

Marine (189 6) Department.

G.O., No. 70 Mar.

DATED 5/2/96.

[Despatch Abstract.]

Tidal operations — Govt of India's
report regarding Mangalore with a
view to establish Survey of India
Department — Communicated to the
Quadrant Port Office.

Endorsement from the Government of India forwarding correspondence embodying a report on an examination of Mangalore and its neighbourhood in November 1895, with a view to establishing Survey of India Department —, communicated to the Presidency Port Officer.

GOVERNMENT OF MADRAS.

MARINE DEPARTMENT.

READ—the following paper :—

From K. G. SLY, Esq., Under Secretary to the Government of India, Revenue and Agricultural Department (and Surveys), dated Calcutta, the 30th December 1895, No. 3603/146-5.

Forwarded to the Military Department for information with reference to correspondence ending with that department's endorsement No. 1032, dated 18th October 1895.

ENCLOSURES.

Endorsement by the Surveyor-General of India, dated Calcutta, 12th December 1895, No. 3654 S.

Copy of the following forwarded to the Secretary to the Government of India, Revenue and Agricultural Department, for information, with reference to Mr. Sly's letter No. 2745—146-3, dated the 24th September 1895, with the remark that it is evident that the idea of a tidal gauge at or near Mangalore must be abandoned.

From Colonel J. HILL, R.E., in charge, Tidal and Levelling Operations, to the Surveyor-General of India, dated Poona, the 29th November 1895, No. 939.

With reference to your letter No. 2752 S., dated 8th ultimo, I have the honour to inform you that early in this month I sent Lieutenant Morice, accompanied by Mr. Belcham, to Mangalore to examine that port and the neighbouring coasts, and report whether they contain a site suitable for the erection of a tidal observatory. On completing their examination, Mr. Belcham went on to Madras to make the annual inspection of the Madras Tidal Observatory, and Lieutenant Morice returned to Poona. I append Lieutenant Morice's report on Mangalore and its neighbourhood, dated at Mangalore on the 9th instant, with which I concur, and which shows clearly that no improvement has taken place in the locality since Major Bransell reported on it unfavourably in 1872, five years before our systematic tidal operations commenced, and that no site suitable for such operations is to be found in Mangalore or its neighbourhood.

Report on examination of Mangalore and its neighbourhood in November 1895, with a view to establishing Survey of India Department Tidal Operations.

1. The situation of Mangalore renders it highly desirable to undertake tidal operations at the port, both for the connection with the mean sea level of the important levelling operations terminating there, and for the perfection of the general scheme of the tidal operations in this part of India by taking observations about midway between the tidal stations Kärwār and Beypore.

In connection with schemes for improving the port of Mangalore information regarding the tides is required: information for such schemes includes details regarding tidal streams, etc., and much else that is not to be obtained from tidal operations of the Survey of India Department, which deal solely with the rise and fall of the surface of the water, but the desire for information led to local authorities suggesting that such operations should be started just at the time that it was under departmental consideration whether conditions at Mangalore had so far changed as to enable operations, which had been previously attempted without success, to be established.

Under these circumstances I received orders to proceed to Mangalore and endeavour, with Mr. Belcham's assistance, to select a site for a tidal observatory.

2. Rough observations were taken in the river Netráwáti in 1869, and in 1872 precise observations of the tides in the open sea were attempted, but surf and shifting sands in May of that year prevented their being started. Information regarding these observations is given on pages IV and V, Introduction to "spirit levelled heights, No. 3, Southern India, Points in Mangalore," and on page IX (a) of the Synoptical volume of the Madras Longitudinal Series from which the following are extracts:—

Captain Basevi's rough observations in the Netráwáti.

"Mangalore is built along the right bank of the river Netráwáti near its debouchement into the sea; there is a bar across the mouth of the river which is exceedingly dangerous to cross during the south-west monsoon; but there is always several feet of water on it even at lowest tides; so that during north-east monsoon Mangalore is not an unfavourable locality for tidal observations; during the south-west monsoon, however, when the river is flooded by the rains, such observations would be valueless.

