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MADRAS RECORD OFFICE.

Government of Madras.

Public works **DEPARTMENT.**

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Dated 19-12-1872.

Not to be folded or roughly handled

Proceedings of the Madras Government, Public Works Department, 19th December 1872.

Read the following papers:—

No. 438. Memorandum from the Assistant Secretary to the Government of India, Public Works Department, (Irrigation,) to the Joint Secretary to the Government of Madras, Public Works Department, Irrigation Branch, dated Simla, 22nd October 1872, No. 130-1-I.:—

THE undersigned has the honour to invite attention to his office letter No. 130-I. of 24th April 1871, calling for a map showing the present state of the several works comprised in the Kistna project, and requesting certain information in regard to the expenditure and returns thereon, and to request early compliance therewith.

(Signed) G. T. SKIPWITH, Captain, R.E.,
Assistant Secretary to the Government of India.

No. 439. From the Superintending Engineer, 2nd Division, to the Secretary to Government, Public Works Department, dated Camp at Masulipatam, 2nd November 1871, No. 102.

I HAVE the honour to forward a skeleton map showing the works executed, in progress, and proposed for the completion of the Kistna project, and a report which I trust will be found useful, both to explain the map and for general service. The Kistna rises in 18·1 N. 73·41 E. about 40 miles from west coast. Its sources are 4,500 feet above the sea, but its general course is in deep cutting through extensive plains of black earth and sand, slightly undulating, with here and there hilly ranges of black basalt. Its principal tributaries are the Warna, Gutpurba, Mulpurba, Beema, and Toongabuddra, the last named furnishing nearly half the quantity which passes through the gorge in the Eastern Ghauts to the delta proper.

One Statement showing capacity of principal Irrigation channels.
Two Tabulated Statements of Kistna river above and below Anicut from 1863 to 1869.
One Map by banghy.

2. From this point the delta proper may be said to commence. The Budamair, draining 420 square miles of country and pointing towards the Kistna, is suddenly turned by the deposit of the river; thence flowing nearly parallel to it till it has passed through the gap in the short range of hill near Bezwada, it diverges at a considerable angle, and conveys the rainfall of the country east to the Colair lake. This natural basin (about the level of the sea) receives also the Tammilair, a small hill-stream draining 500 square miles, and running by three channels round and through the town of Ellore, the drainage of the western upland of the Godavery, and the surplus irrigation of a part of the delta of that river, as well as of the Kistna.

3. A weir was built in 1854 to keep up the supply in the lake for the irrigation of late crops in its bed, but it has much obstructed the discharge of the increased supply of water; a breach has been made behind the wing-wall, and this will probably not be repaired, so that the water will have a free flow to the sea by the salt creek (Uputair) which forms the boundary of the deltas of the two rivers.

4. The Pullair rises near Porankey, about six miles from Bezwada, and only one mile from the Kistna. It diverges gradually from that river till it reaches Weyoor, 3½ miles in a direct line from the bank, where it turns to the east, falling eventually into the Uputair. Below Weyoor it has, however, from time immemorial been dammed up, and its water, increased by all flood-water that over-topped the edge of the Kistna bank, has been carried into tanks for irrigation by channels of more or less length. In consequence of this the Pullair has really become a minor delta stream running along the ridge, and throwing off its supply on both sides long before the anicut was commenced.

5. On the left bank the channel fed in several cases a series of tanks, and almost reached the Colair—the receptacle of all the rain and surplus water from the fields which slowly found its way to it over the face of the country. Bad as the drainage was then matters are still worse now, for nothing has been done to lead off the water, while for the last sixteen years we have been adding largely to the irrigation. In 1837 Captain (now Colonel) Buckle cut or cleared anew a channel (Aga Kodee) from the Kistna at Wallurpolliam, the head sluice floor of which is 10 feet below high flood level, and thus ensured a larger and more continuous supply. This has been blocked up since the construction of the anicut enabled us to give a still greater quantity of water.

6. On the right bank of the Pullair the channels ran into large tanks generally—Kapleswarapoor, Kowtaram, etc. With the exception of the first these all tailed into the low ground or swamp running parallel to the coast behind the sand ridges, which mark the recovery of land from the sea, and only allow the passage of water at two points between the Uputair and the mouth of the Kistna; one at Masulipatam itself, and one near Gollapollem or Peddapatam, between which two places it appears to vary. The expense of any arrangements for drawing off the water has doubtless caused delay in taking them up; but even now considerable tracts of country have been untouched for sometime, as they could only be cultivated at a loss.

7. The surplus of Kapleswarapuram tank falls into the Beemanuddy, a drain which takes its rise near Vogerala. In the Davarakota Zemindary this water-course has been dammed up for the supply of the large tank at Kaza and for several smaller ones.

8. In the printed survey map it is represented as having a very tortuous course, much increased I believe now, as fresh cuts are made constantly for each village as it needs them. The stream ought to run freely into the creek under Masulipatam fort,* a portion falling into the Kistna near Yadara.

* See paragraph 56.

9. On the right bank of the Kistna, the Toongabuddra, passing within a few hundred yards of the river bank, carries the drainage of 200 square miles of country behind the Seetanagram hill; diverging gradually from the Kistna it receives the Guntur Nulla and the drainage of 804 square miles from the western taluqs and conveys it to the sea at Nizampatam.

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10. Into the backwater flows all the drainage and surplus irrigation water of the tract of country between it and the river; all of it much impeded in its course by the remains of the obstructive earthen works raised in former days to utilize the flood-water; from the map it will be seen how far the swamps extend along this coast.

11. A feeder from the Kistna was carried to this large drain above Seetanagram hill, and irrigation channels led off from the neighbourhood of Jagarlamudy to supplement the supply of the tanks at Bapetla, Commamore, Nandur, etc., whose the surplus waters of these all re-enter the Toongabuddra, but west of Bapetla all the drainage of the upper country, 452 square miles flows into the Rompa swamp, the head of which is near the end of the Bapetla tank bank; it is drained slowly by the tortuous creek near Chinna Ganjam.

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12. The deepening of all these outlets and cutting free water way through the swamps should be carried out immediately, both to save the existing land from inundation and to provide room for more cultivation.

13. So long ago as 1792, Major Beatson suggested the construction of a dam across the Kistna, and in February 1794, Mr. Topping was desired by the Government to investigate the subject; his death, in January 1796, appears to have put a stop to the inquiry.

14. The famine of 1832 33 in the Northern Circars was most severely felt in Guntoor; the loss is estimated (see Report of Committee on the project of an anicut, January 1849,) at one crore of rupees revenue, a larger amount of private property, 200,000 or 300,000 lives, and at least 200,000 cattle.

15. Captain (now Colonel) Buckle made some considerable improvements to the means of irrigation from the river. He cut a channel into the Budamair near Ibrampatam, one to the Pullair at Wallurpolliem, one to the Toongabuddra near Seetanagram, and another at Vellatur. All these, though affording only a precarious supply to the tanks, produced so considerable an increase to the revenue that Colonel Buckle was induced in 1839 to revive the proposal of a dam across the river at Bezwada. Captain Best in 1841, and Captain Lake in 1847, urged the advisability and advantages of this work, which were in consequence examined and reported on in January 1849 by a Committee of five gentlemen:—

Captain Buckle.
Captain J. H. Bell.
Captain Orr.
Mr. H. Stokes, Collector, Guntoor.
Mr. H. Forbes, Sub-Collector, Rajahmundry.

16. The question of a site was discussed over and over again. The Kistna, which flows for some miles in a bed averaging 3,000 yards in width, is suddenly contracted at Bezwada to 1,300 yards by two hills, whose bases it washes even in dry weather.

17. All the officers concerned appear to have at first feared lest the artificial obstruction of the current, already naturally increased, should be too great, but after examination of various other points, all decided on Bezwada, whereas they observed the immediate neighbourhood of the hills afforded an enormous supply of good material at so small a cost for carriage that a much larger work could be constructed in a shorter space of time here than at any other site; an expectation which, I may observe, has been fully realized by the event.

18. The original estimate, amounting to Rupees 7,66,541, was sanctioned by the Court of Directors, H. E. I. C., on the 8th January 1851, and work was commenced in October 1852, Captain Orr, who had had great experience on the Coovery Anicut, being placed in charge.

19. Below the line of the body of the work large stone, loosely packed, was thrown into the hollows, and the bed above was levelled with sand; a double row of wells, sunk 7 feet deep into it, formed the foundation of a front wall, coped on the top with stones 6 feet wide, and backed by 210 feet of rough stone carefully packed with a slope to the rear.

20. The top of the wall is 20 feet above the deep summer channel of the river, and 43 feet above H. W. mark, the highest recorded fresh passing 18 feet above it; a second retaining wall, 6 feet lower in level, was built 100 feet from the front; this section differs from that originally proposed. The following remark, extracted from a letter of Captain Orr to the Secretary Revenue Board, under date 11th August 1854, states reasons for the alteration and omission of cut stone:—
"The anicut, as it at present stands, consisting simply of a substantial masonry wall, backed by rough stone only partially packed, is quite as effective as if it were covered with masonry and is far safer, because the stream, instead of being precipitated over a smooth impervious surface, and thereby acquiring a force which on this river would be almost irresistible, is able on topping the wall, to find its way into and through the interstices of the stone in such quantities as suffices to fill the bed below the dam almost up to the level of the rear portions of it before any heavy overfall can take place, and the roughness of the surface breaks up and impedes the velocity so as thoroughly to destroy its power on the bed of the river below the line of the work."

21. I would here call attention to a point of great natural advantage in the site. The deep hole on the Seetanagram side mentioned in the early reports of the river, produced, in the next oscillation of the stream, a large sand bank on the opposite side, which is only covered in half freshes; the natural pool thus formed below the dam, acting as a cushion, has very much checked the overfall, and permitted the river to deposit at a place where, according to expectation, it should have scoured, and thus has further strengthened the dam. I append a statement of the head of water at different heights both of a rising and falling river.

22. At each end, and in the same line as the anicut, are constructed sluices; their floor 9 feet and 10 feet at Bezwada and Sectanagram, respectively, below the crest of the dam, or 34 and 33 feet above H. W. mark. Their fifteen vents of

6 feet span, 11 feet 6 inches high at Bezwada and 8 feet 10 inches at Seetanagram are intended to produce a scour during the freshes across the front of the *head sluices*.

23. On the Bezwada side these are placed in the line of the river bank immediately above and at right angles to the under sluices. The water passing through fifteen vents 6 × 10 feet 3 inches, floor 37½ above H. W. mark, is received in a rectangular basin, which turns it again into its proper channel almost parallel to the river. The lock for the passage of traffic is built a little higher up the river and enters the canal in a straight line. A bridge carries the Great Northern Road across the main and lock canals. The united streams should be 240 feet wide, but the space is so contracted between the river and the village that Colonel Anderson preferred to add to the velocity, which would not be difficult when the river is moderately filled. I cannot, however, omit to mention my belief that ere long it will be necessary to increase the number of vents in the head sluice, or, which would perhaps be more satisfactory, to add to the height of the anicut.

Three arches of 40 feet span.
Abutments 11 feet 2 inches high.
Versed sine 9 feet.

One arch of 16 feet span.
Abutments 15 feet high.
Versed sine 3 feet 6 inches.

24. I think that the facts stated above paragraph 21 serve to show that we have nothing to fear as to the stability of the dam, and that we may add as much as 2 feet without any risk. It might be done gradually, 6 inches or 9 inches annually; the command of water thus acquired would be very valuable in the beginning and end of the season.

25. For this purpose also we much need improved shutters in the under sluices which leak now enormously; this item will be entered in future estimates.

26. To return to the Main Canal, the estimate sanctioned, and under which work is now in progress, provides for width of only 200 feet, both banks to be pitched with rubble for a distance of 1,000 yards. On the left bank, where the traffic is now largest, 600 feet of this will be broken into masonry steps, with platform and ramp at each end, to enable carts to go up to the level of the road, 13 feet above.

27. I think that ere long it will be necessary to build a landing stage, etc., on the right bank also, to provide for the traffic during the freshes. The great velocity of the river, and the danger of being swept over the anicut, compel the retention of the ferry in its old position below the dam; with only 4 feet passing over that work it is necessary to tow boats five or six miles up one bank before they can venture to pass across to the other.

28. Consequently from June to November goods are conveyed from below the lock at Sectanagram, or by carts from Guntoor, etc., to the ferry boat, and by hand from it to the Bezwada Canal, below the lock where the shipment is at present very roughly and inconveniently done.

29. At the distance of 1,000 yards the Main Canal is divided into three; to Ellore nearly east; to Masulipatam south and south-east; and one, intermediate, generally known as Ryves' Channel.

30. The first of these passes under a stone bridge, which carries the roads to Ellore and Masulipatam, and falls at 11 miles into the hollow of the Budamair; in the original design it was proposed to straighten and improve this drainage stream for twelve miles to the neighbourhood of Kesarapulli, where it was to pass to the Colair over a long weir, which would regulate the supply to the High Level channel; a lock being also provided for any boats that might ply on this line.

One arch 60 feet span.
Abutments 8 feet high.
Versed sine 13 feet 6 inches.

31. A heavy fresh in the Budamair in September 1854 passed up the new channel and down that cut into the old Pullair, and caused so much injury to crops that Captain Orr was induced to modify the arrangement, and to keep the irrigation and drainage separate at a little extra first cost, which must have been more than repaid by the prevention of damage.

32. The separation was effected by carrying the Budamair under the Ellore Canal by means of an aqueduct; its course is, however, so exceedingly tortuous that the discharge of flood-water is very bad; the aqueduct is choked with silt, and early measures must be taken for straightening the bed and constituting it again, as it is by nature the main drain of this part of the country.

Ten arches of 10 feet span.
Abutments 4 feet high.
Versed sine 2 feet.

33. All irrigation now supplied by it must be provided for by other means; for this surveys are not yet taken.

34. From Kesarapulli the Ellore Canal runs at a level for 26 miles principally through private land, as yet not much cultivated, which must be better provided for hereafter by a side channel more capable of carrying the supply needed, this will be preferable to widening the existing canal. It crosses the drainage of the country, which is passed by seven under-tunnels, four inlets, and three outlets. These latter work moderately well, but their crests are generally higher than the ground immediately adjacent, and consequently a small quantity of water is dammed back, for the removal of which I propose to construct small under-tunnels.

