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**PORT OF LAUNCESTON
AUTHORITY**

OPEN FILE

BLUE METAL INDUSTRIES LIMITED

MIDDLE ARM MINING
RECLAMATION AND MARINA PROPOSALS

STAGE I - FEASIBILITY STUDY

MAY, 1975

PORT OF LAUNCESTON AUTHORITY
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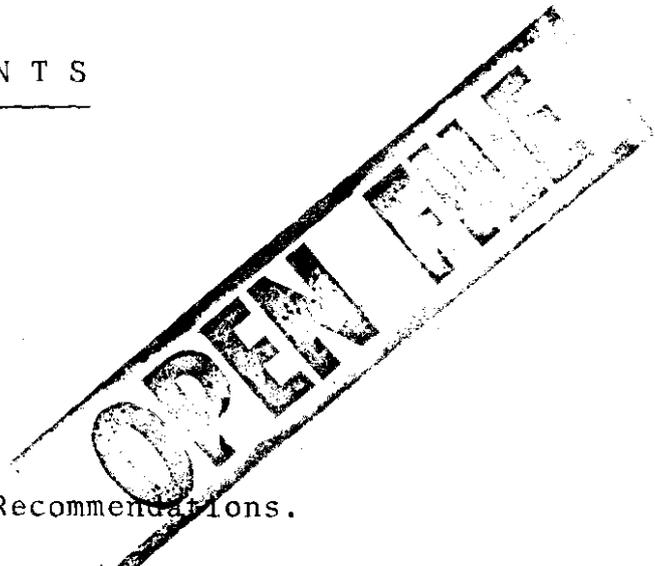
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PART 'A'

GENERAL REPORT

PART 'A'GENERAL REPORT1. INTRODUCTION -

Acting upon the instructions set out in your order No. 02279 of 21/1/1975 we have pleasure in submitting Stage I of the feasibility study for this project. It is understood that the prime requirement is to undertake alluvial mining operations in Middle Arm, River Tamar, in such a manner that a community benefit will result from the work, bearing in mind that such benefits should to a large extent match the additional costs which will be incurred in undertaking any extra works involved.

2. THE PROPOSAL -

The general proposal is to dredge or excavate mine tailings from the river bed and an existing stockpile, pass them through a treatment plant for the extraction of gold and other metals and return the residue to reclamation in a manner which will improve the aesthetics of the area in general and if possible establish a recreation amenity in a potentially very attractive area.

Each of the three proposals submitted has been prepared with a view to developing a reclamation along the Western foreshore of Middle Arm near its head waters and for Proposals 1 and 2, water access and a marina type development to achieve betterment of the adjoining land for the purpose of development into a low density subdivision. It is proposed that the eastern shore of Middle Arm be retained in its present condition of bushland and pasture to retain the pleasant outlook now existing from the area proposed for residential development.

3. THE BRIEF -

The brief as set out in your letter of November 29th, 1974 is -

"... Stage I Feasibility Study:

- (1) Prepare preliminary development proposals.
- (2) Liaise as required with Government and Local Government authorities.
- (3) Undertake a search of adjoining land ownership and advise on availability for purchase.
- (4) Investigate any problems of waterfront rights which may be associated with reclamation along the foreshore of these properties.
- (5) Prepare preliminary designs and estimates.
- (6) Prepare a simple cost benefit analysis.
- (7) Prepare environmental impact study related to dredging and reclamation.

4. SUMMARY -

The requirements of the brief have been studied, details of which are set out in Part B of this report.

Foremost in our considerations has been the prime purpose of the operation - namely to extract gold and other minerals from tailings in the existing dump and from the river bottom, particularly in the upper reaches of Middle Arm.

Investigation of land development and recreation proposals has been directed towards -

- (i) Achieving a public acceptance of the mining operation in a generally attractive region highly sensitive to conservation issues. In any event an environmental impact study is mandatory.
- and (ii) Development of a scheme to satisfy these requirements in a manner which if possible will result in financial benefits by reason of land development and more efficient mining operations sufficient to offset the extra expenditure involved.

Three development proposals have been prepared to give bases for comparison and also to indicate possible alternatives consistent with the likely and future demand for waterfront land in the area upon completion of the mining operations.

These proposals are :-

Proposal 1 (Refer to Appendix VII, Drawing No. 271-16)

To impound the waters of Middle Arm south of the Kildare property to a minimum level of R.L. +9.00' (L.W. datum) by a rock and clay dam, reclamation of about 6.50 hectares of the tidal flats along 1100 metres of the western foreshore, deepening of portion of the Arm to provide pleasure boat mooring areas and provision of an entrance channel and lock to facilitate the entry and departure of small craft at all stages of the tide.

This involves the dredging and/or excavation of 603,000 cubic yds. of tailings and 86,000 cubic yds. of non-productive material. Impounding of water at near high tide level provides financial benefits by permitting dredging of tailings at all stages of the tide, minimises the need for over dredging of unproductive material and provides a settling basin for discoloured water from reclamation operations. It also creates financial benefits by reason of considerable betterment to waterfront land values, particularly on the western shore - development of which would need to become part of the overall project.

The total capital cost of this proposal including the cost of winning and disposal of productive materials and the purchase and development of adjoining land is estimated to be \$1,924,060 made up of -

(i)	Winning and disposal of tailings	\$ 734,140
(ii)	Cost of extra works including marine and channel dredging, dam and lock construction, land purchase & development	\$1,189,920
	Totalling	\$1,924,060
		=====

The potential benefits to be gained by reason of \$1,189,920 of extra works are estimated to amount to \$1,099,000 made up of -

(i)	Reduction in over dredging and ability to dredge at all stages of tide	\$ 134,000
* (ii)	Recover from land betterment & development and riparian rights	\$ 965,000
	Totalling	\$1,099,000
		=====

This results in a cost benefit ratio of -

$$\frac{1,099,000}{1,189,920} = 0.925$$

* The land development could proceed in two stages and reduce the initial capital outlay but with a consequent reduction in the immediate benefits. Details are shown in the Estimates, Section B10 and Appendix V.

Proposal 2 (Refer to Appendix VII, Drawing No.271-17)

To excavate by dredging and/or other means 603,000 cu.yds. of payable tailings and 429,000 cu.yds. of unproductive material. This proposal is designed to provide a marina and entrance channel to a depth of about 5 ft. below low water and 12.2 hectares of reclamation along 1500 metres of the western foreshore. This proposal suffers the disadvantage of tidal rise and fall and the continued exposure of extensive and unsightly mud flats at low water. It involves considerable over dredging for dredge flotation alone, and together with tidal restrictions could result in difficulties in achieving the 18 to 24 months time schedule required.

The immediate benefits from land betterment for this proposal are estimated to be minimal compared to those in Proposal 1 where nominal high water is maintained at all times. The major benefit would be simplification of foreshore reclamation formalities and some general benefit in purchase and resale of land and the added reclamation.

The total capital cost of Proposal 2 including the cost of winning and disposal of productive materials and the purchase for resale of adjoining land is estimated to be \$1,165,480 made up of -

(i) Winning and disposal of tailings	\$ 734,140
(ii) Cost of extra works including marina and channel dredging and land purchase	\$ 431,340
Totalling	\$1,165,480 =====

The potential benefits to be gained by reason of \$431,340 of extra works are limited to providing a site for the disposal of waste material and the possibility of some return from increased land values and sale of the area reclaimed.

These benefits are estimated to amount to \$53,700 made up of -

(i) Recovery from resale of land	\$ 38,700
(ii) No need to buy riparian rights	\$ 15,000
Totalling	\$ 53,700 =====

This results in a cost benefit ratio of -

$$\frac{53,700}{431,340} = 0.125$$

Proposal 3 (Refer Appendix VII, Drawing No. 271-18)

To excavate only the 603,000 cubic yds. of tailings utilising a land based Sauerman scraper type operation for the river work, returning treated residue to reclamation along the western foreshore and generally cleaning up debris and improving the aesthetics of the area in general.

This operation would not provide adequate depth for a marina type development nor cause any betterment to adjacent land values. Basically it involves only that work essential to the mining operation together with a relatively simple foreshore or beach reclamation and area clean up to leave the site in a better condition than exists at present.

The total capital cost of Proposal 3 including the cost of winning and disposal of productive materials and planned foreshore reclamation and clean up is \$720,200 made up of -

(i) Excavation and disposal of tailings	\$683,200
(ii) Cost of minor extra works and clean up including purchase of riparian rights but not land	\$ 37,000
Totalling	\$720,200 =====

The potential benefits to be gained by reason of the extra works are intangible but are the absolute minimum considered necessary to gain overall approval for the mining operation.

5. CONCLUSIONS AND RECOMMENDATIONS -

From the community point of view Proposal 1 is highly attractive and results in returns from land development and increased operating efficiencies which almost match the high cost of dam and lock construction and other extra works. However, the project involves high capital expenditure and several intangible or risk factors in regard to cost and ecological aspects which would require closer and detailed investigation.

Proposal 2 provides limited community benefits but involves considerable costs which are not matched by the financial benefits which can be reasonably anticipated. In this proposal we do not believe that significant land betterment will result from the extra works of marina and channel construction.

Proposal 3 involves the minimum of unproductive work and while it provides no community benefit it would leave the area in a considerably better state than currently existing.

The choice therefore lies between Proposal 1 (impounding of the Arm at nominal high water) and Proposal 3 (mining with a minimal clean up). A decision on the proposal most favoured is desirable before an environmental impact study is prepared. A study for Proposal 3 would be simple and involve fewer uncertainties and complications than for Proposal 1.

Rights to reclamation along the foreshore are vital to any proposal and it is recommended that early purchase of all or part of land owned by Walker and Temby is the best way of avoiding undue complications and delay and ensures that any benefits resulting from land betterment would accrue to your company.

.../Part B.

PART 'B'

RECORD OF INVESTIGATIONS, SUPPORTING INFORMATION

AND MISCELLANEOUS DATA.

PART 'B'RECORD OF INVESTIGATIONS, SUPPORTING INFORMATION
AND MISCELLANEOUS DATA.1. BASIC INFORMATION -

Information supplied by B.M.I. as a basis for this investigation is -

- (i) A chart showing the extent of the mining lease over the water and land areas in the Middle Arm area.
- (ii) A plan and log of probings in portion of Middle Arm indicating thickness of the tailings deposit on the river bed. It has been further indicated from discussions with your Mr. Mearing that payable tailings may also exist in Middle Arm further north and beyond the area already probed but no account has been taken of this in the proposals prepared.
- (iii) From this information and our own surveys we have calculated that there is approximately 142,000 cubic yards of tailings in the stockpile ashore and 461,572 cubic yards on the river bed, making a total of 603,572 cubic yards available for treatment and subsequent reclamation. These quantities include an allowance of 1' 6" for over dredging in the river as instructed by Mr. Mearing.
- (iv) It is understood that the material will pass through the treatment plant without grinding and will be available for reclamation at materially the same grading as it now exists.
- (v) It is further understood that treatment of the available material should be completed within 18 months to two years of commencement.
- (vi) The preferred means of excavation from the river bed is by suction dredger pumping material direct to the treatment plant.

However, our surveys have shown lesser quantities of tailings than originally anticipated with an average level on the underside of about R.L. +4.00' (L.W.datum) over much of the area. This may necessitate considerable over dredging of non-productive material purely to maintain dredge flotation and with Mr. Mearing's concurrence a Sauerman scraper type operation has been assumed for one of the proposals.

2. ALTERNATIVE PROPOSALS -

Three alternative proposals are described in Section A4 of the General Report.

PROPOSAL 1 (water impounded at nominal high water level)

The advantages of this proposal are -

- (i) Aesthetically it creates a vast improvement to the appearance of the Arm and the waterfront.
- (ii) It converts sections of the surrounding land into very desirable and high value residential sites and improves the waterfront around the whole shoreline including the value of the new reclamation.
- (iii) It provides an ideal water area for small boat sailing and recreation and a completely sheltered haven for pleasure craft of up to 50 ft. length and drawing 5 ft. Combined with the very attractive shoreline the whole feature would be magnificent.
- (iv) It permits dredging operations for the recovery of tailings at all stages of the tide by a floating unit and eliminates the need for unproductive dredging to give adequate depths for dredge flotation.
- (v) It facilitates the settling of discolouring silt which may result from dredging and reclamation operations and which otherwise may cause a nuisance in the river beyond Middle Arm.

The disadvantages are -

- (i) The high cost of the dam or barrage and the navigation lock necessary to permit small craft to leave and enter at all stages of tide.
- (ii) The uncertain ecological effects which may result from a major change to the river's condition and which for example may cause weed or algae growth and disturbance to marine and bird life. Distinct from the actual problem the uncertainty could generate undesirable public debate and opposition to the whole operation.
- (iii) Problems which may result from sewage or other pollutant inflow into the impounded water.
- (iv) The protracted delays which may be caused by environmental impact studies and the sophisticated research which may be required before approval to proceed is granted.

In the overall balance the financial value of the benefits appear to virtually match the costs, but there is some risk element in both the financial and ecological elements. Nevertheless the scheme is a highly attractive one from the community point of view and we believe would be well received.

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PROPOSAL 2 consists of an entrance channel and mooring basin dredged to R.L. -5.00' with 12.2 hectares of foreshore reclamation in the vicinity of the mooring basin.

The advantages of this proposal are -

- (i) It eliminates the high cost of the dam and lock.
- (ii) It causes less changes to the natural environment and results in less uncertainties with ecological aspects.

The disadvantages are -

- (i) Dredging operations using floating plant will be severely restricted by tide and 167,500 cu.yds. or 16.22% of the total dredging is unproductive and required merely to provide for dredge flotation.
- (ii) At low water large areas of unsightly mud flats will remain exposed.
- (iii) Land betterment by reason of the work undertaken is not likely to be significant and certainly not sufficient to justify a major subdivision and land development scheme.

Insufficient benefits appear to accrue from this proposal to make it worthwhile.

PROPOSAL 3 proposes the use of a Sauerman scraper type unit to dredge and excavate only payable tailings from the river bed with waste material placed in reclamation as for other proposals.

The advantages of this proposal are -

- (i) It involves the minimum of dredging and the minimum cost and there is no need for over-dredging of unproductive material.
- (ii) Operations can proceed at all stages of the tide.

The disadvantages are -

No community benefit or land betterment results from the operation.

Proposal 3 is purely a mining operation but with care the work can be done in a manner which improves what are otherwise some derelict and rather depressing areas at low tide.

A small expenditure on a general clean up of the area in conjunction with the work of Proposal 3 would, we believe, prove acceptable to the authorities concerned and the community generally.

3. POSSIBLE USAGE OF A MIDDLE ARM RESIDENTIAL & MARINA FACILITY

Good waterfront sites in the Tamar Valley are now at a premium and are eagerly sought and the growth in aquatic activities has grown enormously over the last few years. We would predict that with the large current industrial expansion at Bell Bay there will be a demand for permanent home sites if a high standard of building is established and a Proposal 1 type scheme adopted.

