Project Title:	**Astley High School**
Project No.:	**573**
Document Title:	**Pool Water Treatment and Tank Audit Report**
Document Status:	**Initial Issue**
Document Reference:	**573-M8.05-1**

Revision	Prepared		Checked		Item/change description
	Initial	Date	Initial	Date	
1	JC	01.10.19	TD	02.10.19	Initial version of document.

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1.0 INTRODUCTION

1.1 Devin Consulting Limited was requested by Faithful & Gould to carry out a condition assessment of the swimming pool water treatment and pool tank.

1.2 The purpose of the assessment is to advise on the condition of the existing installation.

1.3 The inspections of the engineering systems were carried out on the 19th September 2019 by James Coombes. Assistance was kindly provided on site by Dave Scott and Ian Cunningham of Seaton Valley Federation.

1.4 The sources of information which form the basis of this report include:

- visual inspections on site
- information provided by the site staff
- 'Swimming Pool Water Treatment and Quality Standards for Pools and Spas' as published by the Pool Water Treatment Advisory Group (PWTAG).
- Managing Health and Safety on Swimming Pools, Health and Safety Executive, 2003.
- BS EN 15288-1:2008 Swimming Pools. Safety Requirements for Design
- BS EN 15288-2:2008 Swimming Pools. Safety Requirements for Operation.

1.5 The audit does not, for practical reasons, cover every aspect of the engineering systems. Excluded items would typically, but not exclusively, include:

- buried pipework
- pipework internals
- machinery internals
- valve internals
- electrical circuitry.

1.6 The author of this report is:

- James Coombes CEng MSc, Project Engineer with Devin Consulting Limited. James has over 12 years' experience of mechanical engineering systems design and support across a range of applications.

- Tom Devin MBA BE CEng MIEI, a technical advisor to PWTAG, a co-author of 'Swimming Pool Water' as published by PWTAG and a Director of Devin Consulting Limited, Water and Ice Specialists. Tom has practised as a specialist engineering consultant on swimming pools since 1985 and has experience on over 100 swimming pool projects in the UK and abroad.

1.7 This report is confidential, personal to the client, non-assignable and not for the benefit of third parties.

2.0 GENERAL DESCRIPTIONS

2.1 The Pool

The Astley High School site has a pool of 20m long and 7.25m wide. The pool has a 1m deep shallow end and 2m deep end.

The pool tank is a freeboard pool finished with a blue liner, likely PVC.

There is a plantroom for the pool water treatment plant, which also contains other items of equipment not related to water treatment. All chemical dosing and storage is located within the plant room.

2.2 Water Treatment Plant

The pool is provided with a dedicated water treatment system. The plant age varies with parts such as pipework likely to be original (approximately 1975) but mainly from 2013 onwards when the pool and plant were refurbished. The treatment principles applied consist of:

- Water removal via skimmer boxes and base outlets
- Straining
- Pumping
- Flocculation using polyaluminium chloride (PAC)
- Filtration on glass media
- Heating of pool water
- Chlorination using sodium hypochlorite
- pH control using sodium bisulphate
- Return of pool water via wall inlets.

3.0 ENGINEERING SYSTEM ASSESSMENTS

3.1 Pool Water Treatment

3.1.1 Key Pool Details

Pool	Size (m)	Area (m^2)[1]	Depths (m)	Approx. volume (m^3)	Measured flow consultant's meter (m^3/hr)	Turnover (hrs)	Maximum Bather Load (PWTAG) based on		Comment
							Area	Measured flow rate	
Main Pool	20 x 7.25	145	1 - 2	223.7	22.0	10.2	44	12	System performance is significantly lower than required by PWTAG.

Turnover is the time for a volume equivalent to the volume of water in the pool to pass through the water treatment system. PWTAG guidelines advise turnover periods should be between 2.5-3 hours for public pools up to 25m long with a 1m shallow end. This is the most applicable guidance category to this pool. The turnover based on the flow rate measured with the consultant's flow meter is 10.2 hours, this is significantly in excess of the value required by PWTAG.

PWTAG defines the maximum bather load (maximum number of people in the pool at any one time) based on pool area and depths, for this pool it is 44. To achieve the maximum bather load under PWTAG a treated water circulation rate of 74.8m^3/hr is required (current circulation rate is 22.0m^3/hr). This would result in a 3-hour turnover which is the minimum under PWTAG.

