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TAMIL NADU ARCHIVES

GOVERNMENT OF TAMIL NADU

P.W.D. DEPARTMENT

G.O. No. 1777 Press.
B.P. No. Mis.

Dated 21 7 1884. 197 .

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1777

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—the following letter from J. W. RUNDALL, Esq., Superintending Engineer, II Circle, to the Chief Engineer for Irrigation, dated Masulipatam, 18th June 1884, No. 894 K.S. :—

I have the honor to forward herewith, for your approval and for transmission to the Chief Engineer, Public Works Department, for sanction, an estimate, amounting to Rs. 9,130, for a new store to be constructed from Provincial Funds at Bezváda.

2 Abstract estimates.
1 Plan.
1 Tracing.
1 Executive Engineer's report.
1 Superintending Engineer's report.

2. You know how badly we are off at present, and that the present building is unsafe. I would request, therefore, that you will arrange for Rs. 5,000 being, if possible, allotted for this work for the current year, and the balance being given next year.

3. I was in hopes I should have been able to send you the estimate for this building at an earlier date, but have only recently received it from the Executive Engineer.

No. 56 E.W.

Forwarded to the Chief Engineer, Public Works Department, with a recommendation that the estimate for constructing a new store building at Bezváda be sanctioned from Provincial Funds.

CHEPÁK,
26th June 1884.

(Signed) J. PENNYCUICK, Lieut.-Col., R.E.,
for Chief Engineer for Irrigation.

ORDER—dated 21st July 1884, No. 1777 W., Public Works.

The plan and estimate, amounting to Rs. 9,130, for constructing a store building at Bezváda, in the Kistna district, are sanctioned as Provincial No. 92 W. of 1884-85 and classified as Civil Buildings, Original Works.

2. As the balance available from the Provincial Reserve is small, the Superintending Engineer, II Circle, will suggest transfers of funds from the grants for other works in the circle, to meet the amount required for this work.

(True Extract.)

Major, R.E.,
Under Secy. to Govt., P.W.D.

To the Superintending Engineer, II Circle, with five enclosures.
" Examiner, Public Works Accounts, with duplicate abstract estimate.
" Chief Engineer for Irrigation.
Exd. A. F. Goodall.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1884) Madras.

PUBLIC WORKS.

Dated July, 21st.

Read. *Encl*

G.O., 21st July 1884, No. 1777 W.

JULY.

Store Building

Plan and estimate of Rs. 9,130 *for constructing a* — at Bezwáda, Kistna district, sanctioned.

1777

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1777

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Irrigation.

READ—the following paper :—

Notes of Inspection by the Acting Chief Engineer for Irrigation, Sangam Project and Nellore Divisions, and Kistna Deltas, II Circle, January 1884.

Sangam Anicut.—The anticipations formed last year of the work that could be done during the season have been nearly realized ; the front and rear row of wells the whole way across the river have been sunk, and the body and retaining wall some feet from the south wing has been partially raised ; the south wing has been completed, the under-sluice wells have all been sunk, part of the flooring laid, the wing on the south of the under-sluices partly built and also three piers, and the north wing of the anicut built to a considerable extent. The progress made is very satisfactory ; the more so as it has been made in the face of difficulties, the freshes in the river having been unusual in frequency and duration during the latter half of the year.

The sand is now being excavated above the anicut, and arrangements are being made for laying down lines of tramway to convey the stone into the river, but there is still a good deal of water in the river, and until it subsides there will be difficulty in getting down tramways. The under-sluices have been bunded off and the water is being pumped out. Stone for the flooring and piers is prepared and this work will soon be in progress again. Subsequently portions of the anicut will be bunded off, pumped out as far as possible, and the lower layers of the apron laid and retaining wall built to full height if possible and body wall rather higher. It seems very doutful whether it will be possible to get down to the level required for the bottom of the apron above the retaining wall ; this level is about 8 feet below water surface and the water would have to be pumped out. If it is found that the level cannot be reached, the thickness of the apron will have to be reduced from $6\frac{1}{2}$ to $5\frac{1}{2}$ feet at the retaining wall and 6 feet between first and second bond walls, the full depth being given immediately below the body wall.

In last notes of inspection a revised section of anicut was referred to, which allows 6 inches of quarry rubbish, $1\frac{1}{2}$ feet of small stone, 2 feet of larger packed stone and $2\frac{1}{2}$ of larger stone packed on end. If the total thickness has to be reduced, $1\frac{1}{2}$ feet of quarry rubbish and small stone might be put down, and $1\frac{1}{2}$ feet of larger packed stone on it ; the lower layer could then be well rammed. The large stone of which the surface of the apron is to be packed should be very carefully put down ; all interstices being carefully filled with small stone, and the large stone should have a slight slope down stream.

The south wing wall is a neat piece of work but it needs coping with laterite which was not provided for. The arch over the roadway at bottom of slope has cracked rather badly at the crown. No doubt this is due to the uneven pressure on the foundations, the wall on either side being very high. It should be left for another season to make it certain that there will be no further settlement, and then the arch should be removed and carefully rebuilt.

The difficulty in the work will be, as stated last year, getting down the large amount of stone required for the aprons; 120,000 cubic yards are required and of this 15,000 are ready to be sent down as soon as the water will permit the tramways to be laid and the excavation being made, and good arrangements will be necessary so as to make the most of the available time.

There is some considerable amount of stone in the old corumboo in the river bed which might be made available for use on the anicut. The new head sluice having been built this corumboo is now of no further service, and it is stated that there is no objection made to its being utilized. Before removing it, however, it would be well to refer to the Collector on the subject.

If the under-sluices can be completed this working season, the river can be turned through them during next freshes, and the work will be more readily got at next year, and a considerable accumulation of sand in front of the head sluice will be prevented.

2. *Head Sluice.*—The head sluice has been completed and opened in July last year. The work is built of brick piers and abutments faced with laterite and is a very neat, sound work; there was water on the floor so it could not be examined. The coping of the sluice throughout is of laterite and is very neatly finished. The revetment above the sluice in the river is in great part done, but a gap has to be left in it through which to bring the tramway. Below the sluice, part of the revetment on either side had been built, but there is still a great deal to be built, the whole of the curve into the channel having to be rivetted; much of the stone has been brought down to the place, but the space is so confined that it must be removed again before the revetment is built. The flooring in front of the sluice is completed, the great bank of earth in front which was referred to last year having been carried out into the river during the freshes; but as the under-sluices were not completed, a great deal of silt accumulated, much of which will have to be removed, though a considerable part may be washed through the under-sluices when opened.

3. *Quarries and Workshops.*—Quarrying has proved more troublesome than was anticipated; all the loose stone on the hill within a reasonable distance has been collected, and an attempt has been made to cut into the rock at the end of the hill near the river and work on a face of rock, as suggested last year, but here solid quartz rock of great hardness was met with, and it is very difficult to make any impression on it with jumpers. The tramway, however, has been carried round this part and runs along the hill face to the west, and at the cost of having to clear away a considerable amount of rubbish, the rock must be laid bare so that it can be blasted down. The material of the hill is very variable; much of it is gravel with only small pieces of stone in it, then masses of workable stone may be met with and then large masses of quite intractable crystallized quartz. The only plan seems to be to clear away the rubbish on both sides of the hill and work into the backbone of rock. The space is so confined and the rock so near the village and works, that very large blasts cannot be attempted. The rubbish that has to be removed could either be run down into the river above the pagoda, or spread over the ground between the river and the hill which is now covered with prickly pear. The great point is to get quarries with good faces to work on on both sides of the hill as near to the river as possible. To avoid any break in the supply of stone sent down to the anicut, the tramway should be well and carefully laid; the rails purchased from the South Indian Railway Company are very good, and the new truck wheels procured from the Public Works Stores are also very good, some of the sleepers, however, seemed to be too light and it would be worth while to spend more in laying the line carefully, so there should be as little interruption as possible on account of repairs.

