G.O.C. 1—2000—24-11-09

MADRAS RECORD OFFICE.

Government of Madras.

Revenue DEPARTMENT.

G.O. No.	905	Press Mis.
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Not to be folded or roughly handled

No. 235. Read the following letter from E. DUVAL, Esq., to J. I. MINCHIN, Esq., Acting Chief Officiating Secretary to Government, dated Madras, 28th February 1870:—

I HAVE the honour to enclose the report I have just concluded regarding Cotton Mills in India, and the capabilities of the river Tambrapoorney, in accordance with G. O., No. 2,524 of the 6th September 1869.

I could well have wished to send it earlier, but was hindered by various causes, which I will explain:—

I arrived at Papanassum at the end of the dry season, which gave me the opportunity of examining the state of the torrent at low water.

The N. E. monsoon did not burst till nearly the end of October, nevertheless I was compelled, in the interests of the scheme afoot, to wait till the floods came down in the Tambrapoorney, in order to notice the difference of level, what portions of the land were left unsubmerged, and to satisfy myself as to the precautions necessary to take in this respect that the buildings in contemplation should be duly protected.

My return journey by land was very tedious and difficult. I encountered the most fearful weather incessantly, and received a violent wind-stroke, which forced me to remain some days at Kytar; moreover, the roads were well nigh impracticable; and yet it was necessary that I should in person describe the situation of the country with regard to its powers of producing cotton, the cultivated and non-cultivated tracts of land, and the roads running round Papanassum.

I left Madras on the 12th of September, and did not return till the 18th of December.

A short time after my arrival I was compelled to take to my bed seriously indisposed, and for more than six weeks the state of my health prevented my getting on with this report as I wished to do.

Trusting, Sir, that you will take into consideration all these obstacles, which have been the causes of delay in presenting this report.

REPORT.

ORDER THEREON, 6th September 1869, No. 2,524.

The Government cordially concurs in the opinion expressed in His Excellency the President's Minute here recorded . . . . M. Duval will present himself to the Collector of Tinnevelly before entering upon the contemplated inquiry, and the Collector will be directed to afford to M. Duval all the information and assistance which he may deem conducive to the purpose in view . . . . M. Duval will report on what date he will be prepared to enter upon the duty which the Government propose to entrust to him.

(True Extract.)

R. A. DALYELL.

REVENUE DEPARTMENT, 11th September 1869, No. 198.

Read the following letter from M. E. Duval, to the Acting Secretary to Government, Revenue Department, Fort Saint George, dated Madras, 11th September 1869.

With reference to the Order of Government, under date 6th September 1869, No. 2,524, I have the honour to report that I shall be happy to undertake the duty proposed to be assigned to me, and will be prepared to leave Madras to-morrow, the 12th instant.

(True Extract.)

R. A. DALYELL.

In accordance with the marginal orders, I finally quitted Madras on the 12th September 1869.

On the 5th October following I arrived at Palamcottah; the Collector was absent; but he sent me the following order by the Deputy-Collector ..... :—

From C. T. LONGLEY, Esq., Acting Collector, Tinnevelly, to E. DUVAL, Fsq., on special duty, Tinnevelly, dated Courtallum, 18th September 1869, No. 1,734.

Referring to Order of Government, No. 2,524, dated 6th September 1869, as I am about to proceed on tour to the north, I request you will, on arrival, put yourself in communication with the Acting Sub-Collector Mr. Stuart, at Shermadavy, who has been requested to afford all the information and assistance you may require in the prosecution of your inquiries.

I shall be back at Tinnevelly in the beginning of next month, when I shall be glad to have a personal interview with you.

After these fresh instructions I went on the 7th to Shermadavy, where the Sub-Collector placed at my disposal everything necessary, and wished to accompany me to Papanassum on the next day. Having examined the locality we ascended the stream, and my first observations led me to remark that the Tambrapoorney river—

1*st*.—Takes its source from the table-land of the Elephant mountains which run to the west, as well as from the chain of Ghauts running north and south, which form the limit of the Tinnevelly District.

This immense plateau is surrounded by vast and luxuriant forests, and, owning the elevation that it does, is sufficient to account almost alone for a condensation of moisture large enough for the formation of this torrent, whose source is therefore, so to speak, inexhaustible.

2*nd*.—Ten miles lower down, two tributary streams, which find their origin in the same common cause, and, like the first, are so far exempt from any tax upon their waters for purposes of irrigation, (that is to say, they flow unchecked) join the main flood; and again some miles further down the river, swelled by these tributaries, precipitates itself over the cascade Kaliyana Tirtum, down the rapids of Papanassum, and thence rolls tumultuously to the pagoda; at which spot, or rather a little higher up stream, is to be found a dam of native construction, where the water divides itself into five branches, of which two are artificial, and supply the irrigation to the east and west of that part of the country situated literally at the foot of the mountain range, while the other three branches, which are, of course, those in the centre of the group, continue their course unfettered, and, after taking a sweep outwards, again reunite, so that two islands may be observed on the map, and they then form finally the river Tambrapoorney, which descends by Shermadavy and Tinnevelly, fertilizing the land in its neighbourhood from Papanassum to the sea.

All these features, so well observed by His Excellency Lord Napier, are carefully defined in the following Minute:—

No. 118.

MINUTE by His Excellency the President.

I took occasion not long since to bring under the notice of Council the capacities of the river Tambrapoorney as an instrument of irrigation.

I desire now to refer to the water-power which it affords for the purposes of manufacturing industry.

2. In attempting the establishment of a factory, the following important points must be taken into consideration:—

1*st*.—Motive-power.
2*nd*.—Access to the raw materal.
3*rd*.—Access to markets of consumption.
4*th*.—Labour.
5*th*.—Capital.

In all these respects the site of Papanassum in Tinnevelly, where the Tambrapoorney issues from the Ghauts, appears to me to offer great encouragement for the creation of a Cotton Mill.

3. After breaking from the mountains in a magnificent cascade, the Tambrapoorney descends, by a course of rapids, to the pagoda where the shoal of sacred fish is fed, and where the torrent subsides into a long series of level reaches.

The interval between the water-fall and the temple presents more than one spot perfectly adapted for the erection of buildings and machinery. I allude particularly to a place where, I think, a temporary weir is used, and were the first irrigation channel is taken off. The volume of water is probably more than sufficient at all times of the year; but, if it were not the projected, irrigation reservoirs in the hills would repair the deficiency in dry seasons.

No objection could be raised by the cultivators below, for the supply would be restored undiminished; and if hereafter dyeing works were established, the river could well afford the insignificant loss which would be caused by the diversion of the contaminated water. On the value of water-power, with reference to cheapness and salubrity, I need not enlarge; the examples of Scotland, Saxony, Switzerland, and of other countries attest its advantages.

4. The northern part of Tinnevelly and the adjacent district of Madura produce the raw material in abundance, which would be laid down by the railway, twenty miles from the factory. It may also be presumed that, if the mill were established, the ryots in the immediate vicinity would devote themselves to the cultivation of cotton in a greater degree than is at present the case.

5. The facilities for the circulation and export of the manufactured article would be as great as those for the receipt of the raw material; the home consumption in an opulent district would be considerable; the railway would carry the fabrics northwards, while the port of Tuticorin would be their natural outlet towards Ceylon and other foreign markets.

6. Labour is nowhere scarce in India; in Tinnevelly it would be superabundant, for emigrants repair in numbers from the Southern Provinces to Ceylon and other Colonies. Nor would these people be deficient in aptitude for factory work. No race in the world has greater flexibility and delicacy of manipulation than the Hindoos, and what is done with perfect success at Bombay and at Calcutta would be done as well at Papanassum.

7. I am not prepared to affirm that the capital of natives would be immediately invested in the establishment of a Cotton Mill; but I am justified in asserting that there is more capital in native hands in Tinnevelly than in any other part of the Presidency, and that it would become available for a purpose of this nature with some encouragement on the part of the English Commercial Houses of Madras and Tuticorin.

There is, in fact, a plethora of money in Tinnevelly derived from the exportation of cotton; and it would be a further benefit to direct these accumulated gains into a reproductive channel, which are now hoarded or employed in usury.

8. Two arguments may perhaps be urged against the project which I recommend to the attention of the Council.

1*st*.—That it is not the duty of Government to co-operate in the introduction of any branch of industry; 2*nd*, that the development of cotton manufactures here would be detrimental to the interest of Great Britain.

9. It is not the legitimate function of Government to support manufacturing establishments, except perhaps exceptionally in the interest of the fine arts; and it would plainly be wrong to foster them by a protection or prohibitive system; it will, however, hardly be affirmed that a Government may not rightfully point the attention of private parties to new avenues of speculation and enterprise and afford them some kind of aid in the outset. Even the expedient of bounties is not absolutely excluded by the less rigid economists.

Should the undertaking which I now advocate prove to be acceptable to practical men, I do not contemplate a greater measure of State assistance than would be involved by the gratuitous concession of water-power and building sites, the improvement of roads, the exoneration of imported machinery from duty, the purchase of the manufactured article for public purposes, with due regard to price and quality, and similar occasional and indirect good offices which may be indulgently extended to an incipient attempt.

10. The increase of cotton manufactures in India would undoubtedly tend to restrict importations of the same articles from England; but we are not to be deterred by this consideration from giving free scope to all the natural facilities for manufacturing industry which India possesses.

India is a valuable market for English manufactures, and in the interest of the great mass of native consumers themselves, that market should not be limited by artificial obstructions, such as high tariffs; but India is not a preserve for Manchester, and the Government and people of England would repudiate a calculated neglect of the industrial capacities of the country.

That we have already been guilty of inactivity is proved by the fact that Pondicherry possesses a flourishing cotton factory in which the raw material grown, and the thread spun on the British Territory are worked up with great profit to the proprietors and benefit to the population.

Yet the French Settlement enjoys no advantage for this industry which does not exist at Madras, and suffers under several drawbacks and disabilities if contrasted with Tinnevelly, the chief of which is the total absence of water-power.

11. As a first step toward the introduction of factory labour into the Presidency, I propose that the Government shall charge M. Duval, a gentleman who possesses a competent knowledge of machinery and manufacturing processes, to proceed to Tinnevelly with the view of reporting on the three following points :—

1*st*.—On the capacity of the river Tambrapoorney as a motive-power.

2*nd*.—On the adaptability of the site I have designated at Papanassum, for the purpose of establishing a cotton factory.

3*rd*.—On the probable approximative cost of erecting a water-power mill, including machinery and buildings, which would employ about one thousand hands of both sexes and all ages.

M. Duval has been strongly recommended to me by the Governor of Pondicherry; he was employed at that place in the management of a cotton factory, and has informed me personally that he has some knowledge of water-power engines in France.

A project of this nature, presented with the credit and authority belonging to a Government inquiry, would not fail to attract the attention, and, I trust, eventually to enlist the support of those who possess capital, and are disposed to embark it in industrial pursuits.

12*th August* 1869. (Signed) NAPIER.

These natural peculiarities of the country watered by the Tambrapoorney are very favourable to the creation of manufactories in many places, but most especially so at Papanassum, where they are supplemented by various exceptional local advantages which may be summed up as follows :—

1. Good roads reaching almost to the centre of the Ghauts and passing by Papanassum. The possibility of using the Tambrapoorney as far as Tinnevelly as a navigable river, with the assistance of, at the most, two or three locks, which should be built parallel to the current and opposite the dams already in existence. (I have descended the Tambrapoorney as far as Shermadavy in a canoe, and have satisfied myself that the depth of the river varies from 1½ yard to 4 yards, but never less than 1½ yards; and yet this was in the dry season.) Again, the proximity of the railroad from Dindigul to Tuticorin now making, which is to touch at Tinnevelly by a special line, and which might well be prolonged to the foot of the Ghauts, as the transport of timber there (which is really considerable) would without doubt afford a large amount of traffic, and the line would also serve for many other commodities.

2. Papanassum verges on the centre of one of the finest cotton districts, and possesses throughout vast tracts of land hitherto uncultivated; but I propose to return hereafter to this part of the subject. Again, materials for all sorts of building, and such like, are to be found there in abundance, the population is numerous, and, fitally, it possesses that hydraulic motor, so highly prized, which is available free of expense to manufacturers anxious to utilize it, and which, when compared with steam, is altogether beyond rivalry.

All these points attentively noted, my first care was to seek the most suitable spot for the establishment of the factory under consideration. This spot would require to be of sufficient elevation to provide for the due descent of the motive-power, and further it must be free from any risk of submersion during the great down-fall of water which frequently and suddenly occurs in this stream—a down-fall which in a few hours, and sometimes almost at one swoop, attains a height of from 1 to 8 and sometimes even 10 yards (on an average,) overthrowing in its course any and every obstacle.

