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MADRAS RECORD OFFICE.

Government of Madras.

Public works DEPARTMENT.

G.O. No. 726-27
169-172.

Press
~~Mis.~~

Dated 8 4 1870.

Not to be folded or roughly handled

*Proceedings of the Madras Government, Public Works Department,
8th March 1870.*

Read the following papers :—

No. 169. Proceedings of the Government of India in the Public Works Department, (Buildings and Roads—Civil Miscellaneous,) dated Fort William, 7th December 1869, No. 727-B-C.

Read again :—

Despatch from the Secretary of State, No. 59, dated 30th June 1869.

Read also the following—

Despatch from the Secretary of State for India, to the Government of India, dated 20th October 1869, No. 104.

I HEREWITH transmit, for the information of your Excellency's Government, with reference to previous papers sent out with my despatch, dated 30th June last, No. 59, a copy of a letter with its enclosure which, in compliance with my request, has been drawn up by Sir Frederick Arrow, of the Trinity House, on the subject of improving Blackwood's Harbour on the Coromandel Coast.

From SIR FREDERICK ARROW, to the Secretary of State for India.

IN compliance with your Grace's desire, I have now the honour to place before you a few remarks on the subject of the capabilities afforded by the Armogham Shoal on the Coast of Coromandel, for forming a safe roadstead for the port of Madras and for a harbour of refuge on the East Coast of the Indian Peninsula, and I cannot do better than in the first place furnish your Grace with a copy of a letter which I wrote upwards of twenty years ago to the Honourable R. D. Bethune, the then Crown Member of the Council of the Governor-General of India. I believe, if my memory serves me right, that Mr. Bethune became interested in the question through his brother, who was a Naval Officer. I was at the time commanding a merchant vessel, and frequently about the Madras and Coromandel Coasts; was very much alive to its drawbacks and the risks to which shipping were exposed, and, being well acquainted with Mr. Bethune and having frequently expressed my opinions to him, he requested me one day to put them in writing, intending, when an opportunity arose, to place the subject before the Governor-General in Council. His premature and sudden death, however, prevented his doing so, and the matter entirely dropped: nor have I ever pursued it myself, except that I have occasionally corresponded with my friend Major-General Philip Anstruther, C.B., of the Madras Engineers, who takes a great interest in the subject: unfortunately he has mislaid my letters, of which I kept no copy, or I should have been able to place more detailed information than I can do now before your Grace.

2. A reference to my letter of the 1st December 1848 will furnish your Grace in brief with the circumstances which first called the attention of Sir Henry Blackwood to the importance of the anchorage, though you are no doubt furnished with copies of his correspondence which I remember to have seen, and I do not think that I could usefully extend the slight description of the topography of the place therein. It has always seemed to me nature's own provision to remedy the disadvantages of this side of the Indian sea-board, and it has always seemed *extraordinary* to me it should be so neglected, remembering the analogy there is between it and the East Coast of England, where in Yarmouth and Lowestoft Roads our Fleets of Colliers and Coasters ride out the fury of the gales of the North Sea under the protection of sands outside of them with little less water over them than is to be found in the shoal part of the Armogham opposite to the anchorage known as Blackwood's Harbour; these, like the water inside of the Armogham, are approached by gut ways, and perhaps few places exist forming so clear an approach as the Point Poondy entrance, while to the northward the overlap of Point Pennar is sufficient to keep dangerous sea, or current of violence, from its waters, properly lighted and buoyed, a scheme for which I will readily furnish if upon discussing the question it is entertained and your Grace should so desire. I see nothing even in

