considered as the First Stage of a 3 Stage process and will consist of a technical assessment of the Renovation Options with Preliminary Cost Estimates

The Second Stage will include the testing of the existing concrete tank, the detailed design of the Renovation Works, the preparation of Contract Documents and the accurate identification of both Capital and Operating Costs

The Third Stage will involve Construction and the Installation and Commissioning of the pool plant and equipment.

1.4 Codes of Practice and Legal Requirements

It should be noted that there are no statutory requirements for the quality of swimming pool water and pool hall air in School Swimming Pools in the UK.

The industry generally follows the Pool Water Treatment Advisory Group (known as the PWTAG) Code of Practice. This is not mandatory and many swimming pools in schools do not meet the standards recommended in this Code of Practice.

However in the event of an accident or illness it is very probable that the School Governors would be held liable to have failed in their "Duty of Care " obligations if they have not complied with it. Furthermore the reputation of the School can be badly damaged by any incident where the health of pupils using the pool is put at risk.

So the Report will identify the elements of the existing pool plant and equipment that do not currently meet the recommendations of the PWTAG Code of Practice with regard to water and air quality.

The operational management recommendations of the PWTAG Code of Practice will also need to be met when the pool has been renovated.

The HSE document HSG179 Managing Health & Safety in Swimming Pools is also relevant and the detailed requirements of this document will need to be be considered during the detailed design stage of the renovation project.

The existing pool was built long before the Disability Discrimination Act came into law and it may be difficult to comply with all the requirements of this legislation. It is normal practice to follow the recommendations of the Guidance Note “Access for disabled people” issued by Sport England. This aspect will need to be dealt with during the Design Stage of the Project.

2 The Facilities

2.1 General

The pool appears to have been maintained and operated to the standard that would be expected in a school swimming pool and the water was fairly clear but not sparkling as should be the case in a modern pool installation.

All swimming pools in schools must be classed as commercial pools according to the PWTAG recommendations.

2.2 The Enclosure

The pool was originally built for use as an outdoor facility but has been covered with a sliding pool enclosure that allows the pool to be uncovered during warm weather and closed during cold weather so that the swimming season is extended into the spring and autumn.

If the pool water is heated up to a comfortable swimming temperature (27 °C for fitness and 30 °C for leisure) the evaporation rate causes the environment within the enclosure to become uncomfortably humid leading to a point where the water vapour is visible as mist.

A gas air heater was being used to dry the air but this was never satisfactory because of the lack of dehumidification equipment resulted in a situation where the enclosure had to be opened to maintain air quality.

2.3 The Swimming Pool

The pool appears to consist of a 200 mm thick reinforced concrete tank with a tiled finish. The pool was full of water and so an inspection of the tank floor was not possible but the walls were fairly perpendicular and there was no sign of significant structural cracks. Hence it is considered that the tank is probably in reasonable condition and suitable for the installation of a modern commercial grade vinyl liner.

Further testing will be necessary during Stage 2 of the project.

The pool is about 25m long x 7.3m wide. There is a 200mm high dwarf wall around the pool perimeter – this is considered to be unsafe in a modern pool installation.

The water depth at the shallow end of the pool is 1.1m.

At 5.3m from the shallow end the pool is 1.3m deep increasing to 1.4m at half way (12.3m from the shallow end) and then deepening to 2m at 17.2 m from the shallow end and this is maintained up to the far end of the pool. This results in a pool water volume of about 300 cubic metres.

2.4 The Pool Plant and Boiler Rooms

The pool plant room is located about 8.5m from the deep end of the pool and the pipework runs underground from the plant room to the pool.

The Boiler room is next door and the 2 x gas boilers provide heat to various school buildings as well as the pool. The pool heating water is circulated into a steel concentric tube heat exchanger via a pipe through the wall between the boiler and plant rooms. The water is circulated by a Grundfos 1kW central heating type pump.

2.5 Pool Equipment

2.5.1 Pool Wall Equipment

The pool has 4 x inlets at the shallow end and 2 x Skimmers at the Deep End with 2 x large (410 x 410) floor outlets a few metres away from the deep end. The pipe running from the two floor inlets is 75mm in diameter

The maximum suction flow rate through the 2 skimmers and 2 main drains on a 65 / 35 % split in accordance with normal practice is about 25 m^3 per hour . The maximum return flow rate through the 4 water inlets is 25 – 30 m^3 per hour.

