C. No 491

Govt. of {18 } Madras.

PUBLIC WORKS.

Read

Recd. Encl.

G.O., 1st June 1896, No. 468.

Coolair Lake

≡

Scheme for diverting the
water of the Budameru away
from the — considered prohi-
bitive on account of its excessive cost and
the Supdtg. Engineer directed
to devote his best endeavours
towards improving the two
natural outlets from the
lake with the remark
that the necessary establish-
ment will be plan at
his disposal.

Further papers 2806C
13.7.96.

No. 468 I., 1st June 1896.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Irrigation.

Read—the following papers:—

From Major W. L. C. BADDELEY, R.E., Superintending Engineer, II Circle, to the Chief Engineer for Irrigation, dated Bezwada, 10th April 1896, No. 90 K.N.

In reference to G.O. No. 3049 W., dated 28th November 1895, I have the honour to forward a report by Mr. Pereira on the subject of controlling the floods in the Budameru and to offer the following remarks thereon.

2. I consider that it would not be safe to carry out the proposed diversion without constructing a strong masonry regulator at the point where the cut is to take off. In the absence of such a work, we should have no guarantee against too great a portion of a flood in the Budameru being carried into the cut, with the result that the banks would be breached and the whole line of diversion would be wiped out.

3. Allowing for the cost of a regulator, we could for about 8 lakhs divert into the Kistna, under favourable conditions, 15,000 cubic feet per second, or about three-eighths of the maximum flood discharge, which in September last must have been about 40,000 cubic feet per second. Under unfavourable conditions, viz., the Kistna being in flood, the proportion would be reduced to one-fourth.

4. As regards the plans and estimates, I have nothing further to say, the project is feasible from an engineering point of view, although it is directly opposed to the general principles which govern the construction of drains, inasmuch as we propose to make a drain across the natural line of drainage of the country.

5. The object of the diversion is to reduce the flood-level on the margin of the Colair lake and it is necessary, therefore, to consider what effect may be expected in this direction from the proposed diversion.

6. The bulk of the drainage entering the Colair lake in the Kistna district passes the line of railway and the canal between Bezwada and Ellore. Our works on the canal formerly provided for a discharge of about 82,000 cubic feet per second, and for several years the canal suffered no serious damage; but the late floods proved that the railway bank had altogether insufficient water-way and steps are now being taken to largely increase the water-way of the bridges on the railway and to provide more inlets and outlets for the canal. It may, therefore, be said that in the interests of the railway and canal, it is not necessary to go to any great expense to divert a portion of the flood discharge passing these lines, for the proper remedy is already being applied to render them safe.

7. The drainage area of the Budameru being 364 square miles, the calculated flood discharge would be about 25,500 cubic feet per second; but from Mr. Pereira's report it is clear that, owing to the abnormal rainfall last September, this discharge was increased to about 40,000, or by 35 per cent. It is not unreasonable to assume a proportionate increase along the line of country between Bezwada and Ellore and probably during the floods of last September the maximum rate of discharge into

the Colair was about 110,700 cubic feet per second across the line of canal. Under favourable conditions, therefore, the proposed cut would relieve the Colair of a little more than one-seventh of the water pouring into it from the locality named and of about one-tenth of the total discharge from the districts of Kistna and Gódávari.

8. The area of the Colair lake in high floods is about 260 square miles and in the dry season about 160 square miles. Taking the level of low water as + 0·0, the M.F.L. has hitherto been considered as about 8·50, but probably in September last it would be about 10·00. With an excess of inflow over outflow of 50,000 cubic feet per second, it has been calculated that the lake would rise 6" in 24 hours, so that the effect of diminishing the inflow by 15,000 cubic feet per second would not have any material effect on floods in the lake. The damage to the crops, however, is serious when the water level reaches + 5 and it is perfectly certain that the proposed diversion would not prevent the lake from steadily rising to that level during periods of abnormal rainfall.

9. I think I have clearly shown that though the proposed cut is feasible, there are no sufficient grounds to justify such a large capital outlay with a heavy yearly charge for maintenance, and I could not even recommend that the work be placed in the famine-relief programme, for I see nothing to recommend it.

10. The Colair lake is the natural flood moderator of the district and our object should be not to attempt to divert the natural lines of drainage flowing into it, but to obstruct them as little as possible; but at the same time we should endeavour to make the Colair as efficient as possible, and upon this subject I hope shortly to send in a report as to what we are doing and what we propose to do in the future.

Enclosure.

Report on the disposal of Budameru River Flood water.

[G.O. No. 3049 W., dated 28th November 1895.]

Instructions given me are attached.

2. The first point to be replied to is whether a large reservoir could be formed by bunding up the gap between Bezwada and Nainavaram hills with F.T.L. slightly above Kistna maximum flood-level.

There is no doubt that such a reservoir presents no engineering difficulties, but I consider it would be a highly undesirable undertaking for the following reasons:—

(*a*) The danger to Bezwada town and all the outlying works of public and private interest, should anything happen to cause the tank to breach. Such a calamity would cause far greater damage than that done by the flood of 1895.

(*b*) The M.F.L. at Kistna anicut is about + 66·25 and in order that the proposed reservoir may surplus into the Kistna, the M.F.L. in it could not be less than + 68·; now the crest of Rayavapad tank weir is + 64·46 and that of Ilaprole tank + 64·86. It may therefore be assumed that all the wet cultivation in these villages (800 acres) would be submerged, when water in the reservoir stood at + 64·00 or 4 feet below M.F.L., and in all probability the villages themselves would be under water which would render them uninhabitable.

(*c*) The N.G.S. Railway for 5¼ miles above the gorge varies in height from 61·50 to 66·00; this portion of the line would have to be raised from 5 to 9 feet and larger bridge openings provided.

(*d*) The proposal of a reservoir is, of course, with a view to utilize the water stored for irrigation purposes. About 8,000 acres are said to be commanded, but from a sanitary point of view, I consider it inadvisable to encourage irrigation in the vicinity of an important centre like Bezwada.

3. With the above remarks, therefore, the subject of a large reservoir is dismissed as being inadvisable from all points given. I will now proceed to show how the Budameru flood water can be treated higher up the valley.

4. A low-level reservoir at the same spot on the lines proposed by Mr. Joyce still remains a possibility, but this has no connection with the disposal of the Budameru flood water. I however very much doubt whether such a shallow tank would hold sufficient water for anything like the area commanded, and I also doubt whether there is so much water (700 cubic feet per second) running to waste in the Budameru as Mr. Joyce makes out. No attempt was made to gauge the quantity available in 1895 and there are consequently no figures to go on. Finally I consider that even this proposal should not be countenanced on sanitary grounds.

5. I have examined the levels of the country lying in the Budameru valley and find that the slope between Bezwada gorge and Ilaprole is very gradual, not more than about 1 foot per mile and above Kowlur, it is as much as 4 feet per mile. A little above Kowlur tank, the Budameru river is joined by the Pullivagu and the whole of the flood water brought down by these two vagus has to be passed between Kowlur and Balarow tanks, a distance of about 1¾ miles. The Budameru itself below the junction is not more than about 60 feet wide and about 6 feet deep within soil, and itself is capable of carrying about 1,980 cubic feet per second. Now the drainage area above this point has been taken out carefully and is found to be 294 square miles and the calculated flood discharge, taking C = 500, is $D = C M^{\frac{3}{4}} = 500 \times 294^{\frac{3}{4}} = 22{,}000$ cubic feet per second.

The capacity of the Budameru is therefore quite out of proportion to the very large body of flood water which occasionally comes down and hence the water has to find other outlets and it spreads all across the country between the above-mentioned two tanks. In 1895 flood, a large breach was formed on the right wing of Kondaguraza head-sluice and the water which escaped here did much damage in Velagaleru village, and a broad sandy channel has been formed in rear of the sluice.