There would also be a demand for retirement homes and for high class holiday home sites. We believe, however, that it would be unwise to assume any development to be as popular or to achieve the land values of the Queensland developments but nevertheless with the steady growth of the Tamar Valley we visualise establishment of a much sought after area by Tasmanian standards.

It is anticipated that the proposed lake or impounded water would be used for small boat sailing where an ideal course could be laid out, and for the mooring of larger pleasure craft in an extremely sheltered and safe situation and close to a residential area.

We see the need for provision of sites for boat clubs, boat ramps and other community amenities which perhaps should be made available gratis to the Beaconsfield Municipality. The success of the whole venture would depend upon the proper planning of the facility, good standards of construction and strict covenants on the standard of buildings and other structures erected.

4. GENERAL SITE INVESTIGATIONS -

- (i) Probing - Details of logs and probings undertaken by B.M.I. to determine tailing depths have been made available to us and used in our quantity calculations. In addition, probings and shear vane tests have been carried out on the line of the Proposal 1 "Dam Site" to provide foundation information. Test pits have been sunk into tailings on the mud flats and grading analyses have been made of the tailing materials. Details of this information is included in Appendix VII, drawing 271-20.
- (ii) Some soundings and levels have been taken of the bed of Middle Arm in conjunction with detailed ground inspections.
- (iii) An aerial photographic survey has been flown at four different stages of tide to provide approximate bottom contours and general topographical details.
- (iv) Geological maps of the area have been studied particularly with a view to sources of material for dam construction and field surveys have been undertaken.

- (v) An ecological survey is being undertaken by the Queen Victoria Museum, Launceston, with a view to assembling a catalogue of terrestrial fauna including birds, but further investigations in regard to fish life and effects on the marine eco-system may be necessary to satisfy an environmental impact study, particularly for Proposal 1.
- (vi) Surveys and calculations have been made of rainfall run-off from the catchment area feeding into Middle Arm above the Proposal 1 dam site.
- (vii) Analyses are being made of the tailings to determine its suitability for maintaining vegetation over the final reclamation.
- (viii) Analyses have been made of water from tributary streams to determine the degree of pollution and the chemical content, particularly as it would affect weed growth in an impounded water.

5. ENQUIRIES FROM GOVERNMENT & LOCAL GOVERNMENT BODIES -

(i) Department of Lands -

The project has been discussed with the Director of Lands and his comments are :-

- (a) The project will be subject to an environmental impact study.
- (b) Where there is a crown reserve existing around the present foreshore it will be necessary to shift this reserve forward to any new foreshore alignment created by reclamation. Such a reserve exists from about Bowen's Jetty along the western shore of Middle Arm and partway down the eastern shore, as indicated in Appendix VII (Drawing No. 271-19).
- (c) Private owners on properties fronting onto the waterfront or the Crown Reserve have riparian rights and these rights would either have to be purchased or some formal arrangement made with the owner where his water frontage is affected.

(ii) Department of the Environment -

Discussions have been held with the Director of Environmental Control to determine his Department's requirements and attitudes in regard to the project and a continuing liaison is being maintained.

The Department's requirements will be :-

- (a) An environmental impact study for the total operation of dredging, reclamation and treatment plant operation. This must be submitted by B.M.I. before a licence to operate will be issued by the Department.

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We will prepare an environmental impact study for your Company on the dredging and reclamation aspects when its decision on the adoption of one of the three proposals submitted has been reached.

- (b) Submission of information relating to the settling time of dredged and reclamation material related to its particle size and likely water discolouration and disturbance.
- (c) Proposals for re-grassing reclaimed areas to conform to the natural environment.
- (d) An ecological study of plant and other life in the area generally and the likely effect on such life by the proposed works.
- (e) A statement and substantiation of the benefits claimed to exist for boating and recreation activities by the proposal adopted.
- (f) A detailed study of the following aspects if Proposal 1 is adopted -
 - Volume of fresh water inflow and analyses of the nutrient and pollution loadings of tributary streams.
 - Flushing times, salinity and possible weed and algae growth.
 - Comparison with existing and similar schemes and with particular reference to the Orielson Lagoon, Sorell, Southern Tasmania where weed growth and offensive odours have created problems.

A description of investigations undertaken on these matters is contained in Section B7 "Investigations of Environmental Aspects".

(iii) Department of Health -

The Department of Health has an interest in this project from the point of view of sewage and other waste disposal and any health risks which may exist in impounded water. Discussions which have been held with officers of this Department were mainly with a view to keeping the Department informed. We would not expect to receive any firm commitments from the Department at this stage as it would be mainly concerned with sewage and treatment disposal from any land or residential development incorporated in the project and considerably more detailed information than is currently available would be required.

(iv) Department of Mines -

The project has been discussed with the Director of Mines who has been kept informed of the work which the Authority has been doing. Close liaison has also been maintained with Mr. H. Wellington, Chief Chemist and Metallurgist of that Department.

(v) Beaconsfield Council -

The proposals have been discussed with the Warden and officers of the Beaconsfield Council to ensure that the Council is fully informed and to also ensure that it conforms with the Council's overall planning schemes. Close liaison is being continued.

(vi) Tamar Regional Master Planning Authority -

The project has been discussed with the Director of the T.R.M.P.A. who raises no objection to the proposals. In fact they conform to the general concept of the preliminary Outline Development Plan prepared by the T.R.M.P.A. for the Middle Arm area annexed as Appendix II.

(vii) Port of Launceston Authority

The proposals comply with the general requirements of the Port of Launceston Authority but final layouts, designs and dredging and reclamation methods and operations will require the Authority's specific approval.

6. INVESTIGATION OF LAND OWNERSHIP, VALUES & DEVELOPMENT -

A search has been made of the Beaconsfield Council and Department of Lands' records in relation to land ownership and current valuations and a schedule of the various properties and their valuation is shown in Appendix VII (Drawing No. 271-19). These are 1972 valuations and it is generally agreed that current market values are probably 60% in excess of those values shown.

The extent of the 100 ft. Crown reservation is also indicated on this drawing.

The advice of a land valuer and real estate consultant, Mr. J. Martin of E.E. Richards Pty.Ltd. in conjunction with Mr. E.M. Pedley, registered surveyor, both of Launceston, has been obtained and a copy of Mr. Martin's report is attached as Appendix III. The report includes proposals and estimates for a low density type residential land development.

Both of these men are highly experienced in land development of this type in the Tamar Valley area and their views in this field are held in high regard.

Summarising the report's recommendations -

- (i) Land subdivision and development should be restricted initially to 300 metres back from the south western foreshore of Middle Arm and over a length of about 1500 metres and the eastern shore should be left undisturbed.
- (ii) Greater emphasis should be placed on developing water area then reclaimed area. The reclaimed area should be relatively narrow and extend over a considerable length of foreshore and be used for parkland, boat clubs, etc. Housing should not be on the reclamation but on the existing natural country.

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- (iii) Subdivision of this land with Middle Arm in its present condition would be uneconomical as it would also be for any development which does not eliminate the unsightly and extensive mud flats and provide adequate access for small craft at all stages of the tide.
 - (iv) Proposal 1 is the only one which would make a subdivisional development attractive. It is considered that between 90 and 170 allotments ranging in area from 1 to 5 acres and in value from \$5,000 to \$12,000 each could be provided on the western shore and these would sell at the rate of 20 to 25 per annum by reason of the permanent high water.
 - (v) If this scheme was to proceed it would be essential to purchase the land as soon and as quietly as possible. No direct approaches have been made at this stage.

Based upon the consultant's advice and recommendations the following procedures would therefore appear desirable.

- (i) If Proposal 1 or 2 are adopted by your company then early action should be taken to purchase from the present owners, Temby and Walker, 1500 m of water frontage land at least 300 m deep in the area of the proposed reclamation. The current market value of this strip of about 43 hectares is estimated to be \$32,000 while the total value of the two properties of 106 hectares could be in the order of about \$55,000. Purchase of this part, or all of these properties would automatically overcome any problem of riparian rights along the foreshore.
- (ii) If Proposals 1 and 2 are rejected and Proposal 3 is adopted, then the following alternatives are open -
 - (a) Purchase the 300 m waterfront strip or the whole area as in (i)
 - or (b) In view of the relatively low commercial value of the reclamation on its own in Proposals 2 and 3, make an arrangement with Temby and Walker to exchange the rights to the reclaimed area for the right for your company to reclaim along their frontages.

7. INVESTIGATIONS OF ENVIRONMENTAL ASPECTS -

The environmental problems likely to be encountered will depend upon the proposal adopted. If Proposal 1, impounding of the waters of Middle Arm, is adopted a very substantial alteration to the prevailing conditions will occur. One can therefore anticipate considerable queries and requests for research from the Department of Environmental Control and opposition from conservation interests.

For Proposals 2 and 3 no significant change is being made to the river's hydraulic or ecological regime - only a disturbance of the river bottom in a localised area and probably some discolouration of the river water in the immediate area during dredging operations. Any resulting problems from these causes are likely to be reasonably determinate and readily controlled.

In anticipation of likely queries, problems and objections whichever proposal is adopted we have under investigation the following aspects :-

(i) Inflow from tributary streams -

Analyses have been made from water samples from tributary streams to determine the pollution load and chemical content, both of which could cause problems of weed and algae growth in an impounded water. These tests have shown an E.Coli count of 530 pp 100 ml, indicating that Middle Arm Creek is heavily polluted with sewage.

Results of these tests together with a chemical analysis of the water from Middle Arm Creek are given in the Schedules, Appendix VI.

Calculations have also been made on peak inflows from all tributary streams indicating that a maximum of 5,500 cusecs (10 year storm) and an average annual inflow of $5,500 \times 10^6$ gals.

(ii) Ecological Aspects

Staff of the Launceston Museum headed by its Director, Mr. W.F. Ellis, have been retained to advise on the ecological aspects of the area as they exist with a view to determining the likely effects of the project on the ecology of the area. Their formal report has not yet been received but discussions indicate that the Arm is a breeding ground for some fish and forms of marine life which probably would be disturbed by an impounding of the Arm. While this may or may not be important - some sections of the community may use it as a basis for objection and any investigation to satisfactorily answer such an objection could be a very protracted process. This provides another argument against Proposal 1 when looked at in relation to the prime purpose of the project. That is, to mine gold.

Otherwise, for Proposal 2 and 3 few problems are expected, provided measures are taken to prevent undue pollution of the water by dredging or reclamation operations.

(iii) Agricultural Aspects -

An Agricultural consultant, Mr. K. Brennan of Launceston, has been requested to advise on methods for re-grassing the reclaimed areas. Analyses of tailing samples are being made but firm recommendations have not yet been received.

Investigations and enquiries into weed growth within an impounded water has shown that if the water is allowed to become fresh, weed growth will occur when depths are less than 25 ft. For this reason it would be important for the impounded water to be maintained in a saline condition and for this reason a dam crest level for Proposal 1 of R.L. +9.00' has been selected to allow adequate flushing on every high tide.

(iv) Pollution -

Already significant sewage pollution is occurring into Middle Arm Creek and Brandy Creek and discharge from a proposed sewage treatment plant at Beaconsfield into Brandy Creek will discharge into Middle Arm.

With the proposal for a housing development on the western shore of the Arm rigorous control of effluents would be necessary, particularly for Proposal 1 and for any proposal which uses the water of the Arm for aquatic recreation purposes.

(v) Dredging and Reclamation -

The Department of Environmental Control will require gradings of the materials to be dredged and those used for reclamation together with tests and statement of settling times. If material is placed into reclamation by hydraulic means adequate bunding or cycloning will be necessary to allow adequate separation and dewatering of deposited material.

8. INVESTIGATION OF MARINA FACILITIES -

Discussions have been held with office bearers of the Port Dalrymple Yacht Club which operates a very progressive yacht club 2 miles north of the site, but the project is a little far removed from their centre of operations to be of immediate interest to their activities.

Detailed inspections have been made of marina and canal developments on the Gold and Sunshine Coasts of Queensland and also at other Australian and overseas marinas as a guide to modern requirements.

9. ENGINEERING ASPECTS -

(i) Dam and Navigation Lock -

For Proposal 1 the dam and the navigation lock constitute major structures to be built before major mining operations can proceed.

The dam proposed is a rock fill structure with an impervious clay core and a crest height of R.L. 9.00' or about 2' 0" below normal high water. Refer Appendix VII (drawing No. 271-16). The whole 500 metres length of the dam crest would serve as a spillway adequate to

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discharge tributary flood flows at low velocity and to permit flushing of the impounded area by salt water at every high tide. Suitable rock is readily available near the Eastern shore to provide the 80,000 cu.yds. required for construction. Weak silts existing on the river bed indicate possible foundation problems but in view of the relatively low height of the dam - namely 9 ft., we believe that this problem can be overcome. With the ready availability of good rock in the immediate vicinity we believe that a fairly simple type of dam construction can be evolved, although considerable site investigation will be necessary for confirmation. The problem is made simple by the low head of water to be impounded and the relative unimportance of minor leakage and dam settlement.

Road access across the dam is not necessary other than for maintenance purposes.

The Navigation Lock is necessary to allow entry and departure of small craft to and from the lake at all stages of the tide. This requires a lock at least 50 ft. long and 15 ft. wide with two sets of mitre gates and a simple valve system to enable regular users to operate the gates and the lock without assistance.

A surface inspection of the Eastern shore at the dam abutment indicates sand stones and mudstones which could be ideal for an unlined lock and entrance canal construction. Gate sills and abutments would need to be of concrete construction. The gate sill at the downstream end would need to be at R.L. -5.00' and at the upstream end at R.L. +1.00'.

(ii) Dredging and excavation -

For the general dredging operations for Proposals 1 and 2 a suction cutter dredger is envisaged pumping payable river bed material by floating and land pipeline to stockpile areas adjacent to the treatment plant, with unproductive material pumped directly to reclamation over previously mined areas along the foreshore. For Proposal 1 dredging can continue over the full tidal cycle but for Proposal 2 a balance will have to be struck between the costs of over dredging for flotation and for lost time due to insufficient water depth.

For Proposal 3 excavation by a land based Sauerman scraper is proposed enabling the majority of tailings to be scraped to the western foreshore, drained and conveyed to the treatment plant as required. The estimated quantities of materials to be excavated are -

	<u>PAY DIRT</u>	<u>STOCKPILE</u>	<u>NON-PRODUCTIVE OVER DREDGING</u>	<u>TOTAL</u>
Proposal 1	461,572	142,000	85,628	689,200
Proposal 2	461,572	142,000	429,428	1,033,000
Proposal 3	461,572	142,000	---	603,572

The large quantity of unproductive dredging for Proposal 2 combined with tidal restrictions to dredging makes this proposal both uneconomic and impracticable to complete within a 2 year period.

