

(1) Number of Pages 16  
(2) Date of repair 17-2-1966  
(3) Initials of the Referencer Ms

# MADRAS RECORD OFFICE

GOVERNMENT OF MADRAS

Revenue DEPARTMENT

G.O. No.  
B.P. No.

7

Press  
Mis.

Dated

2-7-

1873  
196 .

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No. 249.

Read the following:—

MEMORANDUM.

No. 86.

THE Chief Engineer for Irrigation having, between the 15th February and the 3rd March, inspected the Madras Irrigation and Canal Company's Canal, has the honour to submit for the information of Government a few remarks thereupon. Paragraphs 2 to 11 of this Memorandum contain observations on several subjects connected with the undertaking, and bearing upon the interests connected with it, and paragraphs 12 to 25 show the present state of the several sections of the Main Canal.

2. EXPENDITURE ON MAINTENANCE IN 1873-74.—The expenditure upon maintenance provided for in the Budget of 1873-74 will suffice, it is considered, for the probable requirements of the canal under present circumstances; but were it requisite that the canal should carry a full supply and be available also for navigation, a very large increase of outlay would be needed. The canal generally is in very fair order with reference to the duty it has to perform, and it would not be advisable to lay out more money than is necessary to maintain it in a state which may be considered efficient for the conveyance of all the water which will be wanted, and as yet navigation has not been started.

3. NAVIGATION IN ABEYANCE FOR WANT OF BOATS.—It is undoubtedly to be regretted that nothing has been done to make this long line of canal available for the transport of produce and merchandize, but, so far as can be learnt, the Company have not the funds necessary for the provision of floating plant, and it is not likely that private persons will build boats until they have seen that there is really a demand for such means of conveyance, or indeed so long as the canal may be open for navigation for only one half of the year. The obligation to provide boats and start the navigation lies with the Company, and it may be hoped that even the difficulties which they may find in raising money will not oblige them to postpone much longer the commencement of the navigation on a modest scale. Whether or no water carriage would exercise any material influence on the spread of irrigation may be a matter of opinion, but at any rate it was one of the great advantages to this tract of country to be secured by the Company's operations, and it is a pity that the benefit should be rendered inoperative, after the canal with its numerous locks has been constructed, for want of the necessary boats.

4. STATE OF DISTRIBUTION OF WORKS, AND NECESSITY FOR A REVISION OF THE RULES RELATING TO IRRIGATION.—The Chief Engineer of the Company has not at present any map showing the irrigation channels which have been constructed in connection with the several sections of the Main Canal. The need of such a map is recognized, and its absence is due to the rapid reduction of establishments which took place in 1871, which left the staff unable to do more than attend to the more pressing current duties of their divisions. From what the undersigned has seen and from what also he has heard from the Chief Engineer, it seems clear that very great care and attention have been bestowed on the distribution works; and though, from the novelty of this kind of work, some modifications of arrangements will probably

*Proceedings of the Madras Government, Public Works Department,  
18th June 1873.*

be necessary, there is little doubt but that, so far as the Main Canal and distribution channels are concerned, nearly 100,000 acres could be successfully irrigated during the coming season, were there to be applications for water to that extent. The Company are ready to irrigate, but the ryots are not ready to take water. There are very many miles of the canal with land suitable for irrigation alongside its banks, but with not a single irrigated field within sight; and, except near and above Kurnool, there is nothing larger than here and there a patch of irrigation to be seen anywhere from the canal banks. Although knowing beforehand that the total area under irrigation was very small it seemed surprising that a greater number of at least experimental fields had not been tried with water. It may be noticed also that some of the patches irrigated have not been arranged in a way likely to prove successful; they have been laid out as for garden crops, with small bunds two or three inches high, and rice will not grow well if treated thus. The subject of the very slow extension of irrigation under this canal has already\* been brought to the

\*No. 69, dated 28th December 1872.

notice of Government, with a view to measures being devised for getting rid of any removable hindrances to its spread. This subject has been repeatedly under discussion between Colonel Rundall, the Chief Engineer, and the undersigned, during the last fortnight, and the more the question was looked into the more evident it became that present arrangements are not likely to lead to a successful result. The people are not sufficiently informed, if indeed they have individually any information at all, as to what will be the consequences of their applying for water: the machinery for registering applications is inefficient, for it appears that the Curnam, upon whom this duty devolves, is liable to be, and is often, away from a village for days, and it may be even for weeks, on one or other of the various duties appertaining to his appointment; the time occupied in conveying intimation of the application to the Canal Officers is, from the circuitousness of the prescribed channel, too long to meet the requirements of the case. Again, the rules fixing the water-rates appear to need amplification and additions so as to fit them the better to the circumstances of the different kinds of cultivation in favour among the villagers: thus raggy, indigo, and several other crops would benefit by regular irrigation, but as they do not need as much water as rice it may not be worth the while of the ryots to pay Rupees 6 an acre; and, on the other hand, it is not altogether convenient to treat them as dry crops and charge 1 rupee an acre for each flooding afforded. What seems to be wanted is clear and full information as to the views and wishes of the landholders, as a basis for the revision of the rules, and likewise clear and full explanation to them of the rules as they now stand, and of the liabilities attaching to irrigation under them. Practically the ryots do now in many cases apply direct to the Canal Overseers for water; but these applications are unaccompanied by that definite information as to the position and area of the land to be irrigated, which is necessary for the convenient identification of the lands on the Revenue Survey Maps, and for the subsequent fixing of the charge for water supplied.

