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# ADMINISTRATION REPORT

OF THE

PUBLIC WORKS DEPARTMENT,

(IRRIGATION)

BOMBAY PRESIDENCY,

FOR THE YEAR

1897-98.

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ADMINISTRATION REPORT  
OF THE  
PUBLIC WORKS DEPARTMENT  
(IRRIGATION)

**BOMBAY PRESIDENCY.**  
FOR THE YEAR 1897-98.

GENERAL REMARKS.

In the year under report the expenditure on Irrigation Works throughout the Presidency amounted to  $44\frac{1}{3}$  lakhs as compared with  $45\frac{1}{3}$  lakhs in the previous year. This outlay was divided between Sind and the Presidency proper in the proportion of 4 to 1 respectively.

2. Of the total outlay of Rs. 34,80,231 on Works and Repairs, Rs. 14,56,611 were expended on repairs. The expenditure on repairs was in Sind Rs. 12,61,703 and in the Deccan and Gujarát Rs. 1,94,908.

DECCAN AND GUJARÁT.

3. The principal works in progress in the Central Division were the Mutha and the Nira Canals.

4. In connection with the Mutha Canals the expenditure incurred was principally on fixing meters to fire plugs. These are required to check the consumption of water used by the different departments for road watering in Poona.

Mutha Canals.—Lake Fife  
and Poona Water-supply.

5. The main item of expenditure was “repairing the wall in front of the under-sluices.” This work was taken in hand at the end of the year after the heavy demand for water for rabi irrigation was over.

Nira Canal.—Bhatghar Dam.

The under-sluices were opened for the monsoon on 18th June and were finally closed on 12th August, and all gates worked satisfactorily.

6. The only works in the Southern Division on which outlay under the head “Capital” was incurred during the year were:—

(1) The Yerla River Irrigation Works.

(2) The Gokák Canal (1st Section) and Storage Works.

7. In connection with the Yerla River system, the F. S. L. of the Nehr Tank was raised 5 feet and the dam to R. L. 2,675, leaving a height of about 4 feet to bring it up to the sanctioned top level. The work was, however, stopped on account of the appearance of another slip from chainage 900 to 1,000. Weekly observations are being taken to note the movement of the dam. The Capital expenditure during the year was Rs. 1,392.

Yerla River Works.

8. On the Gokák Canal, the Capital outlay during the year was Rs. 3,657, and from the commencement of the work, Rs. 6,98,469. The work of raising the weir 2 feet was completed during the year at a total cost of Rs. 8,327, excluding land compensation, a good deal of which still remains to be paid. The work of sub-dividing the land of 7 villages under the canal, commenced in the previous year, was completed during the year at a total cost of Rs. 1,147 against the estimate of Rs. 1,154.

Gokák Canal.

9. In pursuance of the policy of Government in connection with the treatment of irrigation tanks, large and small, in Gujarát and the Southern Marátha Country, expenditure on repairs and improvements was incurred as noted below :—

District.	No. of Tanks.	Expenditure during 1897-98.
		Rs.
Ahmedabad District ... ..	2	888
Surat and Broach Districts ... ..	5	2,217
Belgaum District ... ..	12	6,911
Dhárwár District ... ..	51	20,970
Total ... ..	70	30,986

10. On the 1st April 1897, the water at Lake Fife was 16·27 feet above the sill of canal sluices, and the minimum level was reached on the 17th June, when the depth was 8·40 feet. On the 18th it began to rise, and the lake filled to overflowing on the 26th. The highest flood of the year occurred on the 7th August, when the water rose to R. L. 247·82, or 3·75 feet above finished crest level of the waste weir.

11. The irrigation works commenced during the previous year for affording relief to the distressed people were in progress. In addition to these several new works were started during the year under review. All these are mentioned in the district reports.

12. The total area irrigated from all works during the year was 124,851 acres and compares with the previous five years as follows :—

Years.	Area irrigated.	Rainfall.
	Acres,	Inches.
1892-93 ... ..	63,772	33·59
1893-94 ... ..	78,188	21·62
1894-95 ... ..	82,475	22·88
1895-96 ... ..	73,159	24·48
1896-97 ... ..	116,252	21·63
1897-98 ... ..	124,851	23·49

13. The following table shows the area irrigated and water-rate assessment for each work during the year :—

Serial No.	Name of work.	Area irrigated.	Assessment.
		Acres.	Rs.
1	Háthmati Canal ... ..	5,390	14,486
2	Khári Cut ... ..	2,501	16,815
3	Hartála Tank ... ..	44	92
4	Mukti Tank ... ..	1,307	4,874
5	Mhaswa Tank ... ..	207	504
6	Jámda Canals ... ..	3,046	10,946
7	Pársul Tank ... ..	476	2,241
8	Pálkhed Canal ... ..	2,077	8,611
9	Wadáli Canal ... ..	452	1,671
10	Ojhar Támbat Canal ... ..	573	2,263
11	Ojhar Canal ... ..	6,068	13,095
12	Lákh Canal ... ..	950	1,410
13	Bhátodi Tank ... ..	1,400	4,318
14	Mutha Canals ... ..	12,691	1,27,249
	Carried over ... ..	37,182	2,08,575

Serial No.	Name of work.	Area irrigated.	Assessment.
		Acres.	Rs.
	Brought forward ...	37,182	2,08,575
15	Mátoba Tank ... ..	2,883	12,926
16	Kasurdi Tank ... ..	142	305
17	Shirsuphal Tank ... ..	1,623	3,801
18	Bhadalwadi Tank ... ..	1,895	3,745
19	Nira Canal ... ..	47,574	1,32,552
20	Koregaon Tank... ..	324	656
21	Ekrak Tank ... ..	3,547	12,390
22	Ashti Tank ... ..	1,790	4,458
23	Mhasvad Tank... ..	6,133	13,866
24	Muchkundi Tank ... ..	4	10
25	Krishna Canal ... ..	4,321	48,608
26	Yerla River Irrigation Works ... ..	3,371	10,638
27	Upper Mán River Works ... ..	2,022	5,623
28	Rewári Canal ... ..	1,647	8,265
29	Maini Tank ... ..	1,646	4,705
30	Chikhli Canal ... ..	524	2,151
31	Gokák Canal. ... ..	6,856	15,755
32	Madag Tank ... ..	744	1,927
33	Medleri Tank ... ..	72	593
34	Dámbal Tank ... ..	440	1,190
35	Asundi Tank ... ..	111	588
	Total ...	124,851	4,93,327

14. The total assessments amount to Rs. 4,93,327, and thus show a decrease of Rs. 18,873 or 3.68 per cent. notwithstanding the increase of 8,599 acres in the area irrigated.

15. A statement showing the results of run-off from the catchment areas of tanks for 1897 is appended.

Results of run-off.

### SIND.

16. The inundation of 1897 was an exceptionally favourable one and was the highest on record. At the time when the river was highest during the month of August there was a considerable fall of rain, the combined effect of which was to cause floods more or less in all districts, the districts which suffered most being the Northern Hyderabad and Karáchi Canals. The river and other bunds, which had been put up after the high inundation of 1894, proved of great service in controlling the flood waters, and these, together with the prompt measures taken by the Executive Engineers and their establishment, minimized the effect of the flood, which would otherwise have probably been disastrous.

17. The river rose rather later than usual; the highest level attained in Bukkur Gauge. May was 9' 1" on the 13th of that month and the lowest 6' 11" on the 22nd and 23rd. In June, after an oscillation from 7' 6" to 10' 2" and then down again to 8' 4" on the 14th, the river began to rise steadily and the gauge read 12' 3" on the 30th of that month. In July the river fell again to 10' 11" on the 7th and 8th and then steadily rose with slight variations until it reached 13' on the 14th July and the maximum of the year 17' 11" on the 28th August. This level is the highest yet recorded since the Bukkur gauge was established in 1848. The previous record of height was 17' 7" on the 7th August 1882. After staying at 17' 11" for two days the river steadily fell; 13' on the gauge was again registered on the 8th September and the water went down to 7' 4" by the 30th of the month.

18. At this station the early supply was somewhat better than usual. In May the height was between 12' and 13', except for 7 days when a rise and fall took place. On the 4th June the gauge registered 11' 11" and from that date the rise was fairly steady though accompanied by the usual small variations. A height of 17' 3" was registered on the 1st July, a descent to 16' was marked on the 10th of the same month and 17' was again attained on the 13th. The maximum height of the season, 22', was reached on the 4th September and this level was maintained for two days, after which the fall was steady and 17' was again registered on the 17th September; on the 30th September the water level had fallen to 13' 10".

The maximum height reached, *viz.*, 22' was not a record one as in the case of the Bukkur gauge, for in 1894 the Kotri gauge registered a height of 22' 7".

19. Readings were taken during the year at the new gauge referred to in last year's report as having been established on the island of Din Belo just below the Sukkur Pass, the Bukkur gauge being situated just above the pass.

20. The variations in the readings on the Bukkur and Din Belo gauges are approximately as follows at the different heights, indicating a very considerable afflux above the pass during the floods:—

Reading on Bukkur Gauge.	Average lower reading on Din Belo Gauge.
1 foot to 2 feet.	1½"
3 feet to 5 do.	3"
6 do. to 8 do.	4"
9 do.	5"
10 do.	6"
11 do.	8"
12 do.	1' 0"
14 do.	1' 6"
15 do.	2' 0"
16 do.	2' 6"
17 do.	3' 0"

21. The fair irrigating level of 13' on the Bukkur gauge was maintained continuously for a period of 57 days from July 14th to September 8th.

At Kotri the river stood at and over 17 feet from June 30th to July 4th and again from July 13th continuously to September 16th, a total of 71 days.

22. The following table shows a comparison of the water-supply during this and the previous 10 years:—

Year.	Bukkur Gauge 13' and over.	Kotri Gauge 17' and over.
1887	45	36
1888	30	24
1889	76	66
1890	37	37
1891	30	45
1892	38	41
1893	44	50
1894	80	87
1895	25	27
1896	49	59
Average	45.4	47.2
1897	57	71

From the above it would seem that the inundation of 1897 ranks much above the average. The inundation of 1894 has so far been regarded as almost an ideal one, and as regards the duration of the supply at and above fair irrigating level, was a much better one than that of 1897. The principal feature of the 1897 inundation, however, was the abnormal rise that took place from the middle to the end of August, just when water was most needed for final waterings of kharif crops and also for the first waterings for rabi. Judged by the duration of the supply and its distribution, the inundation of 1897 may be classed as excellent.

23. The revenue figures for 1897 will, it is believed, prove very satisfactory, for, although there was some destruction of kharif crops by floods, this description of cultivation was on the whole good and the rabi cultivation, it is believed, excellent.

24. A heavy fall of rain, occurring during the month of August when the river was at its highest, rendered canal water for irrigation unnecessary for a short period. The result was that in many districts the canal banks were over-topped and numerous breaches occurred.

Floods and Accidents.  
State of supply.

25. The Northern Hyderabad Canals District probably suffered most. This district was previously considered secure against river floods. During the year under report, however, a very disastrous flood occurred owing to the breaching of the new bund constructed at the beginning of the year between the Dambro and the Bhorti new feeder. On the 18th July, a breach occurred which was, however, promptly closed. Again on the 17th August, with the Bukkur gauge at 16' 2", heavy rain fell and another more serious breach occurred which, owing to the force of the flood and the absence of an adequate supply of labour, could not be closed. Added to this, breaches also occurred in the left bank of the Bhorti Canal from the 10th to the 18th August, carrying away the end of the above bund. The river also overflowed its banks in the Bhorti Forest and part of this water, joining that from the breach in the bund, flowed southwards, and crossing the Dad Canal, both banks of which were submerged from miles 14 to 21, re-entered the Indus a few miles to the west of the town of Moro. About 23,000 acres of kharif in the Naoshahro and Moro talukas were destroyed by this flood, and the loss of kharif revenue is estimated at about Rs. 47,000. The cost of closing breaches was about Rs. 4,000.

26. Numerous small breaches occurred in the Naolakhi, Nasrat, Alibahar Myle and the smaller canals in this district, all of which were promptly closed and very little damage was done to crops. Two of the breaches in the Naolakhi were allowed to remain open for several days, in order to relieve the canal and prevent breaches lower down; the water from these breaches joined the flood water from the Bhorti Bund, doing little or no additional damage. The cost of closing breaches on these canals was about Rs. 4,000.

27. On the Dad Canal several escapes were cut at suitable places in order to relieve the pressure, the water finding its way along natural depressions to the river without doing any damage. Owing to a change in the set of the river, erosion of banks took place both above and below the mouth of this canal, completing the destruction of the village of Mithiani, which was partially carried away by the inundation of the previous year, and destroying the Police Lines, the value of which is estimated at about Rs. 2,500. A heavy deposit of silt also occurred in miles 2, 3 and 4 of this canal to an average depth of 5 feet, involving a cost of about Rs. 15,000 for removal; it did not, however, interfere with the supply of water in the canal, which, owing to the floods, was ample.

28. The Ren Canal was practically submerged for the first 6 miles, and the Jallalani embankment in connection with it was breached, flooding the land from the town of Sakrand to the Ren; no attempt was made to close the breaches, as it would have been useless; moreover they were beneficial in closing breaches lower down the canal and flooded a considerable area of rabi cultivation, while doing comparatively little harm to the kharif. Repairs to banks, &c., on this canal cost about Rs. 4,000.

29. In the Central Hyderabad Canals District, all the canals worked well and the breaches were neither so numerous nor so extensive as in the other districts and were all promptly closed. One large one in the Shahu Wah and another in the Great Marak each flooded about 800 acres of land and cost a considerable sum to repair. The Ghalu Alibhar Bund in this district, constructed in 1894, proved most useful in controlling the flood waters. Although the river water was higher than in 1894, and the rainfall much above the average, the damage done was much less than in that year.

30. In the Fuleli Canals District a total of 111 breaches occurred in the Main Canal and its distributaries and 20 in the canals-taking off direct from the Indus. All were promptly closed at a cost of Rs. 6,775. The most extensive breach was in the Mir Wah, a branch from the Fuleli in Badin taluka, which flooded a considerable area, and cost Rs. 1,400 to close. The loss of revenue due to this breach was about Rs. 2,000, and the probable total loss of revenue due to all breaches in this district about Rs. 5,700.

31. The river bunds in the Fuleli District were severely tried by the high river level and were kept from serious breaching by careful watching and timely repairs. A small breach, which occurred in the Mall Bund near Hyderabad, was promptly closed and no damage was done. In the Hajipur Bund a breach occurred in the Sang bund portion; the flood water however only flowed over waste land and no damage was done.

32. Some flood water appears to have entered the Nára Supply Channel from the Rohri District on 18th July, when the gauge reading on the 12th mile gauge was 22' 9", or about 9 inches above the flood standard of 22 feet, increasing to 23' 6" on 4th August: as the water was cut off at the Rohri Head Regulator the level then fell slowly, but rose again to 23' 6" on 18th August, and, continuing to rise, reached its maximum of 27' 2" on the 31st August, or 2 inches above the maximum of 1894.

Heavy rain falling at the time of high water level in the Supply Channel caused very considerable floods in the Nára Valley.

33. On the 22nd August, the water rose so high on the Bakhora-Bakar Regulator gauge that it became necessary to make a cut in the Makhi Bund. On the 5th September a breach occurred in the Bakhora-Bakar Bund shortly followed by three others; it was then deemed necessary to make a cut in the bund in order to lessen the chance of a breach near the Head Regulator. On the 7th September, an additional cut was made in the Makhi Bund, the water from which flowed freely through the breaches in the Bakhora-Bakar Bund.

34. On the 2nd September it became necessary to make a cut in the Adwana Bund in order to relieve the very severe pressure on the Rata Bund, and so diminish the danger of damage to the Jámrao excavation and Falls.

35. The Pabnai Bund was also cut on the 1st September, and flood water escaped through this cut until the 28th idem, helping a free flow in the Nára above, and preventing any ill effects being felt on the Nára below.

36. The Lunar Bund was breached on the 4th September and again on the 10th; a cut was also made in it on the 12th idem. The Sabharji Bund was also cut on the 5th September. The water from these breaches and cuts escaped into the Jatri Dhands and into those opposite Chotiari.

37. On the 9th September the Phatantori Bund was breached.

38. On the Mitrao Canal a breach occurred on the 21st August in the 44th mile on the right bank; it was however closed on the 24th. Several minor breaches were also caused near the tail of the canal by rain water running off from unoccupied higher ground.

The flood from all these breaches passing down the unprotected area reached the Mitrao protective embankment at its 29th mile and there became absorbed. It destroyed about 8,500 acres of kharif cultivation and to a certain extent damaged about 6,500 acres more.



39. The supply to all the canals in the Begári Canals District was ample, though in the case of the Unharwah a rotation of waterings had to be adopted at the close of the season. The inundation was favourable for the maintenance of the bunds, as the rise was slow and steady, accompanied by falls, which enabled repairs to be executed whenever necessary.

40. The old portions of the Kashmor Bund gave no trouble, but the new loops showed many leaks which were all successfully dealt with. Floods from the Shori Nai due to heavy rain on the hills gave much trouble, but the bund at this point was successfully maintained although numerous leaks occurred.

41. In the Shikárpur Canals District the water-supply to the canals was excellent, except in the case of the Sind Sanri Branch of the Sind Canal, in which a deposit of silt was formed at its mouth. Although the flood embankments in this area were severely tried by the high inundation and numerous leaks occurred, the bunds were successfully maintained and only one breach took place, which fortunately did not cause much damage.

As was to be expected in a year of such inundation, floods occurred in the Ghotki and Ubauro talukas and caused much damage to the canals which they crossed. As a set-off to the damage done to the canals, the floods enabled a large area of rabi to be cultivated.

42. The supply to the Sukkur and Ghár systems of canals was, on the whole, good, although lands dependent on the upper reaches of the Ghár suffered to some extent towards the end of the season from an insufficient supply. Serious erosion took place at and above the mouth of the Ghár and ultimately caused the early closing of the canal by the deposit of a heavy bar of silt. Favourable rainfall in August and a well-sustained high river, however, did much to help the working of the Ghár system, and it is expected that the kharif and rabi revenue will be satisfactory.

The river bunds in the Ghár Canals district were satisfactorily maintained.

43. All the canals in the Western Nára District worked well.

The flood embankments were severely tested by the high inundation, and though numerous leaks and one small breach occurred they were all satisfactorily closed and no damage was done.

The river bank is being eroded near miles 4, 8, 25, 26, 27 and 67 of the Nágesha Bund and near Sehwan, but no new retired loops are at present necessary.

The Aral and Dunster worked exceptionally well in draining the Manchar Lake.

44. In the Karáchi District the canals received a very early and ample supply of water throughout the season. Some damage and breaches of canal banks took place owing to the unusual height of the inundation, but all the breaches were promptly closed.

The new Laikpur Canal worked very satisfactorily.

The extensive line of river embankments in this district was severely tested by the high floods of the year. The levels recorded on the bund lines have exceeded those registered in previous years and the water stood at a high level against the banks for an unusually long period. A very large breach occurred at Munarki, owing to the carelessness of the subordinate in charge, and very extensive areas in the Sujával and Sháhbandar talukas were flooded. Two other breaches were caused through sluices giving way. Minor breaches also occurred in other places without resulting in serious damage. On the whole the season was a very trying one for the bunds, and the unusually steady rise of the river did not give an opportunity for closing the breaches with the necessary promptitude. Repairs have been carried out and the new loops, necessitated by large breaches, have been constructed.

The river has not changed its course very much during the past inundation. Erosion is in progress in the Manjhand taluka, at Panah, in Táta

Taluka, also at Muchara and Bhiman below the Baghar, at Bunno, Kotalmo and Machi in Mirpur Bathoro, and the river bank was badly eaten into at Munarki, where a new loop has been constructed.

45. The principal works in progress in the Indus Right Bank Division were, the construction of the Dhámrao, the Rajwah and the Laikpur Canals, the widening of the New Feeder and works in connection with the new loop, Kashmir Bund.

46. In the Indus Left Bank Division the principal works in progress were the construction of the Jámrao Canal, improvement to the Dád Canal, and the construction of an escape for the Fuleli Canal.

47. On the Jámrao an excellent year's work was done in both the First and Second Districts. In the First District good progress was made with the head works as detailed in the district report; the earthwork of the Main Canal within this district was also nearly completed.

In the Second District very satisfactory progress was made with the earthwork of the Main Canal, and that on some of the Minors commenced. Good progress was also made with the masonry works. In this district 73 miles of base lines for the square survey for colonisation were also laid down and nicked out.

In the Third District not much work, beyond surveying and laying down the lines of some of the branches, was done; the allotment for this district being very small, work had to be deferred until that in the other district was more advanced.

Labour was plentiful on the Jámrao during the year, and practically the whole of it was imported.

48. The progress made with the Dád works was, owing to the difficulty in procuring contractors, not so satisfactory; details are given in the district report.

49. In the Fuleli Canals District very good progress was made with the earthwork of the Fuleli Escape; the Escape Head Regulator was also commenced. A new mouth to the Sani Guni was also in hand and good progress made with it. The new bridge over the Jamshora mouth of the Fuleli Canal, mentioned in last year's report, was completed.

50. In the Eastern Nára District the principal works carried out were—

- (1) The extension of the Rata Bund.
- (2) The completion of the escape through the Bhaiti Bund and the extension southwards of that bund.
- (3) The completion of the regulator in the Makhi Weir and the channel in connection therewith.
- (4) The completion of the head regulator of the Thar Canal.

51. During the year under report, an additional executive district was constituted in this Division, by dividing what was the Hyderabad Canals District into two districts called, respectively, the Northern Hyderabad Canals District and the Central Hyderabad Canals District. This was considered necessary in view of the early commencement, in the northern part of the Hyderabad District, of the improvements and extensions of the Dad, the Naolakhi and the Nasrat Canals. To the Central Hyderabad District were also allotted the Civil works and buildings in the city of Hyderabad, which were formerly in charge of the Executive Engineer, Fuleli Canals.

52. The usual statement of entire expenditure with a detailed statement showing the various items of works on which the canal clearance grant for the year has been expended and the Establishment debitable to it is appended

(Appendices A and B). A general summary of this expenditure for the whole province is given below :—

Class of Works.	NEW WORKS.				REPAIRS.			Establishment Proper.	Tools and Plant.	Total under all Heads.
	Capital.	Revenue.	Ordinary Agricultural.	Total.	Works.	Canal Conservancy Establishment.	Total debitable to Clearance Grant.			
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Major Works ...	13,80,771	13,795	...	13,94,566	1,75,628	46,875	2,22,503	2,69,183	13,135	18,99,387
Minor Works, Capital ...	1,14,232	53,756	...	60,476	1,64,800	46,999	2,11,799	70,344	1,715	3,44,334
Do. Revenue, ...	...	1,93,265	...	1,93,265	3,43,663	1,00,776	4,44,439	1,89,728	2,870	8,30,302
Ordinary Agricultural ...	...	...	80,906	80,906	3,38,020	43,678	3,81,704	1,02,417	1,793	5,66,820
Total ...	14,95,003	1,53,304	80,906	17,29,213	10,22,117	2,38,328	12,60,445	6,31,672	19,513	36,40,843
Deposits, Contribution— Ordinary ...	..	...	4,831	4,831	1,258	...	1,258	15	...	6,104
Total ...	14,95,003	1,53,304	85,737	17,34,044	10,23,375	2,38,328	12,61,703	6,31,687	19,513	36,46,947

\* Inclusive of Refunds of Revenue, Rs. 556.

### GENERAL.

53. The revenue receipts during the year amounted to Rs. 8,40,452 of which Rs. 6,26,765 were on account of works in the Deccan and Gujarát and Rs. 2,13,687 on account of works in Sind. These receipts represent direct revenue accounted for in the Public Works Department, and do not include the receipts credited under Land Revenue. The figures for the year under report compare with those for the previous two years as follows :—

	1895-96.	1896-97.	1897-98.
	Rs.	Rs.	Rs.
Major Works—			
Protective Works ...	1,02,652	92,646	1,51,008
Productive Works ...	4,73,953	4,00,571	4,41,257
Total ...	5,76,605	4,93,217	5,92,265
Minor Works—			
Imperial—			
Works for which Capital and Revenue Accounts are kept ...	1,47,000	1,49,322	1,49,297
Works for which only Revenue Accounts are kept ...	79,580	70,578	65,098
Agricultural Works—	1,547	2,190	1,955
Provincial—			
Works for which Capital and Revenue Accounts are kept ...	23,023	22,441	31,837
Total ...	2,51,150	2,44,531	2,48,187
GRAND TOTAL ...	8,27,755	7,37,748	8,40,452

Expenditure.

54. The expenditure of the year was distributed under different heads as under :—

				<i>Imperial.</i>		
				Rs.	Rs.	Rs.
Capital—						
Major Works—						
Protective Works ...	...	...	...	1,90,438		
Productive Works ...	...	...	...	* 16,00,731		
				17,91,169		
Minor Works and Navigation—						
Works for which Capital and Revenue Ac-						
counts are kept ...	...	...	...		† 1,59,595	
Revenue—						
Major Works—						
Protective Works ...	...	...	...	82,998		
Productive Works ...	...	...	...	4,86,254		
				5,69,252		
Minor Works and Navigation—						
Works for which Capital and Revenue Ac-						
counts are kept ...	...	...	...	2,81,939		
Works for which only Revenue Accounts are						
kept ...	...	...	...	9,48,947		
				12,30,886		
Agricultural Works—						
Works for which neither Capital nor Revenue						
Accounts are kept ...	...	...	...		‡ 6,58,638	
Contribution Works ...	...	...	...		14,198	
				44,23,738		
	Total, Imperial ...				44,23,738	
<i>Provincial.</i>						
Capital—						
Minor Works and Navigation ...	...	...	...		4,231	
Revenue—						
Minor Works and Navigation ...	...	...	...		5,394	
				9,625		
	Total, Provincial ...				9,625	
				44,33,363		
	Grand Total ...				44,33,363	

55. The total expenditure is classified as follows:—

	Deccan and Gujarát.	Sind.	Total.
	Rs.	Rs.	Rs.
Works ...	(a) 2,89,576	(b) 17,34,044	20,23,620
Repairs ...	(c) 1,94,908	(d) 12,61,703	14,56,611
Establishment ...	2,82,215	6,31,687	9,13,902
Tools and Plant ...	7,164	19,513	26,677
Suspense Account... ..	9,131	3,422	12,553
Total ...	7,82,994	36,50,369	44,33,363

56. The cost of Works Establishment for certain districts in the Central and Southern Divisions is shown in Appendix C. The information as regards Sind works has been omitted from the statement for reasons given in the report for 1893-94.

59. Maps showing the position of the principal irrigation works in the Gujarát, the Deccan and the province of Sind, as also a diagram showing excavations on the Jámráo Canal, are attached.

