

Brought up by
Senator Newland

*By Mr. Speaker,
Clerk of the Senate*

PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS



P A P E R S

to be laid on the Table of the Senate.

R E P O R T

together with Minutes of Evidence relating to the proposed
BREAKWATERS, EXCAVATIONS, QUAYWALLS, ETC. for HENDERSON NAVAL BASE.

1918.

COMMONWEALTH OF AUSTRALIA.

PARLIAMENTARY STANDING COMMITTEE ON
PUBLIC WORKS.

REPORT

TOGETHER WITH

MINUTES OF EVIDENCE

RELATING TO THE PROPOSED

BREAKWATERS, EXCAVATIONS, QUAYWALLS,
ETC., FOR HENDERSON NAVAL BASE.

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MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

(Second Committee.)

The Honorable HENRY GREGORY, M.P., Chairman.

<i>Senate.</i>	<i>House of Representatives.</i>
Senator George Henderson. Senator Edward Needham. Senator John Newland, Vice-Chairman.	William George Mahony, Esquire, M.P. James Mathews, Esquire, M.P. Sydney Sampson, Esquire, M.P. Hugh Sinclair, Esquire, M.P. The Honorable William Henry Laird Smith, M.P.

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PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

HENDERSON NAVAL BASE—BREAKWATERS,
EXCAVATIONS, QUAYWALLS, ETC.

REPORT.

THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS, to which the House of Representatives referred for investigation and report the question of the carrying out of the following works at Henderson Naval Base, namely:—Two Breakwaters, Excavations, Reclamations, Basins or Quaywalls, Floating Dock, Administrative Buildings, and Permanent Railways, has the honour to report as follows:—

INTRODUCTORY.

1. Following upon the determination of the Government that the time had arrived when necessary action should be taken in the direction of the development of a Commonwealth Fleet, Admiral Sir Reginald Henderson, K.C.B., was invited to visit Australia and report in the matter, and in 1911 submitted his recommendations in regard to the general administration, organization, distribution, &c., of the Naval Forces of the Commonwealth.

One of his recommendations was:—

The harbor of Cockburn Sound, including Owen's Anchorage and Jervoise Bay, to be examined thoroughly as soon as possible by experts, with a view to locating the site of the future Naval Dockyard. The site should include space for graving docks, building slips, workshops, storehouses, and all plant, &c., for the building of ships and for the repairs and maintenance of a Fleet. It appeared to me that a site in the vicinity of Jervoise Bay was best suited for Naval Dockyard requirements.

2. Early in 1912 the first work was commenced at the Henderson Naval Base, Cockburn Sound, the initial operations being largely of an exploratory nature and consisting chiefly of soundings and borings to find out exactly the nature of the ground, the depth of water, &c., so that a knowledge might be obtained of the engineering conditions.

3. About this time a tentative scheme for a Base was prepared by the then Director of Naval Works (Mr. Fanstone), but in view of the great expenditure involved in the establishment of a Naval Base it was considered that the services of an eminent engineer should be obtained to report on various questions associated with the creation of the proposed Base in Cockburn Sound. Accordingly, it was arranged that Sir Maurice Fitzmaurice, President of the Admiralty Committee on Naval Bases, and a member of the British engineering firm of Coode, Matthews, Fitzmaurice, and Wilson, should visit Australia for the purpose in question.

4. At Sir Maurice's request, further exploratory work was undertaken, and the data furnished to him, and in 1914 he submitted his report with plans showing proposed lay-out, &c.

5. Between 1915 and 1917, the Commonwealth acquired various areas of land aggregating 8,000 acres for the Base itself, and, in addition, about 607 acres at Wongong for quarry purposes.

DESCRIPTION OF WORKS NOW UNDER CONSIDERATION.

6. The works now under consideration are intended to include those considered necessary to provide the first instalment of the Base, or what is known as "Scheme No. 1."

They comprise:—

(a) *Foreshore Breakwater*—

Proposed to be constructed at the southern extremity of the works to give protection from the south-west and shelter to a quaywall. It will run out in a north-westerly direction for a distance of about 1,000 feet, and is designed to be 25 feet wide across the top, and be raised to a height of 15 feet above low water. The breakwater will consist of a heaping of sandstone indurated with carbonate of lime, which is being obtained close at hand, and will be faced with granite which will be brought from the Wongong Quarry. Estimated cost . . . £61,200

EXTRACT FROM VOTES AND PROCEEDINGS OF THE HOUSE OF REPRESENTATIVES.

No. 35 of 26th SEPTEMBER, 1917.

19 PUBLIC WORKS COMMITTEE REFERENCE OF WORKS HENDERSON NAVAL BASE. The Order of the Day having been read for the resumption of the debate upon the following motion of Mr. Watt:—

That in accordance with the provisions of the *Commonwealth Public Works Committee Act 1913-1914*, the following works be referred to the Parliamentary Standing Committee on Public Works for their report thereon, namely:— HENDERSON NAVAL BASE—Two Breakwaters, Excavations, Reclamations, Basins or Quaywalls, Floating Dock, Administrative Buildings, Permanent Railways.

Debate resumed.

Question—put and passed.

