REVIEW OF GROUNDWATER ISSUES
AT JABILUKA

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REVIEW OF GROUNDWATER ISSUES AT JABILUKA

SUMMARY

This report was prepared for exclusive use of the Wilderness Society and reviews groundwater information presented in three documents referring to the Jabiluka mining project:

- the Jabiluka Draft Environmental Impact Statement,
- the Supplement to the Draft Environmental Impact Statement and

It was found that the proposal of burying the tailings at the well studied pits at Ranger is environmentally safer than leaving them buried in tailing pits near Jabiluka.

It was also found that the groundwater investigations completed at Jabiluka are preliminary. Predictions referring to the volume of groundwater that will flow into the tailing pits and into the mine, as well as impacts on the Boyweg Soak, need further review and assessment.

The documents above predict that groundwater inflows into the pits will be of up to 20 litres per second. To reduce groundwater inflows, pit sealing and grouting as well as pit dewatering bores are proposed in the Jabiluka Mill Alternative. The pit inflow predictions are based on figures representing the average permeability of the rocks. These were obtained from permeability tests carried out on a small number of deep bores drilled in the pit area which did not target geological structures.

The rocks in the area of the pits are cut by major geological structures, and the permeability and position of all these structures are presently unknown. If the structures superimpose fracture permeability over the estimated average permeabilities, pit inflows will be much larger than estimated. If so, pit outflows and long term impacts of the tailings on the environment could also have been underestimated.

Consequently, in the case of the Jabiluka Milling Alternative, a major site investigation is required. The investigation should be as comprehensive as any geotechnical dam-site investigation, and should determine the position, total number and permeability of the geological structures cutting through the rocks of the area of the pits. Its main outcomes should be the optimum positioning of the pits in the most impermeable rocks, and the intersection of permeable structures by an efficient network of dewatering bores. Once the pits are infilled with tailings, the dewatering bores could be used for long-term monitoring purposes.
The documents above assume that only one geological feature - an unconformity between two formations - will produce groundwater. They predict that this feature will produce a small mine-inflow of 2.3 litres per second. This prediction is a cause of concern because the assumption of low mine-inflows is a mainstay of the Jabiluka project's present water management strategy.

Mine-inflows may also be generated by other geological features, such as regional faults, fracture zones and permeable layers. These features occur within the rocks intercepted by the mine, have not been studied in detail and need to be appraised. The appraisal may lead to a reassessment of mine dewatering requirements; to the proposal of a new water management strategy and, perhaps also, to an adequate estimate of mining impacts on insufficiently studied and poorly understood hydrologic features such as the Boyweg Soak.
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REVIEWS OF GROUNDWATER ISSUES AT JABILUKA

A. INTRODUCTION

This report was written on request of the Wilderness Society and reviews groundwater issues at Jabiluka. The report covers three documents prepared by Kinhill Engineers and ERA Resources which were provided by the Wilderness Society:

• The Draft Environmental Impact Statement (DEIS) released in October 1996,

• The Supplement to the Draft Environmental Impact Statement (DEIS) released in June 1997 and


When discussing general information contained in these three documents, they are referred to as the “Environment Impact Documents”.

Groundwater reports forming part of the lists of references of the Environment Impact Documents, but not included in them, were not reviewed.

Four figures displayed in the Environmental Impact Documents are used in this report to illustrate points of the discussion.

The discussion centres on three main areas of concern:

• The Jabiluka tailing pits
• Predicted mine groundwater inflows
• Mine-dewatering impacts on the Boyweg Soak
B.- THE JABILUKA TAILING PITS

B.1 General

The rocks underlying the area of the pits at Jabiluka form part of a stratigraphic sequence known as the Kombolgie Sandstone. This sequence is formed mainly by well cemented sandstone strata, which have a very low primary porosity.

Although most strata conforming the Kombolgie Sandstone are essentially impermeable, the sequence is criss-crossed by major vertical fracture zones sometimes developed by faults and often formed by joint systems separating rock blocks that have not moved significantly. As it can be seen in the escarpment in vicinity of the Ranger Mine and in the Katherine National Park\textsuperscript{1}, these fracture zones occasionally extend for kilometres. Above the surface of the land, they control stream flows and dominate regional processes of erosion. Below the surface of the land, the fracture zones frequently form permeable zones that control groundwater flow directions.