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its present state to prevent its being a most valuable place of resort for shipping and adjunct to Madras Roads if connected with port either by an improvement in the existing inland water communication or by a short line of rail; and I think I am not wrong in saying that the latter would be quite as deserving of a Government guarantee as the line connecting the port of Mutlah with Calcutta, and to which it would bear a strict analogy; but to do full justice to the place, and to remove even the small per-centage of risk therewould be in its use at present, there should unquestionably be erected a breakwater to protect the area known as Blackwood's Harbour. I am not Engineer enough to know how this should be carried out, whether by simply depositing stone or whether by a more elaborate construction; but I cannot believe that, looking to the depth of water and to similar operations in this and other countries, and to the lengthened periods of fine weather, shortening the period of working, anything more formidable than financial difficulties would be encountered. I do, in conclusion, sincerely hope the question may be taken up seriously under your Grace's auspices, feeling assured that no greater boon could be given to the commerce of the East and the prosperity of Southern India than by carrying such a plan into effect. If one axiom more than another at the present day rules mankind, it is that time is money, and what an effect might not in this view this harbour produce (with such a port which ships could use at all seasons) for rapid transit of goods or passengers to China and the Eastern Settlements. Connected by railway to the Madras system, terminating at Beypoor on the Western Coast, it would entirely supersede the circumnavigation of Ceylon, and make Madras, what it never can be without a safe port, the great entrepôt of the commerce of Eastern and Southern India and of the Straits.

From FREDERICK ARROW, Esq., to R. D. BETHUNE, Esq., dated 1st December 1848.

You have asked me to give you a seaman's opinion of the practicability of converting the roadstead inside the dangerous shoal of Armogham, on the Coast of Coromandel, into a safe harbour, as well as of its utility when so made; and, though my opinion on a question of surveying will bear no weight, I give it, and you will take it for what it is worth.

2. The originator of this scheme was the late Sir Henry Blackwood, Captain, Royal Navy, who first broached the subject and paid great attention to all its bearings. This is now many years since, and, although bearing his name, the roads have never yet been used by shipping.

3. A very careful survey was made under the immediate orders and inspection of Sir Henry, and upon this was founded the highly favourable opinion he always expressed of its capabilities. This survey, however, I have never seen in detail. After Sir Henry Blackwood left the Indian seas the subject seems to have been lost sight of: it has always appeared to me wonderful that, with such capabilities within reach, the Presidency of Madras, or perhaps I might say, the Government of India, did not make some effort at least to test its value. My own opinion is that it does possess very great natural advantages, and more particularly during the north-east monsoon, when the whole body of water that has been pent up in the head of the Bay of Bengal by the south-west monsoon is released and swollen by the discharge from the Nuddish rivers, flows rapidly along the coast to the southward assisted and regulated in its velocity by the monsoon, from which arises principally the formidable and destructive surf, or rather sea, which at that season breaks along the whole Coast of Coromandel, and from which no part is free, save under the lee of the Armogham Shoal, where, by Sir Henry Blackwood's report, he was always enabled to land whilst at Madras, and immediately to the northward the surf was impassable even in a Masulih boat.

4. By a reference to the chart you will see that the shoal itself runs fair with the bending of the coast inside of it in a N. N. W. and S. S. E. direction for nearly fourteen miles, terminating off Point Poondy to the southward where it closes with the land, its northern extreme somewhat sheltered by Point Pennar. The stream of current, as a rule in deep water, will follow the coast, running in and around its bays and promontories; but, when the water is shoal, it seems more guided by the irregularities of the ground over which it is passing, and it is from this cause probably that the current stream is here deflected from the coast and expands its violence on the outside edge of the shoal, leaving comparatively smooth water within.

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5. That these roads possess great natural capabilities for the formation of a harbour is clear, looking to the fact that, in an area of ten miles by four, there is good holding-ground and regular soundings carrying six fathoms to the edge of the shoal and four within half a mile of the shore; that the southern end is protected by the bank of Point Poondy, (called Pandy Spit), which overlaps it to the eastward, leaving a fair channel of five fathoms a mile in width running in a N. W. by W. and S. E. by E. direction, and that the northern end is covered by the projection of land about Pennar, which no doubt is the fulcrum by which the current is thrown off the shore to the outside of the shoal. With these conditions, and the channels and the inner edge of the shoal sufficiently and judiciously buoyed, it seems to me that ships even without steam might at any time of the year go in or out, and that it only requires art to be called to the assistance of nature in the shape of a breakwater on a portion of the southern part of the shoal to make it a safe and commodious harbour at all seasons of the year, and; though no Engineer, I would say that the depth of water on the part of the shoal where the breakwater would, I imagine, be placed, is not greater than was successfully overcome at Plymouth when engineering was—compared to the present day—in its infancy.

6. Having now given what I fear may be but a crude opinion on your first point, I will turn to the second, viz., its utility.

