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19 SEP 1974		ANSWERED		
DEPT		REF. No. 6440/74		

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CLADSTONE DISTRICT

REPORT FOR B.M.I. MINING PTY. LIMITED.

FOR PERIOD 19TH APRIL, 1974

TO

31ST MAY, 1974.

BY: WATSON DREDGING PTY. LIMITED.

OPEN FILE

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MICROFILMED

Watson Dredging Pty. Ltd.

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10th May 1974

Mr. R.W. Hooper

B.M.I. Mining Pty. Ltd.

Greystanes Road

Wentworthville

SYDNEY 2145

OPEN FILE

Dear Sirs,

INTERIM REPORT BY WATSON DREDGING PTY. LTD.

Your letter of 19th April is acknowledged, the movements of our staff at present are that Mr. A.E. Thomas, after attending 2 conferences in Sydney on 16th and 22nd April proceeded to South Mt. Cameron on 23rd April. He has been in residence in the Winneleah Hotel since that date.

Mr. J.A. Watson and Mr. H.E. Sloane joined Mr. Thomas on Monday 6th May, J.A. Watson returning on 8th May and H.E. Sloane on 10th May.

Discussions were held with your staff members in your South Mt. Cameron office during the 3 days as well as Mr. Tony Mearing who arrived at the office at mid-day on the 8th May. Reverting now to your letter of 19th May, containing the terms of reference of our engagement, your Ringarooma project was inspected with Mr. Ken Davey as were the Endurance Extended, The Monarch Deposit, The Scotia Deposit and the Dorsett Flat Dredge.

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Preliminary discussions were also held on the Banca Deposit, which has not been bored for values but only for depth.

The writer and his staff were impressed with the River Operation which generally is quite well set out. However in carrying out your terms of reference there are a few areas where modification could be made to improve efficiency and these will be contained in our next report. It is quite obvious dredges could not be applied to this deposit, so we are concentrating on the instruction contained in paragraph "a" of the terms of reference of your letter of 19th April. This operation was initiated basically on the information prepared by Dr. Standard where boring was by 2'0" grab samples and the values to a depth of 14'3" were inferred. Once the operation had proceeded your mine manager was able to obtain 2 samples from the bottom wash, the results of which have been sent to you, but for record purposes they are:-

Sample No. 1 - 3.79 Lbs Tin Oxide per cubic yard
0.28 Ozs Gold per cubic yard

Sample No. 2 - 2.1 Lbs Tin Oxide per cubic yard
Trace Gold

The inferred value of this bottom wash has been confirmed but not to the value of 2.7 Lbs of Tin Oxide per cubic yard overall, but to approximately 1.25 Lbs Tin Oxide per cubic yard overall with the gold not yet accurately determined.

In view of the sporadic nature of the ground the gold values would parallel the experience of the Cocks Eldorado Dredge at Wangaratta and the Dorsett Flat Dredge at Gladstone where it was a welcome bonus but not to be relied upon.

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An additional hole put down under A.E. Thomas supervision in the next beach or bend of the river downstream from the plant showed only a few ounces of Tin Oxide per cubic yard and no gold.

Work is proceeding on the examination of the River Project and our attitude to this has been modified by Mr. Mearing's statement that work will proceed by drag line and treatment plant at least a further one year adjacent to the 7 months work already carried out by the plant.

This decision, incidentally, has the full agreement of the writer but as we received only yesterday, working costs enabling us to assess the profitability of the operation, more time is required to finalise our report on this area.

There remains only one preliminary matter to be attended to, and to do this Mr. Thomas has made arrangements to go to the Mines Department, Hobart to obtain their boring results on the Scotia Lead.

Mr. Thomas, because of his long association with Dorsett Flat, has obtained on a confidential basis, the logs of 24 bores put down by Dorsett Flat on the Scotia Lead. This information will, of course, be available to you.

This Interim Report is to inform you on the lines on which we are working.

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MONARCH DEPOSIT

This area previously worked by you appears to have 2.7 million cubic yards of ground containing tin, the value of which is not yet known definitely but appears to be, on the evidence of boring and past records, 5 to 6 ozs of Tin Oxide per cubic yard.

This deposit is ideally suited to being worked by a small suction cutter dredge and floating treatment plant which will, incidentally, level the ground while recovering the tin.

No problems are anticipated in recovering the tin as to 80% of the bore hole values by suction cutter dredge due to the shallow nature of the deposit (20 to 30 feet) and the easily dredgable nature of the ground.

We will be presenting G.A. Drawings of suitable equipment, its capital cost and working cost in our report. We can, incidentally, show you similar equipment in operation in Australia on Rutile from the 34 dredges the writer has designed and built.

SCOTIA, ENDURANCE EXTENDED AND BANCA DEPOSITS

Because of the somewhat similar nature of these deposits and the radical change of the dredging methods the writer has developed, they are considered in unison to inform you on our suggested lines of work.

Firstly they are all deep and the values from surface to bottom of the order of 5 to 6 ozs of Tin Oxide per cubic yard. One must discard the Deep Digging Bucket Dredge as units already built to 150'.0" below water level weigh 6000 tons dead weight and cost in Australia \$A2,000 per ton.

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It is not believed the reserves warrant such a large expenditure, even though such dredges would qualify for Shipbuilding Board Subsidy currently 35%.

The principal being advanced is that successfully used by the writer in other mining applications where the dredge digging depth is no more than 70'0", but the treatment plant is capable of stacking tailings to a height of at least 100'0" above water level. The capital cost of dredge and treatment plant working to these parameters could be of the order of \$A2,000,000. The working cost on tin would be of the order of 30 cents per yard, including depreciation over the life of the property.

Such a means of working would be carried out within the capital cost and working cost structure mandatory for working such deposits. Again our report could contain G.A. Drawings of the equipment as well as capital and working cost estimates which will be based on previous dredges. The throughput would be in the 500 to 750 cubic yard per hour range.

The area where special attention is to be paid by boring is the capacity of the ground to stand or be stacked and Mr. A.E. Thomas is paying detailed attention to this. The first hole on the Scotia Lead was commenced on the morning of Wednesday 8th May, the information so obtained and added to past experience will allow us to present a carefully considered opinion of the characteristics of the ground in these deposits. Naturally he will obtain the opinions of Mr. Mearing and your staff in doing this work which we find is readily and expertly given.

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There is no doubt the working of these deposits to win tin is a major earth moving project where the capital cost and working cost of major earth moving equipment equals or exceeds that of dredges. The presence of clay and drift sand already known to all involved, demands the character of the ground must be closely examined before recommendations are made and decision taken.

The matter of dredging this ground is not a problem, nor is the stacking if the characteristics of the ground allow it.

A second report will be presented within the month.

Yours faithfully,



J.A. Watson,
Managing Director,
WATSON DREDGING PTY. LTD.

Watson Dredging Pty. Ltd.

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REPORT FOR B.M.I. MINING PTY. LTD. ON THEIR TIN DEPOSITS IN TASMANIA

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RINGAROOMA SECTION1. PRESENCE OF GOLD

The first question in the B.M.I. Mining Pty. Ltd. letter of 19 April, 1974 paragraph (a) is a report on the gold reported to be present in the Gorge Deposit in the Ringarooma River. While this is reported on by A. E. Thomas pp 15-20 of his section of the report a brief summary is given here.

The results of samples sent to The Mines Department for assay were accepted as a valuation per cubic yard of deposit. In fact this had the effect of increasing the valuation by 100 times.

The ratio of concentration of the drill cores to sample size was approximately 100.

2. PRESENCE OF TIN OXIDE

The wide range of valuations on the Ringarooma in toto and the section being worked make it extremely difficult to summarise this matter without further work. Commencing with Dr. Standard's figure of 2.79 lbs per cubic yard for shallow 2' holes we find his inference that the values would live at depth is not realised by working.

In fact, B.M.I.'s valuation over 82 holes is 5 ozs per cubic yard.

A further variance is that the present operation is recovering over 12 ozs per cubic yard. While this value may be sporadic only, at least it shows further detailed examination is necessary.

With the existing situation we have concentrated on submitting suggestions to improve throughput. These figures show that unless areas within your deposit can be shown to contain 12.5 ozs per cubic yard of which 80% or 10 ozs per cubic yard can be recovered the operation will not be profitable even at increased throughput of 120 cubic yards per hour.

It will be noticed that B.M.I. drilling undervalues the respective areas on the evidence of results by working. See Monarch Report by A. E. Thomas and results from the Gorge workings on the Ringarooma. Further work is necessary to accurately define the values.

3. SUGGESTED WORKING METHODS

SHIFTING DORSET FLAT DREDGE IN ITS PRESENT FORM TO OTHER AREAS HELD UNDER TITLE BY B.M.I.

The options open to B.M.I. are:-

- (a) To dig the dredge to an area such as the Monarch deposit a distance of four miles.
- (b) Tow the dredge through a prepared canal a similar distance.
- (c) Completely dismantling the dredge transporting it and re-erecting on a new site.

The main problem is the age of the working machinery of the dredge. Any move must have a first step the replacement of the bucket band, top and bottom tumblers ladder rollers, all wire ropes and the replacement of virtually all electricals to satisfy modern requirements. A full maintenance programme to re-condition the main drive, screen jigs, pumps and cranes must be undertaken.

It would be undesirable to recommence working on a new mining property without carrying out this work. The cost of this work which is necessary whatever means of moving is adopted, is estimated at \$250,000.