The following is an abstract of the irrigation during the last three seasons, and it appears to show the urgent necessity that exists for introducing rules and regulations more likely than those now in force to meet the circumstances and wants of the ryots and to secure the sale of the water available.

*Proceedings of the Madras Government, Public Works Department,  
18th June 1873.*

| Talugs.        | 1872.            |           |            | 1871.     |            | 1870.     |            |                                                                                                                                                                                           |
|----------------|------------------|-----------|------------|-----------|------------|-----------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | No. of villages. | Ordinary. | Flood-ing. | Ordinary. | Flood-ing. | Ordinary. | Flood-ing. |                                                                                                                                                                                           |
| Ramalkota ...  | 11               | 1,530     | 2          | 1,147     | 128        | 880       | 62         | The table includes all the measured first and second crop and the estimated additional (unmeasured) first crop. But nothing is entered for second crop still being sown (say, 100 acres). |
| Nundikotkur..  | 36               | 2,292     | 177        | 1,228     | 1,318      | 583       | ...        |                                                                                                                                                                                           |
| Nundial ...    | 17               | 576       | 19         | 1,196     | 109        | ...       | ...        |                                                                                                                                                                                           |
| Sirwell ...    | 29               | 793       | 182        | 141       | 436        | ...       | ...        |                                                                                                                                                                                           |
| Koilkootla ... | 5                | 174       | 15         | 8         | 19         | ...       | ...        |                                                                                                                                                                                           |
| Prodatoor ...  | 24               | 1,000     | 557        | 752       | 1,175      | ...       | ...        |                                                                                                                                                                                           |
| Caddapah ...   | 20               | 1,300     | 300        | 815       | 528        | ...       | ...        |                                                                                                                                                                                           |
| Total...       | 142              | 7,665     | 1,252      | 5,287     | 3,713      | 1,463     | 62         |                                                                                                                                                                                           |

5. PRESENT MODE OF ASCERTAINING THE AREA IRRIGATED.—The applications for water, with the details of areas to be irrigated, would, under no circumstances, suffice for fixing the revenue to be collected, as some check upon the correspondence between those areas and those actually irrigated would always be necessary. At present the Company's Surveyors measure up the whole of the lands irrigated, and the Curnams appear to base their accounts entirely upon such measurements. The Chief Engineer admits that this is an expensive arrangement, and it ought to be entirely unnecessary. The rule is that only entire revenue fields should be irrigated, and where two or more such fields are included in a Revenue Survey field, the information required to enable the Canal Officers to lay down the minor fields on their maps should be afforded by the Revenue Department, and tables of the areas of such fields should be prepared. No water should then be given except upon a regular application in an authorized form, which should show what field or fields are to be irrigated, and the check to be exercised should be the comparison of the actual irrigation with that applied for, which latter should be laid down on the village maps when the application is received and accepted by the Canal Officers. No actual measurements would then be necessary, and any member of the Company's staff could at any time see, with but little expenditure of time, whether any extension of irrigation beyond the area included in the applications had taken place. All irrigation not provided for in the applications would be surreptitious or, as that word is not easily explainable to the ryots, "unauthorized" (without order) might be substituted with advantage; all unauthorized irrigation should then invariably be charged double the usual rate. At present every thing is done so irregularly that the penalty for surreptitious irrigation has not been enforced.

