EFFECTS OF BAUXITE MINING IN THE DARLING RANGE

Report by Supervisory Panels Projects 3 and 4.

PROJECT 3 - Changes in the water table following mining.

Supervisory Panel: Mr. E. Bettenay (Convener), CSIRO;

Mr. J. Havel, Forests.

Mr. I. O'Hara, MWB

Mr. T. Bestow, Mines.

PROJECT 4 - Catchment monitoring

Supervisory Panel: Mr. E. Bettenay (Convener), CSIRO;

Mr. J. Havel, Forests

Mr. T. Bestow, Mines

Mr. I. O'Hara, MWB

Mr. D. Collett, PWD

Mr. T. Stoneman, Agriculture

Members of the Panels met at CSIRO, at 1400 hours on 7th April, 1975 to prepare the following report. Mr. Stoneman was represented by Mr. C. Shedley.

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1. Scope of Report

This report is based on direct results of core analyses and water table monitoring undertaken during the projects, and on the general experience and expertise of panel members.

2. Drilling and Monitoring

2.1 Results: Results to date are confined to Project 3 activity, and even here to a single set of observation wells at the Del Park (Pinjarra) mine site.

Results of core analyses and monitoring of water levels have been reported previously as follows: a progress report was submitted to the Steering Committee by Mr. T.T. Bestow, acting convener, on the 31st May, 1974. There have been subsequent follow-up statements by Mr. C.C. Sanders of the Mines Department of 26th September, 1974, and for the period 18/9/74 to 25/3/75.

2.2 Interpretation of Results: Results to date indicate that current mining practices do not materially affect stream water quality in the Del Park area. There is no marked concentration of salts in the profiles examined, these being generally less than 100 parts per million of total soluble salts. Stream base flows in the area are also low being in the order of 100 to 150 mg/l total dissolved solids.

Monitoring of water table levels indicates massive fresh water replenishment through the pit floor which had been ripped. Groundwater salinity is 40 mg/l, or more, higher under the forest than under the adjacent pit, the mean salinities for January 1975 being 181 mg/l from the forested bores, and 157 mg/l in the pit bores. These data may indicate a rapid flushing through of salts, the *in situ* salt levels having been quickly reduced following intensive recharge.

It is considered that because of pit construction and subsequent rehabilitation mining has not lead to major silt contamination of streams in the area. However the spread of silt from mine roads, and general mining traffic is a factor in the spread of jarrah die-back. It is understood that this aspect is covered by the report of the Project 5 Supervisory Panel.

3. Wider Implications

The conclusions that mining has no adverse effect on water quality in the Del Park area should not lead to complacency as to the likely effects of bauxite mining generally. Del Park is situated in the highest rainfall part of the Darling Range in an area where soil salt concentrations are low, and natural flushing of soils may be expected to be at a maximum. There is ample evidence that in other areas, some of which have no much less rain than at Del Park (e.g. CSIRO, Salmon and Wights catchments), - salt storage is much higher (Mulcahy et al, 1971, Dimmock, Bettenay and Mulcahy, 1974). In such areas mining practices which encourage a greater recharge to groundwaters would increase the salinities of effluent streams.

The store of soluble salts, and the probability of seriously impairing water quality increases dramatically in areas of lower rainfall in the eastern sector of the Darling Range. Here soil salinity associated with agricultural development, and with minor clearing for pine plantations is well known. The greatly increased salt yield of streams having catchments part cleared for agriculture over those with forested catchments has been documented by Peck and Hurle (1973). There is evidence that such changes may take place within only a few years (3-5 years) after clearing. Thus current mining practices, which may be resulting in slightly higher yields of fresh water at Del Park, would have very different effects elsewhere. Salinity changes as a result of surface disturbance including clearing of native vegetation are a complex interaction between increased input of relatively fresh waters, of waters dissolving stored salts in areas not normally

subject to flushing, and of increased base flow of groundwaters through piston type discharge. Further detailed hydrological studies are indicated, and should be set within landscape frameworks such as those suggested by Mulcahy, Churchward, and Dimmock (1972), and Bettenay and Mulcahy (1972).

All the evidence points to an eastern zone - approximately the low rainfall zone of Dimmock, Bettenay and Mulcahy(loc cit.) - in which slight disturbances will lead to greatly increased salt yields; to a high rainfall zone in which salt storage is low and mining may continue without undue effects; and to an intermediate zone in which a more detailed environmental picture may need to be built up before any disturbance is allowed. This latter area will come under scrutiny from Project 4, but unfortunately no results are available to date. The use of base flow stream salinities will be of some value in evaluating such areas, but recent evidence indicates that salt storage may be high in some parts of catchments and yet not be indicated by abnormally high base flow salinity levels. Areas where mining may proceed without undue effect may occur as isolated pockets since salinity associated with agricultural development is evident close to the scarp, where rainfall is somewhat lower, at for example, near Harvey and Roelands.

4. General Statement

There is now available a large amount of data relating to total salt storage, groundwater salinity and stream salinity over much of the higher rainfall zone of southwestern Australia (see Table (which is being prepared by Trevor Bestow)). This data has in part been summarised, and the relationships between salinity, climate, and topographic position brought out in the paper by Dimmock, Bettenay and Mulcahy (loc cit.) However there is much recent and current drilling for which data is not yet available. For much of this drilling data is being collected in a defined and orderly manner so that collation of data should be relatively easy. During the

next few months data will be accumulating from the south coast near Northcliffe to as far north as Mundaring, and in the near future may well be augmented from the Paxminex leases north of the Swan River. When all this data is collated it should be possible to make an authoratative statement, in broad terms, as a guide to allowable land usage for the whole of the high rainfall area. Mining practices which work successfully in the present areas may not be applicable to other areas. Some alternative practices aimed at reducing intake to the groundwaters, which leads to the flushing out of stored salts, may need to be sought. An investigation into the effects of agricultural practices such as contour ploughing, and the construction of contour banks, in relation to the translocation of stored salts may be useful as a guide in the drier, eastern, areas.

E. BETTENAY
Convenor - Projects 3 & 4
9th April, 1975

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