7. Of this I imagine there could be little doubt, though doubtless local interests and vested rights might throw obstacles in the way. But these would soon be overcome, more especially as, from the chain of the inland waters which run the whole way to Madras, and which might without much difficulty be united, there would be a cheap and effectual method of transit for goods, and this would do away with the necessity of moving the large mercantile establishments from the present port. That ships would gladly make use of it had they the facilities for loading I cannot for a moment doubt, and a greater boon to a seaman or a ship-owner I cannot conceive. Instead of laying in a position of great peril, as they often do now, in the height of the north-east monsoon, straining and knocking about, even if not obliged to go to sea, they would be laying quietly and safely, and able to ship their cargo in half the time they now consume, and many an under-writer can tell the tale of losses from ships either going out to sea half-loaded and unprepared, of lives lost and injury done, days, even weeks, before the vessel got back to complete her loading, or, if not taking warning in time, of vessels entirely lost, driving ashore.

8. These tell their own tale, and the history of Madras roads is full of them. If the plan should ever be carried out, Blackwood Harbour would be a true harbour of refuge, and of what value may be ascertained by a glance at the chart, which shows no place between the river Hooghly and Trincomalee on the western side of the Bay of Bengal, where even the commonest repairs could be executed to any vessel beyond the size of a small coaster.

9. Trusting the length to which these remarks have run may not be tedious to you.

ORDER.—Ordered that a copy of the above despatch and of its enclosures be forwarded to the Government of Madras in continuation of Public Works Department No. 546-C, dated 14th August 1869.

(Signed) R. B. PEMBERTON, Captain, R. E.,
Asst. Secy. to the Govt. of India.

No. 170. Memorandum from the Assistant Secretary to the Government of India, Public Works Department, (Buildings and Roads—Civil Miscellaneous,) to the Secretary to the Government of Madras, Public Works Department, dated Fort William, 18th January 1870, No. 37-B-C.

In compliance with Colonel Orr's Memorandum, No. 17, dated 5th January 1870, the undersigned has the honour to forward copy of Public Works Department Resolution, No. 546-C, dated 14th August 1869, on the subject of improving Blackwood's Harbour on the Coast of Madras.

(Signed) R. B. PEMBERTON, Captain, R. E.,
Asst. Secy. to the Govt. of India.

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PUBLIC WORKS DEPARTMENT PROCEEDINGS—AUGUST 1869.

CIVIL WORKS.

Miscellaneous.

Harbour improvements, Madras—(Secretary of State's Despatch.)

Procs. (C. W. Miscell.) June 1869, Nos. 1—4.

From the Secretary of State for India, to the Government of India, dated 30th June 1869, No. 59.

I HEREWITH transmit copy of a letter* from Major-General Anstruther, with its enclosures, in which he urges the importance of substituting a safe anchor-

* Dated 9th June 1869.

age for the dangerous roadstead at Madras as the principal port of the Presidency. He recommends that an experiment should be tried at a part of the coast known as Blackwood's Harbour.

2. These papers are forwarded for the information of your Excellency's Government with reference to your despatch, dated March 10th, (No. 37), 1869.

From Major-General P. ANSTRUTHER, to the Under-Secretary of State for India, dated 9th June 1869.

I AM anxious to bring to the notice of the Government of all India a matter which, although apparently concerning only the Government of the Madras Presidency, is in reality of the highest importance to the trade and revenue of all India and to the communication between England and China.

2. It is a question which cannot fairly be referred to the Governor of Madras, who ought not to be placed in the invidious situation of recommending measures opposed by all the mercantile body at his Presidency.

3. Therefore, when in September 1865 the Chamber of Commerce refused to recommend to Government the experiments I asked for avowedly, because they would not "advocate the removal of the shipping from Madras," the most dangerous roadstead in the whole world, "even should it be found practicable to make a safe harbour" a few miles north, I did not feel myself justified in asking the Governor in Council to overrule their objections, nor should I now ask the local Government to do so.

4. But it is a question of great imperial interest, and I beg with your permission to forward the accompanying papers and memoranda on the subject, viz:—

1st.—A paper by Colonel DeHavilland, Chief Engineer of the Madras Presidency, showing the advantages which would accrue from adopting "Blackwood's Harbour," distant forty-two miles north from Madras, as the shipping port of the Presidency. With this he gives a very clear and instructive chart of the coast between the harbour and Madras.

