Iron bacteria in water bores

Iron bacteria are found in all parts of the world, with the exception of the southern polar region. In Queensland they occur naturally in dams, swamps, watercourses, lakes and groundwater. Reports of iron bacteria in bores have increased rapidly throughout the State in recent years. This fact sheet discusses the occurrence, treatment and prevention of iron bacteria-related problems in bores.

What are iron bacteria?

Iron bacteria are micro-organisms which obtain energy by oxidising soluble ferrous iron into insoluble ferric iron which then precipitates out of solution. This energy is used to promote the growth of thread-like slimes which together with the ferric iron, form a voluminous mass.

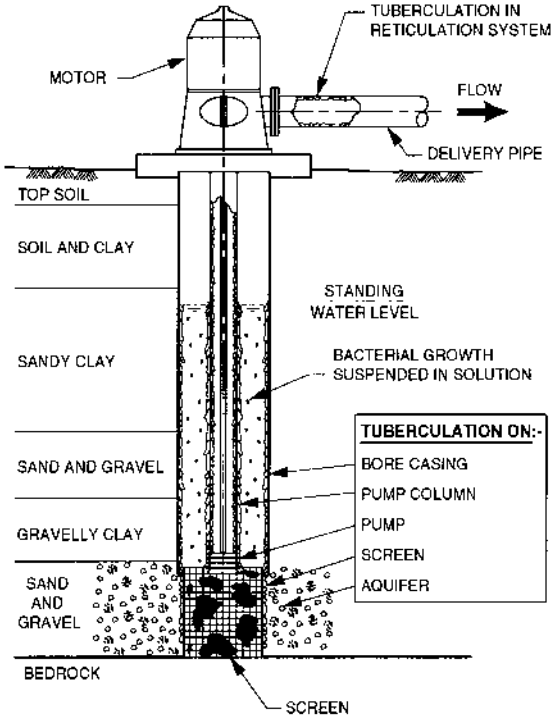
Many species of iron bacteria have been identified. There are also some bacteria which live on manganese in water. However, as most groundwaters contain lower concentrations of manganese than iron, it is iron bacteria which have caused the majority of problems in bores.

Effects on bores

Whilst most groundwaters contain a certain concentration of ferrous iron, iron bacteria do not affect all bores.

When iron bacteria infect a bore, the resultant growths may either suspend in solution or tuberculate (deposit growth) onto the bore casing, screens or the aquifer itself. Tuberculation may also occur in pumping equipment and reticulation systems. The result may be:

- blockage or restriction of groundwater into the bore
- blockages in reticulation systems
- decreased pumping efficiency
- increased pumping costs
- burn-out of submersible pumps due to overheating.



Water bore infected by iron bacteria

Micro irrigation systems are particularly susceptible to clogging due to the fine aperture sizes of the common outlets.

In fixing to metallic fittings the bacteria are thought to secrete an acidic substance which increases metal corrosion resulting in deterioration of bore casing, screen, pump, column and reticulation system.

Iron bacteria may cause a decline in the standard of water quality with adverse effects on taste, colour and odour, and lead to staining (usually reddish).

Why do these problems occur?

There is some debate as to why certain bores suffer adversely due to iron bacteria while other bores never become infected. Often the bacteria are present in the aquifer before the bore is drilled. The method of bore construction and the way the bore is used generally determine whether iron bacteria problems eventuate.

Some tips on how to avoid iron bacteria problems occurring in bores are:

- never allow water from low capacity upper aquifers to enter the bore. The resultant cascading water increases the oxygen concentration in the bore and promotes bacterial growth
- never overpump the bore so that it breaks suction
- seal the annulus between the borehole and the outside of the casing with concrete to a depth of at least 5 m. This is to stop highly oxygenated water running down the annulus after rainfall
- disinfect the bore after drilling is complete and ensure pumping equipment is not contaminated at installation
- seal the bore if you are not installing pumping equipment immediately
- establish a routine disinfection program on your bore when it is operational. This will reduce the risk of major rehabilitation work in the future.

Identification

Instances of iron bacteria in bores are usually discovered through one or more symptoms:

- reduction in the bore's pumping capacity
- deterioration of water quality (colour, odour, taste, feel and staining)
- supply failure caused by motor burn-out in submersible pump
- sand entry into bore
- tuberculation on pump column, bore casing, screens and reticulation system.

Positive identification of iron bacteria contamination may be achieved by microscopy or biological techniques. However the symptoms displayed by a bore will usually indicate if iron bacteria infection has occurred.

Bore rehabilitation

If iron bacteria contamination has occurred, a typical rehabilitation program involves both chemical and mechanical treatments.

Chemicals used in the treatment process usually consist of an inhibited acid and an antibacterial agent. Several companies in the groundwater industry now market a range of products designed to rehabilitate and disinfect bores with iron bacteria problems.

Mechanical treatment will be necessary in most cases to remove encrustations so that chemical disinfection of the bore and water bed will be more effective. This may require the use of specialised equipment, so you should seek advice before proceeding.

- Determine pH of the bore water and test drawdown behaviour for comparison after treatment.
- Mechanically clean the interior of the casing and screens. Bail or airlift scrapings to waste.
- Dose bore with appropriate chemicals. Where a specific section of a bore is to be treated (e.g. slotted or screened section), a tremie pipe may be used to place the chemicals at the specific area of interest. This results in a lower cost than if the complete bore was treated.
- Agitate the bore intermittently with a surging block or jetting tool for a period of at least 24 hours. This ensures that the chemicals will infiltrate the water bed.
- Pump chemicals to waste along with any residues until pH is within 0.5 units of the value before treatment.
- Test drawdown behaviour of the bore. If the treatment has been successful, the drawdown should be less than previously measured.

Once rehabilitation of the bore is complete, ongoing surveillance of the bore's pumping capacity and water quality should be undertaken. Future disinfection/rehabilitation of the bore should be carried out when required.

All chemicals used in the disinfection and rehabilitation process may be dangerous and corrosive, and appropriate safety precautions must be taken at all times.

Bore disinfection

Disinfection will prevent major infestation or encrustation occurring in the first place. New bores, or any existing bore where possible contamination is suspected, should be disinfected. This will avoid the need for rehabilitation which is often complex and expensive.

Disinfection may be achieved by dosing the bore with sodium hypochlorite or with one of the several propriety chemicals currently on the market. Information on bore disinfection and use of chemicals is contained in fact sheets **'Disinfection of water bores'** and **'Using chemicals in water bores'**.

Further information

Should you require assistance or advice on this topic, please contact a local groundwater consultant. You will find their contact details in the yellow pages under the headings of ‘Natural Resources Consultants’ or ‘Boring and Drilling Contractors.’

Further information on groundwater or other natural resource management topics may be downloaded from the Natural Resources and Water web site at <www.nrw.qld.gov.au>.

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