AgEcon

Fact Sheet

December 2019

Borehole maintenance – Bundaberg case study analysis

Borehole rehabilitation can improve yield and reduce energy costs

Irrigators with access to ground water have the advantage of year-round assured water for cane crops on one hand, but often carry the burden of high per megalitre energy costs from increased Total Dynamic Head. If pump testing data reveals a reduced flow rate and increased costs, it may well be the case that the borehole requires remedial action. Continuous monitoring of borehole performance can be cost-effective, helping to detect any problems before they become serious. Table 1 sets out the symptoms to be noted in a monitoring program, along with causes and suggested remedial actions.

Table 1. borehole monitoring: symptoms, causes and remedies

Monitored symptom	Causes	Remedial action
Regional fall in water table	Drought, earth movements, large-scale abstraction	Lower pump inlet Deepen borehole Drill new, deeper borehole
Localised fall of water table	Over-pumping Blocked screens or gravel pack	Check earlier pump data Reduce pumping rate Rehab: camera inspection, chemical and pressure cleaning
Change in water quality (chemical)	Chemical pollution Saline influx Aquifer mixing	Analyse water: if hazardous, shut down borehole and reassess
Change in water quality (biological)	Pollution Change in water chemistry	Analyse water: If temporary, pump out water and disinfect borehole or cathodic protection
Unusual corrosion/incrustation of borehole headworks equipment	Pollution Change in water chemistry	Remove pump, rehabilitate
Reduction of bore yield	Pump faulty Piping blocked through incrustation	Remove and inspect pump Inspect and replace piping as required

Bore maintenance and redevelopment allows the bore to operate at full capacity by removing all growth, biofilms, scale etc. that may be blocking the draw area of the bore and redeveloping the surrounding gravel pack. The redevelopment process not only increases yield in most cases but also achieves greater pumping/energy efficiency and generally the efficiency increases over a 12-month period, easily repaying for the redevelopment cost.

An example Cost-Benefit Analysis

Table 2 shows before and after scenarios of a 55m deep line-shaft borehole pump (common in the industry) undergoing bore maintenance and redevelopment. This analysis includes the cost of lifting, refurbishing the turbine pump and reinstalling the line-shaft pump. Due to the pump not operating on its duty point, the energy use is inefficient. Once the flow rate improves, the pump operates at more optimum levels. In most situations bore yield improves offering high ML/day following bore remediation.

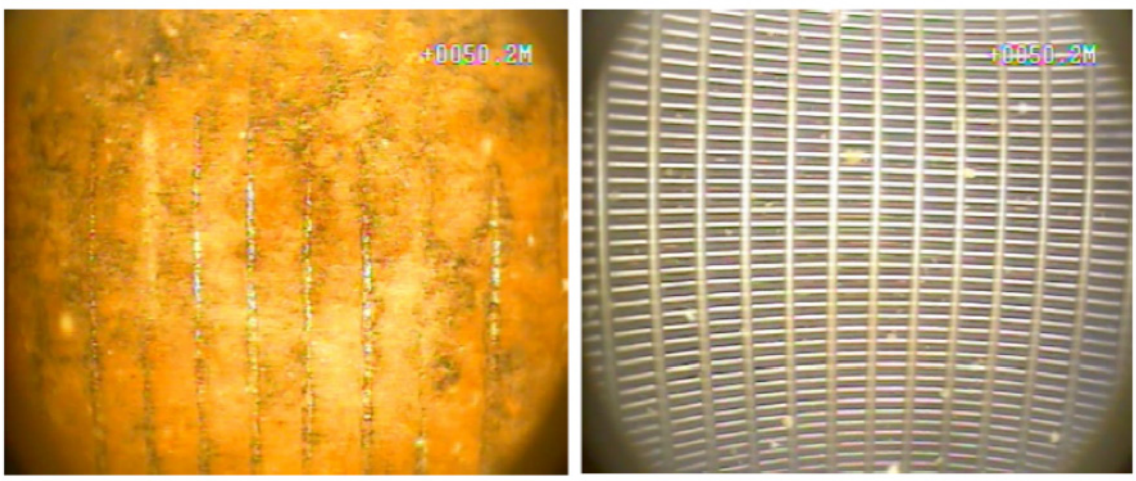
Table 2. payback analysis of borehole maintenance and pump repair

Item	Business as usual	After borehole maintenance
Standing water level	35m	35m
Drawdown level	48m	38m
Electricity used per ML per m head	5.42 kWh	4.1 kWh
Total extraction cost to surface (@$0.25/kWh)	$65.04	$38.95
Energy usage p.a (350ML)	91,056 kWh (A)	54,530 kWh (B)
Annual savings (kWh)	A-B = 36,526 kWh	
Annual savings ($) @$0.25 / kWh)	$9,131.50	
Bore refurbishment one-off cost	$12,500	
Bore pulling and pump reconditioning	$5,000	
Simple payback ($17,500/$9,131)	1.9 years	
Reduction in energy costs	40%	

A sample irrigation bore maintenance plan;

- CCTV Downhole camera inspection to be undertaken each time the pump is out for maintenance. This should be completed every 5 years;
- Bore maintenance and redevelopment: this should be completed every 5 years at the same time the pump is out for servicing. The extent of works will depend on the findings of the CCTV Inspection;
- Following the bore maintenance and redevelopment the bore should be treated annually (with pump in place) with a bore cleaning product. Providing the annual dosage (~$600-$2500 p.a) is kept up to date the redevelopment intervals can be increased.

Recommendation courtesy: Luke Woods, ACS Equip www.acsequip.com



Before at 50.20m

After at 50.20m

Bore screens, before and after cleaning through targeted chemical jetting (Source: ACS Equip)

Further reading

- Borehole Drilling and Rehabilitation under field conditions (2004): https://www.icrc.org/en/doc/assets/files/other/icrc_002_0998.pdf

- Repair or Replace? Line-shaft vs Submersible Pumps (2019): https://www.cottoninfo.com.au/sites/default/files/documents/Irrigation%20borehole%20pumps%20CRDC_FINAL.pdf

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