6. INDUCEMENTS TO CONVERT LAND INTO PADDY FIELDS.—Taking into consideration the circumstance that the preparation of land for irrigation costs something considerable in all cases, though the outlay varies, according to the slope of the ground; secondly, that the large heavy cattle used in agricultural operations on dry lands are not adapted to wet cultivation; thirdly, that the profits from irrigation cannot be secured without the knowledge obtainable, at least in part, only from experience; and, fourthly, that the ordinary ryot is not

generally much given to speculative investments; it seems desirable to try whether some inducement may not reasonably be offered to get him to ascertain for himself whether cultivation, with the aid of water, is more advantageous than trusting entirely to the rainfall. From the point of view of the Government, if not necessarily also of the Company, it must be assumed that irrigation is likely to be highly beneficial, otherwise the State would not have been subjected to such heavy charges to provide water. The mere discussion of such a subject is perhaps apt to make those who are hesitating about taking water resolve to wait, but a solution of present difficulties will not be arrived at without free discussion; and, as the Chief Engineer is certainly disposed to grant some concession, the question has been noticed here. It does not seem requisite to relieve the ryot of all, or nearly all, the charge which must be incurred by him when commencing to irrigate, and perhaps the extent and form of the concession had better be settled after learning the opinions of the people interested; all that need be said here is that to do any good the concession should be liberal; a trifling remission of water-rate would have little or no effect, and more liberal terms might be hoped and waited for. The water is valueless while not used, and to allow it to be used for a limited time without, or at a small charge, will not probably reduce, and may greatly increase, the revenue receipts. It may, moreover, be politic to extend the indulgence to those who have already become irrigators. To be convinced that present action will not shut out a cultivator from future benefits is a very powerful incentive to do now what otherwise might be postponed indefinitely. It should be understood that, under no circumstances, can it be expected that the water will be taken up very rapidly. The population is small and the appliances are not ready; the ground will take time to prepare; and therefore a comparatively slow and sure progress will not be unsatisfactory. What is very desirable, however, is that in every village commanded by the canal a few ryots should be induced to try what the results of irrigation are, so that their example may act on others, and that experience may be gained rapidly. Probably, it would be a good plan to employ a few labourers from one of the neighbouring deltas, or from irrigated parts of Kurnool and Cuddapah, to show the people how the ground should be prepared: it is of importance that a fair out-turn should be obtained, and it cannot be wise to leave those who are ignorant to learn for themselves at a considerable loss what could easily be taught them at a very trifling expense.

7. REMUNERATION TO CURNAMS.—The time seems to have come for a reconsideration of this question. There has not been very much hitherto for the Curnams to do in connection with the canal, but irrigation might have increased had there been in every village some one whose interest it was to facilitate matters by readily affording information as well as duly attending to the specific duties placed upon him. While human nature is what it is, and slow as has been and may still be the spread of irrigation in Kurnool, it will not be safe to calculate upon any radical change in that nature before this irrigation has reached its limits: duties are generally better performed when fairly paid for, and work is most zealously done when the labour yields a tangible reward. If by paying a per-centage on the water-rates levied, the receipts can be augmented, the Government, the Company, and the Curnams will alike have reason to be satisfied.

8. EARLY APPLICATION FOR WATER FOR EACH SEASON DESIRABLE, AND SHOULD BE INSISTED UPON.—When the rules relating to irrigation were first framed, it was probably thought that the great bulk of the applications for water would be made so long before the commencement of each season as to leave ample time for all arrangements to be made, and that only under exceptional circumstances would ryots ask for water for rice crops after part of the season had gone by. It is not quite clear where the difficulty lies, but it is certain that the applications are much later than they should be, and that some are received and admitted at dates when, as it is impossible to cultivate successfully, they should be rejected. This point should receive special attention; the ryots should understand that the rate for ordinary irrigation is the same whether water be taken for nearly six months or six weeks, and that it is greatly to their interest to ask early, to get their seed beds ready before the water comes down, to put in the seed at the first favourable opportunity, and so to ensure getting the water throughout the full time needed to secure a good crop. It would be well to have brief and easily understood notices on this subject printed and distributed widely; and, even if arrangements be made for every application for water reaching the Canal Officer within a couple of days of its being made, it would be well to refuse applications for water for ordinary rice cultivation after the 31st July at latest.

9. SUPPLY OF GOVERNMENT TANKS FROM THE CANAL.—In connection with the orders contained in Proceedings, Madras Government, as per margin, the Chief Engineer raised the question as to whether, if a supply to a Government tank were applied for and, after a few days, the tank were filled by rainfall drainage, the Company could claim for the water asked for. Several considerations are involved. At first sight it might appear that only the water actually supplied from the canal should be charged for; but it may be noticed that if the Company undertake to provide a supply to a tank, they may have to refuse subsequent applications for water, and afterwards it may not be practicable to utilize the water intended for the tank. It needs to be remembered too that the quantity of water which the canal below the 5th section can carry is not very large, and that the filling of tanks of any but a small size therefrom would take a long time. The filling of tanks leads to various complications, and unless tolerably complete and satisfactory arrangements can be come to it will not be well to encourage the extension of the practice. It is the custom under most tanks to proportion the area of cultivation in any year to the supply received into the reservoirs at a certain period. If the ryots believe that this supply will regularly be supplemented when necessary from the canal, they will soon get into the habit of cultivating without reference to the tank supply available, and there will be a yearly demand for additional water from the canal, though the quantity required may vary considerably. The arrangements at present in force under the Government Order above quoted, whereby the charge for water is proportioned to the area under cultivation below the tank, and to the time that the crops have to be supplied is not altogether a good one, for, in the first place, the natural supply in the tank will be apt to be ignored; and, secondly, the crops will generally be in various stages of progress, and will require water for a longer or