"The river runs parallel to the sea for several miles, and is separated from it only by a narrow strip of sand: the mouth of the river is steadily progressing northward, and is now well to the north of the town, whereas it was formerly considerably to the south of it, and judging by the atlas sheets published in 1872, the mouth of the river has northed about 3 miles since the survey was executed, giving an average of 100 yards a year.

"The site selected for the gauge was rather less than two miles inside the mouth of the river, on the west bank, about 300 yards south of the custom and look-out houses and directly opposite the door of the offices of Messrs. Alston & Co., Agents for the British India Steam Navigation Company. The gauge was erected at a distance of 150 feet from the shore; it consisted of a stout beam 6 inches by 4 inches and 10 feet long, driven to a depth of 3½ feet into the bed of the river. One face of the beam was grooved to admit a plank of well-seasoned teak 4 inches broad by 1½ inches thick and 7 feet long, graduated to feet and inches; besides fitting tightly in the groove, the plank was further fastened by two screws.

"The gauge was surrounded on three sides by a frame of bamboos and matting carried up to near the top of the beam to limit the action of waves or wind on the gauge. After setting up the beam and fixing the graduated piece at the requisite height, the zero of the scale was referred to a mark on the wall of a building near the edge of the water (Messrs. Alston's offices already alluded to); this was done by means of a small 5-inch theodolite, which was set up at a point equidistant from the gauge and mark. The zero of the gauge and mark were compared weekly.

"Observations were commenced on the 17th November and continued for a whole lunation up to the 15th December. The method of observation followed was to take a series of readings of the gauge at intervals of 5 minutes, commencing at about half an hour before the expected time of high or low water and continuing them until the water had perceptibly fallen or risen according as high or low water was observed. The day observations were made with a hand telescope; at night the gauge had to be visited in a boat.

"On the completion of the observations the zero was again finally compared with the referring mark. This was done both by Mr. Macdougall, Assistant Surveyor, Great Trigonometrical Survey of India, with the same instrument that he had previously used, and also by Captain Basevi with a larger (8-inch) theodolite. Mr. Macdougall obtained the same result as before, but Captain Basevi found a difference of one inch, which was verified by a slightly different process. As the difference was probably due to the superiority of the instrument, the result obtained by Captain Basevi has been retained, but little or no suspicion can be attached to the permanency of the zero of the gauge.

"Major Branfill was occupied during a part of the field season of 1871-72, in the attempt to set up a self-registering tide gauge at Mangalore. The river Netráwáti which runs northwards past the town of Mangalore, is separated from the open sea for several miles by a spit of sand varying in width from 100 to 400 yards and 10 or 12 feet above sea-level in the highest parts. It appeared that this spit had been extending northwards for several years driving the river mouth and bar continually before it. The older parts of the sand were covered with a growth of sea pink and many other plants, and were apparently very firm and not liable to shift. Some years before, a breach had been cut in the spit to allow the river to enter the sea direct and a little south of the town, instead of flowing round the spit which extended a mile from the cut; but a very few tides sufficed to fill up the gap. From this and other local information there seemed good reason to suppose that the sand spit might be considered more than sufficiently permanent for a year's tidal observations. Major Branfill therefore had a masonry well sunk in the highest part of the spit where it was 12 feet above sea level and 30 yards away from high water mark on the beach about a mile south of the river mouth and nearly opposite the town of Mangalore. The sand was very firm at a small depth below the surface but very 'quick' at the permanent water level below,

Major Branfill's attempt to set up a self-registering tide gauge in communication with the open sea at Mangalore.

"As regards the tidal observations taken at Mangalore by Captain Basevi in 1869-70, a memorandum by that officer is subjoined.

which appeared, however, to be considerably higher than mean sea level. The well was sunk until there was always a depth of 6 feet or more of water in it and 10 feet of masonry above high water mark.