* Inclusive of expenditure in England ... ..	Rs. 10,750.
† Do. do. do. and exchange ..	8,894.
‡ Do. do. do. do. do. do. ..	2,040.
(a) Exclusive of Rs. 388 } On account of Receipts on Capital Account.	
(b) Do. " 396 } ..	
(c) Inclusive of " 1,090 } On account of Refunds of Revenue.	
(d) Do. " 556 } ..	

## GUJARAT AND THE DECCAN.

## GUJARAT.

## AHMEDABAD DISTRICT.

Though the rainfall during the year at Prantij was only 23·08 inches against 39·26 inches for the preceding year, and the average of 32·93 inches for the ten years ending 31st December 1897, the season was on the whole favourable, and there was an increase both in the kharif and rabi areas irrigated, due to the people taking fuller advantage of supply available.

2. The total area irrigated was 5,390 acres (1,837 kharif and 3,553 rabi) against 3,900 acres (1,130 kharif and 2,770 rabi)

Years.	Area Irrigated.	Total net Revenue.
	Acres.	Rs.
1892-93 ...	2,727	6,972
1893-94 ...	3,701	10,256
1894-95 ...	4,199	11,733
1895-96 ...	3,439	10,419
1896-97 ...	3,900	10,816
1897-98 ...	5,390	14,486

for the last year, and the revenue amounted to Rs. 14,486 against Rs. 10,816. From the information given in the margin, it will appear that both the area irrigated and revenue have increased considerably during the last six years. Before 1891-92 the average yearly receipts amounted to about Rs. 5,000 only. The revenue during the year under report is the highest on record, and is more than 23 per cent. of the revenue realized in 1894-95, which is the next best of the series.

3. The cost of maintenance and repairs, &c., was Rs. 4,430, including clearance of silt and special repairs to certain branches under the canal, against Rs. 5,193 in the previous year.

4. Only one flood occurred in the Háthmati river on 11th August 1897, when the water rose 3·40 feet above the crest of the weir, the rainfall on that day being 1·30 inches.

5. The works referred to in the report for 1896-97 for diverting experimentally the Háthmati Canal water into the Bhujwa were nearly completed during the year at a total cost of Rs. 2,727, against the sanctioned estimate of Rs. 2,962, and the necessary experiments will be carried out at once.

6. During the season 2,501 acres were irrigated (2,477 kharif and 24 rabi), against 2,926 acres (2,891 kharif and 35 rabi) last year, and the assessment amounted to Rs. 16,815, out of which free grants and remissions to the extent of Rs. 4,646 were given, leaving a net revenue of Rs. 12,169, against a net revenue of Rs. 15,674, last year. The decrease is due to insufficient rainfall for the rice crop, which was in consequence not sown to the usual extent. Owing to want of water in the Chandola tank, it was not found practicable to give necessary waterings to mature the crop, thus rendering heavy remissions necessary.

7. The cost of maintenance and repairs was Rs. 2,903 compared with Rs. 3,946 last year.

8. The people are appreciating the advantages of water, and the irrigation revenue has considerably increased during the last five years as shown by the figures quoted in the margin. During the year under report, owing to the scanty rainfall, there was a marked decrease of water in the Khari, in which there was no high flood during the year.

Years.	Total Net Revenue.
	Rs.
1892-93 ...	4,803
1893-94 ...	10,474
1894-95 ...	12,907
1895-96 ...	15,175
1896-97 ...	15,674

9. During the year under report, certain extensions to the Ghodasar Branch No. 1, called Vatwa Distributary, referred to in the last year's report, were completed at a total cost of Rs. 2,920 against the sanctioned estimate of Rs. 3,576. This sum is exclusive of charges for land compensation, which will

be paid for during the following year.

10. The cost of maintenance amounted to Rs. 928, as against Rs. 904 last year. During the year a sum of Rs. 1,651 was spent on silt clearance from the bed of the river Khari, in addition to the ordinary repairs to the sluices on which a sum of Rs. 944 was expended.

11. A further sum of Rs. 390 was also spent in providing bed level and bench mark stones in the Khari. The total expenditure incurred on the work was Rs. 775 against the sanctioned estimate of Rs. 1,240.

12. The renewal of the bund at Dhamatwan, referred to in the last year's report, was completed, and the result, so far as it can be judged at present, is very satisfactory. The new banks have been planted with bábul which thrives well on this soil and which will not only afford a very good protection to the banks, but will also prove to be a source of revenue to the State. The total expenditure amounted to Rs. 8,811, of which Rs. 549 were expended during the year, against the estimated cost of Rs. 11,036.

13. During the year under report, the Sher tank in the Viramgám Táluka was repaired at a total cost of Rs. 308 and certain improvements to the tank at Sahijpur-Gopalpur in the Daskrohi táluka, estimated to cost Rs. 1,690, were sanctioned; a sum of Rs. 580 was expended on the latter work before 31st March 1898.

14. The inspection of the irrigation tanks in the Sanand táluka was completed in 1897-98 for the purpose of making out a list of tanks and giving effect to the orders contained in Government Resolution No. 34-W. I.—419, dated 25th March 1895.

#### KAIRA AND PANCH MAHALS DISTRICTS.

15. During the past year a tank at Malav in the Panch Máhals District was brought on to the register of irrigation tanks in charge of this department; an estimate amounting to Rs. 2,899 for certain repairs to this tank has been lately sanctioned, and some materials for the work collected at site to the value of Rs. 200. The repairs, which will be completed during the rains, consist of:—

- (1) Raising the embankment.
- (2) Repairing the existing outlets and constructing one additional outlet.
- (3) Constructing a new waste weir 174 feet in length.

16. The Anand and Mogri Drain was maintained throughout the year at a cost of Rs. 574.

#### SURAT AND BROACH DISTRICTS.

17. The Ora-Vichiad-Badalpore Drainage Channel in Wagra Táluka was in progress. The Chanchwell Branch of the channel, which was in progress last year, was completed, and the Keshwan Branch of the channel commenced. The expenditure during the year was Rs. 3,659 and Rs. 5,446 from the commencement of the work.

18. Repairs to five tanks were carried out during the year at a total cost of Rs. 2,217.

19. The breaches and eroded portion of the embankment were repaired at a cost of Rs. 2,336, while Rs. 1,006 were spent in current repairs.

#### THE DECCAN,

#### KHANDESH IRRIGATION DISTRICT.

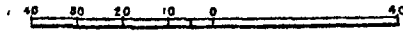
20. A great deal of the ordinary work of the district was delayed owing to the pressure caused by the famine.

# BOMBAY PRESIDENCY

## Part I.

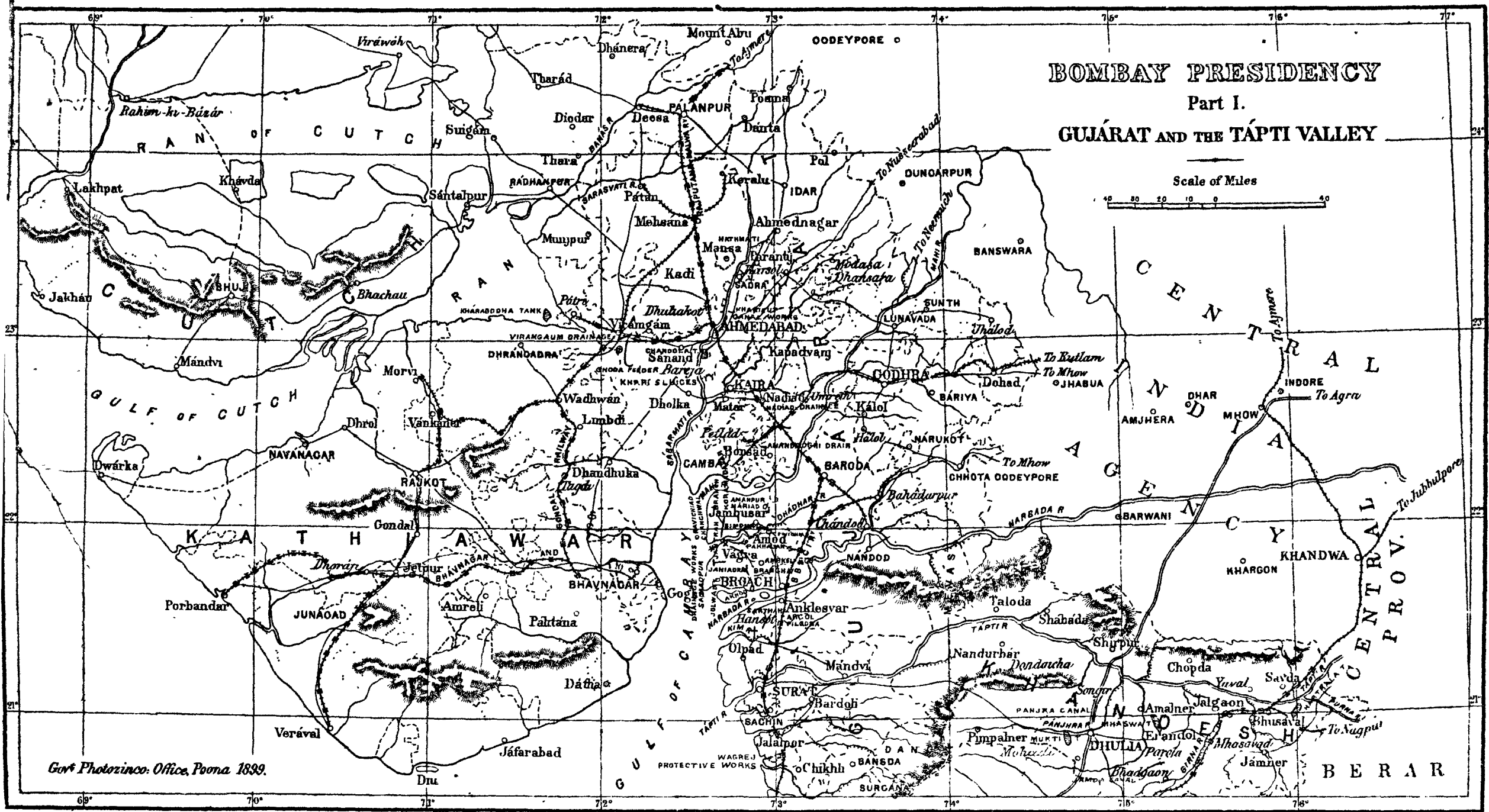
### GUJARAT AND THE TÁPTI VALLEY

Scale of Miles



Govt Photodupl. Office, Poona 1899.

- |                 |                                     |                   |                                       |
|-----------------|-------------------------------------|-------------------|---------------------------------------|
| JAMBUSAR TALUKA | 1 AMANPUR NARIAD CHANNEL            | △ JAMBUSAR TALUKA | 6 SINDHAD CHANNEL                     |
| * VAGRA DO      | 2 KORA MADAFAR DO                   | ⊕ VIRAMGAUM DO    | NARSINGPUR VIRAMGAUM DRAINAGE CHANNE- |
| + ANKIESHWAR DO | 3 SAMADPUR KADODRA FANIADRA CHANNEL | ○ VAGRA DO        | JOLWA CHANNEL                         |
| x VAGRA         | 4 SARTHAN ARDOL PILDORA DO          | ○ VAGRA DO        | AMHOD DO                              |
|                 | 5 PAKHAJAN AMBHEL DO                | ○ VAGRA DO        | 7 LONAR NARIAD CHANNEL                |
|                 |                                     |                   | 8 ... CHANNEL BRANCH                  |



21. The following is a list of the famine works which were taken in hand, giving the expenditure on works and gratuitous relief, and the average daily number relieved on them during the period each was in progress.

Names of Works.	OUTLAY.			DAILY AVERAGE NUMBER RELIEVED.		
	Works..	Gratuitous Relief.	Total.	Workers.	Non-Workers.	Total.
1. Special Repairs to Jámnda Canals... ..	1,203	792	1,995	665	289	954
2. Kasara Channel Improvements .	235	600	835	471	174	645
3. Shaháda do. ... ..	2,705	174	2,879	421	234	655
4. Talwada Tank ... ..	169	...	169	...	...	...
5. Jalgaon Water-supply Improve-ments... ..	3,638	392	4,030	504	187	691
6. Chankápur Tank ... ..	3,506	} 3,578	38,700	{ 398	135	533
7. Girna Left Bank Canals ...	31,616					
	43,072	5,536	48,608	3,757	1,439	5,196

The first three works were commenced in the previous year. These are irrigation works in operation and would have been repaired and improved in the ordinary course. The earthwork and collection of materials being suitable items for the employment of famine labour, were made available for relief purposes. The expenditure on them at normal rates has been debited to ordinary grants. What is shown above is the abnormal expenditure due to the employment of famine labour.

The expenditure on Talwada tank is for preliminary arrangements to start the work, but no work was actually carried out.

The last three works were taken in hand during the year when, with the advance of the season, necessity arose for large concentrated works. The Jalgaon water-work was in hand till the 25th of August 1897, and the Girna Left Bank Canal till the 9th of October 1897. The Chankápur tank work, which is situated in the hilly part of the district where early and heavy rains prevail, did not attract the people who were drafted to it from the plains, and the work was closed in the beginning of the monsoon (10th June).

22. With the advent of the hot season the supply in the tanks and the Girna river, which is the source of water-supply to the Jámnda Canals, began to fail. The demand for water for hot weather crops was heavy, and economy and vigilance in preventing waste resulted in hot weather supply being delivered to areas as under :—

Mhaswa Tank	...	...	14 acres.
Parsul do.	...	...	60 do.
Mukti do.	...	...	117 do.
Jamda Canals	...	...	191 do.

The area shown against the Mukti tank includes dry crop land as well as the permanently irrigated land. This irrigation being under the Survey Settlement and not under the direct control of the Irrigation Department, the area irrigated in it during the hot weather is not exactly known. There was some difficulty in meeting the requirements of irrigation in the lower reaches of the Jámnda Canals with the stinted water-supply in the Girna, but it was successfully accomplished, and no applications for water in the hot weather were refused. The Hartala tank was empty.

23. The following table shows the Capital and Revenue expenditure on these works. The latter represents the cost of the year on the up-keep of the works and the plantation, &c., on them.

New Irrigation Tanks and Canals.



Works.	Capital Outlay.	Revenue Outlay.
	Rs.	Rs.
<i>Irrigation Major Works. Productive Public Works.</i>		
1. Lower Panjhra River Works ...	...	3,001
<i>Irrigation Minor Works.</i>		
2. Jámda Canals ... ..	...	10,503
3. Hartála Tank ... ..	...	86
4. Mháswa do. ... ..	...	313
5. Pársul do. ... ..	19	305

Except the Jámda Canals all the projects have been completed. A small sum remains to be spent on the extension of distributaries under the Lower Panjhra River Works, but owing to the pressure of famine nothing could be done in that direction. This accounts for the absence of Capital expenditure during the year. The small sum shown against the Pársul tank is a liability of the previous year paid during the year under review.

The Revenue outlay on the Lower Panjhra River Works includes the year's expenditure of Rs. 1,856 on repairs to Nimkhedi and Jápi Bandharas, which have been practically completed. In the outlay on the Jámda Canals is included a sum of Rs. 6,948, spent on special repairs to remedy the damage done by the floods of 1896 to aqueduct No. 1 on the Left Bank Canal and to the banks and the flood embankment at Wadgaon above the head of the Right Banks Canal. The canals are now in good working order.

24. These are very important works in this district, but owing to the pressure of famine, the usual attention could not be bestowed upon them during the year. The expenditure incurred on these works, both from Imperial revenues and the balance of Patphála (voluntary cess), is shown in the following table :—

	IMPERIAL.			PATPHÁLA.		
	Khándesh.	Násik.	Total.	Khándesh.	Násik.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Improvements ... ..	15,640	6,222	21,862	567	729	1,296
Repairs... ..	873	1,929	2,802	268	426	694
Total ... ..	16,513	8,151	24,664	835	1,155	1,990

The large outlay on improvements in Khándesh is due to the Kasára and Shaháda Channels, which were taken in hand as Relief Works. After the pressure of famine subsided, grants for Kandhana, Kanasi, Satána, Shirasmani and Deola were obtained and the work thereon was pushed on. The Deola Third Channel is a new work taken up at the request of the irrigators.

The Patphála cess has been abolished, and the balance of former collections is being gradually utilised. The rules contemplated for fixing the responsibility of patels, patkaries and irrigators in effecting silt clearance have been approved by the Commissioner, C. D., and are being introduced.

25. During the year no new proposals of improvements and repairs to channels were taken in hand, but the preparation of the last year's projects, which were kept in abeyance owing to the pressure of famine, was resumed. The Dhadna Project has been submitted for sanction and the Malpur and Ashtana Projects have been drawn up and will shortly be sent up.

Surveys and Preparation of  
Tank Projects.

26. The following expenditure was incurred on surveys :—

Item No.	Name of work.	Amount.
	<i>Protective Works—Famine Relief.</i>	Rs.
1	Surveying channels and a new canal in connection with the Chankápur Reservoir ... ..	85
	<i>Works for which neither Capital nor Revenue Accounts are Kept.</i>	
2	Mulher tank or a reservoir on the Musam... ..	112
3	Markandi Tank... ..	6
4	Prospecting the Jalgaon and Jamner Talukas for a tank site ... ..	22
	Total ... ..	225

The Chankápur Tank Project has been completely revised. The Mulher Tank Project was surveyed with a view to be ready to start work for relief purposes. Similarly, a tank smaller than the one already designed on the Markandi river was considered and reported upon.

27. The rainfall is gauged on all the new irrigation works in operation, but a special river and rain gauge was maintained at Parampada on the Bori in connection with a proposed tank site. The expenditure on it during the year amounted to Rs. 138. A rain gauge was also maintained at Nizámpur to continue the record of rainfall which was cut off by the removal of the Mahalkari's Katcheri from that place. This part of the country abounds in tank sites, and at some future date, this record may be useful. The expenditure during the year amounted to Rs. 85.

28. The following buildings require to be separately mentioned with the cost of repairs during the year—

	Rs.
Bungalow at Chankápur ... ..	167
Irrigation Office at Malegaon ... ..	62

The repairs of other buildings, viz., the bungalows at Jámda, Goadgaon, Nalhandé and the Subordinates' quarters at Kolgaon on the Jámda Canals and the Subordinates' quarters at Nahalod, Stores shed at Dhulia and the boat house on the Mukti tank on Lower Pánjhra River Works have been carried out. The Store shed at Satana was repaired at a cost of Rs. 43, which is included in the repairs expenditure of old irrigation works in the interest of which it was built.

29. Two over-bridges, one on the Amalner Channel in Khándesh and the other on the Satána Channel in Násik, were built during the year. The expenditure on the former amounted to Rs. 274, and it was completed. The latter is in progress and the year's outlay is Rs. 239.

30. On the Deothan Channel an escape costing Rs. 72 was built; the Inamdár of Wadel and the irrigators contributed towards the improvements of the Wadel Bandhára and channel to the extent of their shares, and the rest of the expenditure was incurred from Imperial Funds. The expenditure from contribution during the year amounted to Rs. 184. The repairs and improvements have been completed.

A sum of Rs 24 was contributed by the Walkeda villagers for maintaining a patkari for their channel, and this has been expended.

31. The Mukti tank was first replenished on the 11th June 1897 and overflowed on 29th August 1897. The heaviest rainfall, 2.50 inches, was gauged on 28th August 1897 at Dahiana and 3 inches at Sargaon. The mean of rainfall at the two stations comes to 2.75 inches. An examination of the rainfall and its effects gives on 27th to 29th August 1897, a run-off of 12.97 per cent. of the rainfall.

32. The Mhaswa tank commenced filling on 27th July 1897 and overflowed on 12th August 1897. The greatest rainfall occurred on 24th September 1897 and was gauged 2.27 inches. The run-off from 25th to 28th July 1897 was 69.50 per cent. of the rainfall.

33. The total rainfall on the Hartála tank from 11th June to 28th August was 11.67 inches, but no water rose over the sill of R. L. 80.30 and from 29th August the outlet began to flow at its highest measure of 3.10 feet over the sill on 28th September, or 10.60 feet below the crest of the waste weir. The total replenishment during the year was 15.71 millions cubic feet against 134.86 millions cubic feet, the contents of the tank at F. S. L.

The heaviest rainfall, 1.82 inches, was gauged on 28th August 1897. An examination of the rainfall and its effects from 24th to 26th September gives a run-off of 17.70 per cent. of the rainfall.

34. The Parsul tank commenced filling on 6th July 1897 and filled to overflowing on 22nd September 1897. The greatest rainfall occurred on 22nd September and was gauged 2.85 inches. The run-off from the catchment from 19th to 22nd September 1897 is seen to be 21.30 per cent. of the rainfall in the same time.

35. The percentage of work establishment on expenditure of the year has been Rs. 4 on ordinary outlay and Rs. 11-5-0 on famine expenditure.

#### NASIK DISTRICT.

Kádwa River Works. 36. This system comprises the following works :—

- |                   |                        |
|-------------------|------------------------|
| 1. Wághad Tank.   | 3. Wadáli Canal.       |
| 2. Pálkhed Canal. | 4. Ojhar Támbat Canal. |

37. The usual temporary dam in the waste weir-portion (sill level R. L. 110) was constructed at the close of the monsoon and the water level in the tank rose to R. L. 113.21 on 6th November 1897, when the storage was 248.719 millions cubic feet. The tank's designed F. S. L. is R. L. 128.00, at which the available storage would be 605.555 million cubic feet.

Proposals are made for securing this F. S. storage by permanent masonry works for the waste weir, for which plans and estimates are under preparation. The outlet sill is R. L. 80.00. During 1897-98, water was passed down to Pálkhed from 1st April 1897 to 7th June 1897 and from 7th December 1897 to 31st March 1898.

38. A sum of Rs. 15,567 was expended from the Capital Account, as detailed below :—

	Rs. a. p.
1. Making survey for ascertaining the Wághad Tank area and fixing boundary stones ... ..	202 14 9
2. Tools and Plant ... ..	55 7 0
3. Waste weir wall flanks in waste weir cut of Wághad Tank ... ..	126 2 0
4. Waste weir wall in waste weir cut of Wághad Tank ... ..	210 8 0
5. Raising the retaining wall of the waste weir of Wághad Tank ... ..	55 10 5
6. Completing the earthwork in connection with Wághad Tank dam embankment ... ..	14,916 0 0
Total ...	15,566 10 2

The last item was carried out by famine labour, and the value shown represents the normal cost of the work done. The top level of the dam will be raised, when completed, from R. L. 137.00 to R. L. 141.00. Of the estimated quantity, viz., 1,069,600 cubic feet, only 651,750 cubic feet were done, leaving 417,850 cubic feet to be executed at some future time.

Item (3) is for work necessary to permanently raise the sill of waste weir from R. L. 110 to R. L. 114 to avoid the recurring charges for the temporary bund, and (4) is in connection with raising the F. S. L. from R. L. 114 as per item (3) to R. L. 118 by planks.

The tank and the bungalow at Wághad were maintained at a total cost of Rs. 692.

39. The canal and its main distributary are complete for a length of 18 Pákhed Canal. miles down to the G. I. P. Railway. The canal is 11 miles long, and the completed distributaries are 14.36 miles in length. They were maintained at a cost of Rs. 1,378.

The net irrigable area under command of the complete project is 23,466 acres, of which, however, only 9,837 acres can be served by the existing distributaries. Proposals are under consideration for widening this canal so as to pass a supply of 75 cubic feet at the head, and for providing necessary cross drainage works.

There was an expenditure of Rs. 51 debit to Capital Account, incurred on the survey for the revised project of the Pákhed Canal and its distributaries.

The irrigated areas, assessments, and the rainfall from June to January for the last three years are given below :—

Years.			Area.	Assessment.	Rainfall at Pákhed.
			Acres.	Rs.	Inches.
1895-96	...	...	1,622	6,398	30.65
1896-97	...	...	2,260	8,865	30.82
1897-98	...	...	2,077	8,611	21.73

The canal was closed five times (18 days in all) during the year as usual for clearance of silt and weeds. The silt from this canal was cleared and the breaches caused by the heavy floods of the last year closed at a cost of Rs. 821 from the special repairs grant. The foundations of the Pákhed weir were repaired at a cost of Rs. 238.

40. The charges for establishment, excluding direction and collection, were :—

Executive...	...	...	...	Rs.
Revenue ...	...	...	...	688
				7,982

The cost of repairs per mile was nearly Rs. 54.

41. The canal, 5½ miles long, was maintained at a cost of Rs. 458 or Rs. 87 Wadáli Canal. per mile. There was no expenditure from Capital Account.

The net irrigable area commanded is 2,433 acres, of which 286 acres at the head of the canal are assessed at consolidated rates. The irrigated areas, assessments, and the rainfall from June to January for the last three years were as under :—

Years.		Area.	Assessment.	Rainfall at Niphad.
		Acres.	Rs.	Inches.
1895-96	... ..	339	1,062	27.77
1896-97	... ..	515	1,983	20.98
1897-98	... ..	452	1,671	25.37

The canal was closed five times for the usual silt and weeds clearance for 19 days in all.

42. The charges for establishment, excluding direction and collection were :—

				Rs.
Executive ...	...	...	...	1,556
Revenue ...	...	...	...	171

43. The canal is  $4\frac{1}{2}$  miles long and is supplied during the hot weather, when the river's discharge is very small, by Wághad Tank water led into it by a feed channel from Páلكhed Canal. The expenditure on maintenance and repairs during the year was Rs. 447 or Rs. 99 per mile. On Capital Account, Rs. 21 were expended in surveying for the revised canal project of Ojhar Támbat Canal, with the proposed Sukena Distributary. An expenditure of Rs. 325 was incurred on special repairs to the canal during the year, against the estimated amount of Rs. 2,294, as the sanction was received late.

44. The charges for establishment, exclusive of direction and collection, were :—

				Rs.
Executive ...	...	...	...	2,491
Revenue ...	...	...	...	175

The net irrigable area under the canal is 6,824 acres, of which 2,367 are at present commanded. The irrigated areas, assessments, and the rainfall for the last three years were as under :—

Years.		Area.	Assessment.	Rainfall at Páلكhed.
		Acres.	Rs.	Inches.
1895-96	... ..	528	2,185	27.77
1896-97	... ..	628	2,707	20.98
1897-98	... ..	573	2,263	25.37

45. The total number of trees on the Páلكhed Canal is 9,398, consisting of *bábul*, *nimb*, and *mango*. They were preserved during this year at a cost of Rs. 78 which was spent on watering and hedging. On the Wadáli Canal, there are 2,128 trees. The cost of watering and hedging was Rs. 25. The number of trees on the Ojhar Támbat Canal is 764, maintained at a cost of Rs. 25.

46. In the talukas under the Násik District charge there are 191 old *bandháras*, producing a revenue of Rs. 80,804 and irrigating 17,817 acres under consolidated assessment.

