
*Charters Towers Deep-sinking Proposal* is copyright by Edward O. Marks 1913.

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The Geologist’s Report.

Memo for the Under Secretary for Mines, Brisbane, re Application from Mr. T. Mills for £60,000 subsidy towards sinking a deep shaft in Lissner Park, Charters Towers.

By E. O. Marks, B.A., B.E., Assistant Government Geologist.

In preparing this report it is assumed that such questions of policy as the granting of large subsidies merely as a loan, without any share either in the direct profits resulting from the venture or in the management, being questions of policy, are entirely outside its scope.

Many people in Charters Towers seem to be of the opinion that since the past prosperity of Charters Towers has been of great financial benefit to the State, both directly and indirectly, the Government should grant the subsidy applied for more or less in the nature of a gratuity as consideration for past favours. Presumably any benefits the State has derived from the goldfield have been only what the State was justly entitled to, and if any subsidy is to be granted it is solely in consideration for the future welfare of the mining industry and not for the past.

Mining is a business, though a speculative one, and any expenditure of capital is only to be made where the prospect of reward is commensurate with the risk taken. Thus, in two cases bearing equal prospects of reward, in the one the highly speculative expenditure of £15,000 might be entirely justified, in the other case an equally speculative expenditure of £150,000 might not be at all justifiable.

In making this report, therefore, I can only suppose that my opinion is desired by the Government, like any private investor, as to whether the Deep Shaft proposal as it stands is a sound mining speculation, whether some modification is desirable, or whether the whole scheme is to be condemned as unsound. It is with no small amount of regret that I have come to the conclusion, for reasons given later, that the scheme as outlined requires considerable modification before it can be regarded in a favourable light, especially as I am aware that the suggested modifications do not meet with the approval of the majority, if not all those controlling the mines interested in the proposal.

The Day Dawn and Brilliant reefs have each produced some £6,000,000 worth of gold from the shoots of payable ore exploited up to the present time. In view of these returns it is unnecessary for me to emphasise the desirability of prospecting both of these reefs for fresh shoots of ore in as thorough a manner as the prospects of profitable mining justify. That the desirability of this is appreciated is shown by the fact that the Bonnie Dundee, Brilliant Block and Pfeiffer’s gold mines have already been granted subsidies amounting to £6,000 to assist in developing the Day Dawn and Brilliant reefs.

In that portion of the Day Dawn reef to the rise of the proposed shaft near enough to have any bearing on the prospects thereof two main shoots of ore appear to have been worked. The first extends from within 300 or 400 ft. of the surface in the Day Dawn P.C. and Block and Wyndham No. 1 shaft downwards on the dip of the lode into Mills’s United ground, gradually acquiring a pitch to the west beneath the lower workings of the Block and Wyndham, the shoot becoming horizontal and only extending to a depth of about 1,900 ft. in the upper levels of Pfeiffer’s and dying out apparently to the west. Other smaller shoots, to judge by the plans, have also been worked in the Block and Wyndham ground. The second large ore shoot extended from near the New Brilliant Freehold shaft west, between 1,400 and 1,700 ft. vertical depth, into Mills’s United ground, to where the levels curve southwards to the footwall formation. Two extensions of this shoot occur one in the Freeholds extending from the dip of the reef down to the No. 6 level, where it appears to die out, the other in Mills’s United extending irregularly to the dip also, down to the 13 or 14 level, where it becomes too small and poor to be of value.

The first shoot is entirely worked out, while the second is practically so, as far as present developments are concerned, the only portion of either the New Brilliant Freeholds or Mills’s United mines showing any promise being a winze in No. 5 level of the Freeholds. In this level the lode appears to split into two. Two winzes of Nos. 6 and 6 level, with which they connect, have been sunk and driven on the footwall branch, which is here very steep. Between these two winzes from No. 5 level a winze is now being sunk on the hanging-wall branch, which is for about 50 ft. very flat, but shows a tendency to become steeper at the bottom of the winze, 60 ft. from the level. This winze has exposed over nearly its whole length an average of 2 to 3 ft. of ore, which, judging by its appearance, should be payable throughout. While it would be unwise until further work has been done to place too much importance on this development, it certainly forms a bright spot in an otherwise very dark background.

In Mills’s United a great deal of unsuccessful prospecting work has been done, and the bottom level (No. 15), 2,543 ft. in vertical depth, could not be very much more discouraging. A few very small patches of quartz carrying a little “mineral” form the only and very slight inducement it offers to further search. Both the hanging and footwall formations have been driven on near the main underlite shaft, the hanging-wall level being connected with the No. 2 east underlite shaft. East of this the present workings make it appear as if the hanging-wall formation had split up into several small and unlikely looking formations.