shorter interval, consequently the Company's proper charge will be difficult to ascertain, and much correspondence will be likely to ensue. There are not very many tanks in a position to be supplied, and were these contoured and their capacity at different levels ascertained, it would be much simpler to pay for quantity supplied. The rate, if fixed at one rupee per thousand cubic yards, would approximate to that derived from irrigation direct from the canal, and the requisition for a supply would state the number of cubic yards required; and the Company's officers being furnished with a tabulated statement showing the contents of the tank for every foot or so on the gauge, there would be no difficulty in meeting the demand with sufficient exactness, though, if the throwing into the tank of the water asked for were to occupy a considerable time, the draught of the sluices, and perhaps evaporation also, would have to be taken into account.

10. TIME DURING WHICH COMPANY MAY TAKE WATER FROM THE TOOMBUDRA.—At present the Company are allowed to take water from the Toombudra only between the 1st June and the 31st December, except the small quantity required for the supply of Kurnool regarding which there is no limitation. It appears, however, to be desirable to relax the prohibition to take water for irrigation after the 31st December to such an extent as may be feasible without depriving the Kistna Delta irrigation of the water which it may require. As there is communication by telegraph between Bezoara and Kurnool, it will be easy for the Chief Engineer of the Company to ascertain whether any water in excess of the Kistna requirements is in any year, on the 31st December, running to waste over that anicut; and, if so, the quantity could be reported, and the head sluices at Soonkasala might be allowed to pass anything below that quantity, until the Chief Engineer was advised that the supply must be reduced, or altogether discontinued. Similarly, when the Kistna canals are closed, as is done annually about March, the Chief Engineer might be advised of the fact from Bezoara, and he could then be allowed to take whatever water might be available in the Toombudra, until again advised, a few days beforehand, of the re-opening of these canals. By this means it is anticipated that some material advantage will be derived, for the tanks formed by the single banked part of the canal could be filled up to bed level, whereby some days would be saved at the beginning of the season; and, if sugar-cane were cultivated under them, as is quite practicable, its area could be somewhat extended.

11. CHIEF ENGINEER'S STAFF.—The Chief Engineer has at present two Assistants, and a third is shortly expected from England. These three officers will have 190 miles of canal between them, and they ought to be able to manage it efficiently; but the staff is only just sufficient, and it is to be hoped therefore that the Company will take care that the Chief Engineer is not left, as was the case the other day, with only one Assistant actually on the canal, though another joined very shortly afterwards.

12. ANICUT AND HEAD WORKS, SOONKASALA.—The anicut across both the north and south branches of the Toombudra has stood the freshest very well indeed. The coping has remained uninjured and comparatively very few of the joints require re-filling. Portland cement was used for these, and in addition to the security afforded it stands so well that its use is economical. In 1870 many of the holes in the rock below the weir were filled in, some with concrete, others with rubble

masonry, or with loose stone, and a covering of stone on edge in chunam, while some were filled with concrete on which was laid stone on edge in Portland cement. This last is the only plan which can be relied upon, though in places the other descriptions of work have stood better than was expected. Some more work of the same kind will be carried out this year. The rock generally has not suffered much from the overfall, but its quality varies greatly, and the wear and tear on the softer descriptions is very considerable. The pools in rear of the dam will shortly be baled out so as to admit of the lower parts of the wall being examined. The leakage through the weir is now but very small indeed. The groyne above the under-sluices has cleared away the silt from in front of one-half of the head sluice, and a prolongation of it would no doubt lead to the removal of the remainder. At present the unmasking of the southern half of the sluice is not necessary. Below the head sluice a wall 4 feet high at the revetted sides of the channel and about 2½ feet in the middle has been built to direct the current to the centre, and this appears to answer very well. It does not interfere with the supply of water except when there is so little in the river as to make the leakage through the under-sluices of consequence. Between 50,000 and 60,000 cubic yards an hour were entering the Main Canal, and the greater part of this was being returned to the river at No. 9 waste weir near Kurnool. The object of this arrangement is to secure fresh water for the Kurnool Town supply.