2nd.—The last-published Admiralty Chart of the same.

3rd.—A letter which I addressed to the Chief Engineer of the Madras Presidency; it is marked letter A, and is dated 18th September 1855; it details the experiments I wished to try.

4th.—A second letter to the same, marked letter B, replying to some objections to my letter A.

5th.—A paper marked C, in which the former letters and the replies are quoted from and commented upon. This paper I send in triplicate: if I did not give the exact

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which could not fail to double the value of the trade of the port and prove the greatest possible blessing to all Southern India, it would be supposed that I was unjust in assigning such motives to any men; their own letter is, therefore, printed *in extenso*.

5. If a safe harbour existed at or near Madras, the mails and passengers from Europe would go from—

Aden to Cannanore	...	...	...	...	By steamer
Cannanore to Madras	...	...	...	...	„ railroad
Madras to Mergui	...	...	...	...	„ steamer
Across to Puto Bardia	...	...	...	...	„ railroad
Puto Bardia to Canton	...	...	...	...	„ steamer

having saved 1,000 miles of sea between Cannanore and Madras, and 1,400 miles of going round the Malay Peninsula. Therefore I trust my experiment will be tried.

Account by Colonel DEHAVILLAND of the Armogham Shoal and Blackwood's Harbour on the Coromandel Coast near Madras.

[Deposited.]

From Lieutenant-Colonel P. ANSTRUTHER, to the Chief Engineer, Madras, dated 18th September 1855, A.

I HAVE the honour to request you will obtain the requisite sanction of His Lordship the Governor in Council for the trial of an experiment to ascertain the time in which, by the action of the current on our coast, a bank of sand will be formed, under the shelter of which boats might land cargo without danger from the surf.

2. I propose that some stones should be laid on the shallowest part of the Armogham Shoal, large stones thrown in and allowed to take any position chance may give them; the experiment to be suspended when the highest stone level with the top of the water, is visible.

3. I believe that one portion of this shoal has only sixteen feet of water on it; the experiment cannot, therefore, be an expensive one.

4. I expect that the result will be a deposit of sand formed on the north side of this heap of stones, widening as the sand is deposited, and getting deeper and deeper as it is further from the nucleus. I recommend that soundings be then taken once a month, and further proceedings would, of course, depend upon the result of this first trial.

5. If, as I expect, a long spit of sand should be formed in a moderate time, a thing only to be ascertained by experiment, I would again erect a similar heap of stones, in sixteen feet water on such part of the sand as should be indicated by the shallowest water, and continue building these pyramids of stone along the crest of the sand-bank at intervals, thus gaining at little cost a natural breakwater of sand.

6. The experiment detailed in Colonel DeHavilland's book on the Public Edifices of Madras shows that at Armogham a common English-built ship's boat did land people and take them off daily for a year, and Sir Henry Blackwood recommended this as a harbour for Madras, from whence it got the name, now forgotten, of Blackwood's Harbour.

7. There is canal communication from the place with Madras, and no country in the world affords greater facility for a railroad.

8. If this plan proved successful I should recommend another similar work being erected on the Pulicat Shoal, very much nearer Madras; but as the water is more than double the depth, the quantity of stone would be ten times as much.

9. This latter work I proposed twenty years ago to Colonel Arthur Cotton, but he did not take it up. I submitted my plans to a very distinguished Civil Engineer; he admitted the feasibility of them, subject, however, to the consideration of "time." I could not give any answer as to the time it would take to form a sand-bank to serve as a breakwater, nor do I think it possible to give in answer without actually trying the experiment, which, therefore, I request you will recommend to Government.

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10. You will have no difficulty in giving to Government all the information that may be required as to the best place to procure stone, the expense of getting it, and of carrying it, either by canal or by sea, to Blackwood's Harbour. I hope you will also furnish them with statements of the size of stones you could procure, and the quantity required to form a rough cone sixteen feet high, natural slope.