(b) North Breakwater—

Proposed to be constructed at the north-western extremity of the works to give protection to the enclosed area from the north and north-west. From the western extremity of Woodman's Point a retaining bank will be formed extending westerly, and when this reaches deep water it will be continued as the north breakwater in a south-westerly direction for a distance of approximately 4,200 feet. This breakwater will be of similar construction to the foreshore breakwater. The estimated cost of the retaining bank and breakwater is £316,000

(c) Excavation and Reclamation—

The reclamation work proposed is equal to about ten millions of cubic yards. The greater part of the quantity will be obtained from the sand dunes and hills to the east of the Base, and the necessary excavation will give a good width of level land back from the existing foreshore to form the dockyard. Estimated cost £578,344

(d) Main Basin and Quaywalls—

The main basin is in the form of a rectangle 2,000 feet long by 1,500 feet wide, with a projecting reinforced concrete jetty and two openings in the north wall to form entrances to the floating dock berths. These walls, which will project about 10 feet above low water, are to be 50 feet high and 200 feet wide. The centre of the wall will consist of material won from excavation and dredging, and the facing will be of reinforced concrete blocks weighing about 7 tons each, and keyed into each other. The stone required for these blocks will be brought from the Wongong Quarry. The Ordnance wharf will be about 36 feet high, and faced on one side only; while the coaling wharf will have the concrete blocks and vertical faces on the south and east sides only.

The reinforced concrete jetty projecting into the main basin will be 800 feet long and 150 feet wide. This it is proposed should be of reinforced concrete pile construction, the overhead portion of the whole of the jetty to be also of reinforced concrete.

The estimated cost of these works is set down at—

Ordnance Wharf Wall	£45,300
Walls of Main Basin and Main Wharf (including Crane Foundations)	1,474,600
Reinforced concrete Jetty in Main Basin	84,375
Main Wharf Wall—Heavy Travelling Crane Foundation	4,250
Walls of Coaling Wharf	231,840
	<hr/>
	£1,840,365

(e) Floating Docks—

Provisional amounts have been included for three floating docks of 6,000, 20,000, and 35,000 tons respectively. Estimated cost £1,342,000

(f) Administrative Buildings—

Provisional amounts have been included for the construction of the following buildings on the reclaimed areas :—

Senior Naval Officers' and Administrative Offices— 650,000 cubic feet at 1s. 6d.	£48,750
Dockyard Surgery— 45,000 cubic feet at 2s.	4,500
First $\frac{1}{3}$ portion of Chief Constructor's and Chief Engineer's Workshops— 6,400,000 cubic feet at 4 $\frac{1}{2}$ d.	120,000
Various other Dockyard Buildings	187,500
	<hr/>
	£360,750

(g) Sewers and Drains—Estimated cost £10,000

(h) Permanent Railways—

Is intended to cover the cost of constructing a railway to connect the magazines and the ordnance wharfs and in and around the buildings and for feeding the quaywalls. It is proposed to use the 3 ft. 6 in. gauge and 45-lb. rails. The length of railway proposed is 13,500 yards, and the estimated cost £20,250

Total £4,529,109

COMMITTEE'S INVESTIGATIONS AND RECOMMENDATIONS.

7. The Committee visited Henderson Naval Base, carefully examined the whole of the area, viewed the work in progress, and inspected the sites of the proposed quaywalls and breakwaters, the positions and extent of which were indicated by buoys.

The Committee also got aboard one of the Naval launches at Fremantle, traversed Cockburn Sound, and made an examination of the Base and of the shores of Garden Island from the sea.

A visit was then paid to the area of land acquired by the Commonwealth at Wongong, about 17 miles from the Base, on which it is proposed to establish a quarry which will supply the granite required for the facing of the breakwaters, the aggregate for the concrete blocks, &c.

On the same day an inspection was also made of the position on Wongong Creek, about 2 miles distant from the quarry site, where it is proposed to throw a dam across this stream in connexion with the scheme of water supply projected for the Base.

8. Plans showing the complete scheme for the Base, the first section or "Scheme No. 1," and diagrams indicating the extent of the proposed excavations and reclamations were explained in detail and carefully scrutinized by the Committee.

9. The Committee made itself acquainted with the terms of Admiral Henderson's report, Sir Maurice Fitzmaurice's reports, and a more recent report by the present Director of Naval Works (Mr. J. R. Settle).

10. Inquiries were made respecting a method claimed to be more economical for the construction of quaywalls, which had been patented by Mr. H. H. Rumble, Resident Engineer, Bunbury Harbor Works, and careful consideration was also given to a report by Messrs. King Salter and Swan, recommending an alternative lay-out for the Base, and suggesting, in conjunction with John S. Metcalf Co. Ltd., another method of constructing wharfs and quaywalls.

11. It was laid down in Admiral Henderson's scheme that the Henderson Naval Base should be a Fleet Primary Base, one of the attributes of which is that it should be eventually capable of building the largest ships. As it is understood that this proposal was approved by the Government, it has not been considered part of the function of the Committee to investigate that aspect of the question, and in considering the present reference Admiral Henderson's recommendations have been adopted as a basis for the scheme of the Base.