13. 1ST SECTION, MAIN CANAL, 17 MILES.—A good deal of work would be required to place this section of the canal in complete order. The banks are in some miles very uneven, and the top width at places insufficient; some of the revetment requires repacking also, while the masonry works need more or less repair, and the sluices more efficient shutters than most of them now possess. However, for the quantity of water likely to be required next season, the banks are everywhere sufficiently high, and, with the exception of two or three places where breaches have occurred in past years, or where settlements have recently taken place, they are also sufficiently strong. From the 3rd to the 15th mile the canal and the succession of small tanks formed by its bank where single, are much infested with rushes and weeds; the growth of these during the past four years has been surprising, and energetic measures are required to extirpate those which propagate by seed, otherwise they will become a serious nuisance not only from the diminution of the water, but also from the greatly increased amount of deposit which they occasion. The rushes should not be allowed to flower, otherwise there will be no limit to their increase. Perhaps the villagers would cut them for thatch or for manure if permission were given. In the tanks the Chief Engineer proposes to let the rushes grow, deposit silt, and so raise the ground considerably above bed level, then to clear out the bed for the width of the canal proper and form a second bank with openings at every 100 yards or so. He thinks then that the ground outside these banks will be cultivated, and that the rushes will not grow in the deep water. If the rushes can in the meantime be prevented from spreading in all directions this may be a good plan.

The reformation of one waste weir has been completed, and another has been cut down to carry out the improvements.

14. HINDRY AQUEDUCT is in very fair order. The towing-path is very inconveniently narrow.

15. 2ND SECTION, MAIN CANAL, 15 MILES.—The embankments and walls below the Hindry Aqueduct are in good order. A cut has been made for irrigation in the left bank just below the 21st mile cutting, and a dam has been placed across the canal to pond up the water. This is an experimental arrangement, and it has not yet been settled whether a sluice is to be constructed. The Kadrabagh Aqueduct still leaks and the joints want re-filling. The high wall (A section) below the aqueduct is in good order; it is the best wall of this pattern on the canal. The banks of this part of the canal are generally in good order, but near the aqueduct a good deal of repair has been provided for in the estimates.

The lower part of this section, or at least from the 26th to the 29th miles inclusive, is a succession of walls of various patterns. The old walls in lieu of banks have for the most part been improved and made secure, and the leakage is much reduced. The new walls have nearly everywhere answered their purpose, though in the 26th mile there is still considerable leakage where one of these has been built in front of an old core wall.

The high banks at the lower end of the section near Sultanpore are in very fair order. Some improvements have still to be carried out; one of the core walls which leaked badly has been opened out, and the material used for the core sufficiently accounts for the leakage; a masonry wall is about to be built in front of it. The five-arch bridge near Sultanpore has cracks in spandrels and elsewhere and repairs will be required.

16. 3RD SECTION, MAIN CANAL, 11 MILES.—The banks between Sultanpore and Ulloor are generally in good order, but in the 34th mile the top level is irregular.

The Ulloor Aqueduct is in good order, an iron railing has been added to the tow-path, but its attachments to the masonry are too slight and consequently not efficient.

Just below the aqueduct a bridge has to be built, but it has been postponed for want of money. The traffic at present crosses at a ramp, and this is very steep and inconvenient. A little further down Weir No. 18 is being altered. Fourteen 8 feet vents with the sills 4 feet above bed level are being inserted. There is some doubt as to where the additional weirs required for the part of this section near Shaitancotta should be placed. There are several walls which might be converted into escapes, but at some of these the ground is much below bed level. The first wall below the Shaitancottah bridge appeared best suited to the purpose. One of the high walls further down has been opened.

The Malayala bridge arches and superstructure are very rough and indifferent: the centrings must have been bad. Part of the Muddegutla bridge will, I think, need re-building; the lower face of the left arch has separated from the rest of the arch owing, apparently, to the joints of the interior being thicker than those of the face; the skew back is cracked on the upper side and some of the joints are very open and need filling. The 45th mile weir has had eight vents of 8 feet at 5 feet above bed level inserted. The embankments are for the most part in very fair order.

17. 4TH SECTION, MAIN CANAL, 17 MILES.—The upper end is in good order. In the bed of the tank in the 46th mile cultivation has just been commenced,

and there is a promise of a fine crop of chenna if no considerable fall of rain takes place before it is ripe. Between Nagatore bridge and the tank above Puggydial the canal was not inspected.

The Nullavagu tank bund and most of the revetment are in good order, but where the soil is soluble the want of a backing to the revetment is apparent. The bunds of the tanks below Puggydial are as regards earthwork in good order, and not much in the way of repairs is needed to the revetments. The waste weir below these tanks is to have its crest lowered so as to increase the capacity of discharge. This may be necessary under the arrangement, whereby the water is to be prevented from rising at any time above ordinary full supply level, but the canal banks were designed to meet totally different conditions, and their cost would have been much less had their level been made suitable to the altered height of the weir crests. Many of the weirs, which are to be made more capacious, have never had a drop of water over their crests, the sluices having sufficed to discharge all the surplus water. It is true that the canal was not at such times carrying nearly a full supply, but the circumstance indicates nevertheless that, with no rain fall which has hitherto been experienced in the part of the country traversed by the 3rd, 4th, and 5th Sections of the Main Canal, would the water have risen more than a few inches above full canal level, had the canal been carrying the full quantity it has been designed to convey.