The purchase price of the dredge must also be considered and this is estimated at \$85,000

The cost of digging the dredge a distance of four (4) miles through a path four (4) miles long, $2\frac{1}{2}$ chains wide and 15' deep would involve

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dredging 2,000,000 cubic yards and it would take 16 months. The operating cost at minimum level is \$25,000 per month amounting to a shifting cost of \$400,000.

The path would have to be carefully surveyed and bored to ensure water level could be maintained and that no undredgable ground lay in the path.

Furthermore the path crosses one main road and would pass through a well improved farm and compensation must be paid for both these crossings.

A minimum amount of \$750,000 must be spent to transfer the dredge this distance by digging a path using the dredge itself.

Considering now towing the dredge through a prepared canal the cost of dredge purchase and new parts would be necessary, amounting to \$250,000 plus \$85,000 = \$330,000.

Incidentally this procedure is normally used to transfer a working dredge quickly from one area to another to obviate loss of production.

The cost of the canal involves excavating $1\frac{1}{2}$ chains wide 15' deep and 4 miles long amounting to 1,160,000 cubic yards. A moderate cost for this would be 20¢ per yard amounting to \$230,000

Careful survey of the route of the canal must be undertaken to be certain of its practicability and water supply arrangements made, as well as dam construction facilities located to move the dredge up gradients and down hill where necessary. A 22,000 volt power line must be constructed along the line of the path, in this case and when the dredge digs its own path.

Again compensation for crossing a main road and a developed farm would be necessary and this amount which cannot be specified would be a significant amount.

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Attention to the dredge move, hiring of tractors to move it and filling the canal and rehabilitating the country make it unlikely that the move could be accomplished under \$700,000.

The third method of dismantling the dredge transporting it and re-erecting it on site could not be accomplished under \$200 per ton for this 1000 ton dredge = \$200,000.

Roads out of the present site of the dredge and into the new site must be constructed and craneage hired for dismantling and re-erection - these are special cranes with long reach.

Accommodation for employees dismantling and re-erecting must be provided and transport facilities to move the dredge segments.

Finally the purchase of the dredge, supply of new parts would still apply amounting to \$330,000. There is very little chance of the total amount being less than \$750,000.

The history of the Dorset Flat Dredge has been known to J.A. Watson for over 30 years and while a new pontoon was constructed on its last shift from South Mount Cameron to its present location the dredge has served a long and useful life and is in need of maintenance and repair, especially in the tumbler drive area.

On arrival at a new site it will still be in its present form which is a digging depth of approximately 50 feet below water level which is too great for the Monarch and too shallow for the Endurance Extended and the Scotia.

It would therefore be necessary to modify it and retrim the dredge to suit the new property. It would not be possible to add to the digging depth beyond its present depth within the bounds of economic possibility. Perhaps the best way to convey this is to record a 1000 ton dredge digging to 50 feet below water level is a rarity, as the normal weight of dredges digging to this depth is 1500 to 2000 tons deadweight, the variation in weight depending on bucket size and the strength of the dredge structure.

A detailed study can be carried out on the subject of modification of the Dorset Flat Dredge to suit various digging depths but past experience enables us to state the total cost of buying the dredge, transferring it by whatever means to a new site and modifying it to suit the new property would at present day prices approximate \$1,000,000.

On the matter of prices and assuming local staff would be used for the move the recent increase in wages of \$36 per week is important. Under dredging conditions wages represent one third of the total cost and this recent wage increase is 50%. Therefore the dredging cost of \$25,000 per month would be increased by over \$4,000 per month or \$64,000 for the 16 month shift.

Similar remarks would apply to supplies in the present wage and cost situation in Australia forcing us to allow ample contingencies for the move.

SUGGESTED WORKING METHODS

MONARCH DEPOSIT

This is an ideal deposit for a Suction Cutter Dredge and Floating Treatment Plant. The equipment would overcome difficulties encountered in using earth moving plant and it would also leave tailings in an acceptable condition.

A drawing illustrating the plant is attached and illustrations of similar plants are contained in the Watson Dredging Brochure and individual sheets attached.

This suggestion is developed in full under the "Conclusions" relating to this deposit which forms part of this report.

DEEP DEPOSITS

These include the Scotia, Endurance Extended and possibly the Banca deposit. The three main methods suggested are:-

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- (1) A deep digging bucket dredge.
- (2) A Suction Cutter digging to approximately 70' below water level working in conjunction with a floating treatment plant capable of stacking to 120' above water level. There are several variations of this suggestion.
- (3) Use a sluicing plant.

1. BUCKET DREDGE - Such a unit of which about six are in operation on-shore and off-shore in Malaysia, Indonesia and Thailand would weigh 6000 tons dead weight and cost of the order of \$A12,000,000 designed and built in Australia. These dredges are capable of up to 1000 cubic yards per hour.

Arrangements exist for the design of such a unit to be carried out by F. W. Payne of London and in fact Watson Dredging is working with this Company tendering two large dredges for Indonesia, the Bangka II and the Billeton I.

Such a dredge could progressively work all the deep deposits held under title by B.M.I. but the capital cost rules it out as depreciation cost would prevent profitability.

Undoubtedly suitable dredges could be built more economically overseas, notably in Malaysia but import duty would counteract this saving.

The Australian Ship Building Board offer a subsidy currently at 35% of Finished Erected Cost and we could initiate negotiation with this Board if it is required.

As the deposits in question are valued so far at only 5 to 6 ozs per cubic yard the value of the tin in the ground is only 55 to 65 cents Australian per cubic yard and a recovery of 44 to 52 cents at

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80% recovery on borehole values can be expected. These figures are calculated on the price of tin ruling in May, 1974.

Although working costs for bucket dredges in Malaysia have stabilised at the end of 1973 at about 12 cents Australian per cubic yard, this figure is for dredges built at a much more economic cost. Recent cost increases in Malaysia, Thailand and Indonesia will undoubtedly have increased both building and operating costs but not to the Australian level. Australian bucket dredging costs for Tableland Tin and Ravenshoe are nearer 40 cents per cubic yard at present including all costs.

Depreciation over 30,000,000 cubic yards (Scotia plus Endurance) would amount to 30 cents Australian per yard if the Dredge, after subsidy built in Australia, cost \$A9,000,000.

It is not believed this means of working, sound though it may be, will be entertained by B.M.I. as no profit would be made.

2. With the development of the Suction Cutter for mineral dredging a changed concept of working emerged. This was to use shallow digging by the dredge and mineral recovery by a floating treatment plant capable of stacking tailings to a much increased height compared to the bucket dredge.

Drawings are attached illustrating this principle not only for the Monarch Deposit but the deeper deposits such as Scotia and Endurance Extended. The attached brochure also illustrates many plants of this type.

The capital cost of such equipment is much lower being \$A2,000,000 for a 450 cubic yard per hour dredge and floating treatment plant.

As doubts exist as to the stability of the deep ground being considered it is quite possible for a suitably designed dredge to dig the entire face and pump the material to a sectionalised treatment

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plant mounted on skids situated at the side of the dredge course. This treatment plant would return the tailings to the dredge course.

No. 1

The working cost of a suction cutter dredge and floating treatment plant would be 25 cents Australian per cubic yard and depreciation over 30,000,000 cubic yards 7 cents per cubic yard. Additional costs would be incurred by pumping the material to a treatment plant located on the side of the dredge course but in any event costs including depreciation would not exceed 35 cents Australian per cubic yard.

3. This appreciation would not be complete without listing a large sluicing plant operation as a possibility. Certainly hydraulic sluicing and elevating the material by an adequate pump to a treatment plant is as economic a method as any of moving it.

Mr. Vern Wood of the Pioneer Mine is benching his deposit but the total depth is 200' and he informs us his costs are 20 cents Australian per cubic yard.

Undoubtedly certain risks are involved in such a working procedure but the possibility exists of using it on B.M.I's deep deposits.

RINGAROOMA

There is no possibility of using a dredge in the Gorge Area of this deposit which is currently being worked and our comments are confined to an appreciation of the present method with suggestions to improve throughput.

Further detailed examination of the entire deposit may well reveal the possibility of applying more sophisticated equipment capable of continuous mining as opposed to batch operation.

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RINGAROOMA RIVER OPERATION

The absence of gold in the quantities at first anticipated in this area calls for a change from a low throughput leisurely operation to a maximum capacity fast moving one.

After a brief view of the situation it seemed obvious that the limit to production with the present equipment and circuitry is at the jigs.

In the present arrangement of three primaries one scavenger and one secondary the maximum throughput available would be approximately seventy yards per hour.

This is quite a low output when compared with the obvious capacity available on the mining end of the operation.

The operation generally is quite common and units with equipment of the type being employed have been very successful and efficient in many dry mining or land based operations.

It is felt that with a few minor modifications and additions to existing equipment and circuitry that the operation can be made to show quite a good return on outlay.

Dealing with the mining side. To determine capacity at that end, it was found that the R.B. 88 dragline allowing for a 70% bucket capacity and a conservative 50 second cycle could supply 180 yards minus $\frac{1}{2}$ " material to the jigs over a given period. The rest of the mining equipment up to the jigs can match this capacity also.

The maximum throughput over the existing jigs using a modified circuit with four primaries in parallel feeding one secondary would be approximately 95 tons per hour and with one additional primary would be in the order of 120 tons per hour.

