

REPORT on the proposed Water Scheme for supplying the North-Eastern Tin Mining Districts.

Launceston, October, 1884.

In carrying out the instructions I was honoured with by the Hon. Minister of Lands and Works, it may be observed that that scheme will not in its present scope supply the mines situate on the east side of the Ringarooma River from above Branxholm down to and opposite the Pioneer T. M. Co.'s workings, north of Moorina.

The Tin Ore Deposits.

As these constitute the most important factor in the proposed scheme, it may be stated that these occur as formed at three different geological periods, viz.:—

1. The older Pliocene, in an ancient river system.
2. The more recent marine ancient beaches,—*i.e.*, "raised sea beaches"; and
3. The Recent or Pleistocene formations.

With regard to the first-named period, those deposits have been found to extend from above Branxholm (see Geological Sketch Map) to a point west of Mt. Cameron, and they comprise the ancient bed of the Ringarooma River. It may be concluded from evidence at hand that that river system extends farther south, but as at that point on that side of the river (west) tin ore has been found and is therefore a certainty, mere theoretical deductions are at present left on one side. Generally, the "wash" in that channel of country is composed of fine quartz drifts and coarsish gravels interstratified by beds of clay, which exhibit impressions of stemlets and leaves of prehistoric plants so frequently observed elsewhere with pliocene drifts of the diluvial epoch. Concretionary nests and veins of sand impacted by iron pyrites are also found, and as converted into brown iron concretions. These diluvial drifts are likewise capped in places by the older volcanic feldspathic basalts which, after decomposition, yield such fertile soils in the Colonies. Evidences establishing the geological age of these important stanniferous deposits were observed near Branxholm, at the North Brothers' Home Co.'s mine, David's Creek, and indistinctly in the workings of a tributary at the Pioneer Co.'s mine. From the latter mine to where the old river channel has become obliterated through marine action the basalts only partly overlie this "wash," but here and there the prospectors have discovered the ore of a similar description, and as embedded in similar drifts as anywhere higher up this old and now silted up river channel.

2. The lithological character of the tin ore deposits from the extremity of the "lead" and in the vicinity of Gladstone conforms, in my opinion, with that of "raised sea beaches" which I have observed so prevalent along the northern and western coasts of Tasmania, and which are proof of a gradual upheaval of the land by volcanic action in the past. Here and there these tin-bearing formations consist of sands, beds of gravel and of clays of considerable thickness resting on granitoid and schistose rocks. The higher beds are very argillaceous, and contain also a good percentage of kaolinic (impure) clays. Their former continuity appears to have been interrupted by extensive and more recent denudations, resulting in other still more recent deposits also carrying tin ore, to which those classed under No. 3 may be added, which include deposits from the fluvial action of the rivers. (See Cross Sections.) The upper tin-bearing beds are of altered clays and gravels converted into ferruginous conglomerates by the overlying basalts from beneath which they emerge in places. These conglomerates overlie in turn stanniferous indurated grey sandstones and also a softer kind. Whether the lower beds beneath those described are also tin-bearing remains yet to be proved.

The shingly and pebbly beds which have been found so rich in tin ore in several localities are found as the lowest strata, and they extend to considerable distances as filling in an irregular manner all kinds of depressions, scooped out, by marine action, of the softer underlying bed-rocks, thereby differing materially from the confined channels filled with pliocene drifts.

At the same time it is quite evident that that ancient channel did not furnish all the tin ores now found in these marine beds or terraces, and that other sources contributed to the same. Besides several tin-bearing "mica trap" dykes of porphyry—"elvanite"—the well known "Dally's Dyke," with others of a similar description, were proved to carry the ore in veins, nests, and bunches. That dyke (quartz porphyry) is about 200 yards in width, and observes a bearing of N. 32° W. while traversing the barren granite, which runs from east to west. Many of the richer "terraces" have been found along its course, and it is probable that remunerative veins may be found in that dyke which enriched the former through disintegration. The general wasting and decomposition of such rocks as these, either during periods of submersion beneath the sea level and after the gradual elevation of same, from atmospherical action caused the removal of the softer components and their redeposition as siliceous and kaolinic clays at various levels. The much heavier tin ores or denser minerals were so redeposited likewise, but in the vicinity of their original places of occurrence, thus forming the present horizontally bedded terraces. In this manner there now exist several extensive stretches of tin-bearing country, the depth of which can only be at present surmised. They assimilate in character to former inlets from the sea, since silted up by sands and benches of gravel. But it is, of course, the more friable and sandy stanniferous deposits that deserve most attention, both on account of their great extent and their average good productiveness. These, on account of their "free" character in working same with water under great pressure, can be manipulated at a very moderate expense.

