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Development of a Cover System Design for Potentially Acid-Forming Tailings at Peak Gold Mines

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ABSTRACT

Peak Gold Mines (PGM), a member of the Rio Tinto Group, is an underground and open cut gold mining operation located near Cobar, NSW. A multi-phase study was initiated in 2001 in support of developing a dry 'moisture store and release' cover system design for the PGM tailings dam, which contains potentially acid-forming tailings material. The first phase consisted of characterising the tailings and potential cover material (waste rock from an open cut operation) as well as soil-atmosphere cover design modelling. The second phase involved construction of two cover system field trials on the tailings dam and installation of a variety of field instruments to monitor the hydraulic performance of the test covers during all seasons of the year. Field performance monitoring commenced in April 2002 and will continue for a minimum of two wet-dry climate cycles (third phase), prior to using the field data for calibration and subsequent validation of numerical models developed for the cover system trials (fourth phase). This paper describes the work completed for the first two project phases and also discusses the initial performance of the cover system trials.

INTRODUCTION

Peak Gold Mines (PGM), a member of the Rio Tinto Group, is an underground and open cut gold mining operation located near Cobar, NSW. The mining operations commenced in 1992, and are expected to continue operating until 2007. The tailings dam contains potentially acid-forming tailings material and at closure, the impoundment is expected to contain approximately 10.6 Mt of tailings. Preliminary closure planning for the mine site identified that research of suitable cover options for the tailings dam was required. PGM is located in a semi-arid region and have therefore chosen to investigate a dry 'moisture store and release' cover system.

A four-phase study was initiated in 2001 in support of developing a cover system design for the PGM tailings dam. The first phase has been completed, which consisted of characterising the tailings and potential cover material as well as soil-atmosphere cover design modelling. The second phase involved construction of two cover system field trials on the tailings dam and installation of detailed performance monitoring systems; this work was completed in April 2002. Monitoring the performance of the cover system field trials over a minimum of two wet-dry cycles is the third phase of this study. The fourth and final phase of this study will utilise the collected field data to calibrate/validate the cover design numerical model, which will lead to a defensible design for the full-scale tailings dam cover system.

The focus of this paper is on the design of the cover system field trials through soil-atmosphere numerical modelling, construction of the two experimental dry cover systems and installation of the field performance monitoring systems. The initial field performance of the two cover system trials is also discussed.

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BACKGROUND

Site description

The PGM tailings dam, which is operated using the central thickened discharge technique, covers a surface area of approximately 70 ha. The site is underlain by siltstone, shale and sandstone. The tailings dam operation has produced a relatively dry, dense stack of tailings with an average beach slope of 1.7 per cent. The tailings are characterised as potentially acid-forming with moderate sulfur content (two to five per cent) and low acid neutralising capacity (EGi, 2000).

The climate at the site is seasonal, with average maximum daily temperatures ranging from 34°C in January to 16°C in July. The average annual rainfall is approximately 415 mm falling fairly steadily throughout the year. The historic minimum and maximum annual rainfall for the site, dating back to 1969, is approximately 197 and 810 mm, respectively. On average, the greatest amount of rainfall occurs in January (49 mm), while June receives the least amount of rainfall (24 mm). The annual potential evaporation in the region is approximately 2000 mm.

Dry cover systems

Dry cover systems as a closure option for management and decommissioning of waste rock and tailings is a common prevention and control technique used at numerous sites around the world. Dry covers can be simple or complex, ranging from a single layer of earthen material to several layers of different material types, including native soils, non-reactive tailings and/or waste rock, geosynthetic materials, and oxygen consuming organic materials (MEND, 2001).

The two principal objectives of a dry cover system are to control the ingress of oxygen to the underlying reactive mine waste and/or to control infiltration of meteoric waters to the underlying waste. Additional objectives include: control of consolidation and differential settlement; oxygen consumption (ie organic cover materials); reaction inhibition (ie incorporate limestone at the surface which does not prevent oxidation but can control the rate of acid generation); and control of upward capillary movement of process water constituents/oxidation products (MEND, 2001).

It is difficult and usually not economically feasible in arid and semi-arid climates to construct a cover system that maintains a highly saturated layer thereby reducing oxygen transport. The cover system will be subjected to extended dry periods and therefore the effect of evapotranspiration will be significant. However, subjecting the cover system to evaporative demands can be beneficial in arid and semi-arid climates, and result in a reduction of infiltration to the underlying sulfidic waste material. A homogeneous upper cover surface layer with a well-graded texture and possessing sufficient storage capacity can be used to retain water during rainfall events. Subsequent to the increase in moisture storage in the well-graded layer, it would release a significant portion of pore water to the atmosphere by evapotranspiration during extended dry periods, thereby reducing the net infiltration across the cover system. The objective is to control acidic drainage as a result of preventing moisture movement into and through the waste material. A cover system with the above objectives is often referred to as a 'moisture store and release' cover system.

