March	May
1. INTRODUCTION Waterman Building Services have been engaged by the London Borough of Bexley to produce a report highlighting the issues associated with the Belvedere Splash Park facility that have led to reports that at times the water quality is not adequate enough for the children using it, and leading to the splash park closures. This report sets out to understand how the splash park equipment operates and how the park is utilised and the suitability of the installation for the demands placed upon it. To this end Waterman Building Services attended site on the 11th February 2015, together with Paul Newland, a representative of Sun Safe Play Systems, the original installation contractor, Chris Mitchell a member of the splash park`s maintenance team and Bob Smith a member of the councils engineering team. The splash park was closed, usual winter shut down, and the plant and equipment not in use. The bulk water storage tank had been emptied. The purpose of the visit was to provide Waterman Building Services with an insight into the history of the splash park, the issues associated with the splash park and to gain an understand of how the splash park operates and an appreciation of how the onsite drainage and water systems operate.	1. INTRODUCTION Waterman Building Services have been engaged by the London Borough of Bexley to produce a report highlighting the issues associated with the Belvedere Splash Park facility that have led to reports that at times the water quality is not adequate enough for the children using it, and leading to the splash park closures. This report sets out to understand how the splash park equipment operates and how the park is utilised and the suitability of the installation for the demands placed upon it. To this end Waterman Building Services attended site on the 11th February 2015, together with Paul Newland, a representative of Sun Safe Play Systems, the original installation contractor, a member of the splash park`s maintenance team and Bob Smith a member of the councils engineering team. The splash park was closed, usual winter shut down, and the plant and equipment not in use. The bulk water storage tank had been emptied. The purpose of the visit was to provide Waterman Building Services with an insight into the history of the splash park, the issues associated with the splash park and to gain an understand of how the splash park operates and an appreciation of how the onsite drainage and water systems operate.
2. BRIEF HISTORY OF THE SPLASH PARK The splash park is situated within a depression in the land and was previously used as a boating lake. The splash park play area is circled by tarmacked paths, grass banks, grassed seating areas and established trees. The entire park is edged with fencing and has three gates for entry. The play area has a concrete base covered in a coloured EPDM surface and the area is graded to a number of recirculating drain points. At the high end of the splash park there is a drinks and snacks facility and the pool	2. BRIEF HISTORY OF THE SPLASH PARK The splash park is situated within a depression in the land and was previously used as a boating lake. The splash park play area is circled by tarmacked paths, grass banks, grassed seating areas and established trees. The entire park is edged with fencing and has three gates for entry. The play area has a concrete base covered in a coloured EPDM surface and the area is graded to a number of recirculating drain points. At the high end of the splash park there is a drinks and snacks facility and the pool

equipment plant room both housed with a single storey building. The splash park equipment was installed in the early part of 2005 to provide a free, engaging and varying water play facility for children to enjoy and use throughout the warmer spring and summer months and beyond. There are a number of different attractions such as tilting buckets, jet sprays of various styles and a splash pool at one end for the younger children to enjoy and play in.	equipment plant room both housed with a single storey building. The splash park equipment was installed in the early part of 2005 to provide a free, engaging and varying water play facility for children to enjoy and use throughout the warmer spring and summer months and beyond. There are a number of different attractions such as tilting buckets, jet sprays of various styles and a splash pool at one end for the younger children to enjoy and play in.
2.1 Brief Description of the Splash Park Equipment There is a single GRP storage tank, buried below the splash park, which provides the bulk storage of water for the splash park equipment. The tank has an estimated storage capacity of around 20,000 litres which is filled initially from the local authority potable water mains supply and topped up as and when required by the same supply. During periods of operation treated water keeps the tank levels topped up from a circulated return line from the plantroom which returns the treated water into the “treated” water end of the tank. At the opposite end of the tank “dirty” water is collected from the splash park drainage system. At the water features end of the splash park water is drained back constantly to the storage tank via a network of drainage gullies and runs through a filter before entering the tank. At the pool end of the splash park water is drained, after the splash park has closed, via a network of drainage gullies which can be opened or closed as required to create a depth of water providing the pool when the splash park is in operation. In addition to these gullies there are additional gullies around the top level of the pool which drain water constantly to prevent water from spilling onto the surrounding area. Drainage from all of these gullies also pass through a filter before entering the tank at the “dirty” water end. There is currently no division between the “treated” water and “dirty” water ends of the tank. “Dirty” water, from the drainage inlet end of the tank, is drawn from the tank by a duplicate	2.1 Brief Description of the Splash Park Equipment There is a single GRP storage tank, buried below the splash park, which provides the bulk storage of water for the splash park equipment. The tank has an estimated storage capacity of around 18,000 litres which is filled initially from the local authority potable water mains supply and topped up as and when required by the same supply. During periods of operation treated water keeps the tank levels topped up from a circulated return line from the plantroom which returns the treated water into the “treated” water end of the tank. At the opposite end of the tank “dirty” water is collected from the splash park drainage system. At the water features end of the splash park water is drained back constantly to the storage tank via a network of drainage gullies and runs through a filter before entering the tank. At the pool end of the splash park water is drained, after the splash park has closed, via a network of drainage gullies which can be opened or closed as required to create a depth of water providing the pool when the splash park is in operation. In addition to these gullies there are additional gullies around the top level of the pool which drain water constantly to prevent water from spilling onto the surrounding area. Drainage from all of these gullies also pass through a filter before entering the tank at the “dirty” water end. There is currently no division between the “treated” water and “dirty” water ends of the tank. “Dirty” water, from the drainage inlet end of the tank, is drawn from the tank by a duplicate