Many sites offered great advantages, but coupled with these threatened great contingent expenses, as for instance :—

1*st*.—With reference to the district lying south, at the foot of, and, in fact, touching the mountains, it was at once evident that to avoid the invasion of the winter floods, that is to say, the season of heavy rains, it would be necessary to raise all the buildings on arches, with a system of drainage-pipes running underneath, with a view to facilitate the outflow of the waters, and thus maintain in the interior a uniform atmosphere, an indispensable condition in this species of manufacture and also in order that the buildings themselves should be protected from damp; and finally, it would be very difficult to conduct the stream by means of an ordinary canal; it would, in fact, be shorter to pierce a tunnel through the mountain overlooking the spot, thus directly reaching the cascade immediately in rear, which is at a convenient height and sufficiently near (about ¾ mile;) this system would supply the column of water required with much regularity and without danger of any accident from sudden inundation for the diameter of the tunnel would be determined by the actual requirements of the factory, such for instance, as an ordinary pipe furnished with valves; but, on the other hand, this plan would prove very costly; for to pierce a tunnel of more than 700 yards, and also to cut a canal of equal length down to the rapids, would demand a large capital.

Again, towards the north, all the land consists of paddy fields, and is already under cultivation, far too expensive to purchase in the first place, and above all, which are on too high a level to admit of the use of a hydraulic motive-power without difficulty, or at best one on an imperfect principle.

I allude to an undershot water-wheel, in which, owing to the motion being communicated from below ⅔ of the power are lost, while an overshot wheel on the new pattern retains ⅔ of its force, that is 75 per cent. in the latter case against 25 in former.

Before coming to any decision however, I searched again and ended by discovering a very favourable spot a little lower down, with reference to which I will quote from a letter I addressed to the Collector of Tinnevelly :—

"In front of the pagoda at Papanassum there is a spot easily accessible from the road, surrounded by two arms of the Tambrapoorney, one of which could by means of a dam be made to supply the factory, while the other, lower down and more central, would act as a waste weir; this natural configuration of the ground presents great industrial and sanitary advantages, and above all, great facilities for constructing the works necessary to direct the stream properly, works, which must possess great powers of resistance. The relation between the bed hollowed out by the torrent, and that to be made, will materially facilitate the attainment of this object."

For this reason I stopped at this spot, forming as it does an island, free from any kind of irrigation; (the two artificial streams intended for that purpose lying too high up, borrow nothing from the arms surrounding the island,) and, therefore, offering me all those indispensable advantages of which I was in search; a plan drawn up to this effect will make them evident; but, before proceeding to their description, it is well to examine the capabilities of the Tambrapoorney as a motive-power; for, although at first blush the point appears incontestable, it was necessary, in order to obtain exact information, to make many experiments, and at considerable distances one from another; for nothing is more variable than the velocity of water in the bed of a river or canal—a more or less rapid fall, lateral friction against the banks, chance peculiarities of the beds, windings in the course—are all causes which modify unceasingly the progress of the particles of fluid, and consequently produce eddies and whirlpools and a crowd of phenomena impossible to calculate before-hand, though it may be easy to explain them in any given locality. (Canals, which have a uniform slope, run in a straight line, and are of constant dimensions, are easily dealt with.) The different strata of water, from that of the surface to that of the bed, are all imbued with different velocities, and in each stratum again the particles near the sides and those in midstream cannot have the same velocity, on account of the adherence and friction which take place between the former and the banks. In general, of all the

particles which pass at any moment through a prependicular section of a river, torrent, or canal, that which possesses the greatest velocity is the particle *on the surface and at midstream*, *i.e.*, equi-distant from both banks, and this maximum velocity may be determined by throwing some light substance into the stream when it will take pretty nearly the same motion as the water. Now it has been proved by numberless experiments that, if all the particles of water in a stream were animated with a common velocity equal to $\frac{8}{10}$ of the maximum velocity, the volume which would pass in a given time would be equal to that which passes in the same time by virtue of the various velocities with which the particles are in reality endowed; therefore, in the case of a canal it is only necessary, in order to estimate the outflow, to multiply the area of a perpendicular section by ·8 of the maximum velocity, and this very simple formula is sufficiently accurate for all practical purposes: now through all the perpendicular sections which can be taken in the course of a river there flows in the same time the *same* volume of water, the *velocity* alone varies, for it is on this hypothesis that the formula is established, that is to say, the level (?) remains constant at each point so long as there is a tendency neither to rise nor fall. To ascertain, then, the discharge of a river, it is necessary to know the quantity of water which passes through any section, a section of which one can easily determine the area, and the average velocity of all the particles which traverse it; but the average velocity varies a little here, some times indeed a good deal, and it becomes more difficult to determine the general relation existing between the particles, since a rise in the bed, a hole, a wind in the stream, and other influences even less apparent are sufficient to change its value. The more accurate plan then is to search for spots of known depth, easy to measure and as uniform as possible, and by repeating the observations at different intervals, one arrives at an average maximum sufficiently accurate to permit of the same calculations as in the case of canals. True, it would have been easier to make the torrent pass through a cutting or over a dyke, when it would have formed a sheet of water, the breadth and depth of which could be ascertained, but in this instance it was impossible for me to employ this method; so I proceeded, in the manner described above, to try certain experiments, of which the following are the results. First, however, I would present a table indicating the monthly changes in the flood of the Tambrapoorney, by the aid of which it is easy to determine the state of the river throughout the year:—

Month.	State of the Flood.	Atmosphere.
January	8 Strong, changing to 4 moderately strong ...	Cold.
February	4 Moderately strong	Temperate.
March...	2 Moderate	Temperate.
April	2 Moderate, changing to 1 small	Warm.
May	1 Small, changing to 2 moderate	Warm.
June	2 Moderate	Foggy.
July	4 Moderately strong	Foggy.
August	2 Moderate, changing to 1 small	Foggy.
September	2 Moderate	Warm.
October	2 Moderate, changing to 4 moderately strong...	Warm.
November	8 Strong, changing to 32 very violent ...	Temperate.
December	16 Violent, changing to strong...	Cold.

Experiments made in October 1869.

1 yard=92 cents.
1 foot=31 ,,
1 inch=2·6 ,,

The metre of 100 cents. is about equal to 1 yard, 3 inches, 1 line.

The south arm experiments made every 5 yards at the narrowest part of the stream, that, viz., selected as the site for the motor. *See* Map, Arm E. at M.

The Arm E. is the feeder.

	Feet.	Inches.
Breadth	6	10
Depth	7	7
Velocity	131	0

6·10 × 77 × 131 = C.

1 { Breadth ... ... 2 Metres. 10 Cents.; Depth ... ... 2 35; Velocity per minute 40 0

2·10 × 2·35 × 40 = 197·4 metres, cube, per minute.

Breadth	4	11
Depth	6	8
Velocity	212	0

4·11 × 6·8 × 212 = C.

2 { Breadth ... ... 1 50; Depth ... ... 2 0; Velocity 65 0

1·50 × 2·0 × 65 = 195·0 metres, cube, per minute.

Breadth	8	10
Depth	5	0
Velocity	141	0

8·10 × 5·0 × 141 = C.

3 { Breadth ... ... 2 70; Depth ... ... 1 55; Velocity 46 0

2·70 × 1·55 × 46 = 192·5 metres, cube, per minute.

Experiments on the same arm, at very distant spots.

	Feet.	Inches.
Breadth	25	10
Depth	2	11
Velocity	98	0

25·10 × 2·11 × 98 = C.

4 { Breadth ... ... 7 Metres. 75 Cents.; Depth ... ... 0 90; Velocity 30 0

7·75 × 0·9 × 30 = 209·25 metres, cube.

Breadth	45	6
Depth	2	8
Velocity	72	0

45·6 × 2·8 × 72 = C.

5 { Breadth ... ... 14 0; Depth ... ... 0 80; Velocity 22 0

14·0 × 0·8 × 22 = 246·4 metres, cube.

Breadth	72	0
Depth	1	11
Velocity	81	0

72 × 1·11 × 81 = C.

F.

6 { Breadth ... ... 22 0; Depth ... ... 0 40; Velocity 25 0

22·0 × 0·4 × 25 = 220·0 metres, cube.

North arm, or waste weir marked F. on the Map.

Experiments made at the mouth during the dry season.

	Feet.	Inches.
Breadth	79	0
Depth	1	11
Velocity	66	0

79 × 1·11 × 66 = C.

7 { Breadth ... ... 24 Metres. 0 Cents.; Depth ... ... 0 40; Velocity 20 0

24·0 × 0·4 × 20 = 192·0 metres, cube, per minute.

Breadth	84	0
Depth	1	2
Velocity	82	0

84 × 1·2 × 82 = C.

8 { Breadth ... ... 26 0; Depth ... ... 0 35; Velocity 25 0

2[illegible] × 0·35 × 25 = 227·5 metres, cube, per minute.

Breadth	72	0
Depth	1	8
Velocity	95	0

72 × 1·8 × 59 = C.

9 { Breadth ... ... 22 0; Depth ... ... 0 45; Velocity 18 0

22·0 × 0·45 × 18 = 178·20 metres, cube, per minute.

Breadth	...	...	97	0	10	Breadth	... ...	30 0
Depth	...	...	1	8		Depth	... ...	0 45
Velocity	...	...	49	0		Velocity	... ...	15 0

$97 \times 1{\cdot}8 \times 49 = C.$

$30{\cdot}0 \times 0{\cdot}45 \times 15 = 202{\cdot}5$ metres, cube, per minute.

These experiences were made at intervals of many days.

Recapitulation for the obtaining of an average.

Arm E. at point M.

The foot, cube, may be calculated at 28 or 29 to the cubic metre (?)

(Note.— There are really rather more than 32 cubic feet in a cubic metre. The difference, however, is all in favour of the calculations below.— J. A. G.)

			m. c.	
6,516 feet, cube	1c		197·4	
6,516 do.	... 1	... ...	197·40	Per minute.
5,460 do.	... 2	... ...	195·00	
5,376 do.	... 3	... ...	192·51	
5,852 do.	... 4	... ...	209·25	
6,888 do.	... 5	... ...	246·40	
6,160 do.	... 6	... ...	220·0	
36,252			1,260·56	

Divide by 6=6,040 Divide by 6 = 210.

This is the average on this arm per minute.

Arm F. at its mouth.

5,376 feet, cube	... 7	... ...	192·0	Per minute.
6,356 do.	... 8	... ...	227·50	
4,928 do.	... 9	... ...	178·20	
5,656 do.	... 10	... ...	202·50	
22,306			800·20	

Divide by 4=5,570 Divide by 4 = 200.

For a general average.

5,000
6,000

11,000 feet, cube.

$\frac{11,000}{10} \times 8 = 8,800$ feet, cube.
$8,800 \times 60 = 528,000$

For a general average.

Arm E. 210
Arm F. 200

Total... 410 metres, cube.

But I said above that only $\frac{8}{10}$th of the result thus obtained was to be taken.

That is $\frac{410}{10} \times 8 = 328$, and for the unit of measurement, *i.e*, by hour we shall have $328 \times 60 = 19,680$ metres.

There now only remains to inquire into the possible height of the fall of the water, in order to have the two terms necessary for discovering the force of the Tambrapoorney in horse-power, at the site chosen.

I said above that I should revert to the favourable conditions of the soil at the point under consideration. In reality the whole of this island is composed of good soil for building, and rests on a rocky foundation ; further, it is above the high water level which cannot be said of any other land bordering the Tambrapoorney. Its average level is some 9 metres (10 yards) above low water. The map shows the course of the stream from the native dam overhanging Papanas-

sum to the spot where the Tambrapoorney actually becomes a river, that is to say, below the island. Going back to the site marked in the map as intended for the establishment of the Mill, the fall to be obtained may reach by means of a dam of very easy construction (the torrent in this place actually assisting the work) a height of eight metres in ordinary seasons, and six metres during the floods, without fear of any part of the sluices being swamped by the down-pour of waters. I shall take, then, the lower amount as denominator, and taking also seventy-five kilogrammes as the unit of horse-power,* reducing, of course, the metres into litres and the hours into minutes, we obtain

$$\frac{\text{Metres. } 19,680}{3,600} = \frac{5,460}{75 \times 6 = 435.}$$

The Tambrapoorney owned, therefore, in October last a motive-power equal to 435 horse-power, and this was during a rather dry season.