4. The workshops are neatly arranged and are working satisfactorily under Lieutenant Joyce. There are now three centrifugal pumps with engines complete available for baling; these have of course to be kept in working order, but the principal work is the construction and repair of trucks, tramway, and tools.

Brick manufacture has ceased, all the bricks required having been made. The lime kilns are actively employed, and surkhi is being sifted; two Stoney's surkhi screens are in use and it was noticed that both require repairs.

5. *Buildings.*—The officers' quarters are in fair order and also the office and workshop buildings, but the thatched roofs will require repair before the next rains. The contagious diseases sheds have been removed as suggested last year, but during the late outbreak of cholera in the neighbourhood they were not used. It is reported that there were eight cases of cholera in the village and on the works, but the apothecary, Mr. Coggan, and the deputy tahsildar exerted themselves in a very praiseworthy manner; the place was cleaned, houses fumigated and huts burnt, and to this it is in all probability owing that the disease did not spread, as in a village only a few miles distant, Jangalongole, there was an extremely bad outbreak.

6. *Main Canal.*—The head of the canal has been cut, though not to full depth, as water was sent through the head sluice during the season; for some distance the banks and the slopes of the canal have been cut up very badly indeed by the heavy rains, and the soil is so bad that I think it will be necessary to turf both banks and slopes; beyond this, where it was remarked last year that the banks were so badly cut up, the camel's foot creeper and grass which has been planted has grown remarkably well, and with continued attention the banks will probably be so well covered that there will be no further cutting, but they will in any case need careful conservancy. The Duvur tank channel which runs just outside the north bank for some distance has some provision made in the estimates for improvements; no clearing will be necessary, but the bushes should be removed and the channel slopes attended to where necessary.

7. *Duvur Channel Regulators and Bridge.*—These regulators are to pass water from the Duvur tank into and out of the main canal; they have both been completed and shutters fitted, and are neat well-built works, but the wings should be coped with laterite and not plastered on the top. The regulator to the tank may have the water on either side highest, and therefore the shutter grooves have been made V shaped so that the shutters can take pressure on either side. The weight of the pier and cutwater towards the tank appears to be sufficient to stand the pressure in that direction. The road bridge above the upper regulator has been finished and looks a neat work; the diversion of the road over this bridge and the bridge below the drop on the main canal has been completed and opened to traffic.

8. *Drop and Bridge.*—The drop is nearly completed, the coping of the body wall with solid cut granite 2 feet in depth being now in progress; it is a solid good work, but the channel is much contracted and the action below is sure to be excessive. As stated last year the revetments to the banks below will need to be extended up to the bridge. A good toe should be given to these revetments, and the action on the channel bed must be watched, possibly it may be necessary to floor the whole of the channel up to the bridge.

The bridge is completed and open to traffic; unfortunately drainage from the roadway seems to have leaked down between the string course and the face wall below it, and runs down the face disfiguring the work. Drainage pipes have been put in through the face walls to drain the spandril spaces, but these apparently do not prevent the water running down the face walls. It will probably be necessary to dig up the roadway at the sides and carefully point the walls below the string course. Below the bridge there is still a good deal of earthwork to be done to complete the main channel, but it will probably all be done during this season.

9. *Kanigiri Tank.*—A great deal of work has been done, both earthwork and revetment, but there is still a great deal to do. In part of the bund the soil is very bad, and where a strip of turfing has been put down at the outside toe of the bank, gullies have in some places cut behind the turfing and washed out the soil at the bottom. Very bad parts will probably need turfing both in front above the revetment and to the whole of the rear slope; turf is close at hand and the work could be done very reasonably. In other places planting grass will be sufficient. The stone for the revetment is being brought by country carts of which 200 are employed, and there seems to be no doubt but that it can be completed by this means. The revetment in places has not been as well packed as it ought to be, the interstices not having been properly filled with small stones and chips; the contractors should be carefully watched

on this work and made to do it thoroughly. When the bund is completed water must be very carefully raised in the tank and not allowed to rise to F.T.L. the first season.

10. *Tank Weir.*—A great deal of blasting has been done, and the rock is now over the whole length of the weir down to about crest level; the stone is very unsatisfactory to work, part of it being exceedingly hard and part very friable, and in places there are veins of gravel; where the gravel is found under the weir, it must be excavated as deep as possible and the gap filled in solidly with concrete. The channel from the weir as at present cut turns to the right below the weir and soon falls rapidly; but there is a contraction which it seems might check the discharge. Levels should be taken to ascertain whether the channel as cut is capable of carrying the full discharge of the weir and, if not, the rock will have to be further cut away.

11. *Designation of Channels.*—In the project estimates the canal supplying the Kanigiri tank is styled the "Kanigiri canal," and the channel from the tank to supply the southern and central channels is, for a certain distance, styled "feeder to supply the southern and central channels" and beyond that "southern channel." These designations may be simplified; the "Kanigiri canal" being in future styled "main canal," and the "feeder to supply the southern and central channels" being included in the "southern channel." From the southern channel the eastern channel will take off.

12. *Southern Channel Head Sluice.*—This work is in good progress; it is founded on rock immediately below the old Kanigiri escape and is built of brick, the piers and facings of abutments being of granite. Greater care should be taken in bonding this facing into the walls, otherwise the work is being very well and carefully built and looks very well; it will be completed in a short time. The tank bank should be very carefully aligned to fit into the sluice wings.

13. *Eastern Channel Head Sluice.*—The excavation for this work has been completed and the channel below has been cut out to full section. The work will be built entirely on rock, the piers being well stepped into it. The rock cannot be cut to a true face, and therefore it will be necessary to build facing which will be connected with the rock by concrete. Below the work the rock will take the place of rear wings, and above the front wings can be turned into the rock, being carried sufficiently far back to get a good hold, and in front rough stone revetment to hold up the earth into the tank can be built.

14. *Nellore Anicut.*—The damage done in the floods of 1882 and mentioned in last notes has been carefully repaired, and the anicut has stood a fresh of about 10 feet over it this year with very little damage. Some stones have apparently been displaced in the aprons of both under-sluices, and below the south under-sluice a small piece of laterite rock forming the rear wing has been scooped out; a few stones at the end of the apron a short distance from the south under-sluices have been washed up. Generally the state of the anicut is satisfactory, and it is proposed now to floor the under-sluices with cut granite as soon as it can be done, and to extend the apron towards the south side. This extension is especially necessary at the point where the greatest action has been noticed in floods which is at nearly one-third the length of the anicut from the south wing.

The flood levels on the south wing of the anicut were noticed. All that is necessary in marking flood levels on masonry works is a line to show the level with the date of the flood and the level + M. S. L.; the figures should be black and all should be cut into stone or on a slab of Portland cement.

Planting up the bays on the south side of the river above the anicut with nanel is being satisfactorily carried on; the grass is growing well and a good deal of silt had already accumulated. Constant watching is necessary to keep cattle out, and in every season the planting should be extended a little until the proper alignment is reached.

The old store shed in the river above the north wing has been removed, except the flooring and foundations which have to be dug out, and most of the bushes and prickly pear on the lunka noticed last year have been removed, and the lunka has begun to cut away; by constantly removing all growth, ploughing up the grass and loosening the edge during floods, this lunka, which is really the ground in rear of the new portion of the anicut, will gradually be removed.