pump set located within the plant room. Within the plant room the drawn water passes through bucket filters, duplicate stainless steel bodied sand filters, is chlorine dosed with a granular feeder system and the PH levels are controlled by calcium and sulphuric acid, before the "treated" water is returned into the tank via the circulated return. During the open periods of the splash park water is circulated 24 hours a day. From The "treated" water end of the storage tank a separate display pump draws water which provides a suitable high flow rate and high pressure feed the water jet features.	pump set located within the plant room. Within the plant room the drawn water passes through bucket filters, duplicate stainless steel bodied sand filters, is chlorine dosed with a granular feeder system and the PH levels are controlled by calcium and sulphuric acid, before the "treated" water is returned into the tank via the circulated return. During the open periods of the splash park water is circulated 24 hours a day. From The "treated" water end of the storage tank a separate display pump draws water which provides a suitable high flow rate and high pressure feed the water jet features.
3. REPORTED ISSUES, HISTORICAL COMMENTS AND GENERAL OBSERVATIONS From the site visit a number of issues and theories were brought forward by Chris Mitchell, the longstanding operator of the splash park, Paul Newland from Sun Safe and Bob Smith of Bexley Council, regarding the upkeep of the splash park and the possible reasons why water quality has been poor. Waterman Building Services made comments, noted observations and took note of the plant installation and site conditions. Subsequent information provided by various interested parties has been received and incorporated into the findings. This information has been very helpful and open and indicates a combined effort to resolve the outstanding issues.	3. REPORTED ISSUES, HISTORICAL COMMENTS AND GENERAL OBSERVATIONS From the site visit a number of issues and theories were brought forward by the operating staff. Paul Newland from Sun Safe and Bob Smith of Bexley Council, regarding the upkeep of the splash park and the possible reasons why water quality has been poor. Waterman Building Services made comments, noted observations and took note of the plant installation and site conditions. Subsequent information provided by various interested parties has been received and incorporated into the findings. This information has been very helpful and open and indicates a combined effort to resolve the outstanding issues.
3.1 List of Comments, Issues and Observations 3.1.1 Overcrowding It was reported by Chris Mitchell, the operator, that at times there have been in excess of 600 children in the park at any one time. This may only have been on rare occasions, when the weather conditions were suitable but large numbers will have a detrimental effect on the water quality as more people bring more soiling and puts	3.1 List of Comments, Issues and Observations 3.1.1 Overcrowding It has been noted that at times, especially during the summer holidays and when the weather has been fine, there have been very large numbers of children in the park at any one time. This may only have been on limited occasions, but very large numbers will have a detrimental effect on the water quality as more people bring more soiling and puts the water treatment system under extreme