The bund of the Tangadancha tank has stood very well of late years. The earthworks require some making up. A considerable sum will have to be spent in re-building a large part of the revetment and in re-packing the shingling. To the former a backing should be given wherever it may be re-built, for stability cannot otherwise be secured.

18. 5TH SECTION, MAIN CANAL, 12 MILES.—The earthworks will require some making up to bring them to a correct level. The heavy banks near the Teragopila aqueduct have not yet taken a final bearing, and a good deal will have to be done to them. The Mettacondal cutting has stood well; the narrow part at the lower end will need widening when the canal comes to be used for navigation, and the towing-path under the bridge across the cut will have to be completed and provided with ramps. With a current of three miles an hour the navigation here will always be difficult. The Teragopila aqueduct is the most important masonry work in this section. Although the water is at present only a pool above this work, the leakage is excessive, and measures should be taken at once to stop it. The water is passing in very considerable streams through the upper side of the first arch, a great deal has evidently found its way through the wing-walls. Some of the culverts in this section look hardly secure, but it is doubtful whether carelessness at their first construction rather than subsequent settlement is not the cause of their being out of shape.

19. 6TH SECTION, MAIN CANAL, 19 MILES.—The shutters of the surplus sluice and head sluice have not been as well fitted as they might have been, and the iron grooves should be properly fixed. The regulating lock is in good order, the masonry having stood better than the shale used in the greater part of the walls was expected to do. New balance beams to the gates will be required.

The earthworks for the most part require only ordinary repairs, but some of the high banks above the locks have settled considerably and will need making up to their proper level and section. Just above lock No. 9 A, where the banks are very high, a breach has occurred, and as this part of the bank had given trouble before, and as the soil on which it stands is bad, care will be taken to put the whole of the doubtful part, which is of no great length, into an efficient state.

The masonry of the locks, of which there are thirteen including the head lock, is nearly all good, and the appearance of these works creditable. Where the plank-ing of the gates and the balance beams are of country-wood, teak will have to be substituted, as the former material is rotten and useless. A considerable outlay will be required on this account. Some of the lock sills have been re-built in a substantial manner, but the dressing of the stones has not been completed.

Rushes and weeds are springing up in some places, and should be carefully removed.

The canal banks and locks at the lower end of this section have not as yet had water against them.

The bed of the canal in the upper part requires to be levelled, and all lumps of kunkur or shale above bed level should be removed.

20. JOOTOR ANICUT AND HEAD WORKS.—Seven and a half feet of water went over the anicut this year. About 35 feet, sixteen stones of the coping of the crest of the weir were carried away; the stone is excellent and well suited for a coping, but the stones were not properly bedded. The cushion wall has been a good deal knocked about; it was placed too near the main wall, and its coping was not sufficiently massive; such walls would stand much better if constructed with a high batter on the cushion side. A considerable quantity of the shale on which the under-sluice is built has been washed away from the rear of this work. It is intended to construct a masonry apron with stone on edge. The head sluice, a carefully built work, is in good order. A good deal of silt has accumulated in the navigation channel above the head lock; this is unavoidable, and the arrangements for creating a scour are as good as they can be.

21. 7TH SECTION, MAIN CANAL, 23 MILES.—Except near the two streams which enter the canal in the 98th and 99th miles this section has not suffered. The surplus weirs which were built some years ago have proved insufficient, and it is intended to increase largely their capacity of discharge. The earthworks are generally in good order.

The masonry works are many of them creditable, but it is noticeable that the parapets and sometimes the superstructure above the arches have been less carefully built than the lower parts of these works; and this is probably owing to the Company having run short of funds.

The towing-paths at the upper and lower aqueducts across the supplying channels of the Nundial Tank are much too narrow, the latter being  $3\frac{1}{2}$  and the other only just over 3 feet. The same want of convenience exists at very many of the masonry works on this canal.

22. 8TH SECTION, MAIN CANAL, 29 MILES.—The earthworks are almost everywhere in very fair order, and in many miles in excellent condition.

Above Lock No. 1 a surplus weir of 13 arches of 5 feet span with at either end two sluice vents  $5' \times 4'$  has been constructed. It is a carefully built and creditable work. The lock weirs in connection with Locks No. 1 to 9 were partly built many years ago, and have been altered to adapt them to the present requirements of this part of the canal. Some of them will need further improvement. The lock drop walls and, in some cases, the side walls also, leak more than is right. Some of the sills are likely to require re-construction.

The iron-work of the lock gates requires overhauling and putting to rights.

