Painless extraction? Mining and water-resource protection

by Oliver Carr

Mining brings jobs to rural areas, but the immediate and long-term environmental costs can be high. Can project planners put into place assessment and monitoring systems to prevent permanent damage to local water resources?

THE PROTECTION AND management of water resources during the construction and implementation of mining projects can make a substantial difference to people living in or near to mining concessions. Effective planning is an essential process to ensure water resources are considered to an appropriate level and to protect local people and their interests. All too often in the past, the people planning mining operations have not fully considered environmental issues, which has led to degradation of resource quality and, sometimes, long-term adverse economic and social effects.

Mining in south-west Ghana

The management and minimization of adverse effects in every project phase in order to protect fully local people must be included in any project-planning exercise. Environmental impact assessment (EIA) provides an effective opportunity for an examination of water resources to assess and manage the implications of a mining project at birth, and forms the basis for on-going management throughout the project's life. This article recounts the experience gained by environmental consultants SGS Environment during environmental assessment for several mining projects in south-west Ghana.

In recent years, Ghana's mining industry has expanded considerably; the Government has recognized the potential adverse environmental effects and has introduced regulations demanding an EIA before operation start-up. An important part of any environmental assessment is ensuring appropriate water-resource management, together with the protection of local people. Many of the mines in south-west Ghana are located in relatively well-populated areas previously used as mixed forest and agricultural land, although local people mine the rivers extensively for gold. Water resources are used for drinking and washing, as habitat for fisheries, and for transport; they also have religious significance. In addition, the rainforests of the area can form important components of catchment hydrology for water-resource management.

Surveys

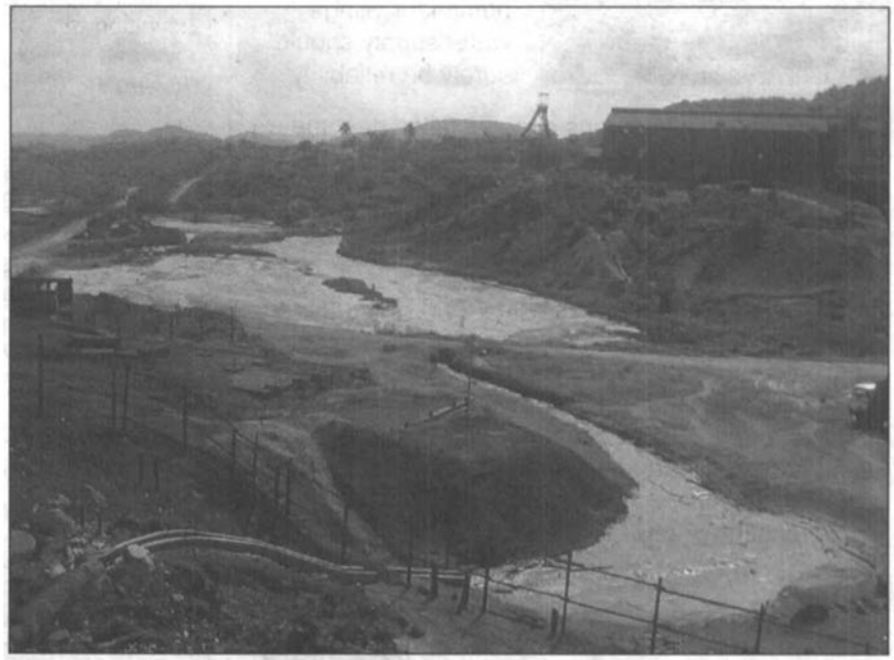
In order to understand fully how a mining project might affect water resources, a thorough examination of the resources and their uses is needed. This involves carrying out surveys of water resources, including an assessment of resource quality and uses. The value of the resources is then examined, enabling evaluators to grasp fully the project's significance. This evaluation requires specialist understanding of the environment under consideration; standards and guidelines, such as those on water quality issued by the World Health Organization — and comparisons with experiences in other areas — will help.

SGS Environment found that, in the rural areas chosen for new sites, local people generally used either surface waters or shallow wells for their drinking- and washing-water supply; water was frequently of poor quality. The shallow wells were frequently contaminated by overland flow of water, and the surface waters were polluted by faecal wastes, and from small-scale gold excavations. Local people search for gold deposits in river gravels in and around the rivers; this causes high levels of suspended solids and pollution by the mercury used in gold processing. Some of the more accessible villages had piped water supplies, mostly of good quality, although, in some cases, iron contamination reduced its suitability both for drinking and clothes-washing.

Diet and health

Use of the local water bodies for fisheries was found to be important, as freshwater fish is an essential source of protein in the local diet, although most of it is sea fish bought at the market. The types of fish vary; from migratory species, to those found all year in tributaries, and species which live and breed in swamp habitats. The maintenance of the living and breeding habitats for fish, and pathways between tributaries, swamps, and the main rivers and fishing sites, therefore, was important.