That the above flood discharge has been under rather than over-estimated may be judged from the following. Mr. Joyce calculated the flood discharge through the gorge to be 20,800 (nearly) cubic feet per second—assuming a depth of 2 feet (the then maximum known depth) on the road between Bezwada and Nainavaram hills, a distance of 1 mile 3 furlongs and a fall of 1·397 feet per mile. From levels now taken it appears that in September 1895 the water stood 6½ feet deep on the same road, but I am of opinion that this greater depth must be partly due to the water being backed up by the East Coast Railway embankment as well no doubt to the breaching of so many tanks.

The area draining into the Budameru valley above the gorge is 364 square miles and C being 500, flood discharge works out to 25,500 cubic feet per second. The rain fall in September gauged in Bezwada was 11 inches in 24 hours. Assuming that the run off from the above area was only 4 inches, the flood discharge would amount to 39,154 cubic feet per second. In all probability, therefore, the above quantity is by no means over-estimated.

6. The proposal now made is to divert a portion of the Budameru flood water along a high level channel starting a little above Kowlur tank from a point in the Budameru, 800 feet below where the Pulivagu joins it, crossing the railway N.G.S. line at 329th mile and running straight for the old head to Jagamandra kalva; the channel which was mentioned by the Collector in his report on the floods and one which was, as far as I can ascertain, used for irrigation purposes before the anicut was built. The channel is to start at bed-level of the Budameru + 77·00 and to have a uniform fall of 2·62 feet per mile and bed-level of + 58 at the outfall into the Kistna which is the present bed-level of the Jagamandra kalva at the same point. A channel with the above fall and 300 wide carrying a depth of 9 feet of water will discharge about 15,000 cubic feet per second when the Kistna is not in flood. When the Kistna is down in flood, this same channel will discharge not less than 10,000 cubic feet per second, which ought to give considerable relief lower down the Budameru valley.

7. The latter quantity assumes a surface fall of 1 foot a mile with the same bottom width and depth. The Kistna maximum flood-level at the point of outfall is not known, but the value of the 1895 flood, which rose to 15·55 *on the old anicut crest*, was ascertained to be 69·14. Top of bank at same place is + 77·40. Now M.F.L. at Kistna anicut is + 66·25, but this height has only been attained for one day in 41 years and similarly:—

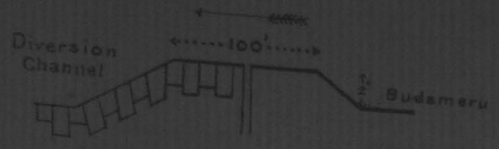
M.F.L.		
20′ or + 66·25	... ...	one day in 41 years.
19′ or + 66·25	... ...	3 days „
18′ or + 64·25	... ...	9 „ „
17 or + 63·25	... ...	15 „ „
16 or + 62·25	... ...	39 „ „

It may, therefore, be assumed that a 16-ft. flood may be expected every year and provision for disposal of Budameru flood water should be, with reference to such a flood and the risk of Budameru and Kistna being in maximum flood at the same time is one which may be accepted without fear. The flood of 1895 rose, as already stated, to 15·55 and at the point of outfall to 69·14, and it may be assumed that a 16-ft. flood would not rise higher than 69·75 at the same point which gives a surface fall of 1 foot per mile for the diversion channel. The point of outfall is 6 miles 3,040 feet (river bank mileage), or very nearly seven miles from the anicut.

8. The maximum flood discharge of the Kistna over the anicut has now been calculated from three different formulæ and the lowest figure gives a discharge of 550,000 cubic feet per second to which it is now proposed to add 10,000 cubic feet (the calculated discharge of the diversion channel when the *Kistna is in flood*) or $\frac{1}{55}$ of the whole. This is a small quantity compared with the whole and at the distance from the anicut it cannot have any effect on that work.

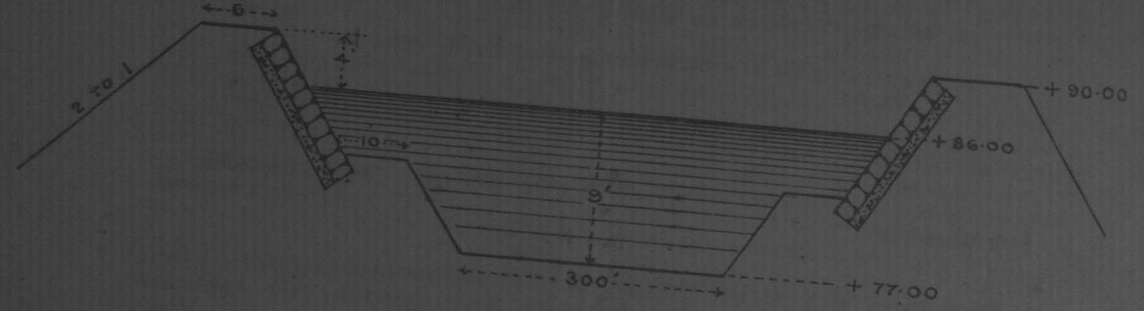
9. The proposed channel will have to be banked on both sides and the cross drainages which are marked on the plan (enlarged tracing of taluk maps, scale 2 inches to the mile) will have to be passed under the channel by means of under-tunnels. Three bridges at least will be required—

one for the railway and two for roads [(i) Kondapalli-Ilaprolu and (ii) Hyderabad]. The railway line will have to be raised 9 or 10 feet at the point of crossing. The channel will have an open head at its off-take from the Budameru; it is not thought that this will interfere with the supply of water to the tanks depending on the latter, because it has a greater bed-fall. For the present the head of the "diversion channel" might be left 1½ feet or 2 feet higher than the bed of the "Budameru" for a length of 100 feet to ensure adequate supply passing down the tanks below. The channel will also be open at its junction with the Kistna and floods in the latter will be allowed to enter the channel without restriction. This arrangement would be infinitely preferable to having an expensive and complicated masonry inlet with perhaps self-acting shutters to admit the Budameru flood into the Kistna and to exclude the high floods in the latter. The banks of the channel must be expected to withstand the flood water against them just the same as the ordinary river banks than which they are considerably higher. The Kistna flood could never flow so far up the channel as to reach the Budameru, the bed of which is + 77·00 and the probable height of Kistna maximum flood at the outfall is + 72·00.

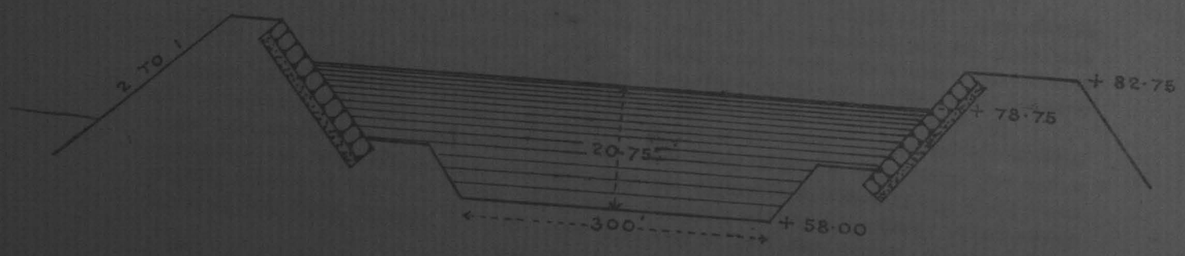


10. In all systems of irrigation the supply channels are run on the high ground and the drainage channels on the low ground. The channel now proposed may be called a high level drainage channel and its conditions are vastly different to the ordinary drainage channel. The levels of the ground do not admit of a line for the channel in which the flood water can be run within soil—it can only be run between banks and the flood water must rise above the level of the ground. It is therefore, in my opinion, a necessary condition that the inner slope of both banks of the channel should be fully revetted from end to end. If this is done, the banks will require very little attention. The section proposed for the channel is as follows:—

At Head.



