

TEINDEX: A COMPUTERISED DATA BASE OF MINING
TENEMENT INFORMATION

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ABSTRACT

The Department of Mines in Western Australia is responsible for the registration and processing of application for mining tenements.

In a period of reasonable mining interest and activity, the number of applications lodged in the Department are in excess of 10,000 per year, rising to between 60,000-80,000 in a boom year.

Tendex is a computerised data base holding the most important attribute data against approximately 35,000 tenements. It was designed as the first step in a building block approach to an eventual large data base management system of tenement information, and scientific data connected to a geographic base.

This paper outlines the philosophy, method and results of the Tendex system.

IMPORTANCE OF MINING TO THE STATE

The importance of mining to the economic well being of Western Australia can be gauged from the fact that in 1984 the value of minerals extracted was almost \$4.7 billion (Aus) of which the Government collected more than \$180 million in royalties, rent and fees. (See Fig 1)

The Western Australian Mining industry contributed 30% of the total value of overseas trade for Australia and more than 80% of the value of W.A. mineral production is exported. (See Fig 2)

There are currently 5 different types of tenement that maybe applied for to carry out exploration and mining under a new Act introduced in 1978.

- EL - Exploration lease
- ML - Mineral lease
- PL - Prospecting licence
- GPL - General purpose lease
- ML - Miscellaneous licence

ROYALTY REVENUE

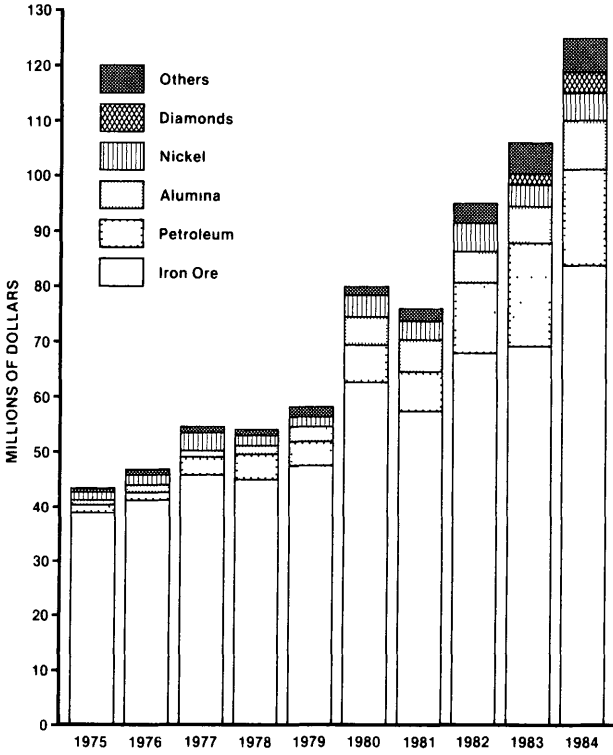


Figure 1

VALUE OF MINERAL PRODUCTION

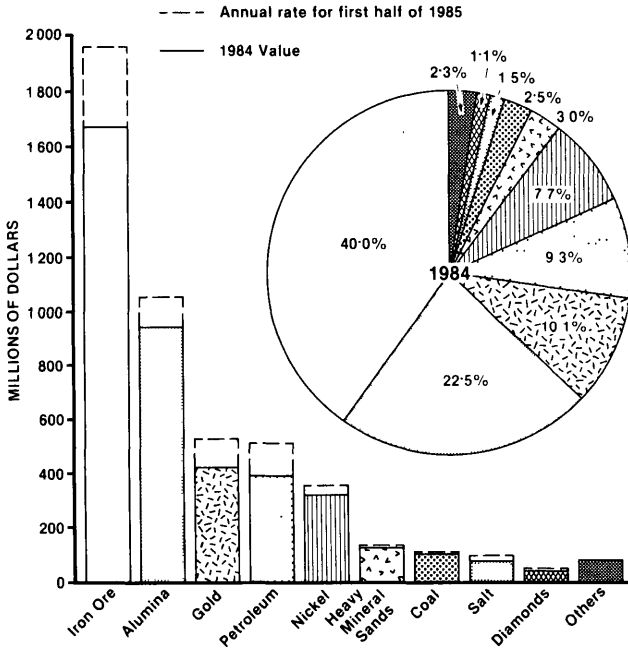


Figure 2

Prior to that, more than 40 different types of tenements could be applied for under the original Act of 1904.