the water treatment system under extreme pressure and would be well beyond the envisaged number of users. It is unknown what the designed maximum number of users should be or what the current filtration system can accommodate, but typically the number of users appears extremely high. It is understood that during the summer, in an attempt to limit the number of users at any one time, during operating periods (typically between the hours of 11am and 5pm, 7 days a week) that access into the water park is limited to a single point of entry with all other gates being locked. This has not always proved to be effective with instances of users climbing over fences or forcible entering through the one open gate.	pressure and would be well beyond the envisaged number of users, that the splash park was originally designed for. It is unknown what the designed maximum number of users should be or what the current filtration system can accommodate, but typically for a park of this size and utilising the PWTAG figures for a recirculating system, the numbers would be around 475. It is understood that during the summer, in an attempt to limit the number of users at any one time, during operating periods (typically between the hours of 11am and 5pm, 7 days a week) that access into the water park is limited to a single point of entry with all other gates being locked. This has not always proved to be effective.
3.1.2 Human Soiling There are no feet wash trays or facilities for showering before entering the EDPM area and therefore no ways or removing dirt and debris from the children. Also in hot weather conditions the children would be covered in sun tan lotion and not being able to remove excess sun tan lotion would possibly result in more being removed once playing within the water features and pool areas. It was reported that soiling from smaller children and babies, especially from the pool area of the splash park, had resulted in the closing of the facilities until suitable remedial action had been taken by the maintenance team. It was also reported that the pooling water appeared to encourage some parents to wash their babies in it after they had soiled their nappies.	3.1.2 Human Soiling There are no feet wash trays or facilities for showering before entering the EDPM area and therefore no ways or removing dirt and debris from the children. Also in hot weather conditions the children would be covered in sun tan lotion and not being able to remove excess sun tan lotion would possibly result in more being removed once playing within the water features and pool areas. It was reported that soiling from smaller children and babies, especially from the pool area of the splash park, had resulted in the closing of the facilities to enable the Council to undertake an emergency clean, water dump and total replacement of the water. This action is necessary as the Council have no other way to remove the risk of **Cryptosporidium**.
3.1.3 Rainwater Collection Rainwater falling onto the EDPM surface can obviously not be separated from the circulatory system serving the water features as the	3.1.3 Rainwater Collection Rainwater falling onto the EDPM surface can obviously not be separated from the circulatory system serving the water features as the

drainage system discharges to the storage tank buried beneath the splash park. In the main this rainwater would be reasonably clean containing only minimal fines or dirt. The issues are rather from the rainwater that falls onto the surrounding grass banks and tarmacked paths. Even though these areas are separated from the EDPM surface by floor gullies sited near the entrances to the EDPM area and drainage channels that run across the entrances they are ineffective and poorly maintained. The drainage channels and gullies are all blocked with dirt and silt and rainwater cannot run into them, and therefore runs across them to spill onto the EDPM area. This in turn delivers more silt and dirt onto the EDPM surface. It was reported by Bob Smith that the gullies and drainage channels run to a number of soak-a-ways around the perimeter of the EDPM area but it would be best to assume that these are blocked and not performing any benefit.	drainage system discharges to the storage tank buried beneath the splash park. In the main this rainwater would be reasonably clean containing only minimal fines or dirt. The issues are rather from the rainwater that falls onto the surrounding grass banks and tarmacked paths. Even though these areas are separated from the EDPM surface by floor gullies sited near the entrances to the EDPM area and drainage channels that run across the entrances they are ineffective and poorly maintained, and will require regular maintenance, such as cleaning of loose debris and jetting clear as and when required. The drainage channels and gullies have become blocked with dirt and silt and rainwater cannot run into them, and therefore runs across them to spill onto the EDPM area. This in turn delivers more silt and dirt onto the EDPM surface. It was reported by Bob Smith that the gullies and drainage channels run to a number of soak-a-ways around the perimeter of the EDPM area but it would be best to assume that these are blocked and not performing any benefit.
3.1.4 Trees, Grass and Dirt As already mentioned above there is little to prevent grass and dirt entering the EDPM surface and therefore being washed down into the storage tank via the drainage system. There is currently grass verges on all sides of the EDPM area and large grass areas surrounding the whole park. There are many mature trees close to the EDPM area in the surrounding grassed areas which contribute year round leaves debris and pollen onto the surface, which again eventually finds its way into the storage tank.	3.1.4 Trees, Grass and Dirt As already mentioned above there is little to prevent grass and dirt entering the EDPM surface and therefore being washed down into the storage tank via the drainage system. There is currently grass verges on all sides of the EDPM area and large grass areas surrounding the whole park. There are many mature trees close to the EDPM area in the surrounding grassed areas which contribute year round leaves debris and pollen onto the surface, which again eventually finds its way into the storage tank.
3.1.5 EDPM Surface The EDPM coloured in-situ formed resin bound rubber surface provides a comfortable and soft play surface for the children`s wet play	3.1.5 EDPM Surface The EDPM coloured in-situ formed resin bound rubber surface provides a comfortable and soft play surface for the children`s wet play