35. Near Ellore the Tammilair flowing in two streams crosses the canal at two points about 2 miles apart. This hill stream has a fall of 8 feet per mile to the Colair lake, its natural bed is 2 feet above that of the canal, but the surface of its water (rarely more than 4 feet deep) is about the same as that in the canal. The original plan forwarded by Captain Orr, 23rd December 1854, provided for sluice bridges to regulate the water, and to permit the discharge of floods with gates to shut out the silt, and to retain the canal water in the event of the Tammilair subsiding more rapidly than the shutters could be closed.

36. The cost of these works was estimated at Rupees 18,284. They were not commenced for some years and in the interval this plan was set aside, on one branch in favour of an aqueduct* which Captain Orr had condemned on the ground of the enormous outlay needed for deepening the channels of the Tammilair.

* Twelve vents 15 feet span.
Abutments 4 feet high.
Versed sine 3 feet.
Crest of extrados 33 feet 5½ inches above H. W. mark.

37. The new design cost Rupees 80,000, though a part only of the channel was deepened; a weir was built immediately above the aqueduct to produce a scour though the arches of the latter work, but all has been in vain, the river has silted up and scarcely any of the masonry is visible.

38. In the other branch an inlet and outlet have been built; but they have also caused so much deposit that I am inclined to recommend the entire closing of this branch. The Godavery Officers are examining a project for constructing a large reservoir a few miles above Ellore across the Tammilair. If this is carried out we shall probably have so little water to deal with in the surplus that we may leave it to percolate under the aqueduct.

39. If this reservoir is not built I think it would be more satisfactory, as it would be certainly cheaper, to revert to the old plan; this however may stand over for the present.

40. Immediately beyond the outlet is the lock which with a drop of 8 feet connects the Kistna and Godavery Canals.

41. The Ryves' Channel (paragraph 29) formerly was a branch taken from the Ellore Canal a little above the Budamair Aqueduct, to supplement the supply from the Pullair; when it was found necessary to enlarge this latter Colonel Winscom, the Superintending Engineer, preferred, for various reasons, to take a separate line from the Main Canal.

Sluice 3 vents 6 feet span.
Abutments 6 feet high.
Versed sine 3 feet.
Water discharge 40,000 cubic yards.

42. He thus proposed to avoid the delay and expense of widening a canal in which water would be flowing for nine or ten months in each year; and to secure economy in the expenditure of the water at times when it is required only for navigation, for which this new* line is not intended.

The head sluice consists of fifteen vents of 6 feet span.
Abutments 5½ feet high.
Versed sine 3 feet.
Bridged by 3 arches of 40 feet span.
Abutments 5½ feet high.
Versed sine 12½ feet.
* Sanctioned in G. O., No. 2,543, dated 20th August 1867.
† 90 feet wide, 4 inches per mile fall.

43. It runs† for nearly 7 miles parallel to the Ellore Canal, and then joins the original Ryves' Channel which, following a line almost parallel to the Masulipatam Canal, falls into the Pullair at Marrivada.

44. At Komategunta, 14 miles from its head, the Gudivada branch channel is taken off by a head sluice adjoining which is a regulating sluice across the main stream.

Four vents of 4 feet span.
Abutments 4 feet high.
Versed sine 2 feet.

45. The branch channel is 19½ miles long, tailing into the Polrazkodu. It has a fall of nearly 14 inches per mile, regulated by two falls bridged; this gradient is found in practice to be too great for direct irrigation, and I propose, instead of widening this channel as sanctioned, to cut other channels with less fall; surveys are now in progress for laying these out; below Gudivada this canal obstructs all the drainage of the

Three vents of 16 feet span.
Abutments 3 feet high.
Versed sine 4½ feet.
Two vents of 10½ feet span.
Abutments 5 feet 4 inches high.
Versed sine 3 feet.

country to the south, and the surplus water from the Pullair, the branches of which all tail into it, and cause great inconvenience and frequent injury; various plans have been suggested for remedying this, but none of them appeared to me satisfactory. The Chief Engineer, with whom I discussed all, has therefore assented to my proposal to abandon the last 6½ miles of the branch channel and to carry both irrigation and drainage in their natural courses from the Pullair converging to the Colair lake.

46. The surveys of this part of the country are still incomplete.

47. The Masulipatam Canal was the new head of the Pullair, formerly the main irrigation duct; it follows its course generally as far as Kankipaud, 12½ miles, avoiding its greater turns; the bed of the artificial channel has a fall of 2 inches per mile, but in consequence of the great demand for water in the Pullair at present we have frequently a surface fall of 7 inches per mile.

48. At Kankipaud is the first lock 150 feet long 20 feet wide as there is generally a depth of 6½ feet on the upper and only 5 feet on the lower sills; there is really a drop of 9½ feet in the lock; a large weir was built at this point on the original system of utilizing the old channels; now only a part of it is required for the lower reach of the Masulipatam Canal; another part has been altered to form a head sluice for the West Side channel, which was proposed by the late Colonel Anderson, when Superintending Engineer, to separate irrigation from navigation in canals carrying water so extraordinarily charged with silt as that of the Kistna.

Upper sill 35 feet, 4 above H. W. M.
Lower sill 27 feet 4 ,, ,,

Three vents of 3 feet span.
Abutments 10 feet high.
Versed sine 2 feet high.

Nine vents of 2 feet 9 inches span.
Abutments 2 feet 9 inches high.
Water discharge 80,500 cubic yards.

49. His idea was that by giving to the side channel a steeper gradient than could be allowed for navigation, he would avoid much of the deposit; he has however approached too nearly the natural fall of the country, and consequently the water, instead of passing to the fields by sluices, theoretically large enough to convey the needful supply, continues its course in its own bed, and we have been obliged to obtain an artificial head by dams. These, of course, reduce the fall, and diminish the velocity of the current, consequent on which deposit takes place.

50. I would suggest, therefore, that in future the gradient of irrigation channels should be reduced and navigation channels have no fall in their beds, the slope of the country being overcome by locks. In a still-water canal the amount of water required to replace evaporation, lockage, etc., would be so small that we could not receive much increase of silt; the improvement to navigation would be very great, as now traffic is much impeded by having, during nearly the whole of the season, strong winds blowing down-stream.

51. The West Side channel has been excavated generally as a separate line, but for some miles, where the Masulipatam Canal was too wide, a bank has been erected in its bed to part off a portion for irrigation.

52. By some oversight the masonry works were omitted; a supplemental estimate is therefore being prepared.

1st Set.
Six vents 4 feet span.
Abutments 3 feet 6 inches high.
Versed sine 1 foot 6 inches.

2nd Set.
Six vents of 4 feet span.
Abutments 4 feet high.
Versed sine 2 feet.

53. Opposite to this the Pullair is supplied in its old course by two sets of sluices which are intended to pass 120,000 cubic yards per hour, supplementing the quantity through Ryves' Channel head sluice and providing for 156,000 acres in all.

54. The arrangement of all these works is exceedingly unsatisfactory; the navigation is for a short distance very dangerous as boats have to pass between these two head sluices to the lock immediately beyond; this is in dead water, there is, therefore, a constant deposit of silt in the spot which a boat would seek for refuge; the lock establishment is obliged to remove every day enough to enable them to open the gates; another culvert has been recommended by the Chief Engineer to reduce the time of working the lock. I would urge its construction, the more as it would help to remove this shoal by the scour.

Upper sill 24 feet above H. W. M.
Lower sill 16 feet ,, ,,
Depth of water U. S. 6 feet 6 inches.
Do. do. L. S. 4 feet.

Calingulah.
Three vents of 15 feet span.
Abutments 2½ high.
One vent 4 feet span.
Abutments 7 feet high.

Nedamole Lock.
Upper sill 12 feet above H. W. M.
Lower sill 5 feet 8 inches.

Aukumarru Lock.
Upper sill 5.
Lower sill.

Tidal Lock.
Upper sill.
Lower sill 7 below H. W. M.

55. The second lock on the Masulipatam Canal is at Veranky, 25 miles from Bezwada; this is of the same dimensions as that at Kankipaud; the lower channel is supplied by a weir.

56. The third lock is at Nedamole, 37 miles; the fourth at Aukumarru, 43 miles; the last which drops the canal into tide-water is at the Fort of Masulipatam; the creek is 3 miles to the sea. At its mouth is a bar always inconvenient, sometimes dangerous. The south wind and current, which prevail for several months along the coast, tend to carry the mouth year by year further north; the counter-current during the north-east monsoon is turned by Narasapur point, and has very little direct effect on the bar. The clearing out of the old Chinnapoor Canal from the Kistna near Yadara to the creek is also suggested by Captain Smalley both as furnishing a scour and as a means of communication. I doubt its efficacy for the first, but it would be so valuable for traffic that I strongly support it. It was mooted by me in 1855, but for some reason the clearing which I began was stopped and has never been resumed.

57. The cyclone wave of 1864 cut the mouth in another place, and Colonel Anderson hoped to maintain it there by clearing out a channel from the swamps around and west of Masulipatam, which receive the drainage of about 88 square miles of country.

58. An estimate for Rupees 21,360 was sanctioned, but funds have not been provided, and meanwhile the work done is yearly being injured and doing no good.

G. O., No. 1,928, dated 14th June 1869.

59. Returning to Kankipaud we have on the left bank the Pullair running with a fall of 10⅓ inches per mile to Weyoor, 9 miles, where its descent is regulated by a fall of 4 feet with shutters; a little below this is taken off the old channel to the Kapleswarapoor tank, having its sluice in the line of the Masulipatam and Hyderabad road.

One vent 2 feet 3 inches span.
Abutments 1 foot 7 inches high.
Versed sine 1 foot 1 inch.

60. After running 5 miles more in cutting, it meets at Marrivada the Ryves' channel, see paragraph 43.

61. Immediately below their junction is the sluice of the Gandikodu, another of the old irrigation channels, which, flowing past Gudivada, supplied a considerable area of land towards the Colair lake.

Two vents of 4 feet span.
Abutments 6 feet high.
Versed sine 1 foot 6 inches.

62. It now crosses the branch channel from Komatigunta (paragraph 44) by an inlet and outlet. I propose that the branch channel shall be dammed at this junction, and be passed over the outlet; and that the Gandikodu be turned into the branch channel at a lower point to maintain the supply for the Dondapaud channel, a mile lower down, a space being thus left for the drainage of the triangle between the branch channel, the Pullair and the Gandikodu, which is now regularly swamped.

63. The Pullair is crossed at Pamarru by a bridge carrying the road from Masulipatam to Gudivada. In its floor are built grooved iron posts to hold shutters by which the water may be raised 3 feet for the supply of another channel running towards the north end of Gudivada.

Three vents 20 feet span.
Abutments 3 feet high.
Versed sine 6 feet.
One vent with lift bridge 16 feet wide.

64. At Pamarru the Masulipatam canal is about half mile from the Pullair; a small canal with a lock has been cut to facilitate communication.

65. About half a mile below Pamarru on the right bank is the head sluice of the East Side channel; this runs along the Masulipatam Canal bank supplying water to 12,500 acres; north of the latter, at Aukumurru, it turns to the east, and, under the name of the Ramrazpolliem channel, irrigates the low land between it and the swamp; a part of which we look forward some day to reclaiming and cultivating.

Two vents of 8 feet span.
Abutments 5 feet high.
Versed sine 2 feet.

66. The Butlerkodu head sluice is a short distance below the East Side channel on the same bank. It and its branches irrigate the space between the Pullair and the sand ridge on which stand Gudur, Pedana, etc., eastward to a short distance beyond the road from Masulipatam to Kowtaram. The surplus water of this tract is collected in the Luzzabunda Kodu, close to the sand ridge, and conveyed to the swamp.

Two vents of 8 feet span.
Abutments 4 feet high.
Versed sine 2 feet.

67. The Palakodu and Chittrum channels taking off on the left bank supply 1,000 and 510 acres, respectively, of the slope towards the Colair. As soon as the

weather permits surveys will be carried on to arrange for the drainage and irrigation which is now much affected by the Ryves' branch channel.

68. The slope of the country being both north and eastwards, the irrigation generally will be from the right bank of each of these four channels, the surplus water of each tract being carried away by a drain cut along the left bank of the next irrigation channel below. All channels, whether for drainage or irrigation, conveying and discharging into the Colair.

69. At 7½ miles below Pamarru near Kowtaram the Pullair passes over a weir with road bridge into its old bed somewhat straightened at first. It supplies a little land on its immediate banks, but is on generally too low a level, and will probably be the principal drain of this part of the country into the Uputair (see paragraph 3).

Two vents of 8 feet span.
Abutments 5 feet 2 inches high.
Versed sine 2 feet.

70. A short distance above the weir on the left bank is the head of the Polraz Kodu, a sluice bridge with posts and shutters to regulate the discharge, which we shall probably find advisable to convert into a regular fall with a lock for navigation; the lower part of this old irrigation channel has been left as a drain receiving the end of the Ryves' branch channel, and a new line has been cut running easterly on a higher level, as far as Vinjarampaud. It must be extended to the Uputair into which it is proposed to lock, thus completing the communication with the Godavery system of navigation.

Two vents of 15 feet span.
Abutments 9½ feet high.
Versed sine 5 feet.

Names.	Vents.	Span.	Abutments, height	Versed sine.
		FT.	FT.	FT.
Dakeru	3	2	3	1
Guraja Kodu ...	1	2	3	1
ChigurucotaChannel	2	2	3	1
Chevuru Kodu ...	4	2	3	1
Thadigunta Kodu.	1	2	3	1

71. On its right bank are the Dakeru, Guraja Kodu, Chigurucota channel, Chevuru Kodu, and Thadigunta, head sluices of which are of dimensions given in margin.

72. On the left bank is the Kykaluru channel watering 4,000 acres, which requires also to be extended. This tract of country consists entirely of alternate sand ridge and hollow, and our plans are drawn up with a view to conveying irrigation water along the former and draining the latter into the Uputair.

Kykaluru head sluice.
Three vents of 4 feet span.
Abutments 2½ feet high.
Versed sine 1½ feet.