At the end of 1985, more than 35000 tenement applications under the 1978 act had been lodged in the Department and approximately 394000 under the 1904 act.

Each tenement may have up to 70 items of information related to it, such as the name and address of the holder, Departmental file number, area, plan name and other legal dealing attributes.

Since the beginning of this century and until recently all tenement information was recorded by hand in large leather bound volumes.

Because of the vastness and remoteness of Western Australia, a system of registration offices was established in remote areas where tenement applications may be lodged in the field to avoid the long trip to Head Office in Perth, capital city of Western Australia. (See Fig 3)

A duplicate set of registers is kept in each outstation covering tenement applications in that particular region.

All tenements are plotted onto plans at various scales although mostly at 1:50 000 and a duplicate set of plans is maintained in each outstation similar to the registers.

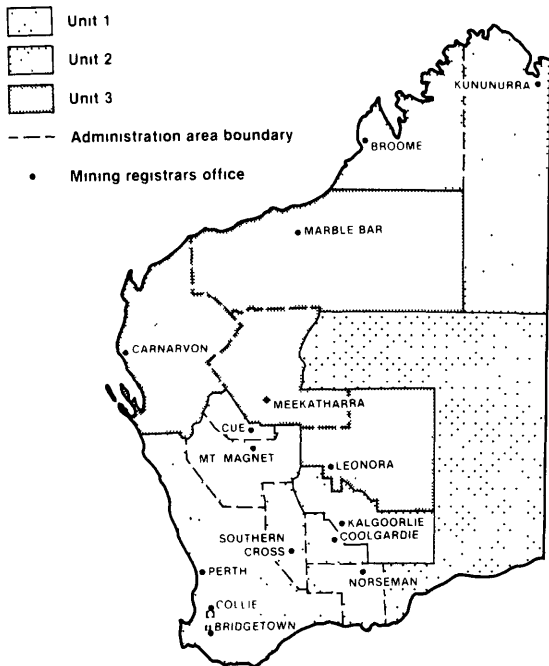
The Department is required to service the public and the mining industry by providing up to date information on all aspects of current applications and in particular, evidence that ground is available for pegging.

The massive amount of information requiring recording, plotting and processing has severely strained the ability of the Department to maintain manual systems.

In 1981/82 investigations were carried out into ways of computerising the information so that more efficient methods of recording and processing the tenement data would enable a better service to be provided to the industry and the Department.

When an application for a mining tenement is lodged, it is allocated a file number and a tenement number. The State is divided into Mineral Fields for the purpose of administration and as the names are quite long a 2 digit code is used to precede the tenement number. Thus, a tenement applied for as an Exploration Licence in the Marble Bar District would carry a number like this - E 80 3962.

REGISTRATION OFFICES



APPLICATIONS

1-1-84 TO 30-6-85

UNIT 1

TENEMENT	NUMBER	AREA (ha)
PL	1873	211 488
EL	291	3 184 000
ML	260	37 655
MISC.	52	1 121
GEN	6	155

UNIT 2

PL	1 717	225 866
EL	435	6 327 500
ML	199	17 890
MISC.	94	6 744
GEN.	21	404

UNIT 3

PL	2 155	282 720
EL	444	6 411 300
ML	309	46 510
MISC	143	6 144
GEN.	35	591

TOTAL 8 034 16 740 088

PL = PROSPECTING LICENCE

EL = EXPLORATION LICENCE

ML = MINING LEASE

MISC. = MISCELLANEOUS LICENCE

GEN = GENERAL PURPOSE LEASE

Figure 3

The application form (See Fig 4) contains all the data necessary for processing and in the event of disputes arising, marking off time and date may become an important issue.