On reference to the Geological Sketch Plan it will be perceived that the really worked portions of the Gladstone deposits—shown on that plan at twice the scale—occupy but a mere fraction of those deposits still *in situ*. The latter are indicated by the black vertical lines, so that the scope for employing water as a dissolving agent for the production of clean tin ores is really very extensive. And so far as my careful examinations of that district have gone, the question of a water supply to such localities involves the future existence and prosperity of all these various localities, the inhabitants of which have so large quantities of these valuable ore deposits at their very doors, which they have only been able to get at in a perfunctory sort of a fashion, and in most cases it was found that these terraces became richer as they were being opened up. This present paucity in the supply of water causes the loss of eight months on the average each year, and it cannot possibly tend to the settling of a population on the land, nor can it be expected of the mine-owners that they would work their mines, owing to the inadequacy of a supply of water, on a comprehensive and therefore more economical scale.

So far as I have been enabled to ascertain, I feel satisfied as to the extent and value of these ore deposits, and that if a high level water supply scheme were constructed under certain conditions, so as to ensure a continuous and copious supply all the year round, the Government would be justified to incur the expense for the same, as such would greatly advance both the mining and agricultural industries.

The Supply of Water.

This comprises the three schemes I was instructed to examine,—viz., the main or national scheme, Ringarooma River proper; the Boobyalla River; and that of the Mount Cameron Hydraulic M. Co., Mussel Roe River. The two first-named were to be joined as a whole for the supply of mines *en route* from Branxholm to Gladstone, and the latter for the mines north situated on the east side of the Ringarooma.

Before proceeding any further it is submitted that it would greatly facilitate matters by stating the measurements taken on the several dates and at various points on those rivers, bearing in mind, however, that such were noted during a period when the Ringarooma was subsiding from a previous flood, and that the Boobyalla and Mussel Roe were also above their usual level.

On the 2nd September last the Boobyalla was 16 feet in width and 2 feet deep at the intake. On the 8th September the Mussel Roe was, opposite the "Middle Huts," 25 feet in width by 22 inches in depth. And on the 13th September the Ringarooma, in partial flood, and half a mile below the intake, was 40 feet in width and a little over three feet in depth.

As these single observations during a larger supply than usual cannot be taken as a basis, computations as to number of sluice-heads or gallons of water for a given period were not considered necessary.

The principal supply in these mining districts likely to be served with water by any of the proposed schemes, it has already been stated, barely averages four out of twelve months; and still, even with this serious drawback, the export, as the attested schedule now enclosed shows, from Ringarooma port or Boobyalla, by the steamers *Avon* and *Pioneer*, exclusive of any other craft, amounted, from the 11th July, 1877, to the 30th July, 1884, to 165,190 bags, containing 8350 tons 10 cwt. of tin ore. (Appendix.) This, in the face of the present periodically recurring paucity of water, deserves therefore special attention and full consideration.

By means of the scheme or schemes now projected it is simply proposed to construct races or complete such where wanted, and to take the water in the rivers into the "intakes" and deliver same in such quantities as required at a certain price to be agreed upon to the mine-owners *en route*.

Were this course to be followed it would simply, in my opinion, perpetuate the present stagnation of mining operations during the greater portion of each year, and the Colony at large would not derive the full advantages resulting from a reliably continuous and very copious high-level water supply.

These schemes, undoubtedly, should therefore include the construction of large impounding reservoirs from which the races could take their supply during the whole year; also, catchment reservoirs subsidiary to the former at suitable locations *en route* of the race or races. At other points especially selected for the convenience of consumers distributing reservoirs should also be constructed, from which mine-owners and others could obtain their supply according to measurement, at such rates as per million gallons as may be fixed by the authorities from time to time. As a matter of fact the State should simply construct the necessary works, husband the supply of and deliver the water at given points to the purchasers of the same, leaving the mine-owners and others to construct their own pipes, races, &c. to their mines or other works.