We do not have detailed drawings of the pipework and diameters and so the figures in this section are preliminary.

2.5.2 Bathing Load

The recommended maximum bathing load for a pool of this size and depth is about 60 people and it is assumed that this is unlikely to occur at the xxxxxxxxxxxx School. The daily bathing load based on a maximum bathing load of 60 is 60 x 12 x 50% = 360 using the using the PWTAG recommendations.

The accepted rule of thumb is that the pool water circulation rate is equal to the bathing load x 1.7 and this amounts to 60 x 1.7 = 102 m^3 per hour . The actual maximum circulation rate is 25 m^3 per hour (return rate through the water inlets) and this implies that the maximum bathing load should be limited to about 45 people

2.5.3 Pool Pumps and Filters

In the pool plant room there is 1 x Caldepa 5.6kW pump rated at 96 m^3 per hour at a 10m head and 2 x Lacron CL42 filters that will process about 85 m^3 per hour.

2.5.4 Pool Water Turnover Rate

The pool water turnover rate is equal to the pool water volume divided by the circulation rate and so in this instance is 300 / 25 = 12 hours. The recommended rate for public pools up to 25m long with a 1m shallow end is 3 hours and a maximum 1.5 hours for learner pools.

The large pump and filters are relatively new and must have been installed quite recently in the light of the knowledge that the pool circulation rate is far too low. Unfortunately this will mean that the suction of the two floor outlets will be much higher than is advisable and there is a danger of entrapment. The higher pipe velocities and pressures may also cause other problems in due course.

2.5.5 Pool Water Disinfection and Treatment

The pool disinfection is managed by a modern “Bayrol Compact” controller that continuously measures the pH value and chlorine concentration of the water as it is delivered into the plant room from the balance tank and injects the correct amount of sulphuric acid and calcium hypochlorite to maintain the correct pH and chlorine concentration levels.

The PWTAG Code of Practice strongly advocates the addition of coagulation dosing and UV or ozone water treatment systems. Neither of these are provided at the xxxxxxxxxxxx School pool.

Coagulation dosing is designed to agglomerate Cryptosporidium and Giardia cysts into large particles that will be trapped in the sand filters. Otherwise the cysts will remain in circulation as they are not killed by chlorine. Cryptosporidium is the most common cause of severe diarrhoea outbreaks in swimming pools. The most common dosing agent in current use is Polyaluminium Chloride (PAC).

Ultra-Violet or Ozone treatment systems are also advocated by the PWTAG Code of Practice. Basically these systems do the same thing as chlorine but do not involve the dosing of pool water with chemicals. Some residual chlorine is required because neither UV nor ozone kill all the pathogens than can exist in swimming pool water. But the amount of dosing and so the volume of chemicals required is substantially reduced.

2.5.6 Air Handling Unit

There is no heat recovery system in the old air heating sytem at the xxxxxxxxxxxx School and as a result most of the heat energy being put into the pool water is being vented straight out into the atmosphere. This is now illegal under the modern building regulations.

Modern AHU's are extremely economic to operate because they carry out the following on a continuous basis:-

- Remove stale hot humid air from the pool hall and extract the heat energy from it and thus maintain the humidity at the level set on the control panel (normally about 60%).

- Discharge the stale air to the atmosphere, take in fresh air and heat it using the energy extracted from the stale air and more heat energy as required to the temperature set on the control panel.
- Maintain the pool water temperature at the level set on the control panel by measuring its temperature and adding the heat energy required.

Such modern AHU's do require a heat source to maintain the indoor pool air and water temperatures. This is normally provided by high efficiency condensing boilers that are designed to provide a Low Temperature Hot Water (LTHW) supply that provide water at about 65 degrees C and reheat the return water from about 55 degrees C.

2.5.7 Pool Water Heating

At the xxxxxxxxxxxx School building heating boilers are being used to provide heat energy to a heat exchanger in the plant room that heats the pool water.

If the average temperature difference between the pool water and outside ambient air temeperature in 10 degrees C it is estimated that annual gas heating costs are about £15,000 per annum at a gas price 3.56p / kWh and an average heating rate of 48kW per hour.

