Mine site : What to consider if Rehabilitation is to Occur.

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I. INTRODUCTION

Mine site rehabilitation is one of the biggest issues faced by mine operators. Increasing pressure from the community regarding the environmental impact of mining activities has lead to the formulation of government legislation and industry practices with a high emphasis on environmental management during and after the operation. Australia possesses rich mineral resources, and extraction of these minerals involves several different methods, resulting in different types of impact on the environment. The impact of these different extraction methods in conjunction with future land use will need to be addressed when planning or developing suitable rehabilitation methods for particular mine sites. A wide range of environmental circumstances need to be considered when planning or implementing mine site rehabilitation.

A visit was undertaken to three mine sites, Captains Flat Mine, Woodlawn Mine and Northparkes Mine. Northparkes is currently operational and the other two have already ceased operation, although Woodlawn mine site is currently utilised as a bioreactor. This essay will attempt to explore the type of rehabilitation that will need to be implemented for the non-operational Woodlawn and Captains Flat mines and also explore the type of rehabilitation needed for Northparkes Mine should the operation cease in the very near future.

II. BACKGROUND

A. Captains Flat

1) LOCATION AND HISTORY

Captains Flat is a small New South Wales town at approximately 343 km from Sydney and around 60 km away from the Australian Capital Territory. It is set in a valley and surrounded by hills. Gold was initially discovered during the early 1850's but was not heavily explored until 1881 when fossickers found large amount of gold [Yarrowlumla, 2001]. The discovery of ore minerals made this small mining operation site a major mineral producer of copper, lead, zinc and silver in NSW [Walkabout, no date], [Yarrowlumla, 2001]. Large infrastructure such as smelters were built for copper smelting during the first stage of the mining operation. The zinc content in the copper caused processing problems which eventually resulted in closure of the mine operation during 1899. However, the development of better processing technology for efficiently extracting zinc, pyrite, lead, gold and copper from ore enabled its re-opening in the 1930's [Yarrowlumla, 2001]. Supporting infrastructure, including a railway and a hotel were developed in response to the booming economy and increasing population, until its closure in 1962 [Yarrowlumla, 2001]. There are ongoing issues regarding its rehabilitation.

Figure 1. Old infrastructure at Captains Flat.

Figure 2. Sludge mound at Captains Flat mine site.

2) HERITAGE VALUE

The Ngarigu Aborigines occupied the region prior to white occupation [Walkabout, no date]. Currently, relics from the old settlement and some remains of the old mine infrastructure still exist, as seen in Figure 1. Mounds of mine sludge dumps and tailings deposits are still structurally visible, as seen in Figure 2. Old architectures such as the hotel, and some old mine housing still exist in the village.

3) REHABILITATION ISSUES

There are many issues that need to be considered during rehabilitation assessment of any mine site, especially for an old closed site. Firstly, questions such as the type of rehabilitation needed (preservation or completely demolish and re-vegetate) need to be answered. Regardless of the type of rehabilitation chosen, the following issues need to be considered:

- mine site age;
- environmental impact;
- safety;
- health issues;
- social issues;
- government assistance available; and
- community commitments.

B. Woodlawn Mine Site

1) Description

Woodlawn mine is an open cut zinc, copper, silver and lead mining operation that started in December 1978 and operated for nine years until the exhaustion of open cut minerals, resulting in commencement of the underground mining operation at the bottom of the existing open pit until its closure in 1998. The mine occupies approximately 350 ha, including the open pit void area covering 39 ha and 100 ha for stockpiled waste rocks. The owner, Denehhurst Ltd, was unable to rehabilitate post the mine's operation. However Collex Pty Ltd took over the mine for a bioreactor operation [ABARE, 2001], [Hansard, 2003].

2) Tailing Dams

Woodlawn mine site has numerous large tailings dams and waste rock stockpiles around the surrounding mine area. The tailings dams are quite old and diffuse an unpleasant smell typical of toxic materials. Evidence of active acid formation due to heavy metals such as Fe oxidation can be found on the soil surface and water in and around the tailings dams.

3) Environmental Impact

The area surrounding the mine, in particular around the tailings dams, have no vegetation coverage. Woodlawn is located on the upper catchment of the Canberra and Sydney Water Supply. Any accident resulting from instability of the tailings dams structure will have an enormous environmental impact on these nearby water ways.

4) Rehabilitation Activities

The surrounding landscape of Woodlawn mine site is highly disturbed due to previous mining activities. The manager of the current site occupant (Collex Bioreactor) claimed that there are ongoing rehabilitation projects, such as re-vegetation, that are currently active in some areas of the mine as part of their 20 year rehabilitation plan.

