

5774
5775
5791.
Public Works (1898) Department.

Printed by
✓

G.O., No. 584
585

DATED 29 July 1898

[Despatch Abstract.]

Periyar Project. Directing that the Scheme submitted by the Chief Engineer for Irrigation for lowering the bed of the Periyar escape channel & the parapet of the main dam, be forwarded for the consideration & orders of the Govt of India.

Periyar Project : Forwarding for the consideration & orders of the Govt of India, Scheme for lowering the bed of the Periyar escape channel & the parapet of the main dam, with note thereon by the Chief Engineer for Irrigation.

Dr

Forwarding, for the consideration and orders of the Government of India, estimates for lowering the bed of the Periyár escape channel and the parapet of the main dam, with note thereon by the Chief Engineer for Irrigation.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Irrigation.

READ—the following papers:—

From the Chief Engineer, Public Works Department, Bombay, to the Chief Engineer for Irrigation, Madras, dated Bombay Castle, 20th January 1898, No. C.E. 5.

I have the honour to acknowledge receipt of your letter, dated the 27th August 1897, and, in compliance with the request therein made, to forward copies of letters from local officers furnishing the requisite information in connection with the Lake Fife, Bhatghar Reservoir and Tansa Lake, together with a tracing* showing the catchment and gauge stations of the two former lakes. I also enclose a copy of Notes on Floods in some of the rivers in the Nasik district supplied by the Executive Engineer of that district, which may afford useful data. The remaining two works, viz., Maladevi and Newri tanks, mentioned in the margin of paragraph 2 of your letter under reply, have not yet been constructed.

*To be returned please.

ENCLOSURES.

From the Executive Engineer, Bombay, to the Municipal Commissioner, Bombay, dated 15th October 1897, No. 9686 of 1897-98.

I have the honour to report that hourly observations of the rainfall are not made at Tansa, but only twelve-hourly and daily rainfalls are registered.

2. I beg to submit a statement showing the heaviest rainfall at Tansa during the last four years.

3. The Tansa catchment area measures nearly 52 square miles and is surrounded by ranges of high hills both on the north and south gradually sloping towards the east.

4. The masonry dam built across the valley to a length of over 9,000 feet, almost faces the direction of the storm.

5. The hills are thickly covered with teak, dhavra and other trees which form the Tansa forest.

6. Rice and nachni are cultivated over a limited portion of the high ground, but grass grows over a large tract of the land.

Date and month.	Time of taking observations.	12 hour's rainfall.	24 hour's rainfall.	Remarks.
12th July 1894	6 P.M.	1.95	5.81	24.54 inches in three continuous days.
	6 A.M.	3.86		
19th July 1894	6 A.M.	1.07	7.32	
	6 P.M.	6.25		
20th July 1894	6 P.M.	5.63	9.56	
	6 A.M.	3.93		20.65 inches rainfall in three days.
21st July 1894	6 P.M.	3.73	7.66	
	6 A.M.	3.93		
20th June 1895	6 P.M.	4.14	5.34	
	6 A.M.	1.20		
17th July 1895	6 P.M.	2.90	4.15	
	6 A.M.	1.25		
7th August 1895	6 P.M.	3.79	4.34	
	6 A.M.	.55		
7th September 1895	6 P.M.	1.50	4.12	
	6 A.M.	2.62		
21st June 1896	6 P.M.	1.62	5.12	
	6 A.M.	3.50		
22nd June 1896	6 P.M.	2.80	4.20	
	6 A.M.	1.40		
24th July 1896	6 P.M.	3.40	8.11	
	6 A.M.	4.71		
25th July 1896	6 P.M.	3.54	5.38	
	6 A.M.	1.84		
28th July 1896	6 P.M.	.40	6.60	
	6 A.M.	6.20		
29th July 1896	6 P.M.	4.45	8.30	
	6 A.M.	3.85		
30th July 1896	6 P.M.	.75	5.75	
	6 A.M.	5		
10th August 1896	6 P.M.	2.70	5.15	
	6 A.M.	2.45		
15th July 1897	6 P.M.	3.30	5.10	
	6 A.M.	1.80		
7th August 1897	6 P.M.	5.15	7.95	
	6 A.M.	2.80		
8th August 1897	6 P.M.	2.25	4.25	
	6 A.M.	2		

No. 18034.

Copy forwarded with compliments to the Secretary to Government, Public Works Department, with reference to his No. 726 I. of 16th September last.

(Signed) J. H. DuBOULAY,
Dy. Munl. Commr. for the City of Bombay.

16th October 1897.

From the Executive Engineer for Irrigation, Poona District, to the Superintending Engineer, C. Division, dated Poona, 12th October 1897, No. 5323.

With reference to G.M. 725 I., dated 16th ultimo, forwarded under your No. 6905, dated 21st idem, I have the honour to report as follows:—

Lake Fife.

- (1) Catchment area, 196 square miles.
- (2) Estimated rainfall—information not available.
- (3) Estimated discharging capacity of the W. weir, 62,000 cubic feet per second.
- (4) Average rainfall at Kharakwasla for the last 20 years, 31.21 inches.
- (5) Maximum observed rainfall in 24 hours, 4.34 inches.
- (6) Maximum observed flood, 106,083 cubic feet per second.
- (7) Maximum run off in any 24 hours—information not available.

With regard to (4) I would, however, point out that the figures given are those taken from the gauge at Kharakwasla, which is at the dam end of the lake. Figures of rainfall during the two years 1878 and 1879 at eight places in the catchment area are available. These two years were, at Kharakwasla, years of slightly over the average fall. The figures are as below:—

	Average.	Maximum.
Athkarwadi	49.69	2.72
Singhur Hill	57.47	2.94
Ambegaon	84.67	4.50
Musa	108.53	6.85
Yejra	217.29	8.60
Dupsura	145.10	8.15
Mutha	58.14	3.68
Bamboa	37.39	3.45

8) 758.28

94.78

It is this rainfall that is instrumental in filling the lake and not that gauged at Kharakwasla. The maximum gauged at Kharakwasla itself occurred during a storm in November while the greatest floods have occurred in July.