(iii) Reclamation -

It is proposed that reclamation should proceed from the western foreshore outwards over areas previously mined and on the assumption that waste will be handled from the treatment plant hydraulically. The granular nature of the material should allow it to drain freely and enable it to be used after a relatively short period for the construction of retaining bunds to impound further pumped material.

It is recommended that the finished level of the reclamation be at R.L. 15.00' at the river edge, grading up at 1 in 60 to about R.L. 21.00' at the existing shore line. On the river side no retaining walls are envisaged initially but a sloping beach at 1 in 7 down to low water level and below that a slope of 1 in 3.

On completion of the mining operation the reclaimed areas would be graded and trimmed to a neat profile, loamed or fertilised as may be necessary and grassed.

10. ESTIMATES OF COST -

The estimates of costs included in this report are based upon inadequate site information and very preliminary design and operating proposals. They should therefore be considered as indicative only and mainly for the purpose of comparing various proposals.

The bases of the following estimates are annexed as Appendix V.

Summary of Estimates

Item	Proposal 1	Proposal 2	Proposal 3
1. Dam	\$ 457,600	\$ -	\$ -
2. Lock	165,000	-	-
3. Tailings - winning & disposal	734,140	734,140	683,210
4. Extra winning & disposal	75,420	377,520	-
5. Land purchase & development	438,000	31,820	15,000
6. Misc. jetties, etc.	31,900	-	-
7. Clean up	22,000	22,000	22,000
TOTAL	\$1,924,060	\$1,165,480	\$ 720,210

Extra Works included in Estimates above

Item	Proposal 1	Proposal 2	Proposal 3
1. Unproductive winning & disposal	\$ 75,420	\$377,520	\$ -
2. Dam & Lock	622,600	-	-
3. Land Development	432,500	31,820	-
4. Miscellaneous	37,400	-	-
5. Clean up	22,000	22,000	22,000
TOTAL	\$1,189,920	\$431,340	\$ 22,000

11. FINANCIAL BENEFITS -

Item	Proposal 1	Proposal 2	Proposal 3
1. Reduced unproductive dredging	\$ 134,000	\$ -	\$ -
2. Receipts from land development	\$ 950,000	\$ 38,700	\$ -
3. Saving on riparian rights	\$ 15,000	\$ 15,000	\$ -
TOTAL	\$1,099,000	\$ 53,700	\$ -

12. COST BENEFIT RATIOS -

Rough cost benefit ratios for each proposal are listed below.

The cost benefit ratio shown is -

$$= \frac{\text{Estimated value of benefits}}{\text{Estimated cost of extra works to provide these benefits}}$$

<u>Proposal 1</u>	<u>1,034,000</u>	=	0.868
	1,189,920		

In spite of the high capital costs for extra work this is nearly matched by the benefits gained.

<u>Proposal 2</u>	<u>431,340</u>	=	8.03
	53,700		

The cost of extra work of channel and marina dredging and land purchase is far from being recouped by the benefits gained.

Proposal 3

The cost/benefit ratio is not applicable as this proposal does not involve any significant work with a view to realising a corresponding benefit.

PART 'C'

APPENDICES

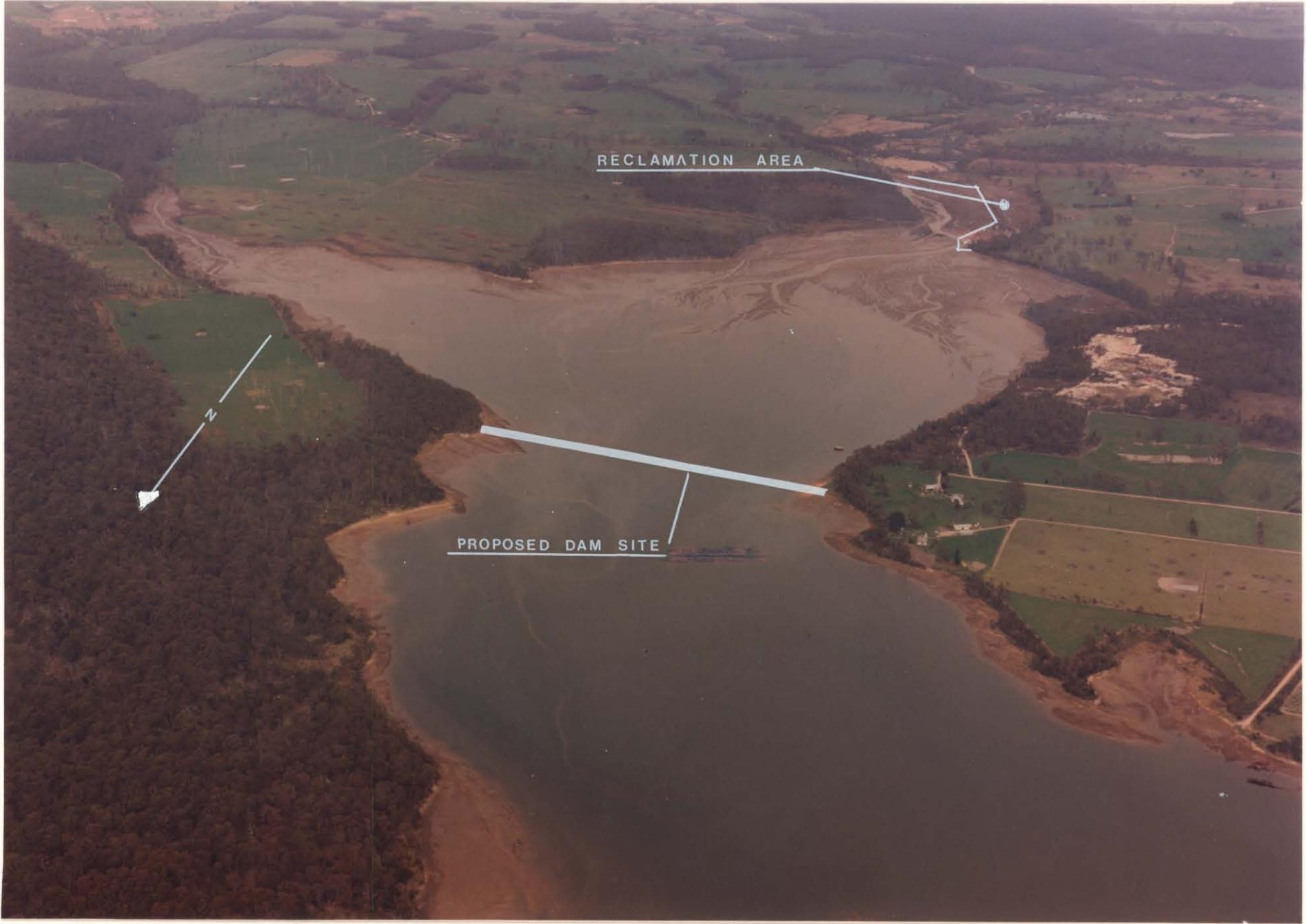
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APPENDIX I.



MIDDLE ARM AT HALF TIDE - SHOWING PROPOSED DAM SITE & RECLAMATION

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APPENDIX I

MIDDLE ARM AT LOW TIDE - SHOWING PROPOSED DAM SITE & EXTENT OF MUD FLATS



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Tailings beach at half tide - opposite plant site.



Middle Arm Upper Reaches at half tide.



Typical beach on Eastern shore at high tide.

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Navigation lock site - showing sandstone bedrock.



River bank at high tide - adjacent to lock site.

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View from Land Development Site at High Water.



View from Land Development Site at Low Water.



Land Development Site - Stage I.

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APPENDIX II

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EXTRACT FROM TAMAR REGIONAL MASTER PLANNING AUTHORITY'S

OUTLINE DEVELOPMENT PLAN FOR MIDDLE ARM

MIDDLE ARM

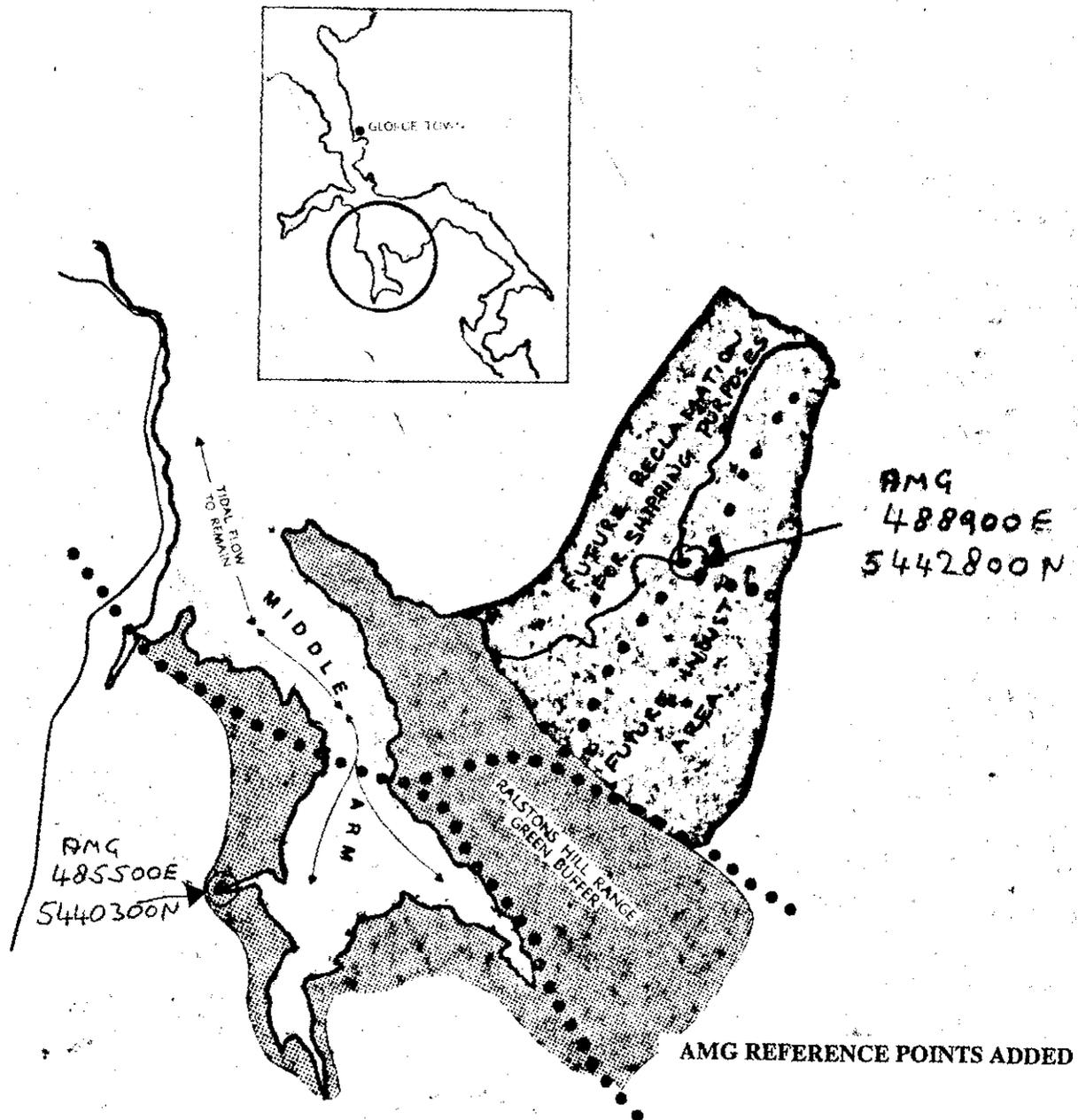
Map No. 8

This industrial area is to be served by new roads and rail as shown on the map and is to be physically buffered off from the Beaconsfield living area by the Ralstons Hill Range which will form part of a regional park around Middle Arm. It is intended that Middle Arm should remain tidal. The proposed new road link across the neck would be constructed in causeway and bridging form with a sufficient bridge gap to allow easy access to small craft and tide movements.

The town sites of Beaconsfield and Beauty Point are shown as being eventually joined to form one integrated area between Middle Arm and West Arm, set back from each by considerable future public open space.

MIDDLE ARM

MAP No. 8



AMG REFERENCE POINTS ADDED



PROJECTED PARK



PROJECTED RAIL GROUND

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APPENDIX III

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APPENDIX III

E. E. RICHARDS PTY. LTD.

AFTER HOURS:
J. F. MARTIN R.E.I.V. (AUST.),
O.R.V. 44 1244
D. C. YOUNGMAN 31 1810

PROPERTY CONSULTANTS, VALUERS, ESTATE AGENTS, AUCTIONEERS
AGENTS FOR:
AUSTRALIAN GENERAL INSURANCE CO. LTD.
RENTALS COLLECTED AND ARRANGED

TELEPHONE 31 3033
46 BRISBANE STREET
LAUNCESTON, TAS. 7250

REPORT

PROPOSED SUB-DIVISION

MIDDLE ARM

BEACONSFIELD

Pursuant to your instructions I have inspected the Middle Arm section of the Tamar River and the adjoining land on its western boundary and wish to report as follows:-

SITUATION The subject property under review is situate approximately 1½ miles east of the Township of Beaconsfield and 23 miles from Launceston with access via the West Tamar Highway and the Rowella Road which is close to the Batman Bridge provides close access to the East Tamar Highway.

EXISTING POTENTIAL FOR SUB-DIVISION The land fronting onto the foreshore reserve along the western section of Middle Arm is elevated and the majority is under pasture. However, this section of the River Tamar is most unattractive particularly at low tide and in my opinion a rural sub-division in its present state would be uneconomical as the cost of the land purchased together with the development costs would greatly exceed the gross realisation of the sale of the individual allotments.

PROPOSED RECLAMATION DEVELOPMENT After numerous inspections I consider the best and most economical method of developing the site would be as follows:-

- (1) Acquire all the frontage land around the western section of Middle Arm to Brandy Creek (marked B plan 1 on the enclosed plan) to a depth of approximately 1000', a distance of 4600' or thereabouts. The point of commencement being the Rowella Road approximately 600' above the existing tailings dump. The owners of the land in this section are G. Walker who owns 84ha and P. Tenby who owns 22ha and the 1972 Government Valuations are \$26,800 and \$5,300 respectively.



2. Reclaim the first section of Middle Arm (marked C Plan 2) to a height of approximately 6' above high water mark and limit the width of the reclaimed land to 350'. It is essential that the building sites on the already established land is kept as close as possible to the final water line.

It would be an advantage if the reclaimed land could be sloped from the existing foreshore reserve to the new frontage as most existing frontages are 10' to 15' above the foreshore reserve.