The fact that highly profitable ore was mined in the levels above in irregularly shaped shoots does not give, in my opinion, any real reason for supposing that payable ore is more likely to be found at greater depths below these shoots than elsewhere in shallower ground along the same line of lode. The prospects for the deep ground, judging by the present bottom level, are not very encouraging. Nevertheless, I am of opinion that insufficient work has yet been done, and consider that more prospecting should be carried out.

In Pfeiffer’s mine the lode has been tested to a vertical depth of 700 ft. below the ore shoot without finding anything payable. Though such a large blank is discouraging, I recommended last year the further sinking of Pfeiffer’s underlite shaft.

In precisely the same way I am of opinion that the hole should be tested at greater depth in Mills’s United. This prospecting work it is quite feasible to do from the present mine. It would be desirable, and probably necessary, to sink both underlies and to connect them with levels at 200 or 300 ft. intervals. There would certainly be little advantage in driving...
levels at the usual 100-ft. intervals, as only the prospect of large shoots of ore can justify the expenditure, and for such 200-ft. intervals are ample.

Supposing, as it is quite likely but as it is hoped will not be the case, this work is continued to a depth of 600 or 800 ft. below the present workings, and no payable ore discovered, I fancy even the most sanguine Charters Towers man would be satisfied that the chances of success would not justify further work.

Now, this prospecting work will all be necessary whether the proposed shaft is sunk or not, though it may possibly cost a little less per foot if the proposed shaft is sunk first. As the work would be purely of a prospecting nature, and not done with any idea of working the ore from the present shaft, but merely with a view to testing the ground prior to such a large capital expenditure, the underlie shaft and drives could be made as small and as cheaply as is consistent with economy in their further extension. Supposing that the underlies would cost £20 per foot and the drives 45 per foot, which would probably be ample, the cost of the prospecting work would be: Two underlies, say 800 ft., £16,000; say 3,000 ft. of driving, £15,000; total, £31,000.

This sum would probably be ample, and all spent on valuable prospecting work; but supposing even that the cost was £40,000, and that subsequent to the sinking of and connection with the proposed shaft it could have been done for two-thirds of that sum, the £13,000 difference (if it is as much as that) would probably mean the saving of over £100,000, the cost of the proposed shaft, while should sufficient ore be proved to justify the shaft the extra cost would scarcely be regretted, since the knowledge gained as to the position of the ore would enable the shaft and other works to be designed accordingly.

With regard to the Brilliant lode, the payable ore shot found in the Brilliant mine, upper levels of the Brilliant Block and other mines, trended to the north-east away from the position of the proposed shaft. Excepting near the eastern boundary the Brilliant Block Company got no payable ore in its lower levels (from 1,600 to 2,000 ft.).

The New Brilliant Freeholds, the underlie of which is almost in a line with the proposed shaft, only found a little ore worth stoping and of a very patchy nature.

The Brilliant Deeps Mine has also done a considerable amount of work on the main Brilliant reef without success. It has, however, in its workings from No. 2 level (2,413 ft. vertical depth) been successful in finding a very flat reef carrying payable ore in the footwall of, but near to, the main Brilliant fissure. This will be further exploited as soon as ventilation conditions allow. Beneath this, as well as the Brilliant, another reef is being actively developed, and this, striking roughly north and south, appears likely to prove a cross reef between the Brilliant and the Day Dawn. It is being worked by means of Nos. 4 and 5 levels from the underlie on the main Brilliant lode. Crushings have been obtained from this reef varying in value up to £14 18s. per ton. The reef is unfortunately rather patchy in thickness and quality, but the fact that such high-grade ore is found at this depth is certainly very encouraging, and shows that depth alone can hardly have been the determining factor in the deposition of the precious metal, and that therefore depth alone need not be regarded as necessarily unfavorable to the occurrence of ore in the ground, deeper still, in the vicinity of the proposed shaft.

The occurrence of these two reefs of payable ore in proximity to the main Brilliant lode open up much brighter prospects for that fissure than the work done on it alone would have led one to suppose. Efforts at testing it are already in progress by the New Brilliant Freeholds, which mine is sinking its underlie shaft. When the connection, subsidised by the Government, between the Brilliant Deeps and Brilliant Block mines is achieved, the improved conditions should enable the two companies to continue prospecting on the main reef as well as on those in which payable ore has already been located. The position of the Brilliant Deeps shaft is well suited for this purpose in that company's ground.