The type of data on the application form and the following legal transactions were ideal for computerisation and it was eventually decided to proceed with building a data base.

Although the Department did not have a computer, the Central Government Computing Centre had sufficient space on a Vax 780 and terminals were installed in the Department and connected by land line to the central computer about one kilometre away.

The Department decided to proceed with building a data base and staff were trained and much enthusiasm prevailed.

Due to inexperience with data base management systems, no structuring of the data was attempted and it was decided to simply take up all the data and work out any reporting functions at a later date.

The data take up began in 1983 for a system known as MTIS (Mining Tenement Information System) with all data based on the tenement number.

Temporary staff were engaged and the data were taken direct from the source documents, the hand written registers where the information was recorded most of the time, and certainly in the last 20 years, under pressure of continuous high level mining activity and the original entries were never checked.

By mid - 1984, there were obvious signs of trouble. The error rate of data entry was very high and added to the errors in the original data, the whole validation process became unworkable. It proved conclusively the need for data to be checked and validated before entry.

All data entry ceased and a working group investigated the problems and finally concluded that the original plan to take up so much data was too ambitious and recommended that a severely reduced system should proceed. At the same time, a project manager, missing from the first exercise was appointed to co-ordinate all the activities and to design and establish a new system.

During 1984, an IBM 4341 computer was installed in the Department and some data had been transferred to it from the VAX 780.

APPLICATION FOR MINING TENEMENT

(a) Type of tenement
(b) Time & Date marked out (where applicable)
(c) Mineral Field

APPLICANT
(d) Full name for each applicant
(e) Address
(f) No of shares

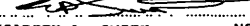
TOTAL No of shares

(a) EXPLORATION LICENCE		No. <u>45,526</u>
(b) a m / p m / /	(c) PILBARA	
(d) & (e) CORDALE HOLDINGS PROPRIETARY LTD. PO BOX 7249 CLOISTERS SQUARE PERTH, WA.A., 6000		(f) Shares 100
		(g) Total 100
(h) DE' GREY		
(i) Datum situated 30.30 km @ 277° from Trig R134		
(j) Thence 19.0 km brg 126° thence 6 km brg 036° Thence 7.0 km brg 306° thence 1.8 km brg 216° Thence 12.0 km brg 306° thence 4.2 km brg 216° back to datum		
(k) 92.40 km ²		

DESCRIPTION OF ROUND APPLIED OR

(h) Locality
(i) Datum Peg or Starting Point
(j) Boundaries


(l) Signature of applicant or agent

(l)  DATE 21.2.86
ELIZABETH A. SMITH NOTE

TYPE	NUMBER

Where a general purpose lease—S 86 (1) or a miscellaneous licence—S 91 (1) is being applied for the mining lease or mining tenement to which it relates should be stated

OBJECTIONS to this application may be lodged at the Mining Registrar's office at MARBLE BAR on or before the 23rd day of MARCH 1986 and the hearing will take place on the 18th day of APRIL 1986

OFFICE USE	File No: <u>474086</u>	FEES PAID	\$	C	812 00 RENT SHORTFALL
	MINING REGISTRAR 24 FEB 1986 MARBLE BAR 18 MAR 1986	Application	500	00	
		Rent	1,848	00	
		Survey Fee			
TOTAL		2,348	00		
	Received at <u>11.30 a.m.</u>	Map ref  Plan <u>DE GREY</u>			
	on <u>24-2-86</u>	Scale <u>1:100 000</u>			
	<u>C J EDWARDS</u> (Mining Registrar)				

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NEW SYSTEM

Although there were several options available in developing a new system, certain constraints were imposed by the Department that had an influence on the final decision.

The constraints were that no extra staff would be available and that in view of the time that had elapsed with the previous system, development time should be as short as possible.