With these figures in mind a number of combinations of working times for the mining and jig plants have been considered and tabulated showing

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corresponding throughputs, costs and returns. All of the methods calculated with the exception of the first show profits of varying magnitude. The first one covering the present set up could not be expected to show a profit because the presence of gold has been completely ignored in these calculations and the total value of the operation related to tin recovery only.

In all cases a time availability factor of 85% has been used along with an efficiency factor of 85% to cover slight variations in tin recovered, plant efficiency, etc.

In studying these figures it appears that any of the latter three methods could be adopted.

However, it is felt that methods C and D have advantages over the other methods, these are:-

1. More profitable than the other methods.
2. It is always a good arrangement to have reserve capacity in the mining end of an operation as this is the area where minor hold ups are most likely to occur for various reasons, some are:- repositioning dragline, lubrication checks, refuelling, minor services, etc., also blocked feed gate at grizzly feed hopper, blinded grizzly and a host of other minor items.

The major item is the complete moving of the mining plant which it is anticipated will have to take place after every 6000 to 8000 yards of operation according to width and depth of the particular area.

A plant of this type and size should not take longer than four hours to move from shut down to start up and as this amount of time would be available to the mining plant if either C or D are adopted, the complete mine should be able to maintain production with a minimum amount of overtime, particularly as 85% of time availability has been used in calculating returns.

In order to assist the operation to maintain target production we could recommend that the following alterations be made:-

1. Re-arrange the present jig plant to a four primary, one secondary arrangement at the same time making provision for one or two more jigs mounted on a semi portable base, if necessary sectionalised, to permit fairly easy transport to future sites further along the river etc.
2. Erect a cover, aluminium or galvanised iron clad over the jigs with provision for heating by electric radiator or wood fire. Operators won't give of their best if they are cold, wet and miserable.
3. Modify the feed arrangement to the jigs to ensure constant even presentation of feed.
4. Modify the water circuit so that overflow from cyclone returns via tundish or small elevated bin to break siphon to the screen at mine site, taking advantage of natural head, so that any solids fine or otherwise reporting to overflow are returned to the primary circuit for retreatment. In the present set up solids in overflow are reporting in part via screen tank - which appears inadequate - to hutch water and must ultimately settle out in the hutches which is undesirable, or carried by overflow to waste and are lost.

With the cyclone overflow returning to vibrating screen a small pump capable of approximately 400 G.P.M. would be required to supply make up water lost in cyclone underflow.

5. Modify screen tank by fitting large area small mesh replacable screens to minimise blockages in sprays sparges jets etc. This tank to be fed by separate electric motor driven pump supplying jig plant water only.

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6. Operating at the suggested higher throughput figures is going to result in grizzly and screen oversize being rejected at the rate of 5000 to 6500 yards per week or between 70 and 95 yards per hour. To dispose of this material clear access to the mined area behind the plant should be maintained. That is, pipelines, electric cables etc. should not cross between the mined area and the grizzly or screen reject piles. It is a waste of time and effort trying to dispose of this material outside of the mining path, particularly as the ground rises sharply away from the mine path.
7. Each unit in the mining section should be self contained on its own solid skid base and if connected to an adjacent unit or pipeline, quick release connections should be used in all cases.
8. Place order for one or two additional jigs preferably one 2 flow line 3 cell 42" jig along with associated equipment for installation upon delivery.

We would recommend that items 1 to 7 be implemented immediately to permit operation method "b" to be adopted to place the scheme on a profitable basis as soon as possible.

Also item 8 be attended to at an early date and when equipment comes to hand, it be installed in the circuit where provision will have been made and then operation method "c" or "d" be instituted.

It is considered that approximately four weeks would be required to carry out the necessary alterations and modifications at an estimated cost of \$25,000 to \$30,000.

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RINGAROOMAMINING CAPACITY

- a) Dragline R.B. 88 Bucyrus Erie
 6 Yd. bucket, 50 secs. cycle @ 70% bucket capacity

$$= \frac{6 \times 60 \times 0.7 \times 60}{50} = 302.4 \text{ yds. per hr.}$$
 Reject material plus $\frac{1}{2}$ over grizzly and vibrating screen = 40%
 Assume 30% loss at grizzly and 10% loss over screen then belt conveyor required to carry 271.68 yds per hour and diesel driven Warman 10/8 pump required to transfer 180 yds per hour for presentation to jig plant.
- b) Conveyor 24 inch width can operate at 400 ft. per min.
 Capacity @ average of 2" bed and 350 ft. per min. would be:-
- $$\frac{24 \times 2 \times 350 \times 60}{144 \times 27} = 259 \text{ yds per hour}$$
- c) Warman 10/8 gravel pump has maximum capacity of 280 yds. per hour at 3,500 G.P.M. @ 30% solids by weight, so would easily cope with material presented from vibrating screen.
- d) Thompson 10/12 transfer pump is capable of handling in excess of 200 yds. per hour.
- e) Linatex 30 inch cyclone is capable of handling 195 yds. per hour @ 2,400 G.P.M. @ 30% solids by weight.

From the above it is obvious that the mining equipment taken as a whole is capable of presenting 180 yds per hour of jig feed to the feed apron under the cyclone.

The present jig arrangement of three primary jigs one scavenger jig and one secondary jig limits the operation to an approximate maximum throughput of 70 yds. per hour.

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It is felt that a better arrangement of the existing equipment would be four primary jigs with one secondary jig increasing the throughput to 90 yds per hour plus - as per recommendation by A. E. Thomas.

A further improvement could be achieved by adding one or two more primary jigs bringing the possible throughput up to 120 yds. per hour plus.

Based on the foregoing a number of costs versus throughput have been run out for purposes of comparison with corresponding returns.

PLANT THROUGHPUT UNDER VARIOUS OPERATING ARRANGEMENTS

- a) 5 days 8 hrs. drag 16 hrs. jigs
= $90 \times 16 \times 5 \times .85 = 6120$ through plant 10,200 yds. ground worked.
- b) 6 days 8 hrs. drag 16 hrs. jigs
= $90 \times 16 \times 6 \times .85 = 7344$ plant 12,240 yds. ground worked.
- c) 5 days 16 hrs. drag 16 hrs. jigs
@ 120 yds/hr. over jigs
= $120 \times 16 \times 5 \times .85 = 8160$ plant and 13,600 yds. ground worked.
- d) 6 days 16 hrs. drag @ 120 yds/hr. over jigs
= $120 \times 16 \times 6 \times .85 = 9792$ plant and 16,320 yds. ground worked.

In (b) and (c) as the dragline is capable of producing 180 yds. per hr. and only 120 yds. are required for the jig plant the dragline only needs to work 66% of the time the plant works. In other words the mining side of the operation gains approximately $2\frac{3}{4}$ hrs. over the jigs per shift giving $5\frac{1}{2}$ hrs. each day for a plant move, maintenance, or build up of stock pile.

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RINGAROOMA

Staff required for five day operation with one shift dragline and two shifts jigs.

Production Labour

1 dragline operator	130.00	
1 Bin and screen attendant	110.00	
2 Jig hands	240.00	
2 Plant assistants	220.00	
2 Day crew	240.00	
1 Fitter	130.00	
1 Welder	130.00	
1 Truck driver	120.00	
1 Tin shed	120.00	
1 Foreman	160.00	1600

Non Productive Labour

Mine superintendant	280.00	
Paymaster, records clerk	160.00	
Typist	90.00	530

2130

Plus holiday, sick work comp., payroll tax 25% 532.50

TOTAL\$2662.50

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RINGAROOMA

Total power requirements, 5 day week, 1 shift dragline, 2 shifts jigs.

<u>ITEM</u>	<u>DIESEL G.P.</u> <u>WEEK</u>	<u>ELEC.</u>	<u>UNIT/WEEK</u>
Dragline RB 88 300 HP V12 GM 8G. P.H. x 8 x 5	320		
Cat/Warman Slurry Pump 310 HP using 200 HP 5.33 x 8 x 5	<u>213</u> 533		
Conveyor belt 212 yds/hr. to 15 ft. elev. 8 hrs/day Stoker.		15 HP 5 HP	480 120
Transfer pump 125 HP motor to Thompson 10/10 pump 8 hrs/day		125 HP	4000
Water to screen hoper 40+10 HP 8 hrs/day		50 HP	1600
Jig drives 5 x 5 HP 16 hrs/day @ 75% div.		19 HP	1216
Plant water 25 HP 16 hrs/day		25 HP	1600
		<hr/> 239	<hr/> 9016

Fuel costs $533 \times 17.5 = \$93.275$ per week.

Power consumed per quarter = $9016 \times 13 = 117,208$ chargable at
(H.P. installed say 240) 1st 240 x 120 = 28,800 @ 4.02 = 1157.76
2nd " " " = 28,800 @ 2.08 = 599.04
Balance = 59,608 @ 1.16 = 691.45
2448.25

Total per quarter 2,448.25 or \$188.13 per week.
Plus lighting and office workshop tin shed etc. @ \$25.00/week.

Total Diesel fuel costs \$93.275

Total Power costs \$213.13

023

594025

RINGAROOMAOperation (a)

Operating expenses for five day operation dragline one shift,
jigs two shifts.