The equivalent cost using a air source heat pump with an average COP of 6 would be 8kW per hour and this would cost about £7,800 at a power cost of 10.8 p / kWh

2.6 Conclusion

The structural integrity of the pool tank needs to be examined and proven before any investment takes place but it is considered that the structure will probably be proven satisfactory following further testing. The existing tank can then lined with a new in-situ commercial vinyl liner that will rejuvenate the appearance of the pool and guarantee its water tightness.

The pool water circulation system at the xxxxxxxxxxxx School is inadequate when compared with the PWTAG standards of water circulation and could be enhanced by the installation of at least 8 new inlets and 6 new skimmers that will provide a pool water circulation rate of 100 m^3 per hour – this is about 4 times the current rate and it is very surprising that the water looks as clean as it does.

This will provide a pool water turnover rate of 3 hours and allow a maximum bathing load of 60 people in the pool at any one time and a maximum 360 swimming sessions per day.

The pool water disinfection system does not come up to the recommended operating standards for a commercial pool and needs to be improved to ensure that the health of bathers is guaranteed.

The best way to improve the water quality in a commercial swimming pool is by the installation of a deck level drainage system where there is a weir around the pool perimeter that continuously removes the thin layer of surface water where the pathogens are at the highest concentration and must be considered as one of the renovation options.

The existing enclosure probably has at least 15 years potential life but if it is retained a dehumidification unit based on heat pump technology should be introduced to maintain the internal environment at more comfortable levels. Replacing the gas based water heating with an air source heat pumnp would probably save about £8,000 per annum.

However the lack of a modern Air Handling Unit will ensure that the pool hall environment will never be really suitable for use as a teaching facility. If the enclosure is replaced with a steel framed building, complying with the Building Regulations and provided with an AHU and ducting the humidity, air and water temperatures will be fully adjustable and will probably reduce heating costs to less than £5,000 per annum. The air will also be changed and refreshed at a rate of 5 / 6 times per hour in full accordance with PWTAG standards.

The pipework that runs between the pool and the pool plant room are buried and completely inaccessible. If any pipe fails it is likely that severe damage would be caused to the pool and this needs to be resolved if it is decided to make a major investment in the renovation of the pool.

Because of the unsatisfactory air environment the enclosure is not really suitable for a swim teaching facility but it would have cost around £100,000 in todays prices and so retention must be considered as one of the renovation options.

3 Development Options

3.1 Considerations

To maximise the usefulness of this Report various Options were initially considered on the basis that they ccould be put in place as and when funds are available on a staged basis.

However after after identification of all the pros and cons it became apparent that there are only really two alternatives and these are to:

1. Bring an unsuitable installation up to a standard that complies with modern practice but that would still be inherently unfit for purpose

   or

2. To dispose of the enclosure and install a purpose built steel framed building

3.2 Option 1

This would bring the installation up to the commercial standard recommended by PWTAG. And include:

- Retention of the enclosure
- Retention of the current plant room including the 2 x filters and existing pump
- Upgrading the water circulation, filtration and dosing systems to PWTAG standards using a deck level drainage system, additional pump, UV water treatment and coagulation dosing
- The construction of a duct with removable covers between the pool and the plant room
- The provision of a suitable Dehumidification Unit and Air Source Heat Pump to heat the pool water