11. I think that if you would order the preparation of two maps of the Armogham and Pulicat Shoals to be prepared, representing the depth of water by shades of black so that the shallowest parts shall be the darkest, it would at once catch the eye better than the figures employed in the Admiralty Charts. If the two shoals are shown in the same map, either the scale used must be very small or the map is too large. You might note on each the distance from the shallowest point to the Madras Railway station in statute miles.

12. I am confident that this will appear to be the true way to form a harbour, for, if not at Madras, and I beg you will obtain for me the support of the Committee for the prosecution of Public Works.

From Lieutenant-Colonel P. ANSTRUTHER, to the Chief Engineer, Madras, dated
10th October 1855, B.

Your letter of the 6th informs me that you consider that I should dispose of Major Cotton's counter-suggestions on the subject of my proposed experiment on the Armogham Shoal before the subject is referred to Government.

2. I proceed, therefore, to offer some remarks upon these suggestions, in which Major Cotton agrees with me as to the main question, viz., the results which may be expected from throwing stones into the current running along our beach, but differs slightly as to the exact shape of the expected sand-bank, and suggests a better, because a nearer, locality, winding up with the suggestion that I should myself investigate the effects of the stones thrown down in Madras Roads for a similar purpose.

3. But I cannot agree with him that I should be the man to examine the soundings of the Madras Roads; I believe it has been done by far more competent persons, but the result either way would not, in my opinion, be conclusive; indeed, I am not sure that they would even guide us in forming a professional opinion.

4. I fully agree with Major Cotton that a better locality might be chosen for forming a harbour for Madras. The nearer, the better doubtless. Assuming that the most desirable place is Madras Roads, in latitude $13^{\circ}51'$, the next most desirable is Pulicat Shoal, in latitude $13^{\circ}46'$, and the least eligible is Armogham Shoal, in latitude $13^{\circ}48'$.

5. The Pulicat Shoal is eleven miles from Madras, and the Armogham Shoal is forty-three miles distant. So far I should agree with Major Cotton, but I do not think we are justified in trying experiments in Madras Roads. They are quite sufficiently dangerous without our assistance: the formation of a breakwater off Madras itself would, at all events, however successful, be enormously expensive from the depth of the water; but if it were unsuccessful—if, as is possible, we did not succeed—we should have added a frightful danger at immense expense, and probably ruined the port, bad as it is.

6. On Pulicat Shoal, eleven miles distant, there is one spot only six feet deep, and here, as a mere experiment on the effect of the current, we might work more cheaply; but no practical good would result from the doing so: there is not depth inside that portion of the shoal, between it and the shore, for ships to get in and out; only twelve feet water between the head of the shoal and the main land.

7. At Armogham Shoal there is at one place twelve feet water, half a mile from it eighteen feet, and half a mile further on fifteen feet water. There is about a mile of breadth of channel between this and the shore, with thirty feet water on at least half of it. I think a ship might sail in, steamers certainly might. There is a very large space inside for hundreds of ships, and we know that it is very nearly a good harbour now. The experiment would be cheap and must do

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some good, while it could do no harm. At Pulicat the experiment would be still cheaper, but would not do any good, it could do no harm. At Madras it would be exceedingly expensive, and might do much good, might do much harm.

8. Major Cotton objects to "scattered heaps" preferring a line, so do I. But a line is formed of heaps closed up; let me try one heap first, if that succeeds by all means let us have a line, and it will be time enough then to discuss whether our line should go along the crest of the sand-bank as I said, or at right angles to it as Major Cotton proposes. Let us begin with a point, and watch the result.

9. I think the experiment should be tried at Armogham. I think taking soundings in Madras Roads could not in any way affect this proposal, and I have no wish to cross the surf unnecessarily.

10. Sir John Herschel's opinion, quoted by Major Cotton, that "suggestions are easy enough, let a man go and do it" is hard upon me, as I shall have no profit from the work; but, if your Committee will not recommend Government to try my experiment, I will do it myself as soon as I can raise the money, which I estimate at Rupees 2,000 in the first place, merely to raise one heap.

11. I propose that you should recommend advertising for tenders to build and maintain for two years, any where between latitude 13 and latitude 14, a pile of masonry stone, brick, or other work, one mile to the eastward of the coast, the top to be visible above water.