C. Northparkes Mine Site

1) Description

Northparkes Mine is currently operating, and is a combination of open pit and underground mining, as seen in Figure 3 and 4. There are large waste rock piles and tailings dams around the mine site, as seen in Figure 5. The tailings dam wall structures are relatively high compared to the ground surface, and are subject to future build up processes as required.

Figure 3. Northparkes open cut mine operation.

Figure 4. Underground mining operation at Northparkes.

Figure 5. One of Northparkes tailings dams.

2) Environmental Impact

The risk of seepage of contaminated water from the tailings dam is very high for every mine operation and particularly at the Northparkes Mine. In order to minimise this risk, good management and active monitoring processes, such as the installation of peizometers around the risk areas, has already been implemented.

III. Discussion

A. Rehabilitation Type

Based on field observation, the old Captains Flat mine site is definitely a site that needs to be rehabilitated. Ground research of the above issues will need to be conducted prior to rehabilitation of this site regardless of whether the preferred choice is complete demolition and re-vegetate, or rehabilitate for heritage preservation purposes. The open pit part of Woodlawn mine is already being utilised for a different type of industry, although the rehabilitation of the existing tailings dams and controlling future acid mine drainage is vitally important during rehabilitation.

1) Rehabilitation for Heritage Preservation

There is a growing community commitment and involvement in rehabilitating and preserving the history of Captains Flat site. The old infrastructure and mound hills of old tailings and capped sludge dumps are worth preserving for history and study purposes. However, there are reports of water contamination from leached heavy metals in Molonglo River and Lake Burley Griffin from this site. According to McGown (pers. communication, July, 2004), the infrastructure of this site is very well preserved and needs to be protected for its heritage value. Careful protection planing around the old infrastructure should preserve them for a period of time.

This site does not have a good environmental record to show. The collapse of the tailings dumps in 1943, which lead to a massive leakage of heavy metals from the settling pond straight into the river resulted in water contamination, affecting aquatic life and livestock along the river [Renwick, 2004]. According to Renwick (2004), the community of Captains flat mine site town are still concerned about water contamination issues from this site, including the potential for the sludge dump mound hills to build up pressure and burst out, polluting the river. This is where a careful environmental impact assessment is critically needed if preservation is chosen.

Other issues such as safety, health and social, are all critical components of the rehabilitation processes. Environmental issues regarding contamination are potential major social issues for stakeholders of the farm land, and residential areas and down stream users.

Previous failure of the tailings dam structure means a future rehabilitation plan should include monitoring of ground seepage and regular structural assessment around the existing tailings dams during and after rehabilitation processes. Revegetation around the mine site should be done as a major part of the rehabilitation process.

The utilisation of Woodlawn mine site for commercial enterprise [ABARE, 2001] seems to have preserved some of the mine infrastructure, a useful outcome for heritage purposes. For Northparkes Mine, it is very hard to speculate if the mine site infrastructure should be preserved for heritage value, but needs to be considered in the rehabilitation plan. The extent of the landscape disturbance is quite enormous due to the open pit operation.

2) Future Rehabilitation : Demolish and Re-vegetate

The strong involvement and interest of the local community in Captains Flat mine site means demolition is obviously not a principal rehabilitation choice for it.

For Woodlawn mine site demolition is not an option for future rehabilitation due to the commercial enterprise. One of the by-products of this commercial enterprise is organic material. Future rehabilitation of this site should include in-filling of the unused tailings dams with those organic by-products for better re-vegetation results. Re-vegetation should be conducted during the rehabilitation. Monitoring for highly toxic water and ground seepage should also be done regularly in order to minimise future environmental impact on the surrounding water ways.

Northparkes Mine staff told us that sound rehabilitation processes are currently implemented for this mine site. They also claim that where possible, the in-fill soils that they use are of the same soil type that they removed, resulting in restoration of the soil condition. Re-vegetation projects seem to be part of their mine site operations, therefore, if this practice is continued, future rehabilitation will be straight forward and cost effective, although long term stabilisation of the additional build up of tailings dam wall structures will be potentially difficult.

IV. Conclusion

The Captain's Flat mine site has managed to preserve some of the old processing infrastructure. The community of this small mining town has recognised the uniqueness of its characteristics, and favours the preservation of the heritage of this old mine site, which should be strongly encouraged and government support should be acquired for a successful outcome. Woodlawn should continue with its recycling facility reuse and Northparkes should continue with its plan for demolition and returning the area back to farmland.

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