The maximum achievable bather load with the current plant is 12, this should not be exceeded.

The pool plant should be upgraded to achieve a minimum design circulation rate of 74.8m^3/hr hereafter referred to as the PWTAG minimum flow rate.

[1] All areas and dimensions are approximate

3.1.2 Main pool water treatment plant condition review

An assessment grade is applied to pool plant/items in this section as follows:

A – As new, can be expected to perform adequately for its full normal life.
B – Sound, operationally safe, exhibits only minor deterioration.
C – Operational but requires repair or replacement soon.
D – Risk of major breakdown or failure/under-designed or inadequate.

Plant/Item	Grade	Assessment notes
Return water inlets	D	Description: 2 No. inlets located in the short wall at the shallow end of the pool. Eyeball type inlets, Certikin or similar in plastic finish with adjustable eye. Aperture approx. 40mm. Comment: • The inlets were in a good condition. • Flow rate through the inlets is very strong. • Based on the information for the Certikin eyeball inlet fitting, which is likely the fitting if not similar, the water velocity is 16.2m/s, BS EN 13451-3 requires a velocity of between 0.75-4.0m/s, this is to prevent the risk of injury e.g. to the eyes. The velocity through the fitting also exceeds the upper limit of 15m/s for massage jets. • The size of the apertures is greater than 8mm and less than 25mm, this is not in accordance with BS EN 13451. The issue here is the risk of finger entrapment, however given the location of the fittings and water velocity the overall risk is regarded as low. • Fittings should be compliant with BS EN 13451 and a certificate of conformance should be provided. • The position of the inlets will likely create dead spots for the water circulation, debris was evident in the shallow end corners. *Recommendation:* • *The inlet fittings pose an increased risk to bathers both from water velocity and entrapment. Fittings compliant with BS EN 13451 should be provided, as a minimum this issue needs to be risk assessed and carefully monitored.* • *To achieve the PWTAG minimum flow rate additional inlet fittings will be required.* • *A dye test should be conducted to check circulation in accordance with BS EN 15288-2.*

Pool base outlet fittings	A	Description: 2 No. outlets located on the base of the pool in the deep end, of approximately 400mm x 400mm, appeared to be stainless steel finish. Comment: • Water velocity through the apertures based on the measured flow rate is 0.06m/s (assumes a free area of 30%). This is within the allowable maximum of 0.25m/s (BS EN 13451-3). • The velocity through the outlets based on the PWTAG minimum flow rate would be 0.22m/s, which is compliant with BS EN 13451-3. • Condition of the grilles appears good. *Recommendation:* • *Retain existing outlet grilles.* • *The grilles could accommodate the PWTAG minimum flow rate, although the size of the outlet sumps would need to be checked.*
Surface water removal	C	Description: 3 No. skimmer boxes located on the short wall at the deep end of the pool. Skimmers complete with strainer basket accessed from the pool surround; all finishes in white plastic.  Comment: • Condition of the skimmers was good. • The pool hand rail is installed across the front of the skimmers. Whilst the clearances are acceptable under BS EN 13451 the arrangement is awkward and could cause an entrapment issue. • The pool water level was low by approximately 100mm meaning that the amount of water removed by the skimmers will be limited. • The overall pool circulation, including the number and position of skimmers and inlets is questionable. • The use of skimmers in public pools is not recommended by PWTAG as the surface water removal and hence water quality will be limited. PWTAG recommends a pool with as much surface water removal as possible, such as a deck level pool. *Recommendation:* • *Pool water level to be maintained at the correct level.* • *Skimmer hand rail area should be risks assessed and managed.*