environment. This was laid and bonded to the concrete surface below and provided good service for a number of years. At the end of the 2011 season the Council decided to refurbish the original soft play surface and appointed a surfacing contractor to install a new covering to a depth of 15mm in the same design and colours as the old surface. This was installed on top of the original surface and bonded to it using coloured EDPM rubber granules. The work was completed in February 2012. Unfortunately in the early months of 2012 when the spray park was in operation the new surface was found to be defective, due to substandard workmanship. With safety concerns being of paramount importance the water park was closed and in 2013 the surface was completely replaced with a new one. The surface was re-laid by Redlynch Installations Ltd, guaranteed for five years and the installation was supervised by Mr Bob Froud from Materials Science Ltd. The EDPM surface has performed well since its installation in May 2013. The disadvantage of an EDPM surface, especially now as there are two layers, is that it acts as a `large sponge` retaining dirty water. In the pool end of the water park this water is in contact with the standing water in the pool and will aid transference of any bacteria, making it difficult to remove. Constant cleaning of the surface is required.	environment. This was laid and bonded to the concrete surface below and provided good service for a number of years. In 2013 the surface was re-laid with a new one. The surface was re-laid by Redlynch Installations Ltd, guaranteed for five years and the installation was supervised by Mr Bob Froud from Materials Science Ltd, an industry expert in these type of surfaces. The EDPM surface has performed well since its installation in May 2013. An EDPM (rubber) surface reduces risk of injury, particularly traumatic head injuries, however the disadvantage of an EDPM surface, especially now as there are two layers, is that it acts as a `large sponge` retaining dirty water. In the pool end of the water park this water is in contact with the standing water in the pool and will aid transference of any bacteria, making it difficult to remove. Constant cleaning of the surface is required.
3.1.6 Water Treatment and Filtration System Water treatment within the plant room consists of “dirty”, water from the buried storage tank, being drawn by duplicate pumps into the plantroom and passing through duplicate bucket filters, for primary filtering of organic matter. The main filtration is currently provided by two stainless steel bodied sand filters.	3.1.6 Water Treatment and Filtration System Water treatment within the plant room consists of “dirty”, water from the buried storage tank, being drawn by duplicate pumps into the plantroom and passing through duplicate bucket filters, for primary filtering of organic matter. The main filtration is currently provided by two stainless steel bodied sand filters.

