A COMBINED OPERATING AND RECLAMATION SCHEME FOR A HORNFELS QUARRY, VICTORIA

BOWEN K.G., Mines Department, Melbourne, Australia

Quarrying of hornfels in the metamorphic aureole of the Lysterfield Granodiorite 30 km southeast of Melbourne commenced more than 50 years ago. Annual production from the area is approximately 1 million tonnes. Reserves of stone are estimated to be in excess of 150 million tonnes and the quarries are a major source of crushed aggregate for Melbourne.

The quarries are located on a northeast-southwest trending ridge of metamorphosed Lower Devonian Humevale Formation sediments. In the unmetamorphosed state the sediments consist of massive to thin bedded siltstones. The degree of metamorphism varies from little or none to the dense purplish black hornfels which makes an excellent source material for crushed aggregate. The ridge extends for a distance of 3.5 km with a width of 400 to 800 m. The crest of the ridge is generally 150 m above the general level of low lying flat land to the north and 50 to 100 m above the general level of the Lysterfield Granodiorite to the south and southeast.

The area is generally rural in character although urban development is gradually encroaching from the north and west. To the south the quarries abut a national park and the water catchment area surrounding the Lysterfield Reservoir, which effectively screen the quarries from urban development in this direction.

Operating quarries are located in the centre and towards the eastern edge of the ridge. The quarry faces have advanced back to the crest of the ridge with face heights of 60 m. The existing faces with their sunlit northerly aspect dominate the skyline and have an adverse visual impact over a very large area.

Planning consent to quarry at the western end of the ridge has also been granted. To date only minor quarrying has taken place on this property and the impact of these operations is minimal.

As the property boundaries are generally close to the ridge crest further development of these quarries can only take place along the ridge. The end result of such an operation would be environmentally disastrous with a bare rock face 60 m high extending continuously for a distance of 2 km.

At the direction of the Victorian government a committee was formed to rationalize quarrying in the Lysterfield Hills and the nearby Dandenong Ranges. The design of a suitable rehabilitation program for the Lysterfield quarries is relatively simple exercise; however, because of the number of parties and authorities involved the implementation of such a program is far from simple. In a complicated and delicate set of negotiations involving two quarrying companies, two local councils and the state government it was agreed in principle to allow quarrying to extend into the adjoining Lysterfield water catchment area. In exchange the quarrying company had to donate to a neighbouring council a company owned property which was equivalent in area and on which they had a

permit to quarry but which had not been quarried to any extent.

The reaching of agreement in principle to allow extension into the water catchment area is critical to the entire project, as this will allow the high face to be removed by extending the quarry to the southeast, thus reducing if not removing altogether the visual impact of the high quarry face.

The committee engaged a landscape architect and other consultants to prepare a proposal that would ultimately lead to the elimination of the obvious scarring caused by past and present quarrying operations in the area. Constraints imposed on the design were:

1. There must be a lessening of the environmental impact of the quarries compared with existing conditions.
2. On completion the landscape is to be suitable for recreational use. The national park, the water catchment area which is to become available for public use, and the quarry area are to form an extensive park catering for a variety of recreational needs.
3. If possible the area should become progressively available for public use.
4. The quarrying companies must be able to extract at least the quantity of stone that they are entitled to extract under existing permits.
5. The operations are to be limited in time.

Several alternative designs including the alternative of no extension were considered by the committee. The recommended design involves the removal of the existing high faces and the creation of three lakes surrounded by slopes comparable with those existing in the hills at present. Although the ridge line will be altered considerably the new profile will be consistent with the appearance of the surrounding hills and ridges.

A comparison of the environmental impacts between the end result of the operations under existing planning consents and the recommended design shows that there are some minor impacts, generally temporary, which are detrimental. These are more than compensated for by the major benefits of the design which are the improved appearance and recreational use of the area after completion of quarrying.

Objections to the proposal have come from a number of quarters although the number is generally less than those against other similar developments. The final arbiter as to whether the proposal will go ahead will be an independent planning tribunal. Based upon the work carried out and the results of other similar cases the committee is confident that the necessary planning consents to enable the implementation of the design will be granted.

THE COASTAL LIMESTONE FORMATION OF WESTERN AUSTRALIA AND ITS ENVIRONMENTAL IMPLICATIONS

GORDON F.R., Perth, Western Australia

The Coastal Limestone Formation of Western Australia consists of eolian calcarenite, variably lithified, kankarized and leached to quartz sand. The formation is made up of four main lithologies: lime sand and shell grit; calcarenite; kankar or capstone; and quartz sand.

The formation originated as a beach dune deposit and shows progressive lithification then leaching, dependant on age and the amount of exposure to rainfall or spray-fall containing carbon dioxide in the form of carbonic acid. The weak acid initially acted to weld the lime sand and shell grit particles together, and then caused decay by continued leaching.

Although a continuous gradation of lithologies occurs between the end types of dune sand and quartz sand, the definition of a number of stages is desirable to serve as a reference model.

(a) Formation Phase:

Stage 1 Uncemented shell grit, lime sand and silica and accumulated in beach sand dunes, along with beach and reef deposits.