DESIGN OF COVER SYSTEM FIELD TRIALS

The design of cover system field trials for the PGM tailings dam involved detailed geotechnical characterisation of the tailings and potential cover materials and soil-atmosphere cover design modelling. A brief description of these two programmes is provided below, as are the key findings from the completion of each study. The complete details of both programmes are documented in OKC (2001).

Geotechnical characterisation of tailings and potential cover materials

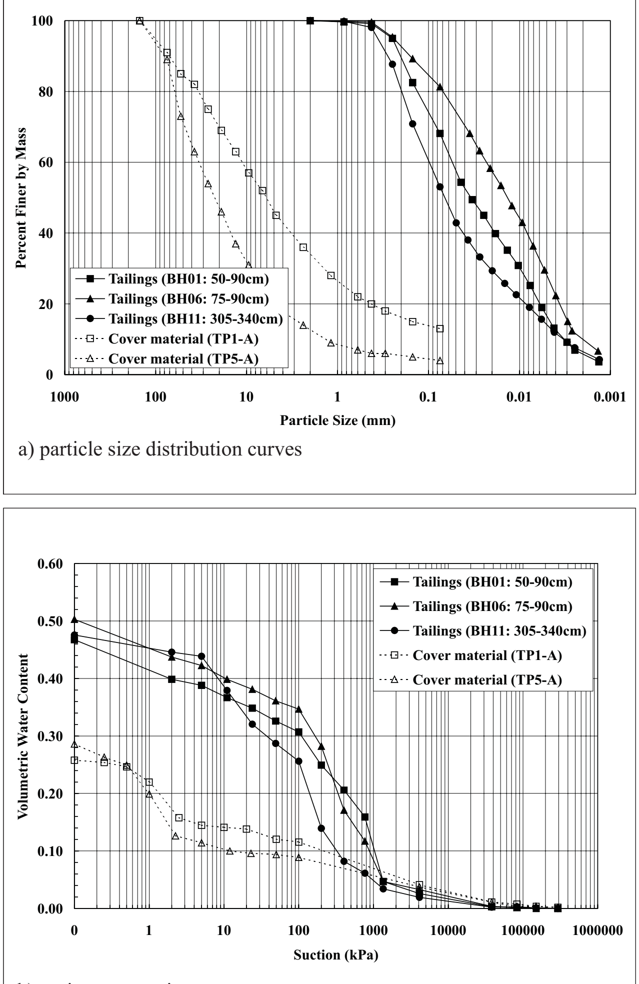
The geotechnical characterisation of the cover and underlying waste materials is required in order to develop a defensible dry cover system design for a waste storage facility. Various hydraulic parameters (eg saturated hydraulic conductivity and the moisture retention or soil water characteristic curve) and physical parameters (eg specific gravity, density or void ratio) are required for input to a soil-atmosphere cover design numerical model. The *in situ* moisture content and density of the cover and waste materials should be determined to facilitate appropriate preparation of laboratory test specimens (ie representative of field conditions) and to provide initial conditions for numerical modelling. The determination of these various geotechnical characteristics requires both a field investigation and laboratory test programme.

A field sampling/testing programme for potential cover and tailings dam materials was undertaken at the PGM site in April 2001. The most promising cover material for the tailings dam is completely oxidised (COX) waste rock from PGM's recently developed New Cobar open cut. Samples of COX waste rock material were collected from five test pits, ranging in depth from 0.25 m to 2.5 m, excavated within a small waste rock dump at the development. Eleven boreholes, ranging in depth from 1.0 m to 4.0 m, were completed in the PGM tailings dam to facilitate the collection of a representative set of tailings samples. All material samples were characterised on-site for *in situ* moisture content, paste pH, and paste electrical conductivity (EC).

The geotechnical laboratory characterisation of the material samples was conducted at laboratory testing facilities located in Australia and Canada. The preliminary test programme involved particle size analysis of all material samples. Following a review of the particle size distribution (PSD) test results, coupled with observations made during the field investigation programme, a smaller group of material samples was selected for detailed physical and hydraulic characterisation. The detailed test programme for both materials included specific gravity, saturated hydraulic conductivity, and moisture retention testing. Large-scale test apparatuses were used for the cover material samples to ensure that as much material as possible was included in the test (larger sized particles up to material <75 mm), such that correcting the laboratory test results for over-size material was minimal.

The key findings from the geotechnical characterisation of the tailings and COX waste rock cover materials are as follows.

- The PGM tailings material is relatively well-graded over a particle size range of 0.001 to 1 mm, with an average D_{50} of approximately 0.02 mm. The COX waste rock cover material is relatively well-graded over a particle size range of 0.075 to 150 mm, with an average D_{50} of approximately 12 mm. The COX material can also be considered to be slightly gap-graded, due to a lower percentage of material between the 1 and 10 mm particle sizes. The PSD curves of samples selected for detailed laboratory characterisation are shown in Figure 1a.
- The tailings material possesses significantly greater moisture retention capability as compared to the COX waste rock cover material, as shown in Figure 1b. Initiation of drainage from the matrix occurs much sooner in the cover material due to its coarser texture. The shape of the moisture retention curves for the cover material is considered bi-modal and is the result of the gap-graded nature of the material.
- The saturated hydraulic conductivity of the tailings material ranged from approximately 5×10^{-5} cm/s for a low-density condition to 5×10^{-6} cm/s for a high-density condition. In comparison, the saturated hydraulic conductivity of the COX waste rock material ranged from approximately 5×10^{-1} cm/s for a low-density condition to 1×10^{-4} cm/s for a high-density condition.



a) particle size distribution curves

b) moisture retention curves

FIG 1 - Particle size distribution and moisture retention curves for tailings and cover material samples selected for detailed laboratory characterisation.