Chris Mitchell believes that the filters are constructed of three trays of sand and have not been recharged for a period of time and has sought a requisition order to have the sand refurbished by the original installers, Sun Safe Water and Play Ltd. It is also believed that the filters are arranged in parallel and that they are Shallow Bed, high rate filters and not Deep Bed, medium rate units which are now recommended for this type of application. As shallow bed filters they **possibly** lack the efficiency to remove cryptosporidium oocyts. There are currently no Ultra Violet (UV) filters fitted on the system which would provide an effective control of both legionella and cryptosporidium. The circulated water is then chlorinated by utilising a granular feeder system and the PH levels are controlled by calcium and sulphuric acid, before the "treated" water is returned into the tank via the circulated return. The turn-over rate of "dirty" water is unknown but current regulations call for a turn-over rate of better than 15 minutes.	The operating staff believe that the filters are constructed of three trays of sand and require recharging. It is also believed that the filters are arranged in parallel and that they are Shallow Bed, high rate filters and not Deep Bed, medium rate units which are now recommended for this type of application. As shallow bed filters they lack the efficiency to remove Cryptosporidium oocyts. Replacing only the sand filter media will not reduce the risk of infection from **Cryptosporidium**, and **Cryptosporidium** is resistant to chlorine. There are currently no Ultra Violet (UV) filters fitted on the system which would provide an effective control of both legionella and cryptosporidium. The circulated water is then chlorinated by utilising a granular feeder system and the PH levels are controlled by calcium and sulphuric acid, before the "treated" water is returned into the tank via the circulated return. The turn-over rate of "dirty" water is unknown but current regulations call for a turn-over rate of better than 15 minutes.
3.1.7 Ponding Water As already indicated the ponded water area is provided for the babies and younger children to play in, but does provide an area where water can be trapped all day, before it is discharged to drain after the closing of the park in the evening.	3.1.7 Ponding Water As already indicated the ponded water area is provided for the babies and younger children to play in, but does provide an area where water can be trapped all day, before it is discharged to drain after the closing of the park in the evening.

This can provide a breeding ground for bacteria and absorption and retention into the double thick EDPM matting can only assist in this process.	This can provide a breeding ground for bacteria and absorption and retention into the EDPM matting can only assist in this process.
3.1.8 Maintenance and Testing Regime No O&M manuals were available on the day of the visit. It would appear, from talking to Chris Mitchell, that he is competent in what he does and that regular maintenance is undertaken. He informed us that the water quality in the tank, at the end of the day, is often found to be turbid, where it should be clear. To alleviate this the tank water is often dumped to drain and the tank filled with fresh and clear potable water. This we understand has been taking place for some time now and would add considerable costs to the operating of the facility. It is not environmentally acceptable and would not comply with general water conservation measures. Currently, twice a day, testing of the water is undertaken and often the samples towards the end of the day show unsatisfactory levels. Water is drawn from a tap on the water features header pipe, before the treated water is returned to the features and therefore should be at its optimum best. No test results were available on site at the day of the inspection. Waterman Building Services understand that it was stated in June of last year that there had **not been a negative bacterial test result returned**, however Chris stated at the time that the samples were taken in the morning after the tank was filled with fresh water. From these tests they would therefore be expected to pass, but this is an unfair sample/test. This highlights however that the sampling and	3.1.8 Maintenance and Testing Regime No O&M manuals were available on the day of the visit. Subsequently a copy of the O&M manual has been provided by the Council. It would appear, from talking to the operating staff, that they are competent in what they do and that regular maintenance is undertaken. They informed us that the water quality in the tank, at the end of the day, is often found to be turbid, where it should be clear. To alleviate this the tank water is often dumped to drain and the tank filled with fresh and clear potable water. This we understand has been taking place for some time now and would add considerable costs to the operating of the facility. It is not environmentally acceptable and would not comply with general water conservation measures. The tank was shut for cleaning twice a week and for emergency clearing prompted by either a soiling incident or heavy rain. Pre and post cleaning samples were taken weekly (around four occasions per week) from the tank and the tap on the water feature header pipe and sent for laboratory testing and monitoring against PWTAG guidelines. **These results often showed levels of bacteria in between cleaning regimes that gave rise to concerns and prompted further investigation.**