B.2 Site-Investigations

In terrains underlain by rock sequences such as the Kombolgie Sandstone, where formation permeability is dominated by fracture permeability, comprehensive site-investigations are usually required before deciding where to construct a dam or where to carry out a major excavation, such as a tailing pit. The general objective of such investigations is to determine the exact position of fracture zones that may control permeability. Air photo interpretation, geological mapping and conventional ground-based geophysics include some of the techniques that can be used to achieve this objective. Once their location is known, the structures are generally avoided when selecting the optimum position of a dam or major excavation. If unavoidable, their permeability is studied in detail.

A similar strategy is used when purchasing an old cast iron bath-tub. The first task is to check it for cracks. If cracks are present, fracture permeability becomes the main issue, and the study of “bulk” (i.e. average) permeability of the cast iron itself becomes less important.

At Jabiluka, a site-investigation is required to determine the exact position and permeability of major fracture zones or “cracks” in the rocks underlying the areas assigned to the tailing pits. Figure 1, which was extracted from the Environment Impact Documents, shows that the area selected for the excavation of tailing pits is crossed by two major geological structures which cut through the walls of the proposed Pit no 1. Other less visible structures may also occur in the area.

\textsuperscript{1} S. Needham, P. Stuart-Smith, L. Bagas, B. Whitehead, G. Salas, 1984. “Explanatory Notes” - Katherine 1:250,000 Geological Sheet. BMR Publication.
B.3 Bulk Permeabilities

Although the permeability of features such as shown in Figure 1 has not been studied yet, the Environment Impact Documents do include a well-documented study of the “bulk” (i.e. average) permeability of the rocks in the pit area (Appendix D, JMA). The study refers to fourteen bores drilled in this area, some of which are shown in Figure 1. As nine of the fourteen bores are less than twenty metres deep, the investigations concentrated mostly on rock materials near the surface. Three bores had depths of 30, 57 and 70 metres and only two bores penetrated the full depths of the pits, i.e. 100 and 200 metres.

Pumping tests were not carried out. Permeability tests were completed but, as the bores did not target geological structures, the results (Tables D1 and D3, Appendix D, JMA) are conservative and mainly representative of the average permeability of the unfractured rocks occurring in the bores’ immediate vicinity. However, the bulk permeability of the strata tested by bore 98/1, drilled near the centre of Pit 1, is five times higher than the bulk permeability of the strata tested by bore 98/2, sited in the centre of Pit no 2 (Table D3). These differences in average rock permeability probably reflect the proximity of bore 98/1 to the geological structures shown in Figure 1. If so, they an indication of the influence that fracture permeability normally has over average permeability.

It should be noticed also that it was not possible to complete permeability tests above 58 metres in bore 98/1. The geological log of this bore ((Page D-6, Appendix D) suggests that this problem may have been caused by the high permeability of the weathered rock near the surface in Pit no 1. This possibility seems to be confirmed by the figures in tables D1 and D3 (Appendix D), which also suggest that the permeability of the shallow and weathered rock materials is relatively high.

B.4 Predictions

Using the average rock permeability values measured by the permeability tests, Appendix D of the JMA makes the following predictions (Pages D-8 and D-9):

- Groundwater inflows into Pit no 1 will be in the order of 20 litres per second (Page D-8). As the pit’s volume is 3.2 millions m$^3$, it could be filled by groundwater in approximately 5 years. This time does not consider the additional input of rainfall, nor the raise of water levels caused by displacement as the pit is progressively filled with paste-tailings.

- Inflows into Pit no 2 will be in the order of 8 litres per second, and will fill this pit in a “substantially longer” amount of time.

- Once the pits are full, groundwater flow directions will be reversed and seepage will move away from the pits to eventually emerge at Swift Creek and its small tributary creeks. The travelling times will be “in excess” of 10 years for tributaries situated at 200 metres from the pit, and 50 years for tributaries at
a distance of one kilometre (Page D-9).

As discussed in the cast iron bath-tub analogy (Section B.2), average permeability figures often do not have much meaning in an environment dominated by fracture permeability. If structures such as shown in Figure 1 increase the average permeability figures used in Appendix E to make predictions, pit inflows may prove to be in reality much larger than calculated. The proposed travelling times could also become shorter.