12. Although no provision for ship-building is included in "No. 1 Scheme," still the fact that this is the ultimate intention radically affects the design of the Base, as space must necessarily be reserved for the future location of this function.

13. *Modification of Original Design.*—It was ascertained that the plan of Sir Maurice Fitzmaurice for the complete Base has been somewhat modified by the present Director of Naval Works in that the area of the main basin has been reduced from 110 acres to 68 $\frac{1}{2}$ acres, and the area of the destroyer and submarine basin has been reduced from 35 acres to 27 $\frac{1}{2}$ acres. The position of the destroyer and submarine basin has also been removed from south to north of the main basin. Although the length of the foreshore breakwater in Mr. Settle's plan has been increased by about 200 feet, the length of the north breakwater has been reduced by over 2,000 feet, and the length of the south or island breakwater has been reduced by about 690 feet, with the result that the size of the enclosed water area or outer harbor has been reduced from 850 acres to approximately 720 acres. The effect of these modifications has been the saving of expenditure for construction of breakwaters and for dredging.

14. "Scheme No. 1."—In the first section of the work—"Scheme No. 1"—it is proposed to omit the destroyer and submarine basin, the gun wharf, three large jetties west of the gun wharf, and the south or island breakwater. Provision is included for one-third of the requirements of buildings.

It was stated that certain works necessary for the completion of "Scheme No. 1," being looked upon as secret, have been exempted from reference to this Committee. The estimated cost of those works is £1,098,907, so that the total cost of providing the facilities required under "Scheme No. 1" is estimated at £5,628,016, and the time for completing these works is set down at ten years from date of commencement.

15. *Temporary Works.*—The Committee was informed that prior to the commencement of the permanent work involved in this scheme it was essential that certain temporary works should be completed at least to a certain point. The more important of these temporary works are—

- The erection of gantries.
- The formation of the block yard.
- The provision of transport from the Wongong Quarry to the Base.

(a) *Erection of Gantries.*—These will be temporary structures 450 feet long, built on piles, and will enable provision to be made for the side-tipping of a train of waggons simultaneously. A reduction is thus made of the time for which waggons and locomotives are standing idle, the output of work is increased, and the working expenses reduced. While the first gantry was being used, a second gantry would be constructed ahead of it, and subsequently the first gantry would be removed and placed ahead of the second gantry, thus providing for the continuous extension of the breakwater. No estimate was furnished of the cost of constructing these gantries, pending the decision as to the class of timber to be used in construction. It was further pointed out that their employment would also depend upon the provision of a greater number of steam navvies for excavation purposes than is in operation at present. In dealing with a work of this magnitude, the smallest percentage of saving in working costs will amount to a substantial sum in the aggregate, and the Committee is of opinion that the gantry system should be installed as soon as it can be shown that economy will result from its use. As regards the timber to be used, the committee considers that jarrah would prove eminently suitable and economical.

(b) *Formation of Block Yard.*—The block yard is a floor on which the concrete blocks to be used in the quaywalls would be made. This floor must be quite level. It necessitates first of all levelling the surface of the ground, and on it packing stone from 8 to 10 inches in cube. This stone is then pounded down to give a solid bearing, and on top is laid a concrete floor about 4 inches thick. The cost of this block yard floor and the block yard establishment, which is purely a temporary work, is estimated at £60,000. The moulds used for making the blocks are generally of Baltic redwood, and it is stated that about 18,000 cubic feet of timber will be required for this purpose. It is estimated that the value of the work of making the moulds is 60 per cent. and the value of the material 40 per cent., so that it is essential to obtain timber of such a quality that the moulds will last for the whole period required, and do all the block work necessary. If the moulds have to be replaced at any time during the period of construction, it will mean considerable additional expense. Inquiries are being made as to the suitability of Australian timbers for this purpose, and indications are that some Australian timbers would be suitable if they could be procured thoroughly seasoned.

The Committee is of opinion that certain Australian timbers, such as huon pine or jarrah, if properly seasoned, might be suitable for this work, and recommends that preference be given to Australian timbers if experiments show that this opinion is justified.

(c) *Provision of Transport from Wongong Quarry to the Base.*—One of the first works required for successful and economical working is the provision of means of conveying to the Base the granite to be won from the Wongong Quarry. The quantity of quarried stone needed for the complete scheme would be about 1,150,000 tons, and for the completion of "No. 1 Scheme" about 840,000 tons. Two methods of transporting the stone from Wongong to the Base have been suggested, namely, the utilization of the existing State railway or the construction of a light "contractor's line" direct from the quarry to the Base. In the former case, it will be necessary to construct a deviation from the State railway near Armadale to the quarry, and also a deviation, known as the Coogee siding, from the Jandakot-Armadale line to the Base. Provided the Commonwealth agreed to bear the cost of these loops and sidings, and furnished its own waggons, the State Railway Department undertook to provide necessary locomotives and transport the stone at the rate of 1d. per ton per mile. In this proposition the railway would be 3 ft. 6 in. gauge with 60-lb. rails.

The construction of a "contractor's line" involves the purchase by the Commonwealth of a strip of land from the quarry to the Base, the provision of its own locomotives as well as waggons, and the laying of about 17 miles of line of a 3 ft. 6 in. gauge with 45-lb. rails.