At River Bank.



11. It has already been shown that the Budameru itself is of quite insufficient section to carry anything but a very small proportion of the flood water coming down the valley. In order, therefore, to make the proposed diversion channel more effective, it is necessary to widen the present stream to a bottom width of 200 feet from a point about half a mile above Kondagurazada head-sluice down to the head of the new channel. A bottom width of 200 feet with a bedfall of 4 feet per mile and a depth of 9 feet will discharge about 13,000 cubic feet per second. It seems that the pressure of water at Kondagarazada head-sluice is always severe and it will be seen from the sections that the ground on either side about half a mile above it is relatively lower and the widening proposed will have the effect of relieving the concentration which seems to take place about this sluice and which has so frequently caused a breach round its right wing. The question of still further widening the Budameru may be kept in view and left for future consideration. In widening the river, opportunity will of course be taken to straighten its present crooked course. The present bed width, as shown by the sections, varies from 45 at C S No. H to 156 at C S D, but the latter seems to be silted, and no doubt the extra width is due to the river changing its course.

12. The approximate cost of the whole scheme may be put down as follows:—

			Rs.
(*a*) *Earthwork*—			
Excavating main channel, forming banks, &c.	...	...	2,65,000
75,695 units earthwork at Rs. 3–8–0	...		
(*b*) *Bridges*—		Rs.	
Railway		60,000	
Road		80,000	
			1,40,000
(*c*) Raising N.G.S. railway line 10 feet at point of crossing		...	25,000
(*d*) *Revetment*—			
Weir slope of both banks with 1′ 6″ stone and 6″ backing.			1,62,000
25,000 units revetment at Rs. 6–8–0			
8,000 units gravel backing at Rs. 4–8–0 per unit		...	36,000
(*e*) Compensation for 600 acres of land at Rs. 50 per acre		...	30,000
(*f*) Ramps, demarcation of land and miscellaneous charges		...	2,500
(*g*) Six under-tunnels to pass local drainage under diversion channel at 5,000 each			30,000
(*h*) Widening Budameru for about a mile above the point of diversion			15,000
(*i*) Compensation for 30 acres of land required for the latter at Rs. 50			1,500
Total		...	7,07,000

(Signed) A. C. PEREIRA,
Executive Engineer.

14th March 1896.

From Major W. L. C. BADDELEY, R.E., Superintending Engineer, II Circle, to the Chief Engineer for Irrigation, dated Bezwada, 15th April 1896, No. 136 K.E.

In continuation of this office No. 90 K.N., dated 10th April 1896, I have the honour to submit the following report on the Colair lake.

2. First, I have to reply as below to the questions in your No. II/21 K.S., dated 11th February 1896:—

(1) There was another outlet from the lake as shown on the accompanying sketch-map. This drain, the Kaniticodu, passed by an artificial cut, through the sand ridge on the southern side of the Colair, with a bottom width of about 20 feet, and though some water must have passed through it when the lake was fairly high, it could have had no appreciable effect in lowering flood level in the lake.

(2) The evidence goes to show that the Colair used to dry up in summer sufficiently for carts to pass, for some years prior to 1884. The lake, however, was never dry before the Kottada weir was breached; this breach was purposely made some years ago to assist in draining the lake. There is no doubt that the irrigation works have caused a rise in the summer level of the lake; but that is merely putting the lake to its proper use, viz., a drainage reservoir. I submit that the artificial drains have had very little effect on floods in the lake.

(3) I have no information as to the sanitary condition of the lake.

3. From the attached extract from the water register at Atapaka, the following information has been obtained :—

(*a*) The flood level of 1895 was nearly a foot higher than in 1892, and the flood of 1892 was said to have been 9 inches higher than that of 1889.

The maximum rate of rise in 1892 was about 6 inches in 24 hours; in 1895 it was 3 feet in 24 hours. This fact fully bears out my argument as to the enormous increase of discharge last September into the Colair (*vide* my letter No. 90 K.N., dated 10th April 1896. We cannot however provide for floods during abnormal periods of rainfall, such as occurred in last September, when 11 inches fell in 24 hours. All that we should do, in my opinion, is to—

(1) consider what should be done to the lake to make it efficient during ordinary years of fairly heavy rainfall;

(2) commence a series of investigations and experiments to try and ascertain the rate at which the lake is silting up;

(3) consider how the 20,000 acres of land affected by floods can be best cultivated, so as to give a good return and avoid remissions due to loss by flood damage.

4. As regards (1), the lake is badly choked with weeds, owing to the mistake made years ago of leasing out the fishing, as the fisherman planted the weeds to assist their business. There are two outlets from the lake into the Upputeru—the Juvi Kanama and the Perantal Kanama; and estimates amounting to Rs. 1,640 and Rs. 9,000 are now being worked out to clear passages through those outlets into the Upputeru. What we aim at is to form two clear channels—one in the direction of Kolletikota for the discharge into the river of the water from the north of the lake, and one in the direction of Kavati lanka for the discharge of the Budameru and Tammileru and other feeders on the Western side, the water from which passes along the south margin of the lake. This work must be vigorously carried over year after year until the kikisa and other aquatic growths have been got under control. About Rs. 15,000 per year will be required for the next five years. It may be said, why not widen the Upputeru? The cost would be enormous as the widening (probably to twice the existing bed width) would have to be carried out for 17 miles from the head of the river as far as the Pedalanka drain, for the river is contracted as far as Tadivada and the effect of only widening the upper reaches would be to throw more water on the Kistna and Gódávari lankas lower down, without effecting any appreciable reduction in flood level in the lake. It may be that the result of the investigations I am about to propose may prove that the Upputeru must be widened, if the cultivation on the margin of the Colair is to be continued under the same conditions as in the rest of the delta; but it will then be a question for Government to decide whether the advantage to be gained is commensurate with the expense. At present, data are not available to make any estimate of the section required, the length that must be widened, the cost and the probable relief to the lake in times of flood by improving the discharging capacity of the river. I do not assume that the clearing of the lake will prevent floods rising on the margin during periods of abnormal rainfall, but it must do considerable good during ordinary years.

(2) The establishment I should require for investigating the Upputeru is—

1 Assistant Engineer or Senior Upper Subordinate.
2 Overseers.
3 Surveyors.
2 Draftsmen.

with the usual petty establishment for one year. It is absolutely impossible for this class of work to be taken up by the ordinary staff of the division, who, owing to their regular work, cannot give the continued attention that special investigations require. The work that the establishment would do is as follows :—

(1) Contour the lake to calculate the capacity at various levels.
(2) Make cross sections and take soundings to estimate the rate of silting up.
(3) Make surveys and cross-sections of the Upputeru and prepare an estimate for widening, and calculate the effect anticipated upon the lake of various levels.

(3) I must now turn to the main question, and that is, what is to be done if we find that the lake is steadily silting up, and that the cost of widening the Upputeru is prohibitive, and only likely to afford relief for a limited number of years? Upon this point, I see no reason to change the opinion I have advocated in my No. 1484 K.S., dated 2nd October 1894, and that is, abandon the practice of growing a five months' crop on the margin of the lake, and grow a three months' crop instead. It would, I believe, be far better to abandon all cultivation within the dangerous margin, than to start costly remedial works which will eventually lead to enormous expenditure; but I cannot believe that if the ryots really suffer, as they say they do, from floods, that they will long refuse to adopt the obvious remedy of growing crops that can be reaped before the floods come.

