

## Fact Sheet

# Water in mining

### Introduction

A reliable water supply is an important requirement for a gold-mining operation. Water for mining is sourced from aquifers, tailings dam return water and the Water Corporation. Kalgoorlie Consolidated Gold Mine (KCGM) is a large user of scheme water (fresh water) drawn from the Water Corporation's main water supply to the Goldfields: the Goldfields and Agricultural Water Supply Scheme.

### Uses of fresh water

KCGM's treatment and processing facilities consume a large quantity of scheme water. Smaller volumes are used for revegetation, exploration drilling, drinking water and sanitation purposes.

It is necessary to use scheme water in some parts of the treatment process because water from the aquifer is extremely salty (hypersaline) and would reduce gold recovery. Scheme water use in the gold milling operation is divided into four main areas: concentrate handling, roasting, gold recovery and general services.

**Concentrate handling:** Some milled ore contains gold that cannot be recovered from the normal leaching process. The slurry from the milling process for this type of ore must first be upgraded, via a flotation process, to produce a sulphide concentrate, and this concentrate must be washed and dewatered using scheme water.

**Roasting:** The roasting process reduces the sulphur content in the sulphide concentrate. As the dry concentrate is transported from the milling operation to a remote site for roasting, the concentrate must be mixed with scheme water to form a slurry again for roasting purposes.

The use of scheme water improves the effectiveness of the roasting process. Roasting of the sulphide ore generates gases to an operating temperature of 650°C, and the scheme water, via spray nozzles, cools these gases to 370°C.



This enables the gases to be channeled via electrostatic precipitators, or large dust filters, to remove dust.

**Gold recovery:** In this part of the process, scheme water is used to wash the collected gold contained on carbon grains and known as 'loaded carbon'. The gold is extracted from the loaded carbon by a mix of chemicals dissolved in scheme water. At this stage, the loaded carbon becomes 'barren' and is transported for reuse in the gold processing circuit. The liquid containing the gold is pumped to the next stage for further recovery. General services: Scheme water is used for drinking water, sanitation purposes, safety showers and eyewash stations, and in the chemical laboratory within the plant operations.

### Water measurement

Scheme water from the Water Corporation is measured by a flow meter, for billing purposes, as it enters the gold-mining operation.

For internal use, additional flow meters measure the volume of scheme water being used in different parts of the operation. This monitoring is part of a water management reporting system and is used not only by the processing and operating personnel but also by accounting personnel in allocating costs to different parts of the operation.

As part of the water management program, water is also sourced from tailings dam return water and from bore water. This hypersaline water contains about five times as much salt as sea water.

Once the gold is recovered from the leaching process, the slurry is transported to large containment dams known as tailings dams. Much of this water can be recovered and reused in plant operations. Additional water for plant operations is sourced from bore water. Kalgoorlie has large underground hypersaline aquifers, and KCGM is licensed to extract groundwater.

## Agreement

KCGM has a special agreement with the Water Corporation for the use of scheme water. This agreement sets out the charges that are to be applied to water use and the volumes that can be used. There are different rates covering normal use and excess use, just as there are for households.

By using treated effluent, bore water and tailings return water for plant operations, KCGM limits the volume of scheme water it uses, and manages its water use according to the special agreement conditions.

As part of good management, or a continual improvement process, KCGM, like other mining operations, continues to pursue ways of achieving the most efficient use of water resources.

## Water Management

Drinking-quality water is piped some 600km from Perth to the Goldfields area. The use of this limited resource is not appropriate for the large quantities required in the processing of gold ore. Instead, KCGM uses the saline and sometimes hypersaline groundwater of the goldfields for mineral processing.

KCGM uses about 12,000 megalitres of water each year. About 17% is potable water obtained from the Kalgoorlie water supply system and the remainder is saline obtained from groundwater and water recycled and recovered from operations.

The total dissolved solids content of the naturally occurring saline waters ranges from about 30,000 to about 200,000 milligrams per litre (sea water has about 35,000 to 40,000 milligrams per litre of total dissolved solids).

KCGM uses this saline groundwater in its mills and plants and also to transport tailings. Groundwater protection and management measures are important at the borefields, in the pipelines and at the tailings storage facilities.

Pipelines are constructed of high-density polyethylene laid within earthen bunds with 'catch' pits located at low points along the pipelines. If a pipe bursts the saline water is contained in the bunds and catch pits, preventing the salt from contaminating surrounding soil and killing plants. Pipelines are also fitted with a leak detection system linked back to a central control room. A pipeline breakage is detected by a drop in water flow and this automatically triggers a shutdown of the pumping system.

At the tailings storage facilities, a balance is maintained to allow the material to settle, compact and dry out as the water infiltrates back into the groundwater. Trenches and groundwater bores around these facilities intercept the groundwater movement and keep the water table in check to protect the vegetation.

KCGM links together its inspections, flow monitors and warning systems on its pipes, computer balance models, mineral processing research and prediction of water needs, to manage water and groundwater resources and thus protect the environment. KCGM also monitors the condition of vegetation around tailings storage facilities to verify the operation is not causing an impact.

KCGM is focused on the continual improvement of site-wide water supply and use so that a cost effective and low-risk process water supply can be maintained. KCGM has implemented substantial improvements in water use efficiency including recycling of decant water and the recovery of seepage water from the tailings storage facilities.