Although a massive amount of data had been taken up, it was unreliable and it was decided that the task of validating would be too great as compared to starting again. However, two small sub-systems had been maintained and although not validated, they provided the important data of a mining tenement such as the Department's file number, the tenement number, the name and address of the holder and some survey details including the plan name.

These two systems, although on different computers and not related, provided an opportunity, if combined, for a small interim system to be developed that would allow a phased approach to the eventual large data base.

The systems had been maintained daily by two separate divisions of the Department but in unsupervised and ad-hoc way.

A complete print out of all information was made which was then validated with the source documents (registers) and corrected. Plans were then made to combine the systems under the name Tendex, an acronym for Tenement Index.

A number of other essential data items were identified and finally, it was agreed that Tendex should contain the following data items:

- Tenement Number
- Holder's Name
- Holder's Interest (Active or Inactive)
- Holder's Address
- File Number
- Status (Live or Dead)
- Locality
- Description of Datum Point
- Mark Off Time
- Mark Off Date
- Lodgement Time
- Lodgement Date
- Date of Grant of Tenement
- Date of Death of Tenement

Reason for Death of Tenement
Local Council or Shire (by code)
Public Plan
Area Applied for
Related Tenements
Comments
1: Million Index Map
Survey Instruction
Date of Survey
Surveyed Area
Diagram or Original Plan
Standard Plan
Surveyors Name
Surveyors Field Book

Because of staff restrictions, an officer of the Cartographic Computing Section of the Surveys and Mapping Division was seconded to the project and with a contract programmer, began the job of writing programmes in the Focus language, a software package that was purchased with the IBM computer.

During the review of the previous MTIS system, it was realised that the Department would ultimately require a huge data base of its information that would include the following:(See Fig 5)

1. All the data listed in Tendex
2. Additional legal Transactions with tenements
3. Production reports
4. Royalty payments
5. Mineral statistics
6. Land rehabilitation information
7. Financial information such as rents, fees
8. Technical reports on operations
9. Geological information
10. Data related to petroleum wells
11. Data related to water bores
12. A range of graphical data including maps

The original philosophy of Tendex was that it would form an interim limited system only until the full data base was developed. It would provide useful experience for users in the general handling of a computerised system and would provide answers to the most common enquiries made by the public and government ministers. It was agreed not to expand it beyond the limits previously set unless there was a good reason to do so.