3.2.1 The Advantages of a Deck Level Pool

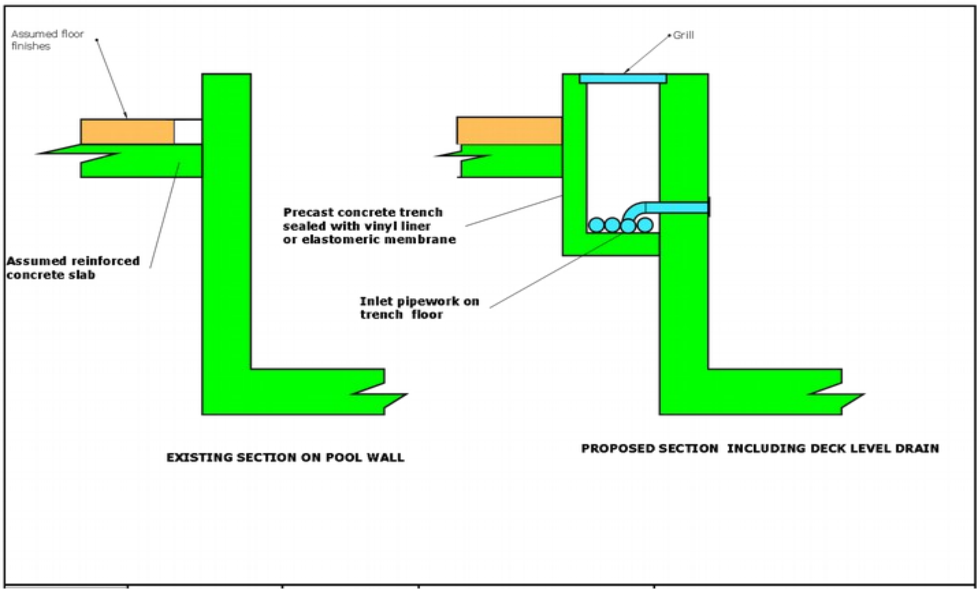
The best way to bring the pool right up to modern "best practice" standard is to install a deck level drainage system.

The water quality in a deck level pool will always be better than a freeboard pool where the surface water in the pool is drained off with a number of skimmers because the whole perimeter of the pool acts as a skimmer. But deck level pools do require a more complicated water circulation system that must include a balance tank.

This is because in a freeboard pool there is a constant volume of water in the pool irrespective of how many people are using it. In a deck level pool the more people there are in the pool, the greater the volume of water displaced from the pool. The displaced water is stored in a balance tank and the pool water circulation pumps draw water from the balance tank and pump it through the circulation system and back to the pool.

In a new installation an "undercroft" would be provided to house the associated piping and balance tank. This would be very costly at the xxxxxxxxxxxx School pool and could be avoided by providing pre-cast concrete units around the pool perimeter to act as the balance tank and to provide a route for the new inlet pipework that woud be required. This is illustrated on the following sketch.

All the existing pipework would be abandoned apart from the suction line from the two newish floor outlets. All the new pipework would be installed in a new precast concrete duct that would connect the pipework in the perimeter precast concrete gutter to the existing plant room.



3.3 Option 2

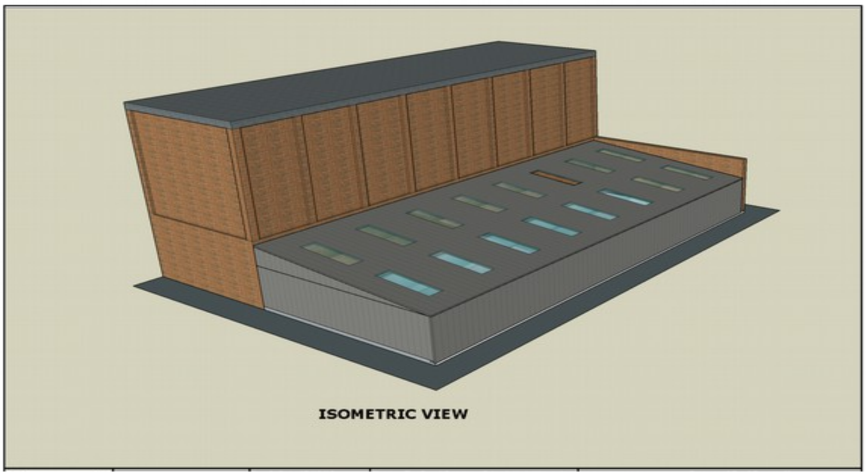
This would involve Option 1 with the following amendments