The following extracts from a report by Mr. Smith who has lately spent a good deal of time in inquiring into the conditions of the Colair require no comment from me beyond a request that the Revenue authorities will co-operate with the Public Works Department in inducing the ryots to grow the three months' crop on the margins, and rigidly prevent any planting of kikisa or other grasses in the Colair lake. The Public Works Department, by itself, can do little in the former and nothing in the latter direction.

"5. The damage done this year is of course abnormal and was all the greater, as the lake rose a month earlier and a good many of the crops had been transplanted later than usual.

"6. The crop of Tanjore paddy at Alapad which was ready to reap was submerged in one night, and was harvested in water the next day, but with smaller outturn than it should have been; but had the ryot sown it ten days earlier as he was advised to do and might have done, he would have been able to cut it before the floods.

"7. The result, therefore, showed that this crop can be successfully grown and reaped in all but abnormal years before the lake rises, and I hope that the experiments about to be tried this year will show that a second crop can be successfully raised after the lake has fallen.

"8. If the ryots take to growing these kinds of paddy, I think it will prevent them from suffering the losses which they undoubtedly do in years of high Colair, and also which they say they suffer every year, though I still think that the losses in ordinary years are over-rated. There is another aspect of the question which, however, requires consideration, and that is, the gradual silting of the bed which is undoubtedly taking place."

No. 106 I.

Note by the Chief Engineer for Irrigation.

The subject of the improvements of the Colair lake, which is the great natural drainage reservoir of the eastern delta of the Kistna district, with a view to its being more rapidly relieved of its water, and thereby reduce the area of flooded lands on its margin, and the destruction of crops grown thereon has, for many years past, engaged the attention of the Government. The question in itself is a particularly difficult one owing to the very large area that drains into the lake, combined with the fact that the outlet whereby its waters find access to the sea is a tidal one, and only therefore half as effective for this purpose as a duct which is not tidal. Several propositions have been made from time to time for improving the drainage into and outfall from this lake, and the two that appeared most feasible and were accordingly selected for investigation were the diversions of the Budameru—a large stream which drains the country north-west of Bezwada and finally after crossing the Ellore canal finds its way into the Colair lake—and the widening of the outlet from the lake itself into the Upputeru.

2. For the former purpose survey establishment was sanctioned in G.O. No. 3049 W., dated 28th November 1895, and the result of the investigations by Mr. Pereira, Executive Engineer, who superintended them, is given in the report forwarded with

letter No. 90 K.N., dated 10th April 1896, from the Superintending Engineer, II Circle. Major Baddeley therein traverses all the proposals made by Mr. Pereira and, I consider, shows conclusively,—

First, that the idea of a compensating reservoir must be abandoned as being but slightly effective, very costly, and as interfering seriously with the line of the Nizam's State Railway.

Second, that the alternative scheme of a drainage channel in the only direction, viz., southwards to the Kistna river, that is practicable, and whereby only about ½ of the total inflow into the Colair lake during the rainfall of last October would be diverted, errs not only in its alignment as athwart the general direction of drainage of the country, but fails in the amount of relief that would be afforded in years of unprecedented heavy rainfall like 1895.

3. Having arrived at the foregoing conclusions, the Superintending Engineer had but to turn his attention to the improvement of the outfalls from the Colair lake and their improvement. His letter No. 136 K.E., dated 15th April 1896, deals with this subject, and apart from the temporary measures for draining the lake referred to in paragraph 4 of his letter, suggests that a systematic series of investigations and experiments be undertaken for surveying, sounding the lake and ascertaining the rate, if any, at which the lake is silting up.

4. The remedy which has so often been suggested of growing a crop suited to the circumstances, and commencing the cultivation of that crop simultaneously with the admission of water into the canals, is obviously a way out of the difficulty, which is in the hands of the ryots themselves, and which they must be induced, if not forced, to make use of.

5. I would recommend that the establishment asked for by the Superintending Engineer be granted. As regards the rate of silting up the lake has been undergoing, I think, it will be found to be very small as all water that finds its way into it is clear and filtered in its passage over the irrigated fields ere it reaches the lake.

(Signed) R. R. E. DRAKE-BROCKMAN, Col., R.E.,
12th May 1896. Chief Engineer for Irrigation.

ORDER—No. 468 I., dated 1st June 1896.

His Excellency the Governor in Council considers that the scheme for diverting the water of the Budameru to any appreciable extent would be prohibitive on account of its excessive cost, apart from any inherent technical defects as viewed from an engineering standpoint.

2. The best endeavours of the Superintending Engineer must be directed towards improving the two natural outlets from the Colair lake, and the necessary establishment for carrying out the investigations proposed by him will be placed at his disposal by the General Branch.

(True Extract.)

(Signed) R. R. E. DRAKE-BROCKMAN, Col., R.E.,
Secretary to Govt., P.W.D.,
Irrigation Branch.

To the Superintending Engineer, II Circle.
„ Chief Engineer for Irrigation, with fifteen plans.
„ Examiner of Public Works Accounts.
„ Revenue Department.
„ Public Works Department, General, Buildings and Roads Branch.

Exd. T. K. Narayana Aiyangar.
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Note for Mr. Pereira

IRRIGATION.

Govt. of {1896} Madras.

PUBLIC WORKS.

Dated June, 1st.

Recd. *Encl.*

G.O. No. 468 I., 1st June 1896.

JUNE.

Colair Lake

The scheme for diverting the water of the Budameru away from the —, considered prohibitive on account of its excessive cost; and the Superintending Engineer directed to devote his best endeavours towards improving the two natural outlets from the lake, —mark that the necessary estab-

T OF PUBLIC WORKS
DEC. 95
THERN DIVISION

Note for Mr. Pereira.

1. See G.O. 3049 W dy 28.11.1895

2. The line of the Budameru sho
be gone over from the old breac
in the 3rd mile of the Ellore Cana
and up the valley for about 12 m
The country between the Budame
valley and the Krishna should be
examined.

3. It will be observed that there
is a site for forming a shallow
reservoir by forming a bund
between the Bezwada and Pukka
-pudi hills. All papers connected
with this proposal were sent to
the Superintending K. N. Dn. by the
Superintending K.E.Dn. - Vide former's
no 217 S-E. dy 17.7.1895 replied to
by S.E's no 927 K.S.
23.7.95.

This small reservoir would be
useless as a flood moderator.
The first point to be decided
is whether a large reservoir could
be formed at this site with
its F.T.L. slightly above the
highest flood level of the Krishna
at the place where the surplus

CHIEF ENGINEER FOR IRRIGATION. 13 APR 96 No. 1123

8 W.S.4 454/96

Water Register of the Collieri at Atapaka for the Months of September, Octr: and Novr: 95.