"Communication was next established with the open sea by wrought iron gas piping, but owing to the persistent high level of the water in the well, a water-tight cistern had to be introduced, which should only admit or deliver the sea water by means of the pipe. This was effected with much difficulty, but bad weather set in almost immediately, and the water shoaled and covered the sea end of the pipe with about a foot of sand.

"Meanwhile the self-registering tide-gauge had been set up. A severe gale now occurred which considerably altered the shore line, washing away much of the sand spit almost up to the observatory and well and shoaling the water for some distance out to sea. A continuance of bad weather rendered it necessary to dismantle the observatory, but not before damage and loss had occurred from the violence of the waves.

"Major Branfill, after his experience, came to the conclusion that to set up a tidal observatory and maintain it in operation for a twelve month on the sandy shore of the open coast, is an affair of such difficulty and expense and at best so uncertain of success that it can hardly be recommended. Mangalore was accordingly abandoned as a tidal station."

3. The following admiralty charts give the configuration of the coast in these parts, and a rough idea of the port of Mangalore:—

Charts and plan of the port.

India, west coast, Viziadung to Coochin with the Laccadive Archipelago, 182—56, add. and corr., 1891-92, west coast of India. Sheet VIII and Sheet IX (which latter includes a larger scale plan of the port of Mangalore).

It must be remembered that all sands, bars, etc., and of course all soundings shown on these charts, are in a state of constant change from season to season and from year to year. The large scale surveys of the port made from time to time by the port officer show the recent changes at Mangalore in a striking manner. Detailed surveys of the port of this kind are not published. The position of the bar, etc., has changed a great deal since Major Branfill and Captain Basevi described it in the extracts given above.

4. Mr. J. M. Simpson, the Port officer, was good enough to explain to me on the spot some recent changes in the spits north and south of the bar and in the channel. He also entered into the question of the suitability of the port for tidal operations, and kindly introduced me to Mr. E. B. Palmer, Agent of the Bank of Madras, whose knowledge of Mangalore, acquired by over 20 years' residence in the place, is extremely valuable in all local questions. Mr. Simpson's and Mr. Palmer's views, after clear explanation had been made to them, of the conditions essential for such operations, may be summarized thus: that the conditions of Mangalore have in no way become more favourable for tidal operations since Major Branfill was here, and that his estimate of them is still perfectly just. Mr. Palmer kindly accompanied us to the scenes of Captain Basevi's and Major Branfill's labours, but no trace of them remains.

5. For the proper conduct of tidal operations it is desirable to find a spot ready of access and suitably situated with a view to attendance, supervision, etc., and such that there may be a safe observatory on firm foundations with simple water communication with these even at the lowest tides.

6. At Mangalore the waters within and those outside the bar, which is at present about a mile south of the town, must be separately examined to see whether tidal operations can be undertaken. The range of the tide is about 6 feet at springs and about 4 feet at neaps.

7. The water inside the shifting bar constituting the back-water or inner harbour is affected by the rainfall in the two rivers, Netráwáti and Gurpur, during a great part of the year; the former of these rivers discharges into the back-water near its southern limit, and the latter near its northern limit; and tidal observations taken here would not represent the sea and would therefore fail to serve the general scheme of the tidal operations; they would presumably, for the same reason, be of little use for the improvement of the port. But, however useful they might be, it is impossible to make sure of carrying them on, as the sands in the back-water or inner harbour shift so much from season to season and from year to year, that no spot could be selected even in the fairway where water and a firm foundation could be guaranteed even for a year. Spots apparently suitable near the "Laccadive store godown," a little north of the junction of the Netráwáti and the back-water and at other representative spots, were visited, but all proved deceptive and no reliable site could be found.