73. At Kowtaram, close adjoining the weir of the Pullair, is a lock and weir for the channel to Buntumilly 14 miles long; the bed has a fall of 6 inches per mile which produces so rapid a current that we have failed to irrigate the adjacent lands. Rough stone dams have been consequently for some years constructed to regulate the supply, these have prevented all navigation from the very important salt pans; we propose, therefore, to construct a lock 12½ miles down it, and to reduce the fall to 2½ inches per mile; the bed is so much raised by silt that this will probably be also cheaper than deepening.

Lock 100 feet long 15 feet wide.
Pulleru weir.
Three vents of 10 feet span.
Abutments 9 feet high.
Versed sine 2 feet.

74. The channel now terminates in a weir at high water mark, the surplus water finding its way through low land and swamp. I propose continuing it to the Uputair and dropping it by a second lock into that tidal creek, which will complete a useful line of navigation into the Godavery system.

75. The irrigation of the land on the right bank will be carried on by a channel taken off above the lock, or rather improving old channels into a good system, which has to be considered, as also the means of draining the swamps close along the coast and recovering at least some portion for cultivation.

76. On the right bank of the Masulipatam canal, about 4 miles from its head, Colonel Anderson proposed to take off the canal to run close along the east bank of the Kistna, and, by an aqueduct or under-tunnel across its smaller branch, to the minor Delta (Divy). It will follow principally the line of pits dug for the embankment, but we require surveys to enable us to select the point at which to build the aqueduct. These will be undertaken shortly.

77. The canal will irrigate about 45,000 acres lying between it and the Beemanuddy, the drain (see paragraphs 7 and 8) of this tract of country.

78. This stream rises near Vogerala and receives the surplus of the Kaplas warapooram tank, it is passed under the Main Canal by a tunnel near Inampudi, but its course beyond has been so impeded by the cultivators in the Devarakota Zemindary that there is now no defined channel; it is represented in the printed map as a tortuous and intertwined channel, but the map gives a poor idea of what it really is.

One vent of 6 feet span.
Abutments 2 feet high.
Versed sine 2 feet.

79. We proposed some years ago to supply water from the Main Canal project, *vide* Budget Item 149 of 1868-69, but the cultivators were afraid that the Zemindar would take advantage of any alteration to increase his demands, and refused to use the water or to increase cultivation.

80. There are, however, villages belonging to Government and to other parties below the Devarakota property, and something must be done in their interests, as well as to draw off the water which floods the country around Inampudi, and which would be of great service in scouring the creek and bar near Masulipatam (see paragraph 57).

81. As soon, therefore, as the season will allow, I propose to have these surveys completed, and, if we cannot make amicable arrangement with the Devarakota Zemindar, to secure at least a clear course for the drainage under Act X. of 1870, "Land Acquisition Act."

82. On the right bank of the Kistna a cut has been made above our works to permit the flow of the Upper Toongabuddra (see paragraph 9) into the Kistna while the lower part of that stream has been supplied from the river by means of a head sluice similar to that at Bezwada, a lock provides for the means of navigation. The under sluices are built on the rocky slope of the Seetanagaram hill which running into the river forms a small bay above the line of the anicut,

Fifteen vents of 6 inches span.
Versed sine 3 feet.
Height of abutment 10 feet 3 inches.
Floor 37 feet above H.W.M.
Fifteen vents of 6 feet span each.
Versed sine 3.
Height of abutment 8·10.
33 feet above H.W.M.

83. For the 8 first miles, the Main Canal below the head sluice follows generally the course of the Toongabuddra, considerably widened and deepened. Unfortunately the soil taken out has been put near the edge, and must be removed a considerable distance before we can complete the excavation to the dimensions, 235 feet which will be necessary, if our expectations as to additional cultivation are fulfilled.

Original breadth 45 feet.
Proposed at present 96 feet.
To be done hereafter 235 feet.

84. Colonel Anderson thought that possibly a supplementary channel might be carried between the river and the hill; and that the quarrying of stone required for public works meanwhile would go far towards its completion. We have not yet cleared sufficiently for the Great Northern Road which has been turned this way to take advantage of the bridges over the lock and head sluice. I see no prospect of our cutting enough for this canal.

85. According to the original design a High Level channel was to have been carried from the right bank in the 7th mile. It was partly excavated as far as Nambur; but Colonel Anderson thought it advisable to abandon it, the dotted line shows its general direction. It appears very doubtful whether the Kistna ordinarily has water enough to cover this upper area, and it is as well at any rate to defer the execution of work till we have completed what is fully commanded, and therefore more certainly advantageous.

86. In the 8th mile the West Bank channel takes off, it follows the line of pits dug for the flood embankment of the river. It has a breadth of 30 feet which must be increased to 75 feet for the supply of 38,000 acres; its slope is 6⅔ inches per mile, which is regulated by a drop at Kollur 14 miles below, bridged for traffic; the head sluice of a branch irrigation channel was built here and the channel itself cut, but the villagers have not taken up any land though they previously made many promises to induce us to take up the work.

Head sluice.
Five vents of 6 feet span.
Abutments 7 feet 6 inches high.
Versed sine 2 feet.

Lock.
Upper sill 35 feet 5 inches.
Lower sill 35 „ 5 „

Six vents of 10 feet span.
Abutments 9 feet high.
Versed sine 2 feet and two cuts 3 feet × 3 feet in the centre of bodywall itself 7 feet high.
Crest 26·5.
Floor 119·5.

87. Five miles further is a second drop near the village of Vellatur to afford a command to the Allur channel or more properly Vellatur channel (paragraph 88).

Head sluice.
Seven vents of 4 feet span.
Abutments 2 feet high.
Versed sine 2 feet.
Floor 15·42.
Crest 19·75.

88. In the 27th mile or 8 miles below Vellatur is a regulating bridge Penamudy for the Iskapully channel (see paragraph 95) and below it, direct irrigation for about 10,000 acres is provided. The Vellatur channel is an old one cut to supplement by water

Four vents of 8 feet span.
Abutments 7 feet 4 inches high.
Versed sine 1 foot 6 inches.
Floor 10·5 with shutters.

from the Kistna, the drainage of the country which it completely intercepted and conveyed to the tanks at Allur and Budam near the Toongabuddra; when this was cut off by the Nizampatam canal (see paragraph 99), a weir was built across the Toongabuddra itself (the Dumpakodu calingulah) and a channel cut to the tanks.

Crest 6 feet 2½ inches.
Floor 3 ,, 2½ ,,
Length 96 feet.

89. This arrangement was wrong and avowedly temporary; it will be done away with on the completion of the Budam project now in progress (see paragraph 109).

Sanctioned in G. O. No. 2,598, dated 31st October 1870.

90. After the supply was obtained from the Kistna above the anicut, some endeavour was made to keep the irrigation and drainage water separate in the first mile from its head sluice; the Vellatur channel passes by a tunnel the Munangy drainage, a stream which rising near the village of that name 18 miles above brings a considerable quantity of the surplus water; the remainder, it will be convenient to say here, finds its way by various means, inundation, or petty drains, to the terminus of the irrigation channel near Razole (see paragraph 92).

Three vents of 8 feet span each.
Abutments 3 feet high.
Versed sine 1 foot.
Floor 7 feet above H.W.

91. A little beyond the Munangy under-tunnel the Vemavaram Branch channel takes off, and a few yards further (within the 2nd mile) the Vellatur channel is regulated by a sluice adjacent to which on the right bank is the head of the Addapully branch channel.

Two vents of 3 feet 9 inches span.
Abutments 3 ,, 6 ,, high.
Versed sine 1 ,, 9 ,,
Floor 9·88.

Three vents of 8 feet span.
Abutments 6 feet 4 inches high.
Versed sine 1 foot 6 inches.
Floor 10 5.

Three vents of 4 feet span.
Abutments 2 feet high.
Versed sine 1 ,, 4 inches.
Floor 11 feet.

Regulating sluice.

Three vents of 8 feet span.
Abutments 7 feet high.
Versed sine 1 ,, 6 inches.
Floor 5·62.

92. After affording by these supply for 8,000 acres, the channel is dropped by a regulating sluice at Razole (paragraph 90) into the drainage channel which spreads into the low pool called the Nallavada formerly in free communication with the Toongabuddra, but now barred by the Nizampatam channel (see paragraph 99).

93. There is a considerable irrigation under the Nallavada into which (see paragraph 102) the East Side channel of the Nizampatam canal also tails, and means must be taken hereafter for draining off the surplus, by one or more of the hollows in the sand ridge which bounds this pool, into the backwater of Nizampatam; this is shown in the map approximately.

94. The Iskapully channel (see paragraph 88) intended to supply water for 20,000 acres runs generally parallel with the Vellatur channel; but beyond the direct course of the Munangy into the lower part of which it tails. This

Three vents of 8 feet span.
Abutments 6 feet 6 inches high.
Versed sine 2 feet.
Floor 9·5.

channel has been partly excavated and has been in some degree remunerative; but its principal returns will be derived from the drainage and irrigation of the Salevendrapara, a swamp of about 20,000 acres.

95. The Iskapully channel at present crosses the salt creek (the natural discharge for the Munangy drainage) between embankments, it is proposed to construct at this point an under-tunnel; at present all the drainage of this part passes through one channel to the sea, by the arrangement proposed the Munangy drain will have an outlet under the Iskapully channel, while the Rapully Taluq main drain will have an outlet by the salt creek which passes near Pregnem, and into which the Iskapully channel tails.

96. Twelve miles from the head sluice near the village of Duggirala, the Main Canal is divided into the Nizampatam and Commamore channels.

97. The former is entered by a lock; the supply of water in its lower reaches being maintained by a weir, and is intended exclusively for navigation, the irrigation being carried on by separate channels running on either side; their head sluices and the weir to the Commamore channel making this part of the navigation as dangerous as that near Kunkipaud (see paragraph 54).

Upper sill 33·5.
Lower sill 25 5

98. Proceeding along the Nizampatam canal we have locks at Kuchipudy 22nd, Inturu 32nd, Nallavada 37th, and the junction with the Toongabuddra below tide mark in the 42nd mile. The line follows generally the dividing ridge between the Toongabuddra and the petty channels which drain all the land east to the Kistna.

Kuchipudy—Upper sill 22 feet 6 inches.
Lower sill 14 ,, 6 ,,
Inturu —Upper sill 11 ,, 6 ,,
Lower sill 4 ,, 6 ,,
Nallavada—Upper sill 4 ,, 6 ,,
Lower sill 0·55.
Tidal Lock—Upper sill H.W.M.
Lower sill 7.

Escape level 2·55.

99. At Nallavada all the collected water used to flow across the present line of the Nizampatam canal to the Toongabuddra; of late years it has laid for weeks in the swamp, finding its way by petty cuts, or percolating through the sand; in cases of extraordinary rain, the canal banks have been cut and some relief thus afforded.

100. It will be both expensive and inconvenient to carry this on permanently, and, as stated in paragraph 93, we propose to drain it through the sand ridge.

101. The navigation from the tidal lock to the salt pans and town of Nizampatam is very bad; the backwater and creeks are ill-defined, low, and covered with vegetation and the course necessarily followed very winding. It is unfortunate that the lock was not built near the town, two miles in a direct line from its present site. Though not immediately necessary, I think that, for the encouragement of the traffic (specially in salt), it may be advisable at no distant period to make this improvement.

102. The East Side channel of the Nizampatam canal takes off immediately above the first lock by a head sluice; its bed has a general fall of 10½ inches per mile for 14,300 acres; this is regulated by drops at 5½, 8½, 13½, 18½, and 23½ miles, Tenally, Kuchipudy, Turumalla, Yuntoor, and Nallavada, the channel

Six vents of 4 feet 6 inches span.
Abutments 4 feet high.
Drop 1 foot 6 inches.
Versed sine 2 feet.

ends in the Nallavada (see paragraph 93). The West Side channel runs parallel to the bank on the other side; it supplies 8,080 acres; its drops are in the same line with those on the eastern side; the channel tails to the Lower Nallavada. Both the channels command the country thoroughly; some of the branches of these channels have much too heavy a fall; their beds should be rectified by the introduction of a few small drops; this will doubtless entail some strengthening to the banks.

Two vents of 5 feet span.
Abutments 5 feet high.
Versed sine 2 feet.

103. The Commamore channel taking off at Duggiralu (see paragraph 96) by a lock and two weirs follows the old tortuous course of the Toongabuddra to Jagerlamudy, where it is regulated by an escape sluice, this discharges also some of the surplus brought down by the Guntoor Nulla which here falls into it. The lock is a revetted excavation, its chamber is 150 feet long 40 feet wide at top and 20 at bottom, the gates being carried by masonry blocks.

Lock.
Upper sill 34 feet.
Lower sill 28·5.

Weirs.
Nine vents of 5 feet span.
Abutments 5 feet high.
Versed sine 2 feet 6 inches.

Seven vents of 4 feet span.
Abutments 4 feet high.
Versed sine 2 feet 6 inches.

Lock upper sill 25.
„ lower sill 22.

104. From this point the whole channel requires much attention; it has been excavated across the drainage of the old country and very inefficient means generally have been provided for its passage.

105. Part of the Nakkavagu is carried under the channel by an aqueduct near Kolemerla, but further means are required at Garikapud where a large body of water falls into the channel.

Six vents of 10 feet span.
Abutments 3 feet high.
Versed sine 1 foot 6 inches.
Floor of aqueduct 9 feet.
Crown of extrados 16·5.

106. The Nallamada, draining 428 square miles, passes the channel at a level; the proposed inlet is not built, as it would head back the water over a very large area; the outlet is a good work of its kind; the principle is, however, in my opinion, wrong. When the Nallamada is in flood we are obliged to close the sluices at Jagerlamudy and to check the supply for irrigation, which would utterly stop navigation on what will hereafter be one of the principal lines of traffic. The Nallamada turns also down the Commamore channel and deposits every flood an immense quantity of silt.

Fifteen vents of 10 feet span.
Floor 11·5.
Crossed by a flat wooden bridge.