A run off of 7 per hour from the whole catchment gives a flood of 126,585 cubic feet per second. So that the maximum observed flood is equal to a run off of 0.84 inch per hour, while the estimated run off is practically $\frac{1}{2}$ inch per hour. The intensity of this flood, which is great, is due to the nearness of the lake to the Western Ghats, the catchment running out to the water-shed.

The basin of the lake is entirely surrounded by high hills partly covered with jungle and includes only a small area of cultivated ground. The sides of the hill are steep. The basin runs nearly due east and west, the dam being at the eastern end. The lake is fed almost entirely from the south-west monsoon rains.

Information regarding Bhatghar reservoir has been asked for from Mr. Morres, Assistant Engineer, and will be forwarded on receipt.

From the Executive Engineer for Irrigation, Poona District, to the Superintending Engineer, Central Division, Poona, dated Wadgaon, 6th December 1897, No. 6246.

In continuation of this office No. 5323, dated 12th October 1897, I have the honour to forward the following information regarding Bhatghar tank :—

- (1) Catchment area—128 square miles.
- (2) Estimated rainfall—145 inches, being the mean between 40 inches at Bhatghar and 250 inches on the Ghats.
- (3) The average and maximum rainfalls of the various reporting stations is as below :—

	Average.	Maximum, 24 hours.
Bhatghar bungalow (15 years)	43.44	4.25
Do. village (17 ")	44.62	3.65
Pasora (1 year)	56.40	No record.
Rajghar (1 ")	46.48	5.75
Mala (1 ")	105.36	7.20
Bopa (1 ")	203.93	7.80
Torna (1 ")	134.84	5.65

A tracing showing observing stations is attached.

(4) Maximum observed flood occurred on 30th July 1896. All lower sluices, 15 in number each 8' x 4', were open. The water level reached 64.50 feet in the lake. The flood was at the rate of 25,500 cubic feet per second. This is at the rate of 3,096 inches per hour.

(5) There is no record of the maximum quantity run off in 24 hours.

(6) The basin of the lake is entirely surrounded by high hills partly covered with jungle and includes only a small area of cultivated ground. The sides of the hill are steep. The basin runs nearly east and west, the dam being at the eastern end. The lake is fed almost entirely from the south-west monsoon rain.

Notes of Flood in Bombay Presidency.

Two floods.—The following are records of large floods in Khandesh, Bombay Presidency. The upper Panjra river has at the site of the Datarti weir a catchment of 265 sq. miles. Its average width is 8 miles on the north, south and west; it is bounded by trap hills with steep uncultivated slopes, the valley between being flat and cultivated. The rainfall gauged was—

Date.		Rain-gauge stations.				
		Amti.	Dahiwad.	Pimpalner.	Sakri.	Lakhala.
7th	September 1882	..	2.03	0.12	0.29	1.35
8th	"	9.71	0.29	0.00	0.00	..
9th	"	..	1.31	1.92	1.54	2.30
10th	"	..	4.03	4.02	2.67	..
11th	"	..	4.31	4.11	3.33	..
12th	"	5.31	..	..	..	2.30
13th	"	..	..	..	..	..
		15.02	11.97	10.17	7.83	5.95

At the stations where two or more days' falls are bracketed, daily observations were not made.

The flood as calculated from the high flood marks amounted to 49,700 cubic feet per second or to a run off of 0.299 inch per hour. During the same time the neighbouring Burai river at Ranniala with a catchment of 65 square miles, which is practically uncultivated and is elevated with hills on the north, south and west had a flood similarly calculated, of 37,800 cubic feet per second equal to a run off of 0.90 inch per hour. There were no rain-gauge stations in this area. At the Jamda weir Girna river on September 15th, 1872, the flood rose to 16.45 feet on the weir crest and was calculated to amount to 373,000 cubic feet per second. The catchment area is about 2,050 square miles, extending from the Ghats, where it is 30 miles wide, hilly and uncultivated, to the weir site where it is flat and cultivated.

This gives a run off of 0.28 inch per hour. At the same place on 11th September 1882 there was another severe flood rising to 15.90 feet on the weir crest, but, as it outplanked the work and broke into a tributary valley damaging the canal, and could not be gauged at the weir site, it was probably as large as the previous one. The rainfall gauged on this latter occasion on September 9th, 10th and 11th was—

Station.	Ghats.		Upper basin.		Lower basin.			
	Hatga.	Alibad.	Chankapur.	Kalvan.	Nandgaon.	Malegaon.	Saigaon.	Jamda.
Miles above weir	..	..	..	..	..	..	..	..
Inches of rainfall	97	82	81	71	34	16	38	2
	22.80	56.59	12.21	14.42	8.15	5.83	9.35	3.35

At Mahilla near Dhulia the Panjra river on the 15th September 1872 had a flood discharge of 276,000 cubic feet per second, equal to a run off of 0.54 inch per hour on a catchment of 788 square miles. The river rises in the Western Ghats; at its source the catchment has its maximum width of 21 miles, is elevated and bounded by steep uncultivated hills. Uncultivated trap hills bound the whole valley but lower down it is itself flat and cultivated. The rainfall gauged was—

	Distance from gauge station.	September.					Total.
		11	12	13	14	15	
Penipalner	45 miles	2.13	0.20	..	9.90	0.60	12.83
Dhulia	1 mile	..	0.34	..	5.69	0.36	6.39

The flood commenced to rise at 8 P.M. on the 14th, obtained its maximum at 6-30 A.M. on the 15th and returned to its original dimension on the morning of the 16th.

(Signed) W. L. STRANGE,
Ex. Engr., Nasik District.

During these periods the whole of the undersluices each 8' x 4' were open. The discharge on 30th when the level stood at 61.6 would be—

$$D = AV$$

$$D = 15 \times 8 \times 4 \times 0.65$$

$$= 312 \sqrt{64.4 \times 57.6} = 312 \sqrt{3,709.4}$$

$$= 312 \times 60.9 = 19,000 \text{ cubic feet per second.}$$

Add the average increase in tank during the period, the total becomes 19,000 + 8,130 = 27,130 cubic feet per second representing a run-off of 0.33 inches per hour from the catchment of 128 square miles. The discharge on 1st when the level stood at 64.5 would be—

$$D = 312 \sqrt{64.4 \times (64.5 - 4)} = 312 \sqrt{64.4 \times 60.5}$$

$$= 312 \sqrt{3,896.2} = 312 \times 62.4 = 19,469 \text{ cubic feet per second.}$$

Add the average increase in tank during the period, the total becomes 19,469 + 5,690 = 25,159 cubic feet per second or a run-off of 0.30 inch per hour from the catchment of 128 square miles.