B5. JMA Recommendations

Even using average rock-permeability figures, the travelling times are rather short and do not agree with the main design principle of the mining project, which intends to ensure that contaminated water will not be released into the environment (Page B1-1, JMA). Consequently, two engineering solutions are proposed (Section B2.3.3, Appendix B, JMA):

- the pits are to be fully grouted and sealed prior to any tailings deposition
- dewatering bores will be placed around the pits to lower the groundwater table during pit construction.

These solutions seem to be viable. However, if the dewatering bores are to be efficient, they will have to target permeable fracture zones in the Kombolgie Sandstone. This implies that the fracture zones should be mapped prior to bore construction and pit excavation. Thus, three additional recommendations referring to the site-investigation proposed in this report’s sections B.2 and B.3 are applicable:

- the dewatering bores will target the most permeable zones in the Kombolgie Sandstone. These will be found by a comprehensive geotechnical site-investigation that will cover the general area of the pits and use up-to-date geological and geophysical groundwater exploration techniques.

- if so required, the evidence provided by the geotechnical site-investigation will be used to re-locate the pits to areas less affected by fracture permeability.

- Unless pit grouting achieves total impermeabilisation and groundwater does not seep through the pits’ walls, tailings will not be placed above a depth of 60 metres below the surface of the land.

If this last requirement is met, the tailings will be positioned below sea level, and this will make difficult the migration of contaminants towards the land’s surface.
C. MINE-INFLOWS

C.1 Inflow Predictions

The DEIS (Page 4-64) predicts that mine-inflows will be in the order of 200 m³/day (2.3 litres per second)

This figure seems to be an underestimate. Since flows in the order of a few litres per second can be obtained from a garden hose, it is not easy to envisage how 72 kilometres of large-diameter-shafts, galleries and declines (DEIS, Page 4-44) cutting through different types of rocks affected by regional faults and fractures (Figure 3), will yield such small groundwater inflows. Experience with groundwater exploration in the vicinity of Nabarlek and Ranger has shown that individual bores intercepting fracture zones - less than 60 metres deep - occasionally yield of up to 14 litres per second.²

The Environment Impact Documents do not include technical evidence supporting the small inflow prediction. Page 4-64 of the DEIS mentions two reports (Kilborn-MWP, 1975/76 and AGC Woodward-Clyde, 1993) that may contain this evidence. As the evidence is extremely important with regard to the project’s proposed water management strategy, the two reports should have been included in the Documents.

If groundwater inflows, instead of the predicted 2.3 litres per second, were to be 23 litres per second - a reasonable figure for a mine of the size of Jabiluka - the project would have to contain 725,000 m³ of mine water per year. This volume is larger than the maximum amount of rainfall produced by the most severe wet season which, according to the JMA, is 659,000 m³ (Table B2-6 in Page B2-9, Appendix B2). The proposed water management strategy would not be able to contain such a large volume of additional water.

Perhaps the Environment Impact Documents assume that 2.3 litres per second will enter the mine after inflows are controlled. As the advancing mine excavation will have to deal with groundwater sources one by one, cement-grouting and other fracture-sealing methods perhaps will achieve satisfactory impermeabilisation results. Even so, the predicted figure seems to be unrealistically small.

C.2 Possible Sources of Groundwater Inflows

The DEIS (Page 4-39) assumes that only the Kombolgie Sandstone/Cahill Formation will produce permanent inflows and does not discuss other possible groundwater sources. Some of the geological features that may produce additional inflows are:

1. Fracture zones in the Kombolgie Sandstone, particularly at the beginning of

the decline construction

2. The calcareous or dolomitic horizons and “stringers” within the schists of the Cahill Formation mentioned and described in Appendix E of the JMA (Page E-26)

3. Unknown fracture zones in the Cahill Formation, as well as mapped regional faults, such as the Hegge Fault, affecting all formations (Figures 2 and 3).

The groundwater producing capacity of geological features such as listed above should be carefully discussed in further mine-inflow assessments. Other features could be identified if geological maps and other mineral exploration information are studied in detail. The discussion of potential mine-inflow producing features should be incorporated into the Environment Impact Documents.
D. IMPACTS ON THE BOYWEG SITE

D.1 Hydrostratigraphic Units

Appendix E (JMA) explains the hydrogeology of the Mine Valley and makes preliminary predictions on the effect that mine-dewatering may have on the Boyweg Soak. The Soak is apparently a spring situated some 600 metres east of the orebody (Figure 4). The Appendix identifies four hydrostratigraphic units that occur in the Mine Valley (Page E-15) and may influence the spring’s recharge:

1. A shallow unconsolidated unit formed by sands contained within the Mine Valley
2. A sandstone/schist bedrock unit (also known as the Kombolgie Sandstone/Cahill Formation unconformity, or simply “the unconformity”)
3. A carbonate-schist unit
4. A pegmatite dike unit (Figure 2) known also as the Mosher Pegmatite.