107. Further on the Saki Calva and Purchur Vagu, flowing in ill-defined beds when low and inundating the whole neighbourhood when in flood, bring down the water of 228 square miles on the channel, the banks of which are consequently almost washed away, and the bed very much altered by scour and deposit. The works named in

Calingulah and under tunnel for Saki Calva.
Inlet and outlet at Karewichedu 9 feet arches.
Do. do. over Konkalamarru.
Do. do. Swarna.
Outlet Santaravuru calingulah for Allairu.

margin have been constructed, but they are quite inadequate and have suffered much and the whole must be re-modelled.

108. When these are completed the channel will tail into the creek which drains off the Romperu near Chinna Ganjam; this will probably be a considerable port, as the anchorage is good and fairly protected by the Motupalli shoal. The subject of situations for locks to afford the means of navigation below Jagerlamudy is under consideration.

109. At Oramunda, 12½ miles from Jagerlamudy escape sluice (see paragraph 103), the Toongabuddra is crossed by a regulating dam, and a channel was taken off in 1862-63 to supply the large tank at Sandole, to supersede the unsatisfactory method of irrigation stated in paragraph 88. A project was prepared and sanctioned in G. O., No. 2,598, dated 31st October 1870, for enlarging and prolonging this channel so as to supply the existing cultivation and that now under the Dumpakodu calingulah. This is now in progress. The land under it is calculated at 9,000 acres, but all of our information is still very bad. The Range Officers have been now for upwards of a year endeavouring to collect the entries in Revenue Survey Registers for the areas of fields under each minor channel, but have had great difficulty in procuring even this.

Four vents of 8 feet span.
Floor 12·15.
Crest 14.

Upper floor of under tunnel 10 feet 4½ inches.
Crest of surplus channel 12 feet 2½ inches.
Floor of Irrigation Channel bridge 10 feet 8½ inches.

110. When these statements are completed, we shall be in a better position to judge of the real wants and to distribute water accordingly.

111. The above, I would beg to say, is intended merely as a sketch of our position at present to which it may be convenient to refer when the details of the project are hereafter forwarded.

Statement showing the proposed capacity of the principal Irrigation Channels in the Kistna Delta.

—	Bottom width in feet.	Depth of water in feet.	Surface fall per mile.	Velocity in feet per second.	Discharge in cubic yards per hour.	Probable acreage of cultivation.	—
Ma[illegible]atan Delta.							
Main Channel	180	8	6″	2·7	5,40,000	2,70,000	.....
Ellore Canal to 8th mile	120-150	8-6½	5″	2·1	2,70,000	1,35,000	.....
Do. 8th to 11 do.	60	6	5″	1·9	88,000	(a)44,000	.....
Do. 11th to Ellore	54	6-5	½″	·5	20,000	9,000	
Branch from Casarapully to Parikeed	30	5	7″	1·9	47,000	23,000	(a) 47,000
Budamair Channel	20	6	6″	1·7	31,000	15,000	
Ryves' Channel to 7¾th mile	100	6	7″	2·3	1,92,000	(b)96,000	.....
Branch Channel	32	4	12″	2·3	51,000	25,000	
Below 7¾th mile	75	6	7″	2·2	1,48,000	74,000	(b) 99,000
At junction with Pullairu	65	6	7″	2·2	1,30 000	65,000	65,000
Pullairu at Kankipaud	60	6	7″	2·2	1,20,000	60,000	.....
Do. at junction with Ryves' Channel	50	6	7″	2·3	99,000	49,000	49,000
	.....	.....	.....	.....	.....	.....	1,14,000
Do. below do.	110	6	7″	2·3	2,15,000	(c)1,07,000	.....
Do. Pamurru to Polerazukodu	75	6	7″	2·2	1,48,000	74,000	.....
Polerazukodu	30	5	5″	1·6	40,000	20,000	.....
Buntumilly Channel...	36	5	6″	1·8	52,000	26,000	.....
Butterkodoo	20	4	8″	1·9	26,000	12,500	.....
Side Channel, Masulipatam Canal	20	4	8″	1·9	26,000	12,500	.....
Old Pullairu...	.....	.....	.....	.....	.....	10,000	.....
Minor Channels	.....	.....	.....	.....	.....	25,000	(c) 1,06,000
Masulipatam Canal to 4th mile	120-126	8½-7½	5″-6″	2·0-2·4	2,70,000	* 1,35,000	.....
Do. 4th to 13th mile	60	7½-6	5″-6″	2·	1,20,000	60,000	.....
Pullairu as above	.....	.....	.....	.....	.....	60,000	60,000
Channel to eastern bank of Kistna	90	6	7″	2·2	1,74,000	(d) 87,000	.....
Eastern Bank Channel	45	6	7″	2·1	90,000	45,000	.....
Side Channel, Masulipatam Canal	42	6	7″	2·1	85,000	42,000	87,000
	.....	.....	.....	.....	.....	.....	* 1,47,000

Statement showing the proposed Capacity, etc.—(Concluded)

—	Bottom width in feet.	Depth of water in feet.	Surface fall per mile.	Velocity in feet per second.	Discharge in cubic yards per hour.	Probable acreage of cultivation.	—
Guntoor Delta.							
Main Channel to 8th mile	196-230	8½-7	6″	2·1	4,70,000	*f* 2,30,000	.....
Western Bank Channel to Kollur	75	6½	6″	2·1	1,54,000	75,000	.....
Do. Kollur to Vellatur...	60	6	7″	2·2	1,20,000	60,000	Diff. 15,000
Do. Vellatur to Iskapully Channel	45	6	7″	2·	84,000	43,000	,, 17,000
	30	6	7″	2·	62,000	30,000	,, 13,000
Do. Iskapully Channel to Terminus	30	.....	.....	.....	.....	.....	15,000
Iskapully Channel	30	.....	.....	.....	.....	.....	15,000
	.....	.....	.....	.....	.....	.....	*f* 75,000
Main Channel, 8th to 13th mile	180	6½	6″	2·	3,20,000	*g* 1,60,000	.....
East Side Channel, Nizampatam Canal	42	4½	10″	2·4	70,000	35,000	
West Side Channel, do.	24	4½	10″	2·2	41,000	20,000	*g* 1,58,000
Commamore Channel to 8th mile	120	6	6″	2·	2,06,000	*h* 1,03,000	
Do. below 8th mile...	100	6	6″	2·	1,74,000	87,000	.....
Toongabuddra	.....	.....	.....	.....	.....	16,000	16,000
Commamore Channel at Garrikepad, 23rd mile	75	6	6″	2·	1,33,000	66,000	Diff. 21,000
Opposite Baputla Tank	50	6	6″	2·	94,000	47,000	,, 19,000
Between Baputla Tank and Terminus	50-30	6	6″	2·	.....	.....	47,000
	.....	.....	.....	.....	.....	.....	1,30,000

BEZWARA,
[illegible]th January 1863.

(Signed) J. C. ANDERSON, Major, R. E.,
District Engineer, Kistna.

Tabulated Statement of Kistna River, from 1863 to 1869.

River rising.								River falling.							
Crest of Anicut.	Water surface above weir.	Water surface below weir.						Crest of Anicut.	Water surface above weir.	Water surface below weir.					
43' above H. W. M. 20' above deep bed.	21 0	6	11	10	3			43' above H. W. M. 20' above deep bed.	21	9	7	9	9	...	..
	22 0	12	0	11	3				22	12	9	...	...	...	...
	23 0	15	5	...	...				23	14	10	15	5	...	...
	24 2	16	6	...	...				24	16	9	17	5	16	3
	25 0	19	3	18	11				25	18	5	18	8	19	7
	26 0	20	11	...	...				26	21	0	...	...	...	...
	27 0	22	10	23	0				27	23	9	...	...	...	...
	28 0	24	3	...	...				28	24	2	...	...	...	...
	29 0	25	9	...	...				29	25	10	26	...	25	8
	30 0	28	0	...	...				30	26	9	27	1	...	...
	31 0	28	3	27	6				31	28	5	...	...	...	...
	33 1	28	10	...	...				33	29	0	...	...	...	...
	33 0	30	7	...	...				33	30	7	30	8	...	...
	34 0	32	0	...	...				34	31	4	...	...	...	...
	35 0	33	6	...	...				35	31	8	...	...	...	...
	35 11	33	10	...	...				36	34	0	...	...	...	...
	36 11	34	11	...	...										

River rising.									River falling.								
Crest of Anicut.	Water surface below weir.	Water surface above weir.							Crest of Anicut.	Water surface below weir	Water surface above weir.						
43' above H. W. M. 20' above deep bed.	21 0	25	9	25	9½	...	...		43' above H. W. M. 20' above deep bed.	21 0	26	1	25	11	26	...	
	22 0	26	11	...	...	...	...			22 0	27	1	27	2	26	5	
	23 0	27	8	...	...	...	...			23 0	27	6	...	...	...	...	
	24 3	28	2	...	...	...	...			24 0	28	1	28	4	28	1	
	25 0	28	6	...	...	...	...			25 0	28	11	28	7	...	...	
	26 0	29	1	29	6	...	...			26 0	29	3	29	...	29	2	
	27 0	30	1	..	...	...	...			27 0	30	4	..	...	...	...	
	28 0	31	7	31	8	31	1			28 0	31	6	30	9	29	11	
	29 0	31	9	...	...	...	...			29 0	31	11	32	...	31	3	
	30 0	32	5	...	...	...	...			30 0	32	5	...	...	..	...	
	31 3	33	3	...	...	...	...			31 0	33	0	33	6	...	...	
	32 0	34	3	...	...	...	...			32 0	34	4	...	...	...	...	
	32 10	34	9	...	...	...	...			32 11	35	2	...	...	...	...	
	34 0	36	3	...	...	...	...			34 3	36	3	...	...	...	...	
	35 1	37	2	...	...	...	...			34 9	36	9	...	...	...	...	

N. B.—No Registers were kept distinctly previous to 1863

(Signed) F. J. MOBERLY, Colonel, R.E,
Superintending Engineer, 2nd Division.

No. 439B. From the Superintending Engineer, 2nd Division, to the Secretary to Government, Public Works Department, dated Camp at Masulipatam, 7th November 1871, No. 105.

I REGRET that, in forwarding report* on the Kistna works generally, I had overlooked the requirements of the Secretary to the Government of India in paragraph 4 of his letter forwarded with G. O. No. 1,389 of 20th May.

* 102, dated 2nd instant.

2. The cost of establishment and maintenance was not included in my statement sent with No. 150 of 1st February 1871.

Proceedings of the Madras Government, Public Works Department, 19th December 1872.

3. All land has been included in the estimates of area irrigable, but our calculations are exceedingly rough; we have no reliable data, but are endeavouring to collect them.

No. 278.

No. 439A. *Note by the Acting Chief Engineer for Irrigation.*

IN November 1871 the Superintending Engineer of the 2nd Division submitted the map, called for by the Government of India, showing the present state of the several works comprised in the Kistna project. This map was accompanied by a general report which, while it shows the great defects and difficulties in connection both with supply and drainage in the Kistna Delta, affords no practical solution of those difficulties; the projects now under preparation will show how the defects are to remedied and the difficulties to be overcome, and with the concurrence of the late Secretary (Colonel Carpendale) the submission of the report and plan to the Government of India was postponed pending the receipt of the estimates for the projects under preparation. As, however, one of the Executive Engineers who was engaged in preparing the project has been removed from the Kistna, and the Superintending Engineer has also been removed, and a further change in the charge of the delta will take place immediately, the submission of the project for the completion of the delta works is likely to be postponed for a considerable period, and as the Government of India have called attention to their letter of April 1871, the map and report submitted by Colonel Moberly are forwarded to Government.

No. 130-1, 22nd October 1872.

FORT ST. GEORGE,
19*th November* 1872.

(Signed) R. F. OAKES, Major, R.E.,
Acting Chief Engineer for Irrigation.

No. 440. ORDER THEREON, 19th December 1872, No. 3,023.

IRRIGATION, No. 29.

ORDERED that the letter and note be forwarded to the Government of India.

(Here enter No. 3,024, dated 19th December 1872.)

(True Extract.)

Colonel, R.E.,
Secretary to Government.

To the Chief Engineer for Irrigation.

Exd. E. C. Shunker.

PUBLIC WORKS DEPARTMENT,

FORT ST. GEORGE, 19*th December* 1872.

No. 441.

No. 3,024.

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,

PUBLIC WORKS DEPARTMENT.

IRRIGATION, No. 30.

SIR,—With reference to your letter No. 130-I., dated 24th April 1871, I am directed to forward the sketch map called for therein, and a copy of Proceedings of this Government, No. 3,023, dated 19th December 1872, which contains an explanatory letter from the Superintending Engineer relative to the map.

2. I am to inform you that the Statement of Expenditure annexed to Colonel Moberly's letter No. 150 of 1st February 1871, did not include the cost of establishments or of sums expended on past maintenance of the works.

3. From a register of the cultivation and assessment in the Kistna District for Fasli 1279 (1869-70) it would appear that the entries in the statement submitted by Colonel Moberly are not correct. They should have been as follows :—

Government Lands.	Acres.	Assessment.
First Crop	122,040	4,88,226
Dry crops irrigated	3,039	6,101
Inam and Zemindary, first crop	28,814	1,04,580
Dry crops irrigated	1,829	4,308
Inam and Zemindary free of water tax	32,408	...
Total...	188,112	6,03,215

4. It will be observed that 188,112 acres were supplied with water from the anicut in 1869-79 and that the assessment realized was Rupees 6,03,215, no charge being credited to the deltaic works on account of the rent free lands.

5. I am to inform you that statements of the rent free lands in all the districts of the Presidency have been called for, and it will then be possible to show what area is really supplied by the large works of the Presidency for which those works receive no credit.

6. The rent free lands in the Godavery Delta amounted to 85,125 acres in 1869-70.

I have the honour to be,

Sir,

Your most obedient servant,

Colonel, R.E.,

Secretary to Government.

Exd. E. C. Shunker.

Proceedings of the Madras Government, Public Works Department, 24th November 1873.

No. 330. Read the following letter from Colonel F. H. RUNDALL, R.E., Deputy Secretary to the Government of India, Public Works Department, (Irrigation,) to Lieutenant-Colonel J. MULLINS, R.E., Joint Secretary to the Government of Madras, Public Works Department, (Irrigation Branch,) dated Simla, 9th October 1873, No. 726 I.:—

In acknowledging the receipt of Colonel Walker's letter, No. 3,024, of the 19th December last, and accompaniments, regarding the works comprised in the Kistna scheme, etc., I am desired by His Excellency the Governor General in Council to say that the preparation and submission of the designs and estimates for the completion of this important project should be expedited.