Realizing the importance of eliminating everything in the nature of unnecessary expenditure, and at the same time arranging for the transport of the stone in a manner most economical to the Commonwealth, the Committee opened negotiations with the Railway Commissioner of Western Australia. As a result, the Commissioner agreed that, if the State railway were utilized, he would undertake—

(a) in the case of a sudden emergency, requiring immediate access from the Base to the quarry and *vice versa*, if the waggons were left loaded at the quarry, his Department would take immediate action by despatching the locomotives either from Fremantle or Perth, or if empties had to be conveyed, send an engine from Fremantle with all speed;

(b) that the charge for the conveyance of the stone in train loads would be 3d. per ton per mile, the Commonwealth to provide its own rolling-stock, except the locomotives; no charge would be made for the return of empty trucks to the quarry.

The estimate furnished by the State Railway Department places the cost of constructing a loop between Coogee and the Jandakot line, plus the cost of the line from Wongong to the quarry, plus the cost of the line from the present terminus at the Naval Base to the block yard, at £14,983, exclusive of rails and fastenings. Deducting the latter section, which it is thought should be more appropriately charged against the internal railway system of the Base, and adding an estimate of the present cost of obtaining rails and fastenings, the cost of this line might be put down at £19,383. The length of the line from point to point for traffic purposes would thus be 22 miles, so that at the reduced rate of 3d. per ton per mile the Commonwealth would also pay, for the conveyance of 840,000 tons of stone, £57,750, spread over a period of ten years.

The Director of Naval Works estimates the cost of construction of 17 miles of direct line at £42,500, to which would have to be added cost of land, purchase of locomotives, &c.

The following table shows a comparison of the two schemes, omitting those items which are common to both:—

HENDERSON NAVAL BASE.—PROPOSED RAILWAY CONNEXION WITH WONGONG QUARRY.

UTILIZATION OF STATE RAILWAY.		COMMONWEALTH DIRECT LINE.	
Scheme "A"—Coogee and Wongong Sidings. (Committee's Estimate.)		(Figures supplied by Director of Naval Works.)	
Cost of construction with 60-lb. rails ..	£ 19,383	Cost of construction with 45-lb. rails ..	£ 12,500
Cost of maintenance—5 per cent. per annum for ten years	9,692	Cost of maintenance 3 per cent. per annum for ten years	12,750
Cost of transport of 840,000 tons for 22 miles, at 3d. per ton per mile	57,750	Running Costs—	£
		3 locos. (secondhand), at	£2,000
		Repairs and maintenance for	ten years, equal to, say,
		2 locos.	4,000
			10,000
		Wages—	
		2 Drivers, at 15s. per day ..	469
		2 Firemen, at 13s. 4d. per day	417
		2 Cleaners, at 13s. 4d. per day	417
		2 Rope Runners, at 12s. 6d. per day	391
		2 Conductors, at 13s. 4d. per day	417
			2,111 per annum
			for ten years
		Fuel—4,200 tons for ten years, at 21s. per ton ..	4,410
		Water—12,600,000 gallons for ten years, at 2s. per 1,000 gallons	1,260
		Stores	1,410
		Purchase of land—120 acres, at £10 per acre ..	1,200
	£86,825		£94,640

This comparison is in favour of the utilization of the State railway, notwithstanding the fact that the Committee is of opinion that the figures quoted for the Commonwealth direct line are on the low side. Under present circumstances it is considered improbable that 17 miles of railway could be constructed in the position indicated for £42,500, and the Commonwealth would no doubt have to pay more than £1,200 for the purchase of the land involved, taking into consideration the fact that compensation would be demanded for severance, &c. Furthermore, it is considered that in a comparison of this nature maintenance at 5 per cent. should be reckoned in respect of the Commonwealth line as in the case of the State line, and, in addition, a sum should be included for the wages of signalmen who will be essential to the scheme.

It is recognised that from a departmental point of view there may be advantages in having a direct line under sole control; still, it is considered that the terms offered by the State Railways to convey stone in train loads at 3d. per ton per mile, and to make no charge for the return of empty trucks to the quarry, to give preference to the stone traffic over ordinary goods traffic, and to take all necessary steps to meet any sudden emergency arising for stone, are reasonable.

Taking a wide view of the matter, therefore, the Committee is of opinion that the interests of the people as a whole would be better served by utilizing the State railway than by constructing a direct Commonwealth line.

The decision arrived at by the Committee is shown in the following extract from its Minutes of Proceedings :—

Senator Needham moved—That the necessary loops be constructed and the State railway utilized for the transport of stone from the Wongong Quarry to the Base on the terms and conditions offered by the Western Australian Railways.

Seconded by Mr. Sampson.

The Committee divided on the motion—

Ayes (8).

Mr. Gregory.
Senator Henderson.
Mr. Mahony.
Mr. Mathews.
Senator Needham.
Senator Newland.
Mr. Sampson.
Mr. Laird Smith.

No (1).

Mr. Sinclair.