Soil-atmosphere cover design modelling

Soil-atmosphere cover system design modelling was completed using the one-dimensional SoilCover model (GeoAnalysis 2000 Ltd, 2000) to evaluate alternate designs on the basis of predicted net percolation to the underlying waste. Material properties from the laboratory and field characterisation programmes were used as input to the model. The climate database was prepared from weather data collected at the Cobar regional meteorological station. Preliminary numerical modelling was completed to establish representative lower boundary conditions.

The detailed soil-atmosphere modelling completed for this project examined four potential cover system designs for the PGM tailings dam. The first design was 0.5 m of COX waste rock material overlying a 10 m thick tailings layer with an upper thin layer of desiccated tailings. The subsequent cover designs included the same profile, but the thickness of the COX waste rock cover material was increased in 0.5 m lifts up to a maximum thickness of 2.0 m. A total of 124 model simulations were completed for this project.

The primary objective of the soil-atmosphere modelling programme was to determine the 'average' net percolation through each cover system design under the same set of climate conditions. Note that the net percolation predicted from the mean or median rainfall record for a given site may not be representative of the long-term 'average' performance of a cover system. The magnitude and occurrence of various rainfall events throughout the year, coupled with antecedent moisture conditions, plays a major role in the computation of the net percolation through a cover system. Therefore, evaluating long-term 'average' cover system using the mean climate year may in fact result in a predicted net percolation that is not representative of the 'average' net percolation. The long-term 'average' performance of a cover system should be determined from a statistical analysis of the net percolation predicted for each year of the climate record. The latter methodology accounts for the impact of antecedent moisture conditions, as well as the occurrence and intensity of daily rainfall when determining the long-term 'average' net percolation.

Each year of the climate database assembled for this study (1969 - 2000) was modelled for each cover system design alternative. The period 1 October to 30 September was used for all simulations such that the generally wetter months of the year were straddled between the start and end of each model year. The net percolation through the simulated cover system and into the underlying tailings was predicted for each of the 31 years in the climate database. The 31 net percolation values were then averaged for each cover system alternative to arrive at the 'average' net percolation value shown in Figure 2. The predicted average net percolation ranges from 15.1 mm (or 3.6 per cent of the average annual rainfall) for the 0.5 m cover to nil (or zero per cent of average annual rainfall) for the 2.0 m cover.

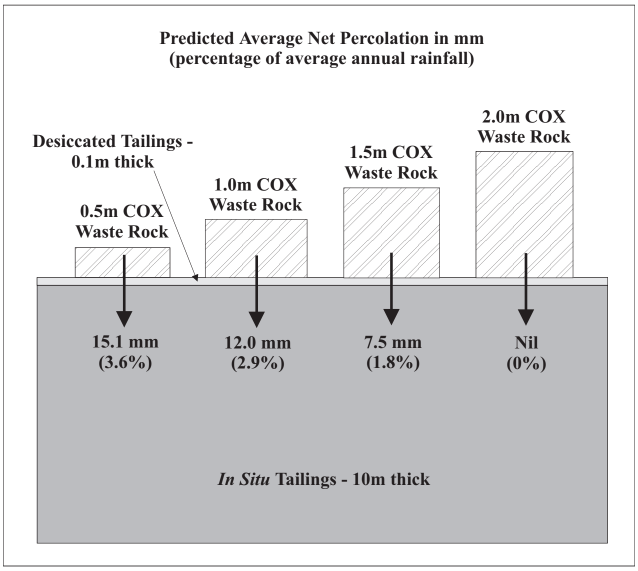


FIG 2 - Predicted average net percolation to the underlying tailings for the four cover system alternatives modelled.

The preliminary and detailed soil-atmosphere cover design modelling was based on bare cover surface conditions (ie no vegetation), which is a conservative approach. The development of any vegetative growth on the cover surface would increase the ability of the cover system to remove stored meteoric waters, thereby improving the predicted performance of the cover system. The effect of adding a 'poor' vegetation agricultural cover (defined as a low leaf area index) to the predicted performance of the cover system was assessed as part of the modelling sensitivity analysis.

Two sensitivity analyses were carried out during the PGM soil-atmosphere cover design modelling programme. The first sensitivity analysis assessed the impact of adjusting key model inputs on the predicted net percolation value. The second sensitivity analysis involved a series of consecutive four-year model runs using average climate years, the highest infiltration or 'worst' years (identified from 'detailed' modelling), and the highest infiltration or 'worst' years with a 'poor' stand of vegetation. The purpose of the second sensitivity analysis was to assess the impact of antecedent moisture conditions on the predicted net percolation value. A sample of the first model sensitivity analysis is discussed below.