The masonry of the tail lock of this section looks very well, and presents a great contrast to that of the head works of the 9th section, a few yards off. It is not however free from leakage. The water from the lock weirs is let into the canal below the locks by inlet weirs, of which the best have curved crests with or without water cushions, according to the nature of the soil.

23. ANICUT AND HEAD WORKS AT RAJOLY.—These works supply the 9th Section, Main Canal. The anicut has not suffered at all from the freshes of the past season, and it needs but very trifling repairs. A good deal of the limestone rock of which the bed of the river consists has been displaced, and further action in the same direction will have to be carefully watched. The sluices are, with the exception of some repairs required to the gearing, in good working order. It is, I think, to be regretted that with such admirable material as that of which these works are constructed a little more pains was not taken to secure a creditable effect, by making the courses horizontal; lines, intended to be perpendicular, vertical; and curves, true.

24. 9TH SECTION, MAIN CANAL, 35 MILES.—The soil varies much, and with it the condition of the banks. These would be the better for being levelled and restored to section, and generally the towing-path, which is also very useful for inspection purposes, might with advantage be improved. On the whole the earthworks may be considered to be in fair order. There is a good deal of silt in the canal: in the upper miles partly from the river and partly washed down from the banks, elsewhere principally, if not entirely, from the washing down of the slopes.

The catch-drains outside the canal require attention. In several places they are beginning to undermine the canal banks, and this action should be stopped and effectually guarded against for the future. The masonry works of this section were finished some time ago, and have already been reported upon. Most of them are efficient, though rough; the leakage at aqueducts and culverts is greater than is desirable, and it is intended to stop this by plastering the inside faces of the walls, etc. Some of the lock sills failed when the locks were tried; repairs and alterations have been carried out, but the results are not yet known, as the locks have not since been worked. The iron-work of some of the lock gates requires attention as many of the bolts proved too large for the holes in the straps, and they have consequently not been sent home and screwed up. The leakage through some of the drop walls of the locks is very considerable, and parts of the side walls are not water-tight. There being no water in the canal, or rather only a few pools, the working of the gates and gearing could not be inspected by me. The two arch aqueduct opposite Dhoor is a very indifferent crossing, and the headway is insuffi-

cient for a loaded cart. Rushes and grass have here and there made their appearance in the bed of the canal. If not allowed to flower, they may with a little trouble be eradicated, otherwise they will become a great nuisance.

The canal in the lowest reach of this section crosses a drainage which used to fall into the Cazeepet nullah and so into the Pennair. A good deal of water accumulated last season, notwithstanding that a cut was opened into the river parallel to the right bank of the canal, and a considerable area of cultivated land was swamped. If possible the drainage should be diverted at some distance to the westward into the Pennair, but, if this cannot be done, the drain alongside of the canal must be considerably enlarged and deepened. A few levels will decide what is feasible.

24. PENNAIR ANICUT AND HEAD WORKS, ADIMAPULLY.—These works have been carefully carried out, the masonry is excellent, and the whole appear to be well adapted to the purposes for which they were designed. The under-sluice of nine vents is worked from a platform well above highest flood level; the shutters are regulated by screw gearing so arranged that the full lift of 8 feet is obtained by a screw of half that length. After the shutter has been raised 4 feet it is held in position by a key passing through a flat bar, and the cylindrical lifting bar is then disengaged by a lever, lowered, and attached at its upper end to the collar piece, when the second lift is made. One of the shutters was raised a few inches and was lowered again without difficulty; the bearing surface is a flat bar of iron fixed to the masonry. The head sluice shutters are regulated by means of similar gearing, but there is no need in their case of the double lift. There will be considerable difficulty in forming and maintaining a boat channel from the tail lock of the 9th Section on the left bank of the Pennair to the head lock of the 10th Section on the right bank. There being no navigation plant on the canal as yet, the channel from the tail lock has not been opened.

The rock on which the southern part of the anicut, which has a vertical overfall, has been built, will require to be watched. It is stratified limestone with a moderate dip up-stream. The part of the anicut having a sloping section is in excellent order; there is some leakage, but with the water at 1 foot below the crest it is not of any consequence. The rough stone apron at the bottom of the slope has not been disturbed, although from its irregularity, absence of packing, and the small size of much of the stone, it might have been expected, judging from the results at the Nellore anicut, that it would not have stood as it has done. The length of the Adimapully anicut from the north wing-wall to the under-sluice is 2,237

feet, that up to the south wing 2,383 feet, and the cost of the anicut has been Rupees 4,37,900 or Rupees 587 per yard of crest and Rupees 551 per yard of extreme length. The head lock gates and gear would be the better for tarring and oiling, and it will be well to provide a plentiful supply of such materials for the wood-work and machinery of all works on the canal in order to preserve them from deterioration.