16. *Foreshore Breakwater North Breakwater.* It has been represented that one of the first questions to be considered in connexion with the work under review is the outer protection required for the Base so that ships can at all times lie in safety alongside wharfs or jetties, and also be sheltered to the requisite extent when lying at moorings in the outer harbor. It was stated in evidence that the gales to be expected in Cockburn Sound usually start in the north-east and gradually shift to the north-west. When the wind draws around to the west and south-west the gale is blowing itself out. Evidence was also given to the effect that observations made at the Base showed that in bad weather it was possible to get a wave action of nearly 10 feet from trough to crest, though that was infrequent, the height usually being about 7 feet. Captain Irvine, late Chief Harbor Master of Western Australia, who has had a life-long experience of this coast, stated, however, that in his opinion the waves to be expected from the south-west in Cockburn Sound had very little "lift" in them, and would not be likely to affect anything but very small vessels. It was represented that the protection which will be afforded by the proposed foreshore and north breakwaters will be sufficient to enable the works to be commenced, and may be all that will be necessary for some considerable time, although it is possible that the further protection of an island breakwater as projected in the complete scheme may be essential later.

The Committee considers, however, that the foreshore breakwater and the north breakwater will meet all present requirements, and is of opinion that the work should be proceeded with as proposed. The decision arrived at is shown in the following extract from the Minutes of Proceedings :—

Mr. Mathews moved—That the Island Breakwater be constructed concurrently with the other Breakwaters, as, in the opinion of the Committee, it will be essential to afford protection for the building of the quaywalls and the safe working of ships.

Seconded by Mr. Sinclair.

The Committee divided on the motion—

Ayes (2).

Mr. Mathews.
Mr. Sinclair.

Noes (7).

Mr. Gregory.
Senator Henderson.
Senator Needham.
Senator Newland.
Mr. Mahony.
Mr. Sampson.
Mr. Laird Smith.

And so it passed in the negative.

17. *Excavation and Reclamation.*—The Committee carefully considered the diagrams submitted showing the excavation and reclamation proposed, inspected the work in progress, and examined the plant at present engaged on the work. The proposals outlined on the diagrams and explained in evidence generally met with approval. The Committee, however, views with alarm the high cost being incurred for the excavation work now in progress. Although Mr. Settle's estimate for this work was 1s. 3d. per cubic yard for reclamation of area and behind walls, including necessary excavation in the range of hill to the east of the foreshore, he stated that he thought that in an operation involving ten million cubic yards of material, and by the employment of the requisite plant, the work might be done at a cost as low as, or even less than, 1s. 1d. per cubic yard. Instead of this the Committee was informed that including establishment and depreciation charges, the cost of excavation by manual labour assisted with steam cranes works out at 3s. 4d. per cubic yard, and the work done by the steam navvies at 1s. 11d. per cubic yard. Although it was ascertained that the cost of moving material is decreasing as the excavation advances into bigger country, and the men become more accustomed to the work, still it is unlikely

that the rates will be materially reduced, nor will it be possible to complete the excavation within the period estimated unless additional and improved plant be provided. It was stated in evidence that two steam navvies are now in operation, but that to do the work in ten years twelve more steam navvies are needed.

The Committee is aware of the difficulties with which the Department is confronted in matters of this kind, and the efforts made by the Director of Naval Works to reduce expense, but in view of the high costs at present prevailing for the work is unanimously of opinion that continued special efforts should be made to secure adequate machinery so as to bring the costs down to a minimum. The Committee looks upon this as a matter of urgency, and in the event of the requisite plant not being obtained by the time the reclamation reaches deep water, recommends that the work should be stopped, as there would appear to be no justification for its continuance unless costs could be considerably reduced.

18. *Main Basin.*—Careful attention was given to the proposal to provide a main basin, and during the Committee's investigation of this proposition consideration was given to the alter native lay-out submitted, at the request of the Naval Board, by Mr. J. J. King Salter, General Manager of the Naval Dockyards at Cockatoo Island, in conjunction with Mr. W. R. Swan, Superintending Civil Engineer for New South Wales, Naval Works Branch, which dispensed altogether with the basins proposed by Sir Maurice Fitzmaurice and Mr. Settle.

Evidence was adduced, however, to show that the provision of basins at Naval Bases is in accordance with the latest accepted practice, and are incorporated in the most recent schemes of the British Admiralty.

The Committee, therefore, recommends that the proposal put forward by Sir Maurice Fitzmaurice, as modified by the present Director of Naval Works, be adopted.

19. *Quaywalls.* In the design of the basin submitted to the Committee, the Director of Naval Works (Mr. Settle) contemplates facing his quaywalls with concrete blocks, which is in accordance with the proposal submitted by Sir Maurice Fitzmaurice, although the blocks are somewhat different in design. In this scheme the blocks will each weigh about 7 tons, and be so shaped that they will key into one another. They will be formed on dry land and will be built into the walls by the employment of divers.

The Committee took evidence from Mr. H. H. Rumble, Resident Engineer, Bunbury Harbor Works, in regard to his design for a cavity wall somewhat in the nature of a series of shelves, which he claimed would be suitable for quaywall purposes, and considerably more economical than the departmental proposal. It was ascertained, however, that his design had not got beyond the experimental stage, and he admitted that he had not constructed any quaywalls according to his system.