The breach in the south bank referred to last year has been carefully repaired, but two sloping groynes or spurs on the inside are wanted to keep the scour during freshes at a distance from the bank, and grass or bushes might also be planted at the toe of the bank as a protection.

15. *Nellore Tank.*—A great deal has been done in clearing prickly pear on the tank bank and near the head sluice, and the bank is in good order. The new west weir crest as has been already reported is, owing to an error in the original levels, 2 feet above F.T.L., and this should be altered as soon as possible. At present there are self-acting shutters 2 feet high on the crest to keep out river water in very high floods, and if the crest of the weir is lowered, this shutter will have to be 4 feet in height, and this is too much for self-acting shutters to act satisfactorily, and it is a matter for discussion what the best arrangement will be. Captain Henderson considered that shutters with screw gearing to be lifted from a light platform bridge were most suitable, but the action is slow and the shutters are expensive. A light bridge will, in any case, probably be necessary, and as an establishment will always be available from the head sluice near at hand, the simplest arrangement will probably be to have swing shutters, which would generally be self-acting, with a chain attached to the lower end of the shutter by which it might, in case of its not acting freely, be lifted from the bridge and hooked on to it. The shutters would generally be kept raised and then the weir would be free to discharge; but in case of a high river flood they could be unhooked and let down in a very short time.

The head sluice to the tank is in good order, the parapets having been raised above M.F.L. in the river, but the old needle shutters should be replaced by plank shutters with screw gearing. The channel above the head sluice is about 15 miles in length with three open heads from the river. Now that the tank has been included in the anicut system, the supply channel of course forms part of the system, and it should be taken up and dealt with systematically. The chief difficulty in it is the passage of cross drainage, and the only way of dealing satisfactorily with this is to construct weirs with their crest at F.S.L. in the channel calculated to pass the maximum land floods. The bank of the channel on the river side must of course be quite safe against river floods, and judging from the survey plan which was examined, there are some places where the channel will have to be retired from the river for some little distance. The place where this is most apparent is the first half mile or so above the head sluice; here the channel hugs the river and has been breached in one or two places. It seemed that the channel could here be thrown back some 50 or perhaps 100 yards, the chief obstacle being a ridge of rocks which runs down to the existing channel nearly half a mile above the head sluice; this ridge, however, seems to be a very narrow one, and though cutting a channel through it would doubtless be expensive, yet all the stone taken out would be of use in building the escapes near at hand, and therefore it may be practicable to carry out the retirement at no very great cost. Levels should be taken for the purpose, and this retirement should be included in the estimate for improvement of the channel. The river would of course in high floods back up over the weirs into the channel, but this would do no great harm, if, where the channel near the weirs is not in cutting, a wall or bar of masonry were built with a notch in it calculated to pass only the full supply of the channel. The estimate for these improvements should have been included in the Survapally revised estimates as it forms part of the delta completion scheme.

16. *Nellore Workshops.*—The re-roofing of the workshops and office has been completed and the buildings are now very nice. The machinery is kept in good order and a new screw lathe has lately been obtained. There is not sufficient work for the employment of the small circular saw, and there is a band saw in good order never used which might, with advantage, be transferred to the Kistna workshops. One improvement noticeable would be to construct an enclosure outside of the present workshop gate in which old iron, out-slabs, &c., could be placed instead of among the stores in the yard. An auction sale of these old materials might occasionally be tried; iron and wood scraps would generally sell so near a large town. For storing famine tools it will probably be necessary to construct a lean-to shed outside the wall of the yard, and this might be within the enclosure suggested.

17. *Commanur Canal, Pedda Ganjam Lock.*—It is a great pity that the facing stone of this lock, which is a very neat work, should have been affected by the salt air; both the Bezváda and the Chebrole stone have been affected. An attempt must be made to arrest the action, and the whole surface, after some of the pointing has been renewed with Portland cement, had better be treated with water glass composition; possibly one application will not be sufficient and it will have to be done twice.

The banks near the Uppakondar vagu aqueduct have been lately very nearly overtopped by the Rompairu water. I think all through this low peice of ground the canal banks should be very considerably raised, earth for the outer part of the bund being brought from a distance, and turf or grass roots placed on the slopes. No pits should be dug anywhere near the outer toe of the banks.

The Ferringhidibba bungalow is in fair order, but the roof will require re-thatching before next rains. The trees have grown much better than I expected round the bungalow, but they require more attention, and I think in this very exposed situation the plantation should be extended; it would arrest the driving sand which is so great a nuisance in hot weather. In this very out-of-the-way situation, where shelter is much needed when the canals are dug, the rest-house should be made as comfortable as possible and kept in good order.

18. *55th Mile, Outlet and Inlet.*—Two thousand feet has been completed; there does not appear to have been much scour below, but there are one or two places where the apron wants extending or perhaps stone should be thrown into the holes below. There is a little stone left lying at the site which might be used in this way, and if more is wanted it could be dug out of the Ferringhidibba mound or brought from the place where the canal crosses the Emileru, where a good deal of stone was collected in former times but is not now required.

19. *Diversion of Emileru.*—The stop bank referred to in Colonel Mullins' last notes of inspection has been completed, and it was last year found that it would be necessary, to prevent extensive loss by flooding of the Emileru, to make a cut parallel to the canal to the low ground near the 53rd mile outlet; an estimate has been prepared and sanctioned for this work; meanwhile the pits from which earth for the canal bank was excavated have been connected, and have formed a channel which though much too small is some relief, and has prevented this year the extensive damage that occurred the year before, although in one storm upwards of 12 inches of rain fell. This channel where it comes out of high ground into the swamp has cut away the soil extensively and eaten into the canal bank having in one place cut nearly through it. When the new channel is dug, which will be done this dry weather, it should here be led away from the canal banks and follow a low piece of ground which is very marked at a little distance from the bank, the earth from the excavation being thrown on the canal bank which should be made very strong; this may necessitate taking up rather more land and having further compensation to pay, but the drainage channel *must* be kept at a distance from the canal and not allowed to cut into the banks.

20. *Apperu Inlet and Outlet.*—The outlet stands out above the banks on either side having been carried away in floods; it is a very ugly place; the Rompairu water backs up and crosses the canal and the drainage above cannot get away until the Rompairu falls, and then it brings down a good deal of silt into the canal which has to be removed. In the outlet, sluices with swing shutters have been built and the intention was to cut out an old channel from them down to the deep bed of the Rompairu, but seeing that when there is any extensive fall of rain the Rompairu fills up and backs up above the canal, this could only be of use in the event of a quite local rainfall when the Rompairu was low, and it does not seem to be worth while incurring considerable expenditure for this purpose. The land for the channel has been acquired, but for the present at all events it should not be dug. The inlet and outlet should, I think, be extended to the whole length for which the bund has been cut away; the inlet probably may be made simply a flooring. Above the bridge a long gap has been left for drainage water to come into the canal, and this I think should also have a rough-stone pavement to prevent cutting. The silt cleared from

the canal should not be deposited above the inlet, or at all on the upper side of the canal, it must be removed before there is any rain.

21. *Inkole Road Bridge.*—The abutments have been built up to level of bottom of girders and the girders will shortly be put up; the tow-paths are completed except coping; the road has to be diverted below the bridge and the new embankment will probably require some revetment until it meets the old road.