Figure 3 is a 'tornado' sensitivity plot that shows the predicted net percolation for the 'base case' and other scenarios with adjusted model inputs for the 1.5 m cover system alternative. The predicted net percolation for the sensitivity analysis 'base case' is significantly higher than the predicted average net percolation for the 1.5 m cover system alternative (54.8 mm compared to 7.5 mm). The explanation for this variance is due to the fact that only three out of the 31 climate years modelled produced positive (ie downward) net percolation values for the 1.5 m cover system alternative. The climate year that produced 54.8 mm of net percolation was used for the sensitivity analysis because it produced the lowest net percolation of the three climate years with positive net percolation values. Figure 3 shows that the performance of the cover system is most sensitive to the saturated hydraulic conductivity and shape of the moisture retention curve of the cover material, as well as the presence of vegetation at the surface.

In summary, the soil-atmosphere numerical modelling completed for this study indicates that a 'moisture store and release' cover system for the PGM site has significant promise for controlling acid rock drainage from the tailings dam following mine closure. The modelling results indicate a minimum of two metres of COX waste rock from the New Cobar open cut development is required to completely shutdown the infiltration of meteoric waters to the underlying waste material. However, if it can be demonstrated with field trials that a cover thickness less than 2.0 m will perform better than predicted by numerical modelling, then it may be justifiable to construct a thinner cover system for full-scale closure of the tailings dam.

IMPLEMENTATION OF COVER SYSTEM FIELD TRIALS

Four instrumented test plots were established at the PGM site in April 2002 as part of the tailings dam cover system field trial project (refer to Figure 4). Test Plot #1 (TP#1) is located in a natural vegetated area adjacent to the tailings dam, while Test Plot #2 (TP#2) is located on the bare tailings surface. Test Plot #3 (TP#3) consists of a 1.5 m thick layer of COX waste rock from the New Cobar open cut project, while Test Plot #4 (TP#4) consists of a 2.0 m thick layer of COX waste rock. The purpose of TP#1 is to develop information for assessing actual transpiration rates for the native vegetation species, which will be a key design parameter for long-term performance of the full-scale tailings dam cover system. The purpose of TP#2 is to provide a basis for evaluating the 'absolute' performance of the two cover system field trials with respect to the infiltration of meteoric waters and ingress of atmospheric oxygen to the tailings mass.