Second Class Revenue Works.

47. The expenditure on original works, extensions and improvements, was Rs. 877 and on repairs Rs. 451 as follows:—

No.	Names of Works.	Allotment.	Expenditure during the year.	REMARKS.
	<b>IMPERIAL.</b>	Rs.	Rs. a. p.	
	<i>IRRIGATION MINOR WORKS AND NAVIGATION WORKS FOR WHICH ONLY REVENUE ACCOUNTS ARE KEPT.</i>			
	<i>Extensions and Improvements.</i>			
1	Improvements to Pálkhed Street Bandhára, at Shirwáda, Táluka Niphád.	.....	2 8 0	
2	Constructing an escape on the Karsul Bandhára Channel, Táluka Niphád...	I. 350	I. 348 5 0	Completed.
3	Improvements to Bandhára at Khopdi Khurd, Táluka Sinnar ... ..	I. 519	I. 461 0 10	Do.
4	Constructing a 6-feet bridge across Channel Bandhára No. 2, Khedgaon, Táluka Dindori ... ..	I. 68	I. 64 12 0	Do.
	Total ...		876 9 10	
	<i>Maintenance and Repairs.</i>			
1	Repairs to Páchora Bandhára, Táluka Sinnar ... ..	I. 37	I. 15 0 2	Completed.
2	Repairs to Thangao Bandhára, Táluka Sinnar ... ..	I. 116 C. 13	I. 92 2 6	Do.
3	Repairs to Bandhára at Khopdi Khurd, Táluka Sinnar ... ..	I. 33 C. 4	I. 15 2 10	Do.
4	Repairs to Bhagoorwat Bandhára at Adgaon, Táluka Násik ... ..	I. 129 C. 14	I. 141 10 4	Do.
5	Maintenance and repairs to old Wadáli Canal... ..	193	187 4 0	Do.
	Total ...		451 3 10	

48. The works sanctioned during the year and the expenditure incurred Survey Works, thereupon are detailed below:—

No.	Names of Works.	Allotment.	Expenditure during the year.	REMARKS.
	<i>Works for which neither Capital nor Revenue Accounts are Kept.</i>	Rs.	Rs. a. p.	
1	Preliminary Survey of Bangangá Tank Site ... ..	W. 35	2 10 0	
2	Survey for Waldevi Tank Site ... ..	74	.....	
3	Resurveying Khirdi Sate Tank ... ..	38	W. 38 4 0	Completed.
4	Surveying Karanjawan Tank... ..	159	W. 99 7 6 E. 59 6 0	
5	Surveying for Odhal Tank ... ..	382	W. 147 6 1 E. 405 9 7	
	Total ...		752 11 2	

49. During the year under report some work was done in connection with the Wághad and Khirdi Sate tanks and on the Máládevi tank in the Ahmednagar District on account of famine.   
 Famine Works.

50. The work done on Wághad tank consisted chiefly of earthwork, and the quantity with cost has already been given.

51. Khirdi Sate tank is situated in the Yeola Táluka, and the dam work was in progress. This, when completed, will be a small tank irrigating a part of the Yeola Táluka.

52. The third work, viz., the Máládevi tank, is in connection with the Pravará River Irrigation scheme.

53. The following statement shows the quantity and normal cost of work done in connection with these three works:—

No	Name of works.	Quantities of work done during famine.	Normal rate.	Normal value.	Remarks.
1	2	3	4	5	6
	<b>NÁSÍK COLLECTORATE.</b>	<b>C. ft.</b>	<b>Rs. a. p.</b>	<b>Rs.</b>	
	<b>B.—IRRIGATION AND WATER-SUPPLY.</b>				
	<i>(a) Construction of Storage Dams for Irrigation.</i>				
1	<b>Waghad Tank—</b>				
	(1) Embankment ... ..	651,771	1 12 0	11,406	
	(2) Stepping ... ..	136,277	0 6 0	511	
	(3) Metal breaking ... ..	52,428	4 0 0	2,097	
	(4) Road work, gutter excavation, murum surfacing, &c. ...	45,100	2 0 0	902	
	Total ...	...	...	14,916	
2	<b>Khirdi Sate Tank—</b>				
	(1) Dam embankment ... ..	1,061,500	1 8 0	15,922	
	(2) Puddle trench filling ... ..	27,300	1 8 0	409	
	(3) Leakage drain ... ..	Rg. ft. 264	1 0 0	264	
	(4) Inspection Bungalow at Khirdi Sate... ..	...	...	4,093	
	Total ...	...	...	20,688	
	<b>AHMEDNAGAR COLLECTORATE.</b>				
	<b>B.—IRRIGATION AND WATER-SUPPLY.</b>				
	<i>(a) Construction of Storage Dams for Irrigation.</i>				
	<b>Máládevi Tank—</b>				
	<i>I.—Puddle Trench.</i>				
1	Earth excavation ... ..	534,631	1 4 0	6,683	
2	Murum do. ... ..	11,127	4 0 0	445	
3	Rock do. ... ..	5,814	6 0 0	349	
	Carried over ...	...	...	7,477	

No.	Name of works.	Quantities of work done during famine.	Normal rate.	Normal value.	Remarks.
1	2	3	4	5	6
		C. ft.	Rs. a. p.	Rs.	
	Brought forward ...	...	...	7,477	
	<b>AHMEDNAGAR COLLECTORATE—continued.</b>				
	<b>B.—IRRIGATION AND WATER-SUPPLY.—continued.</b>				
	<b>II.—Drainage.</b>				
4	Excavation (earth) ...	171,720	1 4 0	2,146	
5	Dry stone drain ...	13,275	5 0 0	664	
6	Murum filling ...	29,205	2 8 0	730	
	<b>III.—Dam Embankment.</b>				
7	Embankment ...	402,400	1 8 0	6,036	
	<b>IV.—Materials at Site.</b>				
8	Murum for embankment ...	76,681	2 0 0	1,534	
9	Rubble, shingle, &c., for dry stone toes ...	95,850	3 8 0	3,355	
10	Metal for concrete ...	15,913	4 0 0	637	
	Total ..	...	...	22,579	

### AHMEDNAGAR DISTRICT.

54. The canal, 19 miles in length with 21 miles of distributaries, was maintained at a cost of Rs. 2,722. A temporary earthen bund was constructed on the weir to increase storage for rabi and hot weather crops.

Ojhar Canal.

55. The canal, 23 miles in length with 9.37 miles of distributaries, was maintained in working order at a cost of Rs. 1,542. A temporary earthen bund was constructed on the weir to increase storage for "Rabi" and hot weather crops.

Lakh Canal.

Bhátodi Tank.

56. The tank and canal,  $4\frac{1}{2}$  miles in length, with  $5\frac{1}{2}$  miles of distributaries, were maintained at a cost of Rs. 1,089.

57. The tank was dry till 13th June 1897. First replenishment took place on 14th June 1897. The supply of water in the tank was sufficient during the kharif season, but insufficient during the rabi season to meet the requirements of the cultivators.

Surveys.

58. The resurvey for Ojhar Right Bank canal was completed during the year.

Famine Relief Works,  
Visápur Tank.

59. The site of this tank is on the Hanga River, in the village of Pimpalgaon Pisa in the Shrigonda Taluka.

The catchment area is 158 square miles. The tank will hold 1,218 millions cubic feet of water. The length of main earth embankment will be 7,000 feet, and its maximum height will be 72 feet.

The work was commenced in August 1897, with a view to give light work to unskilled famine-stricken people. On 18th September 1897, the highest number of people employed during the year on the work of excavating puddle trench and embankment was 3,776 workers, there being also 239 non-working children. The expenditure during the year was Rs. 34,024.



60. This canal is to form a part of the Pravara River Irrigation scheme. The length of the canal will be 38 miles, and the canal will command a gross area of 63,692 acres of excellent land. Preparations were made to start work by famine labour, but the work was not commenced. The expenditure incurred in erecting huts, &c., during the year was Rs 1,900.

Ojhar Right Bank Canal. Clearing bed (silt clearance) of the Lakh Canal. 61. The canal, 19 miles and 4 furlongs in length, was cleared of silt. The work was carried on by piece-work. The expenditure incurred was Rs. 9,894.

62. The banks in miles 1 to 3 and in 5 to 15 were raised and strengthened, and those in miles 4, 16 and 19 were partly completed. The work was carried on by piece-work. The expenditure incurred was Rs. 4,841.

Raising and strengthening Banks of the Lakh Canal

### POONA IRRIGATION DISTRICT.

63. During the year under review, the expenditure under Capital amounted to Rs. 2,314 and was incurred on fixing meters to fire plugs. These are required to check the consumption of water used by the different departments for road watering in Poona.

Mutha Canals. 64. On the 1st April 1897, the water in Lake Fife was 16.27 feet above the sill of canal sluices, and the minimum level was reached on the 17th June, when the depth was 8.40 feet. On the 18th it began to rise and the lake filled to overflowing on the 26th. The highest flood of the year occurred on the 7th August, when the water rose to R. L. 247.82 or 3.75 feet above finished crest level of waste weir.

Lake Fife. The standards and planks were fixed on the weir by the end of September, and on the 14th October the water stood at 4.11 feet above the finished crest of the weir. The draw-off from the storage commenced from this date, and on 31st March 1898 the level of the water was 20.04 feet above the sill of the sluices, i.e., 3.65 feet higher than on the same date in the previous year.

65. The Right Bank Canal was closed for 13 days and the Left Bank for 12 days during the year for silt and weed clearance.

The rainfall of the year at Poona amounted to 37.18 inches, the average for the last 48 years being 29.90 inches.

The canal and the Poona water-supply works were maintained in an efficient state throughout the year at a total cost of Rs. 22,808, as detailed below :—

			Rs.
Mutha Canals	...	...	15,689
Poona water-supply	...	...	7,119
		Total	22,808

In addition to this a sum of Rs. 5,394 was expended for establishment charged to works in the case of the Mutha Canals, and Rs. 5,716 for the Poona water-supply. The sum of Rs. 15,689 under Mutha Canals includes Rs. 6,338 for extending and altering standards at Lake Fife, a work which is classed as Extensions and Improvements. The top of the waste weir has been brought to one level, R. L. 243.32, instead of being in two portions with top at R. L. 243.07 and R. L. 244.07 respectively. Water will be impounded to R. L. 248.07 as at present. This change was rendered desirable by the fact that the sockets for the standards were fixed in small blocks of concrete attached to the inner face of the weir. There was danger that these might be broken off. The sockets have now been fixed in the main weir itself which has been covered with heavy coping 12" in thickness.

66. On the 1st April 1897, the tank was dry and remained so till the 9th September. It commenced to be replenished from the 10th and overflowed on 24th September 1897. The

Kasurdi Tank.

draw-off commenced from the following day, and on 9th January 1898 the tank became dry again.

During the year a sum of Rs. 55 was expended on the maintenance and repairs of the tank and Rs. 84 for works establishment.

67. On the 1st April 1897, the water level stood at 75.99 feet or 15.99 feet above outlet and 3.40 feet less than on the same date in 1896.  
Matoba Tank.

68. The tank was emptied in the middle of June for substituting stronger rods for regulators, the old ones having got out of order. The work was done as quickly as possible, and from 14th of July the tank commenced to be replenished and filled to overflowing on 22nd September 1897, and on 31st March 1898 the level was 16.46 above sill of outlet, or 0.47 feet higher than on the same date in the previous year.

The expenditure on maintenance and repairs amounted to Rs. 685 and Rs. 420 for establishment charged to works.

69. On the 1st April 1897, the water level stood at R. L. 73.07 or 13.07 feet above outlet and 6.43 feet less than on the same date in 1896. There were slight replenishments in June and July, but those which occurred in September were good. No further replenishments occurred during the year, and on 31st March 1898, the water level stood at 76.52 or 16.52 feet above outlet. The supply was sufficient throughout the year.  
Shirsapthal Tank.

The dam and canal as for 7 miles were kept in good repair and the expenditure incurred was Rs. 1,208, of which Rs. 252 were spent on establishment.

70. On the 1st April 1897, the water level stood at reduced level 43.37 or 10.17 feet above sill of outlet and 18 feet lower than in the previous year. The tank became dry on 15th May and remained so till 1st July. It was first replenished on 2nd July and overflowed on 1st October. The draw-off commenced from 16th October and on 31st March 1898 the water level stood at 56.56 or 23.36 feet above outlet.  
Bhadalwadi Tank.

The dam, canals and all works connected with the system have been kept in good repair at a cost of Rs. 1,230, of which Rs. 252 were for establishment.

71. Rain and river gauges were maintained as usual in the Poona District and observations regularly recorded. The registers of heights of water were kept for all tanks and diagrams recorded.  
Gauges.

72. The total expenditure on Capital Account during the year was Rs. 1,751. The main item was repairing the wall in front of under-sluices, on which Rs. 600 were spent. None of the other items were over Rs. 200. This work was taken in hand at the end of the year, after the heavy demand for water for rabi irrigation was over. The wall, where broken, is to be repaired, and the batter of inner face to be made 1 in 4 instead of 1 in 1 as originally designed. The Jet pump worked most satisfactorily in clearing the pool of water between this wall and the dam. Before the monsoon all arrangements were completed for storing the full 8 feet of water over the crest, the usual number of 15 counterweights being removed, cleaned and rehung.  
Nira Canal.

73. The under-sluices were opened for the monsoon on 18th June under a head of 36.5 feet; the heaviest flood while the under-sluices were opened reached 49 feet only, the highest flood level previously reached being 64.5 feet in 1896.  
Bhatghar Dam.

74. The sluices were finally closed on 12th August, when the level of water in the lake was 20.8 feet. The level reached the waste weir level on 19th August. All the gates on the south waste weir were open.

75. The water was regulated by the south waste weir gates till 10th October when the automatic gates were set to open at 7.50 feet and water allowed to rise. The gates all worked satisfactorily, those mentioned in last year's report

working slowly having been reset. During this period the north waste weir gates were tested at various heads and always worked satisfactorily. The amount finally stored above waste weir level was 7.76 feet.

76. The area of rabi was again large and amounted to 30,047 acres. Thanks to this storage there was ample water in the tank and it was possible for the first time since the canal was open to give water for perennial irrigation all along the canal. The level on 31st March stood at R. L. 301.45 or 9.35 feet higher than in the previous year.

77. The storage was drawn on from 18th November 1897.

78. The quantity of water discharged from the catchment area from the beginning to the end of monsoon was 36,497 millions cubic feet, equal to a run-off of nearly 123 inches from the catchment area of 128 square miles as compared with 53,287 millions cubic feet, equal to 179 inches last year.

79. The highest flood of the year passing over the main weir occurred on 7th August, when the water level was 4.90 feet only. This is a flood of very small dimensions, the highest flood during the previous year having been 8½ feet.

80. The canal and distributaries were maintained in good order at a cost of Rs. 15,489 for maintenance and repairs and Rs. 7,598 for establishment charged to works.

81. The work was in progress from the beginning of the year till the end of December. During the year considerable progress was made with the excavation and refilling of the puddle trench and on embankment, the excavation being nearly finished; throughout 774,380 cubic feet out of an estimated quantity of 1,167,227 cubic feet of filling were done and 1,885,245 cubic feet of embankment against an estimated quantity of 20,958,643 cubic feet were completed. The total expenditure on works for the year amounted to Rs. 2,79,295, out of which a sum Rs. 91,955 represents the expenditure at normal rates.

82. The work was, up to the middle of November, carried out under the task work system, after which time, up to the end of December, the greater part of the labour was employed with very good results on limited piece-work. The total number of persons mustered during the period amounted to 1,698,209, the greatest number on any one day being 13,280.

83. The health of the people on the works during this time was on the whole satisfactory, the number of deaths being 245, representing a death-rate of 4.2 per thousand per month. There was an outbreak of cholera during August, when the number on the works was immediately reduced by nearly 6,000. The outbreak was not however a bad one, as the total number of cases treated in hospital was only 54 with 30 deaths. Besides these, however, about 46 other cases died in camp, these being concealed cases. On 20th March the work was again opened as a test work.

#### SHOLA'PUR DISTRICT.

84. The waste weir of the tank was further raised 2.57 feet and has thus been restored to its original height. The work was completed at a cost of Rs. 5,520, against an estimate of Rs. 5,764. The expenditure during the year was Rs. 810, and has been debited to the head "Extensions and Improvements." The masonry constructed was 1,000 feet in length, and consisted of concrete hearting faced with masonry on both sides.

85. There was no expenditure on the Capital Account of the work, which stands as under :—

			Rs.
Estimated amount	...	...	16,03,890.
Allotment for 1897-98	...	...	Nil.
Expenditure during 1897-98	...	...	Nil.
Total expenditure	...	...	15,81,471

86. The dam and canals were repaired and maintained during the year at a cost of Rs. 5,767, including special repairs.

87. Repairs to canals and branches were carried on as famine relief works during the year. The work done was clearing silt from the beds of Canal No. 2, Kasegaon and Wakri Branch Canals, and Gadegaon, Khardi Tanali and Methawadi distributaries; the banks of the above channels were also strengthened and raised at places. The expenditure incurred was Rs. 17,591. The highest average daily number of relief workers employed on the work was 1,588 in September 1897.

88. The waste weir of the tank began to overflow on 27th September 1897, and the maximum depth of water on the waste weir was 1.70 feet on 1st October 1897.

89. The lowest water level reached in the year was R. L. 1,917.95, that is, 2¼ feet above the sill of outlet sluice. This was on 12th June 1897.

90. The Capital Account of this tank was closed in 1885. No original work was executed during the year on the tank or on the canals. The dam and canals were repaired and maintained during the year at a cost of Rs. 4,083 against the estimates of Rs. 3,767 and Rs. 1,118. Certain special repairs to the perennial canal were commenced during the year. These will be completed during 1898-99.

91. The work of improvements to canals under this tank, which was commenced last year as a famine relief work, was continued during the year, the work being reserved for the weavers of Sholapur, whom it was considered undesirable to employ on metal-breaking on roads. The improvements consisted of raising and strengthening the banks of the canals and clearing silt. The expenditure during the year was Rs. 43,604, and the total expenditure to end of March 1898 Rs. 50,604.

92. There was no extraordinary flood during the year likely to affect the dam or canals. The waste weir began to overflow on 11th October 1897, and the maximum depth of water on the waste weir was 1.5 feet on 15th October 1897; the lowest water level in the tank was R. L. 186.60, that is, 17.40 feet below F. S. L. on 10th June 1897.

93. The Capital Account of this tank was closed in 1893. No original work was executed during the year. The dam and canals were repaired and maintained during the year at a cost of Rs. 2,254 against an estimate of Rs. 2,255.

94. The cracks that appeared in the dam were watched and filled in as usual.

95. The work of adding a berm behind a portion of the Ashti tank dam was carried on and completed during the year as a famine relief work, at a cost of Rs. 6,025 against an estimate of Rs. 6,880. The work consisted of earthen berm with longitudinal and cross drains below filled in with dry stones and covered by slabs. The length of the berm added is 700 feet, width 50 feet and mean height 10 feet. The highest daily average number of relief labourers employed on the work was 571 in the month of September 1897. The work was carried on under the limited piece-work system.

96. Water began to flow over the waste weir of the tank on 18th September 1897, and the maximum depth of water on waste weir was 3 feet on 19th September 1897.

97. The lowest level of water in the tank during the year was R. L. 1,530.40 (2.70 feet above sills of outlets), which was reached on 10th June 1897.

98. The Capital Account of this tank was closed in 1892. No original works were carried out during the year on the tank or on the channel under it. The dam and channel were repaired and maintained during the year at a cost of Rs. 306.

99. The tank did not fill during the year under report. The highest water level attained was R. L. 92.15 on 4th October 1897. This level is 3.5 feet below the crest of the waste weir.

100. During the famine of 1896-97, when road improvements and metal-breaking works in Sholapur District were nearly exhausted, it was found necessary to take other works in hand for affording useful employment to labourers requiring relief.

101. The Pathri Tank in Bársi Taluka and the Mangi Tank in Karmála Taluka were amongst the works chosen. Of these, the Pathri tank was commenced in April 1897. The site of the tank is situated about 11 miles to the north-east of the town of Bársi.

102. The tank is formed by throwing an earthen embankment 6,925 feet in length across the Yerai Nála, just above the village site of Pathri in Bársi Taluka. The maximum height of the dam is 63.75 feet, and its top width 8 feet. The dam will be pitched in front to 3 feet above highest flood level. The waste weir is at the right end of the dam and is 800 feet in length. The catchment area is  $27\frac{1}{2}$  square miles. The tank commands a large area of good culturable land and is also capable of giving a copious water-supply by gravitation to the important trading town of Bársi.

103. It is proposed to have two outlets to the tank, one on each side of the nála. The available contents of the tank above outlet sills are calculated to be 407 millions cubic feet. The cost of the works, according to a rough estimate at normal rates, will amount to Rs. 4,39,744.

104. The expenditure on the work during the year was Rs. 3,45,304, which includes all charges, except gratuitous relief and Engineering establishment.

105. The work was commenced on 1st April 1897, on the Famine Code system. The daily average number of work people in April 1897 was 5,046. This gradually rose to 17,249 in September 1897, and again fell to 9,563 in November 1897, when the Code system was stopped and the limited piece-work system introduced. The following are the details of the principal quantities of work executed up to 31st March 1898 :—

Items.						Quantities.
Clearing site ...	...	...	...	S. ft...	687,600	
Embankment ...	...	...	...	C. ft...	5,077,724	
Excavation for puddle trench	...	...	...	" ...	670,782	
Filling in puddle trench ...	...	...	...	" ...	511,346	
Excavation for waste weir	...	...	...	" ...	1,687,000	
Wing wall	...	...	...	No...	1	
Collecting metal for filling concrete trench	...	...	...	C. ft...	98,143	
Excavation for outlets ...	...	...	...	" ...	15,556	
Collecting earth and murum for the dam	...	...	...	" ...	400,000	

106. The Mangi tank was commenced as a famine relief work on 23rd April 1897. The site is situated at a distance of 3 miles to the north of the town of Karmála. The tank is to be formed by throwing an earthen dam, 4,840 feet in length, across the Kanola river, just above the village of Mangi on Karmála-Jategaon Road. The maximum height of the dam will be 76.43 feet, and its top width 8 feet. The waste weir of the tank is to be at the right end of the dam and 800 feet in length. The dam will have two outlets, one on each side of the Kanola river. The available contents of the tank above outlet levels will be 1,241 millions cubic feet. The tank commands about 9,000 acres of good culturable land. The approximate cost of the works will be Rs. 9,87,199 at normal rates. The catchment area of the tank is 106 square miles.

107. The expenditure on the work during the year was Rs. 1,91,597. This expenditure includes all charges, except gratuitous relief and engineering establishment.

108. The work was started as a relief work on the Famine Code system. The average daily number of relief workers at the commencement was 337, which gradually rose to 13,330 in September 1897, and again fell to 3,044 at the end of October 1897. In November 1897 the limited piece-work system was introduced on the work.

109. The following are the details of the principal quantities of works executed up to 31st March 1898:—

Items.						Quantities.
Clearing site of dam	...	...	...	...	C. ft...	510,529
Excavating puddle trenches	...	...	...	...	" "	456,652
Filling in trenches with puddle	...	...	...	...	" "	235,708
Embankment of dam	...	...	...	...	" "	3,090,248
Excavating site of dam	...	...	...	...	" "	100,125
Excavation for waste weir	...	...	...	...	" "	2,066,813
Excavation for Left Bank Canal outlet	...	...	...	...	" "	21,132
Filling in foundations for Left Bank Canal with concrete	...	...	...	...	" "	2,402
Excavation for Right Bank Canal outlet	...	...	...	...	" "	27,451

110. The rabi rainfall of 1897 was not favourable at the beginning, and it was feared that provision for further relief works would have to be made. The surveys of the following tanks were therefore undertaken in order to be in readiness to provide work for relief labourers in case of necessity.

Surveys.

Irrigation Tank at Hotgi  
Do. do. Sapatne.  
Do. do. Nimbgaon.  
Do. do. Budmhal.  
Do. do. Bhamburdi.

111. The expenditure on these surveys during the year was Rs. 2,725, the total expenditure up to 31st March 1898 being Rs. 3,483.

112. Each tank survey included sections for dam, waste weir, and canal lines as well as cross sections of the proposed tank in order to estimate the approximate contents and area submerged.

#### BIJAPUR DISTRICT.

113. The only irrigation work in this district is the Muchkundi Tank. The tank was constructed in the famine of 1876-77, but it never fills owing to restricted catchment area and light rainfall. The tank was repaired and maintained during the year at a cost of Rs. 199.

Muchkundi Tank.

114. The rainfall gauged at the tank during the year was 23.46 inches against 6.96 inches of the previous year. From June to December 1897, 17.79 inches fell, as compared with 5.34 inches for a similar period in 1896.

115. The highest level of water in the tank was 10.50 feet above the sill of sluice as compared with 6.13 feet in 1896.

116. Surveys for the following works were in progress during the year, and expenditure as shown against each was incurred:—

Surveys.

Works.	Amount of Estimate.	Expenditure during 1897-98.	Total expenditure to end of 1897-98.
	Rs.	Rs.	Rs.
(1) Completing the survey of Sangogi Tank ...	1,942	1,125	1,811
(2) Survey and inspection of tank sites in the district ...	200	10	194
Total ...	2,142	1,135	2,005

Second Class Tanks. 117. The outlay during the year on repairs to tanks for which only Revenue Accounts are kept was Rs. 41.

118. Two irrigation works—Hullur and Sangogi Tanks—were opened as famine relief works during the year under report, and expenditure as detailed in the following paragraphs was incurred against each.

119. This work was opened as a relief work on 30th July 1897 and was kept open as a central work up to 21st January 1898. The tank site is situated within the boundaries of the villages of Areshankar and Guddini in Mudebihal Taluka. Relief workers were employed on the excavation of the puddle trench and excavation for trial pits for waste weir line, &c. The average depth of puddle trench excavated is more than 15 feet, including the average depth of 3 feet of soil. The length of the puddle trench excavated is 1,900 feet, of which 1,200 feet is on the right flank and 700 feet on the left flank. The total outlay incurred was Rs. 27,239. In addition to this, Rs. 2,462 were spent for purchasing pumping machines and Rs. 675 on gratuitous relief.

120. This work was opened as a relief work on 19th August 1897 and was kept open as a central work up to 11th December 1897. The work is situated within the boundaries of the villages of Sangogi, Shirshad and Masali in Indi Taluka. Relief workers were employed on the excavation of the puddle trench on the left flank from chainage 1,300 feet to 4,200 feet. The greatest depth to which the trench has been excavated is on an average 6 feet, for a length of about 1,000 feet. The total outlay incurred on the work was Rs. 34,293, of which Rs. 28,315 were for wages to relief workers, Rs. 5,177 for purchasing pumping materials, and Rs. 801 for gratuitous relief.