testing regime may be called into question and further confirmation/investigating into how it is operated is required.	
3.1.9 Latest Regulations When the facilities at the splash park were designed they would have been in line with PWTAG (The Pool Water Treatment and Advisory Service) guidelines current at the time, however a change to Splashpad/Spraypark design by PWTAG was published in March 2005 as a technical bulletin. This was to aid designers and has since been included in the latest edition of the PWTAG-Swimming Pool Design guidelines and should be referred to for any and all future works to the facility. Certain areas such as filter types, water turn-over rates and storage tank design have all been revised in the current edition.	3.1.9 Latest Regulations When the facilities at the splash park were designed they would have been in line with PWTAG (The Pool Water Treatment and Advisory Service) guidelines current at the time, changes to Splashpad/Spraypark design by PWTAG were published in March 2005 as a technical bulletin. This was to aid designers and has since been included in the latest edition of the PWTAG-Swimming Pool Design guidelines and should be referred to for any and all future works to the facility. Certain areas such as filter types, water turn-over rates and storage tank design have all been revised in the current edition.
3.1.10 Life Span of Equipment Generally and in accordance with CIBSE guidelines all equipment has a life span of a number of years, which can be influenced by a number of factors such as general maintenance, site conditions and usage patterns. As the splash park has been operating since 2005 and the equipment has been in use for 10 years, it would be appreciated that further investigations should be carried out to establish what condition the equipment is in.	3.1.10 Life Span of Equipment Generally and in accordance with CIBSE guidelines all equipment has a life span of a number of years, which can be influenced by a number of factors such as general maintenance, site conditions and usage patterns. As the splash park has been operating since 2005 and the equipment has been in use for 10 years, it would be appreciated that further investigations should be carried out to establish what condition the equipment is in. The original installation, installed by Sun Safe Play Systems Ltd was compliant with the Council`s use The JCT Standard Form of Building Contract, which at Section16, Practical Completion and Liability Period, stipulated that a 12 month defects (guarantee) period applied, rather than the standard minimum of 6 months.
3.1.11 Adjacent Below Ground Drainage Before the site visit, there had been an uncertainty as to the extent and	3.1.11 Adjacent Below Ground Drainage Before the site visit, there had been an uncertainty as to the extent and

condition of the existing foul water drainage at the site and if it, in part, was contributing to the poor water quality. The council provided the services of a contractor to undertake a CCTV inspection and despite a number of blockages it was proved that the foul water system was totally separate to the splash parks water system. The only areas where the two systems are connected is for a backwash discharge and drain down facility and neither of these were compromised by the foul drainage	condition of the existing foul water drainage at the site and if it, in part, was contributing to the poor water quality. The council provided the services of a contractor to undertake a CCTV inspection and despite a number of blockages it was proved that the foul water system was totally separate to the splash parks water system. The only areas where the two systems are connected is for a backwash discharge and drain down facility and neither of these were compromised by the foul drainage.
4. CONCLUSIONS AND RECOMMENDATIONS From the information provided within this report, Waterman Building Services would conclude that poor water qualities can be attributed to a number of issues, rather than to any single issue. The primary issue would appear to be effectiveness of the sand filters, but all the other issues highlighted do have an adverse effect on the overall system. Further investigations, where appropriate, would be necessary and suitable actions highlighted below would be required, to ensure the parks water quality is maintained to the required level. The current usage of clean potable water to replace turbid dirty water cannot be continued from an environmental water conservation stand point and ongoing cost implications.	4. CONCLUSIONS AND RECOMMENDATIONS From the information provided within this report, Waterman Building Services would conclude that poor water qualities can be attributed to a number of issues, rather than to any single issue. Further investigations, where appropriate, would be necessary and suitable actions highlighted below would be required, to ensure the parks water quality is maintained to the required level. A key issue would appear to be effectiveness of the shallow sand filters, but all the other issues highlighted do have an adverse effect on the overall system. The current regular usage of clean potable water to replace turbid dirty water in what should be a recirculating system should not be continued from an environmental water conservation stand point and ongoing cost implications.

The overcrowding needs to be addressed and the Council need to establish what are the accepted user numbers at the splash park and how best to police this. From these numbers the water treatment system can be looked at to see if it can be updated and made to work efficiently and effectively. Human soiling cannot be prevented due to the nature of the facility, but the introduction of pre showering and foot trays at the entrances onto the pool surface itself would improve water quality by limiting the amount of dirt, debris and sun tan lotion being carried into the facility. Only better signage, education and policing would be effective in reducing the instances of personal fouling and enforced closures of the park.	With the current levels of water consumption a once through system could be considered with the replacement of the existing water features with some new low flow units. The water treatment system is generally in need of updating and overhauling and bringing into line with current legislation. To what level the system is updated to, is dependent partially on what other actions are taken and put into place. Generally the single storage tank is enabling the “dirty” and “treated” water to mix and dilute the effectiveness of the current treatment. Separate “clean” and “dirty” water storage tanks would improve the effectiveness of the water treatment process. The shallow sand filters are not in accordance with current guidance and are in need of replacement with appropriate deep bed sand filter to meet current PWTAG guidance. Replacing the shallow filter beds with a medium rate deep filter bed in combination with a current PAC dosing system should eliminate the risk of infection from **Cryptosporidium** and would improve the quality of the water and efficiency of the plant. The replacement deep bed sand filters would require additional space to what is currently available in the compact plantroom. An extension to the current plantroom would in all probability be required and this may prove costly and would require planning consent For peace of mind, and where budgets allow, recirculating systems can be installed with UV filters working in conjunction with deep filter beds and PAC dosing to ensure elimination of **Cryptosporidium**. This is considered a ”belt and braces” approach and is not included on all facilities. The duties of all pumps would need to be considered to ensure turnover rates are in line with the current PWTAG guidance.