No. 193 I.

Note by the Chief Engineer for Irrigation.

The estimates called for in the Government of India letter No. 325 I., dated 28th December 1897, for removing part of the parapet of the Periyár main dam and for lowering the level of the escape are herewith submitted. Since the note printed with G.O., No. 992 I., dated 10th November 1897, was written, the Chief Engineer, Public Works Department, Bombay, has kindly supplied some valuable information regarding discharges from certain catchment areas. The observed flood discharges of three rivers in Khandeish give coefficients in Dickens' formula of 1,228 to 1,852 and in Ryves' formula 2,310 to 3,230. In the case which gives the highest coefficient (the Panjra river) the run-off was at the rate of .54 inch per hour from 788 square miles although the maximum width of the catchment is only 21 miles. The Bhatghir reservoir has a long narrow catchment of 128 square miles. The heaviest observed flood gave a discharge of 27,130 inclusive of 8,130 cubic feet per second added to contents of lake. Lake Fife is perhaps the case most in point. Its drainage area is 196 square miles and average rainfall about the same (95 inches) as the supposed rainfall of the Periyár catchment. The proportions between the width and length of the basins and between the lake area and catchment area are also nearly the same. The highest observed flood occurred on 28th to 30th July 1896. The observations which were made hour by hour while the flood was rising from 28th July 9 P.M. to 29th July 9½ P.M. admit of calculations being made which are of much greater value than the rough estimates of a river discharge. The total run-off in the 24½ hours was 11.86 inches, of which 1.24 were added to the contents of the lake. The maximum rate of run-off was 75,207 cubic feet per second discharge and 32,222 added to lake or a total of 107,429 cubic feet per second. This gives a coefficient in Dickens' formula of 2,050 which is nearly the same as calculated for the Periyár; a maximum rate of run-off .85 inch per hour and a rate not much lower than this for the last 4½ hours of the observations.

All the information recently obtained certainly seems to confirm the inference stated in paragraph 8 of my previous note that a flood of the magnitude recorded in the blue book is not only possible, but probable, and that in taking it as a maximum for purposes of calculation a margin should be allowed for error. The Periyár lake is about 50 miles from the west and 80 miles from the East Coast, and if, as is probable, rainfall is not so intense, in country of the same physical characteristics, remote from the coast as near it, it may be safe to take the reputed discharge of the 1869 flood as something near a maximum.

In calculating the discharging capacity of the Periyár escape the formula for discharge over a broad crested weir has been used for obtaining the discharge for given depths at the lower end where the water falls into a deep chasm. The discharges so obtained are used with Kutter's formula to get the surface fall through the escape channel assuming its bed to be level. The fall arrived at in this

practically the same for all depths, and amounts to .7 feet. The results are given in margin. The lowering of the channel any given depth would lower the flood level given in my previous calculations by somewhat less than that depth. It would be useless to go into minute calculations on such uncertain data. The Inspector-General proposed to cut down the escape one or two feet and fit falling shutters. The estimate prepared provides for cutting down the channel 3 feet, but as shutters

of this height could not be worked without great loss of water since they could not be raised until water had fallen 1½ or 2 feet below full lake level, it is proposed to build a weir across the channel. The effect of this will be to raise the water level about a foot when there is 12 to 15 feet in rear of the dam. With 14 feet at lower end of escape the level in lake would be 12¾ feet above crest of weir or 1¼ feet below top of parapets. It could not rise above this in a flood like that of 1869 and as the discharge increases rapidly with increase of depth the margin of 1¼ feet before water begins to pass over the dam parapets seems sufficient. This method of dealing with the matter is much more effective than removing the parapets of the dam, and I recommend that it be adopted expensive though it be. There is no need to cut down the channel bed in front of the weir to 141. It will be sufficient to lower it to 142.0 or 2 feet below the weir crest. The weir is designed to be as near the lake as practicable without getting on the sloping part of the rock.

OOTACAMUND,
28th June 1898.

(Signed) W. HUGHES,
Chief Engineer for Irrigation.

Enclosures to above Note.

- ✓ 1 Detailed and abstract estimate, Rs. 45,900.
- ✓ 1 Specification.
- ✓ 1 Detailed and abstract estimate, Rs. 5,700.
- ✓ 1 Sheet of cross sections right bank escape, dated 31st March 1898.
- ✓ 2 Sheets of cross sections right bank escape, dated 25th May 1898.
- ✓ 1 Survey of right bank escape, dated 25th May 1898.
- ✓ 1 Diagram of calculation of flood discharges of Lake Fife, Bombay.

ORDER—No. 584 I., dated 29th July 1898.

1. Lowering the bed of the Periyár escape channel and constructing a weir 150 feet on lake side of present weir—

	RS.
I. Works	45,900
II. Establishment	10,557
III. Tools and plant	43
Total estimate	56,500

2. Lowering the parapet of the Periyár main dam and providing rails—

	RS.
I. Works	5,700
II. Establishment	1,311
III. Tools and plant	89
Total estimate	7,100

[Here enter No. 585 I., dated 29th July 1898.]

(True Extract.)

(Signed) J. C. LARMINIE,
Ag. Joint Secy. to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
Superintending Engineer, VI Circle.
Examiner, Public Works Accounts.

Ordered that a copy of these Proceedings, together with the estimates for the works marginally noted, be forwarded for the consideration and orders of the Government of India with reference to its letter, No. 325 I., dated 28th December 1897.

ENDORSEMENT—No. 585 I., dated 29th July 1898.

Forwarded.

(By order.)

(Signed) J. C. LARMINIE,
Ag. Joint Secy. to Government,
Irrigation Branch.