22. *Santaravur Lock.*—The bridge has been completed; the lock is now a very neat work and the ground round it is neatly kept, and trees have been planted. The stone facing (both Bezváda and Chebrole stone) has suffered from sondu, especially the latter, and as directed by Colonel Mullins in last inspection, throwing water over those parts exposed to the air twice a-day has been tried, but without success. Both this lock and that at Pedda Ganjam and the Inkole road bridge where the stone facing is being affected should be treated with water glass composition, the joints being repointed with Portland cement.

23. *Allera Inlet and Outlet.*—There has been some displacement of the apron of the outlet which needs attention, and more stone should be thrown in below. The stop bank here has been nearly completed. At the Alleru surplus sluices, there is a considerable increase of traffic and several large tiled godowns have been built; a large amount of rice is brought down by canal here for the supply of large villages on the sandridge and also, it is said, for villages inland. I was informed that it was being brought from Ellore through the Kistna canal, a very remarkable fact, considering the large quantity of rice which is grown between Ellore and this place.

24. *Karenchedu Aqueduct.*—The work is finished with the exception of the coping; the arches were under water, but much of the work, as could be seen, was good. Materials are being collected for a bridge over the canal here; the design is for a brick arch of one span and was approved.

25. *Karenchedu Outlet.*—A new outlet of 1,000 feet has just been completed here and is a good work, but the Chebrole stone of which the apron is constructed being affected by sondu. As, however, it will frequently be in water though perhaps not covered, it will probably stand; at the lower end the soil has been cut away below the apron and some more stone is wanted at a lower level; this may be arranged for from the balance of the estimate. There is no apron or flooring at the inlet and it looks as if some flooring at the lower end would be necessary. Between this and the Parchur vagu, the west bank has been swept away by floods, and in one place there is a breach in the east bank. The canal here runs within soil with grassy banks, and I think a good provision against floods would be to remove the east bank altogether from the old Parchur vagu outlet for 3 furlongs; the water could be allowed to spread over the country without doing damage. Above this and up to the Parchur vagu escape, the bank should be maintained.

26. *Parchur Vagu Escape.*—This old masonry work has been fitted with screw gearing shutters and was discharging as we passed. If it is to be efficient, some arrangements should be made for keeping two lascars on the spot during the flood season.

27. *Kankalamurru Tank.*—Two breaches were noticed in the tank bank, and I was informed that the land formerly supplied by the tank, a strip only between the tank bank and the canal, is now supplied by the canal. If this is the case there can be no reason for maintaining the tank which has always been a source of danger to the canal. The matter should be inquired into with a view to the tank bed being made available for cultivation.

28. *Nallamudda Lock.*—This is a very good work and was referred to in last inspection notes; the lock establishment huts have been built and the rest-house is about to be built. The gearing of the upper culverts is not working satisfactorily, two pinions having broken; these were supplied from the Godávari and are of cast iron with seven teeth; it is supposed that this is a weak point, but the failure may result from defective casting and it should be ascertained from the Godávari how gearing of the same pattern which has been worked for some time has answered before deciding to alter the design. Some planting has been done near the lock, but preference has

been given to guava, lime and cocoanut trees, instead of to shade trees; a garden is not wanted, but shade is much to be desired in this treeless plain in the hot weather, and trees which will afford it should be planted; the ganaga tree seems to do well in this soil, and is in full leaf in the hot weather and would, with others, be a good tree to plant. The banks below the weir have been eroded for some distance and require revetment.

29. *Nallamudda Surplus Sluice.*—The old work has had screw shutters fitted to it, solid cut waters having been constructed in rear, which will probably be sufficient to stand the pressure. Unfortunately these are plastered, and the plaster is already beginning to yield to sondu. The grooves in which the shutters work have been very badly constructed; they are of insufficient width and have been plastered, the plaster having been laid even on the angle irons. They must be entirely cut out in the dry season and remade. The old shed has been pulled down and two lascars' sheds built; just above these an outlet of 2,150 feet has been constructed. In the floods of 1883, 1·7 feet of water passed over this work, and the flood of 1882, comparing the registers at the surplus sluices, was ·75 feet higher than that of 1883. The arrangements proposed by Colonel Mullins for passing the Nallamudda floods were (1) the outlet of 2,150 feet (2) the old Nallamudda surplus sluices (3) a new aqueduct of 17 vents 8 feet span and (4) a second outlet of 1,800 feet immediately below the aqueduct. Inlets are not necessary here, as the canal water is very nearly at ground level, and the ground above is almost perfectly level, so that the sum allowed for inlet can be saved. The aqueduct is a very expensive work, and I doubt if it is necessary. There is no low land above which specially requires draining, and I believe that the flood water can be more economically and as effectually passed across the canal by surplus sluices. The discharge allowed by Colonel Mullins for the aqueduct was 5,000 cubic feet a second, but the record of later floods shows that more water has to be passed than he expected; in extensive floods the whole of the country west of the canal is a sheet of water, the banks breach in all directions and the fall of the water to the east of the canal cannot be considerable; for this reason it is difficult to calculate what a surplus work would discharge, but the work I propose to construct is a set of surplus sluices similar to the old one, and taking the discharge of the old sluices (15 vents of 10 feet) as calculated by Colonel Mullins in the flood of 1879 at 6,555 cubic feet a second, the additional sluices should be say 10 vents of 10 feet; the vents would not be blocked and therefore there would be sufficient waterway for a larger discharge in heavier flood. I think these sluices might be built for 10 or 12,000 rupees and there would be a saving of nearly 30,000 rupees. The floor of the new work should be at the same level as that of the old sluices and the shutters the same height. Plan and estimate for this work should be prepared. The outlet of 1,800 feet immediately below should be built at once; no inlet will be required. This will discharge all the Nallamudda water between the Retur channel head sluice and the Chenkur head sluice, and the bunds in connection with these sluices will keep the flood-water from spreading and pass it on to the Bápatla tank. Another outlet of 800 feet was proposed into the Cherukur tank, but this would do so much damage that I am unwilling to construct it. I would rather make the left bank of the canal between the Cherukur sluice and the Nallamudda lock absolutely safe, block up the head of the Tavu Calva, the branch of the Nallamudda which was cut to the Cherukur tank, and send all water down to our surplus sluices and outlets.

30. *Nakkavagoo Surplus.*—An outlet of 1,800 feet has been constructed immediately below the Poondla head sluice, but in the floods of the last two years there were still breaches in the canal. The Nakkavagoo water here spreads all over the country and there is no defined channel so that here I think also surplus sluice will be more suitable than the aqueduct provided for in the estimates. I propose to build immediately below the Poondla head sluice a set of surplus sluices similar to those proposed at the Nallamudda; 10 vents of 10 feet, floor at 5 feet below F.S.L. These would discharge 3,000 cubic feet a second, the discharge allowed for the aqueduct with a velocity of 5 feet a second which might reasonably be anticipated, and if the vents are open above the shutters, a larger discharge could be obtained. I would also lengthen the outlet by 1,000 feet which can be done from the saving effected by giving up the inlet which is not wanted; this work should be carried out as early as possible. The left bank of the Poondla drain should be then made perfectly safe, and the left bank of the canal between the Poondla sluice and the Retur tank sluice made strong enough to resist floods. The old Poondla head sluice should be repaired to enable it to be used for one or two seasons more.

31. *Pondrapad Surplus Sluices.*—The Nakkavagoo water enters the canal here and above, and discharges through this old work. I propose to substitute for this work, which is not in a good state, a set of surplus sluices similar to those proposed near Poondla head sluice; the sluices could be placed immediately below the old work which should be demolished, and the channel leading from the sluices should be cut out so as to carry the full discharge of the sluices at all events through the high ground near the village of Pondrapad. The right bank of this drainage should be made quite safe and the left bank of the canal up to the new escape immediately below the Kollimerla lock, which it is not proposed to enlarge.