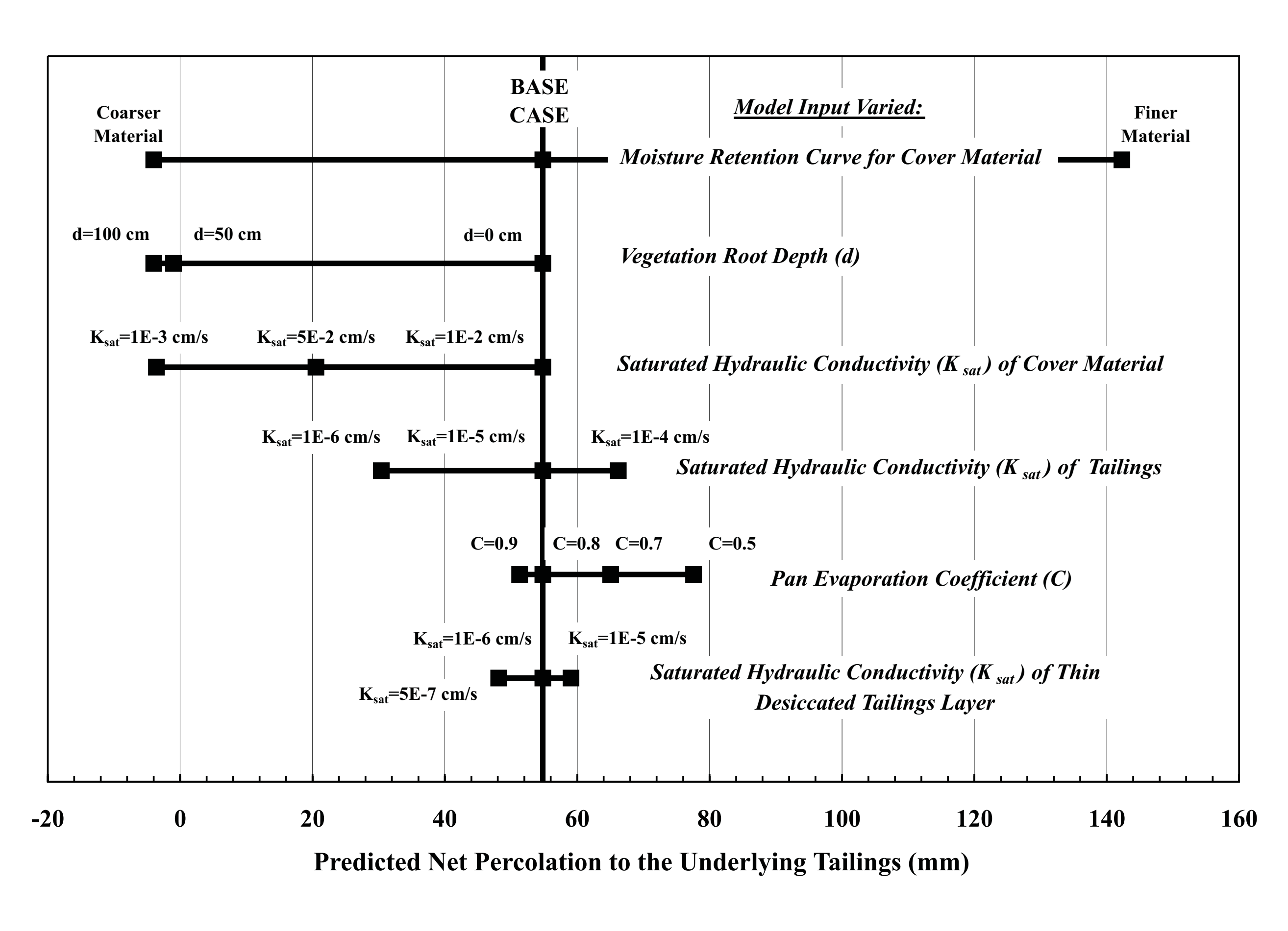


FIG 3 - Tornado plot summarising soil-atmosphere modelling sensitivity analysis for predicted net percolation to the underlying tailings for the 1.5 m cover system alternative.

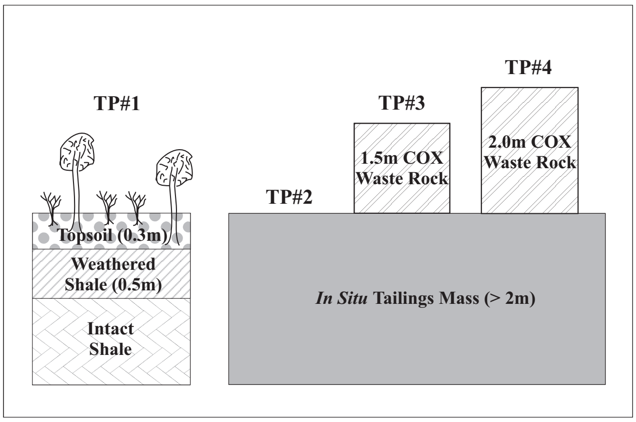


FIG 4 - Schematic of the four instrumented test plots established as part of the PGM tailings dam cover system field trial project.

State-of-the-art monitoring systems were installed to assess the field performance of the test plots during all seasons of the year. Rainfall is being recorded by a fully automated weather station, which also records various other climatic parameters that are required for calculating potential evaporation and conducting field response numerical modelling. Large-scale lysimeters are being used to automatically record the quantity of net percolation through each of the cover system field trials. The *in situ* moisture and temperature conditions of the various test plot materials are being monitored with automated thermal conductivity and volumetric water content sensors. An automated surface run-off collection and monitoring system was installed on the two cover system trials. Oxygen and carbon dioxide concentrations within the various test plot materials are being recorded with a portable gas analyser. A schematic of the field performance monitoring system for the two cover system trials is presented in Figure 5.

The overall objective of the PGM tailings dam cover system trial project is to obtain field data on the performance of the two cover system designs. Monitoring the field performance of the cover system trials for a minimum of two wet-dry climate cycles will enable the short-term performance of the two cover system designs to be evaluated in response to varying site climatic conditions. The collection of accurate and reasonable field performance data, such as *in situ* moisture conditions within the cover and waste materials and net percolation to the underlying tailings, will facilitate the calibration and subsequent validation of numerical models used for cover system design at the site.

The placement of cover material on the tailings dam and installation of the various components of the field performance monitoring system are described in detail in OKC (2002). These items are briefly described below.

