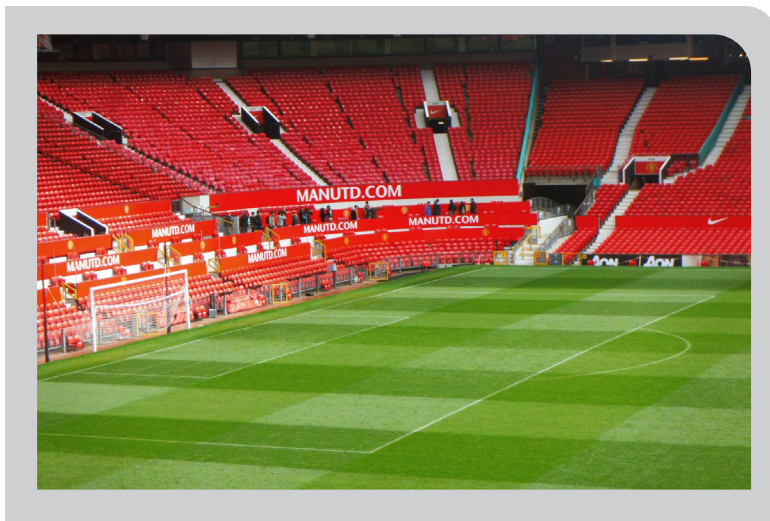


Manchester United is a world-renowned football club that competes in the Premier League, the topflight of English football. In 2018, Envireau Water was asked to investigate issues with yield and water quality from a borehole used for irrigation at their training ground.

Concerns had been raised by the club about reduced yields from the borehole and ongoing water quality issues, which included the clogging of irrigation equipment with iron and discolouration of the pitches. Envireau Water carried out a range of investigations, including geophysical surveying, test pumping, water chemistry modelling and the use of BART test kits as part of the investigation.



The Investigation

In order to understand whether the problems were due to the natural water chemistry or were related to issues with the construction of the borehole, Envireau Water carried out a geophysical survey of the borehole in order to confirm the construction and examine deterioration of screens and casing. Test pumping and water sampling was undertaken to understand the hydraulic performance of the borehole and aquifer, and the water chemistry.

The geophysical survey highlighted issues with the construction of the borehole and the mixing of groundwater from the target aquifer with water from very shallow depths. Analysis of water samples also highlighted high natural unstable iron concentrations in the groundwater. The iron instability was evidenced during the sample collection process with the rapid change in colour of the water sample, from clear to orange, as a result of iron precipitation upon exposure to the air.

In summary the team identified bio-chemical clogging, which was a consequence of how the borehole was constructed, the natural nature of the supplying aquifer, and the chemical and microbiological conditions encountered.

Chemical Clogging

Clogging can dramatically reduce the lifespan of borehole pumps and if left uncontrolled can even result in borehole failure. Clogging may also cause water quality issues including odour related problems, discolouration and the presence of sloughed biofilm in the abstracted water.

Why does it occur?

There are a range of mechanisms. Chemical clogging may occur due to the mixing of different waters and/or oxygenation of water, often resulting in the precipitation of iron or other chemicals. Or it can occur biologically, because the conditions in the borehole allow the growth of different types of bacteria. Often both chemical and microbiological mechanisms go hand in hand.

Can it be fixed?

Where clogging occurs, understanding what chemical-biological processes are taking place is important to design effective solutions to manage the problem.



BART Testing

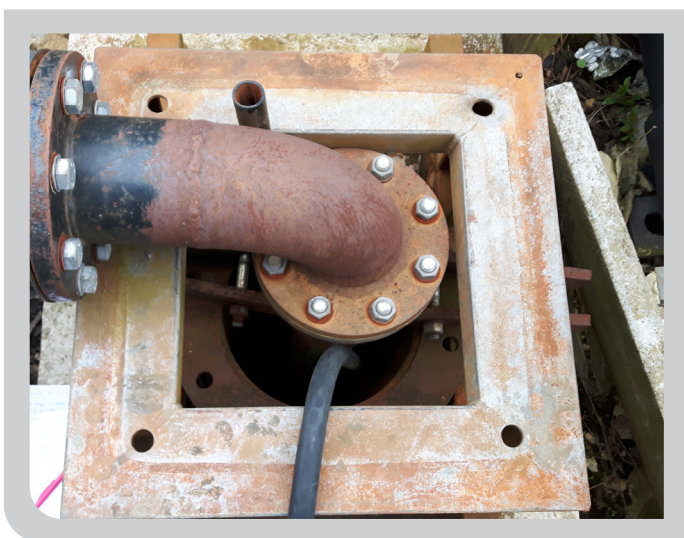
To help assess water quality issues, testing was required. A common method used is a Biological Activity Reaction Test (BART) – a simple test that indicates the presence (or absence) of different types of bacteria and provides approximate population densities to indicate the scale of the problem.

Using BART test kits, Envireau Water was able to confirm the presence of aggressive IRB and aggressive slime-forming bacteria. Identification of the bacteria provided an understanding of the processes operating within the borehole, which highlighted the interactions taking place due to oxygenation of the borehole water column and mixing of water from different depths.



The Result

Following the analysis of all the data collected from the surveys, test work and BART testing, Envireau Water was able to recommend appropriate management options. In this case, it was not possible to address the borehole construction issues without replacing the borehole. Therefore, the recommended management approach included an initial programme of rehabilitation using mechanical and chemical treatment techniques to remove iron precipitates and biofouling, followed by changes to the pumping regime to reduce excessive oxygenation of water within the borehole. The installation of a water storage tank with a spray bar was also recommended to reduce the amount of dissolved iron in the water and prevent pitch discolouration. This was all combined with a programme of routine monitoring and maintenance.



The changes recommended by our expert team resulted in the following:

- The reduction in the formation of iron oxide coatings and biofouling.
- The prevention of further declines in borehole yield and performance.
- Improved water quality.

Sound Familiar?

Borehole design is complex and many failures can be unexpected. Our team has extensive experience in borehole construction, rehabilitation, and investigation with the expertise to optimise your water supply. Envireau Water can conduct testing, analysis, and implement changes to prevent failures and prolong the lifespan of your borehole. Need our help? Get in touch with our technical lead phil@envireauwater.co.uk or contact 01332 871 882.



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