#### SATARA DISTRICT.

121. There was no Capital expenditure during the year on this canal.

122. The canal was maintained in working order, at a cost of Rs. 6,774 as under :—

	Rs.
Ordinary repairs ... ..	3,952
Special repairs ... ..	2,351
Plantations ... ..	471
	<hr/>
Total ... ..	6,774

123. The area irrigated was 4,321 acres, and the assessment amounted to Rs. 48,608, as compared with Rs. 53,748 in 1896-97 and Rs. 38,465 in 1895-96.

124. Besides the Krishna Canal, there are in the Sátára District five other works of which Capital and Revenue Accounts are kept, viz :—

1. Yerla River Irrigation Works, including Nehr Tank.
2. Upper Man River Works, including the Pingli Tank and Gondowli Canal.
3. Rewári Canal.
4. Maini Tank.
5. Chikhli Canal.

125. Of these five works, Capital outlay was incurred only on the first, namely, the Nehr Tank, the dam of which had slipped. A full description of the slip was given in the reports of previous years. During the year under report, the full supply level was raised 5 feet and the dam was raised to R. L. 2,675, thus leaving a height of about 4 feet to bring it up to the sanctioned top level. This work would have been completed at the end of the year, but on account of the appearance of a slip from chainage 900 to 1,000 it was deemed advisable to stop further work. Weekly observations to note the movement of dam were taken and are still continued. The Capital outlay on the work during the year amounted to Rs. 1,392.

126. All the five systems were maintained in good working order at the cost shown below :—

Number.	Work.	Extensions and Improvements.	Maintenance and Repairs.	Special Repairs.	Plantations.	Total.
		Rs.	Rs.	Rs.	Rs.	Rs.
1	Yerla River Irrigation Works...	...	2,532	1,378	356	4,266
2	Upper Man River Works	...	2,091	151	197	2,439
3	Rewari Canal ...	...	866	...	41	907
4	Maini Tank ...	...	1,325	...	100	1,425
5	Chikhli Canal ...	...	380	166	37	583

127. The irrigation of the year is contrasted with that of the year before as under :—

Number.	Work.	Rainfall.		IRRIGATION.			
				1896-97.		1897-98.	
		1896-97.	1897-98.	Area.	Revenue.	Area.	Revenue.
		Inches.	Inches.	Acres.	Rs.	Acres.	Rs.
1	Yerla River Irrigation Works ...	28.05	22.78	3,239	10,672	3,371	10,638
2	Upper Man River Works. } Pingli } Gondowli }	14.99	24.41	1,926	6,705	2,022	5,623
		11.42	21.02				
		33.84	34.75				
3	Rewari Canal ...	33.84	34.75	1,877	8,774	1,647	8,265
4	Maini Tank ...	12.59	15.17	1,166	4,739	1,646	4,705
5	Chikhli Canal ...	15.64	25.87	626	2,452	524	2,151
	Total ...	...	...	8,834	33,342	9,210	31,382

128. The large increase in the revenue on the Rewari Canal last year has been fairly maintained this year, notwithstanding the fact that the rainfall was more favourable. The total revenue on the five systems, Rs. 31,382, compares favourably with the revenue of 1895-96, which was Rs. 27,729.

129. The total area irrigated and revenue for all the works, including the Krishna Canal, during the year under review were 13,531 acres and Rs. 79,990, respectively, as compared with 10,245 acres and Rs. 66,194 in 1895-96. In 1896-97, the revenue, owing to the failure of rain, rose to Rs. 87,090 and there is a decrease in 1897-98 as was to be expected, but a comparison with 1895-96 and previous years shows a satisfactory increase in the revenue-producing powers of the canals in this district.

130. Trial pits were sunk during the year at a cost of Rs. 790, against an allotment of Rs. 806 along the dam line of the Sheothar Tank for the purpose of ascertaining the depth to which a puddle wall would be needed.

131. The expenditure incurred during the year on surveying the Newra Surveys. Tank was Rs. 7,276, and as the result of trial pits is considered unsatisfactory and the site unsuitable for an earthen dam, the work has been abandoned.

Famine Relief.

132. No irrigation works for famine relief were undertaken during the year under report.



## BELGAUM DISTRICT.

133. A full description of the Gokák Canal (1st Section) and Storage Works (Dhupdal 25 feet weir) will be found in the Administration Report for 1891-92. The actual work of raising the weir two feet, sanctioned in Government Resolution No. 139 W. L.—1582, dated 16th November 1896, was completed during the year under report at a total cost of Rs. 8,327. This amount is exclusive of the cost of land compensation, a good deal of which still remains unpaid.

134. The works were maintained in good and efficient order throughout the year.

135. The Capital expenditure during the year was Rs. 3,657 as under :—

	Rs.
Land compensation for 25 feet weir ... ..	—3
Do. for 2 feet raising ... ..	206
25 feet weir ... ..	—270
Raising weir by 2 feet ... ..	3,350
Sub-dividing land ... ..	374
Total ...	3,657

136. From the commencement of the work the capital outlay has been Rs. 6,98,468.

137. Working expenses amounted to Rs. 2,868 against Rs. 3,049 in the previous year.

138. During the hot weather of 1897 the supply very nearly ran short, but owing to a fire that occurred at this time at the mills, the demand was reduced to one-half for a while and the worst period which occurred at the end of March was thus tided over. The cause of this shortness was the failure of the late rains of 1896. The tank actually reached its lowest level on the 25th May 1897, when the water stood at 11·70 feet below the crest of the weir and 10·30 feet deep on the sill of the canal sluices. The river came down on that date, and the tank overflowed on the 9th July 1897.

139. The maximum flood of the year occurred on the 20th July 1897 and rose to 2·85 feet above the weir crest, the discharge being estimated at 44,186 cubic feet per second, equal to a run-off of 0·09 inch per hour from the whole area of the catchment basin (1,080 square miles).

140. The total discharge of the river between 1st July and 31st October amounted to 94,534 millions cubic feet, representing a run-off of 38 inches from the catchment basin.

141. The area irrigated was 6,856 acres, as compared to 5,565 acres of the previous year, showing an increase of 1,291 acres or 23 per cent. This was due to the very scanty rainfall during the kharif season and the failure of rain during the rabi season of 1896-97.

142. The water rate assessment amounted to Rs. 15,755, being an increase of 11 per cent. over last year.

143. Besides the monsoon and cold weather irrigation, the storage gave a constant supply of 58 cubic feet up to 25th May 1897 and 68 cubic feet per second from that date to the end of the year to the mills for which the Company paid Rs. 13,454.

144. The average monthly consumption of water by the Southern Marátha Railway Company was 229,000 gallons, and the bill for the year under report amounted to Rs. 344.

145. Government having granted leave to the Mills Company to raise the crest of their pick-up weir 9", *i.e.*, from R. L. 1,983·75 to R. L. 1,984·50, it becomes necessary to raise the level of the notch of the gauging basin below the

main sluices of the Storage Reservoir (the level of which at present is only R. L. 1,984) by 12", *i.e.*, to R. L. 1,985. The estimate for this work amounts to Rs. 944, and the cost is payable by the Mills Company. The expenditure on this account to the end of March 1898 was Rs. 285.

146. The work of sub-dividing the land of seven villages under the canal, sanctioned and commenced during the previous year, was completed during the year under report at a total cost of Rs. 1,147 against the estimate of Rs. 1,154.

147. The gauging of the Malaprabha River at Gurlhosur was stopped on the 22nd January. The total expenditure incurred on this work during the year was Rs. 232. The gauge had been in continuous operation for a period of sixteen years, *i.e.*, since June 1882. A rain gauge was maintained at Dhupdal near the Head Works of the Gokak Canal. The fall registered here for the whole year was 23.60 inches, as compared with 13.36 in the previous year.

Gaddikeri Tank. 148. The management of this tank is vested in the Revenue authorities. Petty repairs to the extent of Rs. 100 were carried out by this department during the year under report.

Second Class Works. 149. Large tanks irrigating over 50 acres repaired during the year were as under:—

Particulars.	Number of Tanks.	Expenditure during the year.
		Rs.
Commenced in the previous year... ..	5	4,671
Commenced and completed during the year ... ..	1	475
Commenced but not completed during the year ... ..	3	1,059
Total ... ..	9	6,205

Smaller tanks irrigating less than 50 acres repaired during the year were as follows:—

Particulars.	Number of Tanks.	Expenditure during the year.
		Rs.
Commenced in the previous year... ..	3	706
Commenced and completed during the year ... ..	...	...
Commenced but not completed during the year ... ..	...	...
Total ... ..	3	706

150. The expenditure incurred during the year under report was Rs. 800 against an allotment of Rs. 800. The survey work done was as under:—

	Number.
Tanks newly surveyed... ..	15
Do. formerly surveyed, but surveys now completed and checked ... ..	7
	22

151. This work was described in the Administration Report of Irrigation Works for 1896-97. It was originally opened with a view to give assistance to the neighbouring Bijapur Famine Relief.—Taosi Tank.

District, and was continued to the end of March 1898, when the open puddle trench was fenced in and the work closed.

152. Every attempt was made by the Bijápur staff to draft people to Tacsí, and though three drafts of about 500 each were sent, more than 1,200 returned to their own district as soon as they could. However, people in want of relief from the surrounding Native States of Jath, Miraj, Sánгли, &c., resorted to the work.

153. The number of workers was over 12,000 in September, but owing to the unanticipated difficulties met with in the puddle trench, the work was never in a fit state to employ such a large number. As it appeared that more than 4,000 people could not be suitably employed in digging the trench, arrangements were made to relieve the press by drafting the excess numbers to the road works in progress in the same táluka. Just then heavy rain fell and the stress was at once relieved.

154. The cost of the project as an ordinary work is estimated at about twenty lákhs, including all charges. The plans and estimates are now under revision.

155. The expenditure during the year (to 31st March 1898) was Rs. 2,25,609 against the allotment of Rs. 2,24,870. The total cost of the work to 31st March 1898 has been Rs. 2,35,582.

#### DHA'RWA'R DISTRICT.

156. There has been no Capital expenditure during the year.

157. There are four works of this class in this district. These are Madag, Medleri, Asundi and Dámbal. The Mávinkop Tank, which is situated on the western border of the Dhár-wár District, waters lands in the Kánara Collectorate. The distribution of water from this tank is managed by irrigators, who are under the control of the revenue officials.

158. The following table gives details of expenditure incurred :—

Tanks.	Maintenance and repairs.	Special repairs.	Plantation.	Land Compensation and Survey.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.
Madag ... ..	491	50	118	...	659
Medleri ... ..	270	...	...	...	270
Dámbal ... ..	233	...	...	...	233
Asundi ... ..	281	732	...	...	1,055
Mávinkop ... ..	42		...	...	
Total ... ..	1,317	782	118	...	2,217

159. The expenditure, as compared with that of the previous year, is due to work of silt clearance and masonry work repairs to the waste weir.

Medleri  
Dámbal.

160. These tanks call for no remark.

161. The expenditure on the item—Maintenance and Repairs—is in excess of that of the previous year. This is due to works carried out to drain the reh-affected lands below the tank.

Asundi.

162. An estimate, amounting to Rs. 3,142, which provided for the removal and relaying of pitching, and a sluice rod to the outlet, &c., was submitted and sanctioned. The work was commenced during the year, and an expenditure of Rs. 732 has been incurred.

Special Repairs

163. The project for a proposed new sluice and channel has been sanctioned in Government Resolution No. 133-W. I.—1544, dated 3rd November 1897.

164. The water at the beginning of the year was 2·13' above the outlet sill. This depth gradually decreased until by the middle of May water ceased to flow into the canal. In June and subsequently the tank received replenishments, and a fair supply was maintained in the canal till the end of the year.

165. A small amount of water remained in the tank until 14th April. The canals did not again flow until 22nd May. Several replenishments were afterwards received. The water overtopped the waste weir crest on 2nd October. The tank maintained a fair supply of water during the remainder of the year.

166. The tank was dry until the 9th April, when it received a copious replenishment. An ample supply of water was subsequently maintained.

167. The tank contained a fair supply of water throughout the year.

168. The rain gauges were maintained during the year throughout the district. The rainfall gauged at Madag and Asundi shows a decrease, while that gauged at Medleri and Dámbal shows a considerable increase as compared with the previous year.

169. The work of extension and improvements to Balgattikeri at Hoshalli, Táluka Kod, was completed during the year under report :—

Expenditure during the previous year.	Expenditure during the year.	Total Expenditure.
Rs.	Rs.	Rs.
1,549	1,923	3,472

170. Large tanks irrigating over 50 acres were repaired and improved during the year as follows :—

Particulars.	Number of Tanks.	Expenditure during the year.
		Rs.
Commenced in the previous year ... ..	28	13,274
Commenced and completed during the year under report ... ..	4	3,976
Commenced but not completed during the year ... ..	4	2,908
Total ... ..	36	20,158

171. Smaller tanks irrigating less than 50 acres were repaired and improved during the year as follows :—

Particulars.	Number of Tanks.	Expenditure during the year.
		Rs.
Commenced in the previous year... ..	11	674
Commenced and completed during the year under report ... ..	2	31
Commenced but not completed during the year ... ..	2	107
Total ... ..	15	812

172. The total expenditure incurred on second class works amounted to Rs. 20,970, inclusive of contributions Rs. 1,187.

173. The Irrigation Act was made applicable to this canal system in Government Resolution, Revenue Department, No. 3974, of 27th May 1897. The management of the water distribution under the canals was taken over by this department on the 8th July 1897 and has resulted in a more economical distribution of water.

The details of expenditure are as shown below :—

			Rs.	a.	p.
Emergent petty repairs	...	...	1,396	7	2
Supervising the distribution of water	...	...	330	5	6
Surveying Dharma Canal	...	...	12	14	0
Total			1,739	10	8

The survey of the Dharma Canal System made no progress during the year, no subordinate being available for the work.

174. This work was sanctioned in Government Resolution No. 122 F.—1124, dated 14th August 1897.

Orders to commence work on the modified system were received in September 1897. The heavy rain which fell at the end of September prevented labourers from coming to the work until 4th October, then, only 192 arrived. The people employed on the work left on the 18th October and did not return.

175. The total quantity of earth excavated is 68,550 cubic feet and the expenditure incurred is Rs. 433, of which Rs. 30 are for land compensation.

Kardikop Storage Project.

176. The project is being completed.

Pudkalkatti Storage Project.

177. The project is under revision.

#### RATNA'GIRI DISTRICT.

178. The repairs to this tank consisted of removing sluice gates at the beginning of the monsoon and tarring and re-fixing them. The earthen dam and pavement were also repaired where necessary. The outlay during the year amounted to Rs. 50.

Second Class Revenue Works.—Tank at Pat.

179. The repairs to this tank consisted of removing and re-fixing sluice gates as usual, tarring wood work of gates and railing and repairing earthen dam where necessary. The outlay during the year amounted to Rs. 72.

Tank at Varad.

Dhámápur Tank.

180. No repairs were considered necessary to this tank, to which special repairs were done last year.

#### KOLA'BA DISTRICT.

181. The repairs to this dam consisted of repairing and tarring wood work of gates, chunam and cement pointing and renewing pitching with new khándkies where necessary. The outlay during the year amounted to Rs. 36.

Masonry Dam at Borvi in Pen Táluka.

#### SIND.

#### BEGÁRI CANALS.

182. The erosion of the bed of this canal, due to steep gradients and consequent lowering of the water level, has had the effect of taking away the supply from a considerable area of land in British Territory. To remedy this, a fall

Desert Canal.—Capital Account.

regulator is being constructed in the 45th mile. It is designed as part of the project for remodelling the canal, but until this project is sanctioned it is only to be completed so far as to raise the supply level to that of the original design. The work is in progress and will be completed before the canal is opened. The outlay of the year was Rs. 2,500 against an estimate of Rs. 11,866.

183. A permanent escape is being constructed on the left bank of the supply channel to replace the existing temporary one. The estimated cost of the work is Rs. 13,064. The expenditure of the year was Rs. 5,000, of which Rs. 1,300 were charged to Capital and Rs. 3,700 to Revenue Account.

184. The work of cutting out a bend in the 21st mile, described in last year's report, was completed at a total cost of Rs. 9,069, against an estimate of Rs. 9,436, the outlay of the year being Rs. 3,559.

Begári Canal.—Capital  
Account.

185. The additions to the Head Regulator described in last year's report were completed before the inundation at a total cost of Rs. 2,059 against an estimate of Rs. 2,069.

Nurwah.—Extensions and  
Improvements.

186. The special clearance mentioned in last year's report was completed before the inundation at a total cost of Rs. 23,713 against an estimate of Rs. 29,071. The expenditure during the year was Rs. 9,712.

Desert Canal.—Special  
Repairs.

187. This bund, constructed on the bank of the river near the 1891 mouth, to keep out the river floods, was breached in the previous inundation. It was repaired and strengthened at a cost of Rs. 731 against an estimate of Rs. 805.

Sanhro Bund.

188. The special clearance mentioned in last year's report was completed before the inundation at a total cost of Rs. 60,505 against an estimate of Rs. 62,079.

Begári Canal.—Special  
Clearance.

189. The loop bund mentioned in last year's report was completed at a total cost of Rs. 1,415 against an estimate of Rs. 1,508.

Loop Bund.

190. As considerable changes had occurred in the course of the river owing to the high inundation of the year, a complete survey of the right bank with its dhunds and sand banks was made in such parts as had altered. The survey was completed at a cost of Rs. 526. The cost was charged in equal proportion to the Revenue Accounts of the three large canals in the district.

Surveys.

191. A portion of the country above the mouths of the Desert Canal is being surveyed to ascertain what measures are feasible to divert the hill floods direct into the river. The expenditure during the year was Rs. 187 against an estimate of Rs. 319. The survey is nearly completed.

192. The survey for contours of this district was commenced during the year, the expenditure being Rs. 1,500 against an estimate of Rs. 18,837. The survey will be continued as funds are made available. Its cost is at present charged to the Revenue Account of the Begári Canal in order to simplify accounts, but will, when completed, be distributed between the three large canals in this district.

193. A survey was commenced for the preparation of a project for irrigating the Sind Dhoro and the lands between it and the Kashmor Bund, which have been thrown out of cultivation by the construction of that bund. The expenditure was Rs. 667 against an estimate of Rs. 2,753 and is being charged to the Kashmor Bund. The survey will be completed before the inundation.

194. A cattle-pound, store-room and chowkidars' quarters are being constructed in the rear of the new loop embankment to replace those on the front bund rendered dangerous by the flooding of the compartments. The expenditure during the year was Rs. 269 against an estimate of Rs. 1,347. The buildings will be completed before the inundation.

Kashmor Bund.—Exten-  
sions and Improvements.

195. A sum of Rs. 40,395 was expended towards the completion of the work mentioned in last year's report, the total expenditure on which now amounts to Rs. 3,76,505 against an estimate of Rs. 4,13,580. This work is practically completed. For a short distance the upper 3 feet of the bund remain to be done; this, and a few minor items, will be taken in hand when funds are made available.

196. The repairs referred to in last year's report were completed as far as was possible before the last inundation, the work being delayed owing to difficulties in obtaining labour.

The further repairs rendered necessary by the effect of the last inundation are being carried out against the original estimate. They consist of opening out and closing all fresh leaks and the provision of sand trenches in dangerous portions below ground level and in the body of the bund. The expenditure is as follows:—

			Rs.
Amount of sanctioned estimate	...	...	1,00,529
Expenditure up to date	...	...	48,843
Do. during the year	...	...	32,796

197. This work, described in last year's report, was practically completed during the year at a cost of Rs. 26,942. The total expenditure from the commencement was Rs. 72,567 against an estimate of Rs. 77,086. There are a few minor items remaining to be accounted for, such as fencing and payment of compensation for land.

198. The cross bund referred to in last year's report was practically completed at a total cost of Rs. 12,290 against an estimate of Rs. 14,720. The expenditure during the year was Rs. 6,790.

199. The two sluices referred to in last year's report were completed at a total cost of Rs. 14,301 against an estimate of Rs. 13,918.

200. The remaining sluice to be made in the front bund was commenced during the year, and a sum of Rs. 1,800 expended against an estimate of Rs. 8,212. A small sum was also spent against an estimate of Rs. 2,434 in commencing the excavation of a drainage channel for the same sluice. Both these works will be completed before the inundation.

201. Considerable difficulty was experienced last inundation in maintaining some portions of the new loops made to close the breaches in the old bund. These portions are being strengthened by making berms and by providing sand trenches. The expenditure during the year was Rs. 7,200 against an estimate of Rs. 24,328.

202. The usual establishment was maintained and the ordinary clearance and repairs executed at a cost of Rs. 42,999. The details are as follows:—

				Rs.
Repairs	...	...	...	35,786
				Rs.
Establishment	...	{	Abkalani...	3,187
			Revenue ...	2,264
			Works ...	1,686
			—————	7,137
Gardens	...	...	...	76
			Total ...	<u>42,999</u>

Unharwāh.—Maintenance and Repairs.

203. The ordinary maintenance and repairs necessary were carried out and the usual Abkalāni establishment employed. The details are as follows :—

Repairs	...	...	...	...	Rs.	16,973
Establishment	...	{	Abkalāni...	...	Rs.	2,973
			Revenue ...	...	...	1,218
			Works ...	...	...	1,123
Gardens	...	...	...	...	5,314	143
					Total	22,435

Begāri Canals.—Maintenance and Repairs.

204. The ordinary maintenance and repairs necessary were carried out and the annual Abkalāni establishment maintained. The details are as follows :—

Repairs	...	...	...	...	Rs.	29,380
Establishment	...	{	Abkalāni...	...	Rs.	3,321
			Revenue ...	...	...	2,570
			Works ...	...	...	1,579
Gardens	...	...	...	...	7,470	59
					Total	36,909

Kashmor Bund.—Maintenance and Repairs.

205. The usual establishment was employed and the ordinary repairs executed at a cost of Rs. 37,553. The details are as follows :—

Repairs	...	...	...	...	Rs.	18,560
Establishment	...	{	Abkalāni...	...	Rs.	15,930
			Revenue ...	...	...	950
			Works ...	...	...	1,697
Gardens	...	...	...	...	18,577	416
					Total	37,553

206. The ten gardens in this district were maintained at a cost of Rs. 694 and the receipts amounted to Rs. 65 as compared with Rs. 44 in the previous year.

207. The following is a summary of the entire expenditure during the year in the district :—

Major Works—					Rs.	
Capital	...	...	...	...	15,499	
Extensions and Improvements	...	...	...	...	5,913	
Clearance and Repairs	...	...	...	...	1,38,516	
Establishment:	...	{	Abkalāni ...	...	Rs.	9,481
			Revenue ...	...	...	6,052
			Works ...	...	...	4,388
Gardens	...	...	...	...	19,921	278
Total, Major Works					1,80,127	

Minor Works—Kashmor Bund—

					Rs.	
Works	...	...	...	...	936	
Repairs	...	...	...	...	1,48,787	



			Rs.	Rs.
Establishment	{	Abkaláni...	...	15,930
		Revenue ...	...	950
		Works ...	...	1,697
				18,577
Gardens				416
		Total, Minor Works	...	1,68,716
		Total, Major and Minor Works	...	3,48,843
		Add—Cost of regular Establishment and Tools and Plant	...	58,166
		Grand Total	...	4,07,009

208. The cost of establishment and tools and plant was Rs. 58,166, the percentage on the total outlay being Rs. 16·67 as compared with Rs. 10·82 in the previous year.

209. The total cost of the works establishment, exclusive of that employed on gardens, was Rs. 38,498 as compared with Rs. 27,220 in the previous year. The increase was almost entirely due to the increase in the Abkaláni, the total cost of which was Rs. 25,411, as compared with Rs. 14,995 of the previous year. This was partly due to the very high and long-continued inundation, partly to the increase in the water-supply level on the Desert Canal rendered necessary in order to give a better supply of water for irrigation, but chiefly to the fact that on the Kashmir Bund 13 miles more than last year were maintained; all these causes necessitated extra establishment, and the long continuance of the high inundation made it impossible to dismiss it as early as usual.

#### SHIKARPUR CANALS.

210. This work, which was fully described in previous reports, was completed last year. A further sum of Rs. 136 was paid during the year for compensation for land taken up. The total outlay was Rs. 3,12,352 against an estimate of Rs. 3,21,352.

Sind Canal.—Extensions and Improvements.

211. There being no masonry sluice at the head of the zamindari karia, and as one was necessary to guard against the occurrence of a breach in the Sind Canal, this sluice was constructed during the year at a cost of Rs. 644 against an estimate of Rs. 645. Of this sum, Rs. 323 were contributed by the zamindars concerned.

Sluice over Masaharwah.—Ex-Sind Canal.

212. The details of this work were given in last year's report. The improvements to the Garangwah commenced last year were completed, and those of the Rajib and Chitti Canals with Abad Dhund were taken in hand during the year. The expenditure is as follows:—

Rajib, Chitti and Garang Canals.—Extensions and Improvements.

				Rs.
Amount of estimate	...	...	...	1,14,602
Expenditure during the year	...	...	...	22,000
Do. up to date	...	...	...	28,080

213. This work, described in last year's report, was completed at a total cost at Rs. 1,793 against an estimate of Rs. 1,792. The outlay of the year was Rs. 161.

New River Gauge at Din Belo.

214. A great portion of the Bukkur gauge well was washed away by the Indus during the last inundation, and was rebuilt at a cost of Rs. 2,106 against an estimate of Rs. 2,400.

Bukkur Gauge Well.—Rebuilding of—

215. The work was commenced last year and was described in last year's report. It has now been completed at a total cost of Rs. 14,684 against an estimate of Rs. 14,900, the expenditure of the year being Rs. 3,742.

Sukkur-Begari Band.—Special Repairs.

216. To avoid bad leaks in the 4th, 5th and 6th furlongs of the 32nd mile, another trench was excavated in front of the bund and filled with pure sand well

rammed. The expenditure during the year was Rs. 4,000 against an estimate of Rs. 4,385.

217. This work was completed last year at a total cost of Rs. 1,23,795, and a sum of Rs. 2,465 was paid during the year under report on account of compensation for land taken up. The total expenditure up to date is Rs. 1,26,260 against an estimate of Rs. 1,26,602.

Maintenance and Repairs.—  
Canals and Bunds. 218. Ordinary clearance of canals and repairs to bunds were carried out during the year, the outlay being as under:—

				Rs.
Works	...	{	Canals	53,697
			Bunds, Rohri District	1,686
			River Bunds	13,451
				Rs.
Establishment	...	{	Abkaláni	15,450
			Revenue	2,089
			Works	6,323
				<u>23,862</u>
Total				<u>92,696</u>

219. The total expenditure on establishment during the year was Rs. 23,862 as compared with Rs. 19,188, the average of the three previous years. The excess was partly due to extra establishment required on account of the high inundation and partly to that employed on the Garang Canal, which has been newly taken up during the year.