D.2 New Hydrogeological Evidence

Appendix E also provides important new hydrogeological evidence, which has considerable implications for the general understanding of hydrogeology of the project. The evidence is summarised in the following points:

- The Mosher Pegmatite (hydrostratigraphic unit no 4) is not a vertical impermeable barrier separating the mine area from aquifers to the west, as thought previously (DEIS). Pumping tests show that there is a hydraulic connection between aquifers situated at different sides of the pegmatite body (Page E-13), which means that the effects of mine dewatering may extend much further west than thought before.

- The aquifers formed by the shallow unconsolidated sands filling the Mine Valley (hydrostratigraphic unit no 1) are hydraulically connected to aquifers in the underlying bedrock (Page E-26), particularly with the carbonate schists (hydrostratigraphic unit no 3). These carbonate schists are important aquifers in the bedrock of the Valley that may be intercepted by the mine, produce significant mine-inflows and affect mining operations (Page E-26). This possibility was not discussed in the DEIS and its Supplement when estimating mine-dewatering requirements.

- As a result of mine-dewatering, groundwater stored in the unconsolidated sands may flow into the mine through the other hydrostratigraphic units. This scenario could affect the Boyweg Soak.

It is estimated in Appendix E that the cone of depression caused by mine-dewatering will have an influence radius of 175 to 600 metres and may not reach the Boyweg site.
The Appendix concludes (Page E-26) that the “impacts to the Boyweg site...will be minimal (if they occur at all)”, but “this should be confirmed using numerical models”.

D.3 Comments

A number of questions referring to the nature to the Boyweg Soak require an answer. For example, is the Boyweg a soak formed by groundwater that becomes “dammed” by an impermeable clay barrier as it flows along permeable sands? Is this barrier formed by rocks uplifted by the Rowntree Fault (Figure 2)? Is the Boyweg Soak a spring fed perhaps by a deep fault channelling groundwater from a distant recharge source not associated with the Mine Valley aquifers?

Until questions such as these are answered, the nature of the Boyweg Soak will remain a mystery and the development of a conceptual model will not be possible. Without a clear conceptual model, the development of a reliable numerical model is also not possible.

For this reason, the formulas used in Appendix E (Pages E-23 and E-24) to make a “first order estimate of potential impacts” on the Boyweg site are extremely general. For instance, they do not use time parameters nor mine dewatering rates and thus hardly can be used to estimate mine-dewatering impacts.

If the volume of groundwater stored in an aquifer is small; its losses large and the groundwater system does not receive sufficient recharge, it may be possible to predict a quick descent of the water table that could make it inaccessible to humans and animals. The opposite may be predicted if it is known that the amount of groundwater stored is large and/or if there is evidence proving that the losses are quickly replaced by recharge. However, in the case of the Boyweg Soak it is not possible to make such predictions because at present all the intervening parameters are unknown. Even the geometry and number of aquifers involved are undefined.

D4. Hydrogeology of the Mine Valley - a Proposed Work-Hypothesis

A perusal of Figure 4 suggests that the Kombolgie Sandstone/Cahill Formation unconformity forms a planar structure with a dip of approximately 27° to the south and an E-W strike, roughly parallel to the Mine Valley. The unconformity almost reaches the surface of the land below the sands of the Mine Valley, suggesting it has controlled the Valley’s geomorphic evolution. Towards the north, the unconformity sinks under the Kombolgie Sandstone rock mass forming Valley’s northern side. The structural/geomorphic relationship between the Valley and the unconformity assumed here is presented in Figure 5.

The spatial relationships postulated in Figure 5, imply that the unconsolidated sand aquifer deposited within the Valley receives groundwater recharge from the unconformity. The unconformity in turn, receives recharge from the joint systems and
faults in the Kombolgie Sandstone. As discussed previously (Section B1), fractures and faults in the Kombolgie Sandstone control drainage patterns and provide a passage whereby water may penetrate deeply into the rock mass.