Total Labour	2662	
Light and power	214	
Fuel lubs and oils	160	
Equipment hire	750	
Mobile equipment crane, truck, tractor, etc.	250	
Motor vehicles cars, utes	220	
Repairs and Maintenance materials only	750	
Access and supply	140	
Insurance	80	
Depreciation	2500	
Ammortisation	100	
Head office charges	500	
Exploration development etc.	650	
Sundries	500	
	<u>TOTAL</u>	<u>\$9,477</u> per week

024

Additional costs involved in:-

- b) Increasing operation to six days per week.
- c) Increasing operation to two shifts dragline 5 days per week.
- d) Increasing operation to two shifts dragline 6 days per week.
- e) Installation of additional jig plant to obtain maximum throughput from operation on 6 days 2 shifts all round as per (c) and (d).

b)	One overtime shift for all operating crew (6 men)	254
	Overtime shift for $\frac{1}{4}$ of non-operating crew (6 men)	71
	Light & power	43
	Fuel lubs & oils	32
	Equipment hire	150
	Mobile equipment	50
	Motor vehicles	45
	Repairs & Maintenance	150
	Ammortisation	20
	Sundries	100
		<hr/>
	<u>TOTAL</u>	\$915
		<hr/>
c)	One dragline operator	130
	One bin & screen attendant	110
	Other labour maintenance etc.	65
	Light & Power	100
	Fuel lubs & oils	80
	Equipment hire	180
	Mobile equipment	60
	Repairs & maintenance	500
	Ammortisation	50
	Sundries	200
		<hr/>
		\$1475
		<hr/>

d)	a. costs	915
	b. costs	1475
plus	overtime shift for 1 dragline operator	47
	Overtime shift for 1 bin attendant	40
	Light & power	20
	Fuel lubs & oils	20
	Equipment hire	50
	Repairs & maintenance	100
	Ammortisation	10
	Sundries	50
		<u>\$2727</u>

e) Capital cost involved in the following:-

- 1) Installation of additional jig.
- 2) Re-arrangement of existing jig circuit.
- 3) Modification to feed presentation to jigs.
- 4) Modification to water circuit with regard to jigs and mining circuit.
- 5) Erection of shelter over jig deck.

Estimate to carry out the above \$30,000.

There are no further operating costs involved, as for the purpose of this exercise full load conditions have been applied in all cases, to be on the conservative side.

Therefore additional costs involved would only apply to power required to operate and supply hutch water to the additional jig coupled with an increase in depreciation.

Total additional costs for (e) would be \$130 per week.

WEEKLY PRODUCTION FIGURES UNDER VARIOUS WELLY OPERATING TIMES - SEE SECTION

594028

026

Mining Method	Ground Mined Yards	Material Over Jigs Yards	Total Cost of Production \$A	Value of Production \$A	Margin \$A
As at present	7922	4760	$a + 1 f$ 9477 + 300 9777	$\frac{7922 \times 12 \times .85 \times 4000}{16 \times 2204.6}$ 9160	- 617
Method (a) 5 days 1 shift dragline 2 shifts jigs	10200	6120	$a + 1.5 f$ 9477 + 450 9927	$\frac{10200 \times 12 \times .85 \times 4000}{16 \times 2204.6}$ 11798	1871
Method (b) 6 days 1 shift dragline 2 shifts jigs	12240	7344	$a + b + 2f$ 9477 + 915 + 600 10992	$\frac{12240 \times 12 \times .85 \times 4000}{16 \times 2204.6}$ 14120	3130
Method (c) 5 days 2 shifts dragline 2 shifts jigs	13600	8160	$a + c + 2.5f + e$ 9477 + 1475 + 750 + 130 11832	$\frac{13600 \times 12 \times .85 \times 4000}{16 \times 2204.6}$ 15720	3888
Method (d) 2 shifts dragline 2 shift jigs	16320	9792	$a + d + 3f + e$ 9477 + 2727 + 900 + 130 13234	$\frac{16320 \times 12 \times .85 \times 4000}{16 \times 2204.6}$ 18840	5606

ANNUAL FIGURES

594029

027

Operation	Mined Yards	Cost \$A	Cost Per Yard \$A	Return \$A	Margin \$A
Method as at present	396,100	488,850	1.23	458,000	- 30,850
Method (a)	510,000	499,350	0.97	589,900	93,550
Method (b)	612,000	549,600	0.91	706,000	156,400
Method (c)	680,000	591,600	0.87	786,000	194,400
Method (d)	816,000	661,700	0.80	942,000	280,300

RECOMMENDATIONS FOR DREDGING MONARCH & ENDURANCE AREAS

The Monarch Area would be ideal for dredging by either bucket or suction cutter dredge. The ore body contains lightly cemented sands which would stand up well on the face and sides of a dredge pond.

Unfortunately the Monarch ore body is rather small, containing approximately 4 million yards of workable ground and would not be able to support the capital outlay required for equipment with sufficient capacity to work the deposit economically and should only be considered in conjunction with some other area.

Mr. Thomas' report indicates that the Endurance and Endurance Extended show promise of good values over a very large area, at least 30 million yards.

Should the indicated scout bore values in the Endurance deposit be confirmed and the Monarch considered in conjunction with the Endurance it could become a very attractive proposition.

The two deposits are quite different physically, as the Monarch is shallow, twenty to thirty feet, with firm material in ground and the Endurance is up to 170 ft or more deep with a mixture of clays and free flowing material to contend with.

These extreme variations in depth and texture of the two ore bodies would be very difficult to meet with a bucket dredge but not so difficult with a suction cutter dredge.

There is practically no similarity between a bucket dredge designed for 30 ft digging and one designed for 150 ft digging depth. It would take a major modification to convert one to the other.

In the case of the suction cutter dredge the conversion from 20/30 ft. digging to 170/180 ft. digging is comparatively simple.

Should these areas be coupled together for purposes of defraying depreciation etc., then we would recommend that an ultimate throughput of 450 yards per hour be designed for with regards to both dredge and treatment plant capacity. The Monarch could be worked at 350 or 450 yards per hour as desired and operations should commence in this area

023

for the following reasons:-

- a) The Monarch is a comparatively easy area to dredge and with its shallow depth will be quite good for training new crews in the operation of a suction cutter dredge and separate treatment plant.
- b) Values are reasonably well established in this area as previous operations have given fairly conclusive evidence of values obtainable in the ground.
- c) Further exploration work is required in the Endurance areas to outline more clearly the parameters of the ore body and confirm the values already indicated.
- d) Capital costs setting up a plant to start operations in the Monarch would be lower than those required for the Endurance.

A proposed layout for the type of dredge and plant recommended for this operation has been submitted.

The dredge and treatment plant would be built in sections and modules to permit ready dismantling and reassembly.

The dredge would consist of six side pontoons and two centre pontoons keyed and/or bolted together, in such a manner that the forward side pontoons can be replaced with longer units when deeper digging is required.

Similarly the dredge ladder would be constructed in three sections with an underwater cutter drive built into the head section, a winch platform to receive the bow winches on the rear section, so that a mid section of any desired length can be placed in between.

030

In the Monarch area the ladder would be approximately 35 ft. long and actuated by hydraulic rams to ensure positive control when digging firm ground and the dredge would be manouvered by a head line and four side lines or swing lines.

The treatment plant would also be mounted on bolted pontoons and connected to the dredge by floating pipeline and walkway.

The dredged material would go direct from the dredge to an elevated trommel or revolving screen with the oversize being directed by chute over the stern of the plant pontoons. The undersize reports to a rotary distributor for even distribution to the jigs. The tailings would be carried over the stern of the plant by gravity launders extending approximately 30 ft. beyond the plant pontoons.

This would permit of even stacking of tailings and reject materials and minimise the use of earthmoving equipment for contouring.

In the event of this plant being transferred to the Endurance deposit the following modifications would require to be carried out:-

DREDGE

1. Remove small forward pontoons and replace with 32'0" extended pontoons.
2. Break ladder at joint between head and winch platform and insert 46'0" extension. This section would be complete with hydraulic, lubrication and suction lines.
3. Remove ladder rams from dredge and fit bridle to head of ladder. Reeve head line through sheaves to act as ladder line.

TREATMENT PLANT

1. Remove tails launder rear extensions.
2. Fit top sections to tailings hopper.
3. Mount tailings pump and motor and connect up.
4. Fit tailings launder sections between jigs and tails hopper.
5. Connect tails pontoon, complete with boom, to plant pontoons at opposite end to screen discharge.
6. Connect tails line between boom and pump.

031

As the dredge and plant would have to be dismantled for removal from the Monarch area it will be seen that the amount of work and costs involved in changing from 20/30 ft. digging to 170 ft. plus digging is quite minimal

The dredge would be designed with sufficient bouyancy in side and stern pontoons to ensure that the dredge would remain afloat in the event of the centre compartment or pump well becoming filled with slurry should a major leak occur and go unnoticed.