220. The trees along canals and river bunds were looked after by the ordinary establishment. The following amounts were realized by the sale of trees cut during the year.

				Rs.
Sind Canal	...	...	...	1,249
Canals, Rohri District	...	...	...	886
Bunds and River Embankments	...	...	...	85
				<u>2,220</u>
Total				<u>2,220</u>

221. The following is a summary of the entire expenditure during the year:—

				Rs.
Extensions and Improvements	...	...	...	22,457
				Rs.
Repairs—				
Clearance of Canals	...	...	...	53,697
Repairs to Bunds	...	...	...	1,686
				<u>55,383</u>
Establishment	...	{	Abkaláni	6,036
			Revenue	1,670
			Works	5,055
				<u>12,761</u>
Ordinary Agricultural Works—				
Repairs—				
Special	...	...	...	10,207
Ordinary	...	...	...	13,451
				<u>23,658</u>
Establishment	...	{	Abkaláni	9,414
			Revenue	419
			Works	1,268
				<u>11,101</u>
Contributions	...	...	...	500
				<u>1,25,860</u>
Total				1,25,860
Add—Regular Establishment and Tools and Plant	...	...	...	21,367
Suspense	...	...	...	319
				<u>1,47,546</u>
Grand total				<u>1,47,546</u>



231. The former temporary roof over the out-houses of the chowki at Ghár Bunds. Tajodero on the Jhali Bund was replaced by a permanent one, at a cost of Rs. 362 against an estimate of Rs. 375.

Maintenance and Repairs. 232. The ordinary repairs were executed and the usual establishment maintained, the expenditure being as follows:—

Repairs	...	...	...	...	Rs.	3,684
Establishment	...	{	Abkaláni...	...	Rs.	3,021
			Revenue ...	...	...	514
			Works ...	...	...	1,453
						<u>4,988</u>
Total ...						<u>8,672</u>

233. The amount spent upon repairs includes a further sum of Rs. 1,985 spent on fixing the furlong posts and bench marks mentioned in last year's report.

234. The nurseries at Lárkhána and Naodero on the Ghár Canal and Arzi Bhuto on the Sukkur Canal were maintained. Owing to the erosion at the Ghár mouth some trees had to be cut down, these and other trees likely to fall into the canals were cut and sold. The total receipts under this head from all sources amounted to Rs. 1,481 against Rs. 2,036 during the previous year.

Fisheries. 235. The receipts from sale of fishing rights amounted to Rs. 2,069 as under:—

Ghár Canal	...	...	...	Rs.	1,569
Sukkur Canal	...	...	...	...	500
Total ...					<u>2,069</u>

The increase of Rs. 321, as compared with the previous year, was due to the favourable inundation.

236. The following is the summary of the entire expenditure in the Ghár Canals District during the year:—

Capital and Revenue Account Works—

New Works—					Rs.	Rs.
Capital	...	...	...	...	...	
Revenue	...	...	...	...	<u>2,319</u>	2,319
Repairs—						
Clearance and other works	...	...	...	...		1,28,783
Establishment	...	{	Abkaláni	...	9,172	
			Revenue	...	2,455	
			Works	...	7,430	
						<u>19,057</u>
Gardens	...	...	...	...		993
Total					...	<u>1,48,783</u>
Total, Capital and Revenue Accounts					...	<u>1,51,102</u>

Agricultural Works—					Rs.
Works	...	...	...	...	362
Repairs	...	...	...	...	3,684
Establishment	...	{	Abkaláni	...	3,021
			Revenue	...	514
			Works	...	1,453
					<u>4,988</u>
Ordinary contributions	...	...	...	...	9,034
					154
Total					1,60,290
Add—Cost of Regular Establishment and Tools and Plant					39,857
Grand Total					<u>2,00,147</u>

237. The total cost of establishment and tools and plant was Rs. 39,857, and the percentage of it on total outlay of Rs. 1,60,290 was Rs. 24·87, as compared with Rs. 22·81 of the previous year.

238. The total cost of the Abkaláni, Revenue and Works establishments for the year was Rs. 25,038, as compared with Rs. 26,205 during the previous year.

#### WESTERN NA'RA.

239. The works connected with this canal have been described in former reports. The works, which were in progress during the year, were:—Karia Heads; regulator over Main Canal at Garhi; lowering pavement of Head Regulator, Gangrout Branch; and a regulator and road bridge at mile 24. The total expenditure during the year was Rs. 10,540.

240. As described in last year's report, the canal was widened to full designed section. Work was completed at a total cost of Rs. 1,55,011, out of which Rs. 16,875 were spent during the year.

241. A full description of the work is given in last year's report. During the year the following works were completed:—Excavations and Embankments up to 9th mile; Head Regulator and road bridge; road bridge over Mehar Badra road; iron bridge over Mehar and Wara road; sluice and road bridge at Manjan; excavation of new tail to Kakolewah; sluice and road bridge over new tail Kakole on Mehar and Kamangal road; and the following were in progress:—Realigning and widening the Kakole from the point where the Rajwah falls into it; extension of the new tail of Kakole.

Work to the extent of Rs. 72,495 was done during the year.

242. To allow of the supply being reduced and to cut off water in case of a breach, a regulator has been provided at the mouth of this canal. It consists of three openings, two of 7 feet supplied with ordinary vertical needles in front, and one of 10 feet fitted as a boat passage.

Work to the value of Rs. 2,900 was done during the year.

243. Ordinary clearance was carried out and the usual Abkaláni establishment maintained, the details being as follows:—

					Rs.	Rs.
Repairs	...	...	...	...	...	1,752
Establishment	...	{	Abkaláni	...	1,655	
			Revenue	...	1,223	
			Works	...	892	
					<u>3,770</u>	
Total					...	<u>5,522</u>

244. Ordinary clearance and repairs were carried out and the usual establishment maintained. The expenditure, including that on the Pritchard Canal, was as follows:—

				Rs.	Rs.
Repairs	...	...	...	...	44,927
Establishment	...	{	Abkaláni	...	9,497
			Revenue	...	3,864
			Works	...	6,180
				19,541	
Gardens	...	...	...	...	798
Total				...	65,266

245. The ordinary repairs were carried out and the usual Abkaláni establishment maintained, the details being as follows:—

				Rs.	Rs.
Dádu Canal—					
Repairs	...	...	...	...	8,068
Establishment	...	{	Abkaláni	...	346
			Revenue	...	112
			Works	...	326
				784	
Total				...	8,852
Phitta Canal—					
Repairs	...	...	...	...	1,189
Establishment	...	{	Abkaláni	...	304
			Revenue	...	136
			Works	...	277
				717	
Total				...	1,906
Marviwah—					
Repairs	...	...	...	...	780
Establishment	...	{	Abkaláni	...	169
			Revenue	...	39
			Works	...	53
				261	
Total				...	1,041
Wahrwah—					
Repairs	...	...	...	...	250
Establishment	...	{	Abkaláni	...	104
			Revenue	...	27
			Works	...	59
				190	
Total				...	440

246. This work, described in last year's report, was completed at a cost of Rs. 31,978 against the estimated cost of Rs. 34,093; of this, Rs. 18,978 were spent during the year, leaving land compensation to be paid when settled by the revenue department.

247. Ordinary repairs were carried out, and in the Kalar portion in the Lashari and Nagesha Bunds, where leaks are frequent, trenches were dug and refilled with sand.

Fences on both sides of the bunds have been provided.

248. The usual Abkaláni establishment was employed. The expenditure was as follows:—

				Rs.	Rs.
Repairs	...	...	...	...	12,214
Establishment	...	{ Abkaláni Revenue Works	...	5,320	
			...	421	
			...	1,462	
				7,203	
Total				...	19,417

249. The receipts from plantations amounted to Rs. 677, as compared with Rs. 724 in the previous year. Rs. 4,582 were realised by sale of timber, &c., on canals and bunds.

Fisheries.

250. A sum of Rs. 4,236 was realised from sale of fishery rights.

251. The following is a summary of the entire expenditure in the Western Nára District during the year:—

				Rs.	Rs.
Works	...	...	...	...	1,02,810
Repairs—					
Special Repairs	...	...	...	18,978	
Ordinary Repairs	...	...	...	73,684	
				92,662	
Establishment	...	{ Abkaláni Revenue Works	...	17,323	
			...	5,772	
			...	9,197	
				32,292	
Gardens	...	...	...		798
Total				...	2,28,562
Add—Regular Establishment and Tools and Plant				...	51,400
Grand Total				...	2,79,962

252. The percentage of cost of Establishment and Tools and Plant, Rs. 51,400 to outlay on works, Rs. 2,28,562, was 22.49, as compared with 25.67 in the previous year.

253. The total cost of Abkaláni, Revenue and Works establishments for the year was Rs. 32,292, as compared with Rs. 30,677 in the previous year. The increase is due to maintenance of the newly constructed Rajwah.

#### KARA'CHI CANALS.

254. Under this head a total outlay of Rs. 67,358 was incurred, as compared with Rs. 66,762 in the previous year. This amount was expended on raising river bunds, ohowkies, regulators over canals, restoration of old embankments along Baghar Canals, the new Laikpur Canal, landhies and drainage works.

255. The principal works under this class were:—(a) Raising the Sonda Hilaya Bund, completed during the year at a total cost of Rs. 2,471; (b) raising and strengthening the Baghar-Uchito Bunds, also completed at a cost of Rs. 6,958; (c) raising and strengthening the Manjhand Bunds, on which only Rs. 200 were spent against an estimate of Rs. 8,518; (d) raising river bunds, Panah to Baghar, completed during the year at a cost of Rs. 989.

River Bunds, Right Bank. 256. The extensions and improvements of the Mulchand Shahbunder Bunds were completed at a cost of Rs. 10,453.

257. The river bunds on both the banks of the Indus were very severely tried during the inundation of 1897, water having risen in some places to a height never reached in previous years. A few breaches occurred in consequence, the one which proved the most serious in its results being that at Munarki in miles 53, 54 of the Mulchand Shahbunder Bunds. There were two

other breaches in the Left Bank Bunds, which were caused by sluices having given way. The Uterani and Akha Bunds in Manjband Talukā were also breached. The Shekhani and Sonda Hilaya Bunds had their front slopes badly eroded in places. A kachiā sluice near the southern end of the Baghar to Uchito Bund gave way owing to a breach there.

Chowkies. 258. The following three chowkies were completed during the year at the amounts of total costs noted against them.

	Rs.
Two chowkies at miles 13 and 27, Baghar-Uchito Bunds ...	6,898
One chowki at mile 46, Left Bank Bunds ...	3,262

The outlay during the year on each being Rs. 3,399 and Rs. 1,813 respectively.

Regulators. 259. The regulator over Matlawah (Left Bank Bunds) was completed during the year at a cost of Rs. 2,545, and regulators at the heads of the Hajiawah *ex* Gungra' and the Saida-wah are in progress, the outlay on them during the year being Rs. 2,500 and Rs. 1,000 respectively.

Restoration of the old Em-bankment of Baghar Canal. 260. This work, which was commenced as far back as 1893, was completed during the year. The sanctioned amount of the project is Rs. 56,517, and the total cost Rs. 53,842, thus showing a net final saving of Rs. 2,675.

Laikpur Canal. 261. This work, which was described in last year's report, was in progress, and the outlay on it during the year was Rs. 20,132, the total expenditure being Rs. 34,131 against an estimate of Rs. 44,522.

Drainage Channels. 262. Work on these channels, designed to drain the Sujawal Dhunds, was continued, and outlay to the extent of the sanctioned provisional estimate, Rs. 9,395, incurred.

Maintenance and Repairs. 263. The total expenditure under this head was Rs. 1,48,316, as compared with Rs. 1,68,238 in the previous year. The following are details :—

	Rs.
(a) Special repairs to bunds ... ..	23,992
(b) Ordinary repairs to river bunds ... ..	22,654
(c) Ordinary repairs and clearance of canals ... ..	61,528
(d) Canal establishment ... ..	38,747
(e) Maintenance of gardens ... ..	1,395
Total...	1,48,316

264. The following are the details regarding (a) special repairs to bunds :—

1. Constructing new loop at mile 2/7, Baphi Aghamani Baghar Bunds ..	400
2. Do. Baghar on Varjo Goth ...	499
3. Do. in Deh Kathor ...	130
4. Do. near Machi in mile 37 Mulchand Shahbunder Bunds ...	283
5. Do. do. 53/54 do. ...	6,098
6. Constructing straight loop with a sluice in mile 89, Shahbunder Bunds ...	1,090
7. Do. new loop between miles 6/5 and 8/4 of Mulchand Shahbunder Bunds ...	750
8. Do. do. 18/7 and 20/2 do. ...	2,750
9. Do. do. 37/1 of do. ...	300
10. Do. Mangli in mile 39/4 of do. ...	693
11. Do. loop in mile 53 to 56 of do. ...	10,999
Total...	23,992



Item 11 is estimated to cost Rs. 55,599.

Of these, loops 4, 5 and 6 were completed in 1897-98 and the rest were in progress.

265. The expenditure under head (b), Rs. 22,654, is debitable as under—

					Rs.
Right Bank	...	...	...	...	13,107
Left Bank	...	...	...	...	9,547
				Total ...	<u>22,654</u>

and under head (c).

Right Bank	...	...	...	...	28,573
Left Bank	...	...	...	...	32,955
				Total ...	<u>61,528</u>

266. The usual Abkaláni establishment was maintained at a cost of Rs. 38,747, as compared with Rs. 30,983 in the previous year, the increase in cost being due to the high inundation of the year. The cost of establishment was distributed as shown below:—

*For Embankments.*

				Right Bank.	Left Bank.	Total.
				Rs.	Rs.	Rs.
Abkaláni	...	...	...	5,343	9,712	15,055
Revenue	...	...	...	367	515	882
Works	...	...	...	1,237	1,573	2,810
			Total	<u>6,947</u>	<u>11,800</u>	<u>18,747</u>
Cost for previous year	...	...	...	<u>5,265</u>	<u>7,811</u>	<u>13,076</u>

*For Canals.*

Abkaláni	...	...	...	5,139	4,976	10,115
Revenue	...	...	...	1,186	1,347	2,533
Works	...	...	...	3,412	3,940	7,352
			Total	<u>9,737</u>	<u>10,263</u>	<u>20,000</u>
Cost for previous year	...	...	...	<u>8,845</u>	<u>9,059</u>	<u>17,907</u>

Plantations.

267. During the year the receipts from plantations amounted to Rs. 147, as compared with Rs. 233 during the previous year.

268. The following is a general summary of the entire expenditure in the Karáchi Canals District.

				Rs.	Rs.
Extensions and improvements	...	...	...	...	67,358
Maintenance and repairs	...	...	...	...	1,08,174
Establishment	...	{ Abkaláni Revenue Works	...	25,170	
			...	3,415	
			...	10,162	
					<u>38,747</u>
Gardens	...	...	...	...	1,395
					<u>2,15,674</u>
Add—Regular Establishment and Tools and Plant	...	...	...	...	59,821
Mathematical Instrument Depôt Establishment and Tools and Plant	...	...	...	...	—60
				Grand Total ...	<u>2,75,435</u>

269. The percentage of cost of Establishment and Tools and Plant, Rs. 59,821, on the outlay, Rs. 2,15,674, was Rs. 27·7, as compared with Rs. 23·66 during the previous year.

## EASTERN NÁRA CANALS.

270. The important works of the year in this district were:—

- (1) The extension of the Rátá Bund.
- (2) The completion of the escape through the Bhaiti Bund upstream from the Thar Weir, and the extension southward of the Bhaiti Bund to form part of the third revised recapitulation, Eastern Nára District.
- (3) The completion of the regulator in the Makhi Weir.
- (4) The completion of the new channel leading the Nára water through the regulator and back into the old Bakar channel.
- (5) Additional embankment of the right side of the Mitrao Canal within the Makhi Dhand.
- (6) The completion of the new Head Regulator, Thar Canal.

271. The expenditure of the year on the completion of the escape through the Bhaiti Bund was Rs. 2,527, the total expenditure being Rs. 6,427 against an estimate of Rs. 6,395.  
Nára Canal.—Capital Account.

272. The usual Abkaláni, Revenue and Works establishments were maintained, and ordinary repairs were carried out at a cost of Rs. 15,645, the following being items of extraordinary flood expenditure:—  
Revenue Account.—Maintenance and Repairs.

Name of Works.	Cost.	REMARKS.
	Rs.	
(a) Closing breach in Adwana Sang ... ..	2,666	Completed.
(b) Closing breaches in and repairing Bakhora-Bakar Bund ... ..	900	In progress.
(c) Closing breaches in Nára Bund ... ..	4,640	Do.

273. Materials which were collected for the proposed, but now deferred, new Head Regulator, Mitrao Canal, to the extent of Rs. 2,400, have been transferred during the year to other works. Rs. 5,622 have been spent on the completion of the regulator in the Makhi Weir, the whole expenditure being Rs. 46,005 against an estimate of Rs. 48,156.  
Mitrao Canal.—Capital Account.

274. On the south extension of the Rátá Bund, the expenditure of the year has been Rs. 25,533, the expenditure to the end of the year being Rs. 56,323 against an estimate of Rs. 1,07,126; further extension is stopped for the present.

275. Rs. 3,249 have been spent during the year on the completion of a channel leading the Nára through the new regulator in the Makhi Weir and on into the old Bakar channel, the whole cost being Rs. 5,101 against an estimate of Rs. 5,000. Further embanking of the right side of the Mitrao Canal inside the Makhi Dhand has cost Rs. 1,034 during the year, the expenditure to the end of the year being Rs. 2,857 against an estimate of Rs. 7,313; this work is interdependent with the new Regulator, Mitrao Canal, and the extension of the Rátá Bund into the Makhi Weir.  
Earthwork.

276. The usual Abkaláni, Revenue and Works establishments were maintained and the ordinary clearance and repairs executed at a cost of Rs. 22,335, and to this was added the extraordinary flood expenditure of Rs. 900 for repairing the Makhi Bund.  
Revenue Account.—Maintenance and Repairs.

277. The expenditure of the year on the completion of the new Head Regulator, Thar Canal, was Rs. 298, the total cost being Rs. 17,407, against an estimate of Rs. 17,703.  
Thar Canal.—Capital Account.

Thar Canal.—Revenue Account, Extensions and improvements.

278. To this head the original cost, Rs. 6,687, of the Head Regulator of the Thar Canal has been debited.

Thar Canal.—Revenue Account, Maintenance and Repairs.

279. The usual Abkaláni, Revenue and Works establishments cost Rs. 3,976, and the ordinary repairs Rs. 7,774. No extraordinary flood expenditure was necessary, the flood not reaching the Thar Weir.

Dim Canal.—Revenue Account, Maintenance and Repairs.

280. The usual Abkaláni, Revenue and Works establishments cost Rs. 696 and the ordinary repairs Rs. 3,235.

281. One Maistry at Rs. 35 and two Mukadams at Rs. 15 each a month were engaged to help in supervising the construction of the regulator in the Makhi Weir, the escape through the Bhaiti Bund, and the new Head Regulator, Thar Canal, the total outlay on works being Rs. 15,019, and on establishment Rs. 115; the percentage of the latter is Rs. 76.

282. The maintenance of the Sindri garden cost Rs. 537 against the usual appropriation of Rs. 600, and that of the Samara garden Rs. 154 against an appropriation for an equal amount.

The receipts of the year were:—

				Rs.
Sindri garden	...	...	...	867
Samara garden	...	...	...	300
Total				1,167

Summary of Expenditure.

283. The following is a summary of all irrigation expenditure in this district:—

			Rs.	Rs.
New Works—				
Capital expenditure	...	...	36,700	
Revenue expenditure	...	...	7,637	
Ordinary agricultural works	...	...	...	
				44,337
Repairs—				
Clearance	...	...	3,365	
Other works	...	...	37,990	
Maintenance of garden	...	...	691	
				42,046
Establishment	{	Works	6,893	
		Abkaláni	12,350	
		Revenue	7,622	
				26,865
				68,911
				1,13,248
Add—Regular Establishment charges	...	...	35,349	
„ Tools and Plant charges	...	...	855	
				1,49,452

The average expenditure of three previous years on establishment charged to maintenance grant was Rs. 27,405.

### FIRST DISTRICT, JA'MRA'O CANAL.

Extent of District.

284. This district comprises the Head Works of the canal, together with 17 miles of Main Canal and distributaries,

285. Good progress was made on the works in this district during the year under report; labour was plentiful and a large quantity of work was done.

General.

286. The number of foundation wells sunk during the year, including those at the Falls, was 125, bringing up the total to 349 exclusive of 11 wells specially sunk for pumping.

The total quantities of the various classes of masonry laid during the year was over 5½ lakhs cubic feet, bringing up the total from the commencement to 8¼ lakhs.

Four engines—one of 8, two of 12 and one of 13 Horse Power, and four Centrifugal Pumps of 8", 9" and 10" diameter were regularly at work throughout the year. These pumps were set in 18 different positions at the Head Works and 3 at the Falls; the pumps and engines had to be taken out of the river for the inundation and put back again when work was recommenced, the soft sandy nature of the ground adding considerably to the labour of moving this heavy plant.

287. The foundations of the Head Regulator were put in during the previous year, and the abutments and piers commenced; in the year under report, the work was carried above ordinary inundation level before the advent of the flood in May, and arrangements made for proceeding with the arches during the inundation; the arches were successfully completed in July 1897, and the haunching and side walls built up to road level.

288. The cast-iron grooves for guiding the rolled beams for regulating the supply were made in Karáchi and conveyed to the site, and the rolled iron beams were obtained from England and delivered at Rohri ready for conveyance to Jámráo, when the water in the Nára is again sufficient for large boats.

The quantity of work done for the main items was—

				Brick Masonry.	Concrete.
				C. ft.	C ft.
During the year	...	...	...	75,500	...
Total up to date	...	...	...	140,500	26,000
Rs					
The expenditure during the year was	...	...	...	...	27,888
Total up to date	...	...	...	...	96,854

289. Immediately the foundations of the Head Regulator were completed, the engines and pumps were transferred to the foundations of the under-sluices, and work was begun on the thick pavement under the arches. Before any of this pavement could be laid, it was necessary to clear away the whole of the wet running sand to a depth of 10 feet below ordinary water level, to clean out the wells and fill them with concrete, and to drive piles to close the spaces between the wells. The work was carried out one bay at a time; the heat was excessive, 120° in the shade being recorded, but the men and staff worked by relays, and before the inundation water came down the whole of the pavement of the seven bays had been completed. The abutment at the weir ends had also been built up seven feet above the ordinary cold weather level. The building of this piece of the abutment and the completion of the pavement below the under-sluice arches greatly facilitated the progress of the work after the inundation.

290. An additional engine was obtained during the inundation, and those already on the work overhauled and repaired. When the water had sufficiently subsided, which was not until the end of November, engines and pumps were placed on the weir abutments, and the work recommenced on the 1st of December.

291. The pavement of the Approach Channel to the under-sluices, which had been commenced and a little more than half finished before the inundation, was then rapidly completed.

292. About two thousand concrete blocks, weighing two tons each, had to be laid for the upstream and downstream curtains of the under-sluices; these blocks had been made in the previous season and were ready to be carried to the work and laid. A few had been laid before the inundation without any crane. To facilitate the laying of the remainder, the Steam Crane Excavator was brought down from Rohri during the inundation and erected at Jámráo and used for lifting and laying the blocks, and by the end of March the whole of the blocks required for the under-sluices had been deposited in place.

293. The stones for the pavement of 18" ashlar for the 50 feet width beneath the under-sluice ways were quarried at the Arror quarries near Rohri, and conveyed 100 miles to Jámráo by boat, were dressed during the hot weather and laid in January and February.

294. When the pavement had been laid, the piers were proceeded with and the centering put up, and by the end of the year the arching had been completed.

295. The upstream and downstream groyne walls, separating the channels of the under-sluices from the weir, were carried up above ordinary cold weather water level.

296. The treble cast-iron grooves for guiding the under-sluice gates were made in Karáchi and conveyed by boat to Jámráo and the lower lengths erected.

297. Thus the whole of the work of the under-sluices below water level and also the piers and arching were completed before the end of the year.

The quantities in the main items in this work are as follows :—

	Brick Masonry.	Concrete.	Ashlar.	Excavation generally wet.
	C. ft.	C. ft.	C. ft.	C. ft.
During the year ... ..	162,296	55,251	16,600	...
Up to date ... ..	249,696	144,151	16,600	1,800,000

	Rs.
The expenditure during the year was ... ..	1,27,630
From commencement of works ... ..	2,33,022

298. It was not considered desirable to allow the flood waters to flow through the area excavated for the under-sluices which were at that time unfinished, as either silting up of the excavation or scour at the edge of the pavement would have resulted; small embankments were therefore made along the upper end of the excavation and water admitted at the lower end; this arrangement was successful and the excavation was kept clear of silt and free from scour.

299. During the flood in the month of August a large quantity of sand was deposited at both the east and west end of the weir site; the deep channel of the river had moved to the east side, and a low sand bank had formed on the west. The condition of the river seemed favourable for the construction of the two bays at the west end of the weir as early as possible, the opportunity was taken, and a bank run out into the river, surrounding the site of the first bay; by this means the engines and pumps which were at work on the under-sluices were able to assist at the adjacent portion of the weir, care being taken not to excavate an area larger than the pumps could keep dry.

300. The engines and pumps were moved forward from time to time as the work progressed, special wells being sunk to take the pumps. The work progressed steadily.

301. In April of 1897 it had been necessary to close the Rohri Head Regulator on account of some work in the Eastern Nára District below Jámráo; up to that time the works had been almost entirely dependent on the water carriage of the Nára for their stores and supplies, but the Kotri-Rohri Railway having been completed and opened, with a railway station within 35 miles, to which there is a tract suitable for camels but not for carts, light stores could be obtained from the railway, the larger supplies were laid in before the reduction of the water.

302. The result of closing the Rohri Head Regulator was to reduce the height of the water at Jámráo by two feet, and though this does not seem a great reduction, yet, owing to the ground being fine sand through which water percolates freely, and which, when saturated, runs to a flat slope, the reduced head really greatly facilitated the progress of the works, and it was owing to this reduction that the rapid progress of the work in the under-sluices described in paragraph 289 was possible in April and May 1897. The same arrangement was therefore made for 1898.

303. On the reduction of the water, embankments were thrown out into the river, surrounding the second bay of 260 feet length and the site of the division wall, which is founded on a curtain of wells, extending completely across the weir from upstream to downstream edges. The object in view was to build the second bay of the weir up to this curtain of wells, which would protect it from being undermined during the inundation, and by the end of March the work had been well advanced and has since been built up to the desired height.