I shall now demonstrate, by means of the table showing the state of the flood, the approximate power of the river throughout the year ; and this is the manner in which I substitute figures for the terms used in the table :—

Small	= 1
Moderate...	= 2
Moderately strong ...	= 4
Strong	= 8
Violent	= 16
Very violent	= 32

Now the experiments made in October last show a result of 435 horse-power, and the force of the stream is indicated (*vide* table) by 2, *i.e.*, "Moderate," changing to 4, *i.e.*, "Moderately strong," therefore, $2 + 4 = 6$, $\frac{6}{2} = 3$, and $\frac{435}{3} = 145$, so that we have 145 horse-power, is equal to "Small," *i.e.*, 1.

Nothing is easier, then, than to calculate the power for all the months.

January.

$8 + 4 = 12$, $\frac{12}{2} = 6$, 6×145 gives 870 horse-power.

February.

4×145 gives 580 horse-power.

March.

2×145 gives 290 horse-power.

April.

$2 + 1 = 3$, $\frac{3}{2} = 1\frac{1}{2}$, $1\frac{1}{2} \times 145$ gives 217 horse-power.

May.

$1 + 2 = 3$, $\frac{3}{2} = 1\frac{1}{2}$, $1\frac{1}{2} \times 145$ gives 217 horse-power.

June.

2×145 gives 290 horse-power.

July.

4×145 gives 580 horse-power.

August.

$2 + 1 = 3$, $\frac{3}{2} = 1\frac{1}{2}$, $1\frac{1}{2} \times 145$ gives 217 horse-power.

September.

2×145 gives 290 horse-power.

October.

$2 + 4 = 6$, $\frac{6}{2} = 3$, 3×145 gives 435 horse-power.

November.

$8 + 32 = 40$, $\frac{40}{2} = 20$, 20×145 gives 2,900 horse-power.

December.

$16 + 8 = 24$, $\frac{24}{2} = 12$, 12×145 gives 1,740 horse-power.

* The force necessary to raise a height of 75 Kilogrammes (about 150 lbs.) to a height of one metre in one second is the French standard of horse-power.

It is, I imagine, superfluous to dilate at greater length upon the advantages offered by Papanassum as a site, and the Tambrapoorney, not only as a motive-power, but also as a navigable stream. And as to communicating with the various roads which run near the island, nothing is more easy. A small wire-suspension bridge would be very cheap, and would run no risk of being carried away. And here it is proper to notice a most important point—that, namely, of materials for building, etc.

Papanassum is the very type of cheapness in this respect, as an instance of which it may be stated that the cube yard (27 cubic feet) of masonry in lime, sand, and bricks, inclusive of manual labour, costs only Rupees 4½. Timber for building and firewood are also very plentiful; the Kong [sic], a yellow wood, peculiar to the district, is certainly preferable to teak, and the only cost incurred in obtaining it is a license of Rupees 8 per cart, which may be filled as often as possible, and which contains about 28 cubic feet, that is a little more than a cubic yard.

Other materials and labour are proportionately cheap, and I subjoin here an estimate of the prices, both of materials and workmanship at Papanassum :—

	Rs.	A.	P.
Palm tree... ... ... per foot	3	0	0
Bricks ... ... per 1,000	3	8	0
Lime	0	12	0
Do. ... ... per cart	4	8	0
Masons ... ... 0 2 0 to	0	12	0
Stone-cutters ... ... 0 4 0 to	0	8	0
Carpenters ... ... 0 6 0 to	0	12	0
Black-smiths ... ... 0 6 0 to	0	12	0
Wood-fellers ... ... per foot	1	0	0
Wood-squarers ... ... per piece, *i.e.*, 80 × 80 cent...	7	0	0
Pit-sawyers ... per piece of 18 feet × 4 inch × 2 inch...	0	7	0
Cooly to bring down such a piece	0	8	0
Do. per cubic yard	0	1	0
A cart-load of sand	0	4	3
Cooly, per day, man...	0	3	0
Do. do. woman	0	2	0
Do. do. boy	0	2	0
Do. do. girl	0	1	3
Contract masonry work, per cubic yard	0	4	8

Cotton Mill at Papanassum.

Having paid due attention to all the preceding considerations, and weighing every point carefully, I subjoin an estimate of the cost of a Factory at Papanassum, capable of turning out 500 packets, say, 2,500 lbs. per day :—

Capital ... ... Rs. 4,00,000

Expenditure of Capital.

Machinery.

	Rs.
1. 1 Willow and Ventilator	1,100
2. 1 Opening Nachine (Ouvreuses)	1,300
3. 2 Blowers, simple, with ventilators...	2,400

	Rs.
4. 2 Blowers, double	1,600
5. 50 Carding Machines (automatic)...	30,000
6. 4 Twisting Machines with pipes (Reunisseurs)	800
7. 5 Drawing frames with réunisseurs	5,500
8. 5 Do. do. (finer)	5,000
9. 25 Stands for reels (intermediary)	10,000
10. 20 Do. do. (finer)	24,000
11. 40 Self-actors (seuvideurs)...	51,000
12. 50 Spindles	4,000
13. 2 Packing presses	400
14. 2 Sharpening Machines	800

Motor.

	Rs.	
Hydraulic engine (wheel with troughs)	2,000	
Shafting	6,000	
To erecting the barrier (dam) near mill	4,700	
Making the principal waste weir	1,200	
Do. Small do.	600	
Repairing the native dam	1,200	
Bearings for great axle	500	
Trough for the waterwheel	800	
Steam engine, auxiliary, with fittings, ect.	15,600	
		32,600

Various Expenses.—Buildings.

Packing and casual expenses	15,000	
Freight of 500 tons, at Rupees 25	12,500	
Landing and transport, etc.	10,000	
Setting up expenses, including two years' wages for workmen, their passage, tools, etc.	45,000	
Setting up the steam engine	4,000	
Land	3,000	
Building the mills, and houses for workmen, sheds, etc. ...	80,000	
		1,69,500
Total...		3,40,000
Reserve Fund...		60,000
Grand Total...		4,00,000

The floating account would be as follows :—

Necessary sums for current expenses, and also for the conduct of the mill, advances to hand weavers, etc. :—

Expenditure of Reserve Fund.

	Rs.	
Current expenses of the mill for about two months, including		
various fittings, etc.	33,000	
...n and labour	7,000	
By mea... in hand	10,000	
...wn against...ces to weavers	10,000	
		60,000

...3,600.

...d could ...

...th the d...

...e met by...

Running Expenses.

Synopsis of General Expenditure.

...ial—

...andies of cotton of three different qualities necessary for ...arious purposes, at an average price of Rupees 150 ... 450

The wastage may be reckoned broadly at 20 per cent. according to general experience in Indian cotton, and their remains accordingly (the candy containing 480 lbs.,) only $384 \times 3 = 1{,}152$ lbs., or 230 packets of 5 lbs. each.

Out of these 288 lbs. of wastage about 150

would sell at 2 Annas	18 12 0	
and 100 at 1 Anna	6 4 0	
	25 0 0	
		Rs.
Therefore, we have to deduct from cost price		25
which leaves		425

The Factory turning out 500 packets a day, the total result per year of 300 days will be

$$500 \times 300 = 1{,}50{,}000$$

$$1{,}50{,}000 \times \frac{425}{230} = 2{,}77{,}172$$

Machinery, etc.—		Rs.	
Wear and tear of material and plant 4/5 of 3,40,000 ...		13,600	
Repairs		2,000	
A Locksmith		1,800	
8 Native Blacksmiths, at 12 Annas per day		1,800	
10 Coolies to assist the above, at 3 Annas		563	
Fuel for the forge, 10 tons, at Rupees 25		250	
Masons and materials		400	
			20,413
			2,97,585
Waterwheel—			
Ordinary repairs		1,000	
Greasing, etc.		1,000	
Management—			
A Manager		9,600	
Sub-Manager		3,600	
			13,200
Labour—			
Office...		1,500	
Stationery		500	
Workmen, Spinners, Winders, etc.		25,500	
			27,500
	Grand Total ...		3,40,285

COST OF FABRICATION.

500 packets per day, gives in the year of 300 days 1,50,000.

Expense 3,40,285

$\frac{\text{Expense } 3{,}40{,}285}{\text{Result } 1{,}50{,}000}$ = per packet ... ... Rs. A. P. 2 4 4

DETAILS OF COST OF FABRICATION.

Material cost ... ... Rupees 2,77,172

Material, per packet $\frac{2{,}77{,}172}{1{,}50{,}00}$ = Rupees 1 13 2·5

Making, per packet $\frac{63{,}113}{1{,}50{,}000}$ = Rupees 0 7 1·5

Total cost per packet Ruppes 2 4 4

The last price list of thread quoted the cost of 16 packets at Rupees 85—90, and if we deduct the cost of hand-weaving, packing, profit and loss, etc., etc., Rs. A. P.

	56 0 0
etc., there remain	3 8 0
or per packet	
Therefore, we have	
Selling price	3 8 0
Cost	2 4 4
Profit per packet	1 3 8

and allowing Annas 4 Pies 8 for cost of assurance, interest on capital, profit and loss, casualties, etc., we have

	1 3 8
	0 4 8
Net profit per packet	0 15 0
or for 1,50,000 packets	1,40,625

on the 4,00,000 Rupees capital.

The capital invested in the cotton mills would, therefore, produce a net profit of Rupees 1,40,000, that is to say, 35 per cent. Now the 35 per cent. arrived at by these calculations speaks for itself in favour of a cotton manufactory; moreover, the product on dividend thus obtained is not merely the result of a theoretical calculation, but of one that is eminently practical, and is borne out by many very favourable experiments already made in India. Added to which I would point out, that many of the expenses will only be incurred in the first instance, and will cease to exist in the second year of working, such as primary cost of the plant, Rupees 52,000, and also a saving of some Rupees 8,000, which will naturally be effected on the expiration of the European workmen's engagements, for they will by that time have trained up natives capable of taking their places in the various branches of the factory. Moreover, though the Reserve Fund should be diminished by the interest at per cent. payable to the share-holders during the two years of setting up, which I have stated necessary before commencing operations, still this fund will be re-couped, nay increased, by saving just alluded to, and also by the commission gained on the prices of materials purchased in Europe and out in this country.

I calculate that the shareholders will pay (of the 4,00,000) Rupees 2,00,000 by subscribing Rupees 1,00,000 at the end of the first year, and again Rupees 1,00,000 six months later on the whole call being thus effected in fifteen months, and the interest thus accruing to the share-holders would be—

	Rs.
For the first year	12,000
Six months after	9,000
At the end of two years	12,000
	33,000

and this deducted from the Reserve Fund, there remains in the cash box at the moment of commencing business Rupees 42,000 which will increase progressively by means of the savings indicated above, and also by the sum reserved yearly for wear and tear of material, say, Rupees 13,600.

By means of this excessively simple and practical system, the factory could always hold its own against contingencies and accidents without having recourse to loan, or an appeal to the fund, and could well nigh increase till it attained the proportions of those in Europe by keeping step with the daily improvements, and progress in this branch of industry, the expenses of which would be met by the reserve capital.

This latter point would be imperative, for machines structed in 1830 can only be compared to a rattle, so to speak, and certainly could in no way compete with those which the American crisis has caused to spring up. That is forty years since, and it is true that it was difficult to foresee the actual progress and scope afforded to cotton in India, but that is no reason why this country should lose a speciality it has owned so long, such a speciality as are unbleached "guineas," or indigo dyes, which European competition attempts to imitate, but hitherto without success: for fortunately the indigo tint is not possible to reproduce out of India.

Moreover, it will always be easy to put an end to any competition in another country by resting satisfied with profits already realized, for instance I suppose 10 per cent., deducted from the profits shown above, (*see* pages 12, 13, but which profits can not be gained unless by the aid of factories kept up to modern improvements, and calculated to meet all the requirements of the age. Again, could not the Government of India supply itself at such a factory, and thus effect a large saving by obtaining at cheaper rates the large proportion of clothing necessary for the Army, the Police, and the Volunteers.