To a large extent, the northern side of the Mine Valley is not underlain by the orebody and therefore will not be affected by the dewatering of the mine. Consequently, the unconformity will continue supplying recharge to the sands in the Valley during the development of the mine. The unconformity intersects the northern side of the Valley along approximately 800 metres. As its transmissivity is 1 m²/day (Page E-6, Appendix E, JMA), the unconformity could supply the unconsolidated sand aquifer with a recharge of 800 m³/day (approximately 9 litres per second).

If mine-inflows were to be slightly larger or equal to 2.3 litres per second, as postulated in the DEIS (Page 4-64), this recharge of 9 litres per second would be significant. It would maintain the standing water levels of groundwater in the valley sands in spite of mine-dewatering.

Thus, if the Boyweg Soak is recharged by the Mine Valley sands, it may not be affected by small mine-inflows. However, this hypothesis needs the support of adequate evidence proving that the hydraulic connections here assumed do exist in the field.
E. CONCLUSIONS

E.1 General

The groundwater investigations completed at Jabiluka are preliminary. They require to be reviewed, assessed and confirmed by further investigations.

E.2 Tailing Pits

1. The permeability investigations carried out in the pit area suggest that groundwater inflows into the pits of up to 20 litres per second are to be expected. They also indicate that the rocks' found a depth of 60 metres from the surface (ie. within the weathering zone) include the most permeable layers.

2. The investigations are preliminary because they have only studied the average permeability the rocks and still require to study the permeability of geological structures. These structures may have enhanced the estimated primary permeability. As shown in Figure 1, the geological structures form planar sub-vertical features that cut through the rocks of the pit area and intersect some of the pits' walls.

3. If fracture permeability has enhanced average rock permeability, pit inflows and outflows will be larger than predicted in the JMA.

4. Consequently, the study of fracture permeability is a high priority, essential to assess the long-term impact the tailings may have on the environment.

5. Such impact may be highly reduced if the grouting and sealing work proposed for the pits (Appendix B of the JMA, Section B2.3.3) is successful.

6. To be fully successful, grouting and sealing will have to be carried out on dry pits and thus an efficient network of efficient pit-dewatering bores will have to be constructed in areas of high permeability of the rocks.

7. For this reason, the mapping of these high permeability areas prior to pit construction is essential. Detailed mapping and test pumping may also help to identify areas of low permeability, not crossed by major geological structures, where the pits could be relocated if required.

8. In general, the groundwater information collected at Jabiluka up to the release of the JMA (June 1998) suggests that the Kombolgie Sandstone rocks in the vicinity of the mine are likely to be more permeable than the rocks of the pits excavated at Ranger. If this is the case, the alternative of burying tailings at Jabiluka - i.e. the JMA - would be environmentally less acceptable than burying the tailings at Ranger, as proposed in the RMA.
E.3 Mine inflows

1. Considering that the mine will have 72 Km of tunnels, galleries, declines and shafts (DEIS), the predicted volume of groundwater inflows (2.3 litres per second) is unusually small.

2. The evidence supporting this small mine-inflow prediction is to be found in reports not included in the Environmental Impact Documents [Kilborn-MWP (1975/76) and the AGC Woodward-Clyde (1993)].

3. These reports apparently conclude that the mine will intersect only one geological feature capable of producing long-term groundwater flows: the Kombolgie Sandstone/Cahill Formation unconformity.

4. Appendix E of the JMA (Page E-26) mentions a second feature that may produce significant mine-inflows: the carbonste schists underlying the Mine Valley. In addition, the mine will intersect fracture zones and major regional faults - such as the Hegge Fault. All these features combined may produce important groundwater flows. This possibility is not discussed in the Environment Impact Documents in the context of estimating mine-de-watering requirements.

5. This is a cause of concern, since the small mine-inflow prediction is one of the important cornerstones supporting the project’s present water management strategy.

6. If mine-inflows have been underestimated, the project’s water management strategy will not achieve its main aim of containing all contaminated waters. For this reason, the small-inflow prediction made in the Environment Impact Documents needs to be thoroughly checked. If new predictions are made, their technical justification needs to be comprehensive and should be included in the Environmental Impact Documents.