12. This would leave the contractor all risks from erroneous charts and ensure his using permanent material.

13. Major Cotton thinks sand will form south, as well as north, of a heap thrown in. I judge not from the look of the charts of these shoals. As to shape of stone work, let us first get a point and watch the sand-bank to determine on further proceedings.

14. I reject all arguments founded on the result of the groynes on the beach. There may be, probably there is, analogy between those results and those which I expect, but I am not sure that it is so; let us try the experiment, and for that purpose I request your Committee will recommend to Government to advertise for contracts as I have above said.

MEMORANDUM by Major-General P. ANSTRUTHER, late of the Madras Artillery, dated
19th May 1869, C.

IN 1827, Colonel DeHavilland, of the Madras Engineers, printed and published a paper, from which we give extracts in our Appendix, describing a safe and commodious harbour, distant from Madras Roads about forty-two miles. Nothing resulted from the publication of this paper.

2. Some years afterwards, Major-General Sir Arthur Cotton, of the Madras Engineers, proposed a breakwater for Madras Roads: this would have facilitated landing from the ships in the roads, but would not have afforded protection to the ships themselves, which cannot remain on that coast in the monsoon: the scheme failed for want of funds even for its limited end.

3. On the 18th of September 1855 the undersigned wrote to the Chief Engineer of the Madras Presidency requesting him to obtain the sanction of the Governor in Council for the trial of one of two experiments detailed, with the view of ascertaining the time in which the current on the Coromandel Coast would throw up a sand-bank to the northward of any obstruction artificially formed, beneath the protection of which bank ships might ride safely throughout the year and boats of the English build might land cargo.

4. The answer is contained in a long report signed by the Deputy Chief Engineer (now Major-General) Frederick Cotton, C.B.; extracts from this are given in the Appendix, it bears date the 6th October 1855.

5. On the 15th of December the undersigned addressed a letter to the Madras Chamber of Commerce asking them to direct some competent person to try one of the two experiments detailed in the letter above mentioned of date 18th of September, and pointing out that they had in hand a large sum of money raised for the purpose of affording facilities to navigation. This letter it is not necessary to give.

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6. The reply to this, however, is given in the Appendix; it is dated December 24th, 1855, and is signed by the Chairman of the Madras Chamber of Commerce. It acknowledges with much courtesy the receipt of the communication dated the 15th, but states that—

“As the Chamber is not prepared to advocate the removal of the shipping from Madras even should it be found practicable to make a safe harbour at either of the places referred to, and as the latter question and that of the probable expense of making the experiment are points on which the Chamber do not feel themselves capable of expressing an opinion, but which may fairly be left to the judgment of professional men in the Public Works Department, they are averse to making any representation to Government on the subject.”

7. But it is the obvious duty of the Government of all India to prefer the having at least one safe harbour on the western side of the Bay of Bengal, to the convenience which results to the merchants of Madras from having the shipping opposite their own doors, and it is to be hoped that the Secretary of State for India will order the trial of the experiments required to determine the time in which, by the action of the current on the coast, a sand breakwater will be thrown up, as was recommended by the Engineers DeHavilland and Cotton.

8. The experiment would cost less than one mile of the railroad which would infallibly be constructed to join the harbour and the town of Madras. The construction of that railroad would pay for the breakwater, and the Government and people would alike gain greatly, although Black Town would be practically removed fourteen or forty-two miles inland.

9. If the Government prefer it, there is no doubt that the Madras Irrigation and Canal Company ought to be eager to construct such a harbour at the very mouth of their noble canal; but the Government have lately expressed a disinclination to entrust such works to private parties.

10. But somebody should do it, and speedily.

APPENDIX A.

ABSTRACT of Colonel DEHAVILLAND'S account of the Armogham Shoal and Blackwood's Harbour, on the Coromandel Coast.

ADMIRAL Sir Henry Blackwood, in H. M. S. *Leander*, came in through the southern passage and anchored within the shoal. He was pleased with the *locale*, and was convinced that, if established as an anchorage, the advantages to be derived from, etc., etc.

“The entrance of the harbour at Point Poondy, in N. Lat. $13^{\circ} 46' 45''$, is distant from the Madras Roads only about forty-two miles: the backwater to Madras through the Pulicat Lake would afford a more expeditious, convenient, and safe communication than the river Hooghly offers between Saugor and Calcutta.”