8. Outside the same shifting bar the coast stretches for miles north and south in a long expanse of shifting, treacherous sand banks exposed to the full force of a surf considered as dangerous and as violent as that of Madras. No attempt has been made to erect any structure

Outside the bar.

within reach of this surf. The action of the sands is particularly unfavourable to all plans for fixing any kind of structure or even any signal: anchors get buried and sucked down into the sand, and chains become embedded in a similar manner, so that even a channel buoy cannot be maintained in position, but is soon dragged under water by its own anchor chain. I do not think it would be possible to erect and maintain any kind of tidal apparatus whatever for observing the level of the sea at Mangalore or for several miles north or south of it.

9. I am therefore obliged to report that the unfavourable conditions of Mangalore for Difficulty of starting and maintaining tidal operations. Survey of India Department tidal operations have in no way diminished since Major Branfill attempted observations in 1872, and to repeat his concluding remarks: "To set up a tidal observatory at Mangalore and maintain it in operation for a twelve month . . . is an affair of such difficulty, and at best so uncertain of success that it can hardly be recommended; and I greatly fear that Mangalore must be abandoned as a tidal station." It is plain that, having regard to the irregularity and peculiarity of tides in Indian waters, observations at any place out of the neighbourhood of Mangalore would be useless as regards improvements of the port, and I have just stated that no suitable site can be found in the neighbourhood.

No. 74, Marine.

Copy of the above, with enclosures, forwarded to the Secretary to the Government of Madras, Public Works (Marine Department), in continuation of Marine Department No. 1032, dated the 18th October 1895.

(By order.)

FORT WILLIAM,
23rd January 1896.

(Signed) E. DEBRATH, Capt., R.E.,
for Dy. Secy. to the Govt. of India.

ORDER—No. 70, Marine, dated 5th February 1896.

Communicated to the Presidency Port Officer in continuation of G.O. No. 317, Marine, dated 6th November 1895.

(True Extract.)

Under Secretary to Government.

To the Presidency Port Officer.

Exd. T. K. Narayana Aiyangar.

Spare Copies

No. 3654 S., dated Calcutta, the 12th December 1895.

En dorsed by the Surveyor General of India.

COPY of the following forwarded to the Secretary to the Government of India, Revenue and Agricultural Department, for information, with reference to Mr. Sly's letter No. 2745—146-3, dated the 24th September 1895, with the remark that it is evident that the idea of a tidal gauge at or near Mangalore must be abandoned.

No. 939, dated Poona, the 29th November 1895.

From—COL. J. HILL, R.E., in charge Tidal and Levelling Operations,
To—The Surveyor General of India.

WITH reference to your letter No. 2752 S., dated 8th ultimo, I have the honour to inform you that early in this month I sent Lieutenant Morice, accompanied by Mr. Belcham, to Mangalore to examine that port and the neighbouring coasts, and report whether they contain a site suitable for the erection of a tidal observatory. On completing their examination, Mr. Belcham went on to Madras to make the annual inspection of the Madras Tidal Observatory, and Lieutenant Morice returned to Poona. I append Lieutenant Morice's report on Mangalore and its neighbourhood, dated at Mangalore on the 9th instant, with which I concur, and which shows clearly that no improvement has taken place in the locality since Major Branfill reported on it unfavourably in 1872, five years before our systematic tidal operations commenced, and that no site suitable for such operations is to be found in Mangalore or its neighbourhood.

Report on examination of Mangalore and its neighbourhood in November 1895, with a view to establishing Survey of India Department Tidal Operations.

(1) The situation of Mangalore renders it highly desirable to undertake tidal operations at the port, both for the connection with the mean sea level of the important levelling operations terminating there, and for the perfection of the general scheme of the tidal operations in this part of India by taking observations about midway between the tidal stations Kärwar and Beypore. The information regarding the port of Mangalore information regarding the tides is required: information for such schemes includes details regarding tidal streams, etc., and much else that is not to be obtained from tidal operations of the Survey of India Department, which deal solely with the rise and fall of the surface of the water, but the desire for information led to local authorities suggesting that such operations should be started just at the time that it was under departmental consideration whether conditions at Mangalore had so far changed as to enable operations, which had been previously attempted without success, to be established.