As already stated it is impossible to prevent rainwater from falling onto the surface of the splash park and entering into the underground storage tank.	As already stated it is impossible to prevent rainwater from falling onto the surface of the splash park and entering into the underground storage tank.
However by preventing or limiting the rainwater runoff from the surrounding areas it would reduce the amount of dirt and debris being washed down and into the underground storage tank, through the pool drainage system. This could be achieved by removing the grass from around the sides of the splash pool and replacing it with a hard standing material. The sides could be raised slightly, where required, to provide a barrier between the play surface and surrounding areas except from the points of entry. At these points of entry the existing gullies and channels could be replaced with new and the drainage from them combined together and routed to the nearest surface water sewer or drain. The grass should be kept short, limiting the amount than can displaced and transferred onto the play area and the tree branches overhanging the play area should be shortened and kept trimmed.	However with the installation of either a two tank recirculating or a once throughput system it would no longer be considered a problem. The pool area, however appealing to the smaller children and babies, is an area that causes concern. With the obvious ability to trap and retain standing water it provides an area where dirt, debris and whatever else comes into contact with it can be exposed to high temperatures on hot sunny days. Warm water can be a breeding ground for bacteria and should be avoided wherever possible. The Council need to establish the importance of this specific facility as it is the recommendation of this report that the pool area is removed from the park no matter what upgrades or system is agreed upon.
(i.e. – the problem of rain water run off is solvable, without a new system – see above)	**(not what the council are suggesting above)**
The depth of the EDPM surface and how it affects water quality is difficult to gauge and without further investigation Waterman Building Services cannot provide a definitive answer.	The depth of the EDPM surface and how it affects water quality is difficult to gauge and without further investigation Waterman Building Services cannot provide a definitive answer.
The pool area however appealing to the smaller children and babies is an area that causes concern. With the obvious ability to trap and retain standing water it provides an area where dirt, debris and whatever else comes into contact with it can be exposed to high temperatures on hot	It is however the recommendation of this report to remove the existing paddling area on both water consumption and water quality grounds. This being the case it provides a suitable opportunity to remove the entire EDPM surface and provide an alternative coloured hard

sunny days. Warm water can be a breeding ground for bacteria and should be avoided wherever possible. The Council need to establish the importance of this specific facility and whether it should be retained or removed and upon the outcome appropriate measures can be considered. Appropriate measures such as draining the facility on a number of occasions throughout the day rather than the once at the end of the day, or draining it permanently or reducing the depth can be considered. The water treatment system is generally in need of updating and overhauling and bringing into line with current legislation. To what level the system is updated to, is dependent partially on what other actions are taken and put into place. Generally the single storage tank, without a central division, is enabling the "dirty" and "treated" water to mix and dilute the effectiveness of the current treatment. A central division, if installed would improve the effectiveness of the water treatment. The sand filters are in need of urgent maintenance as a minimum and replacing with a more suitable alternative, as already mentioned in this report, would be desirable. This would improve the quality of the water and efficiency of the plant. The replacement deep bed sand filters would require additional space to what is currently available in the compact plantroom. An extension to the current plantroom would in all probability be required and this would prove costly and would require planning consent.	surfacing in accordance with the latest guidance. Human soiling cannot be prevented due to the nature of the facility, but the introduction of pre showering and foot trays at the entrances onto the pool surface itself would improve water quality by limiting the amount of dirt, debris and sun tan lotion being carried into the facility. Only better signage, education and policing would be effective in reducing the instances of personal fouling and enforced closures of the park.
Currently there would appear to be a number of options available to the council, which are: 1. The council need to consider and decide on how they want to run the	Currently there would appear to be three options available to the Council, which are: 1. Updating of current water treatment plant and facilities The Council