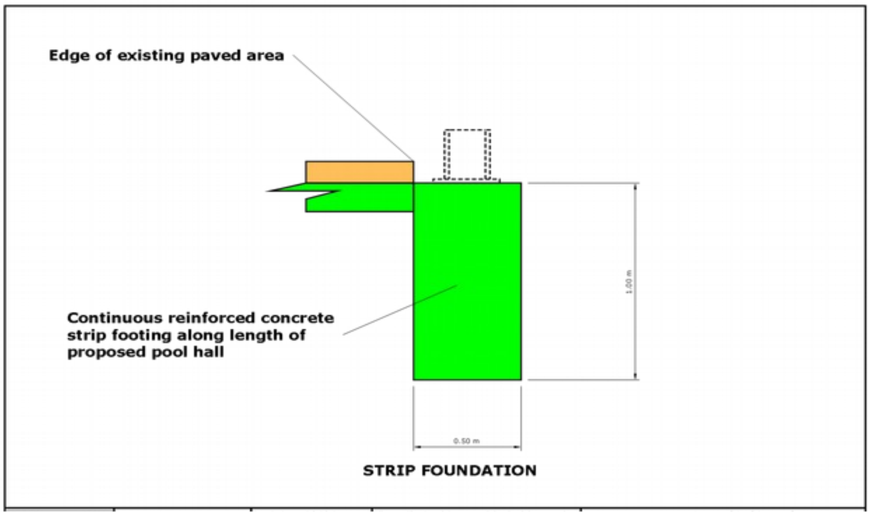
- The removal of the enclosure (Can probably be sold)
- The install of a new steel framed building with its foundations
- The construction of a new plant room and relocation of the plant into it
- The omission of the Dehumidification Unit and Air Source Heat Pump
- The installation of an Air Handling Unit and associated ducting

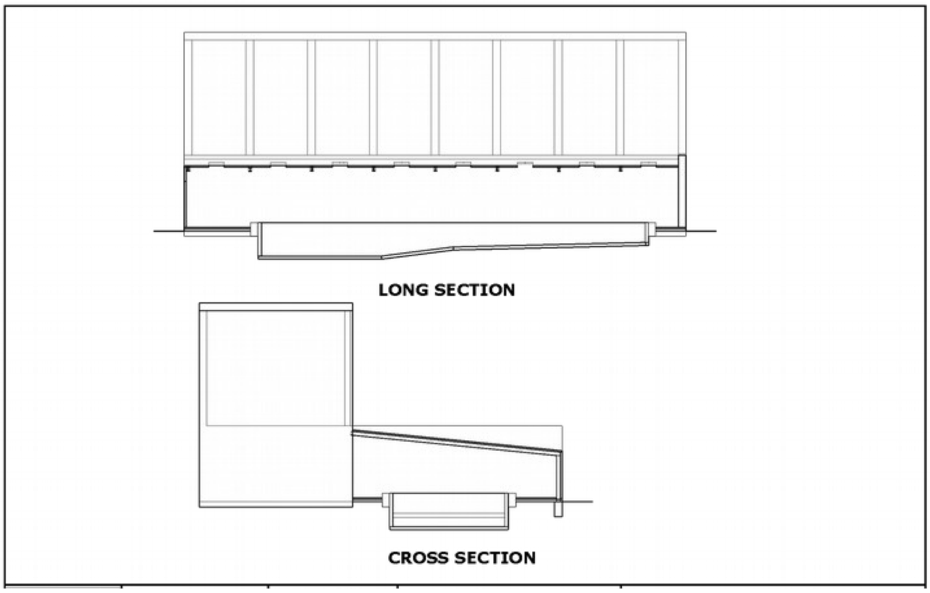
3.3.1 Scope of Works

This will include the construction of a new plant room within the steel framed building and could also provide a viewing gallery on the roof of the plant room.

The proposal is illustrated on the following sketches.




Edge of existing paved area
Continuous reinforced concrete strip footing along length of proposed pool hall
1.00 m
0.50 m
STRIP FOUNDATION


LONG SECTION
CROSS SECTION

4 Cost Estimates

4.1 Qualifications

The estimates in the following table are provided to give an order of magnitude. Accurate costs can only be provided against detailed drawings and an equipment specification.

The costs exclude VAT.

4.2 Cost Estimates

Option No	Description	Cost Estimate (Exc. VAT)
1	Upgrading the water circulation, filtration and dosing systems to PWTAG standards using a deck level drainage system including Air Source Heat Pump and Dehumidifier.	65.000
	Provide 1.5mm thick on-site vinyl liner with 15 year guarantee	35,000
	Total	**100,000**
2	Upgrading the water circulation, filtration and dosing systems to PWTAG standards using a deck level drainage system excluding Air Source Heat Pump and Dehumidifier.	45.000
	Provide Air Handling Unit and ducting	35,000
	Provide 1.5mm thick on-site vinyl liner with 15 year guarantee	35,000
	Steel Framed Building	
	Foundation	5,000
	Steelwork	45,000
	Cladding	40,000
	Plant Room	5,000
	Total	**210,000**