As this National Scheme, if constructed in the near future, will include the subsequent development of the mining as well as the agricultural interests, the influx of population to these so favoured districts will be dependent on the careful conservation of a water supply, and the necessities of the miner and of the farmer will cause a demand, at a steady increase, as the mining operations and the cultivation of the soil extend.

With large impounding reservoirs above the several "intakes," and careful storage wherever practicable besides, I am of opinion that the supply may suffice for the purposes intended, provided also due allowances are made, when deciding upon the capacities of such reservoirs, for absorption, leakage, and evaporation. In California, where hydraulic mining is brought to the greatest perfection, this has been found to be a very important matter, and careful observations were made for several years. The North Bloomfield G. M. Co. convey their water in a race over 40 miles in length, and for a full 24 hours' supply p.d. from 1870 to 1883 proved that out of a total of 9,623,295 miners' inches* delivered from their impounding reservoir, in the Sierra Nevada, 9,134,560 inches were used at the mines, thus showing a loss from above causes of 488,735 inches, or about 5 per cent. on the quantity supplied at the "intake."

As the upper portions of our streams and near the respective intakes show the anomaly of having a larger running stream generally than lower down the rivers, even after receiving some important additional supplies from tributaries, &c., the actual measurements of water at those places cannot be depended on, and the question arises as to the causes of this diminution. The valley flats flanking these three rivers, especially of the Ringarooma, I have been informed, cannot be sunk through to the bed-rock owing to the great influx of water, thus evidencing the existence of an invisible subterranean current of water, the existence of which in that old channel has been also proved by the North Brothers' Home Company, which should be taken into account; at the same time it has been averred that several rocky "bars" would totally prevent such percolation; but, on the other hand, it has been observed that, as at the western side of the Ringarooma especially, the old "pliocene" gravels occur, and extend beneath the level of that stream, the river water must find its way into that ancient sub-basaltic drainage system, thus explaining that decrease of water. This appears to have been conclusively proved by the bore-holes sunk at the lower end of David's Creek, which passed through the same stanniferous wash as at the North Brothers' Home Co., and from which the water is now exuding above the surface, although the latter is not much lower than at the mines mentioned, and higher than the present modern river system, thus establishing two separately distinct drainage channels,—viz., subterranean and visible. This percolation will therefore necessitate the "puddling" of all dam banks to the bed-rock, in order to intercept that underground drainage and thereby also augmenting the supply of that element so very necessary for the miner's operations.

It is necessary to refer also to the reasons why no other but a high level scheme should be countenanced, by means of which only the water can be propelled through the "nozzles" with such force as to dislodge the heavy gravels and tenacious clays. Experiments were made in England by Sir Belzagetti and other engineers with nozzles, which gave the following results; viz.—"A 40 feet 'head of water' (in still air) would give a jet about 35 feet in height; but with greater heights of jets this effect became proportionately less, so that for a jet one inch only in diameter to rise to a height of 80 feet, and to deliver 150 gallons per minute, there must, at least, be a pressure or 'head' equal to 128 feet, and the higher the jets the greater must be the *diameter* of the columns (supply) of water."

* A miner's inch for a 24 hours' discharge is, in California, equal to 2259 cubic feet or 17,648 gallons of water.

If the ground near Gladstone were level, some difficulty might arise in working the higher stanniferous strata, as the main race, at its proposed fall or grade per mile of ten feet, would not be much higher than the Mount Cameron Tin Mining Company's race: by reducing that grade a higher pressure would become available and that obstacle be removed. There being a good slope to the ground from beneath the main race at these ore deposits, with increasing distances from the points of supply, the pressure must materially and progressively increase.

A few remarks relative to each separate scheme are requisite, in order to complete this Report; viz.—

1. *The Boobyalla Scheme.*

The line of race has been surveyed and marked off with pegs. The "intake" is located in a wide valley with extensive marshes. The situation cannot be said to be very suitable, because of the impossibility of constructing a large impounding reservoir thereabouts. Another site said to exist half a mile down the river in a rocky gorge could probably be much better utilised, and, if a five per cent. grade were adopted instead of a ten per cent., the survey would come in to a considerable extent.