The main reasons for the limited width of the reclaimed section are:-

- (a) To ensure a reasonable expanse of water across this narrow section of Middle Arm.
- (b) It is considered unlikely that a building permit or septic tank would be granted over the reclaimed land for many years, so this section would be best suited to beautification in green pastures, ornamental trees, recreation facilities (e.g. Sailing Clubs etc.) but still be within easy walking distance to the higher land where the future residences will be constructed.

3. The building sites and the 18' sealed carriageway all to be sited on the land to be purchased as per recommendation No. 1. The majority of this land in this area from the gravel roadway to Brandy Creek has an 8' to 15' rise from the foreshore and a gentle slope from the foreshore to the top of the slope varying between one in seven and one in fifteen. This ensures that the majority of the allotments would have an unrestricted view over the water and to the eastern mountains.

4. It is considered that a Low Density Development would be the most desirable and this would probably allow for septic tank approval and a simple 18' sealed carriageway together with open drains and culverts. On present day costing this charge would be in the vicinity of \$12.00 per foot. Unfortunately it is impossible to state what the minimum areas of each allotment could be, this would depend on the Health Department report on the absorption capacity of the ground. The soil varies but it would appear that the majority is dry loamy sloping banks but some is wet and it appears that several springs are located in this particular section.

The most desirable areas would be between one and five acres but larger allotments would be necessary in the wet sections.

5. It is advised that a water supply would be available from the West Tamar Regional Supply but it would be necessary to run a main from Beaconsfield, a distance of approximately 1½ miles.

6. Immediate application to be made for septic tank approval from the Health Department for the first section of the development. If a cluster development is later desirable as the sub-division advances to higher land then it could be possible to connect to the proposed sewerage system for Beaconsfield. I have endeavoured to ascertain when this installation is to commence but at the time of writing cannot obtain any definite date.

Brandy Creek establishes where the first section of the sub-division must finish as the bridging of this gulf would be very costly. However, if felt desirable it would be possible to commence the second section of the proposal (See plan 1 marked D) from Bowens Jetty Road running south to Brandy Creek. It would be necessary to purchase a strip 60' wide to the Public Road on Bowens Jetty Road to obtain access together with the strip 1000 feet wide running along the existing foreshore. The length of roadway for this section would be approximately 2600 feet. This proposed development would be confined within the boundaries of the property owned by H. de Runter who has a total area of 85ha.

The Government Valuation dated 1972 is \$19,000 but I consider that this property would be very difficult to purchase at any reasonable price.

GENERAL COMMENTS & RECOMMENDATIONS

If the proposal is to proceed it would be essential to purchase the subject land as soon and as quietly as possible. The enclosed plan shows the total holdings and the existing Government Valuations. It would naturally be more economical to only purchase the 1000' strip around Middle Arm together with the 60' strip to Bowens Jetty Road.

The present day costs of the development would be:-
Roadway and culverts etc. \$12.00 per foot
Water Reticulation \$4 per foot
Road design and Survey \$250 per allotment

If the Middle Arm development with the dam is completed to ensure that the large expanse of water (marked E see plan 2) has a depth of approximately 10' with access to a Marina 24 hours a day, it would be possible to obtain prices ranging between \$5,000 and \$12,000 per allotment depending on the areas available.

It is impossible to give an accurate assessment of the number of allotments that would be available if the two sections were fully developed in a low density design with total septic tank permits over the full section. The minimum number should not be less than 90 blocks but could be extended to 150 to 170 if one acre sites are approved.

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APPENDIX III

- 4 -

It is estimated that the selling period would be approximately 20 to 25 allotments a year but this could be greatly increased if the initial promotion is a success and several desirable homes are commenced immediately (e.g. Successful Danbury Park low density development at Cormiston.).

I feel the location would appeal to retired couples, people working in Launceston who design a water frontage allotment with good moorings, executive employees at Bell Bay and George Town with access over Batman Bridge and local residents.

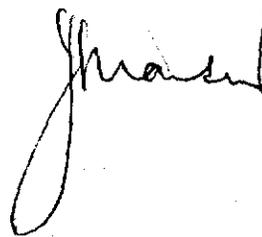
Before a feasibility study can be made it is essential to be supplied with some costings on the reclaimed development together with an approved sub-divisional proposal providing individual areas of each allotment.

The three plans enclosed show:-

PLAN 1 The respective owners of the subject properties with the first proposal marked red and the second marked green.

PLAN 2 Showing proposed boundaries for reclamation area and the proposed roadway.

PLAN 3 Showing extension of the reclamation area if there is more fill available than for the first section.



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APPENDIX IV

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9th June, 1975

Mr. A.F. Jordan,
Deputy General Manager,
Quarry Operations & Mining,
Blue Metal Industries,
70 Pitt Street,
SYDNEY N.S.W. 2000

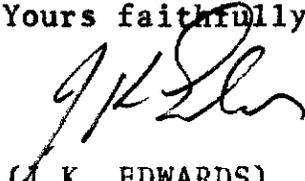
Dear Sir,

MIDDLE ARM MINING - RECLAMATION & MARINA PROPOSALS
STAGE I - FEASIBILITY STUDY

Appendix IV "Ecology Report" was omitted from this report awaiting its submission by the Director of the Queen Victoria Museum and Art Gallery.

This has now been received and I enclose a copy for insertion.

Yours faithfully,


(J.K. EDWARDS)
PORT MANAGER

JKE/NH
Encl.

c.c. Mr. A.T. Mearing.

038
MIDDLE ARM MINING - RECLAMATION & MARINA PROPOSALS
STAGE I - FEASIBILITY STUDY

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APPENDIX IV

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QUEEN VICTORIA MUSEUM AND ART GALLERY

TELEPHONE 31 6777
AREA CODE 003

WELLINGTON STREET,
LAUNCESTON,
TASMANIA, 7250
AUSTRALIA

6th June, 1975.
~~23rd May, 1975.~~

Mr. J. K. Edwards,
Port Manager,
Port of Launceston Authority,
P.O. Box 257C,
LAUNCESTON, Tasmania. 7250.

Dear Mr. Edwards,

Middle Arm Environmental Study

Arising from our discussions, I enclose a report on a biological survey of the Western Inlet in Middle Arm taken on behalf of your Authority. The examination was extended to West Arm for comparative purposes.

The Middle Arm region appears to be a significant fish-breeding area, with a pronounced high density of young fish and their invertebrate food species.

One new species of flounder (yet unnamed) has been located and a general examination of material collected suggests that the area might well include some other yet identified species or distribution records.

The formation of a freshwater system by a barrage or significant alteration to the topography of the bottom of the inlet would cause this ecosystem to be severely affected. Obviously, flounder and other benthic species would not survive in a freshwater pool nor would they surmount a weir raised within a few feet of high-water level.

The area does not appear to be of unique significance as a breeding or feeding area for birds and mammals, which would be expected to retreat to nearby fauna sanctuary areas which have been recommended to the Tamar Regional Master Planning Authority.

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Page 2
Mr. J. K. Edwards
23rd May 1975.

The ecological consequences of the developments under consideration appear to be a possible loss of a fish-breeding area which would have some impact on the surrounding region. The permanence of any effect is difficult to predict but it must be anticipated that turbidity from dredging and drainage would temporarily interfere with fish-breeding, possibly with permanent effects.

There is also a need to extend the biological examination, particularly in invertebrate species and marine plants, and to undertake representative samples adequate for future reference.

Yours faithfully,



W. F. Ellis,
Director.

MIDDLE ARM TAMAR RIVER, FAUNA SURVEY: 1975

Purpose: To assess fauna associated with the tidal flats of an area of Middle Arm, Tamar River, with regard to its importance as a faunal unit.

Historical background: The original nature of the tidal flats was altered by the release of tailings from the Beaconsfield mine about seventy years ago. Since mining operations ceased, a secondary silt deposit has been laid down on top of the tailings and is now of sufficient depth and age to have restored the environment to a condition, probably superficially similar to the original state.

The present fauna: Though useful information has been obtained, more time and resources would be required, ideally over a year, to cover the seasonal influences and subsequent faunal variations. A brief investigation has shown that the area belies an initial impression of being a stagnant and sterile tidal mud flat and is, in fact, rich in animal life. The importance of its contribution to the whole of the Tamar River system cannot be postulated without further data, both locally and in other areas of the river. Peripheral species (such as shore line bush birds) have been excluded.

Birds: Black Swans Cygnus atratus and several species of ducks occur and feed in the waters of Middle Arm, their occurrence and numbers fluctuating considerably with seasonal and tidal conditions, as is typical for this group of birds. Black Duck Anas superciliosa, Grey Teal A. gibberifrons and Chestnut Teal A. castanea are commonly encountered. On the occasion of the visit of 26th February, a pair of Blue-billed Duck Oxyura australis was observed, a species rarely recorded in Tasmania.

The Little Pied Cormorant Phalacrocorax melanoleucus is common and no doubt other cormorant species occur at times. Its occurrence is a good indication of the presence of small fish in considerable numbers. Silver Gulls Larus novaehollandiae and Pacific Gulls L. pacificus are both numerous, the former occurring in hundreds and the latter in dozens and well distributed over the area at low tide feeding upon small fish, crustaceans etc.

Spurwinged Plovers Lobibyx novaehollandiae are commonly found feeding over the mud at low tide, up to one hundred individuals at one time. Oystercatchers, both Pied Haematopus ostralegus and Sooty H. unicolor feed there at low tide, up to a dozen being normal.

A White Egret Egretta alba was seen feeding during low tide on 5th March.

White-faced Heron Notophox novaehollandiae is common, solitary individuals occurring all over the flats at low tide, the total on each of the two visits probably being about twenty.

Fish: Collecting was limited to the drains and residual ponds in the intertidal zone, during the period of low tide. No attempt has been made to collect fish entering the area during periods of high tide. However, it seems reasonable to expect that there would be a considerable influx of species and individuals feeding on smaller fish and crustaceans during the bi-daily access. The abundance of small fish species and the juveniles of large species was surprising as a superficial view of streams and residual ponds revealed little of importance, very few fish being seen. It was not until concentrated collecting was undertaken that the true situation was found as, during the period of low tide, the fish remain in crab holes and natural crevices, or simply wallow beneath the surface of the mud. Such shelter provides protection from predators and the effects of sunlight and heat. Middle Arm appears to be a good breeding area for flounders. Species collected and lodged in the collection of the Queen Victoria Museum are as follows:

Native Trout Galaxias maculatus - very numerous in all the drainable areas, extending from low water to above high water. A Flounder - widely distributed and numerous as small juveniles which is a species previously unknown.

Long-snouted Flounder Ammotretis rostratus - widely distributed and extremely numerous as small juveniles. The area is an important breeding area for this flounder.

Freshwater Mullet Aldrichetta forsteri - numerous in drainage ways from low tide to above high tide. Only juveniles remain in the intertidal zone behind the falling tide.

Tamar Hardy head Taeniombras tamarensis - common in all the drainage ways.

Tommy Ruff Arpipis georgianus - two small juveniles were collected from a drainage way.

Tamar Goby Gobius tamarensis - extremely numerous all over the area, in drainage ways, residual pools and anywhere that free water remained. This was the most numerous species.

Bridled Goby Gobius bifrenatus - found in one residual pool only. This was at about the mid-tide level and there the species was very numerous. It was not found in drainage ways and appears to favour still, warm water where it buries itself in the mud in the bottom of the pools. The species has been recorded from Tasmania previously but has not

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previously been recorded from the Tamar region.

Cobbler Gymnapistes marmoratus - a series of small juveniles was collected from the high tide level where a stream enters the tidal zone.

Short-finned Eel Anguilla australis - found in one residual pool near high tide where decaying timber provided good cover. Several dozen were present, all adult and had been feeding upon crabs.

Crustaceans: The collections and general observations for the crustaceans are similar to those previously expressed for the fish. The group in general is near the bottom of the zoological food chain and forms a major part of the diet of the vertebrate predators. Determinations for some individual species have not been possible in the limited time available to work on the collections but the following list gives an indication of the composition of this group of animals.

Smooth Shore Crab Paragrapsis laevis - common all round the shore about high tide where it lives beneath stones and debris. Mud crab Helice haswellianus - very common and very numerous, living in holes in the mud flats throughout the area.

Crab (family OCYPODIDAE) Hemiplax? sp. - common and very numerous, living in mud holes all over the tidal flats.

Snapping Prawn Cragon sp. - common and widely distributed, living in holes beneath the mud.

Prawn species (yet to be determined) - very numerous in some residual pools at high tide mark.

Mantis Shrimp (yet to be determined) - one specimen collected just below high tide mark.

River Flea (Suborder GAMMARIDAE) - this tiny crustacean (2 to 3mm) is extremely common over the tidal zone and probably is one of the main sources of food for the large juvenile fish population.

Sessile barnacles are common on wood and stones all over the area.

Molluscs: Several species of gastropod molluscs were found and still await determination. One of these was particularly numerous and observed to be a carnivorous scavenger capable of quickly locating and devouring dead fish. Pacific oysters occur densely on rocks in some areas.

Worms: Several species (yet to be determined) of marine worms were collected from beneath the mud. They were found to be quite common, the mud being riddled with their tunnels.