Circulation pipework	C	Description: Predominantly 3" and smaller (some 4"), uPVC Class C. Also, ABS class C. Age of pipe work varies; the ABS pipework is likely original (1975) and the PVC pipework varies from 2005 onwards. Comment: • The main circulation pipework condition varies with age but is generally functional. No significant signs of leakage. • The ABS pipework appears very old and is in a poor condition. • Pipework velocities are acceptable for the measured flow rate however, to achieve the required PWTAG minimum flow rate these pipes will need to be upgraded, this will include buried pipework. *Recommendation:* • *Replace pipework as required.* • *Replace ABS pipework.* • *Upgrade pipework to achieve the required PWTAG minimum flow rate.*
Pipework support	D	Description: Predominantly metal ring clamps secured to Unistrut. Comment: • The support condition varies, many supports particularly lower down, are in a poor condition showing signs of significant corrosion. • Pipe supports are missing in places, this is likely causing damage to pipework. *Recommendation:* • *Replace missing pipe supports.* • *Replace damaged pipe supports as required.*
System valves	C	Description: Various manufacturers of butterfly valves and ball valves on the system, age varies. Comment: • The valves are generally in a fair condition. • Some valves are in a poorer condition showing signs of corrosion. • Operator advised all valves functional. *Recommendation: Replace valves as required.*

Circulation pumps and strainers	B	Description: 2no. centrifugal pumps with integral strainer. Manufacturer Certikin Euroswim 300 T, 2.5kW motor, 2800rpm, 42.6 – 36.6m^3/h at 8 – 12m, advised approximately 2 years old. No. 1 pump is secured directly to a concrete plinth and No. 2 secured to a Unistrut frame. Comment: • Both pumps are in working order. • The condition of both pumps and strainers was reasonable with a general build-up of dirt. • Push button stop start panels on wall near plant room entrance, no local isolation. • Electrical cabling, conduit, and terminal boxes show signs of corrosion. *Recommendation:* • *Replace electrical cabling, conduit and terminal boxes, provide local isolation.* • *Provide pumps capable of achieving PWTAG minimum flow rate, systems will need to be upgraded to achieve this.*
Variable speed drives	N/A	Description: None installed. Comment: Primary function of a VSD in aquatic applications is to provide energy savings. By controlling the speed of a pump rather than controlling flow through use of throttling valves, energy savings can be substantial. In addition, considerable energy savings and night time-set back operation could be implemented to make further energy savings. *Recommendation: VSD's should be installed on all main circulating pumps as part of any plant upgrade.*
Control panel common to both treatment systems	D	Description: There is no central water treatment control panel, various electrical boxes serve individual pieces of equipment. Only safety features included are within the chemical controller which are unknown due to the age of the unit. Comment: • Primary functions of a control panel in aquatic applications are to, provide effective system safety interlocks, to prevent incidents of chemical overdosing and to provide all electrical operation details in one location. • It appears no interlocks/alarms are provided other than the in-built measures of the chemical controller, this should be confirmed. • No certification available at time of audit. • No hours run meters are provided for the pumps. *Recommendation: Provide a central water treatment control panel as part of a plant upgrade to include suitable plant safety interlocks.*

Electrical cabling	D	Description: The condition and age of the electrical cabling varies. Comment: • The condition of the cabling is visually as expected given some appears very old. • There is visible corrosion/staining to some cabling and associated items particularly at low level. • Not all equipment is provided with local isolation. *Recommendation:* • *Replace electrical items as required.* • *Cabling to be replaced as part of upgrade works including the provision of isolators for all equipment.*
Flowmeter	D	Description: No flow meter provided. Comment: A flow meter is an essential system element to monitor if the water treatment flow is adequate, and to check that the filter is being backwashed at the correct flowrate to provide effective cleaning of the sand and removal of dirt and debris etc. *Recommendation: Install an accurate flow meter as part of the upgrade works.*
Make up water system	D	Description: Pool water make up is taken from a header tank in the space above the plant room (inaccessible) through a manual valve into the pump suction pipe. A water meter is provided on the feed to the header tank. The header tank also feeds the acid dosing system. Comment: • The manual make-up system requires the operator to open the valve when the pools need topping up. The pool was approximately 100mm below the correct level at the time of the visit. Operating the pool below the correct level will reduce surface water removal and water quality. • The manual nature of the valve will also mean there is a risk of overfilling the pool from operator error. Given the freeboard on the pool the risk is low. • The make up supply rate measured on the water meter was approximately 0.04l/s. At this rate the pool would take over 31 hours to recover from a properly conducted backwash on the installed filter. With the existing plant a make up rate of approximately 0.2l/s is required. • To meet the demands of an upgraded system the make-up rate will need to be further increased. This will need to be confirmed by a MEP engineer. *Recommendation:* • *Provide an automatic make-up system that automatically maintains the pool water level.* • *Provide a make-up rate suitable for the operation of the existing pool.* • *For any system upgrade a further uplift to the makeup rate will be required.*