PUBLIC WORKS DEPARTMENT,
IRRIGATION BRANCH.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

Letter from Chief Engr. P. W. D. Bombay 10/25/98
with enclosures - 27/28/98
UNDER date the 27/28/98

Note by the Chief Engr. for Irrigation 10/23/98 & 28/6/98
READ the following

Print Issue 11/2/98
57/98
17/2/98

The recommendation of the Chief Engr. for Irrigation in the concluding paragraph of the foregoing note is approved. No. 584 I. & 29/7/98
Ordered that a copy of these Procs. together with the estimates for the works marginally noted be forwarded for the consideration & order of the Govt of India with reference to its letter, No. 325 I. & 18 Dec/97.

Lowering the bed of the Periyar escape channel & constructing a weir 150ft on lakeside of present weir - Rs
I. Works . . . 45,900
II. Establishment. 10,557
III. Tools & Plant. 43
Total Estimate 56,500

Lowering the parapet of the Periyar main Dam & providing rails -
I. Works . . . 5700
II. Establishment. 1311
III. Tools & Plant. 89
Total Estimate 7,100

Endorsement No. 585 I. & 29/7/98
Forwarded.

23/6/98
28/6/98

Engr. for I. & 29/7/98
Engr. II
S.W. 2
12/1/98
diagrams & calculations
of flood discharges
Lake Pigo Bombay

urgent
Public Works (1898) Department.

CURRENT No. 5774

5774
5775
5776

From the Chief-Engr for
Irriga

Order

No. 1932

Dated 28-6-98

Received

Registered } 11-7-98

Enclosures 8 14 (5 plans)

Spare copies

SUBJECT.

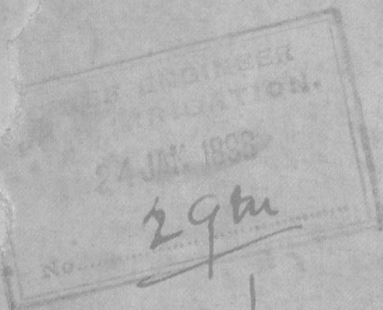
Renewing the parapet
of the Perijar main dam
and for lowering the level
of escape — Note subm
the estimates for — Call
for by the Govt of India

96 square miles and average

gave a discharge of 27,130 inch³ of 8170 Cub ft
per second added to lake. Lake
Life is per case most in point. It
drainage area is 196 square miles and average

BACK

No.



No 19. ¹⁴²

Note by the Chief Engineer for Irrigation

+Kag H

⊙Kag E

The estimates called for in the Government of India letter No 325 I, dated 28th December 1897. This was removing part of the parapet of the Periyar cutting and for lowering the level of the escape ancient submitted. Since the note printed with it was dated 10th November 1897, was written, to remove Engineers, P. W. D., Bombay, has kindly given some valuable information regarding the certain catchment areas. The observed of three rivers in Khandeish give coefficients according to Dicken's formula of 1228 to 1852 and the formula 2310 to 3230. In the case of the highest coefficient of the Parpo River the run off was at the rate of 0.54 inch per acre from 788 square miles although the maximum width of the catchment is only 21 miles. The Bhatghur Reservoir has a long narrow catchment of 128 square miles. The heaviest observed flood gave a discharge of 27,130 inch per second of lake. Lake life is per case most in point. Its drainage area is 196 square miles and average

rainfall about the same (95 inches) as the supposed rainfall of the Periyar catchment. The proportions between the width and length of the basins and between the lake area and catchment area are also nearly the same. The highest observed flood occurred on 28 to 30 July 1896. The observations which were made hour by hour while the flood was rising from 28th July 9 P.M. to 29th July 9 $\frac{1}{2}$ P.M. admit of calculations being made which are of much greater value than the rough estimates of a river discharge. The total run-off in the 24 $\frac{1}{2}$ hours was 11.86 inches of which 1.24 were added to the contents of the lake. The maximum rate of run-off was 5207 cubic feet per second discharge and 32222 added to lake or a total of 107429 Cub. feet per second. This gives a coefficient in Dicken's formula of 2050 which is nearly the same as calculated for the Periyar; a maximum rate of run-off .85 inch per hour and a rate not much lower than this for the last 4 $\frac{1}{2}$ hours of the observations.

All the information recently obtained certainly seems to confirm the inference stated in para 8 of my previous note that a flood of the magnitude recorded in the blue book is

low 142.0 or 2 ft 1 inch below the not only possible, but probable, and that in taking it as a maximum for purposes of calculation a margin should be allowed for error. The Periyar Lake is about 50 miles from the west and 80 miles from the East Coast, and if, as is probable, rainfall is not so intense, in country of the same physical characteristics, remote from the coast as near it, it may be safe to take the reputed discharge of the 1869 flood as something near a maximum.

In calculating the discharging capacity of the Periyar escape the formula for discharge over a broad crested weir has been used for obtaining the discharge for given depths at the lower end where the water falls into a deep chasm. The discharges so obtained are used with Kutter's formula to get the surface fall through the escape channel assuming its bed to be level. The fall arrived at in this way is practically the same for all depths and amounts to .7 feet. The results are given in margin. The lowering of the channel any

given depth would lower the flood level given in my previous calculations by somewhat less than that depth. It would be useless to go into minute calculations on such uncertain data.

Depth at lower end of escape	Depth at lake end of escape	Discharge
4	4.75	9630
6	6.74	18300
8	8.71	28300
10	10.71	40230
12	12.71	53820
14	14.70	70330

The Inspector General proposed to cut down the escape one or two feet and fit falling shutters but this does not now appear to be sufficient. The estimate prepared provides for cutting down the channel 3 feet but as shutters of this height could not be worked without great loss of water since they could not be raised until water had fallen $1\frac{1}{2}$ or 2 feet below full lake level, it is proposed to build a weir across the channel. The effect of this will be to raise the water level about a foot when there is 12 feet in rear of the dam, ~~three quarters foot with 4 feet in rear and perhaps one half foot with 16 feet.~~ With 14 feet at lower end of escape the level in the lake would be $12\frac{1}{2}$ feet above crest of dam or $1\frac{1}{4}$ feet below top of parapets. It could not rise above this in a flood like that of 1869 and as the discharge increases rapidly with increase of depth the margin of $1\frac{1}{2}$ feet before water begins to pass over the dam parapets seems sufficient. This method of dealing with the matter is much more effective than removing the parapets of the dam and I recommend that it be adopted expensive though it be. There is no need to cut down the channel in front of the weir to 141. It will be

sufficient. lower it to 142.0 or 2 feet below the
weir crest. The weir is designed to be as near the
lake as practicable without getting on the sloping part
of the rock.