	September			October			November		
	Date	Time	Register	Date	Time	Register	Date	Time	Register
	1	12 Am.	5·69	1	12 Am.	8·00	1	12 Am.	6·50
	2	do	5·93	2	do	7·90	2	do	6·56
	3	do	5·94	3	do	7·80	3	do	6·90
	4	do	5·85	4	do	7·70	4	do	6·90
	5	do	6·20	5	do	7·65	5	do	6·96
	6	do	6·29	6	do	7·43	6	do	6·90
	7	do	6·42	7	do	7·33	7	do	6·85
	8	do	9·52	8	do	7·28	8	do	6·80
	9	do	9·62	9	do	7·18	9	do	6·80
	10	do	9·67	10	do	7·13	10	do	6·78
	11	do	9·67	11	do	7·12	11	do	6·76
	12	do	9·65	12	do	7·10	12	do	6·73
	13	do	9·60	13	do	7·09	13	do	6·68
	14	do	9·55	14	do	7·08	14	do	6·30
	15	do	9·50	15	do	7·07	15	do	6·20
	16	do	9·34	16	do	7·06	16	do	6·10
	17	do	9·24	17	do	6·84	17	do	6·00
	18	do	9·14	18	do	6·64	18	do	5·95
	19	do	9·11	19	do	6·42	19	do	5·90
	20	do	9·00	20	do	6·37	20	do	5·85
	21	do	8·82	21	do	6·33	21	do	5·82
	22	do	8·70	22	do	6·30	22	do	5·79
	23	do	8·60	23	do	6·20	23	do	5·76
	24	do	8·50	24	do	6·14	24	do	5·66
	25	do	8·40	25	do	6·10	25	do	5·61
	26	do	8·30	26	do	6·03	26	do	5·56
	27	do	8·25	27	do	5·93	27	do	5·51
	28	do	8·20	28	do	6·13	28	do	5·41
	29	do	8·15	29	do	6·24	29	do	5·31
	30	do	8·10	30	do	6·36	30	do	5·21
				31	do	6·46			

M.F.L. #12

Zero of gauge +3·00 above M.S.L.

per C. A. Smith
Executive Engr
KED

I Jno Cotsy/
Jno: Lyttleton Manager,
Collieries Office N.C.

W.S.

CHIEF ENGINEER
FOR IRRIGATION
20 APR. 96
No. R. 120 KS
1

Office of the Supg Engineer
2nd Circle Bezwada
No. 90 K.N 10th April 1896.

From

Major W.F.C. Baddeley R.E.
Supg Engineer, II Circle.

To

The Chief Engineer, 1 Rep
For Irrigation,
Madras.

Encls. 16

1 Report from Mr. A.C. Pereira Esqr
1 Ex Memo dy 17-12-95
+14 Plans
16

+ sent separately.

Sir,

In reference to G.O. No. 3049 W dy 28th Nov: 95 I have the honour to forward a report by Mr. Pereira on the subject of controlling the floods in the Budameru and to offer the following remarks thereon.

2. I consider that it would not be safe to carry out the proposed diversion without constructing a strong masonry regulator at the point where the Cut is to take off. In the absence of such a work we should have no guarantee against too great a portion of a flood in the Budameru being carried into the Cut, with the result that the banks would be breached and the whole line of diversion would be wiped out.

3.

Rec. 2
L.S.W. 96

3. Allowing for the Cost of a regulator one could for about 8 tanks direct into the Kistna, under favourable Conditions 15,000 Cubic feet per Second or about $\frac{3}{8}$ of the Maximum flood discharge which in Septr. last must have been about 40,000 Cub. ft per Second. Under unfavourable Conditions, by the Kistna being in flood, the proportion would be reduced to $\frac{1}{4}$

4. As regards the Plans and estimates I have nothing further to say, the project is feasible from an Engineering point of view although it is directly opposed to the general principles which govern the Construction of drains, in as much as we propose to make a drain across the natural line of drainage of the Country.

5. The object of the diversion is to reduce the flood level on the margin of the Colair lake and it is necessary therefore to consider what effect may be expected in this direction from the proposed diversion.

6. The bulk of the drainage entering the Colair lake in the Kistna D.t passes the line of Railway and the Canal between Beypoor and Ellore. Our works on the Canal formerly provided for a discharge of about 82,000 Cub.-ft. per Sec.: and for several years the Canal suffered no serious damage; but the late floods proved that the Railway Aqueduct had altogether insufficient waterway and steps are now being taken to largely increase the waterway of the bridges on the Railway and to provide more inlets and outlets for the Canal. It may therefore be said that in the interests of the Railway and Canal it is not necessary to go to any great expense to divert a portion of the flood discharge passing these lines, for the proper remedy is already being applied to render them safe.

7. The drainage area of the Budamer being 3614 Sq. miles the Calculated flood discharge would be about 25,500 Cub.-ft. per Second but from Mr. Pereira's report it is clear that owing to the abnormal rainfall last Septr. this discharge was increased to about 40,000 or by 35 per Cent. It is not unreasonable to assume a proportionate increase along

along the line of Country between Bezwada and Ellore and probably during the floods of last Septr. the maximum rate of discharge into the Collair was about 110700 Cuft per second across the line of Canal. Under favourable conditions, therefore, the proposed cut would relieve the Collair of a little more than 1/7 of the water pouring into it from the locality named and of about 1/10 of the total discharge from the districts of Kistna and Godavary.

8. The area of the Collair Lake in high floods is about 260 square miles and in the dry season about 160 Sq. miles. Taking the level of low water as +0:0, the M. F. L. has hitherto been considered as about 8:50 but probably in Septr: last it would be about 10:00. With an excess of inflow over outflow of 50,000 Cuft per sec: it has been calculated that the Lake would rise 6" in 24 hours so that the effect of diminishing the inflow by 15,000 Cft per second would not have any material effect on floods in the Lake. The damage to the crops, however, is serious when the water level reaches

+5

+5 and it is perfectly certain that the proposed diversion would not prevent the lake from steadily rising to that level during period of abnormal rainfall.

9. I think I have clearly shown that though the proposed cut is feasible there are no sufficient grounds to justify such a large Capital outlay with a heavy yearly charge for maintenance, and I could not even recommend that the work be placed in the Famine relief programme for I see no to recommend it.

10. The Collair lake is the natural flood moderator of the district and our object should be not to attempt to divert the natural lines of drainage flowing into it, but to obstruct them as little as possible, but at the same time we should endeavour to make the Collair as efficient as possible and upon this subject I hope shortly to send in a report as to what we are doing and what we propose to do in the future. I have the honour to be

Sir

Your most obt. Servt.

W. W. Badenoch Major

Supdg Surveyor, A. C.

W.1

CHIEF ENGINEER FOR IRRIGATION 21 APR. 96

CHIEF ENGINEER FOR IRRIGATION 15 APR. 96 No. 112-96 S

From

The Supdg Engr:
2nd Circle

To The Chief Engineer
for Irrign.
Madras.

No 90 K.T.

Dated 10 April 96.

Encl 16

The Bndameru-
Dmersion of — wth
Kistna & Reports on
the results of the investiga-
tion of — .

DLS 5.6
15/11/96

Report on the disposal of Budamer
Ruien Flood waters.

G.O. No: 3049 W dy 28.11.1895.

480

1. Instructions given me are attached
2. The first point to be replied to is whether a large Reservoir could be formed by bunding up the gap between Bezwada and Nainavaram Hills with F.T.L slightly above Kistna max: flood level.

There is no doubt that such a reservoir presents no Engineering difficulties but I Consider it would be a highly undesirable undertaking for the following reasons:-

(a) The danger to Bezwada town and all the outlying works of public and private interest should anything happen to cause the bank to breach. Such a calamity would cause far greater damage than that done by the Flood of 1895.

(b) The M.F.L. at Kistna Anicut is about +66.25 and in order that the proposed reservoir may surplus into the Kistna, the M.F.L. in it could not be less than +68; now the Crest of Rayanapad Bank proper is +64.46 and that of

of Nagarole tank +64·86. It may therefore be assumed that all the wet cultivation in these villages (800 ac) would be submerged when water in the Reservoir stood at +64·00 or 4 feet below M.T.L. and in all probability the villages themselves would be rendered uninhabitable.

(c) The N.G.L. Railway for 5¼ miles above the Gorge varies in height from 61·50 to 66·00; this portion of the line would have to be raised from 5 to 9 ft. and larger bridge openings provided.

