# Report on the Opening, Closures and Water Quality Issues of the BHP Billiton Water Park –Elizabeth Quay

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Environmental Health Directorate
Department of Health

## 1. Overview

This report outlines the processes and issues that occurred in relation to the opening and subsequent closures of the BHP Billiton Water Park at Elizabeth Quay.

## 2. Inspection

Prior to the water park opening on 29th January 2016, Department of Health (DOH) officers conducted an inspection of the BHP Billiton Water Park on Monday 19th January 2016. A number of issues that were not compliant with the Western Australian (WA) *Code of Practice for the design, construction, operation, management and maintenance of aquatic facilities* (the Code) were identified. These included signage, sanitary facilities (including toilets), structural and electrical certifications, lighting and appointment of a qualified technical operator. A list of these was generated and issued to the Metropolitan Redevelopment Authority's (MRA) main contractor Leighton Broad/CPB Contractors later the same day (19th January 2016) to address.

## 3. Water Sampling

Monitoring of water quality and potential microbial contamination of the water spray park included taking of samples from surface water (troughs), backwash (potential contaminants captured by the system's filters) and the balance tank (critical determinant of the quality of water to which patrons will be exposed).

Sampling of water quality by City of Perth officers began on Thursday 21st January, with further samples taken on the Monday 25th, Tuesday 26th and Thursday 28th prior to opening of the park on Friday 29th January 2016.

These water samples were submitted to PathWest Laboratories where a standard microbial analysis suite used for aquatic facilities was conducted. This suite looks for two important microbiological contamination indicator species:

***Escherichia coli* (*E coli*)**

A species of bacteria common to human and animal digestive tracts that may indicate faecal contamination of a water body.

***Naegleria fowleri***

A species of amoeba that can cause disease in humans, but is the only species of amoeba in the *Naegleria* genus that is pathogenic to humans. Where *Naegleria* amoebae are detected, DNA analysis is used to determine whether the *Naegleria fowleri* species is present, or whether other non-pathogenic species of *Naegleria* are present.

The BHP Billiton Water Park at Elizabeth Quay also has an automated water quality monitoring system that measures and reports on key water quality parameters including pH and chlorine levels several times each hour.

## 4. Sample Analysis

Final results from samples submitted for analysis are typically received from the laboratory spread over a number of days as the different analytical tests are completed. A summary of results is shown in the attached spreadsheet.

Note that when the term *Naegleria* is used and is not further specified, this refers to generic *Naegleria*. Samples that are positive for generic *Naegleria* are then subject to further analysis to determine whether the disease-causing *Naegleria fowleri* is present.

## 5. Waterpark Opening

On the day of opening, Friday, 29th January, several compliance issues raised from the facility inspection on the 19th January 2016 were still being addressed by MRA representatives and contractors. This included confirmation that toilets were complete and available for users of the water park, being a significant sanitation requirement for aquatic facilities.

Paperwork advising that these issues had been addressed was submitted to DOH for review by a senior officer with substantial experience in aquatic facilities at 11:30am on 29th January. The review was completed mid-afternoon and endorsement provided. A letter of approval was then signed by the delegate of the Executive Director Public Health and issued to the MRA for opening of the water park at approximately 3pm.

The decision to issue a letter of approval to open the park was based on several considerations. Firstly, DOH had confirmation of analysis of the initial sample taken on 21st January 2016, where the only *Naegleria* detected in the system was confirmed not to be *Naegleria fowleri*. Secondly, sanitisation processes had been applied to the spray park, including overnight superchlorination on 28th January to the extent that would kill all *Naegleria* species. Thirdly, a qualified technical operator had been appointed. Lastly, DOH officers were of the opinion that the spray park had been brought up to compliance with the Code based on the available information about remedial work undertaken between the 19th and 29th of January 2016. Based on this information, there was not considered to be a risk to the public.

## 6. First Closure

The presence of a *Naegleria* (non-*fowleri*) organism in the actual water treatment system (detected in the backwash) however indicated some form of contamination had entered the water park and was plausibly due to dust and soil transmission from nearby Elizabeth Quay construction work.