FUTURE DATA BASE

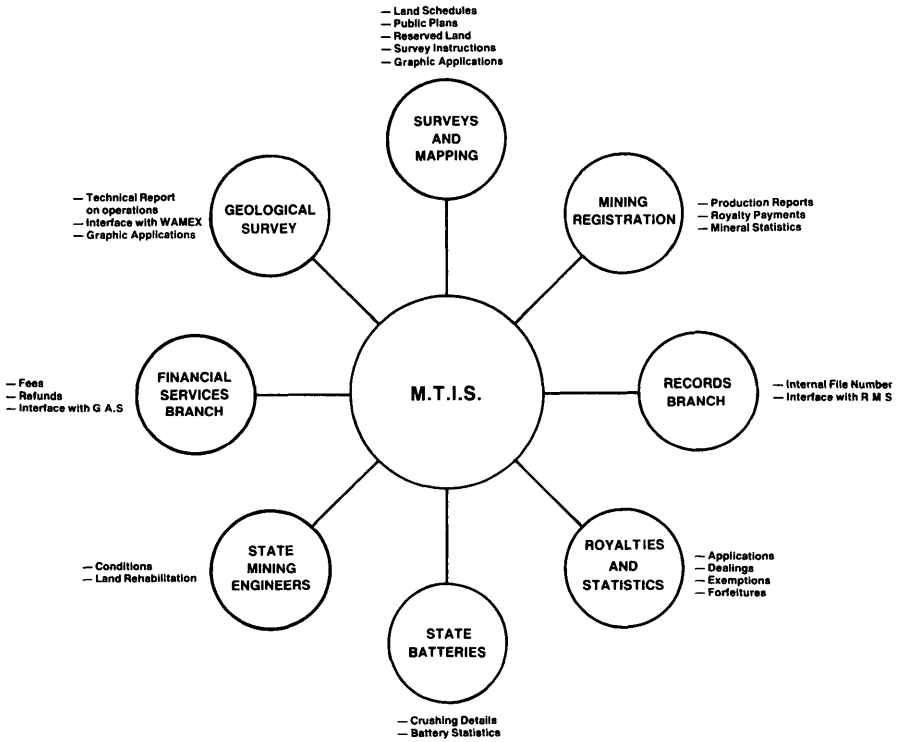


Figure 5

When Tendex became a live operational system, work would begin immediately on designing the large MTIS data base and although the data from Tendex would be used, the programmes and system would be discarded.

Preliminary planning for Tendex began in February, 1985, and the system became live on November 1st, 1985.

Almost immediately a number of enhancements were requested from users. A steering Committee had been set up initially to monitor the planning and all enhancements were examined by the committee to decide whether they should be included. Where it was seen that they system would be improved, the enhancements were built in.

DATA ENTRY

Data entry is carried out daily by two operators on separate input terminals. Entries are made from the tenement application forms that are lodged daily in the Department and those that are received by mail from the outstations. Transactions that take place after lodgement of these forms such as approvals, refusals, transfers, surrenders etc, are entered from internal forms that record such data.

The data base is up to date with all information at the end of each day.

At the end of every data entry session, an automatic print out is produced of all data entered for that session. A senior officer uses the print out to validate all data against the source documents.

DATA ENQUIRY

Many sections of the Department use the data daily and the public and mining industry presently make enquiries by telephone and through public counters in the Department and through the 15 outstations.

Although the system is still under test (as of March) it is expected that between 20 and 30 terminals will be eventually operating to handle all such enquiries. The outstations will also be progressively brought on live for enquiries.

Enquiries can be made via the file number, the tenement number or the name of the holder and any or all of the data can be read on the screen or printed out if required.

Programmes have been written for a number of report functions that are required frequently; such as:-

- (i) List all the tenements by type on a particular plan
- (ii) List all tenements owned by Company X in all districts or a particular district.
- (iii) List all tenements approved between two given dates.

Other similar and more complex functions will be added as users became more confident with the whole operation.

BENEFITS

Tendex has provided faster access to a wide range of data for multiple users that previously took much time and labour to obtain from the manual records.

When the system is available to the public, these benefits will increase particularly with answers to telephone enquiries.

However, there have been many side benefits that are worth mentioning. The need for accurate and up to date information to be computerised, has forced the Divisions of the Department to tighten up their existing records and manual procedures and to introduce checking stages for all data entry.

It is expected that manual registers in one Division will be discarded very shortly and time consuming manually compiled reports will be discontinued in another Division.

DISADVANTAGES

The Department runs a number of other computer systems based on the Focus data base language but the huge amount of data in Tendex has placed a strain on the storage and processing capacity of the IBM.

It was found that only 4 terminals could operate together on Tendex and the response times were too slow to consider a public system.

In addition, it was realised that in its present form, the IBM would not be able to carry the capacity of the next stage, the development of MTIS.

A computer consultant was engaged to recommend a solution and gave 5 options to be considered. The important criteria was to have a public system available as soon as possible and the option taken was to rewrite the programmes into COBOL language and run the system under CICS, (IBM Customer Information Control System); doing it in two stages.

The enquiry system required internally and for the public would be done first with expected completion by May 1st and followed by the update function, expected completion by June 30th.

At the same time, the opportunity will be taken to correct a number of design faults in the original system, brought about by the pressure to complete it quickly.

It is expected that at the completion of the modifications, the Department will have an excellent up to date data base of mining tenement information that can be accessed through 20 to 30 screens including at least one outstation.