CAPITAL COSTS "MONARCH"

DREDGE	\$280,000
PLANT	\$290,000
FLOATING LINE	\$ 40,000
TRANSPORT	\$ 20,000
SITE ERECTION	\$ 30,000 $\frac{1}{4}$
POWER RETICULATION	\$ 20,000
WATER RETICULATION	\$ 20,000
SITE BUILDINGS	\$ 20,000
	<hr/>
	\$720,000
	<hr/>

033

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MONARCHLABOUR REQUIRED FOR 3 SHIFTS, 5 DAYS PER WEEK OPERATION

3 Dredge Operators	390	
3 Jig Hands	390	
3 Jig Hand Assistants	330	
4 Day Crew	440	
1 Fitter	130	
1 Welder	130	
1 Truck Driver	120	
1 Crane Driver	120	
1 Foreman	160	
1 Charge Hand	140	
2 Floaters (fill in for hols. etc.)	260	
2 Tin Sheds	<u>240</u>	
		2850
1 Mine Superintendant	300	
1 Paymaster	160	
1 Typist	90	
		<u>550</u>
		3400
Plus 25% W. Comp., Hol., Sick Pay Roll		<u>850</u>
		<u>\$4250</u>

MONARCHPOWER REQUIRED AND POWER COSTS FOR 250 YD. CAPACITY PLANTH.P. CONNECTED

<u>Dredge</u>			<u>Diversity</u>	
Main Pump	200 H.P.		150	
Cutter Drive	200 H.P.		150	
Winches	60 H.P.		30	
Priming Pump	40 H.P.		10	
Services Pump	<u>25 H.P.</u>		<u>5</u>	
	525	525	345	345

<u>Plant</u>				
Jig Drives	60 H.P.		40	
H.P. Water	30 H.P.		25	
L.P. Water	40 H.P.		25	
Tails Stacker	60 H.P.		45	
Winches	25 H.P.		0	
2nd. Stage	10 H.P.		7	
Screen Drive	<u>20 H.P.</u>		<u>15</u>	
	245	<u>245</u>	157	<u>157</u>

Total Connected H.P. 770 Diversity H.P. 502

Units charged @ 70% of H.P. connected = $770 \times .7 = 539$ use 540

Units per hr = $502 \times .85 = 770$

Units per qtr = $770 \times 13 = 656652$

UNIT CHARGE

1st 540 x 120 = 64800 @ 4.02 = 2605

2nd 540 x 120 = 64800 @ 2.08 = 1348

3rd 540 x 740 = 399600 @ 1.16 = 4635

Balance 129600 @ 0.73 = 946

Cost per quarter = \$9534

Cost per week $9534 \div 13 = \$733$

035

MONARCH

594037

PER HOUR
OPERATING COSTS FOR 250 YARDS/PER 5 DAY WEEK OPERATION

Labour	4250
Light & Power	730
Equipment hire	1000
Mobile equipment	250
Motor vehicles	220
Repairs & maintenance materials only	1000
Access & supply	150
Insurance	100
Head office	600
Exploration	650
Local office buildings etc.	100
Sundries	700
	9,750
Depreciation & Ammortisation	2,400
	12,150

Ground worked per week

$$250 \times 40 \times 3 \times .85 = 25,500 \text{ yds.}$$

$$\text{Operating costs per yard} = 38.2¢$$

$$\text{Depreciation \& Ammortisation/yd.} = \underline{9.4¢}$$

$$\text{Total costs per yd.} = \underline{47.6¢}$$

This ground appears to hold between 6 and 7.3 ozs tin per yard.

Therefore returns could be -

$$\begin{array}{l} @ 6 \text{ ozs} \\ \& 75\% \end{array} \quad \frac{25500 \times 6 \times .75 \times 4000}{16 \times 2204.6} = \$12,800$$

Rec. 0/A

$$\begin{array}{l} @ 7.3 \text{ ozs} \& \\ 75\% \text{ rec. 0/A} \end{array} \quad \frac{25500 \times 7.3 \times .75 \times 4000}{16 \times 2204.6} = \$15,600.$$

These figures do not show sufficient margin. Try higher throughput.

MONARCHOPERATING COSTS FOR 350 YARDS PER HOUR OPERATION

Labour	nil
Light & power	145
Equipment hire	250
Mobile equipment	nil
Motor vehicles	nil
Repairs & maintenance	300
Access & supply	nil
Insurance	nil
Head Office	nil
Exploration	nil
Depreciation	nil
Sundries	250
	<u>945</u>
Ammortisation	100
	<u>1,045</u>

Total operating costs 9750 + 945	=	10,695
Total depreciation & ammortisation		<u>2,500</u>
		<u>\$13,195</u>

Throughput per week $350 \times 40 \times 3 \times .85 = 35700$.

Operating costs per yard	=	29.9¢.
Depreciation & ammortisation	=	<u>7.0¢.</u>
Total cost/yd.	=	<u>36.9¢.</u>

Returns @ 6 ozs = $\frac{35700 \times 6 \times .75 \times 4000}{16 \times 2204.6} = 18,000$
75% rec.

Returns @ 7.3 ozs = $\frac{35700 \times 7.3 \times .75 \times 4000}{16 \times 2204.6} = 22,000$
75% rec.

MONARCH

PROCEEDING A STEP FURTHER TO 450 YARDS PER HOUR - ADDITIONAL COSTS
WOULD BE WHEN RELATED TO 250 YARDS.

Labour	150
Light & Power	350
Equipment hire	250
Mobile equipment	100
Motor vehicles	20
Repairs & maintenance	600
Access & supply	nil
Insurance	nil
Head Office	nil
Local office	nil
Exploration	nil
Sundries	500
	<u>1,970</u>
Depreciation	500
Ammortisation	200
	<u>2,670</u>

Total operating costs 9750 + 1970	=	11,720
Depreciation & ammortisation	=	<u>3,100</u>
		14,820

Operating costs per yard	=	25.5
Depreciation & ammortisation	=	<u>6.2</u>
		<u>31.7</u>

Throughput per week $450 \times 40 \times 3 \times .85 = 45,900$ yards

Return @ 6 ozs $\frac{45900 \times 6 \times .75 \times 4000}{16 \times 2204.6} = 23,200$
 @ 75% rec.

Return @ 7.3 ozs $\frac{45900 \times 7.3 \times .75 \times 4000}{16 \times 2204.6} = 28,400$
 @ 75% rec.

SUMMARY OF COSTS AND RETURNS FC IONARCH AREA BASED ON DREDGING OPERATION

5 DAYS 3 SHIFTS PER WEEK

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Rate in Yds. Per Hr. Per Week		Cost Per Yd. Production Depreciation Cents Cents		Total Cost Per Yd. Per Week \$A \$A		Return Per Week in 6oz ground \$A	Margin \$A	Return Per week in 7.3oz ground \$A	Margin \$A
250	25500	38.2	9.4	47.6	12150	12800	650	15600	3450
350	35700	29.9	7.0	36.9	13195	18000	4805	22000	8805
450	45900	25.5	6.7	31.7	14820	23200	8380	28400	13580

ANNUAL COSTS AND RETURNS OVER 50 WEEKS

Rate Per Hr. Yards	Rate Per annum Yards	Life of Mine Years	Cost Per Annum \$A	Return from 6 oz ground	Margin over costs	Return from 7.3 oz ground	Margin over costs
250	1,275,000	3.1	607,500	640,000	32,500	780,000	172,500
350	1,785,000	2.2	659,750	900,000	240,250	1,100,000	440,250
450	2,295,000	1.7	741,000	1,160,000	419,000	1,420,000	679,000

MONARCH

WORKING 3 SHIFTS, 6 DAYS PER WEEK, 450 YDS. PER HOUR

Additional costs

Labour	783	627 + 25%
Light & Power	115	
Equipment Hire	250	
Mobile Equipment	50	
Motor Vehicles	50	
Repairs & Maintenance	200	
Access. & Supply	—	
Insurance	—	
Head Office	—	
Exploration	—	
Local Office	—	
Sundries	200	
Depreciation & Ammortisation	<u>100</u>	
Total Additional	\$1748	

Increase in throughput

$$450 \times 24 \times .85 = 9,180 \text{ yds/week or}$$

Increase in returns 6 oz ground

$$\frac{9180 \times 6 \times .75 \times 4000}{16 \times 2204.6} = \$4680 \text{ per week or } 234,000/\text{annum}$$

Increase in returns 7.3 oz ground

$$\frac{9180 \times 7.3 \times .75 \times 4000}{16 \times 2204.6} = \$5680 \text{ per week or } \$284,000/\text{annum}$$

PER ANNUM, 3 SHIFTS, 6 DAYS PER WEEK 50 WEEKS

Yds Thruput	Mine life	Cost/yd	Cost/an	Return 6oz ore	Margin	Return 7.3 oz ore	Margin
2,754,000	1.5yds	30.7 cents	828400	1,394,000	565600	1,704,000	875,600

Watson Dredging Pty. Ltd.

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26th July, 1974.

B.M.I. TIN MINING OPERATIONS - TASMANIA

Since submitting our report of the 30th May, Mr. A.E. Thomas has spent approximately three weeks in Tasmania carrying out further work with regard to boring, boring procedure and evaluation methods. His report covering his findings on the latter visit has been submitted for inclusion as an addendum to the report of 30th May.

Also Mr. H. Sloane paid a further visit to the mining areas and interviewed various companies in Launceston to determine costs in Tasmania for labor, cartage, crane hire, steel fabrication etc. in order to check the estimated figures given for equipment in the report.

The information obtained checked out quite favorably with anticipated costs.

Mr Sloane also called on Mr. Earle Henderson in Newcastle to obtain some first hand information on the Endurance workings. Mr. Henderson was in charge of the Endurance Mine as manager for approximately five years when sluicing operations were being carried out.

He informed us that "they had no trouble controlling the water in the cut at any time including seepage over a full week-end", indicating that the ground generally is reasonably dry and would stand up quite well. The only problem if any that he could see with regard to dredging the Endurance areas was the amount of clay in the face which appeared in heavy bands varying in depth from 3 ft. to 15 ft. and generally 30 ft. to 40 ft. below the surface.

Should further drilling of this area be carried out, the drilling crews should be instructed to log as accurately as possible the type of ground passed through, and when changes occur, with regard to hardness and type of material, also ground water level should be recorded. Occasionally a bailing test should be carried out to determine the amount of make up that can be expected in the area.