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APPENDIX V

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ESTIMATES OF COSTAPPENDIX VPROPOSAL 1 - MINING OPERATION

ITEM	Quantity Units	Unit Rate \$	\$
1. <u>Construct Dam :</u>			
Dredge & pump soft material -	40,000 cy	0.80	32,000
Rock fill	70,000 cy	3.00	210,000
Clay fill core	9,000 cy	6.00	54,000
Concrete cut off	1,200 cy	100.00	120,000
2. Construct Lock	Item	-	150,000
3. Dry Tailings ex stockpile, load & transport to plant	142,000 cy	0.40	56,800
4. Tailings ex river bed, Dredge & pump to plant	461,500 cy	0.80	369,200
5. Return processed tailings to bunds & reclamation	603,500 cy	0.40	241,400
6. Deepen marina to R.L.+1.00' and pump to reclamation	24,700 cy	0.80	19,760
7. Deepen access channel & pump to reclamation	61,000 cy	0.80	48,800
8. Site clean up & landscape	Item	-	20,000
			<hr/> 1,321,960
Contingency 10%			132,196
			<hr/> \$1,454,156 =====

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APPENDIX VPROPOSAL 1 - LAND PURCHASE & DEVELOPMENT

ITEM	QUANTITY UNITS	UNIT RATE \$	\$
<u>STAGE I - Middle Arm Creek to Brandy Creek.</u>			
1. Purchase land	43 Ha	744.00	32,000
2. Construct Road	4600 ft	12.00	55,200
3. Water main	12,600 ft	5.00	63,000
4. Sewage & drainage	Item	-	50,000
5. H.E.C. Power	2 mile	5000.00	10,000
6. Block survey & design	53 No.	250.00	13,250
7. General clean up & landscaping	43 Ha	185.00	7,950
Sub-total			231,400
8. Administration, Publicity, etc.	3%	-	6,940
			238,340
Contingency 10%			23,834
<u>TOTAL (A)</u>			\$262,174
			=====
Additional - Jetties	2 No.	10,500	21,000
- Ramp	1 No.	8,000	8,000
			29,000
Contingency 10%			2,900
<u>TOTAL (B)</u>			\$ 31,900
			=====
<u>TOTAL (A) + (B)</u>	=		\$294,074
			=====
<u>STAGE II - Brandy Creek to Dam Site</u>			
1. Purchase land	30 Ha	744.00	22,320
2. Construct road	4600 ft	12.00	55,200
3. Water Main	4600 ft	5.00	23,000
4. Sewage & drainage	Item	-	35,000
5. H.E.C. power	1 mile	5000.00	5,000
6. Block survey & design	37 No.	250.00	9,250
7. General Clean up & landscape	30 Ha	185.00	5,550
Sub total			155,320
8. Administration & Publicity, etc.	3%	-	4,660
			159,980
Contingency 10%			15,998
			\$175,978
			=====
THEREFORE, TOTAL LAND PURCHASE & DEVELOPMENT STAGES I & II :-			
Stage I			294,074
Stage II			175,978
<u>GRAND TOTAL</u>	\$470,052
			=====
<u>RETURN FROM SALE OF LAND</u>	\$950,000
			=====

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APPENDIX V

PROPOSAL 2 - MINING OPERATION

ITEM	QUANTITY UNITS	UNIT RATE \$	\$
1. Dry tailings ex stockpile 1, load & transport to plant	142,000 cy	0.40	56,800
2. Tailings ex river bed, Dredge & pump to plant	461,500 cy	0.80	369,200
3. Return processed tailings to bunds & reclamation	603,500 cy	0.40	241,400
4. Deepen marina to R.L.-5.00' & pump to reclamation	98,000 cy	0.80	78,400
5. Deepen access channel to R.L.-5.00' & pump to reclamation	163,600 cy	0.80	130,800
6. Dredge for flotation & pump to reclamation	167,500 cy	0.80	134,000
7. Site clean up & landscape	Item	-	20,000
			<u>1,030,600</u>
Contingency 10%			<u>103,060</u>
			<u>\$1,133,660</u> =====

PROPOSAL 2 - LAND PURCHASE & DEVELOPMENT

ITEM	QUANTITY UNITS	UNIT RATE \$	\$
1. Purchase land	43 Ha	744.00	32,000
2. Development costs	-	-	-
TOTAL			<u>\$32,000</u> =====
<u>Sale of reclamation & previously purchased land</u>	52.3 Ha	744.00	<u>\$38,900</u> =====

PROPOSAL 3 - MINING OPERATION

ITEM	QUANTITY UNITS	UNIT RATE \$	\$
1. Dry tailings ex stockpile, load & transport to plant	142,000 cy	0.40	56,800
2. Tailings ex river bed:			
- Recover using Scraper	461,500 cy	0.30	138,300
- Load & transport to plant	461,500 cy	0.40	184,600
3. Return processed tailings to bunds & reclamation	603,500 cy	0.40	241,400
4. Site clean up & landscape	Item	-	20,000
			<hr/> 641,100
Contingency 10%			64,110
			<hr/> \$705,210
			=====

PROPOSAL 3 - LAND PURCHASE & DEVELOPMENT

Assume exchange of land covers riparian rights.

049

APPENDIX VI

A
P
P
VI

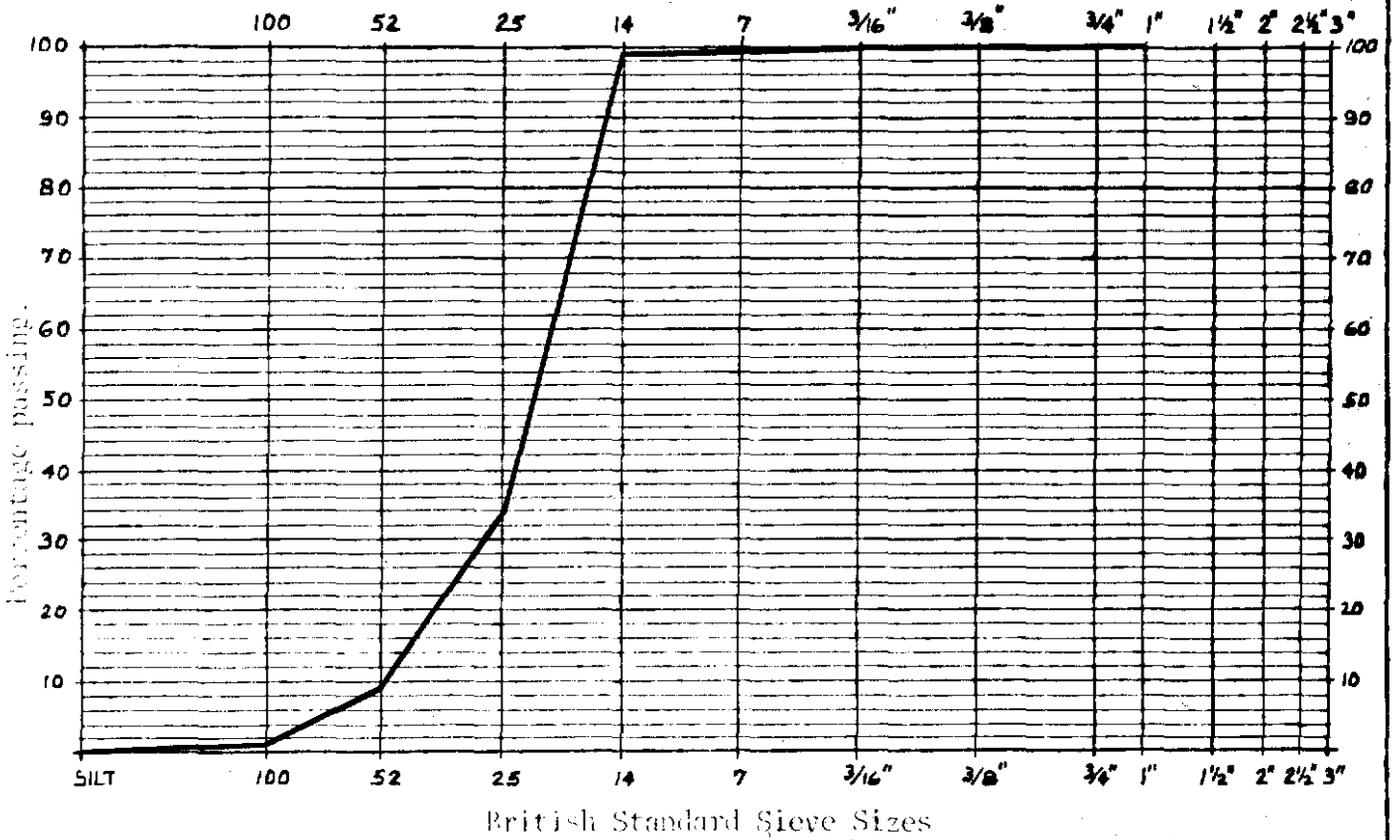


050

323052

PORT OF LAUNCESTON AUTHORITY

MATERIAL SIEVE ANALYSIS GRADING



SAMPLE NO. A1 MIDDLE ARM

SAMPLE WT. 3 lb. 14 oz. Dry

TAILINGS SAMPLE 0.5 FT. BELOW SURFACE.

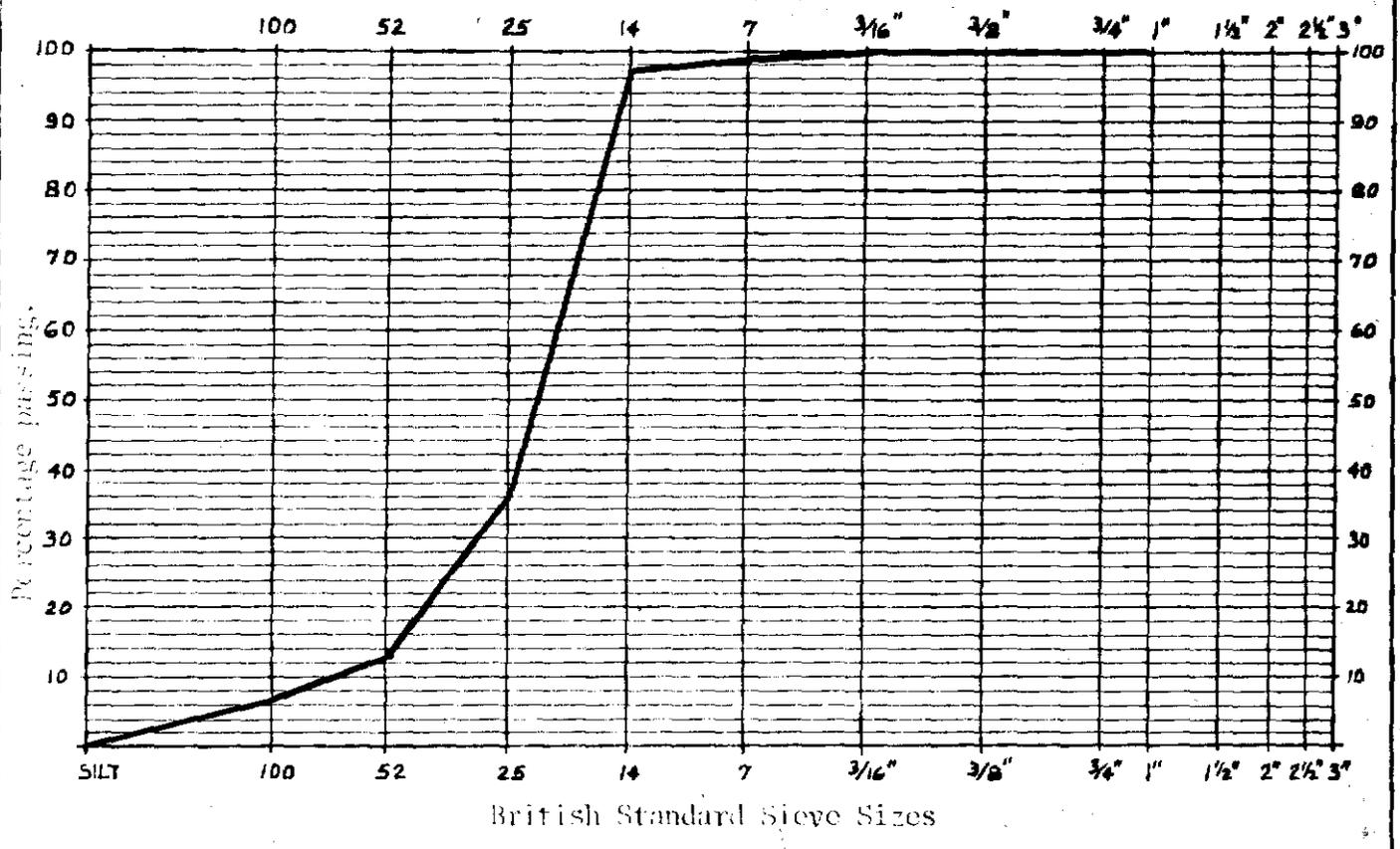
REFER DRG. 271-20 FOR LOCATION.

Sieve size B.S.S.	Weight Retained lbs. oz.	% Retained	% Passing
1"	-	-	100
3/4"	-	-	100
5/8"	-	-	100
3/16"	-	-	100
No. 7	0 - 0.25	0.4	99.6
No. 14	0 - 0.25	0.4	99.2
No. 25	2 - 9	66.1	33.1
No. 52	0 - 0.15	24.2	8.9
No. 100	0 - 4.75	7.7	1.2
FIN	0 - 0.75	1.2	-

051

PORT OF LAUNCESTON AUTHORITY
MATERIAL SIEVE ANALYSIS GRADING

20003



SAMPLE NO. A2 MIDDLE ARM
SAMPLE WT. 4 lb. 2.5 oz. Dry

TAILINGS SAMPLE 2.5 FT. BELOW SURFACE.

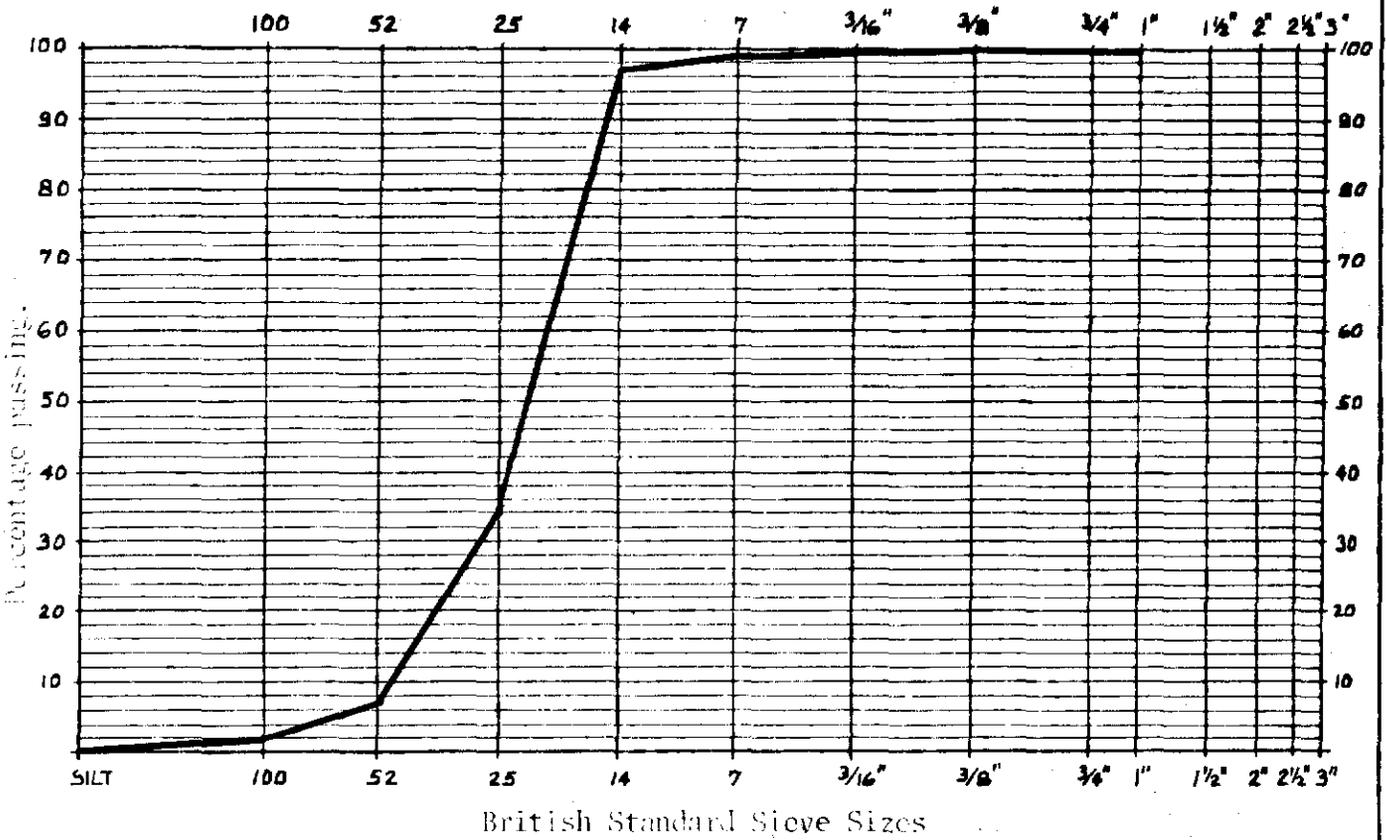
REFER DRG. 271-20
FOR LOCATION.