It is easy to prove that the establishment of Cotton Manufactures in India is very advantageous in many ways; it is only necessary to consider for a moment the hand labour employed in the manufacture of stuffs used in the country, without taking account of what could be done now or hereafter in the way of exportation; for not only must the population be taken as a basis, and the amount necessary for the *clothing* of each individual calculated at average rates, but an allowance must be made for that used for other purposes, and also for the enormous quantities that would be exported. India owns a population of some 200,000,000, all of whom are clad entirely, or almost entirely, in cotton garments, and if we take 3½ kilogrammes (about 7½ lbs.) as the rate of individual consumption, the result is stupendous, well nigh incalculable; and to that again must be added the amount used for bedding, tents, carpets, hangings, etc, and a mass of other articles in use among the civil part of the community as well as the army, (articles made from hemp or wool in Europe,) all of which are made exclusively of cotton in India. It is evident that a scheme for converting cotton into thread at a cheap rate by means of machinery is a scheme capable of utilizing with facility the whole supply of the raw material; and it would encourage growers to produce cotton, an article in universal demand, on a more extended scale. The result of this would be that vast tracts of land hitherto lain waste could be put under cultivation, and that the demand for hands (for the factories) would check the appalling amount of emigration now going on in so many districts, an emigration which only enriches other colonies.

For, in fact, so far from being too numerous, the population of India is sparse throughout, with the exception perhaps of a small portion of this side of the country.

And finally, in support of all the advantages thus enumerated, let us consider for a moment the result accruing to India from each packet of cotton produced by machinery and on a level with the requirements of the day produced, be it remembered, by means of water power, which is universally allowed to be the cheapest motor in existence; looking then at the diminution in the cost of fabrication, which consists in (*see* page 12)—

1*st*.—For the raw material, per packet of 5 lbs., Rupees 1-13-2; out of this sum the growers have already gained their profit.

2*nd*.—Incidental expenses, at the rate of Annas 7-1½ per packet, which sum is divided among a crowd of workmen of all classes, among whom may be noted the weaver, washerman, dyer, and also labourers, artizans, casters, blacksmiths, joiners, carvers, builders, etc., etc., whose labour goes to compose the value of the cotton; and

3*rd*.—The amount of Annas 1-8 deducted from each Rupees 1-3-8 of profit for assurances, banks' interest on the capital, profit and loss, etc.

There still remains to the good of the factory, *i.e.*, to the share-holders 15 Annas on each packet of 5 lbs., sold at Rupees 3-8-0.

We see, then, that every pound of cotton raised gives rise to many distinct advantages, enjoyed by a vast number of people, and consequently this branch of industry should be considered a fertile source of wealth, not forgetting the bearing it would have on all kinds of transport, in which department England has always been foremost.

The Mercantile community, both European and Native, of Madras, of Tinnevelly, and, in fact, of all parts of the country, having once been led to consider the advantages of the project I have described in this report (under the circumstances in question) it would be easy to raise the capital necessary for the establishment of a factory of the proportions laid down in the Minute of His Excellency Lord Napier.

(Signed) E. DUVAL.

MADRAS,
February 28th, 1870.

No. 236. MINUTE BY HIS EXCELLENCY THE PRESIDENT.

THE Minute which I circulated on the 12th of August last was prompted by the desire to do something, if possible, for the decaying manufacturing interest of this country. It appeared to me that a new stimulus could be given to this form of industry by the use of water-power machinery, and that the River Tambrapoorney offered peculiar facilities for its application. The report presented by Mr. Duval strengthens my impression. It affords sufficient *prima facie* evidence that a Spinning Factory could be established on the stream referred to with every prospect of success. The question of weaving is, in the opinion of Mr. Duval, doubtful. I learn from him that hand-loom weaving can be carried on so cheaply and advantageously in the Native villages, that he doubts whether the power-loom can be employed with profit in this department. This opinion, if well founded, need not however deter us from promoting the limited project of a spinning mill. The cheap supply of twist to the Native weaver would give an impulse to a domestic craft of great importance to the welfare of the people. In corroboration of the views of Mr. Duval on this point it is urged that the Pondicherry Factory, which flourished as a spinning mill, has become unprofitable since weaving was introduced. I do not think that the example is conclusive. The use of steam-power must have rendered the manufacturing process far more expensive at Pondicherry than it would be at a site abundantly supplied with water.

2. In recommending Tinnevelly and the Tambrapoorney river as fitting localities for the first experiment, it was not at all my purpose to represent them as the only places adapted for this enterprise in the Presidency. My impression is that manufacturing centres might be advantageously established in connection with three cotton-producing districts, in Tinnevelly on the Tambrapoorney, in Coimbatore on the Cauvery, and in Bellary on the Toongabuddra.

3. I would now suggest to Council to communicate Mr. Duval's report to the Chamber of Commerce for their remarks, and should the question elicit any interest and response on their part, I would propose to send Mr. Duval to examine the Toongabuddra river in the vicinity of the Walavapoor anicut and the other ancient anicuts below it, where the natural fall of the stream and a number of rapid irrigation channels appear to indicate, if my memory serves me, favourable sites for the establishment of machinery. The Cauvery might be undertaken

subsequently. There are admirable positions for using water-power at Seringapatam, one of which is occupied by Mr Hayes; but I make no doubt that equally good situations might be found lower down on the British territory.

4. In illustration of the general question I may remark that in Ireland—a country resembling India with reference to manufacturing industry in so far as cheap labour and the absence of mineral fuel are concerned—woollen mills have been recently established, by far the greater number of which are worked by water-power. In the south of Scotland the old water-power mills have frequently been supplanted by steam-power, but this is accounted for by the insufficient and variable supply of the water-power by the discovery of coal or by its cheaper transport through the development of the Railway system. In the south of India, unless there should be an abundant supply of coal raised in the immediate vicinity of the cotton-fields, the use of water-power appears to be the only proper means for reviving manufactures.

MADRAS,
June 10th, 1870.

(Signed) NAPIER.

No. 237. ORDER THEREON, 20th June 1870, No. 905.

Miscellaneous.

RESOLVED that the Minutes of His Excellency the Governor and Mr. Duval's report be communicated to the Chamber of Commerce for their information and for such remarks as they may wish to offer.

(Signed) R. S. ELLIS,
Chief Secretary.

Gobt. of {1870} Madras.

To

REVENUE.

THE CHAIRMAN OF THE CHAMBER
OF COMMERCE.
&c., &c., &c.

Dated June, 20th.

Recd. *Encl.*

G. O., 20th June 1870, No. 905.

JUNE.
Nos. 235—237.

Water-power Mill in Tinnevelly.— Mr. Duval's Report and the Minute by the Governor on this subject, forwarded to the Chamber of Commerce for remarks.

industrielles cherchant à l'utiliser et par comparaison avec matières à vapeur exempt de toute concurrence possible;

Tout ceci bien observé nous ferons Mr. Levy, après cet examen, fait de rechercher le terrain le plus propice à l'établissement dont il s'agit. Terrain occupant un niveau d'élévation naturellement suffisant à la chute motrice et le plus inaccessible à la grande crue des eaux qui se précipite tout à coup et fréquemment dans ce torrent; . . . . . .

Crue qui atteint dans peu d'heures et quelquefois presque subitement de 10m à 12m et amène dix grands d'élévation (Terme moyen) ravageant dans son parcours tout ce qui peut faire obstacle à cette avalanche. Plusieurs terrains s'offraient avec assez d'avantages, mais aussi avec de grandes difficultés d'exécution sous divers rapports, parce que 1°, Rien ne doit être mis avec frais des maintenues et même si on adoptait il devrait évidemment que pour éviter l'encaissement des eaux

Mr. Duval doubtful,

pendant l'hivernage c'est-à-dire
les saisons des grandes pluies il
fallait construire tous les bâtiments
sur des voûtes ménageant ainsi
un dépôt des canaux déversoirs
facilitant l'écoulement des eaux
afin de maintenir à l'intérieur
une atmosphère uniforme
absolument nécessaire dans ce
genre d'exploitation et aussi pour
protéger les constructions d'une
humidité nuisible, au cas où il
deviendrait très difficile d'amener
l'eau au moyen d'un canal
ordinaire, il était plus court
alors de percer un tunnel dans
la montagne donnant directement
et gradant ainsi directement
la cascade. Situé immédiatement
derrière à une hauteur très convenable
et à peu de distance environ 3/4
de mille; ce système aurait débité
l'eau nécessaire avec beaucoup
de régularité sans crainte d'aucun
accidents dû aux grandes crues
subites des eaux car le diamètre
du tunnel aurait été déterminé
en vue des besoins de l'établissement,
tel qu'une turbine ordinaire aurait
de ses valves, aussi après ce

[illegible] J. M. Duval doubtful,

ce projet devrait bien coûter
700 ℔ quelques pords à draguer
en tunnel et environ autant de
Canal découvert jusqu'aux rapides
demandait de grands expédients.
Ensuite vers le Nord on trouve tous
terrains à Pilly desert déjà
cultivés, trop dispendieux comme
premier achat et surtout dont le
niveau trop sec contre-haut
n'admettaient que difficilement
nos moteurs hydrauliques ou des
noirs d'un système insuffisant
je veux parler des roues à Palis
dont le mouvement s'acquiert aux
dépens et pendent près des 6/8mes
d'effet utile, tandis que celles à
Poncelet de nouvelle construction
donnent avec contraire 6/8mes
d'effet utile dont 75% contre les
premières 25% Seulement du volume
d'eau dépensé. Avant de m'arrêter
à une partie je redressais encore
et je puis par découvrir une pente
plus bas nous conduit très commode,
je citerai à cet effet une proposition de
Lettre que j'adressai aux Collecteurs
de Timbrelles.

A Rivaz face de la Paroisse de
Corsier existe une terrain

[illegible] M. Duval doubtful,

très accessible à la route, entouré par deux bras du Jaudra pourrait, l'un pourrait alimenter la faudrait ou moyen d'un barrage, l'autre Setté plus bas et central servirait de déversoir, cette disposition naturelle offre de très grands avantages tant économiques et sanitaires que et surtout dans l'accomplissement des travaux de direction des eaux demandant une grande force de résistance aux constructions. Les dispositions accidentés du lit où creuse le torrent et celles à prendre simplifieront économiquement ce but)). . . . . .

. . . . . .

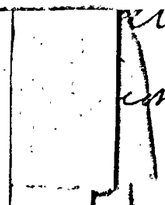
C'est pourquoi je me suis arrêté à ce dernier terrain pourvu ainsi avec lit indépendant de tous espèces d'irrigation; les deux branches artificielles destinées à cela, étant Setrées beaucoup plus haut et n'empruntant rien aux deux bras constituant cette Ile qui m'offrait dès lors tous les avantages nécessaires que je recherchais: mon plan dressé à cet effet, les forts retenus,

Signé J. M. Duval Ingénieur

mais avant de les décrire il est bon d'examiner la capacité de Jambroie pour cette sorte de mobile; quoique à première vue ce dernier point paraisse incontestable, il était nécessaire pour obtenir des données exactes, de prolonger et à des intervalles inégaux les expériences à l'appareil. Car rien n'est plus variable que la vitesse de l'eau dans le lit des fleuves et des canaux: les pentes plus ou moins rapides, les frottements latéraux, les accidents de fond et les sinuosités des rivages sont des causes qui modifient sans cesse la marche des filets liquides et par conséquent qui produisent les Remous, les Tourbillons et une foule de phénomènes qu'il est impossible de calculer d'avance quoiqu'on puisse les expliquer dans chaque localité. Les canaux qui ont une pente uniforme, une direction rectiligne et des dimensions constantes présentent des résultats plus simples et plus généraux. Les différentes couches liquides, depuis

[illegible] par J. M. Duval doubtful.

dans le même temps en vertu de toutes les vitesses différentes dont les molécules sont réellement animées ; donc il suffit pour un canal, pour avoir sa défense d'eau, de multiplier la surface de sa section par les 0.8ème de sa vitesse maximum, cette règle très simple est suffisamment exacte pour la pratique ; dans toutes les sections que l'on peut faire perpendiculairement au cours d'une fleuve, il passe naturellement la même quantité d'eau dans le même temps, la vitesse seule varie, car c'est à cette condition que le Régime est établi ; c'est-à-dire que le niveau reste le même en chaque point sans qu'il y ait tendance à l'accumulation, ni à la déperdition. Pour connaître la défense d'une fleuve ou torrent, il faut donc savoir la quantité d'eau qui passe dans une section quelconque, section dont on puisse relever facilement la surface, et la vitesse moyenne de tous les filets qui la traversent ; mais la vitesse



Mr. Duval doubtful,

moyenne variée aux jours ici et
quelquefois beaucoup et il devient
plus difficile de déterminer en
général le rapport qui existe
entre elle, puisqu'il se fait d'une
réhaussement des fonds d'une
crue, d'une diminution du niveau
ou même quelquefois d'une cause
moins apparente pour en changer
la valeur. Ce qu'il y a donc
de plus exact c'est de rechercher des
endroits d'un fond commun, facile
à mesurer et le plus uniforme
possible, sur une parcours d'affisant
et réitérant les observations à
différents intervalles on obtient
une moyenne maximum
suffisamment certaine que l'on
peut traiter comme pour les
canaux. Il est cette été plus
facile de faire passer le torrent
par un Verlus ou sur une
Digue ou il eut formé une cas
cade et un profil connaître la
largeur et l'épaisseur mais ici
il n'était impossible d'employer
ce dernier moyen et j'ai procédé
tel que je l'explique plus haut
dans les expériences demandées

J. M. Duval doutfol

qui je crois précéder d'une Station
indiquerait pour mois les variations
de la crue des eaux, et à l'aide
duquel il devient facile de se
rendre compte chaque jour
de l'état du Jaillissement
pendant tout le cours de l'année.