(d) The proposal of a reservoir is, of course, with a view to utilising the waters stored for irrigation purposes. About 6000 acres are said to be Commanded but from a Sanitary point of view I consider it inadvisable to encourage irigation in the vicinity of an important centre like Bezwada.

3. With the above remarks, therefore the subject of a large reservoir is dismissed as being inadvisable from all points of view. I will now proceed to show how the Budameru Flood waters can be treated higher up the valley.

4. A low level reservoir at the same spot on the lines proposed by Mr Joyce still remains a possibility, but this has no connection with the disposal of the Budameru flood waters. I however very much doubt whether such a shallow tank would hold sufficient water for anything like the area commanded and I also doubt whether there is so much water (700 Cft. per sec) running to waste in the Budameru as Mr Joyce makes out. No attempt was made to gauge the quantity available in 1895 and there are consequently no figures to go on. Finally I consider that even this proposal should not be countenanced on Sanitary grounds.

5. I have examined the levels of the country lying in the Budameru Valley and find that the slope between Bezwada Gorge and Nagarole is very gradual not more than about 1 ft per mile and above Kowlur it is as much as 4 feet per mile. A little above Kowlur the Budameru River is joined by the Pullinagu and the whole of the flood waters brought down by

by these two rayons has to be passed between Kowtin and Balarow tanks a distance of abnt 1¾ miles. The Budameru itself below the junction is not more than abnt 60 ft wide and abnt 6 ft deep within bnks and itself is capable of carrying abnt 1980 C ft per second. Now the drainage area above this point has been taken out carefully and is found to be 294 Sq: miles and the calculated

Flood discharge taking C = 500 is
Q = C M^2/3 = 500 × 294^2/3 = 22,000 C ft per second.

The Capacity of the Budameru is therefore quite out of proportion to the very large body of flood water which occasionally comes down and hence the water has to find other outlets and it spreads all across the country between the above mentioned two tanks. (Kavuluru and Balarao Tanks)

In 1895 flood a large breach was formed on the right wing of Kondagunta Head Sluice and the water which escaped here did much damage in Velagaleru village and a broad sandy channel has been formed in rear

year of the Sluice.

That the above flood discharge has been under rather than over estimated may be judged from the following. Mr. Joyce Calculated the Flood discharge through the Gorge to be 25,800 (nearly) C ft per second - assuming a depth of 2 ft: (the then max: known depth on the Road between Bezwada and Narsavaram Hills a distance of 1 M. 0 Fur: and a fall of 1.397 ft. per mile. From levels now taken it appears that in Sept 95 the water stood 6½ ft: deep on the same road, but I am of opinion that this greater depth must be partly due to the water being backed up by the E. C. Railway embankment, as well no doubt to the breaching of so many tanks.

The area draining into the Budameru valley above the Gorge is 364 Sq: miles and C being 500, flood discharge works out to 25,500 C ft: per second. The rain fall in Sept: ganged in Bezwada was +11 inches in 24 hours. Assuming that the run off from the above area was only × 4" the flood discharge would

× 36 per cent

would amount to 39,104 cft per sec. On all probability therefore the above quantity is by no means over estimated.

6. The proposal now made is to divert a portion of the Bidamerum flood waters along a high level Channel starting a little above Kowtuntank from a point in the Bidamerum 800 ft. below where the Polinagaw joins it crossing the Railway (N. G. S.) line at 329th mile and running straight for the old head to Jagamandra Kalwa, the channel which was mentioned by the Collector in his report on the floods and one which was as far as I can ascertain used for irrigation purposes before the Anicut was built. The channel is to start at bed level of the Bidamerum +77.00 and to have a uniform fall of 2.62 ft. per mile and bed level of +58 at the out fall into the Krishna which is the present bed level of the Jagamandra Kalwa at the same point. A Channel with the above fall and 300 mds carrying a depth of 9 ft of water will

will discharge about 15,000 Cft per second when the Krishna is not in flood. When the Krishna is down in flood this same Channel will discharge not less than 10,000 Cft per second which ought to give considerable relief lower down the Bidamerum Valley.

7. The latter quantity assumes a surface fall of 1 ft. a mile with the same bottom width and depths. The Krishna max. flood level at the point of outfall is not known but the value of the 1895 flood which rose to 15.55 on the old Anicut Crest was ascertained to be 69.14. Top of bank at same place is +77.40. Now M. F. L. at Krishna Anicut is +66.25 but this height has only been attained for one day in 41 years and similarly:-

M. F. L.		
20' or +66.25	—	One day in 41 years
19' or +66.25	—	3 days in do
18' or +64.25	—	9 do do
17 or +63.25	—	15 do do
16 or +62.25	—	39 do do

It may therefore be assumed that a 16 feet flood may be expected every year and provision for disposal of Bidamerum flood waters should be with reference to such a flood

And is

and the mouth of Bridamere of the river being a maximum flood at the same time is one which may be accepted without fear. The flood of 1895 proves, as already stated, 75.55 and at the point of outfall 69.14 and it may be assumed that a 16 foot flood would not rise higher than 69.75 at the same point which gives a surface fall of 1 ft. per mile for the diversion Channel. The point of outfall is 6 m. 3040 ft. (river bank mileage) or very nearly seven miles from the Ancient.

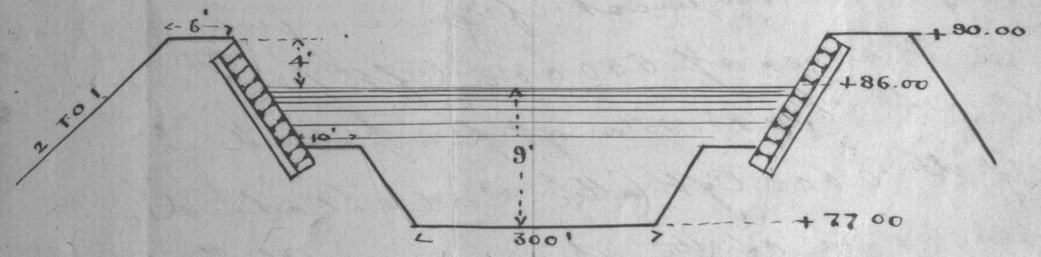
8. The max: flood discharge of the Ouse over the Ancient has now been calculated from 3 different formulae and the lowest figure gives a discharge of 650,000 Cft. per second to which it is now proposed to add 10,000 Cft. (the calculated discharge of the diversion Channel when the Ouse is in flood) or $\frac{1}{55}$ of the whole. This is a small quantity compared with the whole and at the distance from the Ancient it cannot have any effect on that work.

Taking 20ft. max. depth and mean 3458 feet wide: it would fill a 332 acre 10 days after rain had ceased

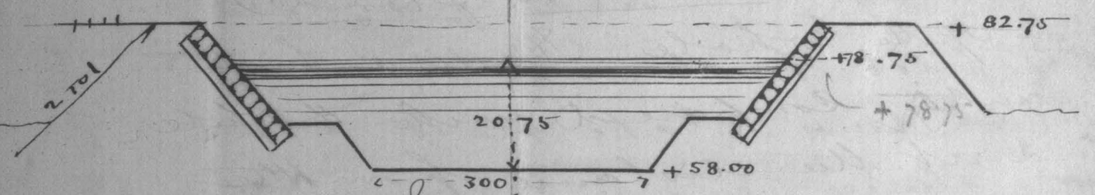
9.

nearly different to the ordinary drainage Channel. The levels of the ground do not admit of a line for the Channel in which the flood waters can be run within soil - it can only be run between banks and the flood waters must rise above the level of the ground. It is, therefore, in my opinion a necessary condition that the inner slope of both banks of the Channel should be fully penetted from end to end. If this is done the banks will require very little attention. The section proposed for the Channel is as follows:-

At Head

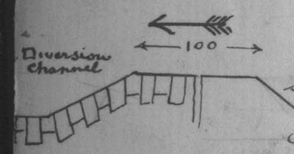


At River Bank.