Sieve size B.S.S.	Weight Retained lbs. oz.	% Retained	% Passing
1"	-	-	100
3/4"	-	-	100
3/8"	-	-	100
3/16"	-	-	100
No. 7	0 - 0.5	0.8	99.2
No. 14	0 - 1.25	1.9	97.3
No. 25	2 - 8.75	61.2	36.1
No. 52	0 - 15.5	23.3	12.8
No. 100	0 - 4.125	6.2	6.6
FIN	0 - 4.375	6.6	-

052

PORT OF LAUNCESTON AUTHORITY

MATERIAL SIEVE ANALYSIS GRADING



SAMPLE NO. B1 MIDDLE ARM
 SAMPLE WT. 4 lb. Dry

TAILINGS SAMPLE 1.5 FT. BELOW SURFACE.

REFER DRG. 271-20 FOR LOCATION.

Sieve Size B.S.S.	Weight Retained lbs. oz.	% Retained	% Passing
1"	-	-	100
3/1"	-	-	100
3/3"	-	-	100
3/16"	0 - 0.125	0.2	99.8
No. 7	0 - 0.5	0.8	99.0
No. 14	0 - 1.25	2.0	97.0
No. 25	2 - 8	62.4	34.6
No. 52	1 - 1.25	27.0	7.6
No. 100	0 - 3.625	5.6	2.0
25	0 - 1.25	2.0	-

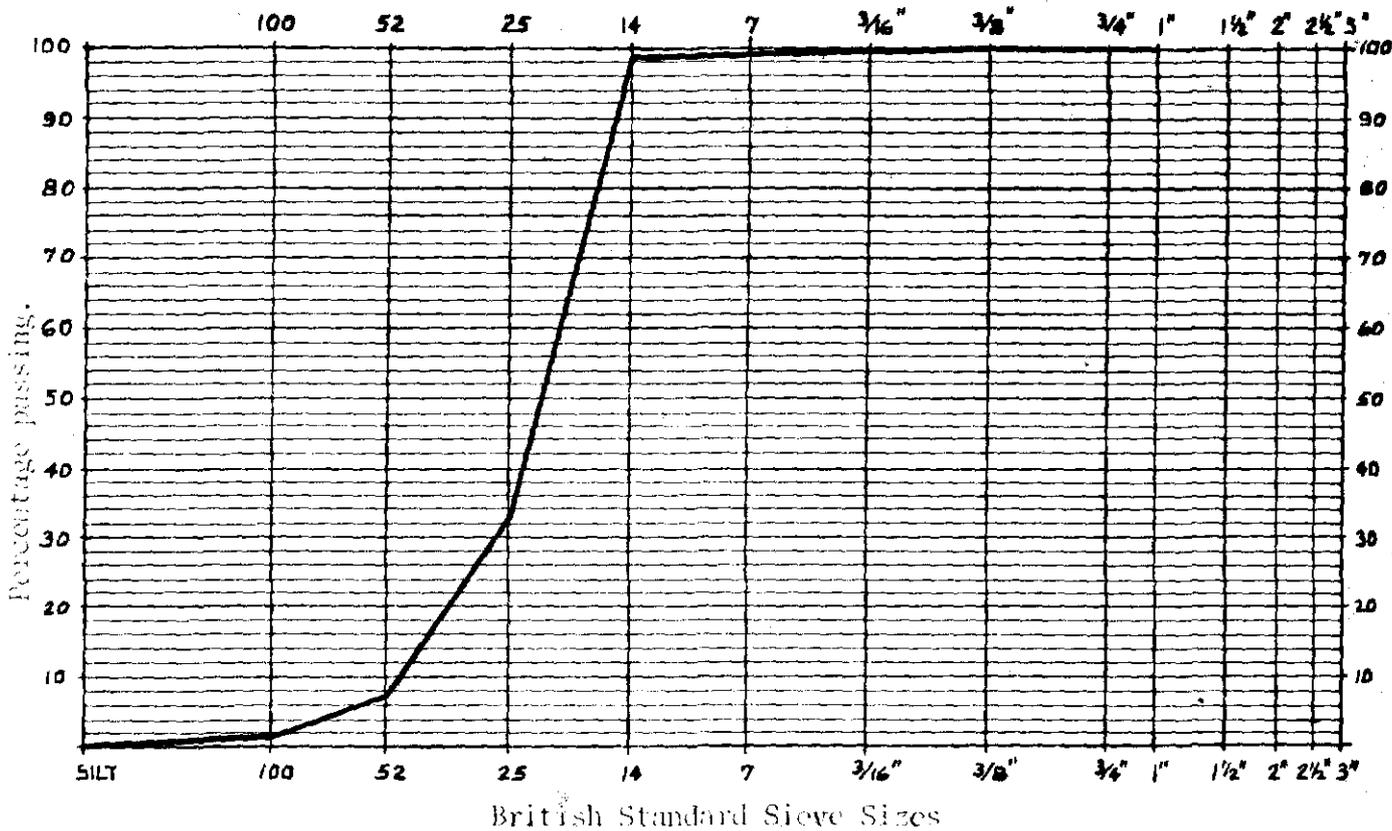
120014

053

PORT OF LANCASTON AUTHORITY

MATERIAL SIEVE ANALYSIS GRADING

523055



SAMPLE NO. B2 MIDDLE ARM
 SAMPLE WT. 3 lb. 7 oz. Dry

TAILINGS SAMPLE 2.5 FT. BELOW SURFACE.

REFER DRG. 271-20 FOR LOCATION.

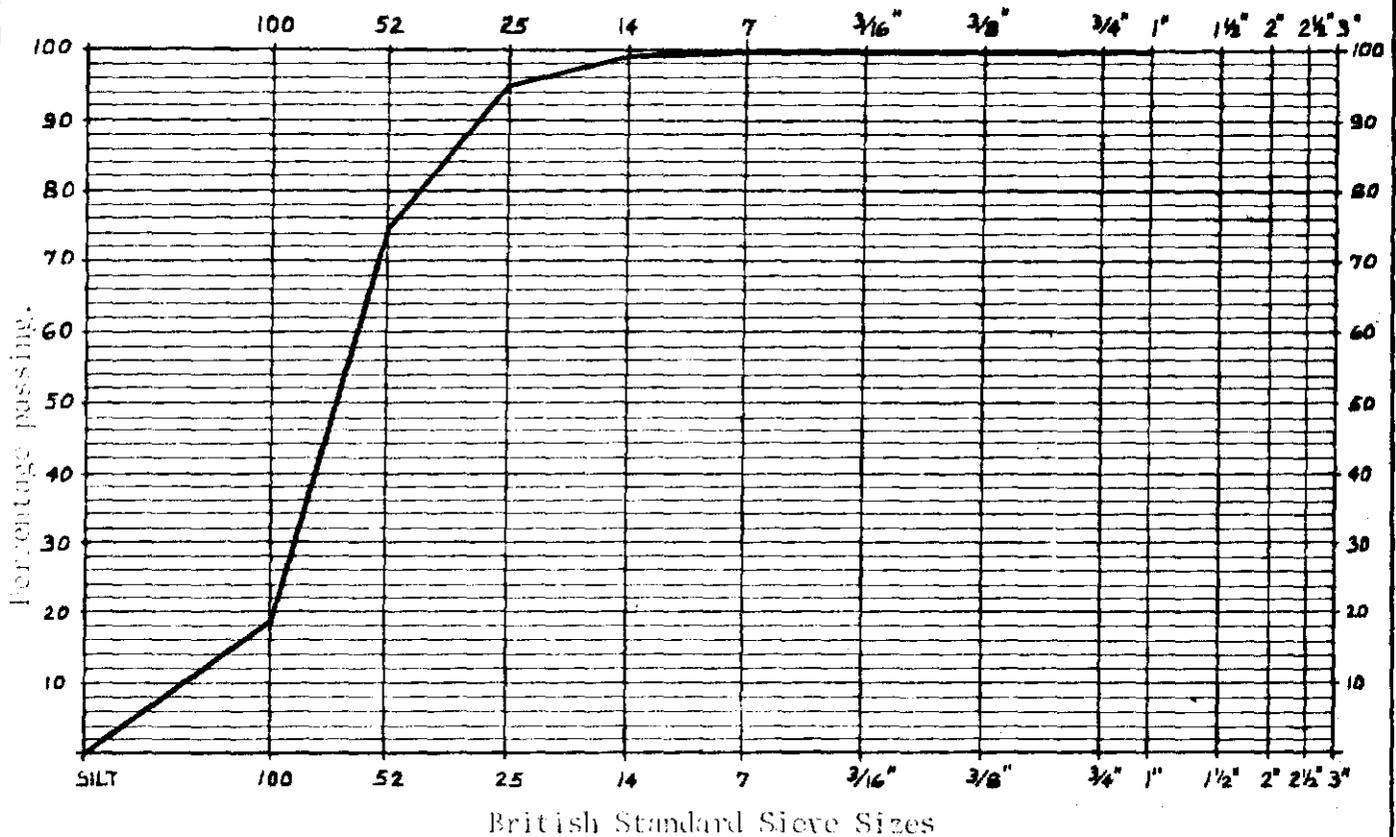
Sieve size B.S.S.	Weight Retained lbs. oz.	% Retained	% Passing
1"	-	-	100
5/16"	-	-	100
3/8"	-	-	100
3/16"	0 - 0.125	0.2	99.8
No. 7	0 - 0.125	0.2	99.6
No. 14	0 - 0.25	0.5	99.1
No. 25	2 - 4.5	66.4	32.7
No. 52	0 - 13.875	25.2	7.5
No. 100	0 - 3.25	5.9	1.6
PAN	0 - 0.875	1.6	-

055

PORT OF LAUNCESTON AUTHORITY

MATERIAL SIEVE ANALYSIS GRADING

523057



SAMPLE NO. C2 MIDDLE ARM
 SAMPLE WT. 4 lb. Dry

TAILINGS SAMPLE 4 FT. BELOW SURFACE.

REFER DRG. 271-20 FOR LOCATION.

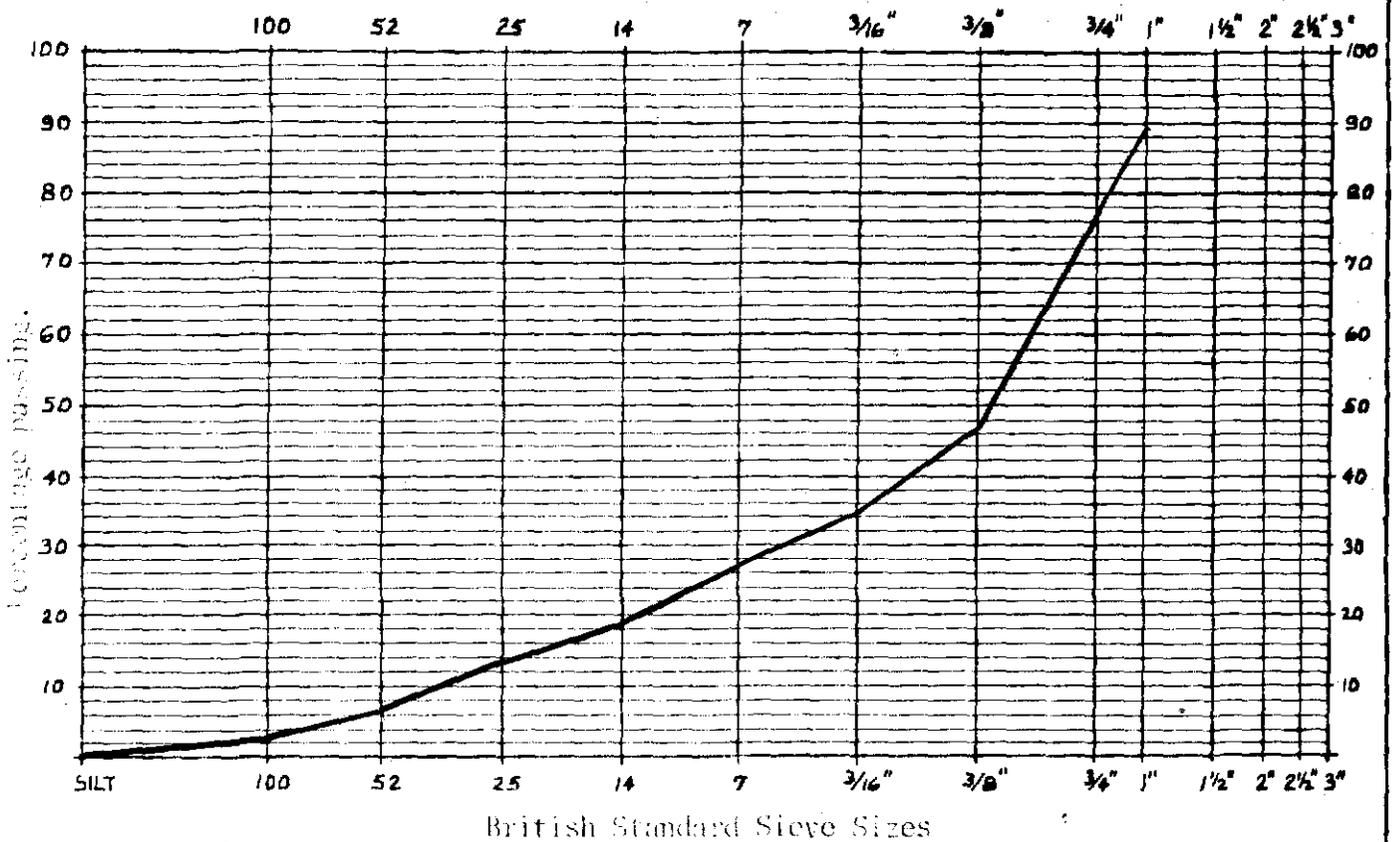
Sieve size B.S.S.	Weight Retained lbs. oz.	% Retained	% Passing
IN	-	-	100
3/4"	-	-	100
3/8"	-	-	100
3/16"	-	-	100
No. 7	-	-	100
No. 14	0 - 0.25	0.4	99.6
No. 25	0 - 3	4.7	94.9
No. 52	0 - 13.25	20.6	74.3
No. 100	2 - 3.75	55.9	18.4
FIN	0 - 11.75	18.4	-

056

PORT OF LAUNCESTON AUTHORITY

MATERIAL SIEVE ANALYSIS GRADING

523058



SAMPLE NO. D1 MIDDLE ARM
 SAMPLE WT. 4.1b. Dry

FALLINGS SAMPLE TAKEN AT SURFACE CONTAINED SMALL FLOATERS OF MUD STONE FROM ADJACEMENT EMBANKMENT.