32. *Kollimerla Lock and Weir.*—The cracks in the lock and bridge which have been before noticed do not seem to extend, and the work has probably taken its bearings now in which case the face wall of the bridge might be rebuilt. The lock-sheds are nearly completed and the ground has been partly levelled. The banks below the weir have been cutting away, and revetment needs extension. The pinions of the upper culvert gearing here are of brass and apparently work satisfactorily. Trees should be planted here by the lock establishment; shade is much wanted. The Kollimerla aqueduct immediately above the lock has stood the heavy floods well; the M.F.L. should be cut on the work both above and below. The stanchions of the hand rail are too far apart, and some supplemental ones should be added.

33. *Chebrole Bridge.*—A wharf is to be constructed on the right side of the canal below the bridge where the cotton, &c., from Guntúr is brought to the canal. The width of the canal below the bridge being in excess of the normal section, the wharf wall should be brought as far forward as possible, or there will be silting in front which will prevent boats getting up to it. The front line of this wall should be a continuation of the tow-path front wall under the bridge which will also give more space for the wharf.

34. *Muthur Aqueduct.*—The old aqueduct carrying a small irrigation channel across the drainage alongside the road not far from the Chebrole bridge has been destroyed by floods; it was an old work neatly built but of insufficient section. It is difficult to make satisfactory arrangements for passing the channel; all things considered I think it will be better not to raise the road, but either to carry water for irrigation by a siphon under the drain, or the drainage water by a siphon under the irrigation channel, whatever may be most convenient and economical.

35. *Jagerlamudi Lock and Weir.*—The completion estimates allow for raising this lock; the alterations to the weir have already been completed. As the gates, even when raised, will not be high gates, the upper sill may be retained as it is, and the walls and gates raised; the heel post buttresses had better be raised with the facing of the old coping left in position. The gates should be of the new pattern; but they must have valves for filling and emptying the lock as there are no side culverts. The left bank of the canal below the lock requires considerable extension of the revetment, as there is always erosion here. The lock-sheds have been constructed, and the silt cleared from below the lock should now be thrown into the pit behind the sheds, so as to fill it up to field level when the ground could be given back for cultivation. Future silt clearing should be deposited in the old tank to the right of the road which might be quite filled up. Sufficient attention has not been paid to planting trees near the lock; a garden has been made, but the spare time of the establishment could be better employed in planting and rearing good trees in the neighbourhood of the lock than in looking after plantain gardens.

36. *Jagerlamudi Escape and Under-tunnel.*—This work is a very neat one, and its soundness was proved by the great flood of 1882 coming down on it while the masonry was green. This flood proved that the waterway allowed under the canal is insufficient. The work was designed on data collected after the cyclone of 1879. The rainfall at stations in the drainage basin was examined, and the actual water-marks,

and the conclusion arrived at was that the drainage basin was incorrectly estimated, and consequently an under-tunnel of 2 vents of 8 feet was constructed with an escape from the canal in connection with it, in place of an aqueduct of 15 arches of 10 feet span allowed in the final estimates. The flood of 1882 conclusively proved that the waterway allowed was insufficient, the land above the canal being extensively flooded and the crops destroyed, and the canal bank had to be breached. The only way in which additional waterway can now be provided would be to build another under-tunnel a little above the present one, and probably one of 2 vents would suffice; but I think it will first be advisable to study the effects of further floods, making up the right bank of the canal from the under-tunnel to the lock weir, so that there shall be no chance of its breaching, and leaving this bank low at some little distance above the tunnel so that in case of necessity the canal can be breached without causing much damage. The diversion cut of the Guntúr nullah to the under-tunnel is very nearly completed, and the water will now come down to the canal without obstruction. The bed of the old part of the nullah above should be cleared of trees and bushes in communication with the Collector. After this, complete records of all floods should be kept to enable a decision to be arrived at as to further works required. M.F.L. should be marked on the under-tunnel as well as on the lock and weir.

More water was going down the canal than necessary, now that cultivation is over. The canal not being completed it is not practicable to keep still water throughout, but in the lower reaches still water could be held up. At all seasons the supply to the canal should be as far as possible restricted to actual requirements; in the flood season every foot of water brings in a certain amount of silt all of which cannot be passed out again, and therefore tends to silt the canal, and when the water is clear, the canals should, in the interests of navigation, be regulated so as to approximate as nearly as possible to reaches of still water.

37. *Commamur Canal Head Lock.*—The chamber walls have been dressed smooth which is a great improvement. The gates are very bad and need renewal at once; they can hardly last another season, unfortunately as the side culverts are arranged, there must be valves in the gates.

New lock sheds are required and when these are built, the number of sheds near the lock should be restricted to the number of lascars, with one superintendent, employed on the works. At present some of the division lascars have established themselves here, and there is a tendency to make a village near the lock which would be most objectionable.

Considering how near the lock is to the officers' residences, it is very desirable that the place should be kept clean and latrines should be built in some convenient situation near the lock and the establishment compelled to make use of them.

38. *Office Buildings, Duggirala.*—The new office has been completed and is a very good building; the officers' quarters not yet having been built, the officers' rooms in the building are made available as residences. The site is a good one, but it is a pity that, as originally intended, the whole of the ground between the old Tungabhadra course and the canals was not acquired, and the part not required disposed of again with the restriction that no wet cultivation was to be undertaken. Trees have been planted on the grounds round the residences and these should be carefully protected from damage. Shade is much wanted here.

The temporary office-shed, which was built near the lock on the canal bank for use while the new building was being constructed, is made use of as a dispensary, part of it being occupied by the dresser's family. The thatch is being devoured by whiteants and the building will require continual repairs. A very small building will suffice for a dispensary and it might well be constructed on the Government ground at present occupied by the old divisional officer's residence, which is to be removed. The new post office could also be built on this ground. The old office could then be removed and the ground near the lock kept clean and tidy.

39. *Old Escape.*—The rough timber bridge over this escape is in a very bad state and needs renewal. It was arranged that brick arches should be turned, which could be done if the roadway is raised 2 feet, and proper shutters should be fitted to the work; this should be attended to as soon as possible.

40. *Main Canal.*—The left bank towing-path, though it is seldom used, should be kept clear; tooma bushes are growing close to the water in some places. The larger tooma trees, those whose trunks are over 3 feet in circumference, are being cut for firewood in places, but the trees have been felled with little discrimination, leaving long gaps in the plantation which it will take years to fill up. The plantations should be thinned with judgment, and new trees planted to take the place of those felled.

41. *Wuddasweram Lime Kiln.*—A new kiln has been built here on the canal lunka, which seems to have been unnecessarily expensive, the steps being of cut stone; it is intended to remove the old kiln, which is said to be very wasteful, and build a second new kiln. Good lime stone in any quantity is procurable within $\frac{3}{4}$ mile from the kiln, and nearly all the works in the delta will be supplied from here. Considering the very large quantity of lime that will be required, I think it would answer to lay down a line of tramway to the quarries, and I would certainly build sheds for storing lime with corrugated iron roofs instead of the present palmyra-leaf huts, which need continual repair if they are to keep out rain, and are likely to catch fire. The roof might be supported on posts and the walls be made of sun-dried brick in mud.

42. *Seetanagaram Head Works.*—The lock upper gates have been fitted with valves lifted with screws. The valves are very large and screw gearing, which is objectionable in other locks, is suitable here, as in high floods it has been found impossible to raise the valves with rack and pinion gearing; one screw worked very stiffly, and on the screw-box being taken off, it seemed that the principal cause was want of oil. These screw-boxes should have a hole bored in them, through which oil could be supplied; in all the later gearing that has been noticed in this district, the hole has been omitted.