Careful consideration was also given to the design for quaywalls and wharfs embodied in the Salter-Swan lay-out. This is a form of cellular reinforced concrete construction, in respect of which certain patent rights are claimed by the John S. Metcalf Company Ltd., of Montreal, Canada. In this design a series of nine reinforced concrete cylinders, forming one section of the wall about 100 feet by 106 feet, will be built upon a heavily reinforced concrete base, and so constructed that on completion the structure will be in the nature of a caisson floating of its own buoyancy. This is then towed to the place where required, sunk in position, and the cylinders filled with sand, and becomes one section of the face of the wall. Similar sections are placed on the other face of the wall to the length required, and the space between filled with excavated or dredged material. This, it is claimed, will form a solid substructure upon which the necessary superstructure, with cranes, &c., may be built as required.

Considerable information was obtained as to structures similar to the sections described being built for use as grain silos, &c., but no evidence was adduced as to the adoption of the principle for quaywalls or wharfs for Naval Bases in other parts of the world.

Without in any way depreciating the utilization of new ideas, the Committee realizes the extreme care which must be taken in dealing with construction under water, and was impressed with the urgent necessity for having quaywalls, wharfs, &c., for naval purposes of such strength as to withstand any reasonable concussion or overloading to which they may be subjected, and is satisfied that less element of risk is involved in the construction of these walls on the concrete block system, which the Committee unanimously recommends should be adopted.

20. *Floating Docks.*—The question of the provision of floating docks was the subject of considerable inquiry by the Committee. Admiral Henderson, in his report, specified one of the requirements of this, as a Fleet Primary Base, is that it should possess docks capable of receiving the largest vessels when in an injured condition, and later in his report mentioned graving docks.

When Sir Maurice Fitzmaurice, however, visited Australia, he requested that a trial pit be sunk close to Jervoise Bay to enable him to give an opinion on the advisability or otherwise of constructing a dry dock at that place. Upon the information being furnished to him as to the difficulty experienced consequent upon the large amount of water encountered, he reported as follows:—

It therefore seems quite clear that even if the construction of a dry dock be possible, such construction should be left until a later stage of development, as the cost of carrying out the work under the physical conditions indicated by the information now before us would be very great, and, in our opinion, unjustifiable.

Mr. J. F. Ramsbotham, who in 1910 was appointed by the Western Australian Government engineer for the construction of a graving dock at Fremantle, in giving evidence before the Committee, described the difficulties met with in that work and its ultimate abandonment. He expressed his opinion that the same difficulties might be expected to be met with in Cockburn Sound, and recommended the provision of a floating dock rather than a graving dock.

The excavation for a floating dock is about as great as that for a dry dock, but there is no necessity to pump out the water. It has been represented, however, that in the event of a floating dock being constructed, the experience gained in carrying out that work would provide considerable information in regard to the under-water strata, and that even if it were afterwards decided to construct graving docks any floating dock already built would always be serviceable and might be moved, if necessary, to another convenient location.

As against the opinions of Sir Maurice Fitzmaurice, Mr. Settle, and Mr. Ramsbotham, Messrs. Salter and Swan, in collaboration with the John S. Metcalf Company Ltd., suggested the provision of a graving dock constructed on the reinforced concrete caisson principle already described as advocated for the quaywalls. In view, however, of the fact that neither of the gentlemen named had ever seen such a dock, or had any experience of its construction, and the engineering company would give no guarantee that the dock, if constructed as recommended by it, would be satisfactory, the Committee cannot recommend the adoption of the suggestion.

Although it is acknowledged that a floating dock has advantages for many purposes, it is agreed that a graving dock is more generally useful, and is to be preferred if it can be constructed at anything like a reasonable figure. An eminent European authority, after a careful analysis of the data at his disposal, has stated that—

“The cost of the establishment of dry docks and floating docks is in general about the same, but that the cost of maintenance of a floating dock is about eight times as great as for a dry dock. With 100 dockings per annum, the cost of pumping the dry dock is only about half the cost of the maintenance of the floating dock. The total cost of the dry dock is for twenty dockings per annum about 12·8 per cent. lower, and for 100 dockings per annum about 7·1 per cent. lower, than the cost of a floating dock. The dry dock compares more than favorably with the floating dock in regard to cost, repairs, and maintenance, and gives much better working facilities.”

It is represented that it is urgently necessary that provision for docking naval vessels should be made as soon as possible in Western Australia, and under Admiral Henderson's scheme these naval docks might be availed of for docking mercantile vessels. The Committee, however, is faced with the difficulty that although graving docks are admittedly the better, the knowledge of the under-water strata of Cockburn Sound is not yet sufficient to enable a definite statement to be made that graving docks could be provided at a reasonable cost. On the other hand, under existing war conditions the cost of providing floating docks is enormously increased. The cost of the floating docks proposed, as furnished to the Committee, works out at £22 per ton. It was stated in evidence that the pre-war rate would have been about £10 per ton, but that the price to-day would approximate £70 per ton, if it were possible to secure the necessary materials, which is doubtful. This means that at existing prices it would cost the Commonwealth £4,270,000 to provide the three floating docks which at pre-war rates could have been obtained for £610,000.