11. It has already been shown that the Bridamere itself is of

9. The proposed Channel will have to be flanked on both sides and the Cross drainages which are marked on the plan (enlarged tracing of Taluq maps - Scale 2" to the mile) will have to be passed under the Channel by means of under tunnels. Three bridges at least will be required - one for the Railway and two for roads (i) Kondapalli - Ibapuram & (ii) Hyderabad. The railway line will have to be raised 9 or 10 ft at the point of crossing. The Channel will have an open head at its off take from the Budameru, it is not thought that this will interfere with the supply of water to the tanks depending on the latter, because it has a greater bed fall. For the present the head of the diversion Channel might be left 1½' or 2 feet higher than the bed of the Budameru for a length of 100 ft. to ensure adequate supply passing down the tanks below. The Channel will also be open at its junction with



of the Sluice is always Lower than the bed of the Budameru, and it will be seen from the sections that the ground on either side about half a mile above the head sluice is relatively lower and the widening proposed will have the effect of relieving the Concentration which seems to take place about this sluice and which has frequently caused a breach in the ground

with the Kistna and floods in the Cutter will be allowed to enter the Channel without restriction. This arrangement would be infinitely preferable to having an expensive and complicated masonry inlet with perhaps self acting shutters to admit the Budameru flood into the Kistna and to exclude the high floods in the Cutter. The banks of the Channel must be expected to withstand the flood water against them just the same as the ordinary River banks than which they are considerably higher. The Kistna flood could never flow so far up the Channel as to reach the Budameru the bed of which is +77.00 and the probable height of Kistna max: flood at the outfall is +72.00.

10. Small systems of irrigation. The supply Channels are run on the high ground and the drainage channels on the low ground. The Channels now proposed may be called a high level drainage Channel and its conditions are

thankly

round its right wing. The question of still further widening the Budameru may be kept in view and left for future consideration. In widening the River opportunity will be taken to straighten its present crooked course. The present bed width as shown by the sections varies from 46 at C.S. No 11 to 156 at C.S. D but the Cutter seems to be silted and no doubt the extra width is due to the River changing its Course.

12. The approximate cost of the whole scheme may be put down as follows:-

(a) Earthwork. Excavating main channel forming banks &c 75,695 units Earthwork at 3/8/-		2,65,000
(b) Bridges.	Railway 60,000 2 Road — 80,000	1,40,000
(c) Raising N.G.S. Railway line 10 feet at point of crossing		25,000
(d) Revetment. inner slope of both banks with 1:6" stone and 6" backing 25,000 units revetment @ 6/8/-		1,62,000
C.O		5,92,000

Brought Forward	5,92,000
8000 units gravel backing at Rs 4.8/- per unit	36,000
(5). Compensation for 600 acres of land at Rs 50 per acre	30,000
(6) Ramps, demarcation of land & miscellaneous charges	2,500
(7). Six underculverts to pass local drainage under diversion channel at 5000 each	30,000
(8). Widening Rudamore for about a mile above the point of diversion	15,000
(9) Compensation for 30 acres of land required for the latter @ Rs 50	1,500
Grand Total	7,07,000

Achevera
14.3.56

List of Plans accompanying

3 sheets Longitudinal Section of Proposed diversion channel
1 Plan showing line of diversion on large scale plan 42" to the mile
1 Sheet Longitudinal section of Rudamore
4 Sheets cross sections of ditto
4 Sheets of tracing long. section of N.S.A.-K. - Bezdada Kendapalli
1 Tracing catchment area of Rudamore

14

CHIEF ENGINEER
FOR IRRIGATION.
15 APR. 96
No. 112 K.S.

CHIEF ENGINEER
FOR IRRIGATION.
21 APR. 96

Rec'd 21/4/96

Office of the Supg Engineer
2nd Cauvery Bezwada
15th April 1896.

No. 136 KE.

From

Major W.L.C. Baddeley R.E.
Supg: Engineer
2nd Cauvery

To

The Chief Engineer,
for Irrigation
Madras.

R.112 Kd/96.

Sir,

Encls. 2
Tracing
Extract from
Water Register
of the lake

In continuation of this Office No. 90 K.N. 10.4.96 I have the honour to submit the following report on the Collair Lake.

2. First, I have to reply as below to the questions in your No. II/21 K.S. dy 11.2.1896.

(1) There was another outlet from the Lake as shown on the accompanying Sketch map. This drain, the Kanitcodu, passed by an artificial cut through the Sand ridge on the Southern side of the Collair; with a bottom width of about 20' and though some water must have passed

through

thought it when the lake was fairly high it could have had no appreciable effect in lowering flood level in the lake.

(2) The evidence goes to show that the Collair used to dry up in summer sufficiently for carts to pass, for some years prior to 1884. The lake however was never dry before the Kotaha weir was breached; this breach was purposely made some years ago to assist in draining the lake. There is no doubt that the irrigation works have caused a rise in the Summer level of the lake, but that is merely putting the lake to its proper use, viz a drainage reservoir. I submit that the artificial drains have had very little effect on floods in the lake.

(3) I have no information as to the Sanitary Condition of the lake.

From the attached extract from the water register at Otaka, the following

the following information has been obtained.

(a). The flood level of 1895 was nearly a foot higher than in 1892, & the flood of 1892 was said to have been 9 inches higher than that of 1889.

The maximum rate of rise in 1892 was about 6 inches in 24 hours, in 1895 it was 3 ft in 24 hours. This fact fully bears out my argument as to the enormous increase of discharge last Septr. into the Collair, vide my letter No 90 KN 10-4-96. We cannot however provide for floods during abnormal periods of rainfall such as occurred in last Septr. when 11 inches fell in 24 hours. All that we should do, in my opinion is to

(1) Consider what should be done to the lake to make it efficient during ordinary years of fairly heavy rainfall.

(2) Commence a series of investigations & experiments to try and ascertain the rate at which the lake is silting up.

(3) Consider how the 20,000 acres

R. 112 KL/98.

of lands affected by floods can be best cultivated, so as to give a good return & avoid permissions due to loss by flood damage.

4. As regards (3). The lake is badly choked with weeds owing to the mistake made years ago, of leasing out the fishing, as the fishermen planted the weeds to assist their business. There are two outlets from the lake into the Uppuveru the Juvi Kanawa and the Perankal Kanawa; and estimates amounting to Rs 1640 & Rs 1000 are now being worked out to clear passages through these outlets into the Uppuveru. What we aim at is to form two clear Channels, one in the direction of Kollekitkotey for the discharge into the rivers of the water from the North of the Lake, and one in the direction of Kanatikanka for the discharge of the Budamera and Sammiteru and other feeders on the Western side, the water from which passes along the South margin of the Lake. This work must be vigorously carried out year after years until

until the Kikisa and other aquatic growths have been got under control. About Rs 15,000 per year will be required for the next 5 years. It may be said, why not widen the Uppuveru? The cost would be enormous as the widening (probably to twice the existing bed width) would have to be carried out for 17 miles from the head of the river as far as the Pedalanka drain, for the river is contracted as far as Tadinada and the effect of only widening the upper reaches would be to throw more water on the Krishna & Godavari Kankas, lower down, without effecting any appreciable reduction in flood level in the Lake. It may be that the result of the investigations I am about to propose may show that the Uppuveru must be widened, if the cultivation on the margin of the Collair is to be continued under the same conditions, as in the past

7

the delta; but it will then be a question for Government to decide whether the advantage to be gained is commensurate with the expense. At present data is not available to make any estimate of the section required the length that must be widened the cost, and the probable relief to the lake in times of flood by improving the discharging capacity of the rivers. Also not assume that the clearing of the lake will prevent floods rising on the margin during periods of abnormal rainfall but it must do considerable good during ordinary years.