A site was selected for lock-sheds on the canal lunka below the lock, there being no other suitable place. Care must be taken to keep the place clean, and latrine arrangements should be made immediately under the hill. Palisading to agree with that round the lock should be put up from the lock bridge and carried round the huts, the present untidy milk hedge being removed. The lock-shed compound may be reduced by altering the present railing to a line at right angles to the lock, starting from the parapet of the bridge; this would give more room for carts bringing cotton, &c., to the shipping wharf. The shed itself should have the tatted walls replaced by stone in mud, which, now that it is so much exposed owing to the removal of trees, would render it more habitable in bad weather, and the roof should be repaired.

43. *The Wondavalli Vagu.*—Shipping place was inspected; there have been several complaints of late from Guntúr merchants of nothing having been done for the convenience of traffic here, but it is really outside of the canals, and merchants have adopted the place as a shipping wharf while they could much more conveniently ship their goods in the main canal. Advantage has been taken of the outfall of a large drainage into the river above the lock to form a shipping place, and here, in spite of great difficulties, the boats *will* ship and no-where else. It is true that they thus avoid the delay of passing through the head lock, but to save at most a quarter of an hour they persist in using a muddy, confined space on the river, rather than pass through the lock and lie quietly in the canal down the side slope of which goods might easily be shipped. I considered a place for forming a wharf in the Wondavalli vagu, but subsequent consideration has led me to the conclusion that it will be better in the interests of navigation to construct a wharf in the canal. The Superintending Engineer should prepare plans and estimates for this, which will be submitted to Government. If a wharf is built here the old shipping place in the Wondavalli vagu may be left to itself. Those who prefer to ship on a muddy bank can, of course, do so.

44. *River Margin above Anicut.*—The continued efforts to get lunka grass to grow along the margin and protect it are at last meeting with success, and, with the exception of a few gaps, grass is now growing well for a considerable distance above the anicut. Care must be taken that the margin is planted up as water falls to at least the level of the crest of the anicut. Wild cane has been imported by the Superintending Engineer from Tanjore, and some of this is growing very well, and will prove a valuable protection to the margin if it can be protected from cattle.

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45. *Seetanagaram Quarry.*—The search after good stone has led to the hill being cut into to such a vertical height that there seems to be great danger to the quarry people from masses of stone falling, and from so great a height the stone is likely to roll on to the under-sluice or walls. The outside of the rock is soft stone, unfitted for good work, but it seems probable that if the quarry were now extended to the east, good stone would be met with and could be got out with less danger. This might be tried.

46. *Anicut.*—The river has kept up so well this year that the rough-stone bund on the anicut crest has not been raised to the usual level, and although it has not had quarry rubbish thrown in front, water is still standing at 1 foot 8 inches on the anicut crest; there is therefore little to be seen of the anicut, but the sloping apron appears to be in good order, and it is stated that the old scour-holes above the anicut have to some extent filled in, and the scour-holes below are not of consequence. Wherever scour-holes are found below, the rule should be in the ensuing dry season to throw on stone so as to face the up-stream slope of the hole and thus protect the tail of the rough-stone apron.

47 *Bezváda Under-sluices.*—One of the vents has been fitted with the experimental shutters with screw gearing. The gearing is in most respects the same as that adopted by Major Drake-Brockman for the Dowlaishweram under-sluices, but some alterations have been introduced by Mr. Grant, the principal being a different design of catches to drag down the upper shutter when it does not fall by its own weight.

The shutters were tried, and though they are only working in temporary wooden grooves where the friction is very considerable, they worked satisfactorily, and there seems to be no reason why this pattern, with some slight modification, should not be adopted. The catches are not self-acting; they must be put in position before the shutters are begun to be lowered, and it is proposed that they shall be held in position by a pin; when the upper shutter has reached the bottom of its groove, the pin will be pulled out by a light chain attached to it, the catch will fall down, and the lower shutter proceed downwards in its grooves. Turning hammer head on the shutter which has to be caught by the screw spear to a position at right angles to the stream, seems certainly to be an improvement.

48. *Bezváda Head Works.*—The roadway over the bridge across main canal and to the top of ramp leading to the anicut has now been raised to a safe level, and the parapets of the bridge are nearly completed. It is a great pity that these were not built of cut-stone instead of brick plastered. The head-lock is to have gates fitted with valves to be raised by means of screws. Part of the revetment below the under-sluices slipped down in the freshes and rough-stone has been thrown down to protect the bank. When the Local Fund landing wharf in the river below the anicut is constructed, the masonry wing of the under-sluice will be extended to meet it and there will then be little danger of the bank between the river and canal being damaged. The wharf is to be built by this department, and so far as could be seen on the ground, the line laid down on the plan, which is approved by the Local Fund Board, is the best that can be adopted.

49. *River Margin above Bezváda Hill.*—The grass-planting here has been very successful, but it might still be extended and the bay more silted up; near the hill is the place selected by the Local Fund Board for loading stone boats, being close to their quarry, and here the grass has been destroyed. It is understood that when this place was handed over to the Local Fund Board as a wharf, it was with the understanding that the slope should be revetted, which has not yet been done; it certainly needs protection. In working their quarry, the Local Fund work-people have thrown some large masses of stone into the river; those which lie on the slope are dangerous to traffic and should be removed. If the Local Fund Board is not willing to remove these stones they might be asked to allow this department to remove them for the convenience of traffic up the river.

50. *Workshops.*—Plans for the extension and improvement of the workshop building have already been submitted and discussed, and revised plans were examined. The existing buildings were in such a dilapidated state that it was necessary to re-roof

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them entirely, and this has in great part been done; the machine shop, the office entrance, and carpenter's shop having been completed with a very good roof. In a position so very hot and dusty it is necessary that these buildings should have a really good roof, but it seems unnecessary to put so expensive a roof on the rest of the building at present occupied by the blacksmiths. Flat tiles are certainly unnecessary here, the pan tiles need not be so thick, and the wood-work could thus be considerably reduced.

The diversion of the Hyderabad road to give room for the extension of the work-shop yard has been completed, and is about to be handed over to the Local Fund Board. The work then necessary will be a wall along the extended boundary of the yard; a new machine shop with engine-shed for heavy machinery, a blacksmith's shop, a shed for spare machinery, a godown for the superintendent's house, and a latrine; the cost is estimated at about Rs. 20,000. New machinery is much required and will have to be purchased, the old machinery in use being much of it worn out. The punching and shearing machine is beyond repair; the drill is so much worn in the working parts that it is doubtful if it is worth repairing. The engine is old and of only about 4 H.P. and the shafting needs renewal. The lathe circular screw and saw sharpening machine are serviceable, and it has been arranged that a band saw now at Ellore and never used should be transferred to Bezváda, but another lathe, a drill, a punching and shearing machine, a general joiner, and a vertical saw to cut up logs of timber are required, and a powerful engine to drive these machines and also a plate-bending machine which is lying useless, being beyond the power of the old engine to work. The cost of this machinery will probably be about Rs. 50,000. Therefore, to make the workshops efficient will altogether cost about Rs. 75,000; but looking to the large amount of work to be done in the next twenty years, while the completion estimates are in progress, and as these estimates provide amply under tools and plant for this as well as for other requirements, it is considered that no time should be lost in getting the workshops into good working order. The estimates should now be submitted with the alterations mentioned at the discussion and an estimate for the new machinery may also be prepared.