With regard to the Monarch a close study of the bottom contours show irregularities. We are now taking out cross sections of the ore bodies and laying out a possible dredge path to determine just what effect these irregularities or undulations would have on a dredging operation,

Mr. Sloane reports that during his recent visit to Tasmania, observations of the Ringarooma Operation confirmed the impressions gained on the previous visit. The main points of interest being:-

1. Mining capacity is very much in excess of treatment capacity. There is one spare jig on the mine site not in use. We strongly recommend that this jig be placed in the circuit as a primary unit and at the same time change the scavenger unit to a primary to give five flow lines over two cells each, concentrates from these feeding one secondary unit.

This would increase the present capacity by 66% and should permit 100 yds to 120 yds per hour jig thruput to be achieved and thus bring the operation onto a profitable basis.

2. A study of down time log sheets indicates that maintenance planning requires close attention, to avoid accumulative shut downs.

Should the plant produce at the desired rate of between 100 yds and 120 yds per hour it will become necessary to move the mining plant on alternate days. This will call for good programming and preparation so that the moves are carried out with a minimum of lost time. Further as these moves will take between 4 and 5 hrs, advantage of this time should be taken to carry out systematic maintenance during the moves.

042

3. The grizzly over the primary feed bin should receive attention to ensure that the undersize is limited to the extent where it will not cause interference at the feed gate.

A suggestion was put forward by B.M.I. Mining staff to move the mining plant to a semi-permanent position on the river bank opposite the jig processing plant. Scrapers were then to be used to haul the ore and establish a stockpile adjacent to the feed bin. The feed bin would then be fed by front end loader and the reject would be moved away by bulldozer.

The estimated cost of using this equipment to present the ore to the primary feed bin is 42¢ per yard.

As the calculated cost per yard throughput at a rate of 120 yds per hour is between 87¢ and 91¢ per yard, if 42¢ is the cost of winning the ore and presenting to feed bin, only approximately 50¢ are left to cover the costs of the balance of the operation including overheads etc., this would not be sufficient. Further the rate of reject from the grizzly and screen would be in the order of 5000 yds per week. The disposal of this material could become quite a problem and would probably increase dozer costs as the distance the material has to be moved increases. In the present operation the plant is moving away from the reject materials and the recently mined area is available to receive them.

Once again we feel that the major effort should be applied to improving throughput and increasing running times of the operation as it is at present.

We would welcome a further talk with one or more of your staff to discuss and outline a program with regard to timing, method and costs of improvements in the Ringarooma area.

Yours faithfully,


J.A. Watson
Managing Director
WATSON DREDGING PTY. LTD.

Watson Dredging Pty. Ltd.

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12th August, 1974.

RECOMMENDATIONS TO B.M.I. FORDREDGING DEEP TIN DEPOSITS

A study of the Scotia bores carried out by Dorset staff indicate that in the ore body the top 80 feet of ground in practically all cases contains no workable values of tin or conversely the tin is concentrated in the deep levels between 80 to 125 feet.

It is obvious that the most economical method of mining the area is one where the top 80 feet of ground can be stripped and replaced at a cheap rate.

The methods which immediately present themselves are:-

1. Dry mining using dozers, drag lines, or scrapers stripping overburden and similar equipment to present the enriched ore to a concentrating or treatment plant.
2. Stripping of overburden by the above method and then sluicing the enriched ore for presentation to treatment plant.
3. A complete dredging operation using two dredges. One dredge to be stripping overburden while the second dredge is feeding the treatment plant.

There are a number of advantages and disadvantages in each of these three methods. However we do not propose at this stage to go into any detail with methods 1 and 2 as your people are much more experienced in the application of dry mining methods than we are, therefore we have concentrated on presenting a reasonably detailed costing as related to method three.

With regard to twin dredges feeding one treatment plant, this method is not new and has been used in the sand mining industry quite successfully over the past fifteen years. Two of your staff were taken to view such an operation in the Port Stephens area in N.S.W. quite recently. The plant inspected is operated by Rutile Zircon Mines (Newcastle) Ltd.

While two dredges working in the one pond has some disadvantages, in the case under consideration two dredges would be a decided advantage for the following reasons:

Should a single dredge be used to carry out both stripping and plant feeding, as overburden is approximately 60% of the total area to be mined then the plant would be idle 60% of available time, and furthermore, to maintain a high rate of thrupt a proportionally larger plant would be required as well as a higher capacity dredge involving increased capital expenditure.

The costs calculated have been based on an average of 1500 tons per hour being mined, with both dredges coupled to a two path treatment plant in such a manner that when one dredge is stripping overburden the second dredge will be working bottom ground supplying jig feed.

The stripped material will be passed through a coarse trommel screen to a dewatering bin and then pumped to a tails stacker nozzle for jetting well behind the plant.

The plant feed would be passed through a $\frac{1}{2}$ " or $\frac{3}{8}$ " mesh trommel screen for presentation to the jigs. The oversize from the two trommels would be discharged in front of the treatment plant to form a barrier, with the jig tailings carried by sluices behind the plant. This should keep the angle of repose of the tailings at a maximum and permit the minimum of dredge line to be used.

As the success of this operation will depend principally on rate of thrupt being maintained, we have been conservative particularly with regard to dredge and jig capacity so that should difficult conditions be encountered and reduce thrupt, lost ground can be made up when the going becomes easier.

045

A general arrangement drawing of a proposed dredge is submitted showing a digging depth of 90 feet below water with the ladder at an angle of 45° .

This would be the recommended depth for the Scotia area where the floor of the deposit is in the order of 120 feet below the surface. In this case a pond level of between 30 to 40 ft below surface would be maintained and when stripping overburden a digging depth of between 40 ft and 50 ft would be used, then when working bottom a digging depth of between 80 ft and 90 ft would be required. Once again a margin is allowed as the dredge can operate with the ladder at an angle of up to 50° .

The 90 ft digging depth of ladder should cater for all of the Scotia deposit and most of the Endurance deposit east of the fault. When areas west of the fault are to be worked at depths of up to 170 ft. an extension would be added to the ladder to cater for the greater depths.

In designing the dredge, the pump would be installed down the ladder a sufficient distance to permit the required N.P.S.H. being maintained up to 140 ft digging depth and the joint for the extension to be inserted would be below the pump so that no alteration would be necessary to the pump delivery line or hydraulic lines, feeding the hydraulic motors driving the pump, when a change is made to extend the ladder. Similarly ballast capacity in stern of dredge pontoons would be available to counter the additional ladder weight and maintain sufficient freeboard.

By arranging the dredge for suitability to varying depths of operation the height of face above water should not be greater than 40 ft at any time, thus keeping tails pumping to a minimum.

A major advantage in dredging is that all materials are being returned to the mining path reducing reclamation to a minimum.

In the case of the Monarch area we would recommend that only one dredge be used, as the area is quite shallow, calling for working depths between 18 and 40 ft and the total material dredged would require to be treated over the jigs. In this case it would be necessary to move the pump inboard and fit a short light ladder to deal with the shallow digging. The jig plant thraput should be extended to maximum as the dredge would have no trouble to maintain maximum jig capacity.

Yours faithfully,

WATSON DREDGING PTY. LTD.

OPERATING COSTS FOR 600/900 T.P.H. 6 DAY WEEK OPERATION

Labour	6,587
Power & light	3,550
Equipment hire	1,500
Mobile equipment	300
Motor vehicles	300
Repairs & maintenance (materials only)	8,350
Access & supply	350
Insurance	250
Head office	600
Exploration	1,000
Local office buildings etc.	150
Sundries	<u>1,500</u>
	24,437
Depreciation on \$2,300,000 over 10 years	4,500
Amortisation	<u>1,000</u>
	\$29,937

On above figures with thruput of 153,000 yds per week, cost per yd treated =
19.57 cents

SUMMARY OF CAPITAL COSTS

Plant	767,550
2 dredges	1,185,400
Floating pipelines	120,000
H.T. trailing cables	30,000
Power reticulation & controls	60,000
Water reticulation	25,000
Site buildings & equipment	30,000
Mobile crane	80,000
Sundries	<u>42,050</u>
	<u>\$2,340,000</u>

PLANT WEIGHT AND ESTIMATED COSTS

594050

048

<u>Item</u>	<u>Weight</u>	<u>Rate</u>	<u>Cost</u>
Pontoons 120' x 60' x 7.5' (12 off 40' x 14' x 7.5')	160 tons @	700/Ton	112,000
Superstructure	40 tons @	650/ton	26,000
Trommel screens 2 off	40 tons @	1000/ton	40,000
Primary jigs 14 off twin x 3 cells	112 tons @	7000 ea.	98,000
Feed launders	2 tons @	1500/ton	3,000
Tails sluices	10 tons @	700/ton	7,000
Tails dewatering bin	15 tons @	700/ton	10,500
Secondary feed bin	3 tons @	700/ton	2,100
Tails stacker boom	15 tons @	650/ton	9,750
A frame for tails stacker	2 tons @	650/ton	1,300
Distributor	1 ton @	1500/ton	1,500
Tails pump, motor & base	12 tons @	2500/ton	30,000
Secondary feed pump motor & base	1 ton @	2500/ton	2,500
Five winches	15 tons @	2000/ton	30,000
Secondary jigs 2 off twin 3 cell	16 tons @	7000 ea.	14,000
Cladding, doors windows etc.	12 tons @	700/ton	8,400
Header tanks hutch water	3 tons @	700/ton	2,100
Electrical installation, inc. switchboard & controls	15 tons		75,000
Transformer	5 tons @	2000/ton	10,000
Pipe work inc. valves & fittings	3 tons		20,000
Rubber lining (launders sluices etc.)	1 ton		20,000
Drop chutes for screens	12 tons @	700/ton	8,400
Hoists	16 tons @	1250/ton	20,000
Sheaves & fairleads	3 tons @	1500/ton	4,500
Ropes & fittings	1 ton @	1000/ton	1,000
Painting	1 ton		7,500
Sanitation & ammenities	1 ton		3,000
			<hr/>
			567,550
			<i>41000.00/ton.</i>
Design & drawing			60,000
Specifications, processing & supervision			60,000
Site labor			40,000
Crane hire			10,000
Transport			20,000
Freight & sundries			10,000
.....			
Est. Plant light weight 517 tons			
Est in working weight 900 tons			
Est. draught 4'-6"			
Freeboard 3'-0"			
		<u>TOTAL PLANT COSTS</u>	<u>\$767,550</u>