Looking at the matter in all its bearings, the Committee decided that, while it approved of the construction of a floating dock of 6,000 tons capacity, it would be advisable in the interests of the Commonwealth that the work of providing this dock be temporarily delayed until prices of materials more nearly approach normal. In regard to the other docks suggested, it is considered that the work necessary to provide the 6,000-ton dock will furnish much-needed knowledge of the conditions to be met, and that the provision of the 20,000-ton and 35,000-ton docks should form the subject of a further reference at some future date.

The decision arrived at is shown in the following extract from the Minutes of Proceedings:—

Mr. Mahony moved—That this Committee cannot at present recommend the construction of either floating or graving docks, but suggests that all necessary steps be taken in order to ascertain the suitability of the ground for the purposes of constructing a graving dock.

Seconded by Senator Nowland.

Mr. Gregory moved as an amendment That this Committee approves of the construction of a floating dock of 6,000 tons capacity, but that owing to the present high prices due to war conditions, the work be temporarily delayed. Further, that prior to a decision being arrived at regarding the construction of the larger docks, these form the subject of a future reference when more certain knowledge of the strata will be available, and enable a determination to be arrived at as to whether graving or floating docks should be constructed.

Seconded by Senator Needham.

The Committee divided on the amendment—

Ayes (7).

Mr. Gregory.
Senator Henderson.
Mr. Mathews.
Senator Needham.
Mr. Sampson.
Mr. Sinclair.
Mr. Laird Smith.

Noes (2).

Mr. Mahony.
Senator Nowland.

The amendment then became the motion; the Committee divided on the motion—

Ayes (8).

Mr. Gregory.
Senator Henderson.
Mr. Mathews.
Senator Needham.
Senator Nowland.
Mr. Sampson.
Mr. Sinclair.
Mr. Laird Smith.

No (1).

Mr. Mahony.

And so it was resolved in the affirmative.

21. *Administrative Buildings and Dockyard Surgery.*—These buildings are not likely to be required for a number of years, and no plans or detailed estimates are available. It is recommended that as the number of men employed on the Base increases, any necessary extension of the present temporary surgery be made so that adequate provision in this direction may be available, but as regards the permanent surgery and the administrative buildings, the Committee is unanimously of opinion that this item should form the subject of further reference at some future date.

22. *Workshops and various other Dockyard Buildings.*—In the case of these buildings, the estimate of cost is approximate only, and no plans have yet been prepared. They will be erected mainly on the land still to be reclaimed, and will not be commenced for some years. The Committee is, therefore, unanimously of opinion that this item should also form the subject of a further reference at some future date.

23. *Sewers and Drains.*—Although the item included in the estimate in respect of sewers and drains was put down merely as a provisional amount, and no details were submitted as to the method suggested for dealing with sewage, the Committee recognises the prime importance of this subject. It was explained in evidence that it would be impossible to have any permanent system established during the progress of the work as the workmen will be in different locations from day to day, and latrines must be as near the workmen as possible to prevent loss of time. The Committee agrees with this view, provided satisfactory arrangements be made conformable with stringent health requirements, and recommends that this item be made the subject of a further reference at some future date.

The decision arrived at in this matter is shown in the following extract from the Minutes of Proceedings:—

Mr. Mahony moved—That consideration of the item Sewers and Drains be deferred pending a further reference at some future date.

Seconded by Senator Needham.

The Committee divided on the motion—

Ayes (8).

Mr. Gregory.
Senator Henderson.
Mr. Mahony.
Mr. Mathews.
Senator Needham.
Senator Nowland.
Mr. Sampson.
Mr. Laird Smith.

No (1).

Mr. Sinclair.

And so it was resolved in the affirmative.

24. *Permanent Railways.*—It was ascertained in evidence that the permanent yard railways will not be constructed until the whole of the excavation and reclamation work is done, and that they will for the most part be laid on the area to be reclaimed. If the excavation and reclamation work takes ten years to complete, it is the intention to spend the money required for the railway in the ninth year. As any estimate given now for the construction of a railway nine years hence must be the merest approximation only, the Committee is unanimously of opinion that no good purpose could be served by giving any recommendation on this work at the present time, and has decided that consideration of this item be deferred pending further reference at some future date.

25. *Continuity of Action.*—After a careful study of the various reports and the evidence taken in connexion with this reference, the Committee is greatly impressed with the magnitude of the work involved in the provision of a Fleet Primary Base, and considers it its duty to stress the importance of continuity of action with the ultimate object of providing a naval establishment fully complying with the requirements laid down by Admiral Henderson.

It is admitted that the full accommodation of the Base as designed by Sir Maurice Fitzmaurice is not required at present, and may not be necessary for a number of years, but there are many advantages to be ultimately derived from the adoption at this stage of a comprehensive scheme for the Base in the shape it will assume when fully completed. Care should be taken that the work is carried out in such a way that the Base may be utilized as early as possible, first of all for destroyers, and later for light cruisers and submarines. Subsequently each stage of expansion should be dealt with as required, and so ingrafted on the instalments of the project already constructed that finally the entire scheme will be available in accordance with the complete design.