W. H.

Ootacamund }
28 June 1898 } Chief Engineer for Irrigation

The Joint Secretary to Government
P. W. D. Sugalein Branch

Enclosures to above Note

1 Specification

1 Sheet of cross sections Right
bank escape of 31-3-98

Survey of Right bank escape
81 25-5-98

Public Works (1898) Department.

CURRENT No. ⁵⁷⁹¹
~~248~~ ~~77~~

following

Feb 1898)

6. Order

From the Chief
Engineer P.W.D.
Bombay

No. 27. C.E.

Dated 26 "May '98

Received } 11-7-98
Registered } ~~15-6-98~~

Enclosures 1

Spare copies

SUBJECT.

Lake Dife and
Bhatgar reservoir.
forwarding copy
of a letter from the
Ch. Engr. P.W.D. for
furnishing the additional
information required
in connection with the

BACK PAPERS.

No.	Date.
949 M	4.10.2.98

FURTHER PAPERS.

No.	Date.
11964	13.6.98

No 2200 of 1898

Executive Engineer's Office

Poona 6th May 1898

From

The Executive Engineer for Irrigation,
Poona District

To

The Superintending Engineer,
Central Division, Poona

Sir

With reference to your No. 1127 of 28
ultimo forwarding Government Memo.
No. 118 of 22nd idem, I have the honour
to report as follows:-

Lake Fife

Date 29 July

Time	R.L. of water	area	content
8 P.M.	249.67	164816876	9083669
9 P.M.	250.22	165498359	
9-30 P.M.	250.57	165932030	5800030

Waste weir clear } Length 513 ft. R.L. 243.0
overfall } Length 716 ft — 244.0

Discharge over Waste weir at 8 P.M.

Lower = $3.488 \times 513 \times 6.6 \sqrt{6.6} = 30351$ cft per second

Higher = $3.488 \times 716 \times 5.6 \sqrt{5.6} = 30593$

Total discharge at 8 P.M. = 60944

Period 8 to 9 P.M. (P.M.)

Discharge at 9 P.M.

Lower = $3.488 \times 513 \times 7.15 \sqrt{7.15} = 34159$

Higher = $3.488 \times 716 \times 6.15 \sqrt{6.15} = 38090$

Total discharge at 9 P.M. = 72249

Mean discharge during hour $\frac{60944 + 72249}{2} = 66596$

Replenishment in Tank = $\frac{90836690}{3600} \text{ cft} = 25232$

Flood in cft per second = 91828

Discharge over weir at 9 P.M. = $72249 \text{ cft. per second}$

Discharge at 9-30 P.M.

Lower = $3.488 \times 513 \times 7.5 \sqrt{7.5} = 36771$

Higher = $3.488 \times 716 \times 6.5 \sqrt{6.5} = 41394$

Total discharge at 9-30 P.M. = 78165

Mean of period $\frac{72249 + 78165}{2} = 75207 \text{ cft. per second}$

Replenishment in Tank

= $\frac{58000301}{1800} = 32222$

Total Flood $107429 \text{ cft. per second}$

I should however state that the actual time at which the highest flood occurred is not exactly known. The float of the automatic gauge was washed away soon after 9 o'clock and the exact level of the water at that time is difficult to ascertain as the line traced is very erratic but it is approximately what I have stated. In the original report on the flood the time at which the maximum height was reached is

stated to have been 9-30 P.M. and the maximum height itself was ascertained the following morning to have been 250.57'. The automatic gauge shows that the intensity of the flood was less during other hours of the day.

The gaugings of the lake and area are as follows:-

Temperature		Date	Time	R.L.	Area
43.07	4.07	July 28	9 P.M.	47.14	161682047
	4.50	"	10 P.M.	47.57	162214845
	5.0	"	11 P.M.	48.07	162834376
	5.53	"	12 —	48.60	163491097
	5.90	"	29 1 A.M.	48.97	163949533
	6.11	"	4 A.M.	49.18	164209736
	6.50	"	5 A.M.	49.57	164692971
	6.80	"	6 —	49.87	165064689
	7.00	"	7 —	50.07	165312500
	7.00	"	8-20	50.07	165312500
	6.80	"	9 —	49.87	165064689
		"	10 —	49.60	164730142
	6.53	"	10 A.M.	49.60	164730142
	6.18	"	11 A.M.	49.25	164296470
	5.85	"	12 noon	48.92	163887590
	5.00	"	1 P.M.	48.67	163577814
	5.48	"	2 "	48.55	163429106
	5.47	"	3 "	48.54	163416797
	5.55	"	4 "	48.62	163515861
	5.70	"	5 "	48.77	163701730
	5.92	"	6 "	48.99	163974314

Period 8.60 p.m. to 9.30 p.m.

Date	Time	R.L.	Area	
July 29	7 P.m.	49.29	164346032	6.22
"	8 P.m.	49.67	164816876	6.60
"	9 P.m.	50.17	165436406	7.10
"	9-30	50.57 (probable)	165932030	7.50
Gauge displaced				
"	30 12 noon	48.03	162784813	4.96
"	" 1 P.m.	47.76	162450266	4.69

Period from 9.30 p.m. to 9.30 p.m.

2 With regard to the flood in Bhat-ghar Lake it is not possible to go into the same detail owing to the less number of gaugings taken. The actual gaugings of the tank show the following -

Date	Time	R.L.	Contents millions cft.	Increase in contents during period millions cft.	Length of period	Increase in tank per second
July 28	6 P.m.	46.8	687.2	569.6	24 hours	6600
"	29 -Do-	54.5	1256.8	702.3	24 -Do-	8130
"	30 -Do-	61.6	1959.1	128.7	24 -Do-	1490
"	31 -Do-	62.8	2087.8	245.8	12 -Do-	5690
1 st August	6 A.M.	64.5	2333.6	"	"	"

During these periods the whole of the undersluices each 8'x4' were open.