304. The east abutment of the weir was also proceeded with, as the training banks on the left bank (described in paragraph 307 below) having been commenced, it was desirable that the east abutment should be built up to flood level, if practicable, so as to link together the upstream and downstream banks and form one continuous line of work. The abutment is founded on wells 15 feet deep, which had to be sunk until the tops were 5 feet below spring water level, so that pumping was necessary: for this an engine and pump, from the right downstream training bank described in paragraph 311, were available and the work was well advanced at the end of the year.

305. The quantity of work done on the weir was:—

				Brick Masonry.	Concrete.	Rubble Masonry.
				C. ft.	C. ft.	C. ft.
During the year	...	...	...	87,826	29,592	8,431
From the commencement	...	...	...	103,826	20,502	8,431

The expenditure was:—

				Rs.
During the year	...	...	...	95,799
From the commencement	...	...	...	3,02,204

Supply of materials. 306. The supply of materials was maintained up to the requirements throughout the year.

Nearly the whole of the bricks and ballast required for the Head Works were delivered. The lime kilns were enlarged and the supply of lime, both for the falls at 7 miles of the canal and for the Head Works, was burned regularly as required.

307. The left upstream training bank is a bank with top 21 feet above weir crest, having the river face pitched with 15" dry brick pitching, with bands of brick and lime 10 feet apart; the toe of the bank is protected by a concrete foot wall, and by an apron of rubble stone 30 feet wide and 3 feet thick. The length of the concrete foot wall is about 950 feet including the length round the end of the bank which is formed into a massive bastion. The greater part of the rubble apron was laid at about one foot below spring water level

The Left Upstream Training Bank.

and was put in without pumping, the upper part of the bank was also completed. A length of rubble apron near the weir had to be laid at 5 feet below spring water level, and the pumping for the east abutment of the weir mentioned in paragraph 299 above also drained this length.

308. The quantity of work done during the year was :—

Brick Masonry.	Brick Pitching.	Concrete.	Rubble Apron.	Earthwork.
C. ft.	C. ft.	C. ft.	C. ft.	C. ft.
9,026	18,856	7,355	73,080	259,000

The expenditure during the year was Rs. 25,272.

309. The left downstream training bank is similar to the left upstream, but the length of rubble apron near the weir had to be laid at 8 feet below ordinary spring water level.

The Left Downstream Training Bank.

The work was well advanced by the end of the year.

310. The quantities of work done during the year were :—

Brick Masonry.	Brick Pitching.	Concrete.	Rubble Apron.	Earthwork.
C. ft.	C. ft.	C. ft.	C. ft.	C. ft.
9,115	17,739	7,709	75,510	250,000

The expenditure during the year was Rs. 24,079.

311. The right upstream training bank is of the same type as described in paragraph 307 for the left upstream bank, but as this bank is next to the canal and leads to the approach channel of the under-sluices, the whole of the rubble apron had to be laid at about 8 feet below spring water level.

The Right Upstream Training Bank.

312. As the rubble apron is over one thousand feet long and thirty feet wide, and the sides of the trench slipped to a flat slope, and as the rubble apron acted like a large stone drain, the quantity of water to be pumped was large. At one time it appeared as if one 9" centrifugal pump with a 12 horse-power engine would not suffice; but, by building two concrete walls across the rubble apron and assisting them by banks of sand and by spreading sand on the apron, and watering it and so silting up the spaces in the rubble and by keeping the engine in first class order, the water was kept under control.

313. Wells were sunk at a distance of about 150 feet apart for the pump and the trench taken out in lengths, the engine and pumps being moved on from time to time, and a powerful body of labour concentrated on the work: by this means the whole of the apron and concrete toe had been laid by the end of March, and the pitching of the slope of the bank having been raised to above flood water level, all difficulties with this bank were over.

314. The quantities of work done were :—

	Brick Masonry.	Brick Pitching.	Concrete.	Rubble Apron.	Wet Excavation.	Earthwork.
	C. ft.	C. ft.	C. ft.	C. ft.	C. ft.	C. ft.
During the year ...	7,468	21,788	10,943	81,000	336,183	313,942
From the commencement ...	7,468	21,788	11,298	81,000	336,183	313,942

The expenditure was:—

				Rs.
During the year ...	...	...	...	31,906
From the commencement	...	...	...	34,664

315. The flank embankments on the right of the works were maintained in good order and were satisfactory throughout the inundation, but a portion of a natural sand hill, connecting two of the banks, showed signs of weakness; a loop bank was therefore constructed to protect it.

Extension of Bank between Jámráo Sang and Nara.

316. The whole of the work was completed during the year and the quantities of work done during the year were 742,852 cubic feet of embankment, the expenditure during the year being Rs. 5,108.

317. The valuable Pathan labour which came up the previous season again came to the work for the year under report, and good progress was made with the work. Some hard earth remains to be excavated in the 14th to 17th miles and an average depth of about 2 feet of wet excavation remains to be taken out from the commencement to 3 miles, but 13 out of the 16½ miles are practically completed and a good deal of work has been done in others.

Earthwork on the Main Canal.

318. The work proceeded with regularity, and there is little to record except the quantities of work done for which the figures are large. The detailed state of progress is shown in the diagram attached, and the quantities and amounts are as follows:—

		Excavation.	Expenditure.
		C. ft.	Rs.
During the year ...	...	37,906,624	2,11,158
From the commencement	...	110,701,667	6,62,594

319. The Falls, situated at 7¼ miles, are Notch Falls with a drop of 8 feet and a maximum discharge of 3,200 cubic feet per second. They have a water cushion, the foundations of which and of the weir wall had to be laid eleven feet below spring water level, the ground being fine sand throughout.

The Falls at 7¼ mileage.

320. As soon as the waters of the inundation of 1897 stopped work at the Head Works, an engine and pump were sent off from the Head Works to the Falls. This was in May, when the temperature reached over 120° in the shade. The engine was taken on planks over the soft sand, the work of drawing it being done at night by men.

321. Pumping was started at the Falls early in July, the right half of the work being first put in.

322. The work included wet excavation, well-sinking, pile-driving, concrete and brick masonry and other items. The lime was sent out from Jámráo (the Head Works) over 7¼ miles of sand, and the bricks and ballast were burned about two miles from the site. By the beginning of October the foundations of the right half had been laid and the engine and pump were shifted to a well on the left side. The foundations were then completed and by the first week of January the work had been built above water level. Pumping was then stopped and the engine and pump taken back to the Head Works where they were used on the weir.

323. The difficult portion of this work was thus constructed during the hottest months of the year.



324. The quantity of work done was as follows:—

	Brick Masonry.	Concrete.	Ashlar.	Wet Excavation.
	C. ft.	C. ft.	C. ft.	C. ft.
During the year ... ..	71,315	30,669	563	341,350

The expenditure was—

	Rs.
During the year ... ..	55,311
From the commencement ... ..	74,068

325. The inundation of the year 1897 was distinguished by a great flood which reached its maximum height on 31st August 1897.

The levels reached were:—

- (1) At the weir site 110.25 compared with the estimated maximum of 110.50.
- (2) At gauge site at  $\frac{3}{4}$  of a mile above the weir on east bank, or Sihuri Bhit 110.64.
- (3) In Mainstream 110.82.
- (4) On west bank on Jámráo Bhit 111.17.
- (5) On the flank embankment connecting the western sand hills with the Jámráo Bhit 112.92.

326. The discharge was gauged in the main channel and estimated in others and was thus calculated as 45,000 cubic feet per second in the main channel and 30,000 between the Sihuri Bhit and the eastern sand hills, or a total of 75,000 cubic feet per second passing Jámráo.

327. A very important point noticed was that the rise and fall were felt at the 12th mile gauge of the Nára Supply Channel near Rohri within a period of seven days before the corresponding rise and fall occurred at Jámráo: in normal conditions the changes are felt in two days' time.

328. The buildings were maintained in good order at a cost of Rs. 926-9-11.

The expenditure on works establishment was limited to Rs. 1,729-13-4.

329. The following is a summary of all irrigation expenditure in this district:—

	Rs.
<b>New Works—</b>	
Capital expenditure ... ..	6,08,059
Revenue expenditure ... ..	...
	6,08,059
<b>Repairs—</b>	
Clearance to Canals ... ..	...
Other works ... ..	...
Maintenance of Gardens ... ..	...
Works ... ..	...
Abkaláni ... ..	...
Revenue ... ..	...
<b>Add—Regular Establishment charges</b> ... ..	41,560
„ Tools and Plant charges ... ..	7,871
<b>Total Charges under all Heads</b> ... ..	6,57,490

## SECOND DISTRICT JÁMRÁO CANAL.

330. This district, as mentioned in previous reports, comprises sixty miles of the Main Line, Jámráo Canal, from mile 17 to 77, and 17 miles of the West Branch from its head to mile 17, together with the minor branches which will take off from the above sections.

331. The district was originally divided into two sub-divisions, *viz.*, (1) Shábdádpur sub-division comprising the area extending from mile 17 to 42½ Main Line, and the minors taking off from this section; (2) Mirpurkhás Sub-division comprising the area extending from mile 42½ to 77 Main Line, head to mile 17 of West Branch and the minors taking off from these sections. A third sub-division was formed in the year under report during the month of January 1898 and called Survey sub-division. The work entrusted to establishment of this sub-division is the square survey for colonisation purposes of the land under command of the Jámráo Canal.

Buildings at Head-quarters  
of District. 332. The buildings at Mirpurkhás were, with the exception of wire-fencing, completed in 1896-97. The wire-fencing was received from England and completed during the year under report at a cost of Rs. 2,478.

333. The Contour Survey of the district was completed during the year at a total cost of Rs. 12,038, the expenditure during the year being Rs. 1,309.

Earthwork—Main Canal. 334. Good progress was made with the earthwork on the Main Canal during the year under report, the total quantity executed being 75,761,581 cubic feet as compared with 23,098,666 cubic feet during the previous year. The greater part of this was done by contract.

335. The work done by the convict gang, whose numbers were considerably reduced during the year, owing to remissions of sentences on account of the Diamond Jubilee of Her Majesty the Queen-Empress, was only 4,410,438 cubic feet, as compared with 5,634,796 of the previous year.

336. The expenditure during the year on this item was Rs. 3,96,399 and the total expenditure to the end of the year Rs. 7,91,560. This includes the cost of jungle cutting, nicking out boundaries, and temporary service roads.

Regulators. 337. There are five regulators in the section of the canal in this division respectively at miles 17, 31, 46, 56 and 65. The completion of those at miles 17 and 31 has been delayed owing to absence of contractors from works, but it is hoped they will soon be completed. The regulators at miles 46 and 65 have been completed. The one at mile 56 is a triple regulator consisting of (1) Regulator on Main Line; (2) Regulator at head of West Branch; (3) Regulator at head of Kapri Minor. Except the upstream pitching and a little teakwood work, this regulator has been completed. The expenditure incurred during the year under this head is Rs. 7,718.

Syphon. 338. At 39th mile of Main Canal a syphon to pass the water of the Shahuwah under the Main Canal is to be constructed. During the year under report some broken brick for concrete was collected for the work at a cost of Rs. 866. The iron work has been ordered from England and the work will be completed in the year 1898-99.

Bridges. 339. Out of seven masonry bridges on the Main Canal in this district, six, *viz.*, those at miles 23¼, 35, 38¾, 42½, 60 and 72 have been completed. The one at mile 51 is being completed departmentally, the contractors having failed to make satisfactory progress. The archwork of this bridge has been completed. Two foot bridges are to be constructed, one at mile 20 and the other at mile 28. Iron work for these has been received from England, but the construction could not be commenced during the year owing to want of funds.

340. The construction of a railway bridge over the Main Canal in mile 77 is under reference to the Railway Department, by whom it will be constructed as soon as the plans and estimates are sanctioned. The expenditure against "Bridges" during the year is Rs. 7,822.

341. The main buildings with out-houses in this district, viz., 5 Inspection Buildings, 2 Chowkies, 2 Upper Subordinates' quarters, 1 Clerk's quarters and 1 Lower Subordinate's quarters have all been completed. There has been no progress on the Lower Subordinate's quarters at mile 24.

342. At each regulator sluice, quarters for establishment and a shed for needles have been provided. Those at miles 45, 56 and 65 have been completed. The one at mile 17 has progressed up to the verandah roof level, and that at mile 31 to plinth level only. Out of the thirteen Mukadams' quarters to be constructed on this line, only two, viz., one at mile 60, and the other at mile 72, have been completed. The third at mile 39 is approaching completion. The work on the remainder has not yet been started.

343. Wells have been constructed at miles 23 and 39. The work of these Wells. has been practically completed. In the project estimate there is provision for two wells more for the Main Line, one at mile 56 and the other at mile 72, but as the water at these places has been found to be brackish, the sinking of the wells has been postponed.

Two Hospital Assistants' Quarters and dispensaries have been constructed of kutchra masonry on the temporary scale, one at mile 24 and the other at mile 46 at a cost of Rs. 504 and Rs. 510 respectively.

There is only one store-room on this line at mile 39. The superstructure, with the exception of pointing, has been completed. The expenditure on the buildings during the year has been Rs. 22,757.

344. Some fruit trees were procured for the gardens at Mirpurkhas and at mile 39th, Jámrao Canal. The expenditure for the Plantation. first was Rs. 72; that for the second Rs. 237. These gardens were maintained throughout the year at the cost of Rs. 1,114 and Rs. 238 respectively. The garden at Mirpurkhas yielded an income of Rs. 110-4-4 during the year.

345. These stones had been fixed in the previous Mile, Bed, and Indicator Stones. years, but some were to be removed and refixed, and this was done at a cost of Rs. 31.

346. Nearly all excavation work on this branch has been completed; only Earthwork, West Branch. a little dressing of the banks here and there is required, and is being done. The quantity excavated during the year is 8,279,853 cubic feet, and the expenditure incurred Rs. 42,059.

347. There are two regulators in the section of the West Branch Canal in this district. One at the head has been combined with that at 56th mile, Main Line, and has been Regulators. nearly completed, and the other is at mile 8. This is a triple regulator consisting of —

- (1) Regulator on West Branch.
- (2) do. at Head of Bhitaro Minor.
- (3) do. at Head of Dosowah.

The contractor has failed to carry out this work; only excavation in foundations has been done, but a large quantity of materials at site has been collected and arrangements are being made to carry out the work departmentally. The expenditure under this head is Rs. 10,117.

348. Three masonry and one Railway bridge are to be constructed on Bridges. this branch within the 17 miles of this district. The masonry bridge at mile 6 has been completed, but not finally paid for; that at mile 11 has not been commenced; bricks are being made and arrangements effected to carry out the work departmentally. The third at mile 17 has been completed departmentally, with the exception of stone caps and approaches. The railway bridge at mile 17 will be carried out by the Engineering Department of the North-Western Railway as soon as sanction to the plans and estimate is obtained. There has been an expenditure of Rs. 9,020 during the year on the West Branch Canal under the head "Bridges."

349. The only buildings on the West Branch in this district are (1) Buildings. Second Class Chowky with out-houses at mile 7; (2) Sluice Establishment quarters at mile 8, and (3) three Mukadams' quarters at miles 3, 2 and 17.

The work of the Second Class Chowky and out-houses was commenced by a contractor, but as he failed to complete it within the stipulated time, it was completed departmentally. The work of Sluice Establishment quarters has been completed up to the superstructure. The work of the Mukadams' quarters has not yet been commenced. The expenditure on buildings of West Branch during the year has been Rs. 6,404. A well at mile 7 has been sunk. Excavation and steining for about 40 feet have been completed, but as the water was found to be brackish further work on it has been stopped for the present.

350. The work on the Rawtiani Minor was started during the year under report. Some 998,013 cubic feet of excavation work was done, and the expenditure, including the cost of jungle cuttings, nicking out boundary lines, &c. amounted to Rs. 4,610. There has been an expenditure of Rs. 769 under head "Preliminary Expenses" and Rs. 10 on mile, bed, and indicator stones. Some land for this minor has been acquired, for which payment will have to be made. Surveys were carried out for some other minors, and the expenditure incurred on each was as under:—

				Rs.
Sinjhora Minor	...	...	...	151
Mirpur do.	...	...	...	15
Berani do.	...	...	...	75

On the Mirpur Minor an expenditure of Rs. 69 has been incurred under head "Earthwork" on nicking out the boundary lines, &c.

351. There are only two minors on this branch under this district, *viz.*:—

- (1) Bhitari Minor.
- (2) Kapri Minor.

In the Kapri Minor earthwork was executed to the extent of 1,216,902 cubic feet at the cost of Rs. 4,126. It was found necessary to acquire some land, and the payment made thereon was Rs. 51. The Head Regulator of the minor has been combined in the triple regulator described in paragraph 347.

352. The Square Survey was commenced in the month of January, and up to 31st March in all 72 miles, 7 furlongs, and 27 feet were measured up and nicked out. The first base line, running true north and south, starts from a point close to the foot of the left approach of the regulator at mile 17 at the distance of 330 feet from the centre line of the Main Canal and cuts the Main Line in mile 37. It is then diverted from chainage 100,800 feet at right angles to start another N. S. line from chainage 16,800 feet on east west line 7/0. This second N. S. line crosses the Main Channel in 46th mile and is diverted again to form a third N. S. line. The third N. S. line is diverted from chainage 50,400 feet, from which a line is run east and west as a closing boundary between Sháhdádpur and Mirpur Sub-divisions, up to which it is intended for the present to confine the operations of land division. Several cross lines have been run at every 16,800 feet, which is fixed as the length of the side of squares forming the base lines.

353. The chief works in this district under Main Canal and branches consist of—

- |                 |  |                |
|-----------------|--|----------------|
| (1) Regulators. |  | (4) Buildings. |
| (2) Syphon.     |  | (5) Earthwork. |
| (3) Bridges.    |  |                |

These works, excepting that of the syphon, have progressed very satisfactorily. The largest work among the five is the earthwork, the total estimated cost being Rs. 11,88,740. The expenditure on this head during the year has been Rs. 4,38,458, more than one-third of the sum total of all the earthwork provided for. The earthwork of the West Branch has been nearly completed.

354. Owing to the heavy rains during last July and August, much damage was done to the banks of the completed portions of the canals. A considerable sum will be required to put them in good repair, and a further expenditure will be necessary to clear silt from the excavated bed, which was washed into it by rain. The rush of water has completely carried away the outer slopes of the banks in some places. Repairs to bridges and buildings, some of which were completed some 12 months back, will also be necessary during the year 1898-99.

355. Very little work has been done on the distributaries. The earthwork on the Rawtiani Minor is in fair progress, and the work on the other minors will be commenced in the ensuing year.

356. Most of the labour employed on this work during the year was imported: the strength employed, including the average daily number (183) of the convicts, varied from 2,000 to 7,000 per day.

357. The following is a summary of the outlay incurred on irrigation works in this district:—

Summary of Expenditure.			Rs.	
New Works—				
Capital expenditure	...	...	...	5,26,459
Revenue expenditure	...	...	...	...
				5,26,459
Repairs—				
Clearance to Canals	...	...	...	...
Other works	...	...	...	...
Maintenance of Gardens	...	...	...	...
Establishment...	{	Works	...	...
		Abkaláni...	...	...
		Revenue	...	...
Add—Regular Establishment charges	...	...	...	51,387
„ „ Tools and Plant charges	...	...	...	1,208
				5,79,054

### THIRD DISTRICT JÁMRÁO CANAL.

358. The district comprises 39 miles at the lower end of the Main Line, Jámráo Canal, and 42 miles of the West Branch besides the minors taking off from the above.

359. During the year under report the alignment and nicking out of the Main Line, Jámráo Canal, was completed, and the following minors from the Main Line surveyed. The total mileage of the minors surveyed is given below:—

	M.	F.
Puran Minor	24	0
Bareji do.	8	7
Dingan do.	10	3
Dabko Minor and Escape, mile 84	7	6
Minor Left, Juriasur Minor	15	4
	66	4

360. The following works, which were in progress at the end of the last year, were completed during the year under report:—

1. Second class chowky at Jhuda.
2. Servants' quarters to do.
3. Stables to do.
4. Check-levelling the Main Line sections in connection with the Contour Survey, First and Second Districts, Jámráo Canal.

The Nursery Garden at Digri is still in progress.

The statement of land required for the Main Line has been sent to the Revenue-authorities, and the land is being acquired.

Contracts for excavation in 12 miles of the Main Line have been given, and work has been commenced in miles 78 to 86 of the Main Line.

Summary of Expenditure. 361. The following is a summary of the irrigation expenditure incurred in this district:—

			Rs.
New Works—			
Capital expenditure	...	...	11,201
Revenue expenditure	...	...	...
			11,201
Repairs—			
Clearance to Canals	...	...	...
Other Works	...	...	...
Maintenance of gardens	...	...	...
Establishment...	{ Works	...	...
	{ Abkaláni	...	...
	{ Revenue	...	...
Add—Regular Establishment charges	...	...	4,767
„ Tools and Plant charges	...	...	—380
			15,588
Total Charges under all Heads			...

362. The accompanying diagram shows the state of progress of the earthwork.

#### NORTHERN HYDERABAD CANALS DISTRICT.

363. This is a new district formed during the year under report under the authority of Government Resolution No. 332-E.—1428, dated the 9th October 1897, out of the former Hyderabad Canals District; it comprises the northern portion of that district as shown on the accompanying map, and includes the extensive works of improvement proposed to be undertaken in connection with the Dád, the Nasrat, and Naolakhí Canals in addition to the care and maintenance of the other canals and works in the district.

Capital Account.—Dád Canal. 364. These works were carried out during the year.

365. This work, referred to in last year's report, was carried out according to the revised estimate amounting to Rs. 77,821 (including baulkshed and quarters for establishment), sanctioned subsequently in Government Resolution No. 121-W. I.—1417, dated 8th October 1897.

It consists of 11 spans, 2 of 15 feet for boat passage and the rest of 10 feet each, giving a total clear water-way of 1,320 square feet at full supply level.

The foundations consist of rectangular wells resting on curbs of bábul wood. Pavement as far as the downstream ends of the pier wells consists of 18" burnt bricks in hydraulic lime mortar on 2' 6" concrete, and from there to the downstream end of 12" masonry on 18" concrete.

Superstructure, up to springing level, has been constructed with burnt bricks and hydraulic lime mortar, cement pointed, and above that with lime. The bed of the canal has been paved with concrete blocks 2' x 1' x 1' laid dry for a length of 30 feet on the downstream side and 15 feet upstream, and beyond that with brickbats.

The work has been nearly completed with the exception of the item 'pitching.'

The expenditure during the year was Rs. 41,410, and the total expenditure from commencement to date Rs. 75,115.

Baulkshed and Quarters for Establishment. 366. The amount shown for the Head Regulator includes the provision for these two works, which were begun during the year under review and are nearly completed.

367. The Regulator at the Head of Surat Suhagan, which was commenced in the year 1896-97, was completed at a cost of Rs. 2,431, against an estimate of Rs. 2,403.

Regulators.

It consists of two openings of 8 feet span, the height of springing level being 11 feet.

The following two regulators and a sluice were also commenced during the year :—

1. Regulator at the Head of Surat, where it takes off from the Suhagan.
2. Do. do. over Reharji do. do.
3. Sluice over Ghatiwah.

The first two consist of two openings of 5 feet span and 9 feet high to springing, carrying a road-way 8 feet wide. The wales consist of old rails and the needles of teak wood. The sluice over the Ghatiwah consists of one span of 6 feet and 8 feet high to springing, and carries a road-way 8 feet wide. The wales are old rails and the needles teak wood.

368. The work of two bridges on the following roads was commenced in the year 1896-97, and completed during the year under report at the cost shown opposite each :—

Bridges.

	Rs.
1. Bridge over Dád in 22nd mile on road from Moro to Gachero ... ..	9,615
Against an estimate of ... ..	9,695
2. Bridge over Dád in 26th mile on road from Moro to Shahpur ... ..	9,602
Against an estimate of ... ..	9,800

The first consists of 3 spans each 32 feet and carries a road-way 15 feet wide, and the second of 3 spans of 33 feet 6 inches each, the road-way being 15 feet wide.

369. The following bridges were commenced during the year :—

1. Bridge over Suhagan-Surat on road from Daulatpur to Kazi Ahmed, one span 16 feet and 9 feet high to springing.
2. Bridge from Thatt to Government well, one span of 15 feet and 9 feet high to springing.
3. Bridge from Thatt to Kazi Ahmed, one span of 14 feet and 8 feet to springing.
4. Bridge over Dád New Branch on road from Daulatpur to Thatt, one span of 14 feet and 8 feet to springing.

370. The work of the three chowkies described in last year's report was practically completed, the expenditure being as noted below :—

Buildings.

	Rs.
1. Second class chowki at Sehra ... ..	4,863
And the total cost to date ... ..	7,866
2. Second class chowki at Jhunghan on the Suhagan-Surat Branch, 15th mile ... ..	3,350
And the total cost to date ... ..	4,744
3. Third class chowki at Mitho Khoso, 9th mile of Dád. ... ..	2,593
And the total cost to date ... ..	3,952

The estimate for the third chowki has been exceeded and a revised estimate is under preparation.

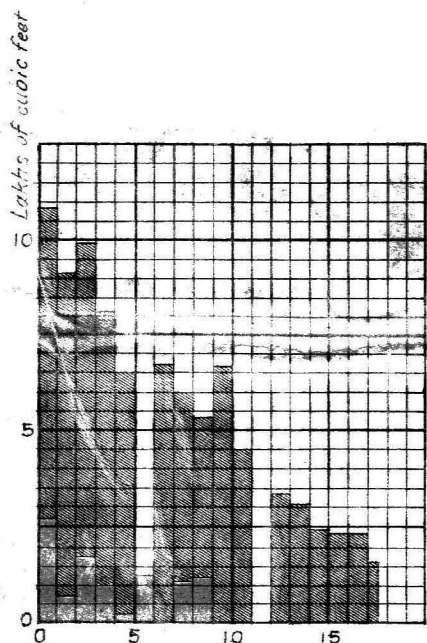
371. The Dád Canal has been widened between miles 20 and 26 and the spoil removed on the left bank from mile 20—30. Earthwork. Rs. 38,120 were spent during the year. The total expenditure from commencement is Rs. 77,464, against an estimate of Rs. 5,91,391. A bend in the 1st mile above the Head Regulator was cut off. The work will be complete before next inundation.

372. This work, as described in the last year's report, was practically completed at a cost of Rs. 18,309, against an estimate of Rs. 22,714, the outlay during the year being Rs. 3,626. Its length is 7 miles, bottom width at head 5 feet and depth 7 feet, and at tail 4 feet and 5½ feet, respectively.