It is certainly a matter for regret that the advice to connect by sinking their underlie, tendered by this Department, was not received favourably by the Brilliant Block Company, for the money now being spent in making the connection through country rock would have been at the same time doing valuable prospecting work itself, as well as enabling more prospecting to be done on the Brilliant lode with greater facilities than will now be the case.

Too little is yet known about the two reefs carrying payable ore in the Brilliant Deeps mine to form any opinion as to the prospects of the proposed shaft on either the main Brilliant or the so-called "footwall" reef of Nos. 4 and 5 levels. The general trend of the shoot of ore cannot be said to have been determined, while the reef though rich is certainly very patchy. The present bottom is not altogether satisfactory.

As soon as ventilation is improved a great deal of prospecting work can be done from the present shaft. As in the case of the Day Dawn lode, this work will have to be done even if the proposed shaft comes first, and there is no doubt that a great deal of prospecting will be done whether or no.

I do not perceive therefore that any advantage is to be gained by rushing into the expenditure of the large sum of money necessary for the deep shaft when the delay of a year or little more might considerably detract from or add to its prospects or enable the determination of the most suitable site for the shaft in working the ground.

In Charters Towers it appears to have been the general rule that so soon as ore is found it is mined, its removal being but little behind the progress of development work, and often ahead of arrangements underground for its economical mining either as regards ventilation or handling. It is also seldom in a mine that sufficient ore is in sight at any time to justify the erection of treatment plant at the mine, although the mine may in its career produce much more than sufficient to have rendered
the erection of plant an economy. The result is the archaic method still in vogue in Charters Towers of carting the ore to a customs battery, and, after crushing, the carting of the sands to a cyanide plant. The handcart which the unemotional mining, cost of carting, and profit on treatment must be to

As far as I have been able to ascertain, these estimates of cost are little more than guesses, and that the shaft, while not likely to cost less, may quite possibly cost very much more than is anticipated. A shaft 18 ft. in diameter in the clear would mean an excavation at least 20 ft. in diameter or 314 square feet. The ordinary shaft of four compartments, 4 ft. by 3 ft. 6 in., having an excavation of about 80 square feet, costs, as far as I could learn in Charters Towers, about 87 per foot, or say £10 per foot inclusive of machinery, down to some 1,500 ft. depth. The excavation of the larger section would be done for less cost per cubic foot than the smaller. Allowing that the decrease is as 3 to 2, and supposing the cost of brick or concrete and timbering are in the same proportion, the cost would be some £26 per foot. That figure is of course purely a guess, as we are without knowledge of the relative cost of timbering and brick or concrete lining, nor have we any knowledge of the cost of a shaft of such large dimensions under Charters Towers conditions. To give some idea of the great range in the cost of sinking shafts, the following has been called from various sources:

<table>
<thead>
<tr>
<th>Shaft</th>
<th>Depth, Ft</th>
<th>Dia., Ft</th>
<th>Area of Excavation, Sq. Ft</th>
<th>Cost per Foot, £</th>
<th>Authority</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myore, India</td>
<td>17&quot; x 6&quot;</td>
<td>20 3 4</td>
<td>Follett</td>
<td>Rectangular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S.A.—Average in Lake Superior, Maine, and Copper Creek region for large workings shafts</td>
<td>8&quot; x 6&quot;</td>
<td>20 1 8</td>
<td></td>
<td>Rectangular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transvaal—</td>
<td>12 1/4&quot; x 6&quot;</td>
<td>20 3 4</td>
<td></td>
<td>Rectangular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knights Deep</td>
<td>10&quot; x 4 1/2&quot;</td>
<td>22 14 6</td>
<td></td>
<td>Rectangular; very wet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer West</td>
<td>8 1/2&quot; x 4&quot;</td>
<td>22 8 6</td>
<td></td>
<td>Rectangular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jupiter</td>
<td>21 3/4&quot; x 4 1/2&quot;</td>
<td>20 1 8</td>
<td></td>
<td>Rectangular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benoni Central</td>
<td>24&quot; x 4 1/2&quot;</td>
<td>20 1 8</td>
<td></td>
<td>Rectangular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chifley</td>
<td>15 1/2&quot; x 4&quot;</td>
<td>20 1 8</td>
<td></td>
<td>Rectangular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>22 1/2&quot; x 4 1/2&quot;</td>
<td>20 1 8</td>
<td></td>
<td>Rectangular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transvaal U.S.A.</td>
<td>15 1/2&quot; x 6&quot;</td>
<td>20 3 4</td>
<td></td>
<td>Rectangular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circular shafts in Colliery in England</td>
<td>20 3 4</td>
<td></td>
<td></td>
<td>Rectangular</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hoover says: "From a metal miner's standpoint, round shafts are comparatively much more expensive than the rectangular timbered type."