26. The Committee deprecates the lack of decision hitherto shown in the matter of the adoption and adherence to a design for the lay-out and construction of this Base. In 1912 a tentative scheme for the Base was prepared by the then Director of Naval Works (Mr. Fanstone), and certain work of an exploratory nature was carried out; then in 1914 Sir Maurice Fitzmaurice, quoted as the "highest known authority" on Naval Bases, submitted his report, which was approved and finally accepted. Notwithstanding this, the Naval Board in March, 1916, instructed Messrs. King Salter and Swan to report on Sir Maurice Fitzmaurice's scheme, and they submitted an entirely different lay-out and method of construction. In December, 1916, a new Director of Naval Works (Mr. Settle) submitted his scheme for the carrying out of the work generally on the lines of Sir Maurice Fitzmaurice's proposal with some modifications, and this was approved and adopted by the Naval Board early in 1917. In September, 1917, the question of carrying out the work involved in "Scheme No. 1" was referred to this Committee for inquiry and report, and while the matter was under investigation the Naval Board adopted the extraordinary course of forwarding to the British Admiralty the reports of Admiral Henderson, Sir Maurice Fitzmaurice, Messrs King Salter and Swan, and Metcalf and Company, and the Director of Naval Works (Mr. Settle) for an expression of opinion as to whether the scheme of lay-out proposed by Messrs. King Salter and Swan and Metcalf and Company or construction in reinforced concrete could be recommended.

This action has in some sense hampered the efforts of the Committee, and some discussion took place as to whether under the circumstances the Committee should submit its report pending receipt of a reply from the British Admiralty. Bearing in mind, however, that some considerable time must elapse before any reply is received from the British Admiralty, and being satisfied from its own investigations that the Commonwealth would not be well advised to embark upon the construction of an expensive work of this kind in accordance with a method largely of an experimental nature, the Committee decided to proceed with the preparation of its report.

The decision arrived at in this matter is shown in the following extract from its Minutes of Proceedings:—

Mr. Sampson moved—That in view of the fact that two schemes for the lay-out and construction of the Base were submitted to the Committee, and that while under consideration the Naval Board, on the recommendation of the Director of Naval Works, arranged for such schemes to be submitted to the British Admiralty for advice, the Committee is of opinion that as it has exhausted its investigations and taken the expert evidence on the merits of the respective schemes available in Australia, it is advisable that the reply of the British Admiralty be awaited before proceeding with the final adoption of the Committee's report.

Seconded by Mr. Mahony.

The Committee divided on the motion—

Ayes (2).
Mr. Mahony.
Mr. Sampson.

Noes (7).
Mr. Gregory.
Senator Henderson.
Mr. Mathews.
Senator Needham.
Senator Nowland.
Mr. Sinclair.
Mr. Laird Smith.

And so it passed in the negative.

27. *Need for Collaboration.*—In carrying out any large work, and especially a tremendous project like that of the Henderson Naval Base, it behoves the Commonwealth to make the very best use of the talent at its disposal. Undoubtedly the most efficient work, and probably a considerable saving to the Commonwealth, would result from a system of collaboration between officials—Although this is freely admitted, collaboration does not appear to have been adopted to any extent up to the present, but in arranging for the lay-out of many of the projected activities of the Base will be essential. That is to say, in determining the lay-out of the Naval barracks, hospital, drill sheds, torpedo school, and such places, collaboration should be arranged with the responsible officers who control those establishments. The Naval Stores Officer should be consulted concerning the design of his stores; the Victualling Stores Officer should be seen about the arrangement and design of his buildings; the Ordnance Stores Officer should have something to say about the design of his establishment; the Shipyard Manager should be consulted as to the details of his shops; and the Engineering Manager as to his shops, &c.; in fine, each technical officer or head of a department should have an opportunity of advancing his views as to details in the lay-out of his particular establishment.

WORKS DEFERRED.

28. Recapitulating the information contained in the preceding paragraphs, it will be seen that the Committee recommends that the commencement of the following works be deferred pending further reference at some future date, namely:—

	Estimated Cost. £
Two Floating Docks of 20,000 tons and 35,000 tons capacity respectively	1,210,000
Administrative Block and Dockyard Surgery	53,250
Workshops	120,000
Various other Dockyard Buildings	187,500
Sewers and Drains	10,000
Permanent Yard Railways	20,250
Total	£1,601,000

SAVINGS EFFECTED BY THE COMMITTEE.

29. If the recommendations made by the Committee be carried out, it is estimated that the saving to the Commonwealth which will result from the reduction in the rate of carrying stone from Wongong Quarry to the Base will be £19,250.

CONCLUSION.

30. In conclusion, the Committee desires to express its surprise and dissatisfaction at the exemption from the operation of the Commonwealth Public Works Committee Act of certain works in connexion with Naval Bases, including water supply, naval barracks, naval stores buildings, electrical generating stations, &c. This will have the effect of withholding from Parliament a considerable amount of information with which it would otherwise be supplied, and preclude the possibility of any variation of the departmental proposals which in the case of certain works already reported upon by the Committee has resulted in increased efficiency combined with considerable saving to the Commonwealth.

H. Gregory
H. GREGORY,
Chairman.

Office of the Parliamentary Standing Committee on Public Works,
120 King-street, Melbourne, 1st May, 1918.