GRAPHICS

One of the most important requirements of the Department is to provide graphical information about mining tenements and this is currently done through the mapping system.

However, it is planned to support TENDEX and ultimately the MTIS, with a graphic system.

There are two main options that have been considered:

- (i) A complete capture of all tenement boundaries plus the topographical and cadastral bases
- (ii) A limited capture only of the boundaries of the very large tenements, a centroid or co-ordinate value of all other tenements and a main framework only of topographic and cadastral information

The first option, while considered to be the best, is beyond the Departments resources in the next 10 years. The second option could be achieved in one year and would provide very useful spatial data as almost all enquiries about tenement data includes a "where is it" question.

Much of the surveyed data has been captured on other systems in the Department both manual and computer, and much of the main topographic features have a co-ordinate reference in a names file of another department.

The proposed plan is to manually digitise the centroid of each small tenement, (by eye only) and to digitise the boundaries of the large exploration tenements. This will be done from existing plans and as new tenements are plotted, a co-ordinate value will be read and entered into the data base. A complete plan or portion only could be printed out to support an inquiry. (See Figs 6.7)

A land information system is being developed in other State Government Departments and in the long term it is expected that the cadastral and topographic data base of that system will be interfaced with the MTIS and will be on line to the Department.

The Department is also involved in geological mapping but at this stage, there are no plans to computerise any areas although it will be one of the long term considerations.

Other future possibilities include the loading of parts of the data base onto a video-tex system to provide greater and faster access for the industry.

A problem in placing computers in the outstations, is combating the erratic fluctuation of power that occurs and the problems of dust. Many outstation areas of Western Australia are like being on the edge of the Sahara Desert where heat and red sand prevail. The use of Video-tex could solve this problem.

The Departments wide range and variety of information will undoubtedly fill a very large management data base in the future.

The development of Tendex has created the first foundation stone and the next few years will see this added with what promises be exciting use of new technology.