The division stores are at present on the ground which will be included in the workshop extended yard, and there being no other space available they must continue in the yard. The building of course belongs to Provincial, and must, I think, be entirely reconstructed. The roof is falling and dangerous, and the building is altogether dilapidated. The arrangement is inconvenient and it would be well to construct a better-arranged building. An estimate for a new building should be prepared at once in accordance with instructions given at the discussion and it will be forwarded to the Chief Engineer, Public Works Department. The cost will probably be Rs. 2,000. No time should be lost in the matter as the old building is certainly dangerous.

51. *Quarries.*—A boundary wall has been constructed round the land reserved by the Public Works Department on the town side of the hill, and this place, which used to be a general latrine, is now kept clean. The quarry immediately behind the workshop has been given up, so that the buildings are not exposed to damage from falling stone any longer, and the quarries further round the hill are being worked. There seems to be a sufficiency of good stone procurable, but there is a good deal of rubbish, and cleaning the quarry of this, is expensive. The work, however, is necessary even though it may add a little to the cost of the stone.

52. *Ellore Canal.*—There has been a great deal of silting in the last season and it will be necessary to dredge to keep the canal open even to the 1st March. Below the bridge, at head of canal, sand has been brought in, which will be difficult to remove. The trees on the bunkas, both here and in the Masulipatam canal, have grown very considerably of late years, and Mr. Grant is doing his best to extend plantations and make up gaps. He has put down a large number of mango trees lately, which, it is hoped, will succeed. The tooma plantations are now so extensive that the thinning provides amply for all the wants of the Public Works Department, and will suffice in future, but they should be carefully conserved and extended, if possible, as

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when the proposed railway is constructed, the demand will be considerable and there will be no difficulty in disposing of any available fuel in excess of our requirements.

53. *Casarapilly Aqueduct.*—The work is now delayed for want of bricks for the arches, the prolonged wet season having made it impossible to undertake brick-making. Some bricks are on the work, but the soil they are made of being from an old village site, and the bricks though apparently well burnt being very light, it is not considered advisable to use them in building the lower ring of the arches; other bricks are being prepared at Bezváda, and it is hoped that in three weeks sufficient will be ready, when as the centrings have been constructed and a large number of bricklayers can be employed on the long arches, they should very soon be completed. The drop-wall, piers and abutments with skew backs, and flooring have all been completed, and the wings raised to a considerable height; only the rough-stone apron and revetment remaining to be completed below, and cutting out the tail channel, which is now in progress. The work could well be completed this official year, in spite of the delay caused by the illness of the sub-divisional officer and the overseer, both of whom have had to go away; but it will hardly be safe to build heavy side-wall over the arches until the arch-work has thoroughly set. No risk should be run; it will be better to transfer part of the allotment to another work and give ample time for the arch-work to dry. The completed parts of the work look good, and it appears to have been well and carefully built.

54. *Casarapilly Bridge.*—The site for the proposed bridge was inspected. Two roads cross the canal near the village which is on the left bank; one, the northern road, from Bezváda to Ellore, which was of course in existence long before the canal was excavated, and the other a Local road from Kunkipad to Casarapilly, which, judging from what could be seen from the canal bank, has not yet been completed. The crossing of the Ellore road is at a considerable angle to the canal, and if a bridge were constructed at right angles to the canal, extensive curved approaches would be necessary. A skew bridge on the other hand would be costly, though it would look better. Rough estimates should be made to ascertain the relative cost of the two methods; in any case, as the ground and water-level are so nearly the same, high approaches will be necessary and iron girders would be more suitable than a brick arch. There has been some correspondence with the Local Fund Board on the subject of building the bridge at the point where the Kunkipad road crosses the canal, but this would entail a diversion of the Ellore road and bring it up to the bridge very awkwardly, and the high approaches would necessitate the removal of several houses in the villages. Our estimate should be made for the bridge at the Ellore road-crossing, and should the Local Fund Board desire that it should be at the Kunkipad crossing, there would be no objection if the cost would not be increased, or if the Board would contribute any excess expenditure that may be entailed by the change of site.

55. *Masulipatam Canal, Kunkipad Lock.*—The weir and Pullairu head-sluices at this lock are very much in want of proper shutters; they should be put in hand as soon as funds can be provided for the purpose.

56. *Veeranky Lock.*—Material is being collected for raising the walls, and this necessary work will be done during the closure of canals.

57. *Pamarru Lock.*—New gates are wanted here; to enable materials to be carried down the Pullairu, the gates have been turned round, but when the water is raised in the Pullairu to full level they will probably have to be again turned. The completion estimates provided for a new bridge to carry the Hyderabad road over the junction cut, but the abutments of the old bridge are good, and may carry iron girders which would give the necessary headway.

The bridge across the Pullairu used to have one bay with a movable platform to allow of boats passing up. The raising machinery of this has been taken down as it was very difficult to work, and some means must be devised of working the platform in future, probably it will be best to make the platform to swing.

58. *Nedemole Lock.*—The completion estimates allowed for construction of a new lock here and further inspection of the old work shows that it will certainly be necessary. The old lock, though cracked in places, has answered every purpose hitherto; but in last year's heavy rains, one side-wall of the chamber has unmistakably given way and is considerably out of the perpendicular; so long as the weather continues dry it will probably stand, but it would not be safe to leave the wall as it is in another monsoon. During the closure it should be demolished and rebuilt of sufficient section, using as far as possible the old material. If this is done the lock will probably be serviceable for some years to come, which will allow other works to be pushed on with instead. It is quite impossible to get down materials for the construction of the new lock now, and whenever the work is undertaken all materials must be collected beforehand, so that the lock may be completed in one dry season.

59. *New Head Lock to Polrázkodu.*—Coping of wing-walls in progress. Walls raised to nearly full height; the work is very well built, the facing being almost too good, that is, too finely dressed. Bricks being very difficult to procure here, it has been decided to construct the bridge arch of concrete. An arch of this material has been turned to a head-sluice near the lock and is standing well, and there seems to be no reason why concrete should not be more extensively used for arches here. It has been arranged that this lock bridge arch and also the arches of the Chendrayakodu aqueduct on the Ryves' canal should be made of concrete as experiments, the faces of the arches and skew backs being of dressed stone. The result should be reported, attention being specially directed to leakage through the aqueduct arches. Greater attention should be paid to ramming the filling behind lock-walls, iron rammers of the pattern ordered in professional circular No. 42 being used for this purpose.

60. *Polrázkodu Head-sluice.*—The old sluice is still being used, but arrangements are being made for fitting it with proper shutters before next irrigation season. The revised plans of this and the other masonry works on the Polrázkodu were examined and some alterations decided on.

61. *Cowtaram Lock.*—The improvements to the lock have been commenced. The bridge over Tail Bay is too low and, if the estimate permits, iron girders should be substituted for the present brick arch. The arrangements for head-sluices to Bantumilly channel and old Pullairu were discussed and settled; every effort must be made to complete these works before the canals re-open. The principal difficulty is procuring and getting down the quantity of dressed stone required, the number of punts available being limited; but it is hoped that this difficulty may be surmounted, and that in next season the water will be raised and the supply to irrigation much improved.

62. *Rest-house.*—The building has been completed and is at present the residence of the Assistant Engineer who pays rent for it. The walls seem sound, but the verandah floor is cracked and apparently has been broken up by the clay beneath the bricks of which the flooring is made being soaked and swelling. It will have to be repaired and it will be advisable then to floor with concrete on a few inches of sand.