No. 331. Order thereon, 24th November 1873, No. 2,834.

IRRIGATION, No. 19.

Communicated to the District Engineer, Kistna, who will do all that may be practicable for the early completion of the delta estimates.

(True Extract.)

(Signed) G. W. WALKER, Colonel, R.E.,
Secretary to Government.

To the District Engineer, Kistna.
„ Chief Engineer for Irrigation.

Exd. S. T. Austin,
Spare Copies

No 105

Supt Engrs Office 2nd Div
Camp Dharmapoolay
7th November 71

From

Colonel F.J. Broberly RE.
Superintending Engineer
2nd Division

To,

Colonel J. Carpendale RE
Secretary to Government
Public Works Department.

Sir,

*No 102 dy 23rd inst.

I regret that in forwarding report on the Kistnah works generally I had overlooked the requirements of the Secretary to the Government of India in para 2 of his letter forwarded with G.O. No 1389. 20 May.

2. The cost of establishment and maintenance was not included in my statement sent with No 150. 1st February 1871

3. All land has been included in the estimates of area irrigable but our calculations are exceedingly rough - we have no reliable data - but are endeavouring to collect them -

I have the honor to be
Sir
Your most Obedt Servant

F. Broberly Coll RE

Supg Engineer 2nd Division

All communications should be addressed to the Secretary.

No. 130 I.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

IRRIGATION.

To

The Joint Secretary to the Govt. of Madras,
Public Works Department,
Irrigation Branch.

Simla, 22nd October 1872.

Sir,

I am directed to invite attention to this Office letter No. 130 of 24th April 1871, calling for a map shewing the present state of the several Works comprised in the Kistna Project, and requesting certain information in regard to the expenditure and returns thereon, and to request early compliance therewith.

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

Capt. R.E.
Asst. Secretary to the Govt. of India.

No. 15 Irrigation, dated 30th Nov. 1871.
" 365-366.

No. 1871.
Dated 15th Dec. 1871.
From Capt. R. Strachey R.E.
To Secy. to Govt. of India, P.W.D.
Irrigation Branch.
Submitting further information relative to the Kistna Project.
Delta works generally.
P.W. 5262/72.

Progress Report for Dec.
No. 5262.

From.

The Govt of India.

No. W-753

Dated 22nd } Dec. 1912.
Recd 30th }

No. 130 I.

Encl: 7. 2-6 Vol. IV

Requesting the early submission of the Maps & information required regarding the Works comprised in the Kistna Project.

No. 3023-3026 W.

Statement shewing the proposed Capacity of the principal Irrigation Channels in the Kistna Delta

	Bottom width in feet	Depth of water in feet	Surface fall per mile	Velocity in feet per second	Discharge in cubic yards per hour	Probable acreage of cultivation		
Diacultatam Delta								
Guntoor Delta								
Main Channel to 8th Mile	196-230	8½-7	6"	2.1	410000	230000		
Western bank Channel to Kollur	75	6½	6"	2.1	154000	75000		
Do Kollur to Vellatoor	60	6	7"	2.2	120,000	60,000	diff	15000
Do Vellatoor to Iskapally Channel	45	6	7"	2	84,000	43,000	—	17,000
	30	6	7"	2	62,000	30,000	—	13,000
Do Iskapally Channel to Terminus	30							15,000
Iskapally Channel	30							15,000
								75,000 (f)
Main Channel 8th to 13th Mile	180	6½-6	6"	2	320,000	160,000 (g)		
East side Channel Nizampatam Canal	42	4½	10"	2.4	70,000	35,000		
West side Channel Do	24	4½	10"	2.2	41,000	20,000		15'8000 (g)
Commamore Channel to 8th Mile	120	6	6"	2.	206,000	103000 (h)		
" Below 8th Mile -	100	6	6"	2.	174,000	87,000		
Jungahundra						16,000		16,000
Commamore Channel at Garrikepad 23rd Mile	75	6	6"	2.	133,000	66,000	diff	21,000
Opposite Bapatla Tank	50	6	6"	2.	94,000	47,000	—	19,000
Between Bapatla Tank & Terminus	50.30	6	6"	2				47,000
								130,000

(Sd) J. C. Anderson Major R.E.
D.C. Engineer Kistna

D.C. Engrs Office
Begwada 6th January 1863

True Copy
J. Anderson Col R.E.
Supdg Engineer

Statement shewing the proposed Capacity of the principal Irrigation Channels in the Kistna Delta.

	Bottom width in feet	Depth of water in feet	Surface fall per mile	Velocity in feet per second	Discharge in cubic yards per hour.	Probable acreage of cultivation
Mankhatam Delta						
Main Channel	180	8	6"	2·7		
Ellore Canal to 8th Mile	120-150	8-6½	5"	2·1		
" " 8 to 11 Mile	60	6	5"	1·9		
" " 11 to Ellore	54	6-5	½"	·5		
Branch from Casarapully to Darkeeds	30	5	7"	1·9		
Budamair Channel	20	6	6"	1·7		
Pyrus Channel to 7 5/8 Mile	100	6	7"	2·3		
Branch Channel	32	4	12"	2·3		
Below 7 5/8 Mile	75	6	7"	2·2		
at Junction with Pullaru	65	6	7"	2·2		
Pullaru at Kankipad	60	6	7"	2·2		
" at Junction with Ryles Channel	50	6	7"	2·1		
Pullaru below Ryles Channel	110	6	7"	2·3		
Do Common to Colony Cope	75	6	7"	2·2		
Colony Channel	30	5	6"	1·6		
Main Channel	36	5	6"	1·8		
Side Channel Branch Lock	20	4	8"	1·1		
Lock to Sea	20	4	8"	1·1		
Pullaru at Colony	90	6	7"	2·2		
Channel to Canal Head Lock	42	6	7"	2·1		
Main Channel						
Side Channel						
Pullaru at Sluice						
Channel to Lock	120-126	8½-7½	5"	2·2		
" to 13 Mile	60	7½-6	5"	2·2		
Pullaru at Colony	90	6	7"	2·2		
Canal to Canal Head Lock	42	6	7"	2·1		
Side Channel Branch Lock	42	6	7"	2·1		
Canal to Canal Head Lock	42	6	7"	2·1		

Statement shewing the proposed Capacity of the principal Irrigation Channels in the Kistna Delta.

	Bottom width in feet	Depth of water in feet	Surface fall per mile	Velocity in feet per second	Discharge in Cubic yards per hour	Probable acreage of cultivation	
Pinnamkhetanam Delta							
	222'8	4.000	.0058		540,000	270,000	
		4.250	.0054		270,000	135,000	
		2.000	.0006		88,000	44,000 (a)	
		1.750	.0008		20,000	9,000	
	60'0	6.000 (p)					
		6.000	.0012		47,000	23,000	
		13.000 x	.0030		31,000	15,000	47,000 (a)
	106'000	4.250			192,000	96,000 (b)	
(d)		1.000			51,000	25,000	
		1.250	.0006		148,000	74,000	99,000 (b)
		1.250	.0006		130,000	65,000	65,000
		2.000	.0012		120,000	60,000	
		4.000	.0020				
		14.000	.0048		99,000	49,000	49,000
		10.000 (e)	.0015				114,000

Engineer's Office
Bezwada
11-20-.
12-20-5
4-28-1
1-.-29-2
9-29-11
-.-31-3

C.B. Pearse

Examined.
Superintending Engineer's Office
Bezwada

Tabulated Statement of Krishna River from 1863 to 1869

34

Canal Number	River Rising: Water Surface Below weir	Water Surface Above weir		Remarks	River Falling: Canal Number	Water Surface Below weir	Water Surface Above weir		Remarks
	21—0	25—9	25-9½	.		21—.	26—1	25—11	26—.
	22—.	26—11	.	.		22—.	27—1	27—2	26—5
	23—.	27—8	.	.		23—.	27—6	.	.
	24—3	28—2	.	.		24—.	28—1	28—4	28—1
	25—.	28—6	.	.		25—.	28—11	28—7	.
	26—.	29—1	29-6	.		26—.	29—3	29—.	29—2
	27—.	30—1	.	.		27—.	30—4	.	.
	28—.	31—7	31-3	31—1		28—.	31—6	30—9	29—11
	29—.	31—9	.	.		29—.	31—11	32—.	31—3
	30—.	32—5	.	.		30—.	32—5	.	.
	31—3	33—3	.	.		31—.	33—.	32—6	.
	32—.	34—3	.	.		32—.	30—4	.	.
	32—10	34—9	.	.		32—11	35—2	.	.
	34—.	36—3	.	.		34—3	36—3	.	.
	35—1	37—2	.	.		34—9	36—9	.	.

43' Above R. C. Sluice
20' Above top side

43' Above R. C. Sluice
20' Above top side

N. B. No Registers were kept distinctly previous to 1863.

A. Hendley.
Supdg. Engineer 2nd Div.

Salem 1st Div.

Chacham is a Telugu word
for the Sluice Regulator
2nd Div. Gun to the Sea
4 Channels 4 Doors
No 102 - 9th Channel 8/9

P. Dr. 5535 = 7/1
P. Dr. 3262/72

Ch
Asst

Tabulated Statement of River Gauges for the Years 1863 to 1867—

25

River Irwing

Great Waterspout Above Chowk	Water Surface Above Chowk	Water Surface Below Chowk	Remarks—
21—	6—11	10—3	
22—	12—	11—3	
23—	15—5	"	
24—2	16—6	"	
25—	19—3	18—11	
26—	20—11	"	
27—	21—10	22—	
28—	24—3	"	
29—	25—9	"	
30—	28—	"	
31—	28—3	27—6	
32—	28—10	"	
33—	30—7	"	
34—	32—	"	
35—	33—6	"	
36—11	33—10	"	
	34—11		

16" Above R. C. Mark
20" Above high Mark—

River Jhelum

Great Waterspout Above Chowk	Water Surface Above Chowk	Water Surface Below Chowk	Remarks—
21—	9—7	9—9	"
22—	12—9	"	"
23—	14—10	15—5	"
24—	16—9	17—5	16—3
25—	18—5	18—8	17—7
26—	21—	"	"
27—	22—9	"	"
28—	24—2	"	"
29—	25—10	26—	26—8
30—	26—9	27—1	"
31—	28—5	"	"
32—	29—	"	"
33—	30—7	30—8	"
34—	31—4	"	"
35—	31—8	"	"
36—	32—	"	"

13" Above R. C. Mark
20 Above high Mark—

P. S. The Registers were kept tolerably from 1863—

36

Executive Engineer
Salt Range Division

No 102

Superintending Engineers Office
2nd Div. Camp Masulipatam
2nd November 1871

From Colonel F. J. Moberly R.E.
Superintending Engineer 2nd Div.

To Colonel J. Pardoe R.E.
Secretary to Government
M.P.C.

Enclosure.
1 Statement showing Capacity of principal Sluices Channels &c.
2 Tabulated statement of Kistna River Labour & Cost Amounts from 1863 to 1869
3
1 Map. by Draughy

Sir

I have the honor to forward a sketch map shewing the works executed; in progress and proposed for the completion of the Kistna project, and a report which I trust will be found useful both to explain the map and for general service. The Kistna rises in 18. 1 N 73. 41 E about 40 miles from the Coast. Its course are 1500 ft above the Sea. but its general Course is in deep cutting through extensive plains of black earth and sand, slightly undulating, with here and there hilly ranges of black basalt. Its principal tributaries are the Warna, Gulpurba Bheema and Tungabadra, the last named furnishing nearly half the quantity which passes through the gorge in the E ghauts to the Delta proper.

2. From this point the Delta proper may be said to commence. The Budamair draining 420 Square miles of Country and pointing towards

to

the Kistna is suddenly turned by the deposit of the river; thence flowing nearly parallel to it, till it has passed through the gap in the short range of hill near Bezwada, it diverges at a considerable angle, and conveys the rain fall of the Country E, to the Colair lake. This natural basin (about the level of the sea) receives also the Tammilair, a small hill stream draining 500 Square miles, and running by 3 Channels round & through the town of Ellore, the drainage of the Western part of land of the Godavery; and the surplus irrigation of a part of the Delta of that river, as well as of the Kistna.

3 A weir was built in 1854 to keep up the supply in the lake for the irrigation of late crops in its bed, but it has much obstructed the discharge of the increased supply of water; a breach has been made behind the wing wall, and this will probably not be repaired, so that the water will have a free flow to the Sea by the Sea Sluice Creek, (Upputair) which forms the boundary of the deltas of the 2 rivers.

4 The Pullair rises near Poranky about 6 Miles from Bezwada and only 1 Mile from the Kistna, It diverges gradually from that river till it reaches Weyyoor 3½ Miles in a direct line from the bank where it turns to the E falling eventually into the Upputair. Below Weyyoor it has

it has however from time immemorial been dammed up, and its water, increased by all flood water that over topped the edge of the Kistna bank, has been carried into tanks for irrigation by Channels of more or less length. In consequence of this the Pullair has really become a minor delta stream running along the ridge, and throwing off its supply on both sides long before the Anicut was commenced.

5 On the left bank the Channel fed in general cases a series of tanks, and almost reached the Colair, the receptacle of all the rain and Surplus water from the fields which slowly found its way to it over the face of the Country. Bad as the drainage was then, matters are still worse now, for nothing has been done to lead off the water, while for the last 16 years we have been adding largely to the irrigation. In 1837 Captain /now Colonel/ Buckle cut or cleared anew a Channel /Aga Kodu/ from the Kistna at Vallur-purlliam, the Lead Sluice floor of which is 10' below high flood level. This was named a Lager & more Common supply. It has been blocked up since the Construction of the Anicut, enabled us to give a still greater quantity of water.