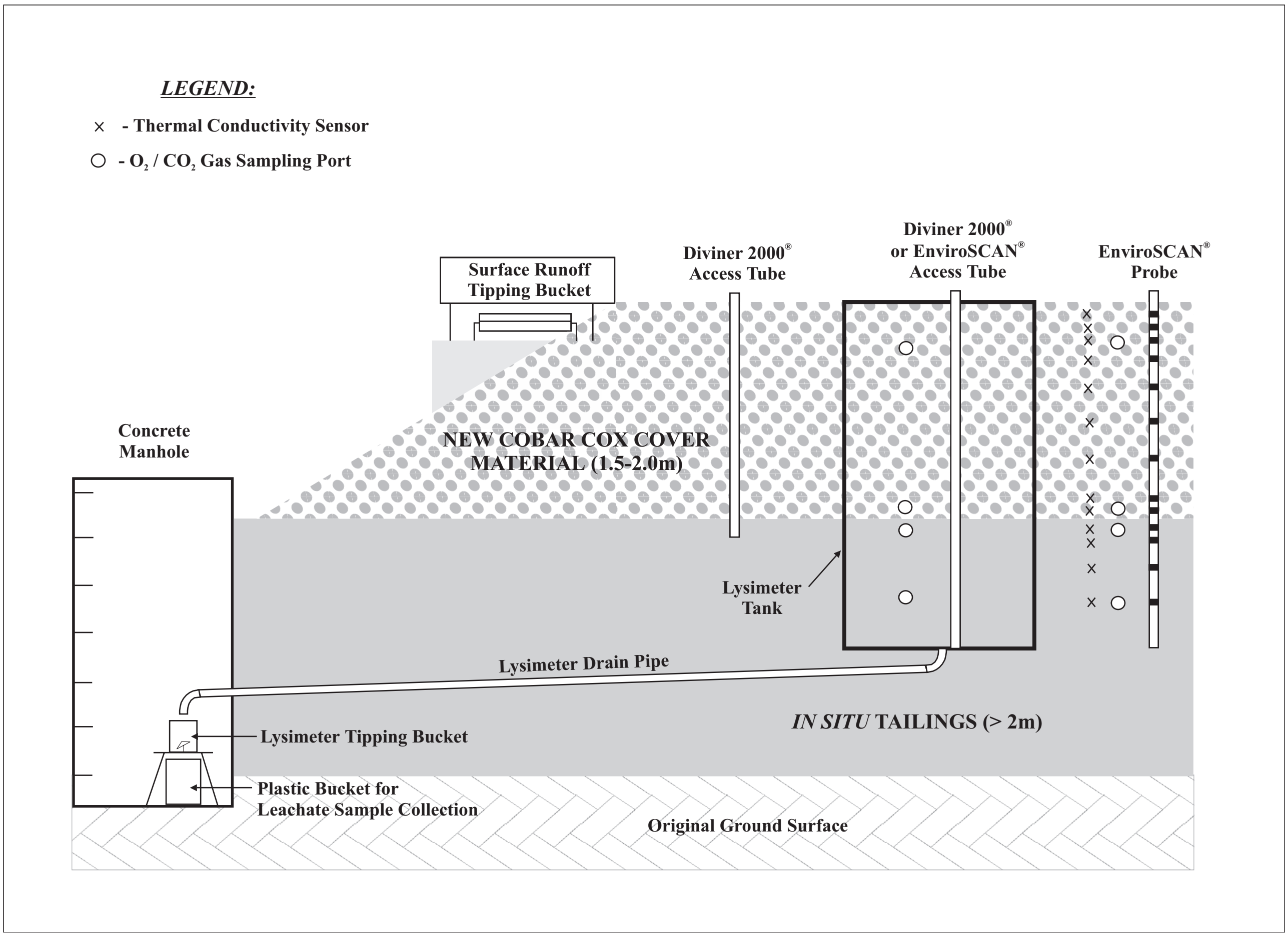


FIG 5 - Schematic of the field performance monitoring system for the cover system trials (TP#3 and TP#4).

Cover material placement

New Cobar COX waste rock material was placed and graded in the 35 m by 35 m footprint of each cover trial using various pieces of construction equipment. A large front-end loader was used to selectively place cover material around areas where field instrumentation was being installed. Two small haul trucks were used to place the majority of the cover material within the footprint of the test plots. The front-end of a rubber-tyre backhoe was used to push and grade the cover material as required. The cover system trials were nominally constructed in two lifts to minimise segregation of the coarse-textured material from the fine-textured material. The intent was to create a well-graded, homogeneous cover profile to increase the moisture storage capabilities and reduce the potential for preferential flow paths within the cover material. No compaction or moisture-conditioning of the trial covers was required or specified. The cover trials slope in the direction of the tailings surface such that the slope angle of the surface of the cover trials is approximately two per cent.

Net percolation collection and monitoring systems (lysimeters)

Large-scale lysimeters are being used in this study to monitor the quantity and quality of water that percolates through each cover system trial. However, the primary purpose is to evaluate percolation rates. Field lysimeters are generally comprised of two main components; namely, a prefabricated plastic collection tank and a net percolation monitoring system. Lysimeters are usually the most important component of a cover system field performance monitoring programme. The units of measure (ie net percolation as a percentage of precipitation) are simple to understand for all stakeholders, much more so than hydraulic gradients and suction profiles. In many instances, the percolation measured in the lysimeter is often the deciding factor on whether a cover system design is effective or not. As a result, two-dimensional saturated-unsaturated flow numerical modelling was carried out using the software package SEEP/W (Geo-Slope International Ltd, 1999) to determine the optimum dimensions for the lysimeter tanks. Design criteria outlined in Bews *et al* (1997) was used to ensure the lysimeters installed at the PGM site will provide an accurate assessment of flow through the cover systems under a variety of rainfall events.