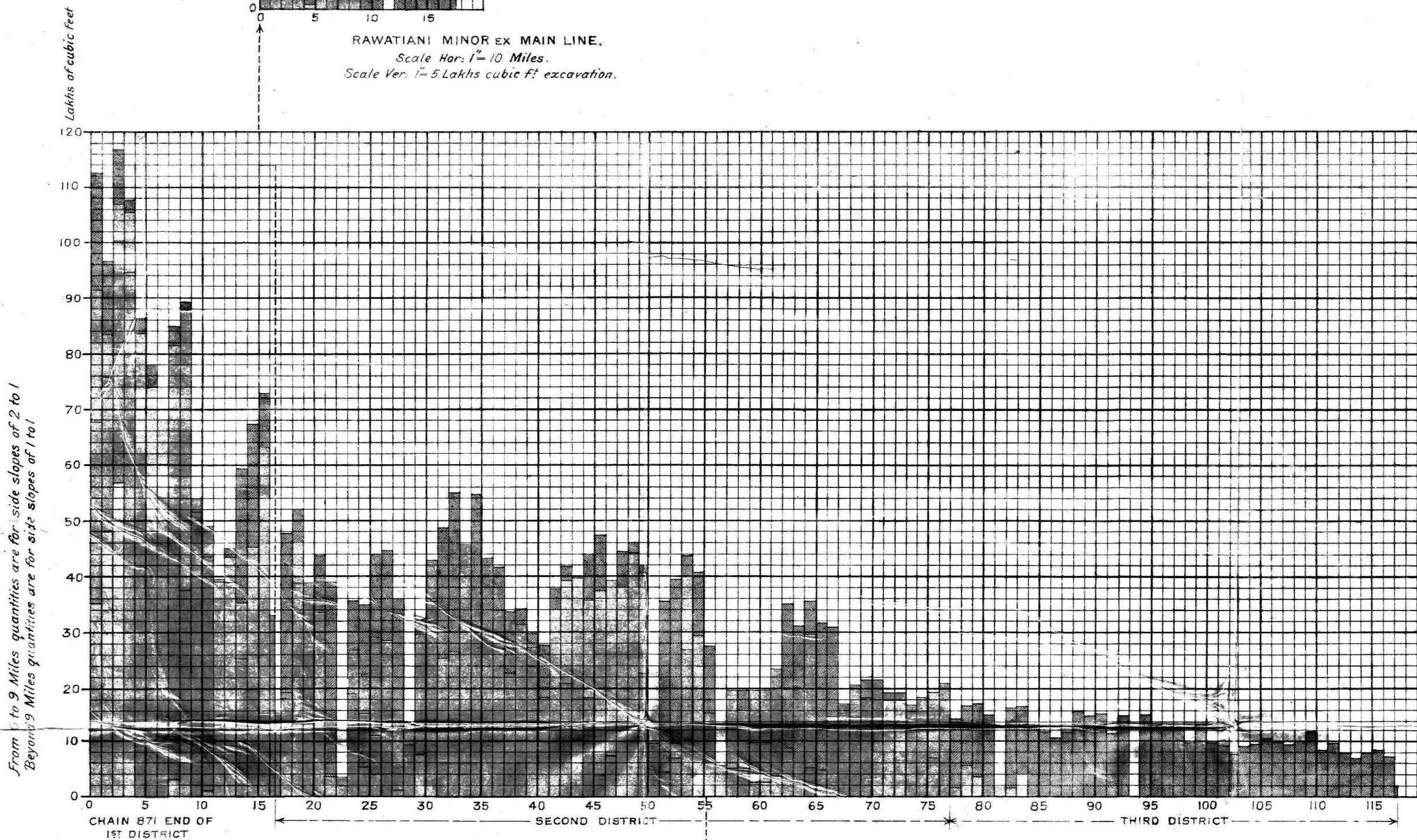
New Branch of Dád at 30th mile.

# JAMRAO CANAL. DIAGRAM SHOWING TOTAL QUANTITIES OF EARTH-WORK AND AMOUNT EXCAVATED UP TO 31<sup>ST</sup> MARCH 1898.

YELLOW PORTION REPRESENTS WORK DONE TO 31-3-96  
RED DO. DO. DO. TO 31-3-97  
BLUE DO. DO. DO. TO 31-3-98

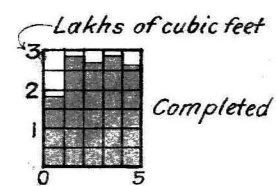


RAWATIANI MINOR EX MAIN LINE.  
Scale Hor: 1" = 10 Miles.  
Scale Ver: 1" = 5 Lakhs cubic ft excavation.

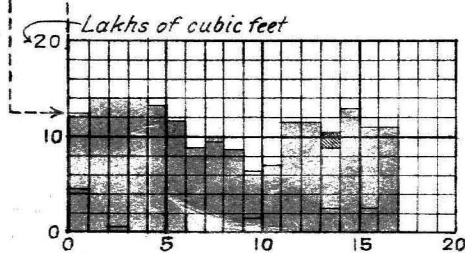


(Signed) A. HILL, C. E.  
Executive Engineer,  
1<sup>st</sup> District Jamrao Canal.

MAIN LINE  
Scale Hor: 1" = 10 Miles  
Scale Ver: 1" = 20 Lakhs cubic ft excavation



KAPRI MINOR EX WEST BRANCH  
Scale Hor: 1" = 10 Miles  
Scale Ver: 1" = 5 Lakhs cubic ft excavation



WEST BRANCH EX MAIN LINE  
Scale Hor: 1" = 10 Miles  
Scale Ver: 1" = 20 Lakhs cubic ft excavation

**NOTE**

Canals taking off on the Left Bank are shown  
above the Supplying Canal.  
Canals taking off on the Right Bank are shown  
below the Supplying Canal.

(Signed) F. B. MACLARAN, M. Inst. C. E.  
Superintending Engineer,  
Indus Left Bank Division.

(Signed) H. C. JOHN, C. E.  
Executive Engineer,  
2<sup>nd</sup> District Jamrao Canal.



Masonry sluices for the Karia Heads, a Head Regulator and mile pillars have still to be provided.

373. This branch takes off from the Dád at mile 28. The work, estimated to cost Rs. 1,24,838, was commenced last year, and the earthwork has been practically completed. Expenditure during the year was Rs. 62,831, and the total outlay to date Rs. 96,487. The length of the canal is 31 miles, bottom width 12 feet and depth 9 feet at head, and 4 feet and 5 feet respectively at tail.

374. The surveys, as described in last year's report, were practically completed at a cost of Rs. 196 and Rs. 149, against estimates of Rs. 333 and Rs. 200 respectively.

375. The usual maintenance work, such as clearance and repairs to banks of the Mehrabwah, the only canal under this head in this district, were carried out and call for no special remarks.

The expenditure against the repair grant was as follows :—

			Rs.	Rs.
Repairs ...	...	...	...	4,843
Establishment...	{	Abkaláni ...	507	
		Revenue ...	186	
		Works ...	419	
			1,112	
Total ...				5,955

376. A new mouth was given to Fatimawah for the purpose of cutting off the bend in the first 1,400 feet. The work was nearly completed, the expenditure during the year being Rs. 813, against an estimate of Rs. 1,235.

The work of constructing a regulator at the head of Bhorti Canal, sanctioned in Government Resolution No. 456, dated 11th March 1898, was commenced, but no expenditure was incurred during the year. The regulator consists of two openings, 8 feet each, and 13 feet from pavement to springing, the regulating apparatus being of teak needles, supported by rolled iron beams.

The work of enlarging the upper head of Naulákhí Canal, as described in the report for the past year, was completed during the year at a total cost of Rs. 22,132, against an estimate of Rs. 21,893.

377. This work, for the purpose of diverting the spill in the neighbourhood of the canal into a large natural depression and thence back to the Indus, was sanctioned during the year and was commenced in March, and will be completed before the next inundation. The bank will be raised 3 feet above the high flood level of 1897, with top width of 6 feet, and side slopes 3 and 2 to 1.

The remaining work, consisting of ordinary clearance and repairs to banks, calls for no special remarks. The total expenditure against the repair grant was as follows :—

			Rs.	Rs.
Repairs	...	...	...	54,698
Establishment...	{	Abkaláni ...	5,068	
		Revenue ...	1,780	
		Works ...	4,727	
			11,575	
Total ...				66,273

378. Previous to the inundation of 1894, there was no embankment to check spill from the Indus between the Naulákhí and Bhorti Canals. Owing, however, to the river having set against its right bank in that neighbourhood, and

to the unusually high inundation of that year, it was found necessary to construct the embankment between the Naulákhí and Dambro Canals.

379. Owing to the river having carried away by erosion, during the inundation of 1896, the high ground between the mouths of Dambro and Bhorti Canals, it became necessary to extend the Naulákhí-Dambro embankment as far as the Bhorti Canal, the estimate for which, amounting to Rs. 9,604, was sanctioned in Government Resolution No. 63-W. I.—776, dated 28th May 1897. The inundation of 1897 was the highest on record and the embankment, which was not considered an important one, was quite inadequate and a large breach occurred. The flood water from this breach, combined with that from the spill through the Bhorti forest and from breaches in the Naulákhí Canal, submerged about 20,000 acres of cultivation. Accordingly an estimate, amounting to Rs. 32,129, embodying that for Rs. 9,604 for raising and strengthening the whole line of embankment and sluices, was submitted and sanctioned in Government Resolution No. 40-W. I.—456, dated 11th March 1898.

The bund throughout is being raised 3 feet above the high flood level, the top width is being increased from 6 to 8 feet, and the slopes from 2 and 3 to 1 to 2 and 4 to 1.

The work will be completed before the next inundation.

The following four sluices were commenced during the year, and materials to the value of Rs. 2,302 were collected—

1. Sluice over Karia Jaro.
2. Do. do. Wado.
3. Do. do. Kamboo.
4. Do. do. Alibahar.

The first three consist of one span 5 feet with 10½ feet height from pavement to springing of arch, and the fourth has one opening 7 feet span and 12 feet from pavement to springing. The works will be completed before the next inundation.

The expenditure on the whole line of bunds, including the materials for sluices during the year, was Rs. 13,435.

380. Ordinary repairs to Indus Survey marks and Naulákhí Bhorti Bund were carried out and the usual establishment maintained.

391. A sum of Rs. 201 was spent on surveying the River Indus Bank in this district so as to keep the Riverain Survey up to date. The expenditure against repairs, including cost of surveys, was as under:—

				Rs.	Rs.
Repairs	...	...	...	...	1,295
Establishment.	{	Abkaláni	...	1,470	
		Revenue	...	63	
		Works	...	...	1,533
				<hr/>	<hr/>
Total				...	2,828

382. The garden at Bhour was maintained and a new one started at Sehra to replace the one at Mithiani eroded by the river. The expenditure on the former was Rs. 450 and on the latter Rs. 389. Rs. 171 were realised from sale of vegetables, fruits, &c., in the garden at Bhour, as compared with Rs. 177 in the previous year. No receipts were realised from the garden at Sehra as it had been only recently established.

Rs. 2,579 were realised by sale of fishery rights and lotus fruits and Rs. 134 by sale of timber, bábul pods, &c.

383. On the new works in connection with the Dád Canal, three Sub-Overseers, Land Measurers, Maistries and a few Darogas and Mukadams were engaged according to requirements. The total expenditure was Rs. 3,624, giving a percentage of 2.05 on the expenditure on "Works."

Summary of Expenditure. 384. The following is a summary of the irrigation expenditure incurred in this district:—

		Rs.	Rs.
<b>New Works—</b>			
Capital Expenditure	...	1,80,227	
Revenue Expenditure	...	813	
Ordinary Agricultural Works	...	13,435	
		<hr/>	1,94,475
<b>Repairs—</b>			
Clearance	...	33,820	
Other works...	...	27,079	
Maintenance of gardens	...	839	
		<hr/>	61,738
<b>Establishment.</b>			
	{ Works	5,146	
	{ Abkaláni	7,045	
	{ Revenue	2,029	
		<hr/>	14,220
			<hr/>
			75,958
			<hr/>
<i>Add</i> —Regular Establishment charges	...	...	2,70,434
„ Tools and Plant	...	...	62,006
			<hr/>
			2,617
			<hr/>
			3,35,057

The average expenditure of three previous years on Establishment, charged to the maintenance grant, was Rs. 12,465.

#### CENTRAL HYDERABAD CANALS DISTRICT.

385. This district comprises what remained of the Hyderabad Canals District after the new Northern Hyderabad Canals District was formed in October 1897, as shown on the index map, and to it has been added the Civil Buildings and Works, formerly in charge of the Executive Engineer, Fuleli Canals.

The irrigation works referred to in the following paragraphs were carried out during the year under report.

386. The estimate, amounting to Rs. 11,256 for the work, has been sanctioned under Government Resolution No. 30-W. I.—374, dated 25th February 1898.

An allotment of Rs. 2,000 was granted during 1897-98, which has been utilised on collecting materials and excavating foundations. The regulator consists of one span of 15 feet and three of 8 feet.

387. The usual maintenance works, such as clearance, repairs to banks, &c., were carried out, and call for no special remarks.

The expenditure against the repair grant was as follows:—

		Rs.	Rs.
Works	...	...	33,958
Establishment.	{ Abkaláni	2,398	
	{ Revenue	1,109	
	{ Works	3,238	
		<hr/>	6,745
			<hr/>
			Total ... 40,703

388. Ordinary clearance, repairs to banks, &c., were carried out during the year to works under this head. The total expenditure against the repair grant was as follows:—

Works for which only Revenue Accounts are kept.—  
Maintenance and Repairs.

				Rs.	Rs.
Works ...	...	...	...	...	45,711
Establishment...	{	Abkaláni	...	...	3,097
		Revenue	...	...	1,487
		Works	...	...	4,307
					<u>8,891</u>
				Refunds of Revenue ...	54,602
				Total ...	<u>54,662</u>

389. The improvement of the Gháro Máhmudo is under consideration, and a project for improvements to the canal has already been submitted, and the report called for in connection therewith will be made after the ensuing inundation season.

390. The work has been commenced and an expenditure of Rs. 152 incurred during the year against the estimated amount of Rs. 439.

391. Ordinary repairs to the "Bund to check spill in Hála Sub-division" were carried out during the year, besides minor expenditure consisting of "Repairs to Indus Survey marks in Hála Sub-division", "Fixing Telegraph post in the Indus Survey mark near the tail of Nurwah", and "Repairs to Indus Survey marks on the Hyderabad-Hála Road."

392. The work of "Raising the banks of Chorewáh *ex* Gháro Máhmudo" was done on behalf of Mir Alahdadkhan, Jágirdár, at a cost of Rs. 9.

393. The following is a summary of the irrigation expenditure incurred in this district:—

				Rs.	Rs.
New Works—					
Capital expenditure	...	...	...	2,000	
Revenue expenditure	...	...	...	...	
Ordinary agricultural	...	...	...	161	
					<u>2,161</u>
Repairs—					
Clearance	...	...	...	55,426	
Other Works	...	...	...	25,184	
Maintenance of Gardens	...	...	...	...	
					<u>80,610</u>
				Rs.	
Establishment...	{	Works	...	...	7,545
		Abkaláni	...	...	5,682
		Revenue	...	...	2,596
					<u>15,823</u>
					<u>96,433</u>
					98,594
				Add—Regular Establishment charges	24,666
				„ Tools and Plant charges	1,177
				Total under all Heads.	<u>1,24,437</u>

394. The average expenditure of three previous years on Establishment charged to maintenance grant was Rs. 14,362.

#### FULELI CANALS DISTRICT.

395. This work, which has been fully described in previous reports, was completed during the year.

				Rs.
Estimate	...	...	...	20,005
Expenditure to end of 1895-96	...	...	...	14,999
Do. do. 1896-97	...	...	...	4,850
Do. do. 1897-98	...	...	...	86
			Total	<u>19,935</u>

Constructing a new Bridge over the  
New Mouth of the Fuleli

396. This bridge, described in last year's report, was completed during the year:—

			Rs.
Estimate ...	...	...	20,348
Expenditure during 1896-97	...	...	15,814
Do. do. 1897-98	...	...	7,725
Total			23,539

397. The object of this work was fully described in last year's report. Good progress was made with the earthwork during the year, and the work is expected to be completed before the end of the next official year, 1898-99.

Constructing an Escape to  
the Fuleli.

398. A regulator at the mouth of the escape, consisting of 6 spans, one of 15 feet for boat traffic and five of 10 feet each, was under construction during the year; materials were collected and foundations laid. It is expected that the regulator will be completed in time for the inundation of 1898.

			Rs.
Estimate ...	...	...	1,95,518
Expenditure in 1896-97	...	...	39,768
Do. 1897-98	...	...	99,682
Total			1,39,450

399. As the old mouth of the Sanhi Guni had been cut off by the new escape under construction, a new mouth taking off from the Main Canal, at about 1,100 feet above the new escape, has been cut for this distributary, the bottom width being 25 feet with side slopes 1 to 1. A masonry sluice consisting of two openings, one of 15 feet for boat traffic and the other of 10 feet, has also been provided. The work was far advanced during the year and will be ready before the inundation.

Providing a new Mouth and construct-  
ing a Head Sluice over the Sanhi Guni  
of Fuleli Canal.

			Rs.
Estimate ...	...	...	9,632
Expenditure	...	...	5,000

400. This work, which consisted of surveying and levelling for the new cut for the Sanhi Guni and taking cross sections in connection with the same where necessary, and also of preserving the line of survey by demarcating it, was completed.

Survey for the improvement of the  
Sanhi Guni, Taluka Badin.

			Rs.
Estimate ...	...	...	139
Cost	...	...	84

401. This bridge, which consists of one span of 20 feet with brick masonry abutments and returned walls, rolled iron girders and teakwood flooring, as described in the last report, was completed during the year.

Constructing a Roadway Bridge over the  
Kamal Wah, new, in the Hyderabad Taluka.

			Rs.
Estimate ...	...	...	1,625
Expenditure to end of 1896-97	...	...	509
Do. do. 1897-98	...	...	1,095
Total			1,595

402. The improvements, which consisted principally in pitching the bund, with the object of making it safe against breaching during high floods, were completed during the year.

Improvements to the Gidu Bund  
Bund, Fuleli Canal.

Estimate...	...	...	Rs.
			17,917
Expenditure to end of 1896-97	...	...	9,978
Do. do. 1897-98	...	...	4,959
			<hr/>
Total	...	...	14,937

403. To protect the Gidu Bunder Bund at the Mir's Tando from the erosive action of the river, stone spurs 50 feet apart have been made from the eroded edge of the pitching to the lowest water level in 8 feet average width and 4 feet height, giving them firm footings by depositing stones in the holes. A loop bund with 6 feet top width, and side slopes of 3 to 1 and 2 to 1 in front and rear respectively, is also being constructed as a second line of defence in the event of the main bund being breached.

Maintenance and Repairs.—Making a Loop Bund and protecting a portion of the Gidu Bunder Bund at the Mir's Tando, Fuleli Canal.

Estimate ...	...	...	Rs.
			8,072
Expenditure	...	...	2,040

The works is in progress.

404. The existing Jamshora Bund is being strengthened by raising it to a level of 3 feet above the highest flood level of the year 1894, with a top width of 8 feet throughout and slope 4 to 1 and 2 to 1 in front and rear respectively.

Strengthening the Jamshora Bund and preventing a further erosion by the river.

405. To prevent the active erosion that is going on from chainage 10,200 to 11,200, *i.e.* in a length of 1,000 feet, stone stacks 50 feet apart, 8 feet wide, and 4 feet high, from the bund to the edge of the river bank are being built.

406. A small bund, with 5 feet top width, and slopes 2 to 1 on both sides is being constructed 150 feet behind the existing bund between chainage 8,000 and 12,000, so that if during the inundation, erosion at any point in this length becomes dangerous, the portion of the new bund opposite can easily be strengthened for the necessary length; the old and the new bunds are being connected at the ends. The work is in progress and will be completed before the inundation.

Estimate ...	...	...	Rs.
			5,883
Expenditure	...	...	3,000

Canal Clearance. 407. The clearance work was of the usual description.

Plantations. 408. Two small gardens were maintained during the year at a cost of Rs. 448, the receipts being Rs. 155.

409. The total expenditure on the Fuleli during the year was as follows:—

New Works, Capital"	...	...	Rs.	Rs.
Do. Revenue	...	...	1,12,577	
			6,054	
			<hr/>	1,18,631
Repairs—				
Works	...	...	1,06,733	
Gardens	...	...	448	
			<hr/>	1,07,181
Establishment...	{	Abkalani	...	6,239
	{	Works	...	8,736
	{	Revenue	...	5,021
			<hr/>	19,996
			<hr/>	1,27,177
Total	...	...		2,45,808

410. To remedy the scarcity of the water-supply in the Gaja Wah, the Hasanali Wah has been extended and tailed into it. The channel cut is 5 feet bed width with side slopes of 1 to 1. A strong wooden bridge is to be made for Extension of the Hasanali Wah into the Gaja Wah.

the Local Funds road from Bulri to Matli. Owing to the scarcity of labour and the excavation being in sand and sandy earth, the work could not be completed before the inundation.

Estimate ...	...	...	...	Rs.	9,879
Expenditure	...	...	...	Rs.	1,001

411. The principal expenditure, under this sub-head was on the ordinary maintenance of the Hájipur Bund, special repairs thereto by raising and strengthening it, and on the clearance of the small canals taking off direct from the river. The detail of expenditure was as follows:—

New Works	...	...	...	Rs.	1,001
Repairs	...	...	...	Rs.	14,613
Establishment...	{	Abkaláni...	...	Rs.	1,691
		Revenue ...	...	Rs.	618
		Works ...	...	Rs.	1,316
				Rs.	3,625
				Rs.	18,238
Total ...				Rs.	19,239

412. It is proposed to fix permanent bench marks at convenient places in the district, the position of which will be marked on the Topographical Maps, for which surveys are now being made in Sind. As the work was sanctioned late, all the stones could not be sent cheaply to different stations as water carriage was stopped. All the stones required were purchased and fixed in such places as were within easy reach.

Estimate ...	...	...	...	Rs.	365
Expenditure	...	...	...	Rs.	271

The work is in progress.

Summary of Expenditure. 413. The following is a general summary of irrigation expenditure incurred in this district:—

New Works—				Rs.	Rs.
Capital expenditure	...	...	...	Rs.	1,12,577
Revenue expenditure	...	...	...	Rs.	7,055
Ordinary agricultural	...	...	...	Rs.	271
				Rs.	1,19,903
Repairs—					
Clearance	...	...	...	Rs.	87,371
Other Works	...	...	...	Rs.	39,015
Maintenance of Gardens	...	...	...	Rs.	448
				Rs.	1,26,834
Establishment...	{	Works	...	Rs.	10,052
		Abkaláni	...	Rs.	7,930
		Revenue	...	Rs.	5,639
				Rs.	23,621
				Rs.	1,50,455
				Rs.	2,70,358
Add—Regular Establishment charges	...	...	...	Rs.	42,411
„ Tools and Plant charges	...	...	...	Rs.	635
Total under all Heads ...				Rs.	3,13,404

414. The average expenditure of three previous years on Establishment charged to maintenance grant was Rs. 23,479.

## APPENDIX A.

Statement showing the entire Expenditure incurred during the financial year 1897-98 on Irrigation Works, Repairs and Establishment in the Province of Sind.

Service.	Works.	Repairs.	Total.
	Rs.	Rs.	Rs.
<b>PRODUCTIVE PUBLIC WORKS.</b>			
<b>MAJOR WORKS.</b>			
<i>41.—Capital Account.</i>			
Works ..	13,80,771	.....	* 13,80,771
Establishment ..	.....	.....	2,07,770
Tools and Plant ..	.....	.....	12,015
Total ..	.....	.....	16,00,556
<i>42.—Revenue Account.</i>			
Extensions and Improvements ..	13,795	.....	13,795
Maintenance and Repairs ..	.....	2,22,385	2,22,385
Establishment ..	.....	.....	61,413
Tools and Plant ..	.....	.....	1,120
Refunds of Revenue ..	.....	.....	118
Total ..	.....	.....	2,98,831
<b>43—IRRIGATION MINOR WORKS AND NAVIGATION WORKS FOR WHICH CAPITAL AND REVENUE ACCOUNTS ARE KEPT.</b>			
<i>Capital Account.</i>			
Works ..	1,14,232	.....	* 1,14,232
Establishment ..	.....	.....	25,628
Tools and Plant ..	.....	.....	360
Total ..	.....	.....	1,40,220
<i>Revenue Account</i>			
Extensions and Improvements...	—53,756	.....	—53,756
Maintenance and Repairs ..	.....	2,11,703	2,11,703
Establishment ..	.....	.....	44,716
Tools and Plant ..	.....	.....	1,355
Refunds of Revenue ..	.....	.....	96
Total ..	.....	.....	2,04,114
<b>WORKS FOR WHICH ONLY REVENUE ACCOUNTS ARE KEPT.</b>			
<i>Revenue.</i>			
Extensions and Improvements...	1,93,265	.....	1,93,265
Maintenance and Repairs ..	.....	4,44,097	4,44,097
Establishment ..	.....	.....	1,89,728
Tools and Plant ..	.....	.....	2,870
Refunds of Revenue ..	.....	.....	342
Total ..	.....	.....	8,30,302
<b>WORKS FOR WHICH NEITHER CAPITAL NOR REVENUE ACCOUNTS ARE KEPT.</b>			
Works and Surveys ..	80,906	.....	80,906
Maintenance and Repairs ..	.....	3,81,704	3,81,704
Establishment ..	.....	.....	1,02,417
Tools and Plant ..	.....	.....	1,793
Refunds ..	.....	.....	.....
Total ..	.....	.....	5,66,820
<b>DEPOSITS.</b>			
<i>Contributions, Ordinary.</i>			
Works...	4,831	.....	4,831
Repairs ..	.....	1,258	1,258
Establishment ..	.....	.....	15
Tools and Plant ..	.....	.....	.....
Total ..	.....	.....	6,104
Total under all Heads ..	.....	.....	† 36,46,947

\* *Notes.*—Expenditure exclusive of Establishment and Tools and Plant .. .. . Rs. 29,95,717  
 Cost of Establishment and Tools and Plant .. .. . " 6,51,200  
 Percentage of Establishment and Tools and Plant on Outlay .. .. . " 21.74

\* Net after deducting Rs. 123 and Rs. 273 on account of Receipts on Capital Account.

† Exclusive of Suspense, Rs. 3,422.