1869	Quantité des crues	Température
	Décroissance variable à Moyenne Forte (8) (4)	Variable
Janvier		
Février	Moyenne Forte (4)	Tempérée
Mars	Moyenne (2)	Tempérée
Avril	Moyenne variable à Peu (2) (1)	Chaude
Mai	Peu variable (Moyenne) (1) (2)	Chaude
Juin	Moyenne (2)	Brûlante
Juillet	Moyenne forte (4)	Brûlante
Août	Moyenne variable à peu (2) (1) (1)	Brûlante
Septembre	Moyenne (2)	Chaude
Octobre	Moyenne variable à moyenne forte (2) (4)	Chaude
Novembre	Beaucoup variable à très forte (8) (32)	Tempérée

[illegible] Juin [illegible]
[illegible] M. Duval douteux,

Décembre (16) Grande variable à beaucoup (8) Trench

Expériences faites en Octobre 1869

Bras Sud, observations de cinq yards en cinq yards à l'endroit le plus repéré du torrent et choisi pour l'emplacement du receleur voir sur le plan au jalon 22 du bras marqué B. — au bras receleur.

Le yard est de 92 centm
Le pied est de 31 centm
Le pouce est de 2 centm 6mm

Le mètre est de 3 pieds 3 pouces 1 ligne 296 millièmes de ligne

6 pieds 10 pouces
7. " 7 "
131 pieds.

1° Largeur 2m 10c
Profondeur 2m 35
Vitesse à la seconde 40m
Doit

6. 10 X 7. 7 X 131. = c. . . . . = 2. 10 X 2. 35 + 40 = 197: 40 mesurés
pour ensemble

4 pieds 11 pouces
6 " 8 "
212 pieds

2° Largeur 1m 50c
Profondeur 2m 00
Vitesse à la seconde , 65
Doit

4. 11 X 6. 8 X 212 = c = 1.50 X 2-00 X 65 = 195m-00c
pour mémoire

8 pieds 10 pouces
6 " "
141 pieds

3° Largeur 2m 70
Profondeur 1m 55
Vitesse à la seconde , 46c
Doit

8. 10 X 5. X 141 = c = 2.70 X 1.55 X 46 = 192-50
pour mémoire

Section of measuring [illegible]
in Mr. Duval's drawing,

Même les observations sur divers jalons très distants.

4e { Largeur 7-75 / Profondeur 0-90 / Vitesse à la minute ,,-30 — Soit par minute

7.75 X 0.90 X 30 = 209mm 25

25 jalons 10 pouces / 2 " 11 " / 98 jalons

25 X 2. 11 X 98 = c

5e { Largeur 14m-00c / Profondeur ,, 80 / Vitesse à la minute ,, 22 — Soit par minute

14-00 X 0.80 X 22 = 246m-40c

45 jalons 6 pouces / 2 " 8 " / 72 jalons

45 X 2. 8. X 72 = c

6e { Largeur 22m-00c / Profondeur 0-40 / Vitesse à la minute ,, 25 — Soit par minute

22-00 X 0.40 X 25 = 220-00

72 jalons / 1 jalon 11 pouces / 81 jalons

72. X. 1. 11 X 81 = c

Bras Nord, ou déversoir indiqué aux plans en J. — Observations faites à l'embouchure par temps Sec.

7e { Largeur 24-00 / Profondeur 0-40 / Vitesse à la minute ,, 20 — Soit

24-00 X. 0. 40 X 20 = 192-00 par minute

(J)

79 jalons / 1 " 11 pouces / 66 jalons

79. X. 1. 11. X 66 = c

Vu et reconnu conforme à l'original en foi de quoi j'ai M. Duval dont-ful,

84 pieds
1 pied 2 pouces
82 pieds

8e { Longueur 26-00
Profondeur 0-35
Hauteur à la moindre 0-25
Soit

84. X 1. 2. X 82 = c

26-00 X 0.35 X 25 = 227-50
pour mémoire

72 pieds
1 pied 8 pouces
59 pieds

9e { Longueur 22m=00c
Profondeur 0=45
Hauteur à la moindre "=18
Soit

72 X 1. 8. X 59 = c

22-00 X 0.45 X 18 = 178-20
pour mémoire

97 pieds
1 pied 8 pouces
49 pieds

10e { Largeur 30-00
Profondeur 0-45
Hauteur à la moindre 15m
Soit

97. X 1.8.X 49 = c

30-00 X 0.45 X 15 = 202-50

Ces expériences furent faites à l'école de pleins cintres pour.

(Pour le pied cube on fait le reporter à 28 et 29 pour cent)

Récapitulation ci pour détailler une mesure.

Brass M. ou point M.

6516 pieds cub. Nr 197m 40c

[illegible] mesure [illegible]
par M. Duval dont fait

2516
466 pieds
5376 "
5852 "
6888 "
6160 "
Total 36252 pieds

observations 6 = (6040).

2e 195_00
3e 192_51
4e 209_25
5e 246_40
6e 220_00
Total 1260_56

1260 mètres = 210 m. c.
par 6 observations

pour terre rouge en ce bras et pour mixte

Bras T. à sec embouchures

5376 pieds
6356 "
4928 "
5656 "
Total 22306 pieds.

observations 4 = 5570

7e 192 m 00 c
8e 227_50
9e 173_20
10e 202_50
Total 800_20

800 mètres = 200 m c.
par 4 observations

et pour moyenne générale
Bras (G) 210
Bras (T) 200
Total égal 410 mètres cubes

et pour moyenne générale
5000
6000
par minute 11000 pieds cubes

Mais je dis plus haut qu'il ne fallait s'arrêter qu'au 8/10me du produit ainsi obtenu.
Soit 410/10 X 8 = 328 et pour l'unité de mesure c'est-à-dire pour 1 mètre égalera 328 X 60 = 19.680 mètres

11.000/10 X 8 = 8800 pieds cubes
8800 X 60 m = 528.000 pieds
ou 60 minutes

Signature de Mr. Daniel Donkfut

Maintenant il n'y a plus qu'à
examiner la hauteur possible de
la chute d'eau, pour avoir les
deux termes nécessaires à déterminer
la force du Tambraporrany en
chevaux vapeur à l'endroit choisi
naturellement. J'ai dit plus haut
que je reviendrais sur les dispositions
favorables du sol auquel je
m'arrêtais. En effet toute cette
H est formée de bonne terre pour
construction et repose sur un rocher
en outre elle est inaccessible, c'est
peut être le seul terrain semblable
bordant le Tambraporrany. Le
meilleur moyen est un déblai
basé carré de 4.00 mètres sur
environ 10 yards; le plan dressé
à cet effet décrit le fond du
torrent depuis le barrage exécuté
sur plus haut Tapanapum jusqu'à
la formation définitive du
Tambraporrany. c'est-à-dire
plus bas que l'H. Après le
reportant à l'exutoire indiqué
dans le plan comme pénétrant
les mortiers, la chute à obtenir
peut atteindre, pour une barrage
de très facile exécution (le torrent
en cet endroit se prêtant lui-même

[illegible] I M. Duval doubtful,

8 mètres en 1 temps moyen et 6 mètres par les grandes eaux sans craindre qu'une partie des Sabots soient noyés par la crue. Je prendrais donc le plus bas chiffre comme terme de comparaison et prenant pour unité la chevaux vapeur de 75 kg^m en réduisant exactement les mètres en litres et les heures en secondes l'évaluation devient :

$$\left(\frac{19680^{\text{mètres}}}{3600}\right) \cdot = \frac{5460}{75 \times 6 = 435}$$

donne le Jaugeur pour une possédant en Octobre dernier une force motrice de 435 chevaux vapeur observée pour un temps moyen plus bas Sec. Ici, je ferais suivre à l'aide des Tableaux de la crue des eaux l'exactitude approximative pour toute l'année et voici comment je ferais pour les 6 termes du Tableau pour des chiffres en rapport et connus pour ainsi

Très	mètres	1
Moyenne	"	2
Moyenne forte	"	4
Basse eaux	"	8
Grande	"	16
Très grande	"	32

[illegible] Duval doubtful

alors les expériences faites en
Octobre dernier ayant produit
435 chevaux vapeur obtenu
ainsi que l'indique le tableau
pour moyenne on (2) nombre
à moyenne forte on (4) donne
$2+4=\frac{6}{2}=3$ et en divisant
436 pour 3 mois avons donné
145 chevaux pour l'année pour
1871 ainsi nous dû plus faible
pour déterminer la moyenne
de tous les mois et alors nous avons

Janvier
$8+4=\frac{12}{2}=6 \times 145$ c
Soit: 870 chevaux.

Février
moyenne forte: 4×145 c
Soit 580 chevaux.

Mars
Moyenne: 2×145 c
Soit: 290 chevaux

Avril
$2+1=\frac{3}{2}$. 1.50×145
Soit: 217 chevaux.

Mai $1+2=\frac{3}{2}$ 1.50×145
Soit: 217 chevaux.

Juin
Moyenne: 2×145 c
Soit: 290 chevaux.

[illegible] y M. Duval doubtful,

Juillet

Moyenne forte : 4 X 145 c.

Soit : 580 Chevaux.

Août :

2 + 1 - $\frac{3}{2}$ 150 X 145 c

Soit : 217 Chevaux.

Septembre

Moyenne : 2 X 145 c

Soit 290 Chevaux.

Octobre

2 + 4 - $\frac{6}{2}$ = 3 X 145 c.

Soit : 435 Chevaux.

Novembre

8 + 32 = $\frac{40}{2}$ = 20 X 145

Soit : 2900 Chevaux.

Décembre :

16 + 8 = $\frac{24}{2}$ = 12 X 145

Soit 1740 Chevaux.

Ces Sommes se rapportant à tout ce que j'avais précédé et la force de 60 à 70 chevaux (Journalière) requise pour un Etablissement dans le genre de celui dont il s'agit dans la pensée de Son Excellence Lord Napier. Il est inutile je crois d'insister plus longtemps sur les avantages que présente Sa proposition comme Site et la

[illegible] Mr. Duval doubtful,

le Sambra pourrez comme fra-
motrice et mené comme
navigation fluvial grandé à
la communication des routes
avec l'Ile, vient de plus loin, à
un petit pont en fils de fer et
suspendu, coûterait très bon
marché sans avoir besoin
d'être enlevé ; Ici, doit encore
se joindre une pierre importante
celui des matériaux (construction)
Sa pour saison est le type du bon
marché et sous ce rapport il
suffit de dire que la yard cu
2 pieds cube de maçonnerie
coûte 4 Bz. 1/2 extraite à chaux,
sable, et briques, ainsi que la
façon d'oeuvre tout compris.
Les bois de construction et de
charpente y dominent généralement
le Rouy (bois jaune) espèce toute
particulière à cette localité et
est certes préférable au teck et
à pensylvanie de pays pris
dans la forêt que 8 Bz pour
licence c'est-à-dire pour charrette
chargée autant que possible et
représentant ainsi environ
28 pieds cube soit un peu
plus d'une yard cube. Le reste

[illegible] y M. Dieul doubtful,

des manœuvres et de la
nœuvre — d'ouvre est proportionné
et ici, je joins mon Aperçue des
Prix des manœuvres ainsi
que de la nœuvre — d'ouvre à
Lespanadjour.

" Palmiers par pied Pr 3—
" Briques par 1000 3—8—
" Chaux par Cotta " 12 "
" par rivière 4—8—
" Maçons 3/4 Pr à 2 Cannes
" Tailleurs de pierres 1/2 Pr à 4es
" Charpentiers 3/4 Pr à 6 Cannes
" Forgerons 3/4 Pr à 6 "
" Cabaliers de bois par pied 10
" Rejeonneurs de bois 7 Pr par
" pièce irrolierrière ou 80 à 30
Sceeurs de bois, par pieces de
" 6 yards: 4 pences par 2/7 annas
" Et par cash pour découvre
" cette même pièce 8 annas. . . .
" Cannes par yard cube 1 Pr la
voiture de sable à construction
" 4 annas 1/4 cooly par jour 3
" Femmes " " " 2
" Garçons " " " 2
" Filles " " " 1/4
" Par yard cube 4 Rs 1/2
" p. un contract (illegible)

[illegible] y nr Dieul doubtful

(35 and 36)

Filature du Coton
à Japonaffem.