Flocculant dosing system	A	Description: Polyaluminium Chloride (PAC) Hydroxide Sulphate, Flocpac Super, EMEC pump, dosed direct from Carboy siting in bund unit. Age appears relatively new. Comment: • Chemical dosing tubes are not adequately supported. • System condition is good. • There is no storage provision for spare PAC carboys. • In accordance with the PWTAG code of practice PAC should be dosed continuously at 0.1ml/m^3 of the total flow rate, at the measure flow rate this is 2.2ml/h. It should be ensured this dosage rate is maintained. • The chemical has a 6-month shelf life, at this rate a 20L carboy would last considerably longer than 6months. • 5 empty carboys and 1 half empty PAC carboy are located in the plant room. *Recommendation:* • *Ensure PAC dosage rate is at prescribed rate.* • *Ensure chemicals are maintained within shelf life and empty carboys are removed by the supplier on a regular basis.* • *Provide dedicated bunded storage provision for a spare carboy.*
Sand filters	D	Description: 1 off Ø1.2m GRP sand filter, manufacturer Astral, model VIC. Age 6 years. Top access manhole, inlet and outlet pressure gauges. Auto air release (closed off). Integral support ring, sited on shallow plinth. Manual drain. Media is glass media 3 years old. Comment: • No viewing window was present so media/internal condition not seen. • Based on the measured flow rate a media bed velocity of 19.5m/h is achieved. This is within the velocity limit recommended by PWTAG for medium rate filters. • This filter will not be suitable to achieve the PWTAG minimum flow rate, this will require 2 No. 1.4m filters. • The filter external condition appeared fair with dirt on the filter externals but this appears superficial. • No air scour is provided. • Operator advised that the backwash is normally conducted at the end of shift. Given the measured flow rate and size of pump, it is likely that the filters are not be being backwashed at the correct velocity. Furthermore, as the system has no flow meter the operator has no way of telling if it is. *Recommendation:* • *Replace filters as part of wider upgrade works.* • *Air scour can help clean the filter media and is recommended by PWTAG. This should be included in any upgrade works,* • *Any upgrade works will require an uplift in the backwash drainage capacity.*

Secondary Disinfection	D	Description: No secondary disinfection provided. Comment: • Ultraviolet radiation provides enhanced water quality and is a secondary disinfection process in swimming pools. It is a good, point of exposure disinfectant which inactivates bacteria and other aquatic species such as cryptosporidium, as well as assisting in the breakdown of chloramines which cause the typical pool hall smell and bather irritation. *Recommendation:* • *A secondary water disinfection system should be provided* • *Install UV as part of wider upgrade works.*
Heat Exchanger	D	Description: 1 No. plate type heat exchanger Alfa Laval, 9 years old, rating unknown. Located on plant room floor. Comment: • The pipe connections to the heat exchanger have failed and there is significant build-up around the connections. • Pipework to the heat exchanger is in a very poor condition. • It may be possible to overhaul the heat exchanger but given the age this is not recommended. • Although the rating is not known, the pool temperature is satisfactory and operator advises no issues with water temperature. *Recommendation:* • *Replace heat exchanger, pipework and all associated items. Replacement pipework to be suitable for the service temperature of the liquid.* • *It is recommended the following are provided on the heat exchanger, pressure relief valve, drain down cock & vent cock.* 

Sodium hypochlorite dosing system	C	Description: 100L capacity day tank with LMI pump and manual stir. Sodium hypochlorite transferred to day tank from carboys by hand tank. Day tank in lined bund of brick construction. Age of all unknown. Comment: • Condition of day tank and pump is fair with some external staining but generally functional. • Day tank and bund are located in the plant room adjacent to the acid dosing area. • Condition of pump isolator is poor with external marking/ discolouration. • Location of the chlorine dosing system in the plant room, in particular adjacent to the acid dosing system significantly increases the risk of an incident such as chlorine gas release. • A carboy was balanced on the bund wall. *Recommendation:* • *In the short-term, measures should be investigated to improve segregation between the chlorine donor and acid dosing areas such as a dividing wall or barrier. PWTAG states that acid and alkalis should not be in adjacent bunds.* • *It is imperative that the management and storage of chemicals is maintained to a high standard, suitably risk assessed and regularly reviewed. Chemicals should only be stored within the correct bunds provided.* • *As part of wider upgrade works dedicated chemical storage and dosing areas should be provided.* • *It should be ensured all chemical dosing lines are suitably supported and renewed as required.* • *Electrical items should be reviewed and replaced as required.*	