6 On the right bank of the Pullair, the Channels ran into large tanks generally. Kasipuramapuram Cowtaram &c. With the exception of the first these

all tailed into the low ground or swamp running parallel to the Coast behind the Sand ridges, which mark the recovery of land from the Sea, and only allow the passage of water at 2 points between the Despatair and the mouth of the Kistna - one at Masulipatam itself, and one near Golla = = pollem or Peddapatam; between which two places it appears to vary - The expense of any arrange = ments for drawing off the water has doubtless caused delay in taking them up - but even now Considerable tracts of Country have been unc = touched for sometime, as they could only be cultivated at a loss -

7 - The Surplus of Kapleswarapuram tank falls into the Bemanuddy, a drain which takes its rise near Vogaràlà in the Davara Kota Zemindary, this water course has been damined up for the Supply of the large tank at Kaza, & for several smaller ones -

8 In the printed survey map, it is represent = ed as having a very tortuous Course, much increased I believe now, as fresh cuts are made constantly for each village as it needs them - The Stream ought to run freely into the Creek under Masulipa = = tam fort, a portion falling into the Kistna near Yasaiah - see page 56

9 On the right bank of the Kistna, the Junga = = dra passing within a few hundred yards of the River bank carries the drainage of 200 Square Miles of Country behind the Seetanagram hill - diverging gradually from the Kistna it receives the Guntur Nulla and the drainage of 804. Square miles from the N. talugs and Conveys it to the Sea at Nizampatam

Seetanagar. 376.
Nallamala. 428
804

10 Into the backwater flows all the drainage & Surplus irrigation water of the tract of Country between it and the River - all of it much impeded in its Course by the remains of the obstructive Earthen works raised in former days to attenuate the flood waters - from the map it will be seen how far the Swamps extend along the Coast -

Nuckalava 238.
Pamidipadu 15
& Gorsua - 209
Tatavarru 452.

11 - A feeder from the Kistna was carried to this large drain above Seetanagram hill, & irrigation Channels led off from the neighbourhood of Jagarlamudy to supplement the Supply of the tanks at Bapatla, Kommamur, Nandur &c &c the Surplus waters of these all return to the Junga Cadra but west of Bapatla all the drainage of the upper Country 452 Square miles flows into the Rompara Swamp, the head of which is near the end of the Bapatla tank bank; it is drained slowly by the tortuous creek near Chinna Ganjam.

12 The deepening of all these outlets & cutting free water way through the Swamps should be carried out immediately both to save the existing land from inundation & to provide room for more cultivation -

3 Sir long ago as 1792 Major Beatson suggested the Construction of a dam across the Kistna, and in February 1794 Mr Topping was desired by the Government to investigate the subject; his death, in January 1796, appears to have put a stop to the enquiry.

14 The famine of 1832-33 in the Northern Circars was most severely felt in Guntur - the loss is estimated (See report of Committee on the project of an Anicut January 1849) at one crore of rupees revenue, a larger amount of private property, 20 or 30 lacs, and at least 200,000 Cattle -

15 Captain (now Colonel) Buckle made some considerable improvements to the means of irrigation from the river - He cut a Channel into the Budamair near Vibrampatam; one to the Pulicat at Wallurpalliem; one to the Tungabadra near Seetanagram; and another at Vellatur - All these though affording only a precarious supply to the tanks, produced so considerable an increase to the revenue, that Colonel Buckle was induced in 1839 to revive the proposal of a dam across the river at Bezwada - Captain Best in 1841, and Captain Lake in 1847 urged the advisability and advantages of the work, which were in some degree examined and reported on in January 1849 by a Committee of 5 gentlemen -

Captain

Captain Buckle

Captain J. W. Bell

Captain Orr

Mr D. Stokes Collector Guntur

Mr D. Forbes Sub Collector Rajamundry

16 The question of a site was discussed over & over again - The Kistna which flows for some miles in a bed averaging 3000 yds in width is suddenly contracted at Bezwada to 1300 yds by 2 Hills whose bases it washes even in dry weather.

17 All the officers concerned appear to have at first feared lest the artificial obstruction of the Current, already naturally increased, should be too great; but after Examination of various other points, all decided on Bezwada where as they observed the immediate neighbourhood of the Hills afforded an enormous supply of good material, at so small a cost for carriage, that a much larger work could be constructed in a shorter space of time here, than at any other site; an expectation which I may observe, has been fully realized by the event -

18 The original Estimate amounting to Rs 7,66,541 was sanctioned by the Court of Directors H.E.I. Co's 8th Jany 1851 and work was commenced in October 1852 Captain Orr, who had had great experience on the Godavery Anicut, being placed in charge -

19 Below the line of the body of the work large stone loosely packed was thrown into the hollows, & the bed above was levelled made and on the rows of wells, sunk 7 ft dia. at distances,

formed to foundations of a first wall, faced on the top with stones 6 ft wide, & backed by 210 ft of rough stone carefully packed with a slope to the rear.

20 The top of the wall is 20 ft above the deep summer Channel of the river, 43 ft above H.W. mark, the highest recorded freshet facing 8 ft above it a second retaining wall, 6 ft lower in level was built 100 ft from the front: this section differs from that originally proposed; the following remarks extracted from a letter of Captain Orr to the Secretary, Revenue Board under date 11th Augt 1854 states reasons for the alteration & omission of Cut Stone.

"The Anicut, as it at present stands, consisting simply of a substantial masonry wall, backed by rough stone only partially packed, "is quite as effective as if it were covered with masonry & is far "safer, because the stream, instead of being precipitated over a "smooth impervious surface, & thereby acquiring a force which "on the river would be almost irresistible, is able on tapping "the wall, to find its way into & through the interstices of the stones "in such quantities as suffices to fill the bed below the "dam, almost up to the level of the rear portions of it, "before any heavy overfall can take place & the roughness "of the surface breaks up and impedes the velocity "so as thoroughly to destroy its power on the bed of the "river below the line of the work."

21 I would here call attention to a point of great natural advantage in the site. The deep hole on the Seetanaggram side mentioned in early reports of the river, produced by the great oscillation of the stream, a large sand bank on the opposite side; which is only covered in part by trees, the natural pool thus formed below

below the dam, acting as a Cushion, has very much checked the overfall, and permitted the river to deposit at a place where, according to expectation, it should have scoured, and thus has further strengthened the dam. I append a statement of the head of water at different heights both of a rising and falling river.

22 At each end, and in the same line as the Anicut, are constructed Sluices. Their floors 9 ft & 10 ft at Bezwada and Seetanaggram respectively, below the Crest of the dam, above H.W. mark. Their 15 vents of 6' span, 11'-6" high at Bezwada and 8'-10" at Seetanaggram are intended to produce a scour during the freshes across the front of the head Sluices.

23 On the Bezwada side three are placed in the line of the river bank immediately above and at right angles to the under Sluices. The water passing through 15 vents 6 x 10'-3" floor 37½ above H.W. mark is received in a rectangular basin, which turns it again into its proper Channel almost parallel to the River. The lock for the passage of traffic is built a little higher up the River and enters the Canal in a straight line. A Bridge carries the Great Northern Road across the main and lock Canals. The united streams should be 240 feet wide but the spaces so contracted between

the

3 Arches of 40 ft span
Abutments 11-2 high
Crossed sines of

Arch of 16 ft span
Abutments 15 high
Crossed sines 3-6"

the river and the village, that Colonel Anderson preferred to add to the velocity which would not be difficult when the river is moderately filled. I cannot however omit to mention my belief that ere long it will be necessary to increase the number of vents in the Head Sluices or which would perhaps be more satisfactory, to add to the height of the Sluices.

24 I think that the facts stated above para 21, serve to show that we have nothing to fear as to the stability of the dam, and that we may add as much as 2 ft without any risk. It might be done gradually 6 or 9" annually; the command of water thus acquired would be very valuable in the beginning and end of the season.

25 For this purpose also we much need improved shutters in the under sluices, which I ask now enormously. This item will be entered in future Estimates.

26 To return to the main Canal, the Estimate sanctioned, and under which work is now in progress provides for width of only 200 feet, both banks to be pitched with rubble for a distance of 1000 yards. On the left bank where the traffic is now largest, 600 feet of this must be broken into masonry steps, with flat form and ramps at each end, to enable Carts to go up to the level of the road 13 feet above.

27 I think that ere long, it will be necessary to build a landing stage &c on the right bank also, to provide for the traffic during the freshes. The great velocity of the river, and the danger of being swept over the Anicut, compel the retention of the ferry in its old position below the dam. Milk only 6 feet passing over that work it is necessary to tow boats 5 or 6 miles up one bank, before they can venture to pass across to the other.

28 Consequently from June to November goods are conveyed from below the lock at Beeta-nagram, or by Carts from Guntur &c to the ferry boat, and by hand from it to the Buggawada canal, below the lock where the shipment is at present very roughly & inconveniently done.

29 At the distance of 1000 yds the main Canal is divided into 3, to Ellore nearly East; to Masulipatam S.W.S.E; and one intermediate generally known as Pynes Channel.

30 The first of these, passes under a stone bridge which carries the road to Ellore and Masulipatam, and falls at 11 miles into the hollow of the Budgemair. In the original design it was proposed to straighten and improve this drainage stream for 12 miles to the neighbourhood of

Arch 60' span. Abutments 8' high. Crossed since 13-6"

+ Kesarapilly of Casarapilly, where it was to pass to the Colair over a large weir, which would be quite to relieve fly to the high land Channel; a lock being also provided for any boats that might ply on this line.

31 A heavy freshet in the Bidemair in September 1854 passed up the new Channel, and down that cut into the old Pulicair, and caused so much injury to crops, that Captain Orr was induced to modify the arrangement, and to keep the irrigation and drainage separate at a little over the first cost, which must have been more than repaid by the prevention of damages.

32 The separation was effected by carrying the Bidemair under the Ellore Canal by means of an aqueduct. As Course is however so exceedingly tortuous that the discharge of flood water is very large the aqueduct is choked with silt and early measures must be taken for straightening the bed and constituting it again, as it is by nature, the main drain of this part of the Country.

10 Arches of 10 span
Abutments 4 high
Versed sine 2

33 All irrigation now supplied by it must be provided for by other means for this Surveys are not yet taken.

34 From Casarapilly the Ellore Canal runs at a level for 26 miles principally through private land as yet not much cultivated which must be better

provided for hereafter by a side Channel more capable of carrying the supply needed. This will be preferable to widening the Existing Canal. It crosses the drainage of the Country which is passed by 7 under tunnels 4 inlets and 3 outlets. These latter work moderately well but their crests are generally higher than the ground immediately adjacent, and consequently a small quantity of water dammed back, the removal of which I propose to Construct small under tunnels.

9

35 Near Ellore, the Jamideir flowing in 2 streams crosses the Canal at points about 2 miles apart. This hill stream has a fall of 8ft per mile to the Colair Lake, its natural bed is 2 feet above that of the Canal but the surface of its water 2 ft above by more than 4 ft dock, is about the same as that in the Canal.

The original plan forwarded by Captain Orr, 23d December 1854, provided for sluice bridges to regulate the water, and to permit the discharge of floods, with gates to shut out the silt, and to retain the Canal water in the event of the Colair subsiding more rapidly than the Sluices could be closed.

2 Vents 15 span
Abutments 4 high
Versed sine 3
Crest of extrados 33.5
Above H.W.M.

36 The Cost of these works was Estimated at Rs 1828 [illegible] They were not Commenced for some years and in the interval this plan was set aside, on one branch in favour of an Aqueduct

[illegible]

which Captain Orr had condemned on the ground of the enormous outlay needed for deepening the Channels of the Pulicat.

37. The new design cost Rs. 80,000 though a part only of the Channel was deepened. a weir was built immediately above the aqueduct to produce a scour through the arches of the latter work - but all has been in vain the river has silted up and scarcely any of the masonry is visible

38 In the other branch an inlet & outlet have been built, but they have also caused so much deposit that I am inclined to recommend the entire closing of this branch - The Godavery Officers are examining a project for constructing a large reservoir a few miles above Ellore across the Tamlair - If this is carried into we shall probably have so little water to deal with in the surplus, that we may leave it to percolate under the aqueduct.

39 If this reservoir is not built I think it would be more satisfactory, as it would be certainly cheaper, to revert to the old plan this however may stand over for the present.

40 Immediately beyond the outlet is the lock which with a draft of 8 ft. connects the Kistna and Godavery Canals.

41. The Pyras Channel formerly was a branch taken from the Ellore Canal a little above the Budamair Aqueduct, to supplement the supply from the Pulicat - when it was found necessary to enlarge this latter, Colonel Winscom the Superintending Engineer preferred, for various reasons, to take a separate line from the Main Canal;

42 By this proposed to avoid the delay and expense of widening a canal in which water would be flowing for 9 or 10 months in each year, and to secure economy in the expenditure of the water at times when it is required only for Navigation for which this new line is intended.