Messrs. Pearce and Bell assert that at the junction of the Boobyalla Road and Trout Creek they could command a race serving Gladstone at the same level as the one above, and that by fluming or "syphoning" for 28 chains, they could save several miles of race to be constructed; this fluming or syphoning would also apply in the former case with equal advantage.

It will be necessary to make trial surveys, or check the survey already made, and, if found to answer, the Boobyalla Company's request to be reimbursed for their actual outlay of survey, to be granted.

2. *The Mussel Roe Scheme.*

The Mount Cameron Hydraulic Tin Mining Company, Limited, of Melbourne, will be able to furnish 68 sluice-heads of water all through the year, and they have 21 miles of race completed. They made an offer to the Government "either to buy the works as they stand, or to subsidise their company as the works progress towards completion up to £10,000 sterling, the Government holding the Company's works as security, and the money advanced to be a first call on their profits; all water to be sold at not higher than 20s. per sluice-head per week, i.e., 10,000 gallons per hour."

The works are so far well constructed, their main race being 5 feet 6 inches wide by 2 feet deep, and on completion this scheme would command a large area of tin-bearing ground that cannot be worked now for want of water, to the north on the east side of the river. Their present difficulty to proceed consists in the encounter with a depression of surface, which is 92 feet in depth, and will have to be "syphoned" across in order to carry the water to its final destination.

With regard to their offer, I would most respectfully submit that if the Government contemplate the construction of the extensive works necessary for a high-level water supply to these mining districts, it would be advisable in such a case to have the sole control of all the water supplied to these localities, instead of a kind of dual authority, as will be the case if this Company is advanced the money whilst completing their scheme: it would be necessary to have inspection, and to see that the works are up to the full value. The security offered should likewise be more ample than only the value of the works; the latter should be carefully valued in their present condition in order to arrive at a fair basis. If the Company's works so valued could be purchased right out all this would be avoided, and payments could probably be arranged, partly cash and debentures on the loan for the proposed National Scheme, whereupon these works could be incorporated with the latter.

The Main Race.

The situation for the intake is similar to that of the Boobyalla, and a better site for an impounding reservoir could probably be found. It is proposed to have a race 20 feet wide by 5 or 6 feet in depth, and it is supposed that, with the grade adopted, such will be sufficient for all purposes. This may be on closer examination found to be capable of modification, for a much smaller race, I am credibly informed, supplying Castlemaine from the Malmsbury Reservoir—Coliban Scheme, Victoria—carried 36 million gallons of water per week in 1884, and in 1881 a total of 1828 million gallons were so delivered.

With the exception of the Esk T. M. Co.,—which forces 100,000 gallons per hour through an 18-inch diameter wrought iron pipe for a length of 3001 feet to a vertical height of 301 feet by the cheaper means of water power into reservoirs supplying 16 nozzles of various sizes,—the steam pumps of the Scotia, Tamar, and Moea Companies have been found too expensive to work, and the quantity of water raised too limited for economical mining purposes.

(5)

From the details furnished in the above Report it will be seen that a favourable opinion has been formed as to the initiation of an extensive high-level water scheme by means of which the large deposits of tin ore existent can be rapidly and economically worked for many years to come. In furtherance of that so desirable project, it is now recommended—

(a.) That the respective rivers be accurately gauged as to their capacity at various points for a whole season or longer.

(b.) That shafts be sunk in certain places so as to test whether any considerable subterranean leakage exists or not.

(c.) That a comprehensive engineering survey be made of all water-courses and races, &c., with a view of bringing in the water at the highest obtainable level.