Captain Maxfield, surveying the harbour by Admiral Blackwood's order, mentions that “while he was surveying and daily landed in his ship's boats, the surf at Madras was breaking with tremendous force,” etc., etc.

Colonel DeHavilland says, “It is evident that a breakwater might be constructed on the shallow part of the shoal with safety, where the water lies from fifteen to twenty feet in depth, and on which it now very frequently breaks even in fine weather.

“The length need not be determined at the outset; it might be continued till the shelter required was obtained, the breadth or thickness of the work would also be left to the operation of the waves upon it, and the height or depth would be so regulated that the upper surface would be just above the summits of the highest waves.

“If the occupation of Blackwood's Harbour should ever take place, those accidents, which from their frequency have become familiar although in themselves appalling, will no more occur, and the communication with Madras will then be as secure, at all seasons, as with any other part of Her Majesty's eastern dominions.”

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APPENDIX B.

MEMORANDUM by Major F. C. COTTON, C.B., Deputy Chief Engineer, on Colonel ANSTRUTHER'S proposal to form a sand-bank for the purposes of a breakwater on the Armogham Shoal.

“I agree with the Colonel in thinking that on the Armogham Sands a heap of stones would raise a bank somewhat to the north of it. It would, in my opinion, form a line of sand somewhat southerly also, the form of the bank being this—

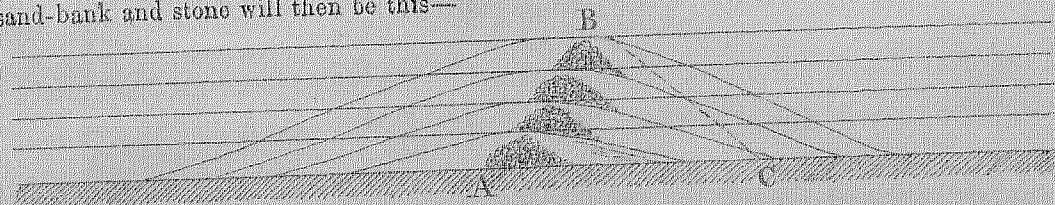
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“The length of each spit would vary with the season, being longer to the northwards when the current runs from the south, and longer southward when the current changes in the north-east monsoon.

“To form a shoal I would throw a very low line of stones across the line of currents which will be found on any part of the coast, not actually in the same line in opposite directions but generally not far deviating from one line. This deviation will not be sufficient to affect materially the accumulation of sand from a line of stone, but

“The line of stone should be very low so that the sand should pass over it, when there will be a deposit on both sides with either current. As soon as the first line is covered another of like character should be thrown upon the accumulation, when a similar effect will be produced; and, as the sand-bank rises, other lines must be raised till the surface is reached. The section of the sand-bank and stone will then be this—



“The effect of the four lines of stone will be equal to the effect of a mass of which A B C would be the section.

“So much for the mode of operation by which I suppose that a shoal could most readily be formed by the use of stone—a mode put to the test by me (Major Frederick Cotton, C.B.) with successful results in the Godavery, near the town of Narsapoor and other localities in the delta of the Godavery.

“If a shoal can thus be formed in moderately shallow water, is it advisable to make the sand breakwater at Armogham? Might it not be better to make it where it is more immediately wanted off Madras?

“I have for some time been of opinion that it would have been better to have thrown the Madras breakwater stone across the current instead of parallel to it, always provided that the line of stone was not so near the land as to risk either the deposit of sand between the shore and the stone-work, or such a set of the current on the beach as should make the works for its defence very costly.

“I have no doubt that a line of stone would raise a sand breakwater off Madras; and, if it did cause a set on the beach, the action might be counteracted by groynes.

“I consider the subject one of great interest. It is, I feel sure, very possible to make the ocean work for us, and”—etc., etc., etc., (a complimentary allusion which may be omitted.)

*Proceedings of the Madras Government, Public Works Department,
8th March 1870.*

APPENDIX C.

From R. O. CAMPBELL, Esq., Chairman, Chamber of Commerce, Madras, to Lieutenant-Colonel
P. ANSTRUTHER, Madras Artillery, dated 24th December 1855.