REFER DRG. 271-20 FOR LOCATION.

Sieve size B.S.S.	Weight Retained lbs. oz.	% Retained	% Passing
1"	0 - 6.875	10.7	89.3
3/4"	0 - 7.625	11.9	77.4
3/8"	1 - 3.75	30.9	46.5
3/16"	0 - 7.75	12.1	34.4
No. 7	0 - 4.5	7.0	27.4
No. 14	0 - 5.5	8.6	18.8
No. 25	0 - 3.25	5.1	13.7
No. 52	0 - 4.5	7.1	6.6
No. 100	0 - 2.5	3.9	2.7
FIN	0 - 1.75	2.7	-

057

523059

(8)

APPENDIX VI

R.P. 1144



DEPARTMENT OF MINES—TASMANIA

TELEPHONES:

Metallurgical Research	} 44 2431-2 (2 lines)
Laboratory	
Mines Inspection	
Explosives & Inflammable Liquids	

LAUNCESTON OFFICES
287 WELLINGTON STREET
SOUTH LAUNCESTON 7250

2nd April, 1975.

Part of Launceston Authority,
Esplanade,
LAUNCESTON, 7250 Tas.

Dear Sir,

The following are the results of water analyses on samples submitted by you on 20th and 28th February, 1975 and stated to be from Middle Arm Creek, Bencafield.

Res. Nos.	NO. 3		NO. 1		NO. 2	
	750130*		750181*		750206	
pH	8.2		7.7		7.7	
CO ₂	nil	mg/l	nil	mg/l	nil	mg/l
HCO ₃	200	"	140	"	320	"
Cl	110	"	16	g/l	53	"
SO ₄	300	"	2.2	"	310	"
F			0.8	mg/l	<0.5	"
SiO ₂	-		-		<5	"
Ca	140	"	550	"	165	"
Mg	25	"	1300	"	27	"
Fe	<0.1	"	<0.1	"	0.1	"
Al	<0.5	"	0.5	"	<0.2	"
K	3.5	"	400	"	3.0	"
Na	40	"	3	gm/l	30	"
Cu	<0.1	"	<0.1	mg/l	<0.1	"
Zn	<0.1	"	<0.1	"	<0.1	"
Pb	<0.1	"	<0.1	"	<0.1	"
Total dis. solids	330		30	g/l	840	
As	0.02	"			<0.01	"

* insufficient sample for determination of all elements

Date 20/2/75 20/2/75 28/2/75

Locality Middle Arm Creek

Analyses by

Fee: \$15-00

Yours faithfully,

(H.K. Wellington)
Chief Chemist & Metallurgist.

058

523060

(9)

APPENDIX VI

DEPARTMENT OF AGRICULTURE, TASMANIABACTERIOLOGY LABORATORY

B6/4/5

P.O. Box 407,
LAUNCESTON, Tas. 7250.

Date: 24th February, 1975.

To: Mr. D. Booth,
Port of Launceston Authority,
Esplanade,
LAUNCESTON.BACTERIOLOGICAL EXAMINATION OF WATERDETAILS OF SAMPLES

Sample collected by	Port of Launceston Authority		
Reason for requiring examination	Bacterial Quality		
Nature of sample	Not known		
Source of sample	Not known	BRANDY CREEK	NO. 1.
Date of sampling	20/2/75		
Time	-		
Date and Time of Arrival at Laboratory	20/2/75 3 p.m.		
Examination commenced	3.20 p.m.		
Other Details			
<u>RESULTS</u>			
Colony count per ml.	37°	18	
	20° - 22°	170	
Coliform count per 100 ml.	MPN MPN	450	
E. coli count per 100 ml.	MPN MPN	75	
Faecal streptococcus count per 100 ml.	MPN MPN	+/50 ml	

REMARKS

(Signed)


 (Bacteriologist)

059

523061

(10)

APPENDIX VI

DEPARTMENT OF AGRICULTURE, TASMANIA
BACTERIOLOGY LABORATORY

B6/4/5

P.O. Box 407,
LAUNCESTON, Tas. 7250.

Date: 24th February, 1975.

To: Mr. D. Booth,
Port of Launceston Authority,
Esplanade,
LAUNCESTON. 7250

BACTERIOLOGICAL EXAMINATION OF WATER

DETAILS OF SAMPLES

Sample collected by	Mr. D. Booth
Reason for requiring examination	Environmental impact study
Nature of sample	Sea Water
Source of sample	Bridge at Middle Arm Creek NO. 2
Date of sampling Time	19/2/75
Date and Time of Arrival at Laboratory	19/2/75 4.45 p.m.
Examination commenced	20/2/75 at 10.00 p.m.
Other Details	Stored overnight in refrigerator

RESULTS

Colony count per ml.	37°	1,600
	20° - 22°	4,000
Coliform count per 100 ml.	MF MM	approx. 600
E. coli count per 100 ml.	MF MM	400
Faecal streptococcus count per 100 ml.	MF MM	134

REMARKS

(Signed)
(Bacteriologist)

DEPARTMENT OF AGRICULTURE, TASMANIA
BACTERIOLOGY LABORATORY

B6/4/5

P.O. Box 407,
LAUNCESTON, Tas. 7250.

Date: 4th March, 1975.

To: Mr. D. Booth,
Port of Launceston Authority,
Esplanade,
LAUNCESTON, 7250

BACTERIOLOGICAL EXAMINATION OF WATER

DETAILS OF SAMPLES

Sample collected by	D. Booth	
Reason for requiring examination	Environmental Impact Study	
Nature of sample	Creek water	
Source of sample	Middle Arm Creek	NO. 3.
Date of sampling	27/2/75	
Time	p.m.	
Date and Time of Arrival at Laboratory	28/2/75 0940	
Examination commenced	0950	
Other Details	Sample stored overnight in refrigerator Sample bottle - clean and scalded sherry flagon	
<u>RESULTS</u>		
Colony count per ml.	37°	300
	20° - 22°	1100
Coliform count per 100 ml.	MF MPN	Approx. 3200
E. coli count per 100 ml.	MF MPN	530
Faecal streptococcus count per 100 ml.	MF MPN	200

REMARKS

(Signed)
(Bacteriologist)

060

APPENDIX VII

A
P
P.

VIA

061

PLAN No 1

MIDDLE HEAD

Scale 10 chains = 1 inch

5 cm

CAMPBELL SMITH, PHELPS, PEDLEY & ASSOCIATES REGISTERED SURVEYORS 60 ELPHIN ROAD, LAUNCESTON



PLAN No 1
523064

U. 063

PROPOSED DAM SITE

PROPOSED RECLAMATION AREA

PROPOSED

MIDDLE ARM

BRANDY CREEK

PROPOSED

RECLAMATION

AREA

PROPOSED

RECLAMATION AREA



Scale 300 Feet to an inch

X X

Rowella

PLAN N°3

Beaconsfield

Gravelled

PUBLIC ROAD

[271/7 P.L.A. reference
27/75]

523066

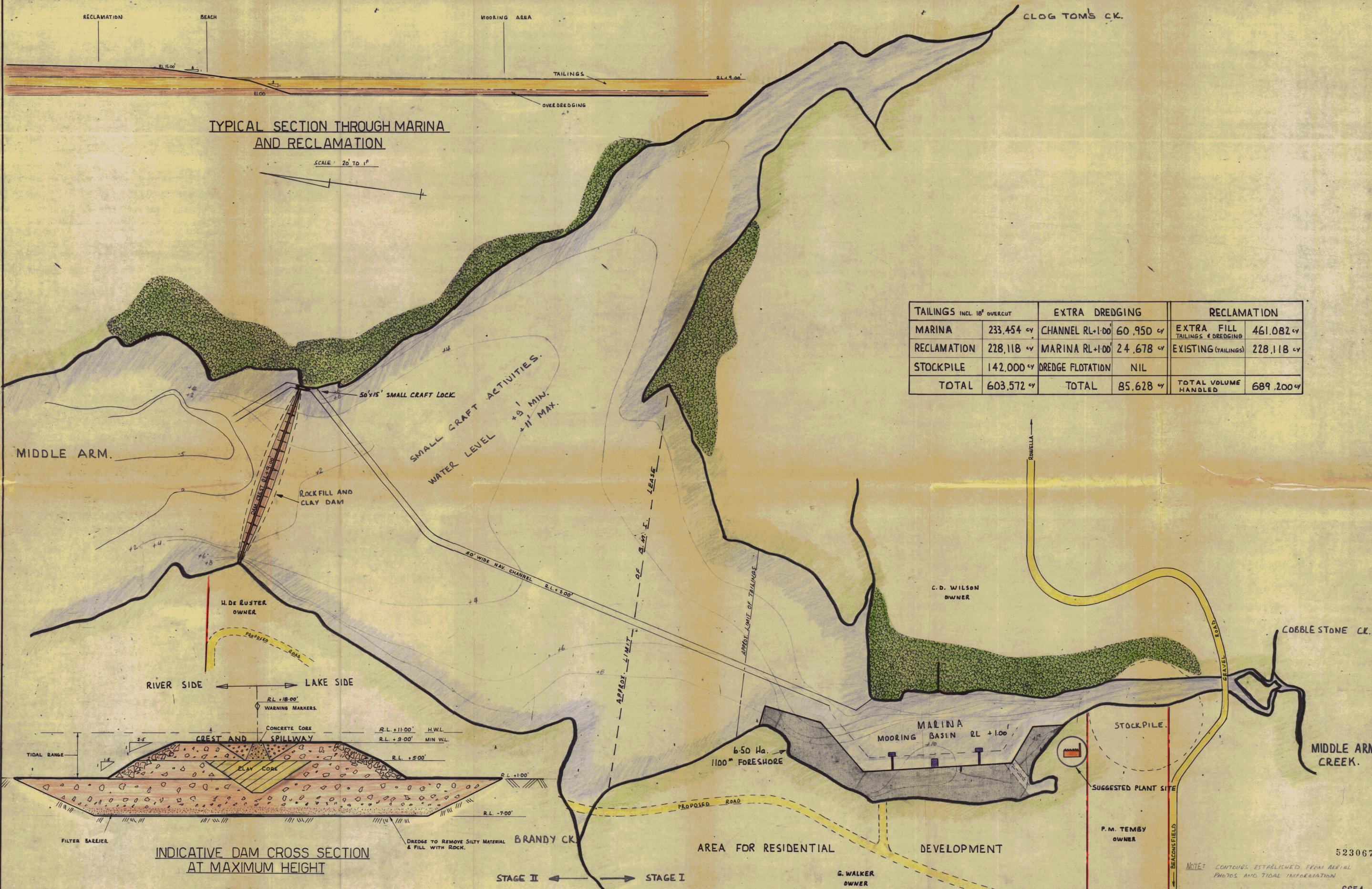
CAMPBELL SMITH, PHELPS, PEDLEY & ASSOCIATES REGISTERED SURVEYORS 60 ELPHIN ROAD, LAUNCESTON

April 1975

APPENDIX

TYPICAL SECTION THROUGH MARINA AND RECLAMATION

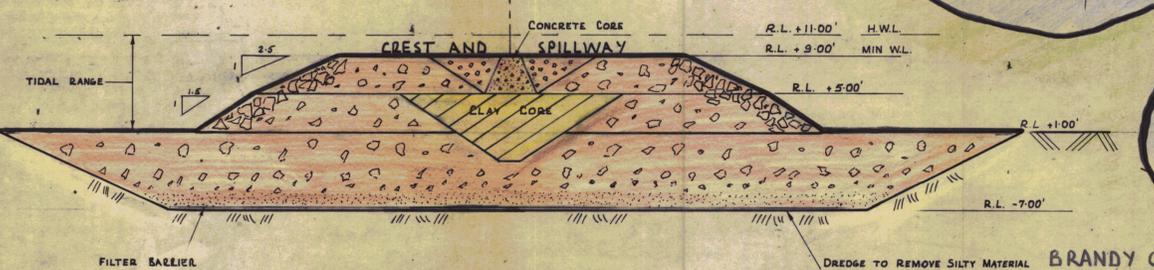
SCALE: 20' TO 1"



TAILINGS INCL. 10' OVERCUT		EXTRA DREDGING		RECLAMATION	
MARINA	233,454 cy	CHANNEL RL+1.00'	60,950 cy	EXTRA FILL TAILINGS & DREDGING	461,082 cy
RECLAMATION	228,118 cy	MARINA RL+1.00'	24,678 cy	EXISTING (TAILINGS)	228,118 cy
STOCKPILE	142,000 cy	DREDGE FLOTATION	NIL		
TOTAL	603,572 cy	TOTAL	85,628 cy	TOTAL VOLUME HANDLED	689,200 cy