43 It runs for nearly 7 miles parallel to the Ellore Canal, and then joins the original Pyras Channel which, following a line almost parallel to the Buckingham Canal, falls into the Pulicat at Narrivadar

44 At Komateguntah 1/4 miles from its head the Gudivada branch Channel is taken off by a head sluice adjoining which is a regulating sluice across the main stream -

45 The branch Channel is 19½ miles long tailing into the Polraz Rodes. It has a fall of nearly 14 inches per mile regulated by 2 falls bridged. This gradient is found in practice to be too great for direct irrigation, and I propose instead of widening this Channel

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(para 29)

Sluice 3 Vents 6 ft span
Abutments 6' high
Versed sine 3'
Water discharge
40000 Cubic yards

Head Sluice consists of 15 vents of 6 ft span
Abutments 5½ high
Versed sine 3'
Bridged by 3 arches of 40' span.
Abutments 5½ high
Versed sine 12½
Sanctioned in G.O. No 2543 d/20th August 67
90 ft wide
4" per mile fall

4 Vents of 4' span
Abutments 4 high
Versed sine 2'

3 Vents of 16 ft span
Abutments 3 high
Versed sine 4½

2 Vents of 10½ span
Abutments 5-4 high
Versed sine 3'

as sanctioned, to cut other channels with less fall - surveys are now in progress for laying them out below Gudivada. This Canal is intended all the drainage of the Country to the South, and the surplus water from the Pulicat, the branches of which all tail into it, and cause great inconvenience and frequent injury various plans have been suggested for remedying this, but none of them appeared to me satisfactory - the Chief Engineer, with whom I discussed all, has therefore assented to my proposal to abandon the last 6½ miles of the branch Channel and to carry both irrigation and drainage in their natural Courses from the Pulicat Converging to the Colair lake

46 The surveys of this part of the Country are still incomplete.

47 The Masulipatam Canal was the new head of the Pulicat, formerly the main irrigation canal - it follows its Course generally as far as Kanikipaud 12½ miles avoiding its greater turns - the head of the artificial Channel has a fall of 2 inches per mile but in consequence of the great demand for water in the Pulicat at present we have frequently a surface fall of 7 inches per mile -

48 At Kanikipaud is the first lock 150 feet long 20 ft wide as there is generally a depth of 6½ feet on the upper and only 5 ft 6 on the lower sills. There is really a drop of 9½ in the lock; a large weir was built at this point, on the original system of utilizing the old channels - now only a part of it is required for the lower reach of the Masulipatam Canal; another part has been altered to form a Head Sluice for the West Side Channel, which was proposed by the late Colonel Anderson, when Superintending Engineer, to separate irrigation from navigation in Canals carrying water or extraordinarily charged with silt as that of the Kistna -

Upper sill 35·4 above H.W.M.
Lower sill 27·4 "

Vents of 3 span
Abutments 10 ft high
Piers 4 wide 2·0 high

Vents 5 of 2-9" span
Abutments 2-9" high
Waste discharge
80,500 cubic yards -

49 My idea was that by giving to the side Channel a steeper gradient than could be allowed for navigation, he would avoid much of the deposit; he has however approached too nearly the natural fall of the Country, and Consequently the water, instead of passing to the fields by sluices, theoretically large enough to convey the needful supply, continues its course in its own bed, and we have been obliged to obtain an artificial head by dams - these of course reduce the fall, and diminish the velocity of the current; Consequent on which deposit takes place -

50 I would suggest therefore that

in future the gradient of Irrigation Channels should be reduced and Navigation Channels have no fall in their beds; the Slope of the Country being overcome by locks. In a still water Canal the amount of water required to replace evaporation & lockage &c would be so small that one could not perceive much increase of silt. the improvement to navigation would be very great, as now traffic is much impeded by having, during nearly the whole of the season, strong winds blowing down stream.

51 The W.Side Channel has been excavated generally as a separate line, but for some miles where the Masulipatam Canal was too wide a bank has been erected in it to lead to part off a portion for irrigation.

52 By some oversight the Masonry works were omitted a supplemental Estimate is therefore being prepared.

53 Opposite to this, the Pulair is supplied in its old course by 2 sets of sluices which are intended to pass 120,000 Cubic yards per hour supplementing the quantity through Rynes Channel head sluice and providing for 156,000 acres in all.

1st Set
6 vents 4' span
Abutments 3-6" high
Versed sine 1-6"
2nd Set.
6 vents 4' 4" Span
Abutments 4' high
Versed sine 2'-

54 The arrangement of all these works is exceedingly unsatisfactory. the Navigation is for a short distance very dangerous as

boats have to pass between these 2 head sluices to the lock immediately beyond; this is instead of water, there is therefore a constant deposit of silt in the spot which a boat would seek for refuge. the Lock Establishment is obliged to remove every day enough to enable them to open the gates. another Culvert has been recommended by the Chief Engineer to reduce the time of working the lock. I would urge its construction the more as it would help to remove this shoal by the scour.

Upper sill 24 above H.W.M.
Lower sill 16' — " "
Depth of water 8ft.5.6-6"
Do Do 5.6 & 4-0"

Caliguloo
3 Vents of 15ft 2 span
Abutments 2½ high
1 Vent 4' span
Abutments 7 ft high

Nedumolu Lock
Upper sill 12' above H.W.M.
Lower sill 6-5-8"

Kukkunarru Lock.
Upper sill 5-0 — "
Lower sill 0-0 — "

Vidavalooru Locks.
Upper sills — 0-0
Lower sills — 7 below H.W.M.

55 The second lock on the Masulipatam canal is at Veranky 25 miles from Bezwada this is of the same dimensions as the last at Kankipandu. the Lower Channel is supplied by a weir.

56 The third lock is at Nedamolu 37 miles; the fourth at Kukkunarru 43 miles; the last which drops the Canal into tide water, is at the Fort of Masulipatam. the Creek is 3 miles to the Sea. At its mouth is a bar always inconvenient, sometimes dangerous. The S. wind and current, which prevail for several months along the Coast, tend to carry the mouth year by year further North. the Counter current during the N.E. Monsoon is turned by Narasapur point and has very little direct effect on the bar.

The closing out of the old Chinnaoor Canal

from the Kistna near Vijaeraj, to the creek is also suggested by Captain Smalley both as promoting a scour and as a means of Communication. I doubt its efficacy for the first, but it would be so valuable for traffic that I strongly support it. It was mooted by me in 1855. but for some reason the clearing which I began was stopped and has never been resumed.

57 The Cyclone wave of 1864 cut the mouth in another place, and Colonel Anderson hoped to maintain it there by clearing out a Channel from the Swamps around & W. of Masulipatam, which receive the drainage of about 88 Square Miles of Country.

58 An Estimate for Rs 21360 was sanctioned but funds have not been provided. and meanwhile the work done is yearly being injured and doing no good.

G.O. No 1928 dt 14th June 1869.

59 Returning to Kankipaud, we have on the left bank the Pulicat running with a fall of 10½" per mile to Beyoor 9 Miles where its descent is regulated by a fall of 4' with shutters. a little below this is taken off the old channel to the Kaipleswara poor tank having its sluice in the line of the Masulipatam and Hyderabad road.

1 Vent 2-5' span
Abutments 1-7" high
Versed sine 1'-1"

60 After running 5 Miles more in cutting, it meets at Mavirevada the Rajues Channel see para 43.

Vents of 5' span
Abutments 6" high
Versed sine 1'-6"

61 Immediately below this junction is the sluice of the Gandikodu, another of the old irrigation channels, which flowing past Gudivada supplied a considerable area of land towards the Colair lake.

62 It now crosses the branch Channel from Komatiguntu (para 44) by an inlet & outlet. I propose that the branch Channel shall be dammed at this junction, and be passed over the outlet, and that the Gandikodu be turned into the branch Channel at a lower point to maintain the supply for the Dondapaud Channel a mile lower down; a spacing this left for the drainage of the triangle between the branch Channel, the Pulicat & the Gandikodu, which is now regularly swamped.

Vents 20' span.
Abutments 3' high
Versed sine 6"
Pavement with cart ridge 16' wide.

63 The Pulicat is crossed at Pamarru by a bridge carrying the road from Masulipatam to Gudivada. In its floor are built grooved iron posts to hold shutters by which the water may be raised 3 feet for the supply of another Channel running towards the North end of Gudivada.

Vents of 8' span.
Abutments 5' high
Versed sine 2'

64 At Pamarru the Masulipatam Canal is about ½ mile from the Pulicat, a small canal with a lock has been cut to facilitate communication.

65 About ½ a mile below Pamarru on the right bank is the head sluice of

the E. side Channel, this rises along the
Dravidiseptam Canal bank supplying water
to 12,500 acres - both of the Tirupal Anikinnipet
turns to the East & under the name of the Ramaya-
pollium Channel, irrigates the low land between
it and the swamps; a part of which we look
forward some day to reclaiming & cultivating.

66 The Butler Kodu head sluice is a short
distance below on the same bank. It and its
branches irrigate the space between the Pulicat
and the sand ridge on which stand Gudur.
Pedanadu, Eastward to a short distance
beyond the road from Dravidiseptam to Kow-
-taram. The surplus water of this tract is
collected in the Lizzabunda Kodu close to the
sand ridge and conveyed to the swamps.

2 Vents of 8' span.
Abutments 5-2" high
Vessel sine 2'

67 The Palakodu and Chittrum Channels
taking off on the left bank supply 1000 &
510 acres respectively of the slope towards
the Colair. As soon as the weather permits
surveys will be carried on to arrange for the
drainage and irrigation which is now much
affected by the Reynes branch Channels.

68 The slope of the country being both
North and Eastwards, the irrigation generally
will be from the right bank of each of these
4 Channels, the surplus water of each tract

being carried away by a drain cut along the
left bank of the next irrigation Channel
below. All channels whether for drainage or
irrigation conveying and discharging into the
Colair.

2 Vents of 8' span.
Abutments 5-2" high
Vessel sine 2'

69 At 7½ miles below Damarin near Kow-
-taram the Pulicat passes over a weir with road
bridge into its old bed somewhat straighter
at first. It supplies a little land on its
immediate banks, but is on generally too low
a level, and will probably be the principal
drain of this part of the Country into the
Upatair (See para 3)

2 Vents of 15 span.
Abutments 9½ high
Vessel sine 5'

70 A short distance above the weir on the
left bank is the head of the Polray Kadey, a
sluice bridge with posts and shutters to
regulate the discharge; which we shall
probably find advisable to convert into a regular
fall with a lock for navigation; the lower part
of the old irrigation Channel has been left
as a drain receiving the end of the Reynes branch
Channel, and a new line has been cut running
Easterly on a higher level, as far as Vinjarampaud.
It must be extended to the Upatair into which
it is proposed to lock, thus completing the
communication with the Godavery System of

Navigation -

71 On its right bank are the Dabbaru, Pinge Kodu

Cheguru Kota Channel Chiruru Kodu & Tadiguntla

Heads sluices of which are of dimensions given

in Margin -

Names	Vents	Span	Abutments height	Versed Sine
Dabaru	3	2	3	1
Guruja Kodu	1	2	3	1
Chiguruccotadi	2	2	3	1
Chiriuru Kodu	4	2	3	1
Thadiguntla Kodu	1	2	3	1

72 On the left bank is the Ky Kaluru Channel watering 4000 acres which requires also to be extended - This tract of Country consists entirely of alternate sand ridge and hollow, and our plans are drawn up with a view to Conveying irrigation water along the former & draining the latter into the Upputair -

Ky Kaluru No 2 Sluice
3 Vents of 4' span
Abutments 2½ high
Versed sine 1½

73 At Kowtaram close adjoining the weir of the Pulicat is a Lock and weir for the Channel to Buntumilly 14 miles long - the bed has a fall of 6" per mile which produces so rapid a current that we have failed to irrigate the adjacent lands. Rough stone dams have been consequently for some years constructed to regulate the supply - these have prevented all navigation from the very important Salt pans - we propose therefore to construct a lock 12½ miles down it and to reduce the fall to 2" inches per mile the bed is so much raised by silt that this will probably be also cheaper than deepening -

Lock 100' long 15 wide
Pulicat weir
3 Vents of 10' span
Abutments 9' high
Versed sine 2'

74 The Channel now terminates in a weir

at high water mark, the surplus water finding its way through low land & swamps - I propose continuing it to the Upputair and dropping it by a 2nd lock into that tidal creek, which will complete an useful line of navigation into the Godavery System -

75 The irrigation of the land on the right bank will be carried on by a Channel taken off above the lock, or rather improving old Channels into a good system - which has to be considered, as also the means of draining the swamps close along the coast, and recovering at least some portion for cultivation -

76 On the right bank of the Masulipatam Canal, about 4 miles from its head, Col Senderson proposed to take off the Canal to run close along the E. bank of the Kistna, and, by an aqueduct or under tunnel across its smaller branch, to the minor Delta (Diry) It will follow principally the line of pits dug for the Embankment but we require survey to enable us to select the point at which to build the aqueduct - These will be undertaken shortly -

77 The Canal will irrigate about 45000 acres lying between it and the Boomanuddy the drain (See para 7 & 8) of this tract of Country -

78 This stream rises near Vogerálá and receives the surplus of the Kaplaswara poorum tank

It is

it is passed under the main Canal by a tunnel near Inampudi, but its course beyond has been so impeded by the cultivators in the Devarakota Zemindary that there is now no defined channel. It is represented in the printed map as a tortuous and intertwined channel but the map gives a poor idea of what it really is.

79 We proposed some years ago to supply water from the main Canal project Vide Bridge at Mile 149 of 1868/69 but the cultivators were afraid that the Zemindar would take advantage of any alteration to increase his demands, and refused to use the water or to increase cultivation

80 There are however villages belonging to Government and to other parties below the Devarakota property, and something must be done in their interests, as well as to draw off the water which floods the country around Inampudy, and which would be of great service in scouring the Creek and bar near Masulipatam (see para 57)

81 As soon therefore, as the season will allow I propose to have these surveys completed and if we cannot make amicable arrangement with the Devarakota Zemindar, to secure at least a clear course for the drainage under Act 10 of 1870 Land acquisition Act.

1 Vent of 6' span
Abutments 3' high
Versed sine 2'

7 Kistna

82 On the right bank a cut has been made above our works to permit the flow of the upper Jungaleddra (see para 9) into the Kistna while the lower part of that stream has been supplied from the river by means of a head sluice similar to that at Bezwada a lock provides for the means of navigation. The under sluices are built on the rocky slope of the Seetanagaram hill which running in to the river forms a small bay above the line of the Anicut.

15 Vents of 6' span
Versed sine 3'
Height of abutment 10-3
Flow 3' above H.W.M.
15 Vents of 6' span each
Versed sine 3.0
Height of abutment 8-10 ave
33' above H.W.M.

83 For the 8 first miles, the main Canal below the Head sluices follows generally the course of the Jungaleddra, considerably widened and deepened. Unfortunately the soil taken out has been put near the edge, and must be removed a considerable distance before we can complete the excavation to the dimensions 235', which will be necessary, if our expectations as to additional cultivation are fulfilled.

Original breadth 45-0"
Proposed at present 96-0"
Ultimately done hereafter 235-0"

84 Colonel Anderson thought that possibly a supplementary Channel might be carried between the river and the hills, & that the quarrying of stone required for public works meanwhile would go far towards its completion. We have not yet cleared sufficiently for the great Northern Road which has been turned this way to take advantage of the bridges over the locks and Head Sluices. I see no prospect of our

cutting enough for this Canal.

85. According to the original design a high level Channel was to have been carried from the right bank in the 9th Mile. It was partly excavated as far as Nambur, but Colonel Anderson thought it advisable to abandon it. the dotted line shows its general direction. It appears very doubtful whether the Kistna ordinarily has water enough to cover this upper area, and it is as well at any rate to defer the execution of work, till we have completed what is fully commanded, and therefore more certainly advantageous.