I HAVE the honour to acknowledge receipt of your letter of the 15th instant, enclosing copies of letters addressed by you to the Chief Engineer. The latter recommend that an experiment be made on one of the sand-banks to the north of Madras with the view of ascertaining the practicality of making a harbour for shipping in the vicinity of the Madras roadstead; and, in addressing the Chamber on the same subject, you urge them to take up the question and to employ a competent person to make the experiment, or to request Government to do so.

2. Your letter and its enclosures were laid before the Chamber at a general meeting which took place on the 17th instant, and I am desired to acquaint you, while thanking you for the copies of your communications to the Chief Engineer, that, as the Chamber of Commerce is not prepared to advocate the removal of the shipping from Madras, even should it be found practicable to make a safe harbour at either of the places referred to, and as the latter question and that of the probable expense of making the experiment are points on which the Chamber do not feel themselves capable of expressing an opinion but which may fairly be left to the judgment of professional men in the Public Works Department, they are averse to making any representation to Government on the subject.

3. I am also desired by the Chamber to send you a copy of your letter under reply, which I now do under the impression that your request to send a copy to the *Athenæum* newspaper arose from your not having retained one.

4. Allow me to add that, while the Chamber do not feel called upon, under the circumstances of the case, to act upon your suggestions, they fully appreciate the public spirit which induced you to address them on the interesting subject of your communication.

RESOLUTION by the Government of India, Public Works Department,
dated 14th August 1869, No. 546-C.

Read the following—

Despatch from the Secretary of State, No. 59, dated 30th June 1869, and enclosures.

ORDER.—Ordered that a copy of these papers be forwarded to the Government of Madras for report with the remark that if, in the opinion of that Government, there are sufficient grounds for so doing, this might be one of the harbours selected for examination by the Engineer whom the Secretary of State has been advised to send out to India.

No. 171. ORDER THEREON, 8th March 1870, No. 726.

CIVIL WORKS, No. 18.

ORDERED that the following letter
be despatched:—

(Here enter No. 727, dated 8th March 1870.)

(True Extract.)

Colonel, R. E.,
Secretary to Government.

Exd. A. S. Rodgers.

PUBLIC WORKS DEPARTMENT,
FORT ST. GEORGE, 8th March 1870.

No. 172.

No. 727.

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,
PUBLIC WORKS DEPARTMENT.

CIVIL WORKS, No. 19.

From Government of India, dated 7th December
1869, No. 727-B-C.

Do. do. do. 18th January 1870, No. 37-B-C.

Sir,—With reference to the correspondence as per margin, in which the Government of India call for a report on a proposal to construct a safe anchorage on the Coromandel Coast, as a substitute for the dangerous anchorage of Madras, by improving the means of shelter to be found at the spot designated Blackwood's Harbour, I am directed to state that the subject will be referred to the Marine Engineer who, it is hoped, will ere long be deputed from England to examine and report on the harbours of this Presidency.

I have the honour to be,

Sir,

Your most obedient servant,

Colonel, R. E.,
Secretary to Government.

Exd. A. S. Rodgers.

*All communications
should be addressed
to the Secretary.*

No. 37 B. C.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.

Carl's Miscellaneus.

To
The Secretary to the Gov^t of Madras.
in the Public Works Department.

Fort William, 18th January 1870.

In compliance with Colonel Pitt Rivers' Memo: No 17 dated 5th January 1870, the undersigned has the honor to forward copy of Public Works Department Resolution No 546 C dated 14th August 1869, on the subject of improving Blackwood's Harbour on the coast of Madras.

W. S. Scarborough Captain R. C.

Ap^{le} Secretary to the Gov^t of India

14. Sec 1570 Ch. 18

5309 & 437

GOVT OF INDIA
PUBLIC WORKS.

The Secretary to the
Govt of India

Dated

Recd.

G. O. S. Memoirs 570, N. 8726 & 727

Nos. 169 (Q. 171 & 172)

Blackwoods Harbour Paperwork
on papers on the subject of im-
proving Blackwoods Harbour
on the Coast of Madras.

Blackwoods Harbour The following
information has been received from
improving Blackwoods Harbour
on the Coast of Madras will be
referred to the Marine Engineer
selected from England.