**1485.00/ton.*

DREDGE WEIGHT AND ESTIMATED COSTS

594051

049

<u>Item</u>	<u>Weight</u>	<u>Rate</u>	<u>Costs</u>
Main pontoons 70' x 40' x 7.5' (8 off 35' x 10' x 7.5')	100 tons @	700/ton	70,000
Ladder forward pontoons 2 off 30 x 15 x 7.5	34 tons @	700/ton	23,800
Ladder 126' x 16' tapered box construction	65 tons @	700/ton	45,500
Ladder pivot pins bridle etc.	2 tons @	1500/ton	3,000
"A" frame on forward pontoon	8 tons @	650/ton	5,200
Dredge superstructure	8 tons @	650/ton	5,200
Control cab	3 tons @	750/ton	2,250
Head "A" frame main pontoon	5 tons @	750/ton	3,750
Dredge pump 24/20 Warman	15 tons @	3000/ton	45,000
Main pump elec. motor 750 hp 3.3 K.V.	5 tons @	3000/ton	15,000
Hydraulic pumps for 24/20 main pump drive & gearbox	1 ton		14,000
Hydraulic motors " " " " "	1 ton @		9,000
Gear box (dredge pump)	1 ton		4,000
3 power packs 30 hp (bow stern & head lines)	2 tons		9,000
1 " " 100 hp ladder hoist	1 ton		5,000
1 " " 250 hp cutter drive & gearbox	2 tons		12,000
Elec. transformer 1000 K.V.A.	5 tons		10,000
Elec. switchboard & controls	3 tons		25,000
2 bow winches	5 tons		12,000
2 stern winches	4 tons		10,000
1 ladder winch	5 tons		10,000
1 head line winch	3 tons		6,000
1 cutter drive 300 hp	3 tons		8,000
1 cutter	5 tons		5,000
sheaves & fairleads	4 tons		6,000
Wire ropes	3 tons		1,000
Cladding windows & doors	3 tons		5,000
Instrumentation	1 tons		10,000
Hydraulic installation	3 tons		25,000
Elec installation	4 tons		40,000
Painting	1 ton		6,000
Pipe work valves etc.	2 tons		8,000
Lubrication	1 ton		2,000
Suction & delivery lines	8 tons		4,000
Service gantry & hoist	8 tons		8,000
Sundries	15 tons		15,000
	429.00/ton		
	339 tons		487,700
Design & drawings			40,000
Specification, processing & supervision			20,000
Cartage & Craneage			20,000
Site assembly			25,000
	1748.00/ton		
	TOTAL		\$592,700

PLANT

050

Steelwork inc. pontoons, superstructure etc.	5%	6,900
Trommel screens	100%	40,000
Jigs	20%	20,000
Launders (feed)	20%	600
Sluices (tails)	20%	1,400
Tails bin (dewatering)	10%	1,000
Secondary feed bin	10%	200
Tails stacker boom	10%	1,000
Tails stacker "A" frame	5%	70
Distributor	10%	150
Tails pump & motor	75%	20,000
Sec. feed pump & motor	50%	1,250
Winches	10%	3,000
Sec. jigs	20%	2,800
Cladding doors & windows	10%	800
Elec installation	20%	15,000
Trailing cables	10%	2,000
Pipework	50%	12,500
Rubber lining	10%	2,000
Drop chutes	10%	840
Hoists	10%	2,000
Sheaves & fairleads	20%	1,000
Ropes & fittings	20%	200
Painting	20%	1,000
Sanitation	5%	250
Sundries	100%	<u>10,000</u>
		\$ <u>145,960</u>

051

ESTIMATED MAINTENANCE REQUIREMENTS PER ANNUM

594053

DREDGE

Steelwork inc. pontoons ladder superstructure etc.	5%	7,000
Dredge pump	100%	45,000
Main pump motor 750 hp.	5%	750
Hydraulic pumps for above	25%	2,250
Hydraulic motor for above	25%	3,000
Hydraulic power packs	25%	5,500
Transformer	5%	500
Electrical switchboard and controls	20%	5,000
Winches	20%	7,500
Cutter drive	25%	2,000
Cutter	200%	8,000
Sheaves & fairleads	40%	2,000
Wire ropes	200%	8,000
Instrumentation	20%	2,000
Hydraulic installation	25%	5,000
Electrical installation	10%	4,000
Pipe work	50%	7,500
Suction & delivery pipe	100%	3,000
Service hoist	5%	200
Sundries	50%	<u>10,000</u>
		138,400

Total Maintenance Costs Per Annum

Plant	145,960
2 dredges @ 138,400 each	256,400
Floating pipelines 33 $\frac{1}{3}$ % on rubber	
10% on pontoons	30,000
Trailing cables 10%	<u>3,000</u>
	<u>\$435,360</u>

1968 9 MONTHS ACTUAL

594054

052

CU. YDS. THROUGHPUT	TOTAL MAINT.	ELECT.	D R E D G E			CUTTER	ELECT	P L A N T			SEP.
			GENERAL	I/LINES	TUMPS			GMN.	/LINE	TUMPS	
2,120,184 458 TPH	101417 4.78	2204 .10	12024 .57	7606 .36	6319 .30	6623 .27	5835 .28	26265 1.24	10022 .47	17728 .63	7791 .37
121,781	6921 5.68						425 .35	1746 1.43	1726 1.42	2992 2.46	32 .03
147,907 320 TPH	14980 10.13	634 .43	522 .35	448 .30	339 .23	723 .49	1704 1.15	4404 2.98	2834 1.92	1365 .92	2007 1.36
187,732 404 TPH	42616 23.84	1101 .62	7120 3.98	2449 1.37	3707 2.07	8763 4.9	1605 .90	5179 2.90	5503 3.07	5867 3.28	1324 .74
511,245				NOT AVAILABLE							
355,321 79 TPH	37918 10.67	710 .19	3291 .93	1684 .47	6373 1.79	9343 2.63	1231 .35	8283 2.33	1360 .38	2224 .63	3419 .96
1,121,000 242 TPH	40897 3.65	5767 .51	13097 1.17	7477 .67	851 .08	6573 .59	5678 .51	1454 .13			
1,453,000 310 TPH	76473 5.34	5997 .42	22864 1.59	8723 .61	5106 .36	8786 .61	16430 1.15	8567 .6			
2,725,043 590 TPH	172262 6.32	2085 .08	42785 1.57	7546 .28	20239 .74	29285 1.07	3846 .14	40446 1.48	6607 .24	5547 .20	14076 .52

053

594055

Power Requirements And Costs For 2 Dredges And Treatment PlantsTotal Thruput 1500 T.P.H.Dredge 24/20

<u>Item</u>	<u>Connected H.P.</u>	<u>Diversity</u>
Main pump	750	650
Cutter drive	300	150
Bow winches	30	15
Stern winches	20	10
Ladder winch	100	15
Head line winch	25	10
Auxiliary pumps	20	10
Light and power	25	15
Total H.P.	<u>1270</u>	<u>875</u>

Plant 750 T.P.H. max.

2 screens	55	45
14 primary jigs 2 line	70	50
3 secondary " 1 "	10	7
L.P. water pump	120	100
H.P. " "	60	50
0/burden tails pump	650	600
Secondary jig feed	7.5	7
Plant winches	25	8
240 light and power	20	15
Pond make up water	150	120
Total H.P.	<u>1167.5</u>	<u>1002</u>

Total Demand

2 dredges @ 875 H.P. = 1750

Plant & water pumping = 1002

Total H.P. = 2752K.W. demand allowing 850 w. per H.P. = $2752 \times .85 = 2339$ K.W.Cost of power = $2339 \times 19.70 = \$46,078.30$ per qtr. or \$3544.48 per week.

CONCLUSIONS:RINGAROOMA

Estimates included in this report show operations in the Gorge section suitably modified will be profitable if ground with an average value of 10 ozs recoverable per cubic yard is worked. This is equivalent to 12.5 ozs per cubic yard in the ground.

Our calculations and drawings have covered only the Gorge section and not the whole length of the deposit as our terms of reference had as a high priority examining the values and working procedures there, analysing them and making suggestions to improve them to ensure profitability.

However, the size of the deposit is much larger than just this area and further detailed examination of the entire length of the deposit including bores where necessary is justified as it may reveal other areas whose topography permit the use of continuous mining procedures which could readily be shifted from place to place.