D'après ce qui précede et toutes ces considérations posées il suit ci dessous l'évaluation du coût d'un établissement hydraulique pouvant produire 500 paquets par jour soit 2500 livres.

Capital Social .... 400.000 Rs

Décomposition du Capital

Machines filature

1 Batteur et ventilateurs	6100	1
1 Ouvreuse id	1300	2
2 batteurs simples et ventilateurs	2400	3
2 id doubles (Etalons)	1600	4
50 Cardes debourreuses (cartonnatiques	30000	5
4 Réunisseurs avec canals	800	6
5 bancs d'étirage avec réunisseurs	6500	7
5 id en fer	5000	8
25 bancs à broches intermédiaires	10000	9
20 id en fer	24000	10
40 Self. actings (renvideurs) 600 Bx	51000	11
50 Devideurs	4000	11
2 Presses à empaqueter	400	13
2 Machines à cafsiser	800	14
à reporter	137900	

(36)

[illegible] Mr. Duval doubtful,

Report		137900
Moteur		
Moteur hydraulique (roue à augets)	2000	
Transmission de mouvement	6000	
Excavation du barrage près du moteur	4700	
id grand déversoir	1200	
id petit	600	
id moteur (réparation)	1200	
Tunnel du grand axe	500	
Canalisation pour le moteur	800	
Une machine à vapeur accessoires &c	15600	32600
Frais divers & Bâtiments		
Emballage et faux frais	15000	
Fret 500 tx environ et à 25 ℔ Lieu	12500	
Déchargement et transport	10000	
Installation comprenant journées dans les frais de Solde des employés Divers		
Passages outillages &c	45000	
Installation de la machine à vapeur	4000	
Serrurie	3000	
Bâtiments filature et constructions diverses pour les employés &c	80000	169500
Total		340000
Fonds de réserve		60000
Total général		400000

Le fonds de roulement se compose

(7)

[illegible] M. Duval doubtful,

(des sommes nécessaires et réserve une
peu grande pour l'approvisionnement
de la filature ainsi que les avances
dues aux Tisserands à la maison.))

Décomposition du fond de réserve

Approvisionnement de la filature.
pour environ 2 mois y compris
diverses fournitures &c ——— 35000
Employés et maison d'ouvre ——— 7000
Caisse de réserve ——— 10000
Avances aux Tisserands ——— 10000 60000.
Total ———

Mise en Marche

Rouages de la défense générale

Matière

3 Candys Coton de 8 qualités diverses
nécessaires pour le mélange et au
prix moyen de 150 ℔ x 3 = ——— 450
Le déchet Statistique généralement
à 20 % Souvent l'expérience (des
Cotons de l'inde) il me restera donc
(le candy étant de 480 livres) par
candy que 384 ℔ x 3 soit 1152 de
Coton qui produiront 230 paquets
de 5 livres.
Sur les 288 livres de déchet

[illegible] Mr. Duval doubtful,

150 ouvriers pourront être vendus
aux prix de 2 annas —— Re 18-12-0
100 aux prix de 1 annas —— 6-4-0
(le reste des débats est insaisissable) 25-0-0
Et à diminuer sur le prix de revient —— 25 :
Reste 425

La fabrication devant être de 500 poignets
par jour, la valeur total des Colons
employés pour un de 300 jours de
travail sera :
500 × 300 = 150000 ⇒ 230 × 425 —— Re 27772

Matériel

Usure du matériel et de l'installation
1/25 de la valeur estimative sur 340000 — 13600
Entretien —— 2000
Un Serrurier mécanicien —— 1800
8 forgerons indiens à 12 annas par jour — 1800
10 Coolis (aide forgerons) à 3 id —— 563
Charbon de forge (10 tns à 25 Re) —— 250
Magasin et matériaux —— 400 — 20413

297585

Moteur

Entretien général —— 1000
Graissage et transmissions —— 1000 — 2000

Gérance

Un directeur —— 9600
Un Sous directeur —— 3600 — 13200

à reporter 312785

(39)

[illegible] y M. Duval doubtful,

Report		312755
Main d'oeuvre		3
Surveillance travaux	1500	
Ecritures	500	
Ouvriers fileurs et dévideurs d'autres	25500	27500
Montant des dépenses total effet		340285

Prix de revient

500 fagots par jour et 300 jours de travail effet 300 x 500 fait:
150.000.

Dépense 340.285 / Produit 150000 = par fagot 2 4 4 cts

Recapitulation du prix de revient=
Matière première 277172 Rt

277172 / 150000 = 1, 13. 2/2 net P fagot

63.113 / 150000 = 0 7 1/2 Frais généraux
Total 2 4 4 prix de revient

Les derniers cours de fils se sont tenus à raison de 85 x 90 la centaine de 16 fagots et ils déduction faite des frais de tissage à la société y compris

(40)

y M. Duval doubtful,

emballage sprofils V sperles ℔ ℔ 56 ℔
ou spar spoupeab ℔ 3_8_»

Sprix de vente ℔ 3_8_,
» de revente 2_4_4.
Differences 1_3_8 (boxe)
et 4 annas 8 dies spour sprais d'apprance,
interet des mentionné Capital total
sprofils et sperles, impreves ℔ ℔
1_3_8
à déduire »_4_8
reste 0_15_» annas spar spoupeab.
et spour 150.000= Egal Rupies 100625

℔
Spour 40.000 Capital=
Les fonds engagés dans la filature
sprovisionnent donné un benefice net
de 140.000 ℔ soit 35%
Le chiffre de 35% acquis spar ces
calculs spour la loi-mesure en faveur
de l'industrie cotonnière, spuis encore
ce sprodiut en dividende, ainsi obtenu
n'est pas susceptible la comparaison
d'un calcul théorique mais bien
plustot spratique et est prouvé par
plusieurs experiences très favorablement
réalisées dans l'Inde. Instruite je
ferai remarquer qu'il faut tenir

(41)

y M. Dival doubtful,

Compte dans ces estimations des dépenses qui n'auront lieu qu'une fois qui n'existeront plus dans le cours de la deuxième année d'exploitation ; ce sont les frais d'installation (52000 Rs) puis je signalerai également l'économie 6000 Rs environ qui se trouvera naturellement réalisée après l'expiration des engagements des ouvriers Européens qui auront formé des Indiens capables de les remplacer, dans les divers détails de la filature ; alors si le fond de réserve se trouve diminuer par l'intérêt à 6% à payer aux actionnaires pendant les deux années d'installation que je déclare nécessaire avant la mise en marche ou d'exploitation. Le fond se trouve aussi reconstitué s'augmentera, même par les économies que j'indique plus haut, ainsi que par la commission perçue

sur les

J. M. Duval doubtful

sur les frais d'achat du matériel en Europe et des matériaux ici. Le fond de réserve devient donc

Caisse ---------- 60.000
Commission ---- 15.000
75.000

Je suppose que les actionnaires réunis verseraient 200.000 Rs en souscrivant 100 000 à l'expiration de la première année et 100 000 Rs 6 mois après, le versement s'effectuerait ainsi en 18 mois, et alors intérêts dûs aux actionnaires à 6% pour première année soit 12000 Rs
6 mois après " 9000
à l'expiration des 2 ans 12000
Total 33 000

donc ceci déduit du fond de réserve, reste en caisse au moment de l'exploitation 42000 Rs qui s'augmenteront progressivement des économies que je présente ci dessus et encore de la somme reservée par avance pour usure du matériel soit environ

[illegible] M. Duval doubtful

soit 1300. A l'aide de ce système successivement étendu et utile, l'établissement pourra toujours faire face à toutes les éventualités d'accidents sans recourir à aucun système d'emprunt ou d'appel de fonds, et se tiendra très facilement à la hauteur de ceux d'Europe, en suivant facilement à l'aide de ces Capitaux en réserve les progrès et améliorations de jour en jour que comporte cette industrie. Cette mesure est urgente car les machines construites en 1830 ne peuvent être comparées qu'à un rôle industriel et ne pouvant certes plus rivaliser en aucune manière avec celles que la vive américaine a fait surgir depuis peu. Il y a quarante ans, il est vrai qu'il était difficile de prévoir les progrès actuels ainsi que l'essor donné au coton dans l'univers mais il ne faudrait pas pour cela que cette contrée perdit

Signé J. M. Duval doubtful,

Jerole une spécialité à
lui est acquise depuis
si longtemps, telle que les
guinées. serings ou teintes
Indigos qui la concurrencent
en Europe cherche à imiter
quoique sans trop de
succès jusqu'ici, aura
encore place à une autre
spécialité je veux parler
de la teinture Indigo pour
ainsi dire inimitable en
dehors de l'Inde. Dans
il sera toujours facile, dans
pour cette spécialité toute
concurrence étrangère, il
suffit pour cela d'abandon-
ner sur les avantages déjà
realisés, par exemple je
suppose 10 p% prélevés sur
les bénéfices plus haut pré-
sentés (voir pages 40 et 41) mais
qui ne peuvent être réalisés
que par des établissements
tout modernes et bien entendu
à la hauteur des possibilités
du jour comme exécution.
Le Gouvernement de l'Inde
lui-même ne pourrait-il
pas s'y approvisionner,
réaliser ainsi une large
économie

Signé J. M. Dural Douthfel

économie. en obtenant le meilleur compte la part principal de l'habillement des troupes, de la police et des volontaires. Il est facile de prouver, que l'établissement des manufactures de Coton est très avantageux dans l'Inde et favorable sous plusieurs points; il suffit pour cela de considérer la valeur de la main d'oeuvre employée dans la fabrication des étoffes, consummées dans l'intérieur, sans avoir égard à ce qui peut former un objet d'exportation, ce moment ou par la suite. Car en prenant pour base la population et la quantité moyenne annuelle de Coton à l'usage de vêtement consommée par individu, il faut encore y ajouter celle employée pour d'autres destinations, et enfin des quantités énormes pour l'exportation. L'Inde seule renferme près de 200 millions d'individus dont les vêtements sont

[illegible] J. M. Duval doublet,

sont exclusivement en Eur
ou a très peu près et en
estimant à 3 Kilogrammes
1/2 (7 livres 1/2 environ) pour la
consommation par individu
et par an le chiffre total
en production est énorme,
incalculable même, surtout
en y ajoutant encore la
consommation des objets de
literie, toiles, tapisseries,
harnachement et une foule
d'autres objets tant pour
le civil que pour l'armée
(faits en chanvre ou en
laine en Europe) auquel
dans l'Inde, on emploie
exclusivement le coton. Il
devient evident que le systè
industriel (automatique)
transformant le coton en
fils et à si bon compte est
un système absorbant facili
tant l'écoulement de la
matière première, encou
ragerait les cultivateurs
à produire d'autant plus
abondamment plus grande
échelle les Cotons longs
demandés dont l'utilité
assistanté se généralise
en

[illegible] Y M. Dural doubtful,

en tout et partout, dès
lors la culture se développa
utiliserait des surfaces
énormes restées vierges
jusqu'ici et qui enda-
vant dant plus de bras,
arrêterait l'émigration
désespérante remarquée
ici sur différents points par
émigration qui tourne tout
au profit des colonies étran
Effectivement loin d'être
désastreuse, la propriété
indienne indubie partout
excepté peut être dans un
cercle très restreint de cet
côté, puis comme dernière
considération à l'appui
des avantages qui précèdent
voyons un instant ce que
laine dans l'Inde chaque
livre de coton traité bien
entendu, industriellement,
d'après les procédés du
jour et encore rehaussés d'un
mouvement hydraulique
comme partout. comme
le plus économique: alors
il faut se reporter à la
défalcation du prix de
revient

Signature J. M. Duval doubtful,

ou aux actionnaires en portant le paquet de 5 livres à Rs 3-8-. On trouve donc que chaque livre de Coton coûtant du fil laisse travailler industrieusement, une marge de bénéfices; ce bénéfices doivent faire par conséquent encourager ce genre d'industrie comme une source féconde de richesse, dans cette contrée et à laquelle viendra se joindre encore l'intervention des moyens de transport auquels l'Angleterre travaille toujours avec activité,

Maintenant en présence de ce qui précède l'association mercantile tant Européenne que Indienne de Madras et de Tinnevelly ou même de tout autre district / prenant en considération les avantages qu'offre ce projet dans de semblables conditions, il devient facile de réunir le capital nécessaires à la formation de cet établissement dans les proportions proposées

selon [illegible]

[illegible] Mr. Duval doubtful,

dans la minute de son
Excellence Lord Napier

à Madras

le 28 Janvier 1870.