Names of Canals.	CLEARANCE PROPER IN CANALS.		Jungel cutting	Re- moving Tudas.	IMPROVING CANAL HEADS.		SIDE SLOPING AND REPAIRING CURVES.		Build- ings and Gar- dens.	Reco- nstruc- tion, Bridges and Stuices.	REPAIRS TO CANAL BANKS.		Remov- ing bank and inven- tion patas
	Cubic feet.	Cost.			Cubic feet.	Cost.	Cubic feet.	Cost.			Cubic feet.	Cost.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Rs.	Rs.	Rs.		Rs.		Rs.	Rs.	Rs.		Rs.	Rs.
Central Hyderabad Canals	Ghro Mahmuda ... ..	4,206,660	19,497	124	1,055	...	...	...	...	...	709,872	2,225	...
	Kan Simah... ..	1,473,968	7,480	...	535	...	...	...	...	...	53,013	238	...
	Nasir ... ..	2,448,812	7,185	73	233	293,624	1,468	...	...	...	216,256	1,163	...
	Other Canal ... ..	.....	...	22	1	...	...	...	...	...	266,000	1,471	...
	Abbar Kachori ... ..	2,36,352	1,386	59	455	...	...	...	...	...	3,007	13	...
	Great Marak ... ..	3,943,717	15,012	564	1,016	...	...	...	...	...	810,302	5,673	...
	Sa'raz ... ..	1,112,155	4,866	155	219	...	...	...	...	...	3,000	17	227
Bund to check spill in Hala Sub-division ... ..	.....	...	...	...	...	...	...	...	...	...	...	...	...
Repairs to Indus Survey marks ... ..	.....	...	...	...	...	...	...	...	...	...	...	...	...
Fuleh Canals	Fuleh Canal ... ..	22,619,348	76,243	1,600	1,725	...	...	...	691	4,115	1,981,561	7,766	2,505
	Other Canals and Bunds ...	3,322,353	11,128	372	396	...	...	...	152	450	164,080	530	...
Legari Canals ... ..	21,729,666	94,697	3,194	3,078	...	...	...	...	7,914	22,640	2,983,586	12,099	935
Shahpur Canals ... ..	5,190,256	22,392	395	2,937	916,044	4,051	...	...	4,169	1,493	3,111,335	12,592	610
Western Nara ... ..	7,714,354	28,595	2,129	1,920	...	...	16,200	53	7,112	5,258	3,883,630	16,720	1,112
Ghar Canals ... ..	20,470,044	103,103	...	1,441	1,323,385	5,910	...	...	3,717	1,813	1,811,670	7,013	...
Karachi Canals ... ..	2,468,693	34,871	684	1,123	33,000	148	...	...	3,410	9,237	5,575,230	22,326	63
Eastern Nara ... ..	1,178,877	4,867	3,365	1,665	125,036	637	...	...	2,722	8,774	1,294,822	4,905	...
Northern Hyderabad Canals ...	7,008,254	33,820	236	3,476	3,439,564	11,529	...	...	1,160	344	985,917	4,654	23
Central Hyderabad Canals ...	12,471,664	55,426	997	3,514	293,624	1,468	...	...	...	...	2,161,230	10,825	227
Fuleh Canals ... ..	25,941,706	87,371	1,972	1,521	...	...	...	...	843	4,565	2,145,641	8,296	2,505
Total ...	1,11,173,514	465,142	12,972	90,674	6,140,653	23,743	16,200	53	31,047	64,124	23,953,321	99,430	5,505

B—concluded.

REPAIRS TO RIVER EMBANKMENTS.		SPECIAL WORKS IN CONNECTION WITH RIVER EMBANKMENTS.		Protecting slopes of Embankments and Canals.	Miscellaneous	Arrears.	Contingencies.	Extraordinary Abkalaní Expenditure, closing breaches, &c.	Total Works.	ESTABLISHMENT.				Total Works and Establishment.	Remarks.
Cubic feet.	Cost.	Cubic feet.	Cost.							Abkalaní.	Revenue	Works.	Total.		
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Rs.		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	
...	...	...	...	...	1,103	...	...	747	24,751	1,495	788	2,180	4,413	29,164	
...	...	...	...	...	281	...	...	...	8,537	764	411	1,151	2,326	10,863	
...	...	...	...	...	763	...	6	12	10,303	662	302	852	1,816	12,719	
...	...	...	...	...	66	...	...	...	1,530	176	36	124	336	1,916	
...	...	...	...	...	283	...	...	250	2,451	450	304	877	1,631	4,083	
...	...	...	...	...	382	...	...	3,530	26,177	1,280	505	1,407	3,192	29,369	
...	...	...	...	...	402	...	...	94	5,980	668	300	954	1,922	7,903	
...	...	...	211	...	...	...	...	...	211	187	...	...	187	393	
...	...	...	...	...	20	...	...	...	20	...	...	...	...	20	
...	...	...	...	927	3,457	...	692	8,060	1,07,181	6,239	5,021	8,736	19,996	1,27,177	
...	...	...	5,040	16	15	...	229	1,325	19,653	1,691	618	1,316	3,625	23,273	
496,048	2,517	12,757,550	107,062	1,316	6,399	4,932	7,288	13,926	2,87,997	25,411	7,002	6,085	38,498	3,26,493	
1,737,383	10,962	294,797	10,207	3,185	3,863	...	863	1,298	79,041	15,450	2,089	6,323	23,862	1,02,903	
3,911,990	18,456	619,794	4,930	768	5,463	...	94	850	93,460	17,323	5,772	9,197	32,292	1,25,752	
531,795	2,223	...	...	...	7,331	...	859	...	1,33,410	12,193	2,969	8,883	24,045	1,57,455	
3,042,932	14,393	3,990,516	27,537	83	3,739	-8,050	...	...	1,09,509	25,170	3,415	10,162	38,747	1,48,313	
...	...	1,781,090	8,573	...	4,103	...	...	2,435	42,046	12,350	7,622	6,893	26,865	68,911	
...	...	...	...	...	3,789	...	51	2,656	61,738	7,045	2,029	5,146	14,220	75,958	
...	...	...	211	...	3,303	...	6	4,633	80,610	5,682	2,596	7,545	15,823	96,433	
...	...	...	5,040	943	3,472	...	921	9,385	1,26,834	7,930	5,639	10,052	23,621	1,50,455	
9,720,148	48,551	19,443,777	1,63,560	6,295	41,462	-3,118	10,082	35,183	10,14,705	1,28,554	39,133	70,286	2,37,973	12,52,678	Difference chiefly due to omission of certain works in Fuleh Canals District and adjustments in supplementary accounts for March 1893
As per booked Accounts ...									10,21,561	1,28,643	39,222	70,463	2,38,328	12,59,389*	

\* Exclusive of Refunds of Revenue and outlay on Deposits Contribution.

APPENDIX C.

Statement showing the Expenditure incurred on Work Establishment employed in the Deccan Districts during the year 1897-98, and the percentage it bears to the Outlay on Works and Repairs proper.

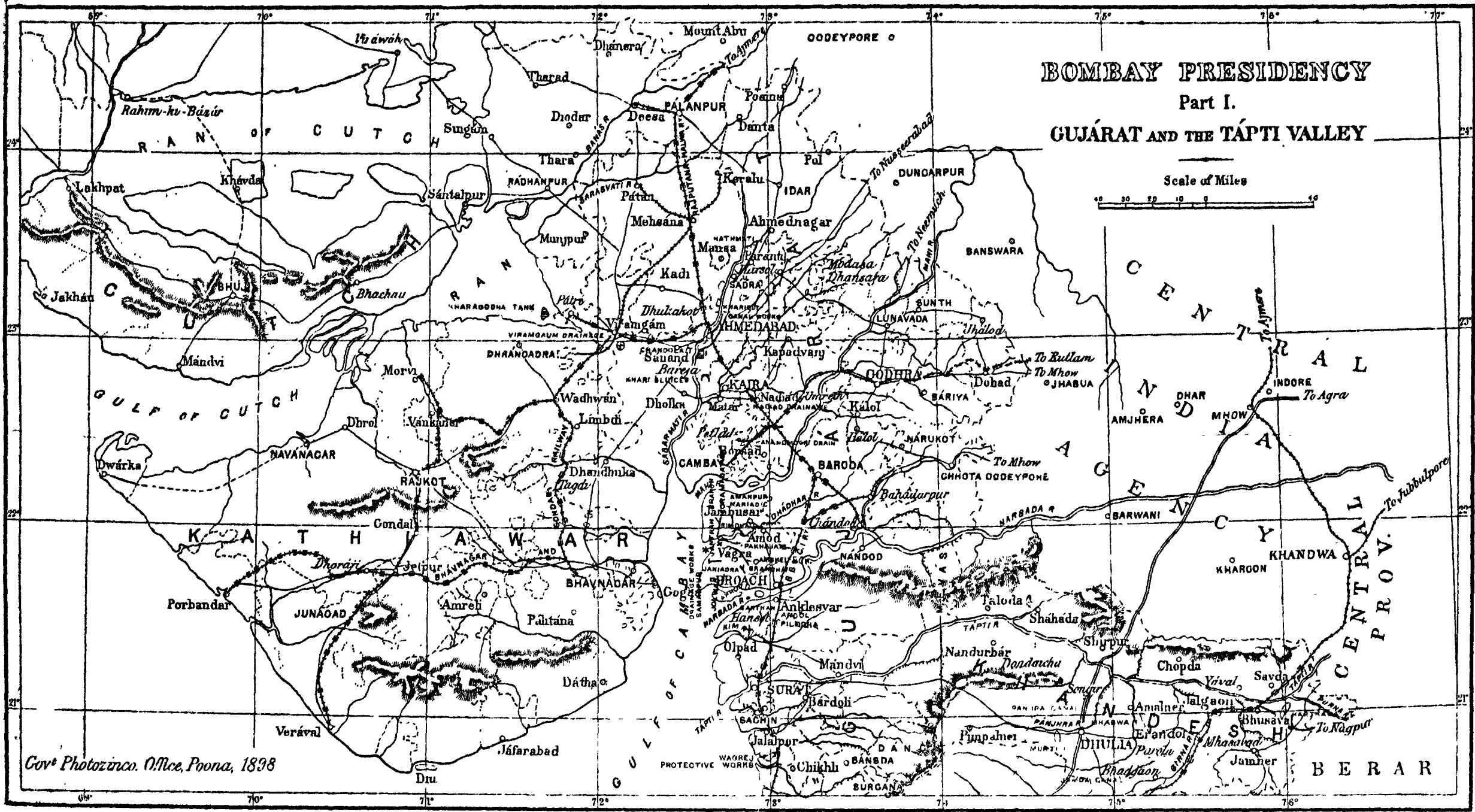
No.	Name of Sub-division or District.	OUTLAY ON						Total Contract and Departmental Columns 5 and 8.	COST OF WORK ESTABLISHMENT SANCTIONED BY			Percentage (column 12 bears to column 9).	REMARKS.
		By Contract.			By Departmental Agency.				Chief or Superintending Engineer.	Executive Engineer.	Total.		
		Original Works, including additions and alterations and improvements, and extensions.	Repairs.	Total.	Original Works, including additions and alterations and improvements, and extensions.	Repairs.	Total.						
1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	
1	Mutha Canals ...	...	...	...	2,314	15,689	18,003	18,003	2,328	3,066	5,394	29.96	} Increased percentage due to less Capital outlay.
2	Poona Water-supply...	...	...	...	...	7,119	7,119	7,119	828	4,888	5,716	80.29	
3	Nira Canal ...	...	...	...	1,751	15,489	17,240	17,240	2,322	5,276	7,598	44.07	
4	*Other Poona Irrigation Works...	...	...	...	2,89,126	2,674	2,91,800	2,91,800	2,938	6,671	9,609	3.29	The result seems to be satisfactory as compared with the last year.
5	†Sholapur Irrigation Works ...	...	...	...	6,24,916	30,001	6,54,917	6,54,917	2,138	24,973	27,111	4.14	
6	Ahmednagar Irrigation Works ...	...	...	...	50,513	2,466	52,979	52,979	959	5,991	6,950	13.11	Increased percentage due to the amounts of repair estimates being less than usual, and the canal establishment maintained being the same.
7	Násik Irrigation Works ...	23,292	...	23,292	1,86,799	2,25,535	4,12,334	4,35,676	5,094	28,551	33,645	7.72	
8	Khándesh Irrigation Works ...	...	...	...	71,110	20,112	91,222	91,222	1,573	5,149	6,722	7.37	
9	Dhárwár Irrigation Works ...	...	...	...	2,714	20,732	23,446	23,446	1,439	1,024	2,463	10.50	Scattered works require large establishment, hence the high percentage. It is also partly due to restricted allotments and consequent small expenditure during the year.
	Total ...	23,292	...	23,292	12,23,243	3,39,867	15,69,110	15,92,402	19,619	85,589	1,05,208	6.61	

\* Includes Shetphal Tank.

† Includes Pathri and Mangi Tanks.

## Statement showing the Results of Run-off from Catchment Areas of Tanks in the Deccan for the year 1897.

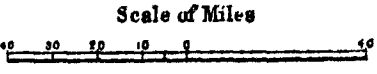
District.	Name of Tank.	Year.	Area of Catchment, Square Miles	Rainfall in Inches.	Supply due to rainfall, millions of Cubic Feet.	Actual run-off, millions of Cubic Feet.	Proportion of run-off to Rainfall, Column 7 divided by Column 6.	REMARKS.
1	2	3	4	5	6	7	8.	9
Khandesh	Mukti Tank ...	1897 ...	34.20	9.40	746.86	227.08	.304	The tank was at its lowest water level on the 8th July 1897 and filled up to overflowing on 29th August 1897. Rainfall is taken between these dates. It is an average of two gauges, Dalina and Sargaon.
	Mhasva Tank ...	Do. ...	13.4	8.43	262.43	143.13	.545	The tank was at its lowest water level on 6th July 1897 and filled to overflowing on 12th August 1897. Rainfall is taken between these dates.
	Hartala Tank ...	Do. ...	6.8	10.89	172.04	15.71	.091	The tank was at its lowest water level on 23rd August 1897 and stood unfilled at its highest water level on 25th September 1897. Rainfall is taken between these dates. The tank did not reach its F. S. capacity this year.
Nasik	Parsul Tank ...	Do. ...	17.73	22.17	914.23	126.22	.138	The tank was at its lowest water level on 5th July 1897 and filled to overflowing on 22nd September 1897. Rainfall is taken between these dates.
Ahmednagar	Waghad Tank ...	Do. ...	29	38.97	2,624.85	2,162.12	0.823	Rainfall from 19th July to 6th October 1897, both days inclusive.
	Bhatodi Tank ...	Do. ...	44	14.37	1,468.91	242.22	0.16	Rainfall from 10th June to 25th September 1897. The waste weir began to overflow on 25th September 1897, the run off to that date being 0.15.
Poona	Bhadalwadi Tank ...	Do. ...	23	14.89	795.62	273.24	.343	The tank was dry up to 2nd July and overflowed on 2nd October 1897. The run-off has been calculated between these dates.
	Shirsuphal Tank ...	Do. ...	23.5	10.45	570.52	244.52	.428	The tank did not overflow this year. Rainfall to 22nd October.
	Mhaswad Tank ...	Do. ...	480	*21.45	23,919.66	9,133.90	.382	Rainfall from 1st June to 31st October 1897. The waste weir began to overflow on the 28th September 1897. The run-off to that date is 0.140.
Sholapur	Ekrak Tank ...	Do. ...	159	27.59	10,191.41	2,932.23	.292	*Average of 5 stations in that catchment. Rainfall from 1st June to 31st October 1897. The waste weir began to overflow on 12th October 1897, and the run-off up to that date is .243.
	Ashti Tank ...	Do. ...	92	†11.09	8,782.34	3,790.40	.430	Rainfall from 1st June to 31st October 1897 and cut in waste weir began to overflow on 7th September 1897, the run-off up to that date being .085.
Bijapur	Koregaon Tank ...	Do. ...	4.40	24.85	254.01	89.99	.350	†Average of two stations in catchment. The tank did not fill to waste weir crest in the year.
	Muchkundi Tank ...	Do. ...	26	5.92	357.587	105.739	.296	From 28th May to 3rd July.
	Do. ...	Do. ...	26	10.23	617.925	122.163	.196	From 7th September to 3rd October.
	Do. ...	Do. ...	26	18.02	1,088.466	219.475	.202	From 28th May to 3rd October.
Dhárwár	Asundi ...	Do. ...	23	3.65	195.033	55.318	.284	From first rainfall—8th April to 21st April.
	Do. ...	Do. ...	23	2.60	138.927	42.345	.305	From 26th May to 6th June, on which date the tank filled to overflowing.
	Do. ...	Do. ...	23	7.00	374.035	96.699	.258	From 8th April to 6th June.
	Do. ...	Do. ...	23	7.55	408.424	39.853	.099	From 8th August to 24th September, on which date the tank filled a second time.
	Dambal ...	Do. ...	43	3.12	311.691	73.176	.234	From 28th May to 6th June.
	Do. ...	Do. ...	43	1.48	147.848	16.428	.111	From 12th June to 16th June. The tank overflowed on the 17th June.
	Do. ...	Do. ...	43	8.14	813.166	145.324	.179	From first rainfall—8th April to 16th June.
	Medleri ...	Do. ...	11	4.61	117.809	41.764	.355	From first rainfall—22nd May to 5th June.
Do. ...	Do. ...	11	12.41	317.140	38.491	.121	From 1st September to 2nd October, on which date the tank filled.	
Satara	Do. ...	Do. ...	11	23.52	575.503	74.166	.129	From 22nd May to 2nd October.
	Maini ...	Do. ...	54	2.12	265.960	107.038	.402	From first rainfall—6th June to 13th June.
	Do. ...	Do. ...	54	1.07	134.234	55.399	.413	From 18th September to 20th September, on which date the tank filled to overflowing.
	Do. ...	Do. ...	54	8.27	1,037.493	191.582	.185	From 6th June to 20th September.
	Nehr ...	Do. ...	59.50	2.52	348.340	51.257	.155	From 10th June to 18th June.
Do. ...	Do. ...	59.50	4.45	615.125	247.894	.394	From 18th September to 28th September.	
Do. ...	Do. ...	59.50	18.23	2,519.940	352.721	.140	From 10th June to 28th September, on which date the tank nearly filled up to the level of the temporary cut in the waste weir channel.	



# BOMBAY PRESIDENCY

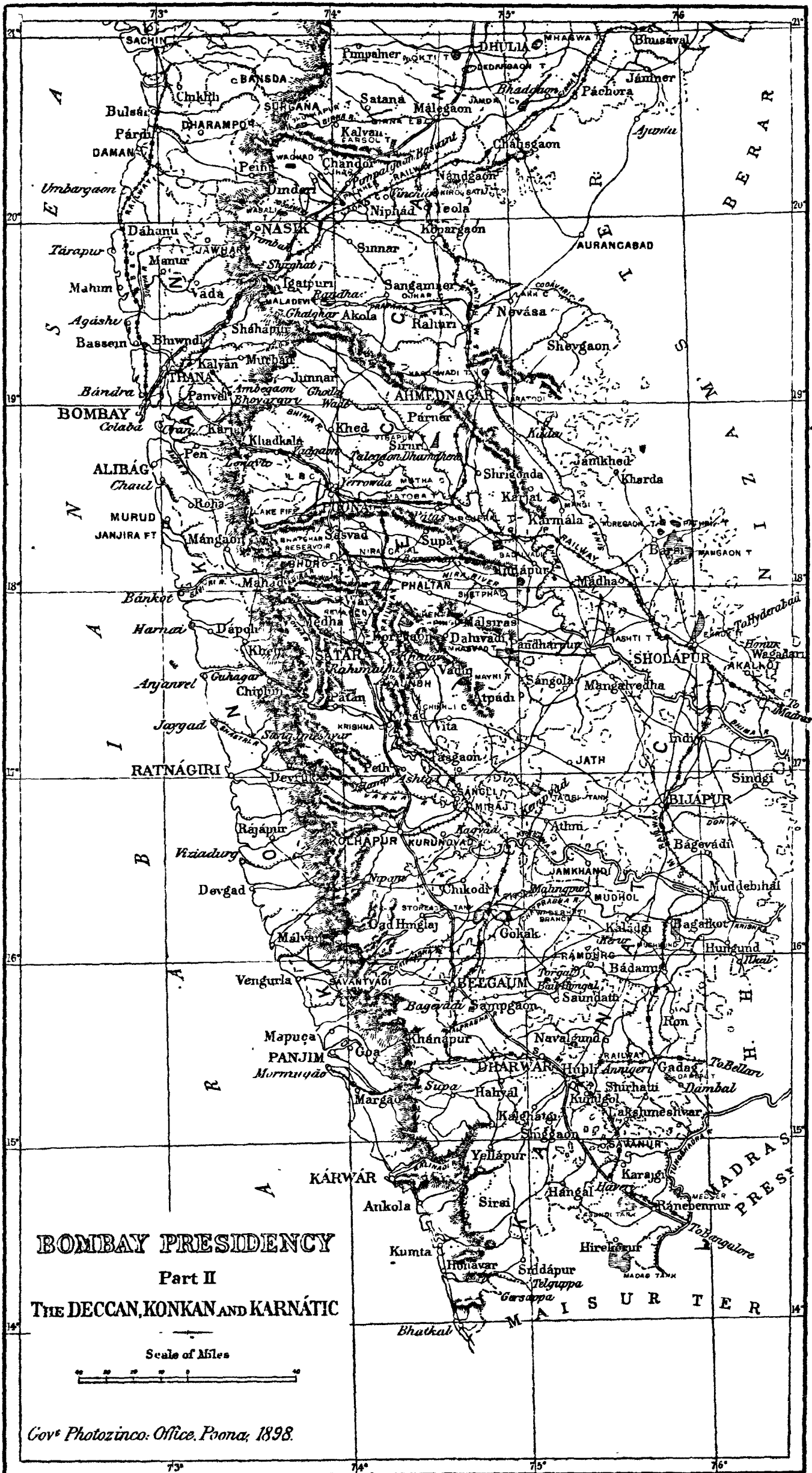
## Part I.

### GUJARAT AND THE TAPI VALLEY

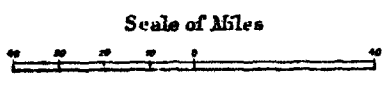


Govt Photodupl. Office, Poona, 1898

- |                 |                                  |                 |                                         |
|-----------------|----------------------------------|-----------------|-----------------------------------------|
| JAMBUSAR TALUKA | 1 AVANPUR NARAI CHANNEL          | JAMBUSAR TALUKA | 6 SINDHAD CHANNEL                       |
| * VAKRA DO      | 2 KURA MADAF 11 DO               | ○ VIRANGAUM DO  | ○ NURSINGPUR VIRANGAUM ORA NABE CHANNEL |
| † ANKLIJHAR DO  | 3 SAMANJH KANDIJA PHADDE CHANNEL | ○ VAGRA DO      | ○ JOLVA CHANNEL                         |
| X VAGRA         | 4 SARHAN ADLI PI OCHA DO         |                 | ○ ANHOD DO                              |
|                 | 5 LOKHAN ANHRI DO                |                 |                                         |

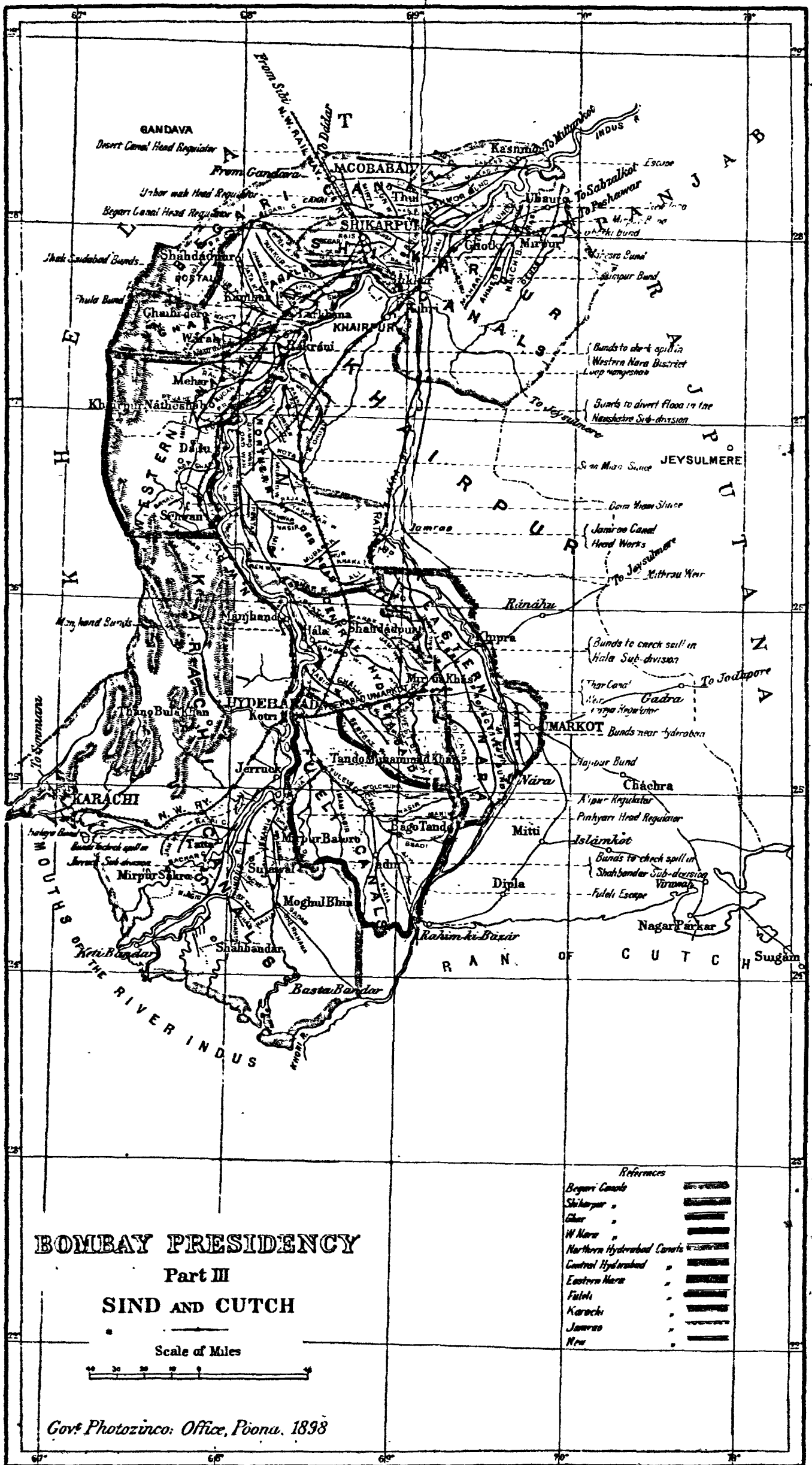


**BOMBAY PRESIDENCY**  
**Part II**  
**THE DECCAN, KONKAN AND KARNATIC**



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**BOMBAY PRESIDENCY**  
**Part III**  
**SIND AND CUTCH**

Scale of Miles



Govt Photodupl. Office, Poona, 1898

- References**
- Begari Canals
  - Shikarpur "
  - Ghar "
  - W. Mer "
  - Northern Hyderabad Canals
  - Central Hyderabad "
  - Eastern Mer "
  - Futli "
  - Karachi "
  - Jamrao "
  - New "