MONARCH

It is repeated that a suction cutter dredge and floating treatment plant be used for more efficient operation than earth moving equipment. A dredge can work without difficulty in wet and clayey ground and it will also leave the tailings in a state acceptable to the Tasmanian Government.

While we have the situation that the value of the three million cubic yards of virgin ground averages 5 ozs per cubic yard the report shows the one million cubic yards previously worked which would have been valued at an average of 4.97 to 5 ozs per cubic yard, actually yielded 7.32 ozs per cubic yard of 70% oxide.

From this we accept the original value of the ground was over 9 ozs per cubic yard as a recovery of 80% on borehole valuation could be expected.

It is therefore reasonable to assume that three million yards of virgin ground exist plus one million cubic yards of tailings and at least a further one million cubic yards of surrounding ground would be available at a value equivalent to that of the ground worked would be available.

Tin has been found in significant quantities in the tailings on the Monarch and it is now suggested a boring campaign be commenced to revalue this deposit.

A drawing is attached showing the plant suggested which would cost \$A750,000 finished erected. It would treat 1,000,000 yards per annum at a cost of 55 cents Australian per cubic yard including depreciation of the entire plant over five (5) years.

As this would not be profitable it is mandatory the equipment be depreciated over a longer period. This is the basis of the recommendation illustrated in the drawings attached and the means of working the deep deposits. In summary it is a small unit capable of being expanded to treat the deep deposits.

ENDURANCE EXTENDED, SCOTIA AND BANCA DEPOSITS

Again drawings of a suitable suction cutter and floating treatment plant capable of handling 450 cubic yards per hour are attached and these drawings show the possibility of amalgamating the Monarch Area with these leases by commencing with a small dredge capable of the same yardage and design to allow the increasing of the dimensions to handle the deeper deposits. These deposits have not been sufficiently bored as yet but the values by Mines Department of the Endurance Extended, West of the fault in particular, are good. Arrangements have been made with your staff in Tasmania to put one hole down forthwith in this area to confirm values.

Mr. A. E. Thomas's report shows values close to 10 ozs per cubic yard in the area West of the fault on the Endurance Extended and this area in particular warrants further investigation.

It is suggested a member of your staff examine a plant operating on Stradbroke Island, Queensland to assess the logic of a suction cutter dredge and floating treatment plant capable of stacking to 100' to 200' above water level. They would be accompanied by Mr. Harold Sloane of Watson Dredging Pty. Ltd. for explanation of technical details.

The total cost of the plant to suit these deeper deposits would be \$A1,500,000 and the working cost would be 32 cents Australian per cubic yard including depreciation if the sum total of the yardages in the deposits exceeded 30,000,000.

If on further examination of these deep deposits the ground proved incapable of "standing up" at an acceptable angle of rill, the dilution factor may be too great to allow profitable working.

This is not considered likely in the light of the photographs of existing workings in similar country which are attached. Certainly a campaign mounted to determine these facts is warranted.

One cannot discard the Sluicing Plant principle as it "opens up" the country as suggested by Mr. Thomas, efficiently handled it would be profitable as Mr. Vern Wood's operation on the Pioneer appears to be and it could be followed up by dredges and treatment plants of the type we are suggesting.

With very deep operations the excavation of the first "Pit" is difficult as a large quantity of material must be conveyed away from the site. When the Pit is opened the normal procedures of dredging will follow with tailings being deposited in the dredge course.

No mention is made in these "Conclusions" of the large costly bucket dredge digging to 150' below water level beyond recording this means of working would be acceptable if the very large depreciation cost did not place profit beyond reach.

594061

Watson Dredging Pty. Ltd.

'Greenhous', 2 Greenhous Ave., Potts Point,
N.S.W., Australia. 2011,
Box 3, Potts Point, N.S.W., Australia. 2011,
Crédit Address - GIBB WATSON.
Telex - 22157
Telephone - 350-1966

30th May, 1974.

INVOICE

IN RESPECT OF MR. A.E. THOMAS - 40 Days @ \$136.00 Per Day = \$5440.00
IN RESPECT OF MR. H.E. SLOANE - 15 Days @ \$136.00 Per Day = \$2040.00
IN RESPECT OF MR. J.A. WATSON - 13 Days @ \$136.00 Per Day = \$1758.00

TOTAL = \$9138.00

PLUS FROM PREVIOUS PAGE \$ 529.50

TOTAL = \$9667.50

Watson Dredging Pty. Ltd.

'Greenhouse', 2 Greenhouse Ave., Potts Point,
N.S.W., Australia. 2011,
Box 3, Potts Point, N.S.W., Australia. 2011,
Cable Address - CEOWATSON.
Telex - 22157
Telephone - 353-1965

B.M.I. Mining Pty. Ltd.
75 Pitt Street
SYDNEY 2030

9th May, 1974.

INVOICE

EXPENSES UP TO AND INCLUDING TUESDAY APRIL 30th 1974.

FOR A.E. THOMAS

ADELAIDE / SYDNEY / ADELAIDE - APRIL 16th. 1974

T.A.A. (Economy)	\$102.80
ACCOMMODATION (2 Nights)	\$ 24.45
TAXIS TO & FROM AIRPORTS (4)	\$ 14.10
MEALS	\$ 9.95
TELEPHONE (Salisbury/Sydney)	\$ 2.15
TOTAL	<u>\$153.45</u>

ADELAIDE / SYDNEY / LAUNCESTON - APRIL 21st. 1974

T.A.A. (Economy)	\$103.70
ACCOMMODATION (2 Nights - Sydney	\$ 24.00
Launceston	\$ 14.50
TAXIS TO & FROM AIRPORTS (2)	\$ 7.40
MEALS	\$ 14.65
FILM (For Report Photos)	\$ 2.55
TOTAL	<u>\$166.80</u>

EXPENSES FOR J.A. WATSON & H.E. SLOANE

T.A.A. (Economy) Sydney - Launceston & Return	
(2 x \$104.60)	<u>\$209.25</u>
TOTAL	<u>\$529.50</u>

061

594063

Watson Dredging Pty. Ltd.

'Greenknowe', 2 Greenknowe Ave., Potts Point,
N.S.W., Australia. 2011,
Box 3, Potts Point, N.S.W., Australia. 2011,
Cable Address - GEOWATSON.
Telex - 22157
Telephone - 358-1966

26th July, 1974.

INVOICEB.M.I. FROM WATSON DREDGING PTY. LTD.H.E. Sloane Expenses To Tasmania 11th June to 14th June Incl.

4 days = 32 hrs @ \$17/hr	\$ 544.00
Return air fare to Launceston	\$ 104.60
Alpha Hire Car	\$ 31.67
Meals & out of pocket	\$ 27.60

H.E. Sloane work on report and carrying
out calculations etc. on dredges and
plant for Monarch & Endurance areas:

10 days = 80 hrs @ \$17/hr	\$1,360.00
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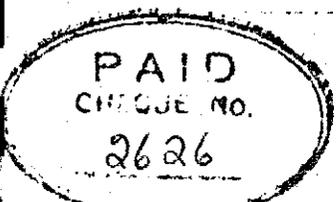
Drawings: Ringarooma layout, G.A.'s of plants
and dredges, layout of mining operation,
Monarch Flats area map & contour map:

Design Draughtsman: 102 hrs @ \$10/hr	\$1,020.00
Draughtsman: 11 days = 88 hrs @ \$ 8/hr	\$ 704.00

A.E. Thomas Expenses 7th June to 25th June Incl.

19 days @ \$136/day	\$2,584.00
Air fares Sydney/Launceston & return	\$ 104.60
Air fares Sydney/Adelaide	\$ 51.40
Accommodation - 9 nights (B & B)	\$ 77.00
Meals - lunch & dinner	\$ 42.50
Petrol for Rent-A-Car	\$ 2.00
Taxis to & from Airports	\$ 59.30
Laundry	\$ 6.50
Out of pocket	\$ 7.50

TOTAL: \$6,676.67



062

594064

Watson Dredging Pty. Ltd.

'Greenknows', 2 Greenknowe Ave., Potts Point,
N.S.W., Australia. 2011,
Box 3, Potts Point, N.S.W., Australia. 2011,
Cable Address - GEOWATSON.
Telex - 22157
Telephone - 358-1966

30th August, 1974.

INVOICE No. 1002B.M.I. MINING PTY. LTD. FROM WATSON DREDGING PTY. LTD.

For work and inspections carried out on your behalf during the month of August 1974 as under:-

Visit to Rutile Zircon Mines (Newcastle) Ltd. to inspect twin dredge operation at Salamander Bay near Port Stephens.

Car expenses 312 miles @ 15¢/mile	46.80
Meals, mid-day and evening	47.00

Visit to Associated Minerals Cons. Ltd. to inspect 1500 ton/hour dredge and treatment plant

Air fares Messers David Hughes, Mearing, Watson and Sloane	422.20
General Expenses	18.00

Drawings & Calculations

H.E.Sloane on above visits also calculations and submissions on deep digging twin dredge operation for Scotia and Endurance areas

116 hours @ \$17/hour	1972.00
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Layout of deep dredging ladder

Layout of deep digging dredge

Layout of mining method for twin dredge operation

Layout of 700 ton/hour treatment plant

Design Draughtsman

128 hours @ \$10/hour	1280.00
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Draughtsman

86 hours @ \$8/hour	688.00
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INVOICE NO 1002

TOTAL

\$4,474.00