63. *Polrázkodu, 1st Reach.*—There is little remaining to be done to the canal, but the banks have to be made up in places and sectioned throughout. Mile-stones are wanted here. Trees should be planted wherever there is room for them, there being a great want of shade and hardly a tree to be met with on the whole canal.

64. *Rest-house at Rudraveram.*—The building is nearly completed; tiles are not very good; the floor should be laid with concrete.

65. *Lock at Vinjerumpad.*—A large amount of swamp kunkur has been collected and broken for concrete, the stone is fairly good, but in ramming some sand will crumble from it. I would therefore reduce the proportion of sand in the mortar. That hitherto used on these works consisted of one lime, two sand, and one soorkhi. I would reduce the proportion of sand to one, the others remaining the same where swamp kunkur is used. The proportion of mortar in the concrete used is also, I think, larger than necessary, being three of broken stone to one of mortar. I think it might be reduced to five of stone to one of mortar. Rough-stone, to some extent, has been collected, and some of it is about to be dressed on the spot; it looked rather small for the purpose. I would rather that the work was somewhat delayed, and temporary arrangements made for next year's irrigation, than that the facing of these works should not be sound and good.

Bricks were being made to be ground into soorkhi, but they were all too sandy and were condemned. As nearly pure clay as can be handled should be used for the purpose, and this need not be moulded into bricks, but may be made into cakes and burnt.

It is hoped that the lock weir will be built during closure; the lock itself above flooring will have to wait till after canals re-open, as materials cannot be got down now.

A site plan should be prepared to show the ground to be taken up by spoil, cut-stone, and other materials near the lock, in order that materials may not have to be moved twice.

The programme of work to be done in the Gudiváda division was discussed with the Superintending Engineer and Executive Engineer. The distance from the quarries is the great difficulty in getting on with the masonry works, and inquiries should be made whether stone cannot be procured from Dowlaishweram for the tidal-lock, Polráz canal. Boats for conveyance should of course be procured in the Godávari delta. The arrangements made by Mr. Hannen are in every way satisfactory, and there is no doubt that under his good management as much will be done as possible.

No. 54 I.

Submitted for the information of Government.

(Signed) J. O. HASTED, Colonel, R.E.,
Acting Chief Engineer for Irrigation.

18th February 1884.

To the Acting Joint Secretary to Government,
Public Works Department, Irrigation Branch.

Order—dated 21st March 1884, No. 321 I., Public Works.

Communicated to the Superintending Engineer, II Circle, for information and guidance.

(True Extract.)

(Signed) J. O. HASTED, Colonel, R.E.,
Ag. Joint Secy. to Govt., P.W.D.,
Irrigation Branch.

To the Superintending Engineers, I and II Circles.
" Chief Engineer for Irrigation.
" Revenue Department.

Exd. E. Fernandez.
Spare Copies

IRRIGATION.

Govt. of (1884) Madras.

PUBLIC WORKS.

Dated March, 21st.

Recd. *Encl.*

G.O., 21st March 1884, No. 321 I.

MARCH.

Notes of Inspection

The — by the Chief Engineer for Irrigation of the Sangam Project and Nellore divisions and Kistna deltas, communicated to the Superintending Engineer, II Circle, for information and guidance.

No. 894 KS Superintending Engineer's office, 2nd Circle,

Masulipatam.

1777 18th June 1884. p 1

From

The Superintending Engineer, 2nd Circle,

To

The Chief Engineer, For Irrigation, Madras.

Enclosures 6
- Estimate
1 Plan
Tracing
Engineer's Report
[illegible] Report

Sir,

I have the honor to forward herewith for your approval and for transmission to the Chief Engineer Public Works Department for sanction, an Estimate amounting to Rs. 9,130 for a new Store to be constructed from Provincial Funds at Bezvada.

2. You know how badly we are off at present, and that the present Building is unsafe. I would request therefore that you will arrange for Rs. 5,000 being, if possible, allotted for this work for the current year, and the balance being given next year.

3. I was in hopes I should have been able to send you the Estimate for this Building at an earlier date, but have only recently received it from the Executive Engineer.

I have the honor to be,
Sir,
Your most obedient Servant,

J. W. Rundall

Superintending Engineer, 2nd Circle

G. O. No 321 I D/ 21-3-84.

Encls. 5 No 56 E W I. p2

Forwarded to the Chief Engr. P. W. Department with a recommendation that the estimate for constructing a new Store building at Bezwada be sanctioned from Provincial funds.

Ph. Penny ——
Lt Col. R.E.
For Chief Engineer for Irrigation

Chepauk
28 June /84
Desp 28/6

SUPT. ENGINEER 25 JUN 1884 FOR IRRIGATION

From
The Superintending Engineer
2nd Circle

(1)

To
The Chief Engineer
For Irrigation,
Madras

Dated 18th June 1884
Desp d 19th do
Rec d 27

No 1777 W dt 21st July/84

No 894 W

Bezvada - New Store to be constructed from Provincial funds, at — Forwards for approval & transmission to the Chief Engr. P. W. D. for sanction an Estimate of Rs 9130 for the —

R. G. 9-7-84 R. 21-7-84

Public Works Department, 1884-85.

Oys. 27/1

Current No. 5202

Letter No. 56 E.W.

Dated the 26th June /84

From the E. W. I.

1777

Note of Remarks.

1. The accompanying plans and estimate provide for constructing a new Store at Bezvada in the Kistna District. They have been submitted with reference to G.O. No. 321 I of the 21st March 1884. The amount of the estimate is Rs 9,130.

2. The Store is to be formed of a shed on the east side of a courtyard and another on the west side. The east shed is to contain a room, 17½ x 25', for storing oils &c, a second room, 17½ x 25', to hold tools, and a third room, 36½ x 25', to store metals. There is a passage, 10' x 25', between the second and third rooms. The west

13 1777 W

D. 9-7-84 R. 21-7-84

shed is to contain a room, 17½'×25', to hold cordage, a second room, 17½'×25', for painters' stores, a third room, 15½'×25', to serve as an office, and a fourth room, 19½'×25', for small stores. A passage, 10'×25', runs between the second and third rooms.

3. The masonry is to be set in mortar; the roof is to be of pan tiles resting on trusses; the flooring is to consist of rough stone 9 inches deep, concrete 3 inches deep, with an asphalte 3/8 inch thick. The scantlings of the roof timbers are correct.

4th July/82
BM

PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the

READ the following

From the Supg. Engineer II Circle M. E. No. 894 K. A. dy 18th June 1884.

Endorsement thereon by the Chief Engineer for Irrigation } M. E. No. 56 E. 15. dy 26th June 1884.

The plan and estimate amounting to Rs. 9,130, for constructing a ~~new~~ Store at Bezwada, in the Kistna District, are sanctioned as Provincial No. 92 IV of 1884-85, and classified as Local Buildings, Original Works.

2. As the balance available from the Provincial Reserve is small, the Supg. Engineer II Circle will suggest transfer of funds from the grant for other works in the

114

circle to meet ~~expenditure on~~ an amount required for
the work

Ce
8-7-14

(1)

— W

To
The Supg. Engr. II Circle with 5
enclos.
Examiner P. W. Accts with
duplicate cert.
Chief Engineer for Irrign.

Ce
W P.W.P. 2777 Circ 1277
8-7-14

1777

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5404

Govt. of (1884) Madras.

PUBLIC WORKS.

(15)

29/1

Dated

Recd. Encl.

G.O. 21 Jany 1884, No. 177

Store-building

Plan, Revd Estimate

of Rs 9,130 for

Constructing a

at Bezwada, Kistna

District, Sanctioned

60/5