The lysimeters installed for this study consist of a large plastic tank, buried in the centre of each cover trial, and an underdrain system to transfer collected seepage waters via gravity to a flow measurement device. The lysimeter tanks, which have a diameter of 2.4 m and a height ranging between 2.5 and 3.0 m, were backfilled in a manner such that the stratigraphy and density-moisture conditions inside and outside the tanks were the same. The flow measurement device is a tipping bucket gauge, which enables the time and quantity of water discharged from each collection tank to be recorded. Plastic buckets are situated beneath each tipping bucket gauge to facilitate collection of water quality samples for chemical analysis. The tipping bucket gauges and sample buckets are at the bottom of concrete manholes located immediately outside the perimeter of each cover trial. Daily totals of seepage water discharged from each lysimeter are recorded. In addition, data is output as bucket tips occur so that intensity-duration curves can be generated for all discharge events.

In situ monitoring equipment

Two different types of sensors were installed for this project to continuously monitor the *in situ* moisture and temperature conditions of the various test plot materials. Campbell Scientific Inc Model 229-L thermal conductivity sensors are being used to monitor *in situ* matric suction and temperature, while the EnviroSCAN® system, manufactured by Sentek Pty Ltd, is being used to monitor *in situ* volumetric water content. These *in situ* monitoring instruments were installed in a single instrumentation nest located in approximately the centre of each test plot. The depths at which these sensors were installed ranges from 5 to 160 cm at TP#1, 5 to 200 cm at TP#2, 5 to 240 cm at TP#3, and 5 to 290 cm at TP#4. These *in situ* monitoring instruments are connected to a datalogger powered by a rechargeable battery/solar panel system; data is currently recorded every two hours.

Manual measurement techniques were selected to monitor changes in moisture storage spatially at each test plot and *in situ* O_2/CO_2 gas concentrations. The Diviner 2000®, a product manufactured by Sentek Pty Ltd, is being used to measure *in situ* volumetric water content at pre-installed access tubes every 10 cm down to a depth of 160 cm. A Model 309BWP portable gas analyser, supplied by Nova Analytical Systems Inc, is being used to monitor *in situ* O_2 and CO_2 gas concentrations in the cover and waste materials. A minimum of three gas sampling ports were installed in a single profile at each test plot, adjacent to the nest of automated *in situ* sensors. Mine site personnel collect these manual measurements on at least a monthly basis.

Surface monitoring equipment

Surface monitoring equipment installed for this project includes a weather station and surface run-off collection and monitoring systems. A fully automated weather station was installed on TP#4 to monitor air temperature, relative humidity, wind speed, net radiation, and rainfall. The station currently measures each parameter every 60 seconds and outputs hourly and daily averages, as well as daily maximum and minimum values, to final memory for subsequent data collection. Data is output as rainfall occurs so that intensity-duration curves can be generated for all rainfall events.

An automated collection and monitoring system was installed at the down-gradient end of TP#3 and TP#4 to assess the volume of run-off on the cover trial surfaces during and following significant rainfall events. The surface run-off collection and monitoring systems consist of an up-gradient run-off contributing area, a lined collection channel, a manifold and tipping bucket mechanism, and a sediment sampling mechanism. The tipping buckets are connected to an automated data acquisition system; data is output as bucket tips occur so that intensity-duration curves can be generated for all run-off events.

INITIAL PERFORMANCE OF COVER SYSTEM FIELD TRIALS

Performance monitoring at the two cover system trials and two control test plots commenced in late April 2002. Field data collected and interpreted up to the end of December 2002 indicates the *in situ* monitoring instruments are responding appropriately to the atmospheric supply of and demand for moisture. The overall data capture rate, based on the number of sensors operating compared to the total number of sensors installed, was 99 per cent for the April to December 2002 monitoring period. Two examples of interpretation of field data collected during this monitoring period are presented below.

Cumulative change in volume of water in test plot profiles

The field performance of the test plots can be gauged by calculating the volume of water within the test plot profile. The volume of water is an estimation of the 'depth' of water if the soil, air, and water components of the test plot profile are separated. For example, if a volumetric water content of 0.20 or 20 per cent was measured in a 1.0 m thick cover material profile with a porosity of 0.30, the 'depths' of soil, air, and water would be 70 cm, 10 cm, and 20 cm, respectively. Figure 6 shows the cumulative change in volume of water within the four test plots from the time of installation to the end of December 2002. Volumetric water content measurements obtained using the EnviroSCAN® systems were used to calculate changes in the volume of water in the test plot profiles. The cumulative rainfall recorded at the site over the same monitoring period is also shown in Figure 6.

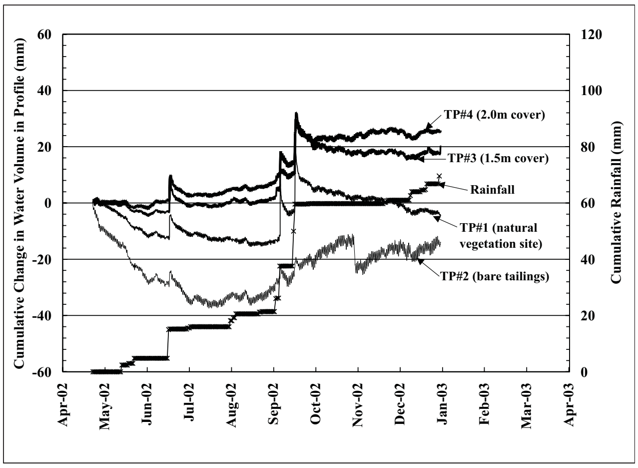


FIG 6 - Cumulative change in volume of water in the four test plot profiles and cumulative rainfall from April to December 2002.