The discharge on 30th when the level stood at 61.6 would be:-

$$D = AV \quad V = C\sqrt{2gh} \quad C = 0.65$$

$$D = 15 \times 8 \times 4 \times 0.65 \sqrt{64.4 \times (61.6 - 3.4)}$$

$$= 312 \sqrt{64.4 \times 57.6} = 312 \sqrt{3709.4}$$

$$= 312 \times 60.9 = 19000 \text{ cft per second.}$$

Add the average increase in tank during the period the total becomes $19000 + 8130 = 27130$ cft per second representing a run-off of 0.33 inches per hour from the catchment of 128 square miles. The discharge on 1st when the level stood at 64.5 would be:-

$$D = 312 \sqrt{64.4 \times (64.5 - 4)} = 312 \sqrt{64.4 \times 60.5}$$

$$= 312 \sqrt{3896.2} = 312 \times 62.4 = 19469 \text{ cft per second.}$$

Add the average increase in tank during the period the total becomes $19469 + 5690 = 25159$ cft per second or a run-off of 0.30 inch per hour from the catchment of 128 square miles.

I have &c

(Signed) F. L. Spivott

True copy.

J. D. Kolathkar
Assistant Secy to Govt.

Engr. Engr. for Irriga Poona District

C.E.

R 2484
26.5.98

W.P.

Total discharge of Lake - 28^{1/2} hrs
9 pm to 29^{1/2} hrs 9^{1/2} pm
= 4835, 684, 000 cft.

Increase in
Contents 501, 858, 140
5397, 342, 140

Area of catchment
196 x 27878400
= 5464, 166, 400

Run off in 24^{1/2} hours
= 5397, 342, 140
5464, 166, 400
= .988 ft
= 11.853 inches

Over 1
579/58

No 27 C.E. of 1898

Public Works Department
Mahabaleshwar 26 May 98

To

W. Hughes Esquire, B.A.
Chief Engineer for
Irrigation, Madras

Sir,

I have the honor to
acknowledge receipt
of your letter No 49 M.
dated 10th February 1898,
and in compliance with
the request therein made
to forward copy of a
letter from the Executive
Engineer for Irrigation
Poona District furnishing
the additional informa-
-tion required in con-
-nection with the

Lake Fife and Bhatghar
Reservoir.

I have the honor to be
Sir,

Your most obed^t. servant

Strouding.

M. Inst C.E.
Chief Engineer P.W.D.

Public Works (1898) Department.

5775
CURRENT No. ~~29~~ ²⁷

Order

Rm. 248 m
x 6.98
recd at 10/15

From the Chief Engineer
P. W. D.
Bombay
No. C. 5 of '98

Dated 20 Jan'y '98
Received 24-7-98
Enclosures 5 (blank)
Spare copies

SUBJECT.

Information in connection
with the Lake Sife Bhat.
gas reservoir & Jansad
Lake together with a
tracing — forwarded
Certain correspondence
furnishing — also a
Copy of H. K. S. on floor
in some of the papers in
Hassik box & stating the
the works of P. W. D.
Maladani and
Hewari tanks
have not yet been
completed.

To S.
P. W. D.
File no. 11/18
Put up Inspector, Jansad, note
P. W. D. no. 11/18
Letter of 12/11/97
LCC
28/1/98
Part of
12/1/98

BACK PAPERS.

FURTHER PAPERS.

Storm in November while the greatest
floods have occurred in July.

A run off of 1" per hour from the whole catchment gives a flood of 126,585 cft. per second so that the maximum observed flood is equal to a run off of 0.84 inches per hour, while the estimated run off is practically $\frac{1}{2}$ " per hour. The intensity of this flood, which is great, is due to the nearness of the lake to the Western Ghats the catchment running out to the water-shed.

The basin of the lake is entirely surrounded by high hills partly covered with jungle and includes only a small area of cultivated ground. The sides of the hill are steep. The basin runs nearly due East and West, the dam being at the Eastern end. The lake is fed almost entirely from the South West Monsoon rains.

Information regarding Bhatzghar
Reservoir.

Reservoir has been asked for from
Mr. Morris Assistant Engineer and
will be forwarded on receipt

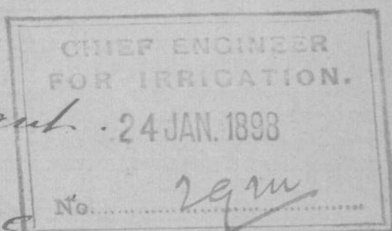
I have the honour to be

Sir

your most obedient Servant. 24 JAN. 1898

(Signed) F. S. Sprott C.E.

Executive Engr for Irriga
P.D.



No 6246 of 1897

Executive Engineer's Office

Camp wadgaon 6 December 1897
13

From

The Executive Engineer for
Irrigation, Poona District

To

The Superintending Engineer, Central
Division, Poona.

Sir

In continuation of this office No.
5323 dated 12th October 1897, I have the
honor to forward the following information
regarding Bhatghar Tank.

- (1) Catchment area — 128 Sqr miles
- (2) Estimated rainfall — 145 inches,
being the mean between 40 inches
at Bhatghar and 250 inches on the Ghats.
- (3) The average and maximum rainfalls
of the various reporting stations is
as below:—

		average	max 24 hrs
Bhatghar Bungalow — (15 years)	43.44	4.25	
Do — village — (17 years)	44.62	3.65	
Pasora — (1 year)	56.40	no record	
Rajghar — Do	46.48	5.75	
Mala — Do	105.36	7.20	
Bopa — Do	203.93	7.80	
Torna — Do	134.84	5.65	

Area of FTL 156 ms ft
Mukherjee 1087 ft

8 = 670 miles

026.3
5725/58

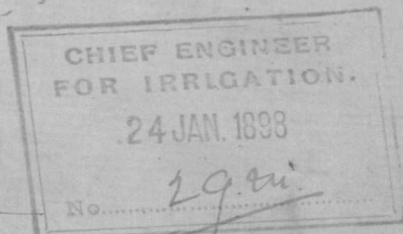
A tracing showing observing stations is attached

4 Maximum observed flood occurred on 30th July 1896. All lower sluices, 15 in number each 8x14 were open. The water level reached 64.50 ft in the lake. The flood was at the rate of 25,500 cft per second. This is at the rate of 3096 inches per hour.