E.4 Boyweg Soak

1. The exact nature of the Boyweg Soak remains largely unknown and therefore the studies of this so-called spring (Appendix E, JMA) are inconclusive. The studies, however, have supplied valuable additional groundwater information relevant to the general understanding of the Jabiluka hydrogeology.
F. RECOMMENDATIONS

F.1 General

1. The original concept of milling the ore and burying the tailings at Ranger (DEIS) should be supported in preference to the Jabiluka Mill Alternative (JMA). By comparison, the Ranger Mill Alternative (RMA) will leave the area of Jabiluka only slightly disturbed, and the tailings safely contained in pits excavated within the well-studied rocks at Ranger. The present state of knowledge suggests that, in contrast, the JMA proposal of burying the tailings within the relatively permeable and still not adequately studied Kombolgie Sandstone rocks carries a much higher environmental risk.

F.2 Tailings Management

1. If tailings are to be buried in pits excavated near the Jabiluka mine, as proposed in the JMA, a thorough site-investigation should be carried out in the areas surrounding the tailing pits. This site-investigation should be at least as detailed as any geotechnical investigation required for the construction of a dam or major water retaining structure.

2. The site-investigation should combine geological mapping, ground-based geophysics and groundwater assessment techniques to achieve two immediate objectives: map the exact location of the main geological structures that cut through the Kombolgie Sandstone and assess their permeability.

3. Test bores should target these structures and pumping tests carried out on these bores using observation bores. The interpretation of all the hydrogeological, geological and geophysical information collected should have the following outcomes: a) the intersection of major permeable fracture zone by an efficient network of pit dewatering bores that should facilitate pit-excavation; b) the optimum positioning of the pits in the most impermeable rocks; c) the calculation of accurate pit inflow and outflow figures and d) a satisfactory pit-water disposal strategy.

4. The pit walls should be fully grouted and sealed prior to the deposition of the tailings, as proposed in Appendix B of the JMA (Section B2.3.3).

5. Once the pits are infilled with tailings, the pit-dewatering bores could be used for long-term monitoring purposes.

6. Unless the proposed pit wall grouting and sealing of the walls of the pits is completely successful and shallow groundwater seepage is effectively stopped, tailings should not be placed above a depth of 60 metres below the land’s surface. This requirement will prevent contaminants from passing easily through the relatively permeable rock materials occurring near the surface (Tables D-1 and D-
3), and continue their migration towards creeks and streams, as described in the and Page D-9, Appendix D of the JMA.

7. The JMA concept of burying part of the tailings within the mine should be supported. It requires, however, an evaluation of the permeability of the rocks intersected by the mine. This evaluation should be compiled by a qualified groundwater consultant. In general, the deep parts of the mine should be favoured for the deposition of tailings.

F.3 Mine Inflows

1. Evidence not included in the Environment Impact Documents and supporting low mine-inflow predictions - i.e. the Kilborn-MWP (1975/76) and the AGC Woodward-Clyde (1993) reports - should be reviewed carefully.

2. This review should be completed within the context of a full reassessment of all possible sources of mine-inflows.

3. This reassessment will need to incorporate the more recent investigations carried out at the Mine Valley (Appendix E, JMA) and appraise not only the Kombolgie Sandstone/Cahill Formation unconformity, but also other possible mine-inflow sources, such as the carbonate schists of the Cahill Formation (JMA, Appendix E, Page E-26).

4. Major regional faults such as the Hegge Fault, as well as fracture zones affecting all rocks should also be included in the reassessment. The identification of these features may require a study of large-scale geological information held by the Company.

5. If the reassessment indicates that the mine-inflows will be much larger than predicted, a new water management strategy should be developed.

F.4 Boyweg Soak

1. The hydrogeological investigation of the Boyweg Soak should continue in order to define the nature of the Soak; its sources of recharge and mechanisms of discharge; as well as the geometry, parameters and interconnections of the aquifers feeding it. The dewatering impacts on the Soak should be determined only after the dewatering requirements of the mine are re-assessed. Numerical modelling may be required, but only after developing a clear conceptual model based on a comprehensive understanding of the Soak's hydrogeology.
FIGURES 1 TO 5
FIGURE 2

FIGURE 4.13
JABILUKA #1 AND #2 OREBODIES

Numbers (eg. 2 3 4)—Stratigraphic
Assay Location (SAL)—refer text
FIGURE 5

SCHEMATIC SECTION ACROSS THE MINE VALLEY