INDICATIVE DAM CROSS SECTION AT MAXIMUM HEIGHT

SCALE: 1/8" = 1 FOOT



E		
D		
C		
B		
A		
DATE	AMENDMENTS	APD

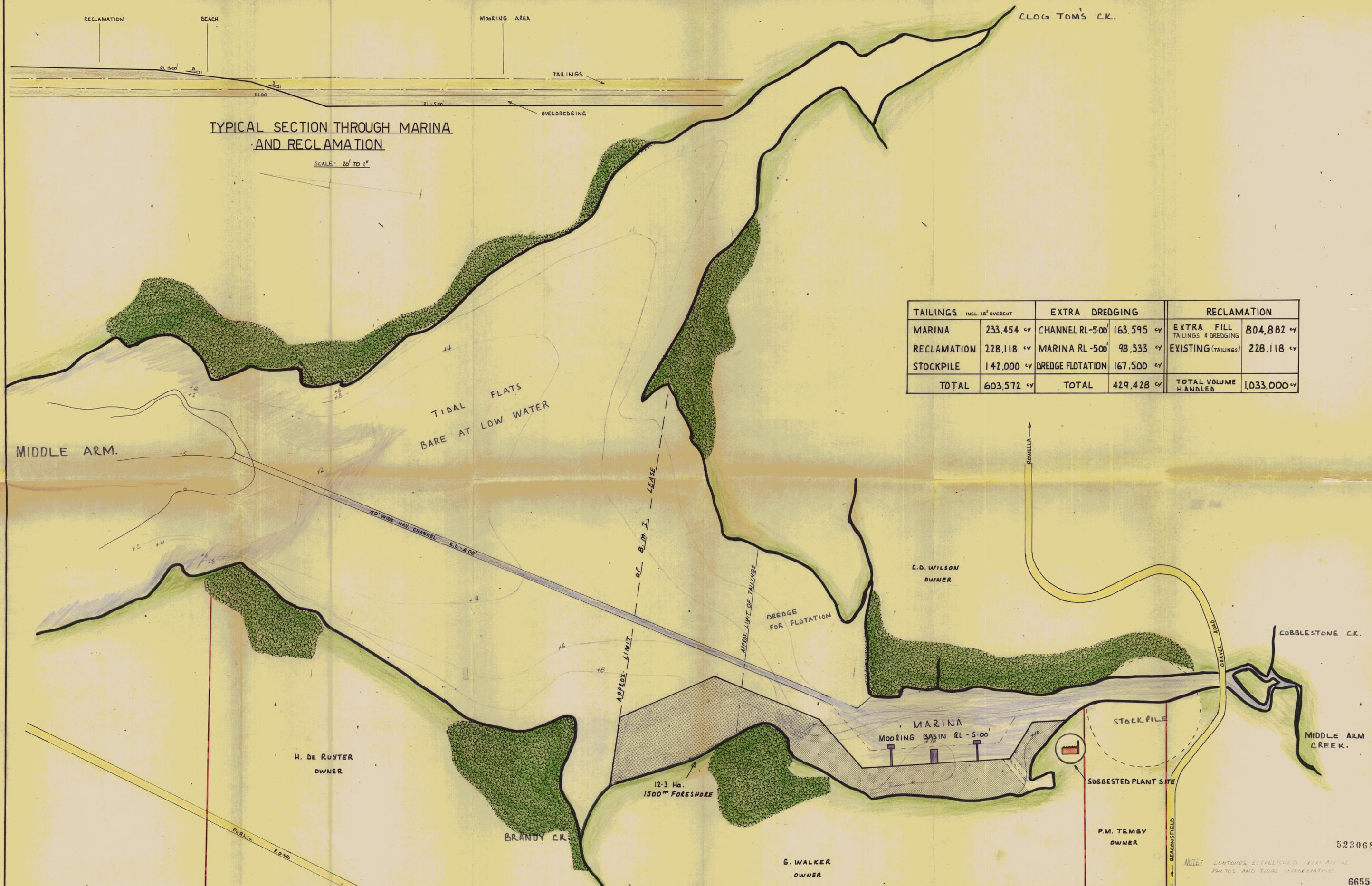
PORT OF LAUNCESTON AUTHORITY
 B.M.I. MINING - MIDDLE ARM DEVELOPMENT
 PROPOSAL 1.
 DAM CREST LEVEL RL+9.00' - CHANNEL RL+1.00' - BASIN RL+1.00' - RECLAMATION

SCALE: 1" = 300 FEET	DATE: 30-4-75
DESIGNED: D.P.C. G.W. F.B.	L.B.
DRAWN: G.W.	DATUM: L.A.T. GEORGETOWN
CHECKED: D.P.C.	DRAWING NUMBER
271-16	

NOTE: CONTOURS ESTABLISHED FROM AERIAL PHOTOS AND TIDAL INFORMATION

523067

6654



TAILINGS INCL. 18" OVERCUT		EXTRA DREDGING		RECLAMATION	
MARINA	233,454 cy	CHANNEL RL-5.00'	163,595 cy	EXTRA FILL TAILINGS & DREDGING	804,882 cy
RECLAMATION	228,118 cy	MARINA RL-5.00'	98,333 cy	EXISTING (TAILINGS)	228,118 cy
STOCKPILE	142,000 cy	DREDGE FLOTATION	167,500 cy		
TOTAL	603,572 cy	TOTAL	429,428 cy	TOTAL VOLUME HANDLED	1,033,000 cy

E		
D		
C		
B		
A		
DATE	AMENDMENTS	AP'D

PORT OF LAUNCESTON AUTHORITY
B.M.I. MINING - MIDDLE ARM DEVELOPMENT
PROPOSAL 2.
 CHANNEL RL-5.00' - BASIN RL-5.00' - RECLAMATION

SCALE: 1" = 300 FEET DATE: 20.4.75
 DESIGNED: D.P.C. G.W. F.B. L.B.
 DRAWN: G.W. DATUM: L.A.T. GEORGETOWN
 CHECKED: D.P.C. DRAWING NUMBER
 PORT MANAGER & CHIEF ENGINEER **271-17**

523068

6655

NOTE: CONTOURS ESTABLISHED FROM AERIAL PHOTOS AND TIDAL INFORMATION

CLOG TOM'S CK.

TYPICAL SECTION THROUGH RECLAMATION

SCALE 20' TO 1"



TAILINGS INCL. 18" OVERCUT		EXTRA DREDGING		RECLAMATION	
MARINA	233,454 cy	CHANNEL	NIL	EXTRA FILL TAILINGS ONLY	375,454 cy
RECLAMATION	228,118 cy	MARINA	NIL	EXISTING (TAILINGS)	228,118 cy
STOCKPILE	142,000 cy				
TOTAL	603,572 cy	TOTAL	NIL	TOTAL VOLUME HANDLED	603,572 cy

MIDDLE ARM.

TIDAL FLATS
BASE AT LOW WATER

APPROX. LIMIT OF B.M.I. LEASE

APPROX. LIMIT OF TAILINGS

C. D. WILSON
OWNER

H. DE RUYTER
OWNER

BRANDY CK.

G. WALKER
OWNER

4.86 Ha.
960m FORESHORE

SUGGESTED PLANT SITE

P. M. TEMBY
OWNER

COBBLESTONE CK.

MIDDLE ARM
CREEK.

PUBLIC ROAD

NOTE: CONTAINS ESTABLISHED FROM AERIAL PHOTOS AND TIDAL INFORMATION

523069

6656

E		
D		
C		
B		
A		
DATE	AMENDMENTS	AP'D

PORT OF LAUNCESTON AUTHORITY

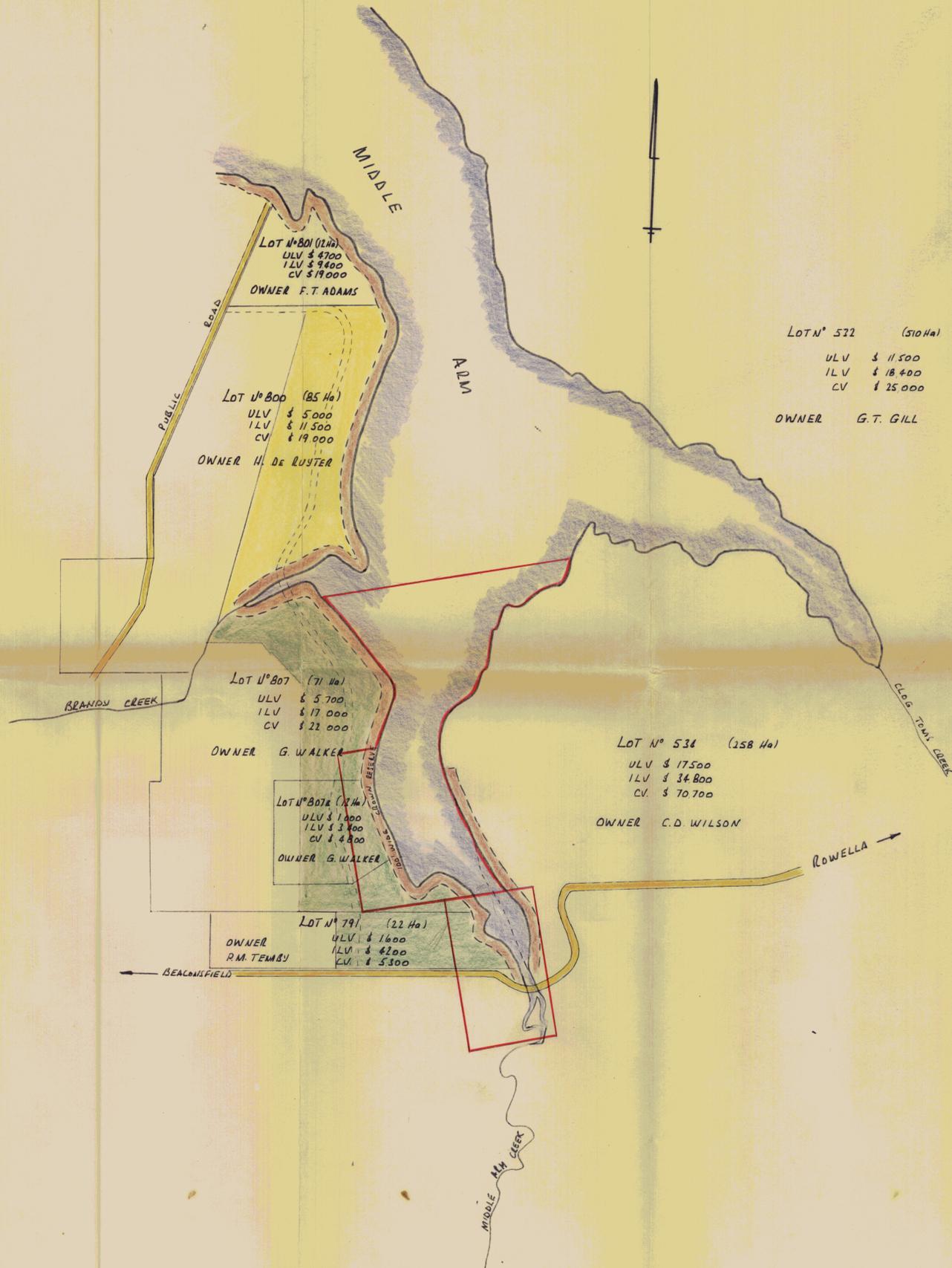
B.M.I. MINING MIDDLE ARM DEVELOPMENT
PROPOSAL 3.
RECLAMATION ONLY

SCALE: 1" = 300 FEET DATE: 30.4.75

DESIGNED: D.P.C. G.W. F.B. L.B.
DRAWN: G.W. DATUM: L.A.T. GEORGETOWN
CHECKED: D.P.C. DRAWING NUMBER



271-18
PORT MANAGER & CHIEF ENGINEER



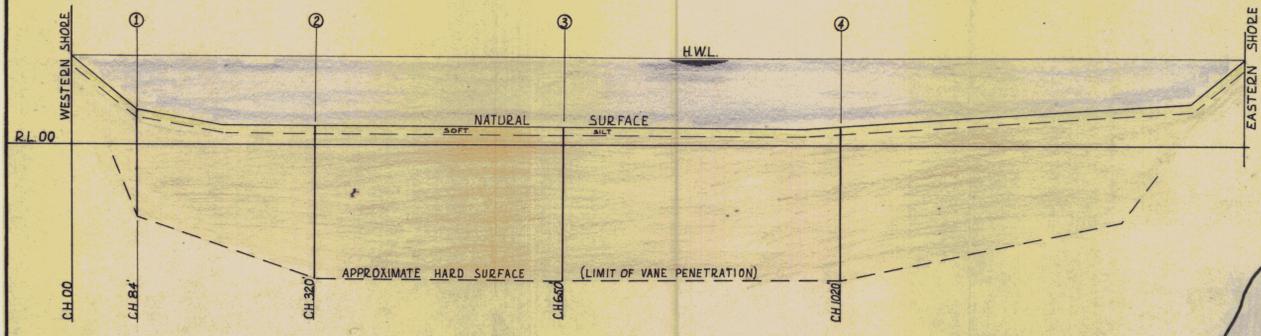
LEGEND

- RECOMMENDED MINIMUM LAND PURCHASE
 STAGE I — PROPOSAL I
 43 Ha @ \$ 740 = \$ 31,820
- RECOMMENDED MINIMUM LAND PURCHASE
 STAGE II — PROPOSAL I
 30 Ha @ \$ 740 = \$ 22,200
- EXISTING CROWN RESERVE
- LIMITS OF MINING LEASE

NOTE: ALL VALUES BASED ON 1972 BEACONSFIELD COUNCIL VALUATION
 GOVERNMENT A.A.V. — CURRENT VALUATION + 60% 523070 6657



PORT OF LAUNCESTON AUTHORITY			SCALE: 1" = 10 CHAINS = 400'		DATE: 12-5-75
DESIGNED:		F.B.		L.B.	
DRAWN:	G.W.	DATUM:	L.A.T.	GEORGETOWN	
CHECKED:	D.P.C.	DRAWING NUMBER		271-19	
PORT MANAGER & CHIEF ENGINEER					



PROBE DETAILS ALONG PROPOSED DAM SITE

SCALE: 1" = 100' HOR.
1" = 10' VERT.

OWNER G.T. GILL

CLOG TOM'S CK.

*4 (NO WATER FLOW AT TIME OF TEST.)

LEGEND

- BORE LOGS — LOCATION OF BORES TAKEN BY BMI FOR TAILINGS SURVEY
 - ◆ SHEAR VANE PROBES — NUMBER AND LOCATION
 - * WATER SAMPLE STATIONS — NUMBER AND LOCATION
 - SOIL SEIVE ANALYSIS SITES — NUMBER AND LOCATION
- REFER TO SCHEDULES NO 1-11 APPENDIX VI FOR DETAILS.

SHEAR VANE PROBE TESTS ALONG PROPOSED DAM SITE.

TEST NO.	DEPTH OF PENETRATION feet	SHEAR STRESS IN SOIL lb/ft ²
1	9'-0"	3.34
	12'-6"	6.73
	13'-9"	12.60 **
2	10'-0"	1.24
	20'-0"	2.10
3	10'-6"	2.96
	13'-0"	13.66 **
	14'-6"	2.10
	16'-0"	2.10
	20'-0"	8.40
4	15'-0"	4.20
	20'-0"	4.20
RESIDUAL SHEAR STRESS IN EACH TEST.		1.05 AVE.

** HIGH READINGS CAUSED BY VANE STRIKING ROCK FLOATERS.

MIDDLE ARM.

OWNER C.D. WILSON

OWNER F.T. ADAMS

OWNER H. DE RUYTER

BRANDY CK.

OWNER G. WALKER

OWNER P.M. TEMBY

COBBLESTONE CK.

MIDDLE ARM CREEK

100' WIDE CROWN RESERVE

E		
D		
C		
B		
A		
DATE	AMENDMENTS	APD

PORT OF LAUNCESTON AUTHORITY
B.M.I. MINING - MIDDLE ARM DEVELOPMENT
SITE INVESTIGATION — LOCALITY PLAN

SCALE: 1" = 300 FEET	DATE: 14-5-75
DESIGNED: G.M.D.	F.B. L.B.
DRAWN: G.M.D.	DATUM: L.A.T. GEORGETOWN
CHECKED: D.P.C.	DRAWING NUMBER
271-20	

523071
6658