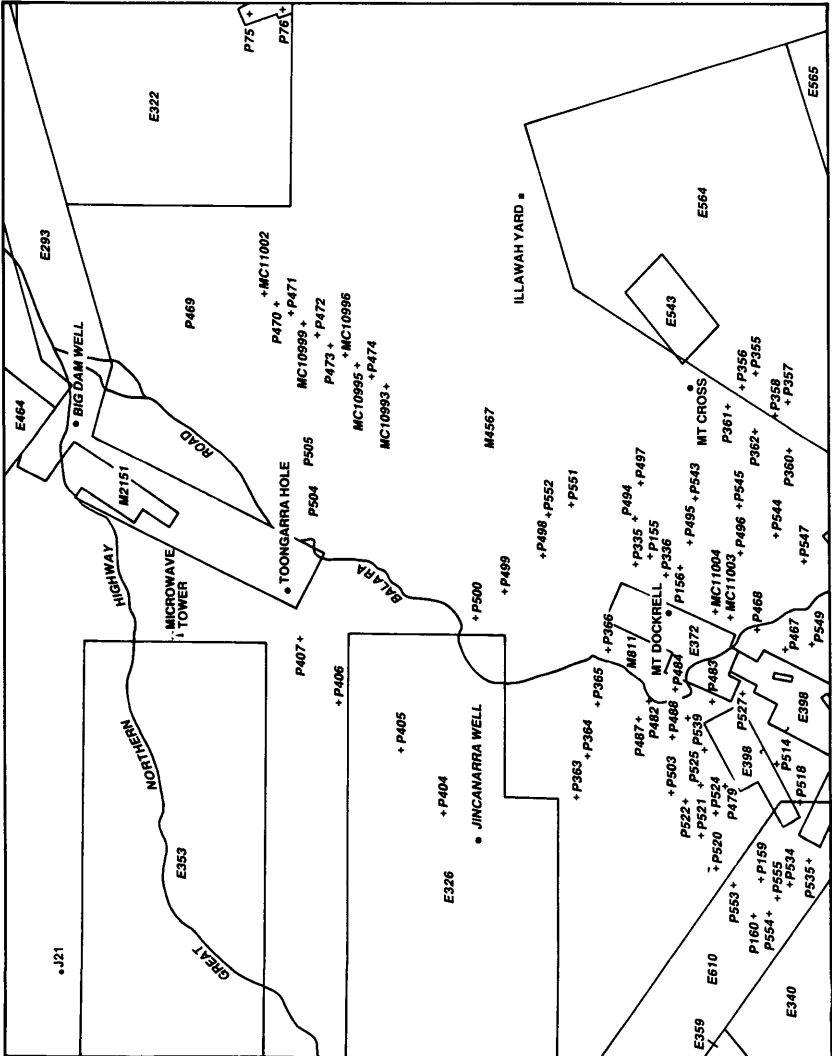
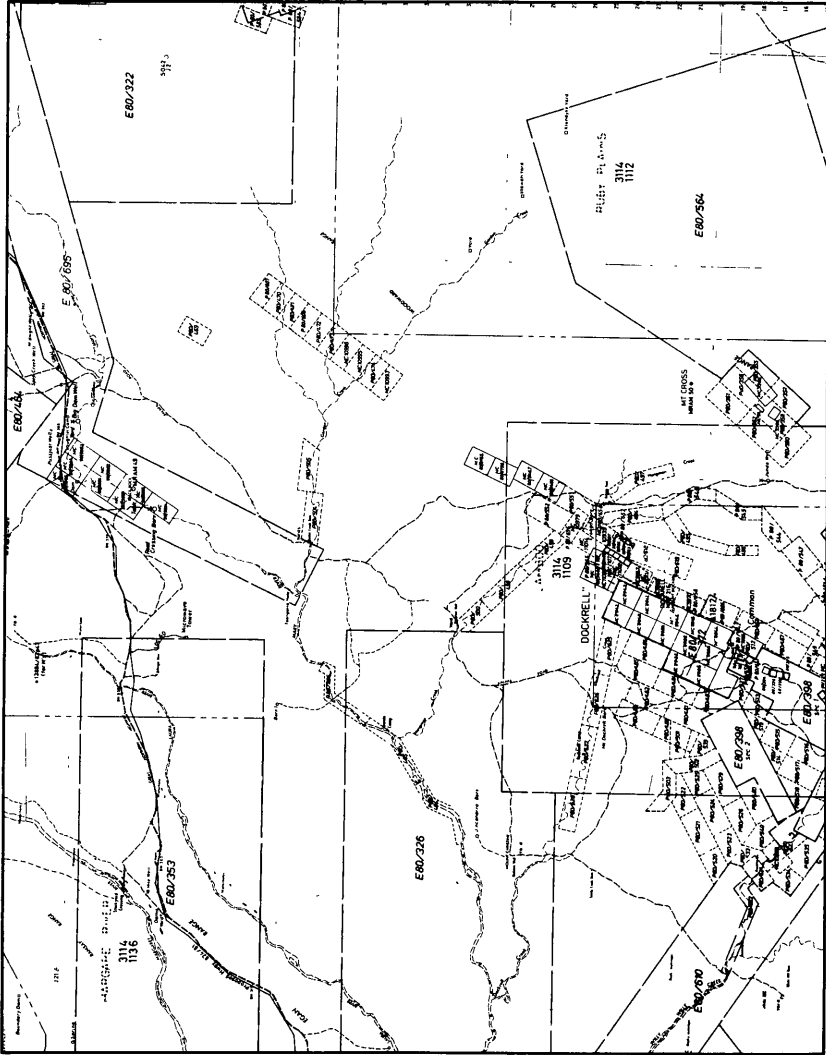


Figure 6 MAP OF TENEMENT CENTROIDS DOCKRELL 8km



DOCKRELL

8 km

ACTUAL TENEMENT MAP

Figure 7