L. Bert

[illegible] de cacher [illegible]
[illegible] de M. Duval doubtful,

Rec = 1759/70.

Pan. 20 Juin 70 L 2.235

Voiron
23 Février
1870

Monsieur le Secrétaire
de la Société
d'Agriculture
de Grenoble

Monsieur le Secrétaire Permettez moi de vous rappeler que j'ai eu l'honneur de vous écrire l'été dernier pour vous prier de vouloir bien me faire connaître la nature du terrain pour lequel M. le Préfet du Département m'a accordé 25 f. par décision du 6 Septembre 1869. J'aurais désiré beaucoup le savoir plutôt mais je n'ai pu me procurer par différentes causes que je vous ai expliquées, que je suis arrivé à l'époque indiquée à la fin de la saison. Cette année je prévois de nouvelles difficultés pour le torrent; la saison est déjà avancée et il est à craindre que dans le courant de Octobre je n'aie rien à démolir. Le projet pour lequel j'ai eu des procédures dans la commune de Voiron a été approuvé il y a reconnaître la [illegible]

Veuillez [illegible]
Monsieur le Secrétaire, mes
salutations [illegible]
J. M. Duval Conseiller,

J'ai l'honneur d'être

avec respect, Monsieur,

Votre très obéissant serviteur

E. Duval

[illegible] J'ai l'honneur [illegible]

J'ai Mr. Duval doubtful,

Revenue 1070 Despatch

No 1759

From

Mr. E. Duval

Dated 28th Feb

Rec'd 5th June 1870

Submitting Report regarding Cotton Mills in India & the Capabilities of the Tambrapoorney River in accordance with G.O. of 6th Sept. 1869.

S.O. No. 905-20 June 1870.

235.

Ordered to be printed

Board of Trade 20th July 1870

8

50

C O P Y.

Chamber of Commerce,

Madras, 8th July, 1870.

To

The Chief Secretary to Government,

Ootacamund.

Sir,

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The great desire that is shewn by His Excellency the Governor to bring the matter to the notice of the mercantile community, is partly based upon a conviction that Pondicherry, "possesses a flourishing cotton factory", that "what is done with perfect success at

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Revenue 1070 Despatch

No 1759

From

Mr. E. Duval

Dated 28th Feb

Rec'd 5th June 1870

Submitting Report regarding Cotton Mills in India & the Capabilities of the Tambrapoorney River in accordance with G.O. of 6th Sept. 1869.

S.O. No. 905-20 June 1870.

235.

Ordered to be printed

Board of Trade 20th July 1870

8

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C O P Y.

Chamber of Commerce,

Madras, 8th July, 1870.

To

The Chief Secretary to Government,

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Bombay and at Calcutta would be done as well at Papanassum", and apparently by a feeling of confidence in Mr. Duval's estimates of the profits to be expected from the investment of Rs.4,00,000 in a Cotton Mill in the locality indicated above. As a matter of fact the Cotton Mill at Pondicherry is now closed, and the plant placed in the hands of liquidators. The concern comprised a Spinning Mill and a weaving Factory. The former was first established, but it was financially unsuccessful, as it could only turn out the low, coarse qualities of yarn, which are in comparatively small request. The Weaving Factory was added for the purpose of working up the yarn which failed to sell at a profit, and a coarse blue cloth was therewith manufactured, known as Salampores, which found a market in Senegal, and which was favoured for a time in that colony by a protective duty on similar cloth manufactured elsewhere. But, in the year 1865, the protective tariff was removed, and European substitutes for the real Salampores was supplied by Manchester and Belgium at prices with which Pondicherry cloth could not compete; and the Company after carrying on the business for four years, at an annually increasing loss, have now withdrawn altogether from the field.

As to the "perfect success" achieved at Bombay

prospect of success. The
estion of weaving is, in the
ion of Mr. Duval doubtful,

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and at Calcutta in cotton spinning, His Excellency would appear to have been somewhat misinformed, and a glance at the following quotations of the shares of Spinning and Weaving Companies in Bombay, obtained from the local Chamber's Market Report of the 28th ultimo, will satisfy the Government that in the Western Presidency the experiment advocated by His Excellency has been tried on a large scale, and has resulted in considerable loss to the shareholders:-

Names.	Shares.	Amount.	Paid up.	Last Div'd.	Rate per Share.
	No.	Rs.	Rs.	per an.	Rs.
Albert Mills Company ...	400	2,000	1,700	50	1,000
Alliance Spinning Co....	500	2,500	all	115	1,985
Arkwright...	100	2,000	all	....	500
Bombay	100	5,500	all	....	2,700
Bombay United	900	1,000	1,000	4 p.ct	775
Broach Mills	800	500	all	12 p.ct	200
Carwar Co.	400	1,500	all	....	900
Coorla Spinning	320	5,000	all	....	1,850
Great Eastern	750	2,000	2,000	150	1,450
Manockjee Petit's ...	2,500	1,000	all	80	750
Oriental	800	2,500	all	80	1,515
Royal	600	2,500	2,500	....	1,500

In Calcutta, on the other hand, the Goosery Cotton Mills Company's paid up shares of Rs.200 per value, were quoted on the 25th ultimo at Rs.221 each, the last ½ year's dividend

prospect of success. The
question of weaving is, in the
opinion of Mr. Davis doubtful,

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having been 6 per cent. This solitary instance of a successful Cotton Mill in India cannot be safely relied upon in calculating the prospects of a similar factory elsewhere, although it may favor the general impression that with cheap, perennial, and ample water-power the speculation should result satisfactorily. Mr. Duval estimates that such a Mill as he proposes at Papanassum would yield a minimum profit of 55 per cent. on the capital, and he is perfectly correct in stating at the conclusion of his very sanguine report that "(under the circumstances in question) it would be easy to raise the capital necessary for the establishment of a factory of the proportions laid down in the Minute of His Excellency Lord Napier." But, without taking upon themselves to dispute the accuracy of Mr. Duval's figures, the Chamber are compelled to remark that the public at large are at present afflicted with a possibly morbid, but insuperable distrust of calculations showing so abnormal a rate of profit. Yet, if the Government are convinced of the soundness of Mr. Duval's conclusions, and will so far participate in the risk of the experiment as to guarantee a dividend of only five per cent., or, of one-seventh of Mr. Duval's expectations, the capital will be at once forthcoming sufficient for one, or fifty, such Cotton Mills.

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prospect of success. The
ection of weaving is, in the
ion of Mr. Duval doubtful,

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Mr. Duval enters carefully into the question of the extent of the hydraulic power that he proposes to utilise. The Chamber cannot presume to offer any opinion on this point, which is one that can only be satisfactorily determined by competent engineers. But, assuming that the water-power would be ample for the proposed Mill, the question naturally suggests itself, could the Mill produce a yarn that in this country commands a ready and constant sale? As His Excellency Lord Napier, in his earlier Minutes, truly remarks "the northern part of Tinnevelly, and the adjacent district of Madura produce the raw material in abundance." But that raw material per se labours under peculiar disadvantages. Its staple is short, as compared with American cotton, and without mixture with the latter it does not readily admit of being spun into thin thread, of which the finer descriptions of cotton cloths chiefly in use in this country are woven. During the American war, Manchester succeeded in adapting some of her machinery to the exclusive use of Indian cotton, but the staple of the thread being shorter, the cloth produced compared most unfavourably, as to endurance, with the cloth it was designed to replace, and consumers had to pay famine prices for goods that had no wear in them. A Cotton Mill that confined itself to spinning only the coarser yarns could not in the nature of things prove successful, as the demand for

[illegible] prospect of success. The [illegible] question of wearing is, in the [illegible] of Mr. Duval doubtful,

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those yarns is ever irregular and limited. In Bombay, the Chamber believe, several of the weaving Companies enumerated above confine their attention to weaving yarn imported from Manchester, and look for their profit in the low rates of labour in India as compared with the prices ruling in England. If Madras could grow American cotton, and obviate the climatic deterioration of the seed, there might be some certainty of a local Spinning Mill producing the finer kinds of yarn; but so far as this Presidency is concerned it has yet to be proved that such yarn can be obtained from indigenous cotton only. The moral support of Government to such an experiment as His Excellency Lord Napier has recommended to the notice of capitalists, would not be without its advantage; but in matters of mercantile enterprise something of a more practical nature is imperatively required.

The Chamber cannot avoid, therefore, arriving at the conclusion that it would be premature to send Mr. Duval to examine the sites on the Toongabudra and Cavery rivers favourable for the establishment of Cotton Spinning Machinery, until the Government are satisfied that it is feasible to spin a yarn from Madras cotton that can vie with the finer yarns of mixed staples that

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are imported to a large extent from Europe. The suggestion of Mr. Duval that "the Government of India should supply itself at such a factory, and effect a large saving by obtaining at cheaper rates the large proportion of clothing necessary for the Army, the Police, and the Volunteers", cannot till then call for serious attention.

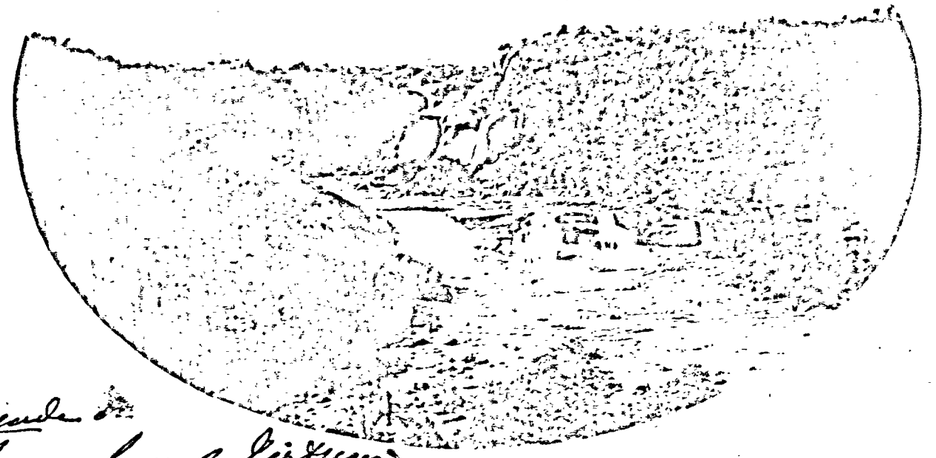
I may add that the question of the practicability of spinning the finer yarns from Indian Cotton alone will shortly be tried by a Joint Stock Company at Rajahmundry where the newest and best machinery has been erected. The Government may, meanwhile, deem it unadvisable to try a similar experiment elsewhere.

I have, &c.,

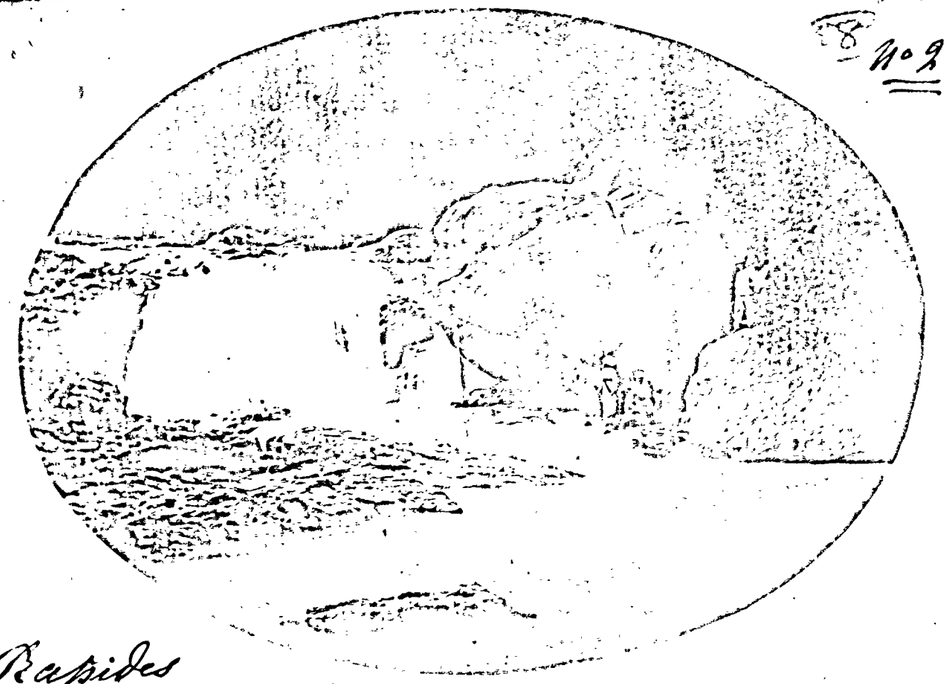
Sd/. P. Macfadyen,

Chairman.