Sodium bisulphate dosing system	B	Description: 100L capacity day tank with USF pump and manual stir. Sodium bisulphate dosed by hand with manual fill connection for water. Day tank in lined bund of brick construction. Age of all unknown. Comment: • Condition of day tank and pump is good and appears newer than the chlorine system. • Day tank and bund are located in the plant room adjacent to the chlorine dosing area. • Condition of pump isolator is fair with some external marking/ discolouration. • Location of the acid dosing system in the plant room, in particular adjacent to the chlorine dosing system significantly increases the risk of an incident such as chlorine gas release. • PWTAG states that the segregation and storage rules should be strictly applied so that the risk of mixing the sodium bisulphate with a chlorine source is removed. The current installation falls significantly short of this. *Recommendation:* • *A motorised stirring system would improve mixing.* • *It should be ensured all chemical dosing lines are suitably supported and renewed as required.* • *Refer to other recommendations of chemical storage inadequacy.*	

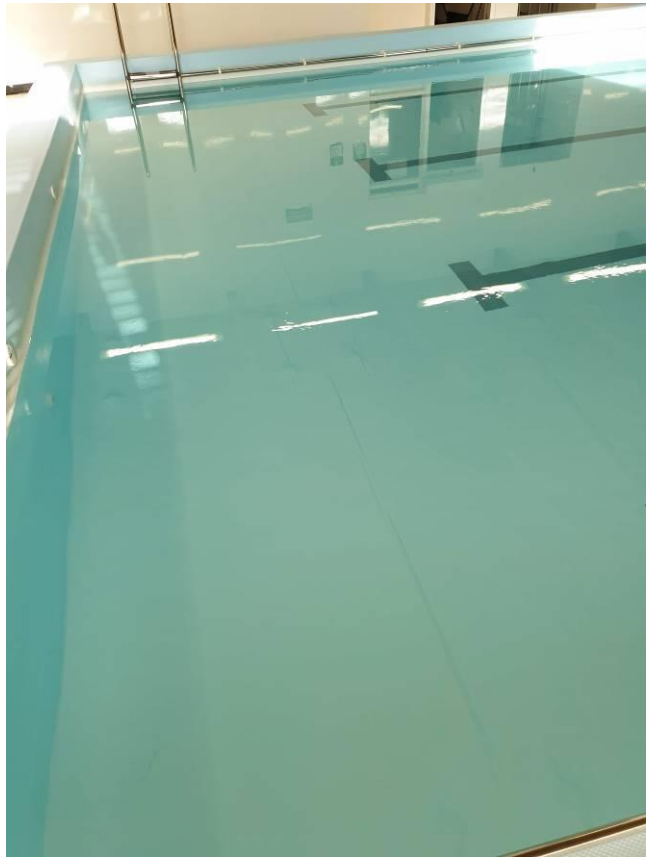
Chemical Storage	D	Description:
		• All chemical dosing and storage is within the plant room.
		  ○ Sodium hypochlorite is stored in a central bunded area.
		  ○ Sodium bisulphate, calcium chloride and sodium bicarbonate bags are stored on wooden pallets adjacent to the internal access door.
		Comment:
		• Chemical storage provision should be such as to enable safe storage of chemicals, different chemicals should be stored separately and separated from the rest of the building.
		• There are a large number of empty chemical carboys (24 in total) within the plant room which is further impacting the safe storage of chemicals. For sodium hypochlorite, a maximum of 2 months' supply of chemical's should be on site, ideally less.
		• Chemical management is generally poor with items balanced on bunds and dissimilar chemicals stored on the same pallets. Dedicated, segregated storage areas should be provided.
		• Although there is external access to the plant room via double doors there is a step up from the outside. Operator advised that chemical deliveries are unloaded in car park and delivered through the school corridor and into the plant room.
		• Chemical deliveries require that the chemical delivery route be controlled and the chemicals securely transported in a bunded trolley or similar. Access to the chemical delivery route should be prevented during deliveries.
		Recommendation:
		• *Safe chemical storage facilities should be provided, with adequate chemical separation and safety provisions adjacent to chemical storage areas.*
		• *The minimum amount of chemicals required should be stored on site with empty carboys regularly removed.*
		• *As part of wider upgrade works dedicated chemical stores should be provided.*
		• *It is recommended that the chemical delivery route be reassessed with the objective to minimise the transfer distance from delivery vehicle to store and minimise the route through public areas/student areas. Consideration should be given to delivering chemicals direct from the external area to the plant room, with modifications to the access as required to achieve this.*
		• *All chemicals not related to water treatment should be removed and chemicals should not be stored on bund walls.*
			