The data presented in Figure 6 demonstrates that the EnviroSCAN® system installed at each test plot is responding appropriately to atmospheric forcing conditions. The volume of water in each test plot profile significantly increases immediately following relatively large rainfall events that occurred in mid-June and the first half of September 2002. This is reflective of the relatively dry antecedent moisture conditions and high-saturated hydraulic conductivity of the near surface material at each test plot. Overall, the volume of water in the profiles of the two control test plots (TP#1 and TP#2) has decreased, while the volume of water in the profiles of the two cover system trials has increased (TP#3 and TP#4). At first glance, the increase in the volume of water in the cover system profiles is somewhat surprising considering that minimal rain fell during the monitoring period; however, the majority of the increase in the volume of profile water is attributed to the capillary rise of moisture from the wetter tailings mass up into the drier cover material. The rate of capillary rise across the cover/tailings interface is decreasing as the system comes into equilibrium.

Water balance – 16 and 17 September 2002

A simple water balance was completed at TP#4 for the rainfall events that occurred on 16 and 17 September 2002. Figure 7 summarises the rainfall, change in moisture storage, and surface run-off rates measured on TP#4 over a 29-hour period. Approximately 22 mm of rain fell in three separate storm events during this period. The change in moisture storage was similar in shape to the rainfall pattern; however, it was slightly delayed and dampened. This suggests that not all the rainfall incident to the TP#4 test plot surface infiltrated the cover profile (ie a portion evaporated from the surface or was diverted as run-off). The delayed response of the change in moisture storage is attributable to the fact that rainfall was recorded in real-time (ie the time of each bucket tip was recorded by the datalogger), whereas the change in moisture storage parameter was calculated from water content measurements collected by the EnviroSCAN® sensors every two hours. Minimal run-off from the surface of TP#4 (0.3 mm) was recorded during or immediately following the three separate storm events.

Overall, the water balance presented in Figure 7 shows that approximately 6 mm of actual evaporation (AE) occurred during the period (AE = 22 mm - 15.7 mm - 0.3 mm). This value appears to be reasonable as daily potential evaporation for the period is approximately 5 mm, and that it could be argued the actual evaporation rate is similar to the potential rate during rainfall events. It should be noted that water balances are rarely calculated to this degree of accuracy. However, the data presented does serve to illustrate the quality of the data collected by the cover system trial performance monitoring system.

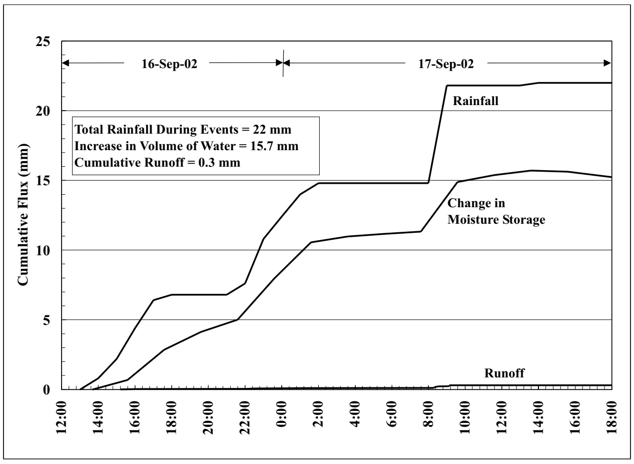


FIG 7 - Water balance at TP#4 for the 16 and 17 September 2002 rainfall events at the PGM site.

SUMMARY

Two dry cover system field trials were constructed on the tailings dam at the Peak Gold Mine, NSW in April 2002. The cover system field trials utilise the 'moisture store and release' concept to limit the infiltration of meteoric waters to the underlying tailings as a means of controlling acidic drainage from the tailings dam. The design of the cover system field trials involved detailed geotechnical characterisation of the tailings and potential cover materials, as well as soil-atmosphere cover design modelling. Two control test plots were also established, one on a bare tailings surface and the other in a natural vegetated area adjacent to the tailings dam. State-of-the-art monitoring systems were installed to assess the field performance of the test plots during all seasons of the year. Field data collected and interpreted up to the end of December 2002 indicates the tailings dam cover system trials are performing as expected in terms of limiting the infiltration of meteoric waters to the underlying tailings. The collection of field performance data for a minimum of two wet-dry climate cycles will permit calibration and subsequent validation of the numerical models developed for the cover system trials, thereby facilitating optimisation of the cover system design for full-scale closure of the Peak Gold Mine tailings dam.

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