Discussions between DOH officers and the spray park's operators during the first few days after opening identified further operational and design issues of potential concern. Although there was no immediate risk to public health, in order to further investigate and undertake remedial cleaning and maintenance work, the spray park operator deemed it necessary for the plant and equipment to cease operation, and for the park to close on Thursday 4th February 2016. During this time, the number of backwash (filter) sampling points was also increased from 1 (prior to 4th February) to 6 (from 4th February 2016 onwards).

The operator re-opened the spray park to the public for a few hours on Friday 5th February. However, DOH advised MRA's representative during the morning of 5th February that the only way to determine whether contaminants disturbed during these remediation works had been removed from the system was through another round of testing of water samples for the presence of indicator microorganisms. Therefore, DOH advised immediate closure of the facility until satisfactory water sample results were returned from PathWest. Accordingly, the park was closed later that morning. Sampling by City of Perth officers on 5th February 2016 returned a clean set of results for indicator microorganisms on 8 February and DOH advised the MRA at noon on that day that the park could re-open.

## 7. Second Closure

***Pseudomonas aeruginosa***

A bacterium that is common in the environment and on human skin. It is used as an indicator of contamination of warm water bodies as it is particularly prevalent in water with temperatures between 32°C and 41°C. As such, it is commonly found in heated pools and spas, and at infective levels can cause skin, ear and eye infections. Specific testing for this bacterium is not normally required for water bodies with water temperatures below 32°C. It is routinely managed in aquatic facilities by maintaining water below 32°C, together with adequate residual disinfectant (chlorine), pH control, and matching number of bathers to facilities' filtration/disinfection capacity. The Code requires that *Pseudomonas aeruginos*a be included in the sampling schedule when water temperatures exceed 32°C.

Higher than expected water temperatures were measured on 8th February 2016 by the automatic monitoring system and these results were received by DOH on 10th February 2016. Therefore, at the time of sampling on the 12th February 2016, the City of Perth officer collecting the sample was asked

to add *Pseudomonas aeruginosa* to the microbial testing request, although water temperature at the time had reduced to 27.8C. Subsequently, P*seudomonas aeruginosa* was added to the analysis suite of further water samples as temperatures measured in the water treatment system continued to climb (reaching a peak of 33$^{o}$C at times), as Perth experienced high temperatures and for part of that time a heatwave.

Results were received on 14$^{th}$ February 2016 and showed detection of *Pseudomonas aeruginosa* in the filters and surface troughs 3 and 4, but importantly, not in the balance tank that holds treated water ready for return to the park surface. It was considered the surface trough detections were consistent with some contamination of these surface waters from pathogens introduced by contact with patrons. The negative results in the balance tank indicated that the filtration and chlorination systems were adequately managing the disinfection, and the quality of water returning to the pool was acceptable. In particular, the absence of *Pseudomonas, E. coli* and *Naegleria* amoebae in the balance tank was reassuring from a public health viewpoint, and it was not deemed necessary to close the park at this point in time.

The temperatures remained high and testing for *Pseudomonas* bacteria was included in the samples collected on 18$^{th}$ February 2016. These results were received on 22$^{nd}$ February 2016 and showed that *Pseudomonas* was being detected throughout the system and importantly in the balance tank where water would be returned for direct contact with patrons. On advice from the Environmental Health Directorate about the results and the evidence that the system was unable to cope with the microbial loading, the Executive Director Public Health acted to close the facility immediately.

## 8. Future Approval to Re-Open

Although aquatic chlorination and filtration systems are designed to deal with microbial contamination risks, in this case, the water park appears to have had higher use than expected, which has placed pressure on the park's design capacity. Subsequently, the park has been closed by DOH, who are now working with the park designers and builders and the MRA to resolve these issues in order to provide a water park that is safe for the public.

Discussions between the MRA and DOH are ongoing and are being given high priority.

The park re-opening is subject to approval from the Executive Director Public Health.