			 

Signage, PPE and safety provision.	D	Description: • Safety signage has been installed throughout. • No chlorine gas detection system is provided; this should be considered given the connection with the school interior. • A small PPE footlocker is provided with a limited supply of PPE, no canister respirators are provided. • A drench shower, eyewash bottles and spill kit are provided. Comment: • The safety signage varies in style and type. • Operator advised that 3 No. dedicated PPE lockers are to be provided with sufficient PPE including canister respirators. *Recommendation:* • *Chlorine gas detection should be installed.* • *Sufficient PPE to be provided including canister respirators, refer to PWTAG and chemical supplier's information for requirements.* • *Whilst safety signage is installed throughout, given the high-risk nature of the chemical storage, it is recommended that the signage is standardised, ensured it is compliant with HSE requirements, made from rigid plastic and mechanically fixed and as visually prominent as possible.*
Chemical controller	D	Description: Ezetrol chemical controller age unknown. Comment: • External condition is poor, age unknown but functioning satisfactorily. • Operator was unable to identify chlorine or pH set points. • Controller safety functions unknown. *Recommendation: The unit is likely approaching the end of its service life and should be replaced.* 
Bund linings common to both treatment systems	C	Description: 3 No. Bunds of brick construction located within the plant room. Comment: Condition of all 3 fair, with some discolouration to internal finish. *Recommendation: Chemical bunds should be checked for water tightness and repaired where required.*

General plantroom details	D	Description: • The plant room ventilation is by way of 2 No. small meshed openings adjacent to the external access doors. The external access doors appear to have originally been louvered but these have been internally boarded. There is an internal access door from the plant room into a school corridor. • The plant room has external access via double doors, there is also an internal access door to school corridor. • 2 No. sinks are provided in the plant room. • A chlorine dioxide unit is located within the plant room for treating the building water, this is downstream of the supply to the pool. • Plant room is approximately 4.3m x 7.1m (30.5m^2). Comment: • The ventilation of the plant room is wholly inadequate. Given that there is an internal access door, in the event of a chemical release incident there is a risk that chlorine gas will enter the school. With chemicals contained within the plant room, the space should be negatively pressurised with respect to the adjacent corridor, so that in the event of an incident chemicals are released externally and not into the school. • The plant room is generally in a fair condition considering its likely age. There are no visible leaks or standing water, although there are some signs of previous flooding. In the event of a leak the drainage is unlikely to be sufficient. *Recommendation*: • *A HVAC specialist is contracted to review the ventilation and provide suitable plant room ventilation.*
Operators records and documentation	C	Description: Operators records were viewed whilst on site. Comment: • The operators' daily records were viewed and compared against the PWTAG example for comparison. • The operators record keeping monitored the basic parameters but did not include filter pressures, which pumps are running, strainer cleans, bather load, water dilution or chemical addition quantities. • Operator, advised testing pool water 3 times daily, once a week a full set of test results is conducted to enable balance to be calculated. Microbiological tests conducted monthly. ○ Based on operators records the full tests to enable calculation of water balance were not being carried out. • Advised a range of NOPs and EAPs are in place but these were not readily at hand to the operator. • There is no written information on what equipment is installed including system schematics. *Recommendation:* • *Implement enhanced operator record system including monitoring bather load, the examples provided by PWTAG should be used for comparison.* • *Accurate as built drawings should be provided including system schematics.* • *NOPs, EOPs and O&M manuals should be easily available to all operating staff.*