water park and consider what facilities they provide.	need to consider and decide on how they want to run the water park and consider what facilities they provide.
With the appropriate measures instigated, the park can continue to operate and provide a service for the local community.	With the appropriate measures instigated as outlined in this report, comprising both redesign, maintenance and operating procedures, the park can continue to operate and provide the current service for the local community.
There will be a financial cost to providing these measures and to developing the solutions, which do not form any part of this report, but these can only be priced when the remedial works and the parks future are established.	There will be a financial cost to providing these measures and to developing the solutions. These can only be priced in detail when the remedial works and the parks future are established.
This would form part of any further design development of the treatment system and general park facilities.	This would form part of any further design development of the treatment system and general park facilities. To retain and upgrade the water treatment plant and facilities it will require some ongoing level of park management and maintenance on a daily basis. However, with an appropriate recirculating system installed the water quality would be dramatically improved and water usage would be reduced. It would also require a reduced level of management and control compared to the current inadequate system.
2. To make the park a mains water only fed system, to do away with the water treatment/recirculating system would not be appropriate.	2. To make the park a mains water only fed system This option would do away with the water treatment/recirculating system entirely and could be achievable provided the water usage was limited by removing the pond area, reducing the number of features and providing new low

	flow features as appropriate.
To remove the current water treatment system would alleviate the water quality issues, but the constant use and dumping of potable water on a daily basis is not advised. Water conservation initiatives and costs of potable water make this option inappropriate.	To remove the current water treatment system would alleviate the water quality issues, overcome a number of the other issues highlighted above and reduce management and maintenance of the park to a minimum. Water usage and drainage discharge would be constant and not affected by numbers of users.
Thames Water Utilities will not permit direct connection of their potable water supplies to the parks equipment and will only guarantee a maximum working pressure of 1bar (10 metres).	Thames Water Utilities would place restrictions on the volume of clean water supplied to the park and discharges from the site but new low flow rate features may alleviate those concerns and water treatment equipment backwash would no longer be an issue. Initial discussion with Thames Water indicate that a grey water tank would be required to reuse a proportion of the parks water. Thames Water restrictions on clean water supply and use of grey water may restrict the park to a size that eliminates a once through system as a feasible alternative but this will need to be investigated as part of the ongoing design. They will not permit direct connection of their potable water supplies to the parks equipment and will only guarantee a maximum working pressure of 1bar (10 metres).
Storage of mains water and pumping of it to the water features would still be required however to ensure adequate supply and pressures, and therefore ongoing maintenance would still be needed and the costs associated with it.	It is anticipated that a higher pressure, in excess of the 1bar will be required to operate the low flow features therefore storage of mains water and pumping of it to the water features would still be required, especially as Thames Water will not permit boosting of pressures directly off an incoming mains water supply. To ensure adequate flow rate and pressures a nominal size cold water storage tank and booster pump set will be required, and subject to a detailed design may possibly be located within the current plant room. Ongoing maintenance of the tank and pump set would still be needed, but on a

	greatly reduced basis and the new equipment could be provided with remote monitoring to alleviate on site attendance. This option would remove any issues relating to water quality and reduce maintenance and operating costs to a minimum.
3. Should the council decide that the park is not cost effective and remove it from its leisure portfolio, then the plant, play surface facilities and associated drainage would need to be decommissioned and removed? As the current play surface drainage system discharges to the below ground storage tank a new system of rainwater removal, draining all the hard standing areas would need to be designed and installed to replace it. This system would need to discharge to the Local Authority sewer system.	3. Remove the facility altogether Should the Council decide that the park is not cost effective and remove it from its leisure portfolio, then the plant, play surface facilities and associated drainage would need to be decommissioned and removed. As the current play surface drainage system discharges to the below ground storage tank a new system of rainwater removal, draining all the hard standing areas would need to be designed and installed to replace it. This system would need to discharge to the Local Authority or public sewer system.