Under these circumstances I received orders to proceed to Mangalore and endeavour, with Mr. Belcham's assistance, to select a site for a tidal observatory.

(2) Rough observations were taken in the river Netráwáti in 1869, and in 1872 precise observations of the tides in the open sea were attempted, but surf and shifting sands in May of that year prevented their being started. Information regarding these observations is given on pages IV and V, introduction to "spirit levelled heights, No. 3, Southern India, Points in Mangalore," and on page IX(a) of the Synoptical volume of the Madras Longitudinal Series from which the following are extracts:—

Captain Basevi's rough observations in the Netráwáti. "As regards the tidal observations taken at Mangalore by Captain Basevi in 1869-70, a memorandum by that officer is subjoined.

"Mangalore is built along the right bank of the river Netráwáti near its debouchement into the sea; there is a bar across the mouth of the river which is exceedingly dangerous to cross during the south-west monsoon; but there is always several feet of water on it even at lowest tides: so that during north-east monsoon Mangalore is not an unfavourable locality for tidal observations: during the south-west monsoon, however, when the river is flooded by the rains, such observations would be valueless.

"The river runs parallel to the sea for several miles, and is separated from it only by a narrow strip of sand: the mouth of the river is steadily progressing northward, and is now well to the north of the town, whereas it was formerly considerably to the south of it, and judging by the atlas sheets published in 1872, the mouth of the river has northed about 3 miles since the survey was executed, giving an average of 100 yards a year.

"The site selected for the gauge was rather less than two miles inside the mouth of the river, on the west bank, about 300 yards south of the custom and look-out houses and directly opposite the door of the offices of Messrs. Alston & Co., Agents for the British India

Steam Navigation Company. The gauge was erected at a distance of 150 feet from the shore; it consisted of a stout beam 6 inches by 4 inches and 10 feet long, driven to a depth of 3½ feet into the bed of the river. One face of the beam was grooved to admit a plank of well-seasoned teak 4 inches broad by 1½ inches thick and 7 feet long, graduated to feet and inches; besides fitting tightly in the groove the plank was further fastened by two screws.

The gauge was surrounded on three sides by a frame of bamboos and matting carried up to near the top of the beam to limit the action of waves or wind on the gauge. After setting up the beam and fixing the graduated piece at the requisite height, the zero of the scale was referred to a mark on the wall of a building near the edge of the water (Messrs. Alston's offices already alluded to); this was done by means of a small 5-inch theodolite, which was set up at a point equidistant from the gauge and mark. The zero of the gauge and mark were compared weekly.

Observations were commenced on the 17th November and continued for a whole lunation up to the 15th December. The method of observation followed was to take a series of readings of the gauge at intervals of 5 minutes, commencing at about half an hour before the expected time of high or low water and continuing them until the water had perceptibly fallen or risen according as high or low water was observed. The day observations were made with a hand telescope; at night the gauge had to be visited in a boat.

On the completion of the observations the zero was again finally compared with the referring mark. This was done both by Mr. Macdougall, Assistant Surveyor, Great Trigonometrical Survey of India, with the same instrument that he had previously used and also by Captain Basevi with a larger (8-inch) theodolite. Mr. Macdougall obtained the same result as before, but Captain Basevi found a difference of one inch, which was verified by a slightly different process. As the difference was probably due to the superiority of the instrument, the result obtained by Captain Basevi has been retained, but little or no suspicion can be attached to the permanency of the zero of the gauge.