Water balance	C	Comment: • The site mains water was tested while on site showing a Calcium Hardness of 100mg/l as $CaCO_3$ and an alkalinity of 35mg/l as $CaCO_3$. • The pool water was tested while on site and a selection of operator's records were reviewed. • The site appears to be struggling to maintain alkalinity within the recommended range (80 – 200mg/l as $CaCO_3$) with the alkalinity lower than 80 on a number of occasions. o The operator is manually dosing sodium bicarbonate to the water to increase the alkalinity. o Sodium bicarbonate should be added as required based on the alkalinity tests, not a standard amount. Frequency of tests should be as required to maintain alkalinity. o The operator doses approximately 2 No. 25kg bags per week, it is recommended that as part of major upgrade works an auto-dosing system is installed to provide more consistent dosing. o The pH appears to be being adequately maintained. • Calcium chloride is being added to increase the calcium hardness. • The site has not been monitoring TDS but the meter has now been identified and this was tested on site. This was 1200 mg/l, the source water at 153mg/l, this is marginally outside the recommended range (of not 1000mg/l more than the source water). • The chlorine levels (free and combined) can be quite high at times (Free up to 4.5mg/l, combined up to 1.3mg/l), but this is to be expected given the poor water circulation and lack of secondary disinfection. Levels of combined chlorine should be maintained below 1.0mg/l and as low as possible. *Recommendation:* • *A water treatment system sized in accordance with the PWTAG requirements will make water balance management easier.* • *Hand dosed chemicals are dosed only as needed to maintain the water balance.* • *Make-up supply is monitored against bather load to ensure dilution is appropriate.*

3.2 Pool tank



The pool tank is lined with a blue PVC liner:

- Operator advised that Kingspan insulation is installed under the liner.
- Signs of fixing bolts/caps for the insulation can be seen under the liner, this is may damage the liner over time.
- The liner is showing signs of creases.
- Liner was installed as part of the refurbishment works in 2013.
- Textured lane lines are provided on the pool base.
- Pool construction underneath is unknown.

A foil type pool cover is provided, this is only deployed in the holidays.

The pool has a freeboard of approx. 150mm (when correctly filled).

2 No. stainless steel access steps are positioned in diagonally opposite corners. Access steps rest on the top of the pool unsecured. The bracket on the access steps into the deep end has sheared meaning the ladder is not secure and moves when used. This should not be used until it is replaced.

The junction between the pool surround and walls is in a poor condition, the pool surround in general is not in a good condition.

4.0 SUMMARY AND COSTS

The following is a summary of the major issues that need to be addressed:

- The pool water circulation rate is substantially undersized resulting in a turnover that is over 3 times longer than the maximum limit for this type of pool. Operating with this system will increase the risk to bathers including of infections and diseases such as cryptosporidium.
- With the current system the maximum number of bathers at any one time in the pool should be 12. This limit should not be exceeded.
- The provision for the storage and dosing of chemicals is not satisfactory. Chemicals are not properly segregated increasing the risk of incidents such as chlorine gas release if there is inadvertent mixing. In particular, the chlorine and acid dosing systems are located adjacent to each other.
- It is critical that given the inadequacy of the safe storage provision for chemicals that the management of the chemicals is as good as possible and the current practices fall well short of this. This includes removal or empty carboys and limiting the volumes of chemicals stored.
- The pool liner is showing creases and the securing bolts for the insulation underneath, this may cause the liner to fail.

The pool water treatment system should be upgraded to one that is suitably sized for the pool and bather load. Safe chemical storage and dosing should be provided, ideally with dedicated chemical stores. This upgraded system will cause significant disruption to the pool and require more space than provided in the existing plant room. The water treatment equipment could be accommodated within the existing plant room if the chemical dosing and storage were moved to new dedicated stores. The chemical stores would require a total internal area of approximately $10m^2$, there does appear to be open space adjacent to the plant room. This would need to be confirmed in more detail.

The cost for the installation of the water treatment system alone will be approximately £150,000, but this does not include the costs of alterations related the building, mechanical systems and excavation/reinstatement for buried pipework. A separate study (architect) should be commissioned to advise on this.