(5) There is no record of the maximum quantity run off in 24 hours.

(6) The basin of the lake is entirely surrounded by high hills partly covered with jungle and includes only a small area of cultivated ground. The sides of the hill are steep. The basin runs nearly East & West, the dam being at the eastern end. The lake is fed almost entirely from the S.W. monsoon rain.

I have the honor to be
Sir
your most obedient servant
sd, F. L. Sprott
C.E.
Ex-Engn for Irrgn P.D.



0.65.4
5775/8

Notes of flood in Bombay Presidency

2 Floods

The following are records of large floods in Jharkhand, Bombay Presidency. The upper Panjra River, has at the site of the Datarti weir, a catchment of 265 sq miles. Its average width is 8 miles on the N.S and W it is bounded by trap hills with steep uncultivated slopes, the valley between being flat and cultivated. The rainfall gauged was:-

Date	Rain gauge Stations				Lakhala
	Amte	Dahusad	Karpalner	Sapri	
September 1882					
7		2.03	0.12	0.29	1.35
8	9.71	0.29	0.00	0.00	
9		1.31	1.92	1.54	2.30
10		4.03	4.02	2.67	
11	} 5.31	4.31	4.11	3.33	2.30
12					
13					
		15.02	11.97	10.17	7.83
					5.95

150.94
10

At the Stations where two or more days' observations are bracketed, daily observations were not made.

The flood as calculated from the high water marks, amounted to 49,700 cft per second or to a run off of 0.299 inch per hour. During the same time the neighbouring Burai River at Ramniāla

(5) with a catchment of 65 sq. miles, which is practically uncultivated and (6) is elevated, with hills on the N-S and W-S had a flood similarly calculated, of 37,800 cft per second equal to a run off of 0.90 inch per hour. There were no rain gauge stations in this area.

At the Jamda weir Gvina River on the September 15th 1872, the flood rose to 6.45 ft on the weir crest and was calculated to amount to 373,000 cft per second. The catchment area is about 2050 sq. miles, extending from the ghauts, where it is 30 miles wide, hilly and uncultivated, to the weir site where it is flat and cultivated.

This

$\approx 2756 \text{ cu ft}$
 $\approx 1780 \text{ cu ft}$

$\approx 1650 \text{ cu ft}$
 $\approx 2340 \text{ cu ft}$

$\approx 1228 \text{ cu ft}$
 $\approx 2310 \text{ cu ft}$

$\approx 1852 \text{ cu ft}$
 $\approx 2230 \text{ cu ft}$

This gives a run off of 0.28 inch per hour. At the same place on ^{11th} September 1882 there was another severe flood, rising to 15.90 ft on the weir crest, but as it is out flanked the work and broke into a tributary valley damaging the canal, and could not be gauged at the weir site, it was probably as large as the previous one. The rainfall gauged on this latter occasion on September 9th, 10th and 11th was:-

Station	Ghauts		Upper Basin		Lower Basin			
	Walgad	Alubad	Chantia	Kabura	Nandgaon	Mulegaon	Sargan	Jamda
miles above weir	97	82	81	71	34	16	38	2
Inches of rainfall	22.80	56.59	12.21	14.42	8.15	5.83	9.35	3.35

At Mahilla, near Dhulia the Panjra River on the 15th Sept 1872 had a flood discharge of 276,000 cft per second, equal to a run off of 0.54 inch per hour on a catchment of 788 sq. miles. The River rises in the Western Ghauts; at its source the catchment has its maximum

maximum width of 21 miles is elevated and bounded by steep uncultivated hills. Uncultivated trap hills bound the whole valley but lower down it is itself flat and cultivated. The rainfall gauged was:—

Distance from Gauge Station	September					Total
	11	12	13	14	15	
Pimpalner 45 miles	2.13	0.20	---	9.90	0.60	12.83
Dhulia 1 mile	---	0.34	---	5.69	0.36	6.39

CHIEF ENGINEER
FOR IRRIGATION.
24 JAN. 1898
No. 29^m
13

The flood commenced to rise at 8 P.M. on the 14th, obtained its maximum at 6-30 A.M. on the 15th and returned to its original dimension on the morning of the 16th.

Sd/ W. L. Strange
Executive Engineer
Nasik District

045.5
5775/88

No D/128 of 1897

Camp Randgaon 22nd December 1897

To

The Secretary to Government
Public Works Department
Bombay

Memorandum

With reference to Government Memo: No 725^I dated 16th September last, forwarding copy of a letter from the Chief Engineer for Irrigation Kotacamand, has the honour to forward copies of Nos 5323 dated 12th October last and 6246 dated 6th Instant from the Executive Engineer for Irrigation Poona, giving the information asked for, for Lake Fife and Whatgha Tank, respectively, also copy of notes on Floods in some of the Rivers in the Nasik District supplied by the Executive Engineer which may be found of interest a tracing also accompanies - Showing the catchment and gauge stations of Lake

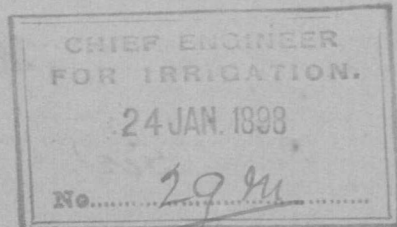
At Lake Fife and Bhatghar Tank.

(Signed)

S. Rebsch

M. I. C. E.

Superintending Engineer C. D. D.



"True Copies"

J. D. Kolathkar
Assistant Secretary to Govt.
E. M.

566.6
5775/50

No 9686 of 1897-98

Bombay 15th October 1897

To

The Municipal Commissioner

Sir,

I have the honour to report that hourly observations of the rainfall are not made at Tansa but only twelve hourly and daily rainfalls are registered.