25 10TH SECTION, MAIN CANAL, 8 MILES.—The soil of this short section which extends from the Pennair to Cuddapah is for the most part bad, and the earth-works have suffered a good deal from guttering. In parts the canal side-slope has

been flattened up to water line to 3 or 4 to 1, while above this the bank is nearly vertical. The Punkal Wunkah aqueduct has leaked a good deal all over; this will in time stop, but after the experience gained in the upper sections such works ought to be constructed fairly water-tight in the first instance. The bed of the stream above the aqueduct requires to be regulated; its present tendency is to set over to the right bank, and if this be allowed to continue, the deep stream will approach the aqueduct very obliquely and may do damage. In the 187th mile the aqueduct of four 10 feet spans has leaked much; the masonry is hardly up to fair, and the wings are too short and too little splayed to make a proper junction with the banks without contracting the waterway. Revetments with a steep batter are now the only remedy available.

The principal irrigation sluices are at a short distance below the Punkal Wunkah aqueduct in the left bank of the canal. The supposed area of cultivation during the season just concluded is 1,600 acres. The returns furnished to this office by the Collector of Cuddapah show 3,322.15 acres in the district which includes nearly all the canal in the 9th section also.

At the lower end of this section there is a set of sluices by which surplus is disposed of. Just below these there is a weir across the surplus channel, and on either flank of this there are double-vented irrigation sluices.

26. LIME USED ON MASONRY WORKS.—The way in which the lime has at all the aqueducts, culverts, locks, etc., been more or less dissolved by the water leaking through the joints of the masonry shows that it is non-hydraulic, and that for canal works it would probably be much improved by the admixture of burnt clay. It seems probable that the absorbent character of the stone was not sufficiently taken into account when construction was going on, and that hot, dry stone having been bedded in the mortar all the moisture was absorbed, and the desired hydrate of lime could not be formed until water was supplied by leakage, when necessarily a good deal of the cementing material was washed out. At the masonry works to be carried out this season the Chief Engineer will take care that the stone is properly wetted, and that the suitability of the lime to hydraulic work is ascertained.

FORT ST. GEORGE,  
17th March 1873.

(Signed) JOHN MULLINS, Lieut.-Colonel, R.E.,  
Chief Engineer for Irrigation.

No. 250.

ORDER THEREON, 18th June 1873, No. 1,595.

IRRIGATION, No. 23.

ORDERED that this Memorandum by the Chief Engineer for Irrigation be communicated to the Manager of the Madras Irrigation and Canal Company with a view to the consideration of the remarks contained therein; also to the Revenue Department with reference to paragraphs 4 to 10, which relate to subjects on which it is desirable that the opinion of the Board of Revenue should be obtained. His Excellency the Governor in Council has in separate orders directed the Chief Engineer for Irrigation and the Chief Engineer of the Company, in communication with the Collectors, to re-consider the Rules relative to the supply of water to ryots; and on receipt of such draft Rules as they may recommend, orders will be passed on the subject.

Proceedings of the Madras Government, Public Works Department,  
18th June 1873.

2. His Excellency the Governor in Council is glad to find that the canal is in very fair order with reference to the duty it has at present to perform. He will not object to a supply being drawn from the Toombudra for the Company's Canal between the 1st January and the 1st June, whenever and so long only as the water may not be required in the Kistna District under the arrangements proposed by the Chief Engineer for Irrigation in paragraph 10 of his Memorandum, and these Proceedings will accordingly be communicated to the District Engineer, Kistna, for information and guidance.

(True Extract.)

*C. Walker* Colonel, R.E.,  
Secretary to Government.

To the Chief Engineer for Irrigation.  
" Manager of the Madras Irrigation and Canal Company.  
" District Engineer, Kistna.  
" Revenue Department. ✓

*Forwarded to the Board<sup>104</sup> of Revenue for an  
Op<sup>d</sup> to the Bd of Rev for an  
expression of their views on the points  
expressed in their views on the points  
raised in paras 4 to 10 of the Chief  
Engineer's Memo.  
Superior Memo*

*List  
10*

*M.D.  
2 July 73*

Exd. S. T. Austin.

20. Spare Copies.

*13 Letters of Rev Dec 11 73*

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••• PUBLIC WORKS.

THE CHIEF ENGINEER FOR IRRIGATION.

&c. &c. &c.

Dated June 18th.

Recd. June 30<sup>th</sup> 1873 Encl.

G. O., 18th June 1873, No. 1,595.

JUNE

Nos. 249-250

Madras Irrigation and Canal Company's  
Canal.—Passing orders on Memorandum  
by the Chief Engineer for Irrigation on  
the Madras Irrigation and Canal Company's  
Canal.

*W. H. Over*  
*No 7-2 July 1873*