Hoover also states that:

In Australia, 8 shafts 10-11 x 4 5 cost, average per c. ft. | £ 6 | £ 4 0 0
7 | £ 2 1 8 5 7 | £ 3 0 0
6 | £ 2 1 8 5 7 | £ 3 0 0
5 | £ 2 1 8 5 7 | £ 3 0 0
4 | £ 2 1 8 5 7 | £ 3 0 0
3 | £ 2 1 8 5 7 | £ 3 0 0
2 | £ 2 1 8 5 7 | £ 3 0 0
1 | £ 2 1 8 5 7 | £ 3 0 0
0 | £ 2 1 8 5 7 | £ 3 0 0

Calculated out to the cost per linear foot, the above would give respectively:

| £ 6 | £ 4 0 0 | £ 6 7 4 | £ 6 7 4
11 15 0 | 23 14 0 | 23 14 0 | 23 14 0
12 3 0 | 24 7 4 | 24 7 4 | 24 7 4
15 7 6 | 25 0 0 | 25 0 0 | 25 0 0

and is presumably exclusive of machinery.

It is obvious from the above that the proposed shaft may cost considerably more than is anticipated. As the working capital of the company, if fully subscribed, is to be £150,000, besides the £60,000 applied for, or £210,000 all told, it is obvious that the shaft alone must absorb most of the available capital, leaving too little for development work, making connections with the other mines and modern treatment plant, &c. (the latter supposing that any ore is found). In the event of a shortage of capital, the Government, if already involved to the extent of £60,000, would probably be expected to continue its subsidy until the completion of the scheme. It is for this reason that the possible insufficiency of capital has been pointed out.

The necessity for so large a shaft, as well as the desirability of having it circular in preference to the more usual rectangular shape, are matters which need very careful consideration before embarking on such an extensive outlay.
In the application it is stated that the proposed shaft will enable the thorough ventilation of all the mines on the Day Dawn and Brilliant lode. That it would be a great boon in the way of ventilation to any mine with which it may be connected is beyond doubt, but I fail to see what serious advantage is to accrue to mines that are practically worked out. If any sufficiently large tonnage of ore to be mined were now proved, this argument would have some weight.

There is now in Mills’s United and the New Brilliant Freeholds ample ventilation for prospecting work; in fact the latter mine possesses ample ventilation for working any ore that is likely to be developed in the winze from No. 3 level which at present has a promising appearance.

It is stated in the application that connection with the proposed shaft will “probably enable some mines to work at a profit large bodies of ore, which under the present circumstances can only be worked at a loss.” It would be very interesting to know in what mines these ore-bodies occur, as their existence seems to be a matter of general belief at Charters Towers. In none of the mines which could be affected by the proposed shaft have I been shown or seen any large bodies of ore of a sufficiently high grade to be worth mining under more favourable circumstances but not worth mining at present.

In the case of the Brilliant Deeps, the connection with the Brilliant Block should improve conditions sufficiently to enable the workings of all the ore at present “probable.”

Should further prospecting justify it the proposed shaft would possibly become desirable, though connections with other mines besides the Brilliant Block might render it unnecessary.

To summarise the above, while desirous of seeing further prospecting done from the present workings, I am strongly of opinion that the present prospects do not justify the enormous outlay which the shaft contemplated would necessitate, particularly in view of the fact that the prospecting work suggested would be equally necessary even if the shaft is sunk first. If the prospecting work is unsuccessful the shaft would not be required, while if successful it would enable the location of the shaft to be selected with a view to economy in later working.

If it is decided to sink a shaft it will be highly desirable that the question of the size and shape be thoroughly investigated in regard to the advantages and probable cost of the different types, as Messrs. Mills’s and Millican’s estimates of £18 and £25 per foot for the circular shaft as proposed appear to be little better than guesses and may quite possibly be greatly exceeded.

(Sgd.) E. O. Marks, Assistant Government Geologist.

On the 5th August the Cabinet decided that, in view of the report of the Geologist, the application of Mr. Thos. Mills could not be entertained.