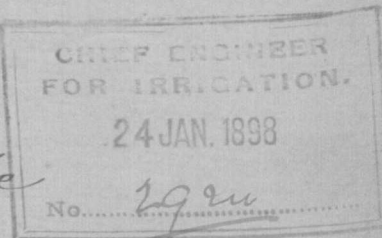
2 I beg to submit a statement showing the heaviest rainfall at Tansa during the last four years.

3 The Tansa catchment area measures nearly 52 sq miles and is surrounded by ranges of high hills both on the north and south gradually sloping towards the east.

4 The masonry dam built across the valley to a length of over 9,000 feet, almost faces the direction of the storm.

5 The hills are thickly covered with teak, Dhavra and other trees which form the Jansa forest.

6 Rice and nachni are cultivated over a limited portion of the high ground but grass grows over a large tract of the land.



I have the honor to be

Sir

your most obedient servant.

(Signed) M. C. Murzban

Executive Engineer.

No 18034 of 16-10-97

Copy forwarded with compliments to the Secretary to Government P.W. Departt with reference to his No 726 of 16th September last

(Signed)

J. H. Du Boulay

Dy. Municipal Commissioner

for the city of Bombay

040.1
5775/98

Date & month	Time of taking observations	12 Hour's rainfall	24 hours rainfall	
12 th July 1894	6 P.M.	1. 95		
	6 A.M.	3. 86	5. 81	
19 th July 1894	6 A.M.	1. 07		
	6 P.M.	6. 25	7. 32	24.54 inches in three continuous days.
20 th July 1894	6 P.M.	5. 63		
	6 A.M.	3. 93	9. 56	
21 st July 1894	6 P.M.	3. 73		
	6 A.M.	3. 93	7. 66	
20 th June 1895	6 P.M.	4. 14		
	6 A.M.	1. 20	5. 34	
17 th July 1895	6 P.M.	2. 90		
	6 A.M.	1. 25	4. 15	
7 th August 95	6 P.M.	3. 79		
	6 A.M.	" 55	4. 34	
7 th Sept 1895	6 P.M.	1. 50		
	6 A.M.	2. 62	4. 12	
21 st June 1896	6 P.M.	1. 62		
	6 A.M.	3. 50	5. 12	
22 nd June 1896	6 P.M.	2. 80		
	6 A.M.	1. 40	4. 20.	
		6	5	5
16-2				8

Date & month	Time of taking observations	12 hours rainfall	24 hours rainfall	
24 th July 1896	6 P.M.	3.40		
	6 A.M.	4.71	8.11	
25 th July 1896	6 P.M.	3.54		
	6 A.M.	1.84	5.39	
28 th July 1896	6 P.M.	.40		
	6 A.M.	6.20	6.60	
29 th July 1896	6 P.M.	4.45		
	6 A.M.	3.85	8.30	
30 th July 1896	6 P.M.	.75		
	6 A.M.	5. "	5.75	
10 th August 1896	6 P.M.	2.70		
	6 A.M.	2.45	5.15	
15 th July 1897	6 P.M.	3.30		
	6 A.M.	1.80	5.10	
7 th August 97	6 P.M.	5.15		
	6 A.M.	2.80	7.95	
8 th August 97	6 P.M.	2.25		
	6 A.M.	2. "	4.25	

20.65 inches
rainfall
in three
days.

Oct 2
5775/50

No. 5323 of 1897
Poona, 12th October 1897

From
The Executive for Irrigation
Poona District

To
The Superintending Engineer, C. D. W.

Sir,
With reference to G. M. 725 I dated
16th ultimo forwarded under your no.
6905 dated 21st idem, I have the honor
to report as follows:—

Lake Fife

- Area of FTL 154.0 sq (1) Catchment area 196 sq miles.
Length of line 13.69 (2) Estimated Rainfall - Information not available
(3) Estimated discharging capacity of the
W. weir ————— 62,000 cft per second
(4) Average rainfall at Kharak-wasla for
the last 20 years ————— 31.21 inches
(5) Maximum observed rainfall in
24 hours ————— 4.34 inches
(6) Maximum observed flood — 106,083 cft per second
7 maximum run off } Information not
in any 24 hours } available

$= 2024 \times 196 \frac{3}{4}$

With regard to (4) I would however point out that the figures given are those taken from the gauge at Kharakwasla, which is at the dam end of the Lake. Figures of rainfall during the 2 years 1878 & 79 at 8 places in the catchment area are available. These two years were, at Kharakwasla, years of slightly over the average fall. The figures are as below:-

	average	maximum
(6) 2 Athkarwadi	49.69	2.72
5 3 Singhar Hill	57.47	2.94
Ambezaon	84.67	4.50
Musa	108.53	6.85
yejra	217.29	8.60
Dupsura	145.10	8.15
Mutha	58.14	3.68
Bamboa	37.39	3.45

8) 758.28
94.78

It is this rainfall that is instrumental in filling the lake and not that gauged at Kharakwasla.

The maximum gauged at Kharak -

Public Works Department
Bombay Castle, 20th January/98

To

W. Hughes Esquire B.A.
Chief Engineer for Irrigation
Madras.

Sir,

I have the honor to acknowledge receipt of your letter dated the 27th August 1897, and in compliance with the request therein made, to forward copies of letters from local officers furnishing the requisite information in connection with the Lake Sife, Bhatghar Reservoir, and Jansa Lake, together with a tracing showing the catchment and gauge stations of the two former lakes. I also enclose a copy of notes on floods in some of the rivers in the Nasik District supplied by

* To be returned please.

by the Executive Engineer of that
District which may afford useful
the data. The remaining two works,
viz Maladevi and Newri tanks
mentioned in the margin of
para: 2 of your letter under reply
have not yet been constructed.

I have the honor to be,
Sir,

Your most obedient servant.

Mulharprasad

B. A. M. Inst. C. E.
Chief Engineer P. W. Deptt.
C. S. P.

CHIEF ENGINEER
FOR IRRIGATION.
24 JAN. 1893
No. 29 In

198

See

To
Do
of the
Gov

Peru
Sanchez
to 214
Do he