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cascade de
(Kanyalum Dirtum)



Rapides
(au dessus du barrage Jordien)

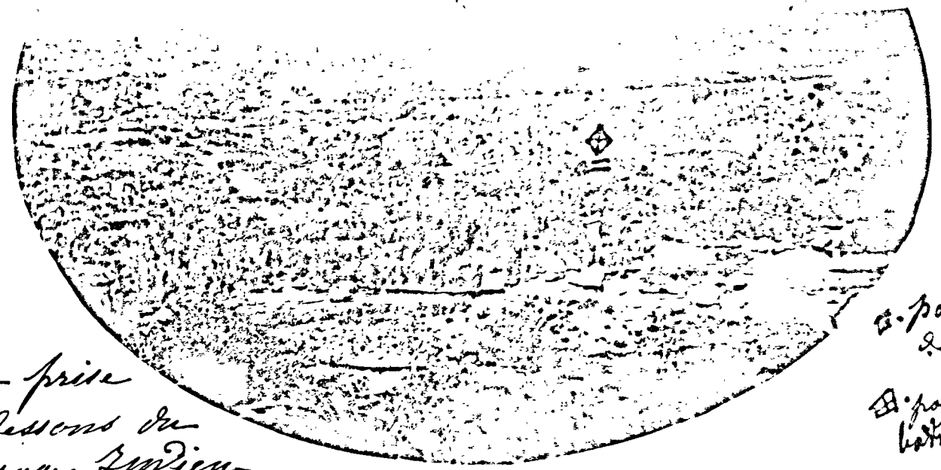
57 N° 3



Barrage Indien près de l'Ile (au dessus de la pagode) etc.

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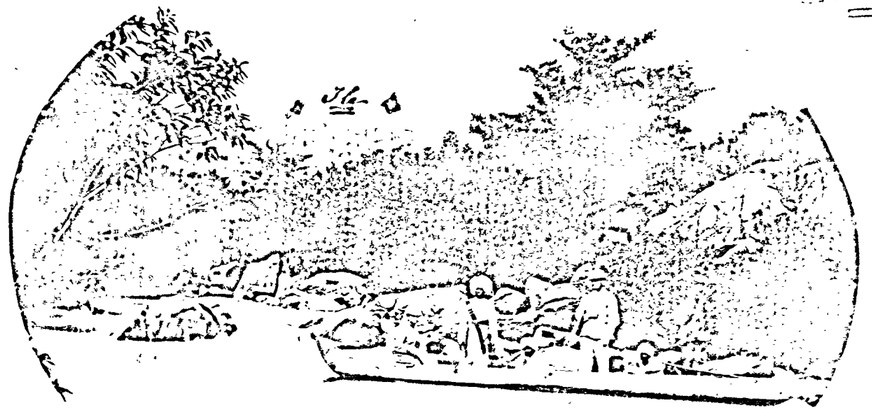
N° 4



a. point central de l'Ile

b. point des bâtiments à faire

a. Ile prise en dessous du barrage Lemien (vers l'amont de la pagode)



Vue pouvant
servir de terme
de comparaison
entre le régime de basses
et d'élévation de la Seine.

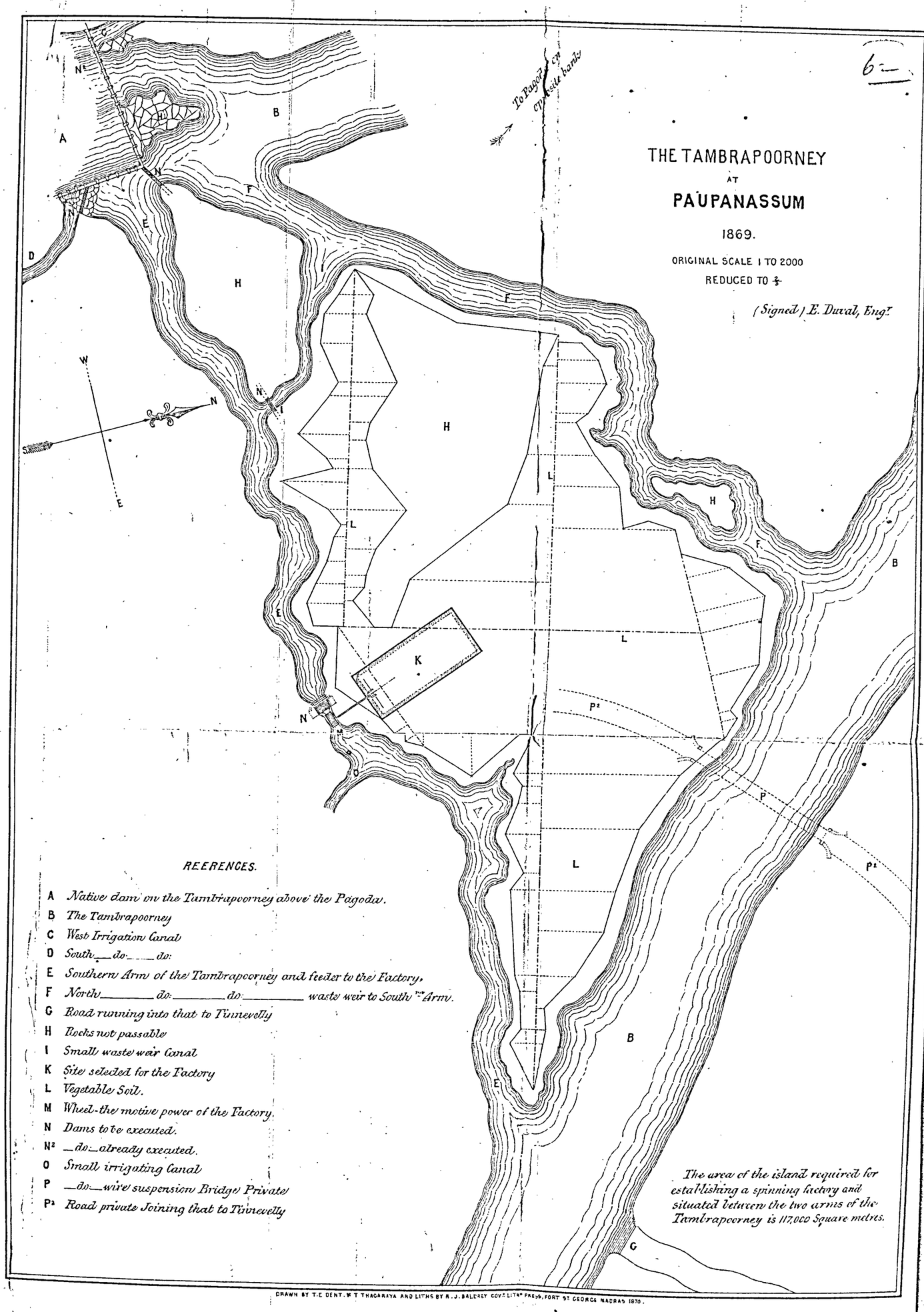
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6

THE TAMBRAPOORNEY
AT
PAUPANASSUM
1869.

ORIGINAL SCALE 1 TO 2000
REDUCED TO ⅓

(Signed) E. Duval, Engr.



REFERENCES.

- A *Native dam on the Tambrapoorney above the Pagoda.*
- B *The Tambrapoorney*
- C *West Irrigation Canal*
- D *South__do:__do:*
- E *Southern Arm of the Tambrapoorney and feeder to the Factory.*
- F *North_____do:_____do:_____ waste weir to South'n Arm.*
- G *Road running into that to Tinnevelly*
- H *Rocks not passable*
- I *Small waste weir Canal*
- K *Site selected for the Factory*
- L *Vegetable Soil.*
- M *Wheel-the motive power of the Factory.*
- N *Dams to be executed.*
- N² *__do:__already executed.*
- O *Small irrigating Canal*
- P *__do:__wire suspension Bridge Private*
- P² *Road private Joining that to Tinnevelly*

The area of the island required for establishing a spinning factory and situated between the two arms of the Tambrapoorney is 117,000 Square metres.

DRAWN BY T.E DENT. W.T THAGARAYA AND LITHS BY R.J. BALDREY GOV.T LITH.PRESS, FORT ST GEORGE MADRAS 1870.

Minute by Mr. The President.

The minute which I circulated on the 12th of August last was prompted by the desire to do something, if possible, for the sleeping Manufacturing interest of this Country. It appeared to me that a few Steamales could be given to this form of industry by the use of water Loom Machinery and that the River Sambrapoonay offered peculiar facilities for its application. The report presented by Mr. Duval strengthens my impression. It affords sufficient prima facie evidence that a Shirting factory could be established on the stream referred to with every prospect of success. The question of weaving is, in the opinion of Mr. Duval doubtful,

J.D.

6—

If on opposite bank

235.

I learn perhaps that hand loom weaving can be carried on so cheaply and advantageously in the native villages that he doubts whether the power loom can be employed with profit in this department. This opinion, if well founded, need not however deter us from promoting the limited project of a Spinning Mill. The cheap supply of the twist to the native weaver would give a impulse to a domestic craft of great importance to the welfare of the people. In consideration of the views of Mr Duval on this point it is urged that the Pondicherry factory which flourished as a Spinning Mill has become unprofitable since weaving was introduced. I dont think that the example is conclusive. The use of Steam Power must have rendered the manufacturing process far more expensive at Pondicherry than it would be at a site abundantly supplied with water.

2. In recommending Tinnevelly and the Tambraparney River as fitting localities for the first experiment it was not at all my purpose to represent them as the only places adapted for this enterprise in the Presidency. My impression is that Manufacturing centres might be advantageously established in connection with other cotton producing Districts, in Tinnevelly on the Tambraparney, in Coimbatore on the Cauvery and in Bellary on the Toongabuddra.

3. I would now suggest to Council to communicate Mr Duval's report to the Chamber of Commerce for their remarks and should

the question elicit any interest and response on their part I would propose to send Mr. Duval to examine the Loongubudda River in the vicinity of the Walaroo Weir and the other ancient circuits below it where the natural fall of the stream and a number of ruined irrigation channels appear to indicate, if my memory serves me, favorable sites for the establishment of machinery. The Lavery might be undertaken subsequently. There are admirable positions for using water power at Serviceton one of which is occupied by Mr. Hayes but I make no doubt that equally good situations might be found lower down on the British Territory.

4. In illustration of this general question I may remark that in

Ireland, a country resembling India with reference to Manufacturing industry in so far as cheap labour and the absence of mineral fuel are concerned, ~~a number of~~ woollen mills have been recently established by far the greater number of which are worked by water power. In the South of Scotland the Adjoining lower Mills have frequently been supplanted by Steam Power but this is accounted for by the insufficient and variable supply of the water power, by the discovery of coal or by its cheaper transport by the development of the Railway System. In the South of India unless there should be an abundant supply of coal raised

in the immediate vicinity
of the cotton fields the use
of water lower appears to be
the only proper means for reviving
manufactures.

Napier

Bolton. June 10th 1870.

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Province 1870 @ Vcte.

Ste. 1813

Minute by Hr.

The President.

June 10. 50.

Received 17th June.

Water Power, Mill

in Seaseville

1 Copy to Colonel Chamberlain Commrs.
1 " to R. Dunbar
14 " Byt Rue. within Rod
21 " Mr Dupuy

Boundary

Lt. Col. Hall. Rl. Mississippi

Quebec, 20th June 1842

Sir,

Referring to the Communication of Mr. Secretary Rush to Mr. Secretary Webster, dated 29th April 1842, I have the honor to transmit herewith, for the information of the President, a Report from Lieut. Col. Mudge, Commissioner on the part of the United States, and Mr. Renwick, Surveyor, on the Survey of the River St. Lawrence, between Lake Ontario and the Thousand Islands.

I have the honor to be, Sir,
Your most obedient humble servant,
Signed R. Jackson
Lieut. Col.

Lt. Col. Hall
&c. &c. &c.

dft. 905. 20 June 1842
Webster

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