Water also influences local people's health, with many diseases being



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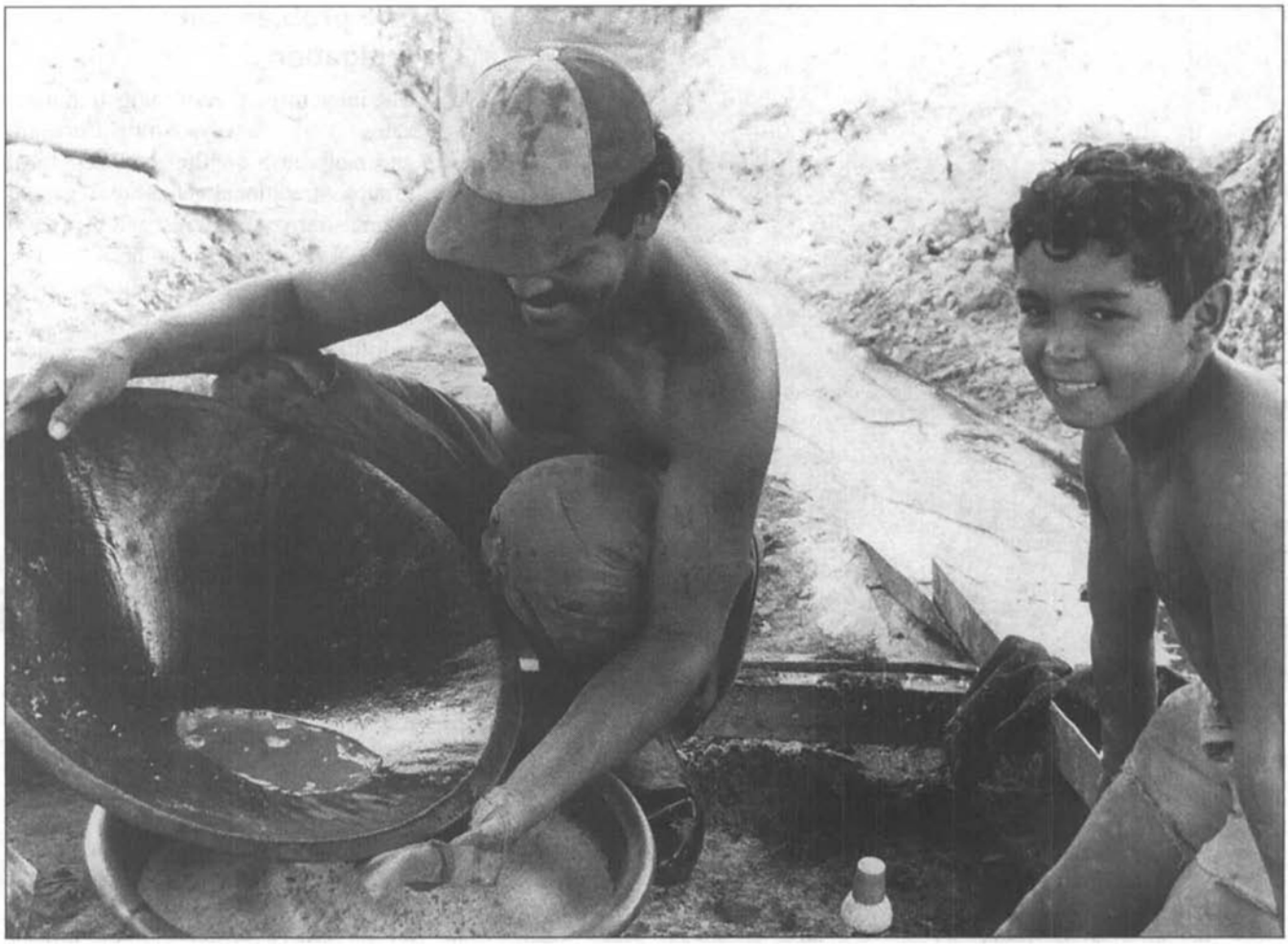
Discharge of arsenic-contaminated water from a gold-mine tailings lagoon into a river in south-west Ghana.



WHO/LO

Gold-diggers in Brazil: they may take away with them more than just gold.

related directly either to water quality, or to the presence of disease vectors in aquatic habitats. The investigations showed that significant diseases in the area ranged from diarrhoea in faecal-contaminated drinking-water to malaria, bilharzia, river blindness, and guineaworm.

The effects of mining projects can be considerable. Both direct and indirect effects can lead to the loss or reduction in resource quality. Direct effects are defined as changes caused by the project, such as land-take. Indirect effects are more difficult to assess, and arise as a result of 'remote' factors; for example, from the movement of people which can result in increased resource-use, and a deterioration in quality. Environmental assessments should be integrated so that indirect effects, such as socio-economic changes, are fully assessed. The assessment must also take into account likely future changes which could influence water resources, and the combined effects of other existing projects.

Environmental impacts

The major direct effect of any mining project is the loss of, or alteration to, surface waters as a result of land-take. This can cause a reduction in the availability of drinking- and washing-water, for example, from water abstraction; changes to catchment-hydrology through the loss of rainforest and occupation of sites traditionally used for drinking-water or washing; the reduction of the fisheries potential of an area by loss of habitat for reproduction and fishing locations, interruption to migration pathways, and loss of fishing sites. A further, serious potential impact in the humid tropics is the likelihood of the fast-increasing number of sites, such as pools, for the growth of disease vectors such as mosquitoes.

