

**60 megalitres of highly acidic water with extreme fluctuations in acidity treated with the CRAB's automated reagent correlation system.**

<b>Name</b>	<b>Gold Coast City Council Quarry</b>
<b>Site Location</b>	South East Queensland
<b>Site Problem</b>	pH & Acidity
<b>Water Volume</b>	58 Megalitres
<b>Water pH</b>	2.8 pH
<b>Acidity</b>	114mg/l to 296mg/l
<b>Suspended Solids</b>	Above license limits
<b>Treatment Objective</b>	Environmental Release
<b>What is causing the problem</b>	Quarrying and rainfall
<b>Dams/Pits</b>	1
<b>Length of water body</b>	195 metres
<b>Width of Water body</b>	68 metres
<b>Water Depth</b>	To 7.2 metres
<b>Bottom Type</b>	Rough and erratic
<b>Aquatic Flora</b>	None
<b>Vehicle Access and Flora</b>	Road access no Flora
<b>Environmental Sensitivity</b>	Contained and Controlled
<b>Aquatic Life</b>	None
<b>Drains or Streams nearby</b>	Yes – environmental risk
<b>Regulatory requirements</b>	Yes - discharge
<b>Urgency level</b>	Very urgent – stopping operations



## **SITE DESCRIPTION**

The Gold Coast City Council Metamorphic Rock Quarry situated at west Burleigh had sufficient rainfall to overflow their containment pit to the point where it was slowing quarry operations.

The containment pit is approximately 195 metres long by 68 metres wide and up to 7.2 metres deep. The water volume was initially estimated to be 58 megalitres.

## **OBJECTIVE AND WATER QUALITY**

The objective was to raise pH, neutralise acidity and to reduce suspended solids and turbidity as per quarry license requirements to allow environmental release.

The pit water was tested before treatment at the southern end near the pump extraction point and was found to have an acidity of 122 mg/l and a pH of 3.01

## **CAUSE OF ACIDITY**

The North Eastern floor of the pit has a low flow of ground water leaching from the rock face. This area has a shale seam with extreme acidity forming. This acidity is visible in the form of a yellow crystalline material formed from the oxidation of pyritic rock and shale. This material during rain dissolves and leaches into the Containment pit carrying dissolved metals.

There are several other highly acidic acid forming areas to the south of this area in close proximity to the pit. The pyritic shale seam which is producing a large amount of acid is situated to the east of the pit and intersects the pit wall and possibly the bottom of the pit. Luckily this seam is only partially exposed in a few places. Exposure and blasting has produced extreme acidity from this shale body.



**Acid formation**

## **INITIAL TREATMENT**

Initial pit treatment consisted of dosing with Calcium Hydroxide supplied by the Quarry.

This treatment reduced acidity to 2 mg/l and raised pH to 8.3.

Acidity, Metals, Turbidity and Suspended Solids were reduced to allowable discharge limits.

Treatment of the pit water to this stage was conducted over 3 days with final water testing and sampling to a depth of 6 metres.

No signs of ferrous iron remained due to our refined treatment processes.

## **SITE PROBLEMS**

### **Stage 1.**

Acid Solutions was called to treat approximately 60 megalitres of low pH acidic water in-situ to allow dewatering and release into the nearby drainage system in accordance with license requirements.

The initial 3 day treatment was satisfactory until dewatering commenced.

### **Stage 2.**

Partial dewatering revealed large volumes of pre-crushed and processed rock. Dewatering caused leaching from this untreated and pre-processed rock situated partially underwater. This leaching caused severe re-acidification of the pit water.

This rock was holding acidity only to be released once water levels fell enough to drain a fresh dose of acid to the remaining pit water.

Another factor affecting release was the high flow of dewatering. This high flow (of aerated water) was eroding pyritic shale situated along one of the drainage channels. This erosion and oxidation was producing approximately 30 milligrams per litre of acidity. Pumping was stopped and the pit was retreated.

The drop in pH from dewatering was not due to ferrous iron being present in the treated pit water.

### **Stage 3.**

Due to the erratic re-acidification during dewatering, it was decided to treat the pit water using the CRAB ATS750 and its automated pH correlation Inline Bulk Treatment System (IBTS). This system automatically adjusts reagent output to match a preprogrammed pH setting. This system was used to produce precise treatment and dewatering results.

Acid Solutions treated the remaining 40 megalitres at a dewatering flow rate of 700 to 750 cubic metres per hour (0.7-0.75 megalitres/hr)



**Two 8 inch pumps and CRAB treating fluctuating acidity of pit water.**



**CRAB treating 750,000 litres per hour.**

## DEWATERING AND PROBLEMS ENCOUNTERED

The site was not stable in terms of pH and acidity.

The dewatering system used with the (IBTS) was two 8 inch pumps transferring approximately 750,000 litres per hour.

The acidity in the initial stages of inline treatment reached a maximum of 296 mg/l measured at the pump whilst the maximum acidity at the surface of the pit was 73mg/l. The acidity would fluctuate over 80 mg/l within time frames of 30 minutes or so as these leaching acidic channels where drawn to the suction inlet of the dewatering pump.

The ferrous iron content of the water was higher from pump samples drawn from the bottom of the pit than from surface water samples. No ferrous iron was observed from samples taken downstream onsite after treatment & pre release.

This was due to super aeration of the reagent & our patented treatment process.

As dewatering continued and the pit water volume was reduced, the ratio of remaining pit water to untreated acid contained in the submerged processed rock decreased.

Towards the latter stages of treatment a small change in water level resulted in a larger change in pit acidity caused by drawdown and leaching of acid.

This caused large fluctuations in treatment rate as the acidity of the pit was not uniform due to channels of acid leaching from the gravel. The CRAB's automatic correlation system coped well with the extreme changes in acidity.

## FAST RESULTS

The use of the CRAB's automatic pH correlation system produced outstanding results considering the extreme fluctuating nature of this site.

This treatment system allowed the Gold Coast City Council to resume works with minimal disturbance to operations.



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