Major Branfill was occupied during a part of the field season of 1871-72, in the attempt to set up a self-registering tide gauge at Mangalore. The river Netráwáti which runs northwards past the town of Mangalore, is separated from the open sea for several miles by a spit of sand varying in width from 100 to 400 yards and 10 or 12 feet above sea-level in the highest parts. It appeared that this spit had been extending northwards for several years driving the river mouth and bar continually before it. The older parts of the sand were covered with a growth of sea pink and many other plants, and were apparently very firm and not liable to shift. Some years before, a breach had been cut in the spit to allow the river to enter the sea direct and a little south of the town, instead of flowing round the spit which extended a mile from the town. A very few tides sufficed to fill up the spit which might be considered more than sufficiently permanent for a year's tidal observations. Major Branfill therefore had a masonry well sunk in the highest part of the spit where it was 12 feet above sea level and 30 yards away from high water mark on the beach about a mile south of the river mouth and nearly opposite the town of Mangalore. The sand was very firm at a small depth below the surface but very 'quick' at the permanent water level below, which appeared, however, to be considerably higher than mean sea level. The well was sunk until there was always a depth of 6 feet or more of water in it and 10 feet of masonry above high water mark.

Communication was next established with the open sea by wrought iron gas piping, but owing to the persistent high level of the water in the well, a water-tight cistern had to be introduced, which should only admit or deliver the sea water by means of the pipe. This was effected with much difficulty, but bad weather set in almost immediately, and the water shoaled and covered the sea end of the pipe with about a foot of sand.

Meanwhile the self-registering tide-gauge had been set up. A severe gale now occurred which considerably altered the shore line, washing away much of the sand spit almost up to the observatory and well and shoaling the water for some distance out to sea. A continuance of bad weather rendered it necessary to dismantle the observatory, but not before damage and loss had occurred from the violence of the waves.

Major Branfill, after his experience, came to the conclusion that to set up a tidal observatory and maintain it in operation for a twelve month on the sandy shore of the open coast, is an affair of such difficulty and expense and at best so uncertain of success that it can hardly be recommended. Mangalore was accordingly abandoned as a tidal station.

(3) The following admiralty charts give the configuration of the coast in these parts, Charts and plan of the port, and a rough idea of the port of Mangalore:—

India, west coast, Vizianag to Cochin with the Laccadive archipelago, 1328-56, add. and corr., 1891-92, west coast of India, Sheet VIII and Sheet IX (which latter includes a larger scale plan of the port of Mangalore).

It must be remembered that all sands, bars, etc., and of course all soundings shown on these charts are in a state of constant change from season to season and from year to year. The large scale surveys of the port made from time to time by the port officer show the recent changes at Mangalore in a striking manner. Detailed surveys of the port of this kind are not published. The position of the bar, etc., has changed a great deal since Major Branfill and Captain Basevi described it in the extracts given above.

(4) Mr. J.M. Simpson, the port officer, was good enough to explain to me on the spot some recent changes in the spits north and south of the bar and in the channel. He also entered into the question of the suitability of the port for tidal operations, and kindly introduced me to Mr. E. B. Palmer, agent of the Bank of Madras, whose knowledge of Mangalore, acquired by over 20 years' residence in the place, is extremely valuable in all local questions. Mr. Simpson's and Mr. Palmer's views, after clear explanation had been made to them of the conditions essential for such operations, may be summarised thus, that the conditions of Mangalore have in no way become more favourable for tidal operations since Major Branfill was here, and that his estimate of them is still perfectly just. Mr. Palmer kindly accompanied us to the scenes of Captain Basevi's and Major Branfill's labours, but no trace of them remains.

(5) For the proper conduct of tidal operations it is desirable to find a spot ready of access and suitably situated with a view to attendance, supervision, etc., and such that there may be a safe observatory on firm foundations with simple water communication with the sea even at the lowest tides.

(6) At Mangalore the waters within and those outside the bar, which is at present about a mile south of the town, must be separately examined to see whether tidal operations can be undertaken. The range of the tide is about 6 feet at springs and about 4 feet at neaps.