86. In the 8th Mile, the Rt. bank Channel takes off - it follows the line of pits dug for the flood embankment of the river. It has a breadth of 30 feet which must be increased to 75 feet for the supply of 38,000 acres its slope is 6 2/3" per mile, which is regulated by a drop at Kollair 11 Miles below, bridged for traffic - the head sluice of a branch irrigation Channel was built here and the Channel itself cut, but the villagers have not taken up any land though they previously made many promises to induce us to take up the work.

Head Sluice
6 Vents of 6' span
Abutments 7-6" high
Versed sine 2'
Lock:
Upper sill 35-5"
Lower sill Do

87. 5 Miles further is a second drop near the village of Vellaturu to afford a command to the Allur Channel. (para 88)

6 vents of 10' span
Abutments 9' high
Versed sine 2-0" and 2 cuts 3x3' in the centre of body wall itself 7' high.
Crest 26.5
Flood 19.5

88. In the 27th Mile or 8 Miles below Vellaturu is a regulating bridge. Permanently for the Istafally Channel (see para 96) and 10 below it, direct irrigation for about 10,000 acres is provided. The Vellaturu Channel is an old one, cut to supplement, by water from the Kistna, the drainage of the Country which it completely intercepted, and conveyed to the tanks at Allur and Bhudam near the Tungabuddra - when this was cut off by the Dimpatam Canal (see para 99) a weir was built across the Tungabuddra itself (the Dimpatadee Calingula) and a Channel cut to the tanks.

4 Vents of 2' span
Abutments 7-6" high
Versed sine 1-6"
Flood 10-5" above sill

Crest 6-2½
Flood 3-2½
Length 96'

89. This arrangement was wrong & avowedly temporary, it will be done away with on the completion of the Bhudam project now in progress (see para 89)

Inclosed in G.O. No. 898 of 31st October 1870.

90. After the Istafally was obtained from the Kistna above the Anicut, some endeavour was made to keep the irrigation and drainage waters separate - in the first mile from its head sluice the Vellaturu Channel passes by a tunnel the Munimaggy drainage, a stream which rising near the village of that name 18 Miles above brings a considerable quantity of the surplus water - the remainder, it will be convenient to say here, finds its way by various means, inundation or petty drains to the terminus of the irrigation Channel near Razole (see para 92)

2 Culverts of 8' span each
Abutments 3-0" high
Versed sine 1-0"
Flood 7-0" above H.W.

91. A little beyond the Munimaggy under tunnel the Veeravaram branch Channel takes off - and a few yards further (within the 2nd Mile)

2 Culverts of 3-9" span
Abutments 3-6" high
Versed sine 1-9"
Flood 9.88

the Vellaiur Channel is regulated by a Sluice adjacent to which on the right bank is the head of the Addapully branch Channel.

3 Vents of 8' span
Abutments 6.4" high
Versed sine 1-6"
Flow 10.5

92 After affording by these supply for 8000 acres, the Channel is dropped by a regulating Sluice at Rayole (para 90) into the drainage Channel which spreads into the low pool called the Nallavada formerly in free communication with the Pungabuddra, but now barred by the Diyampatam Channel (See para 99)

3 Vents of 4' span
Abutments 2.0 high
Versed sine 1-4"
Flow 11.0"

Regulating Sluice
3 Vents of 8' span
Abutments 7' high
Versed sine 1-6"
Flow 6.62

93 There is a considerable irrigation under the Nallavada, into which (See para 102) the Side Channel of the Diyampatam Canal also tails, and means must be taken hereafter for drawing off the surplus, by one or more of the hollows in the sand ridge which bounds this pool, into the back water of Diyampatam - this is shown in the map approximately -

94 The Jetkapally Channel (See para 98) intended to supply water for 20,000 acres runs generally parallel with the Vellaiur Channel; but beyond the direct course of the Drainage, into the lower part of which it tails.

3 Vents of 8' span
Abutments 6.6" high.
Versed sine 2-0"
Flow 9.05

This Channel has been partly excavated and has been in some degree remunerative but its principal returns will be derived from the drainage and irrigation of the Salimedra para

Salimedra para a remand of about 20000 acres -

95 The Jetkapally Channel at present crosses the Salt creek / the natural discharge for the Drainage / between Embankments - and it is proposed to Construct at this point an under tunnel - at present all the drainage of this part passes through one Channel to the Sea - by the arrangement proposed the Drainage Drain will have an outlet under the Jetkapully Channel, while the Rapully Taling main drain will have an outlet by the Salt creek which passes near Pregrum, and into which the Jetkapully Channel tails -

96 Twelve miles from the head Sluice - near the village of Diggiraja, the main Canal is divided into the Diyampatam & Commanmer Channel

Upper sill 33.5
Lower sill 25.5

97 The former is entered by a lock; the supply of water in its Upper reaches being maintained by a weir, and is intended exclusively for navigation, the irrigation being carried on by separate Channels, running on either side their head sluices and the weir to the Commanmer Channel making this part of the Navigation so dangerous as that near Kunkipad (See para 514).

Kuchipudy — Upper sill 22'-6"
Lower sill 16-6"
Intiveedu — Upper sill 11-6"
Lower sill 4-6"
Nallavada — Upper sill 4-6"
Lower sill 0.55
Salt Lock — Upper sill H.W.M.
Lower sill —?

98 Proceeding along the Diyampatam Canal we have locks at Kuchipudy 22nd, Intur 32nd Nallavada 37th and the junction no 42nd to the Pungabuddra below tedemanik in the 42nd Mile. The line

follows generally the dividing ridge between the Tungabaddra and the Petty Channels which drain all the land east to the Kistna.

Escape level 2:55

99 At Nallavada all the collected water used to flow across the present line of the Nizampatam Canal to the Tungabuddra - of late years it has laid for weeks in the swamp, finding its way by Petty cuts, or percolating through the sand. in cases of extraordinary rain, the canal banks have been cut, and some relief thus afforded.

100 It will be both expensive & inconvenient to carry this on permanently and as stated in para 93, we propose to drain it through the sand ridge.

101 The navigation from the tidal lock to the Salt pans & town of Nizampatam is very bad - the back water and creeks are ill defined, low, and covered with vegetation; and the Course necessarily followed very winding. It is unfortunate that the lock was not built near the town, 2 miles in a direct line from its present site. Though not immediately necessary I think that for the encouragement of the traffic / specially in salt / it may be advisable at no distant period to make this improvement.

102 The E side channel of the Nizampatam canal takes off immediately above the 1st lock, by a head sluice; its bed has a general fall

6 vents of 4'-6" span
Abutments 4' high
Drop 1-6"
Vessel sink 2'-0"

of 10½" per mile for 14,300 acres this is regulated by drop of 5½ - 8¼ - 13½ - 18¼ and 23¼ miles Tengally, Kuchipoody, Tirumulla, Guntur and Nallavada (See para 93) the channel ends in the Nallavada.

6 Vents of 6' span
Abutments 5' high
Vessel sink 2:6"

The W. side channel runs parallel to the bank on the other side, it supplies 8080 acres - its drops are in the same line with those on the E side the Channel tails to the lower Nallavada. Both the Channels command the Country thoroughly some of the branches of these Channels have much too heavy a fall. their beds should be rectified by introduction of a few small drops, this will probably entail some strengthening to the banks.

Lock -
Upper sill 34-0"
Lower sill 28-5
Piers
6 Vents of 6' span
Abutments 6' high
Vessel sink 2'-6"

4 Vents of 4' span
Abutments 4' high
Vessel sink 2'-6"

Lock keepers sill 25-0"
" Lower sill 22-0

103 The Commander Channel, taking off at Nizampatam (See para 91.) by a lock and two weirs follows the old tortuous Course of the Tungabuddra to Jagatamiday, where it is regulated by an Escape sluice. Its discharges also some of the surplus brought down by the Guntur Canal which here falls into it. The lock is a remodelled excavation. Its Chamber is 150 ft long 40 ft wide at top 120 at bottom the gates being carried by masonry blocks.

104 From this point, the whole Channel requires much attention, it has been excavated across the drainage of the old Country & very inefficient means generally have been provided for its passage

105 Part of the Dak Kanagu is carried under the Channel by an aqueduct near Kolamar but further means are required at Gui Kapsand where a large body of water falls into the Channel.

6 Vents of 11'0 span
Abutments 3.0 high
Piers 1.6 thick
Floor of Aqueduct 9.0
Crown of Arches 16.5

106 The Nallamada draining 428 square miles passes the Channel at a level. The proposed inlet is not built as it would head back the water over a very large area. The outlet is a good work of its kind. The principle is, however, in my opinion wrong. When the Nallamada is in flood we are obliged to close the Sluices at Jagerlamudi and to check the supply for irrigation, which would utterly stop navigation, on what will hereafter be one of the principal lines of traffic. The Nallamada turns all down the Commanders Channel, and deposits every flood an immense quantity of silt.

15 Vents of 10'0 span
Floor 11.5
Crossed by a flat wooden bridge.

107 Further on the Sathi Calva and Durchur Dagu, flowing in ill defined beds when low, and inundating the whole neighbourhood when in flood, bring down the water of 218 Square miles on the Channel, the banks of which are consequently almost washed away, and the bed very much altered by scour & deposit. The works named in Margin have been constructed but they are quite inadequate and have suffered much and the whole must be renovelled.

Calingulam & Under Channel for Sathy Calva Inlet and outlet at Kurrimchéru 3 arches.
Do Do over Kookalamedu
Do Do Swarna Outlet Sankaravaram Calingulam for Chairu

108 When these are completed the Channel will tail into the creek which drains off the Pampéru near China Ganjam; this will probably be a considerable port as the anchorage is good and fairly protected by the Matupalli shoal. The subject of situations for locks to afford the means of navigation below Jagerlamudy is under consideration.

2 Vents of 6'0 span
Floor 12.15
Crest 14.0

109 At Aramanda 12½ miles from Jagerlamudy to the sluice [See para 103], the Tungabudra is crossed by a regulating dam, and a Channel was taken off in 1862/63. to supply the large tank at Sandole - to supersede the unsatisfactory method of irrigation stated in para 88 a project was prepared and sanctioned in G. O. No 2598 dated 31st October 1870. for enlarging and prolonging this Channel so as to supply the existing cultivation, and that now under the Dumpatadu Calingula. This is now in progress. The land under it is calculated at 9000 acres but all of our information is still very bad. The Range Officers have been now for upwards of a year endeavouring to collect the entries in Revenue Survey registers for the areas of fields under each minor Channel, but have had great difficulty in procuring even this.

Upper floor of Under Tunnel 10-4½
Crest of Surplus channel 12-5½
Floor of Irrigation Channel bridge 10-8½

110 When these statements are completed we shall be in a better position to judge of

of the real wants and to distributes water accordingly -

III The above I would beg to say is intended merely as a sketch of our position at present to which it may be convenient to refer when the details of the project are hereafter forwarded -

I have the honor to be
Sir
Your Most Obedient Servt

F. Heathcote Colonel C.E.
Supt Engineer 2d Div.

6-097.

P.W. 1871 Chief Engineer for Irrigation & Canals No. 5365.

From The Secretary to Government

2nd Dept.

To The Secretary to Government

P.W.D.

Dated 2nd November 1871

Rec'd 10th Received 21st November 71

Secn: 4.

3-6-Pc. No 102

Submits report & Explanatory to the accompanying Map shewing the works Executed, in progress and proposed for the Completion of the Kistna Project.

P.W. 5262/72.

Nos 3023 & 3024 dated 19th Dec 72

Ch 439

P.W.D. 76

3023

Proceedings of the Madras Government

Read the following:-

From

The Government of India. (H. E. No. 130/1 dated 22nd Oct 72)

" Chief Engineer for Irrigation (H. E. No. 278 dated 19th Dec 72)

Ordered that the Letter & Note be forwarded to the Government of India.

P.W.

To the Ch. Engineer for Irrign

Dept. 23/12/72

Ch

Irrig.

Genl. 24

D.W. Dept.

No. 3024

To

The Secretary to the

Government of India

D.P.W.

Sir.

With reference to

your letter No 1301 dated

24th April 1871 I am

directed to forward the

Sketch Map called

for herein and a Copy

of Proceedings of this

Government No 3023

dated 19th Dec. 1872 which

contains an explanatory

letter from the Supdg

Engineer relative to

the

the Map.

2 I am to inform you that the Statement of expenditure annexed to Colonel Moberly's letter No 150 of 1st February 1871 did not include the cost of Establishments or of sums expended on petty maintenance of the works.

3 From a Register of the cultivation and assessment in the Krishna District for Fusli 1279 (1869-70) it would appear that the entries in the Statement submitted by Colonel Colonel Moberly are not correct. They should have been as follows-

	Acres.	Assessment
Government lands		
1st Crop	122,040	4,8,226
Dry Crops irrigated	3,030	6,101
Inam & Zemindary		
1st Crop	28,814	1,04,580-
Dry Crops irrigated	1,820	4,308
Inam & Zemindary		
Free of water tax	32,408	
	188,112	5,03,215.

4. It will be observed that 188,112 acres were supplied with water from the Anicut in 1869/70 and that the assessment realized was

was Rupees 6,03,215 no charge being credited to the Deltaic works on account of the Rent free lands.

5 I am to inform you that Statements of the Rent free lands in all the Districts of the Presidency have been called for and it will then be possible to show what and is really supplied by the large works of the Presidency for which those works receive no credit.

6. The rent free lands in the Godavery Delta amounted to 85.125 Acres in 1869/70.-

Desp. 23/4/72 with Enclosure & 36 Cop-y Ltr No. 3023 of 1872

18/3/03

{1872} 3d

PUBLIC WORKS.

To The Chief Engineer Irrigation
&
The Secretary to the
Govt of India

Dated

Rcvd.

Encl. 6

G. O. 19 Dec 1872. No 5023-30

103 438-439-439A-440
4441

Projects Papers

Orders on Papers relating
the works comprised
the Kistna Project.

Forwards a sketch
works com-
the Kistna
and appended

No 438 C 441.

to 22 Nov 72