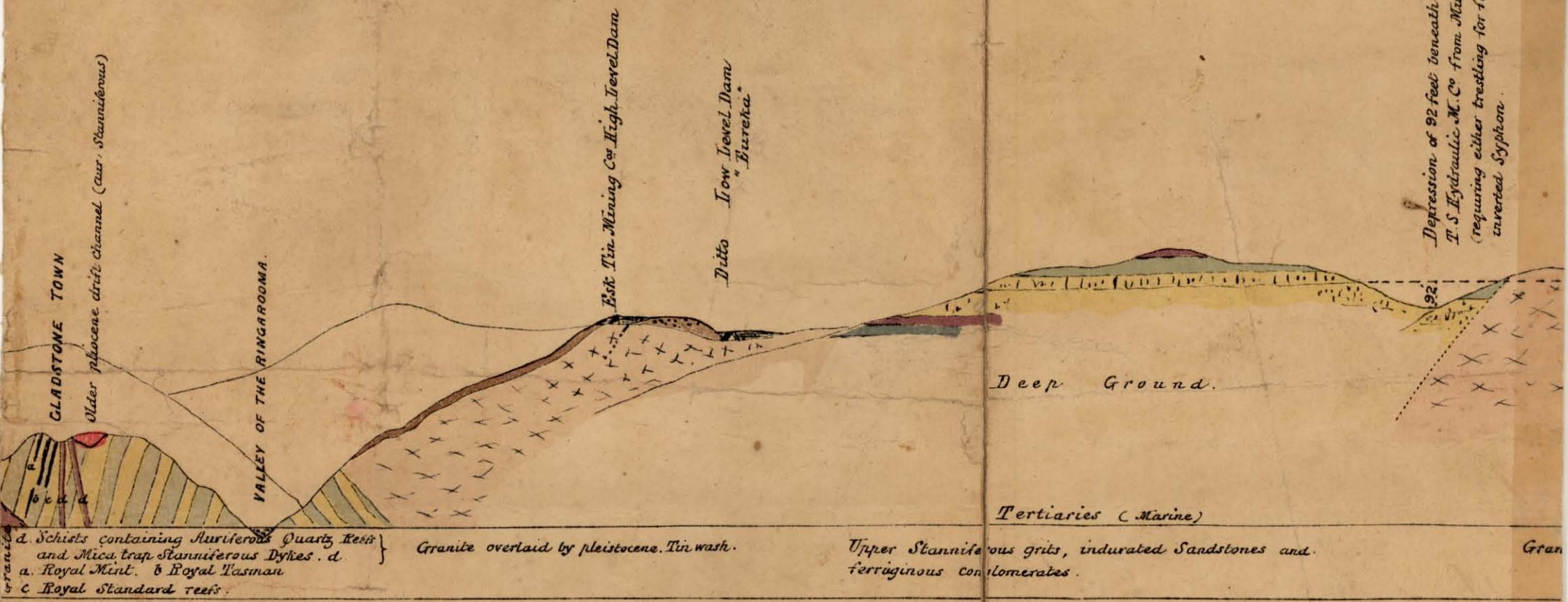
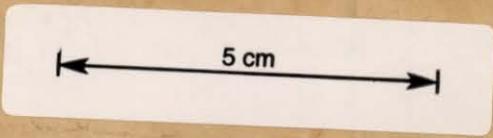
(d.) That these surveys form the basis of all the future works of the scheme or schemes; and it is strongly recommended that before any operations are commenced the services of a competent hydraulic mining and irrigation engineer from California be secured, in order to inspect and initiate the scheme, and carry on the works for the first three or four years. This recommendation is based upon the fact that in Australia similar schemes generally exceed by over fifty per cent. the original estimates of same, and that in that State such works are "handled" much more economically and in accordance with the first estimate of cost, whilst at the same time the latest improvements in connection would be placed by such an engineer in the hands of the Government and the mining community at large.

G. THUREAU, F.G.S.

APPENDIX.

Total Quantity of Tin Ore brought from Ringarooma by Steamers <i>Avon</i>	tons cwts, qrs.
and <i>Pioneer</i> from 11th July, 1877, to 30th June, 1884.....	8350 10 0
<i>Launceston, 1st October, 1884.</i>	R. J. SADLER, Agent " <i>Avon</i> " p.s.

CROSS SECTION FROM GLADSTONE TO THE MIDDLE HUTS MUSCLE RO
6 MILES - Below the intake of the "Mount Cameron Hydraulic Tin Mining Co's
Water Scheme" "Reduced Scale".



CROSS SECTION FROM GLADSTONE
To intake of Water at the Boobyalla River.
"Reduced Scale".