(7) The water inside the shifting bar constituting the back-water or inner harbour is affected by the rainfall in the two rivers, Netráwáti and Gurpur, during a great part of the year; the former of these rivers discharges into the back-water near its southern limit and the latter near its northern limit; and tidal observations taken here would not represent the sea and would therefore fail to serve the general scheme of the tidal operations; they would presumably for the same reason be of little use for the improvement of the port. But, however useful they might be, it is impossible to make sure of carrying them on, as the sands in the back-water or inner harbour shift so much from season to season and from year to year, that no spot could be selected even in the fairway where water and a firm foundation could be guaranteed even for a year. Spots apparently suitable near the "Laccadive store godown", a little north of the junction of the Netráwáti and the back-water and at other representative spots, were visited, but all proved deceptive and no reliable site could be found.

(8) Outside the same shifting bar the coast stretches for miles north and south in a long expanse of shifting, treacherous sand banks exposed to the full force of a surf considered as dangerous and as violent as that of Madras. No attempt has been made to erect any structure within reach of this surf. The action of the sands is particularly unfavourable to all plans for fixing any kind of structure or even any signal: anchors get buried and sucked down into the sand, and chains become embedded in a similar manner, so that even a channel buoy cannot be maintained in position, but is soon dragged under water by its own anchor chain. I do not think it would be possible to erect and maintain any kind of tidal apparatus whatever for observing the level of the sea at Mangalore or for several miles north or south of it.

(9) I am therefore obliged to report that the unfavourable conditions of Mangalore for Survey of India Department tidal operations have in no way diminished since Major Branfill attempted observations in 1872, and to repeat his concluding remarks: "To set up a tidal observatory at Mangalore and maintain it in operation for a twelve month * * * is an affair of such difficulty, and at best so uncertain of success that it can hardly be recommended; and I greatly fear that Mangalore must be abandoned as a tidal station." It is plain that, having regard to the irregularity and peculiarity of tides in Indian waters, observations at any place out of the neighbourhood of Mangalore, would be useless as regards improvements of the port, and I have just stated that no suitable site can be found in the neighbourhood.

Difficulty of starting and maintaining tidal operations.

Navigation
Marine Surveys.

M. D. 18.

No 74.

GOVERNMENT OF INDIA,
MARINE DEPARTMENT.

Fort William, the 23rd January 1896.

N^o. 3603
1116-5

Government of India,
Revenue and Agricultural Deptt.
(and Surveys)

Calcutta, dated the 30th December 1895.

Forwarded to the Military Department
for information with reference to correspondence
ending with that Department's endorsement
N^o. 1032, dated 18th October 1895.

By order,
of H. G. Stry.

Under Secy. to the Govt. of India.

List of papers forwarded.

From the Surveyor-General, N^o. 3654 S, dated
12th December 1895 and enclosures.

Copy of the above, with enclosures, forward-
ed to the Secretary to the Government of Madras,
Public Works (Marine) Department, in continuation
of Marine Department, N^o. 1032, dated the

18th

Encls 1
Recd 72/86

N^o 317 Marine
Blutgr

Marine Current No. 72

18th October 1895.

Recd: 28.1.96

By order,

Esarelli

for Dy. Secy. to the Govt. of India.

No 70 Marine 25th July 1896

3rd Set

Communicated to
the Presidency Port office
in continuation of G.O. 317,
Marine, d/6 November 1895.

- No. 296 d/25-7-94 Marine
- " 297A - 26-7-94 "
- " 377 " 21-9-94 "
- " 406 " 18-10-94 "
- " 419 " 1-11-94 "
- " 294-5 " 7-10-95 "
- " 300 " 10-10-95 "
- " 317 " 6-11-95 "
- memo 33 " 29-11-95 "
- " 84 " 23-12-95 "
- " 33 " 27-1-96 "

The P.P.O.

to be

Mr. G. J. Walsh has since
concluded his investigation &
submitted his final report. The
G.O. is with therefore communicated
to him.

L.S.