(2) The establishment I should require for investigating the upputeru is

1 Asstt Engineer or Senior upper Subordinate.
2 Overseers
3 Surveyors
2 Draftsmen

with the usual petty establishment for 1 year. It is absolutely impossible for

for this class of work to be taken up by the ordinary staff of the Dt., who owing to their regular work cannot give the continued attention that special investigations require. The work that the establishment would do is as follows:- 140

(1) Contour the lake to calculate the capacity at various levels.

(2) Make cross sections & take soundings to estimate the rate of silting up.

(3) Make surveys and cross sections of the upputeru & prepare an estimate for widening; and calculate the effect anticipated upon the lake at various levels.

(3) I must now turn to the main question, and that is what is to be done if we find that the lake is steadily silting up, and that the cost of widening the upputeru is prohibitive and only likely to afford relief for a limited number of years? Upon this point I see no reason to

to change the opinion I have advocated in my No 1409 K.S. 1924 dy 2.10.24 and that is abandon the practice of growing a fine monton crop on the margin of the lake, and grow a three months crop instead. It would, I submit, be far better to abandon all cultivation within the dangerous margin, than to start costly remedial works which will eventually lead to enormous expenditure; but I cannot believe that if the ryots really suffer, as they say they do, from floods, that they will long refuse to adopt the obvious remedy of growing crops that can be reaped before the floods come.

The following extracts from a report by Mr Smith who has lately spent a good deal of time in inquiring into the conditions of the Collair require no comment from me beyond a request that the Revenue authorities will co-operate with the P.W.D. in inducing the ryots to grow the 3 months crop on the margins, & rigidly prevent any planting of Kirisa- or other grasses in the Collair lake. The P.W.D. by itself can do little in the former & nothing in the latter direction.

"5. The damage done this year is of course abnormal, and was all the greater as the lake rose a month earlier and a good many of the crops had been transplanted later than usual.

6. The crop of a Tangive paddy at Alapad which was ready to reap was submerged in one night, and was harvested in water the next day, but with smaller outturn than it should have been; but had the ryot sown it 10 days earlier as he was advised to do and might have done he would have been able to cut it before the floods.

7. The result, therefore, showed that

that this crop can be successfully grown and reaped in all but abnormal years, before the Lake rises, and I hope that the experiments about to be tried this year will show that a second crop can be successfully raised after the Lake has fallen.

8. If the ryots take to growing these kinds of paddy, I think it will prevent them from suffering the losses to which they undoubtedly do in years of high Collair, and also which they say they suffer every year, though I still think that the losses in ordinary years are overrated. There is another aspect of the question which however requires consideration and that is the gradual silting of the land which is undoubtedly taking place."

I have the honour to be,
Sir
Your most obt. humble
Servt
W. Baddeley Major R.E.
Acting Engr. to Govt
with

CHIEF ENGINEER FOR IRRIGATION
20 NOV. 96
No. R. 12065

From

The Engineer
2nd Circle.

To

The Chief Engineer
for Irrigation:
Madras.

No. 136 KE

Dated 15 April 1896.

Encl 2.

The Collair Lake
Forwards further report
on the —.

Orders
Legislation

PUBLIC WORKS DEPARTMENT,

IRRIGATION BRANCH.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the 16 April

READ the following

Letter from the Supt. Engr., Second Circle, (H.E. No. 90-K.E. dated 10 April 1896.)

Letter from the Supt. Engineer 2nd Circle- (H.E. No: 136. K.E. dated 15th April/96)

Note by the Chief Engineer for Irrigation. (H.E. No: 106 I d/ 12th May/96)

The subject of the improvements of the Colair Lake, which is the great natural drainage reservoir of the Eastern DElta of the Kistna District, with a view to its being more rapid-ly relieved of its water, and there-by reduce the area of flooded lands on its margin, and the destruction of crops grown thereon, has for many years past engaged the attention of the Government. The question in it-self is a particularly difficult one owing to the very large area that drains into the lake, combined with the fact that the outlet where-by its waters find access to the sea is a tidal one, and only therefore half as effective for this purpose as a duct which is not tidal. Several propositions have been made from time to time for improving the drain-age into and outfall from this lake and the two that appeared most

feasible

feasible, and were accordingly Select-
-ed for investigation were the diver-
-sions of the Budameru, a large stream
which drains the country northwest
of Bezwada and finally after cross-
-ing the Ellore Canal finds its
way into the Colair Lake; and the
widening of the outlet from the lake
itself into the Upputeru.

2 For the former purpose Survey
establishment was sanctioned in G.O
No:3049.W. dated 28th November 1895,
and the result of the investigations
by Mr Pereira, Executive Engineer,
who superintended them, is given in
the report forwarded with letter
No:90.K.N dated 10th April 1896 from
the Supdg Engineer, Second Circle.
Major Baddeley therein traverses
all the proposals made by Mr Pereira
and I consider shows conclusively,-
1st - That the idea of a compensating
reservoir must be abandoned as being
but slightly effective, very costly,
and as interfering seriously with
the line of the Nizam's State Rail-
-way.

2nd - That the alternative scheme
of a drainage channel in the only
direction, Viz Southwards to the
Kistna River, that is practicable,
and whereby only about 1/7 of the
total inflow into the Colair Lake

during

during the rainfall of last October
would be diverted, errs, not only in
its alignment, as athwart the general
direction of drainage of the country,
but fails in the amount of relief
that would be afforded in years of
unprecedented heavy rainfall like
1895.

3 Having arrived at the foregoing
conclusions, the Supdg Engineer had
but to turn his attention to the im-
-provement of the outfalls from the
Colair Lake and their improvement.
His letter No:136 K. E. dated 15th
April 1896 deals with this subject
and apart from the temporary measures
for draining the Lake referred to
in para 4 of his letter, suggests
that a systematic series of investi-
-gations and experiments be undertaken
for surveying, sounding the lake, and
ascertaining the rate, if any, at which
the lake is silting up.

4 The remedy which has so often
been suggested of growing a crop
suited to the circumstances, and com-
-mencing the cultivation of that
crop simultaneously with the ad-
-mission of water into the canals, is
obviously a way out of the difficulty,
which is in the hands of the ryots
themselves, and which they must be

induced

induced, if not forced to make use of.

5 I would recommend that the establishment asked for by the Superintending Engineer be granted. As regards the rate of silting up the Lake has been undergoing, I think, it will be found to be very small, as all water that findsits way into it, is clear and filtered in its passage over the irrigated fields ere it reaches the lake.

Rncdh

Order thereon. 12/5

His Excellency the Governor in Council considers that the scheme for diverting the water of the Budameru to any appreciable extent would be prohibi-tive on account of its excessive cost, apart from any inherent technical defects as viewed from an engineering standpoint.

2 The best endeavours of the Suptg.-Engineer must be directed towards im-proving the two natural outlets from the Colair Lake, and the necessary establish-ment for carrying out the investigations proposed by him will be placed at his disposal by the General Branch.

Rncdh
13/5/96

No 1685 dy 1st June 1896

A-SH 15.5.96

RN 17/5/96

S 21/5/96

with 15 plans

To
The Suptg Engineer Kistna
" Chief Engineer for Irrign
" Examiner of Pr Accounts
" Revenue Department
" P.W.D, General, Buildings & Roads Branch.

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