Mining can also cause changes to water quality; from excavation activities (with de-watering and drainage water, for example), with increased levels of suspended solids and soluble minerals, the accidental release of oils, sewage from the work camps, and effluents from mineral-processing activities. Gold miners use a number of methods to process the gold ore, some of which use potentially hazardous chemicals, such as cyanide. In addition, other dangerous chemicals, such as arsenic compounds, may be present in some of the gold ores released during processing. Since these compounds have the potential to cause substantial environmental damage, and pose a serious threat to people, strict controls are essential. Any such changes in the quality of water resources — surface or groundwaters — can have implications for the use of water resources, and can extend over the catchment below the mining site. The effects can also be long term.

Socio-economic effects

The indirect effects of a mining project relate mostly to socio-economic changes. Large mining projects will always act as a magnet to people in search of work. Water supplies for all uses are stretched further, and the introduction of disease and water contamination by sewage are likely to occur. These factors are, very often, the most difficult to assess, because predicting the scale of immigration and its effects is never easy.

Assessment of the magnitude, extent, and duration of an impact is made by having a detailed understanding of the project proposals and an understanding of the likely response of the environment to the proposals. The significance of an impact can then be assessed by matching the magnitude, extent, and duration of an impact against the value of a resource for people and wildlife, which is established during the evaluation of the baseline. It is particularly

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Hazards associated with mine water tailings lagoons must be clearly identified to prevent use by local people.

important to understand the significance of an impact because this determines whether an impact or combination of impacts can be considered acceptable, or whether mitigation measures or alternative proposals are needed.

Managing environmental impacts

The main challenge of an environmental assessment is to devise alternative proposals, or to develop mitigation measures to prevent, control, repress, or compensate, and to ensure the protection of people and wildlife resources as and when necessary. It is also important that mitigation measures, in particular preventive measures, are considered at an early stage in the project. This allows time for improvements at the outset of the planning stage, before the proposals are fixed, and mitigation becomes difficult to incorporate.

Mitigation must address the impacts presented in the EIA. It is crucial that impact assessors are experienced, to ensure that the importance of impacts and the effort given to mitigation is appropriate. This also goes back to the baseline study, in particular to justify spending on mitigation, where the value of particular resources has been evaluated.

The most effective forms of mitigation prevent environmental damage. This can involve altering proposals to avoid sensitive areas such as fish-breeding sites, or to prevent the creation of sites which can be used by disease vectors, such as pools which may act as mosquito-breeding sites.

Control measures include the use of systems to treat wastes such as sewage, or the use of sedimentation ponds to reduce suspended solids loadings. In the case of gold-mining projects, effective schemes to treat processing waters — and thus protect local water resources — are needed and, in general, are incorporated into project proposals.

Compensation should be considered as a last resort, albeit an essential one. Compensation can range from replacement, for example, of drinking-water supplies lost to the project by new borehole or treated-water supplies. It can also involve financial remuneration for lost resources such as lost fishing sites and catch returns.

'Restoration' is the attempt to replace the resources lost following an adverse impact. An example would be the restoration of land following a mining operation which, in the context of water resources, would restore catchment-drainage characteristics as well as land productivity.

During the operational phase of a mining project, monitoring plays an important role, in ensuring that mitigation measures are carried out thoroughly, and that the project responds to problems and complaints as they arise. This requires the formulation of an environmental-management system which empowers staff both to solve problems, and to report at a high level in the company structure so that environmental issues are brought to the fore.

The problem with mitigation

The implementation of mitigation measures is not always straightforward, and can cause conflict between local groups, traditional land-holding and administrative structures, and the (new) national government authorities. For example, a mining company can strive to protect a forested area because of its wildlife interest and value for watershed management. Whilst this may be agreed with the government authorities, the local chief may sell the logging rights, so that the forest is lost anyway. A clear understanding of the local political environment is needed, therefore, before implementing this type of mitigation.

Further problems occur with compensation. Its value as a form of mitigation depends on who receives it. All too often, it is unclear who should receive the compensation, and whether the most vulnerable members of a community benefit.

Mitigation must be implemented at an appropriate level of technology, and should not encourage over-dependence on the project. While a mining project should seek to minimize its impacts on local people or, in some cases, improve conditions — for example, by improving access to water supplies — the mine owners and managers should not be expected to solve all local problems. The use of high-technology solutions which, unless operated by the mine would fall into disuse, can lead to over-dependence. The key is careful mitigation planning, and the use of appropriate, probably simple, technology.

The way forward?

In Ghana, new mining projects certainly have adverse consequences for environmental resources. There is no doubt, however, that the quality of environmental protection and the awareness of environmental problems is considerably better than in the dark days before the introduction of environmental impact assessments. The result is markedly better environmental conditions in the vicinity of the projects, and these projects have appropriate plans which seek to minimize future environmental degradation.

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