

TUMARIA RESERVOIR

Report

Uttarakhand State spreads over an area of about 5.566 Mha. It is bounded by Himalayan range in north. The population of state is over 8 million. It has hilly Bhabar and Tarai area with favorite farming climate. Due to uncertainty of rainfall pattern both in time and place this

state has faced and fought many draughts. To overcome this situation the state Govt. has given priority to irrigation sector. For this purpose one of the two dams situated in Uttarakhand and owned by the Irrigation department of state, Tumaria and Tumaria extension dam near Kashipur in Distt.- U.S.Nagar, Uttarakhand were constructed. In the first phase, construction of



Tumaria dam was commenced in 1956-57 by a revised project cost of Rs. 210.69 lacs and finally completed 10.400 km long in the year 1961-62 by total expenditure incurred Rs. 226.96 lacs. Simultaneously 216.31 km long canal system and Dhela Barrage with Dhela Feeder (5.400Km long) were constructed. Dhela barrage at Dhela river having 09 nos of other bays and 04 nos of under sluice are designed for a discharge of 1048 cumec. This reservoir is fed by Dhela feeder with diversion of Dhela river in to this feeder. Later stage for the purpose of extension, other dam was started as

Tumaria extension dam in 1960-61 by a revised project cost of Rs. 254.15 lacs and completed 10.00 Km long in the year 1969-70 by expenditure of total Rs. 225.29 lacs. Also 230.80 Km long canal system for irrigation and 4.100 km long Phika Feeder were constructed to feed this reservoir by diversion of Phika river at Phika Barrage having 07 nos. of other bays and 03 nos. under sluice that are designed for a discharge of 524cumecs . Total catchment area of Tumaria and Tumaria Ext. reservoir is 399.36 sq. km. and total reservoir capacity of both dam at full reservoir level is 151.143 Mm³.

As run off factor for both the project estimate of reservoir is taken as 0.46Mm³/sq Km. but as per actual measurement / survey for the year 1967 to1975 on the basis of 75% availability it came as 0.23 Mm³ per sq Km. Thus to fill the reservoir up to its full capacity, need of water from Kosi river is felt. For this purpose state government sanctioned a project estimate of Rs.286.29lacs in 1968 but due to escalation of rate revised project of Rs.2774.00lacs (year 1981) was sanctioned for the construction of 9.800 km long Kosi feeder to feed Tumaria Reservoir through Sawalده and Dhela river .After completion of Kosi project the provision has been made to feed Tumaria reservoir 75% from Kosi (depends on the availability of water in the river) and 25% from Dhela and Phika river. As per provision made sufficient water is not available from Kosi Feeder and due to lack in surface runoff water Tumaria reservoir is not fed up to FRL , present capacity of Dhela and Phika Feeder is 5000 cusec and 710 cusec respectively. There is need to increase the capacities of both the feeder up to 7000cusec and 2300 cusec respectively so that the reservoir will be easily filled up to its full reservoir level. Other reasons for not filling the

reservoir up to its full capacity are major distress in dam foundation as well as in dam body. For remedial measures of distress in dam a committee of three members was formed in 1975 by chief engineer and later advised to strengthen dam as per recommendations made by central design directorate, Lucknow.

When the reservoir filled up to 259.61 m in 1969-70, up to 260.76 m in 1983-84 and up to 259.75m in 1985-86 major distress are observed as mentioned below-

- (i) Heavy sweating on the downstream slope of dam between km. 13.20 to Km.14.00.



VIEW OF SEEPAGE DRAIN (MUDDY WATER COMES OUT)

- (ii) Boiling in seepage drains between Km. 13.00 to Km. 13.90.
- (iii) Heavy sweating on berms between Km.13.200 to Km. 13.600.
- (iv) Quick sand condition in out fall drains between km.10.400 to Km 16.00.

- (v) Coming out of dirty water from downstream slopes between Km. 8.00 to Km.9.500 and Km.10.500 to Km 17.500.
- (vi) Large cracks are seen on the top road of dam and on the downstream slopes of the dam.
- (vii) Heavy sogginess in different reaches of the dam between Km.7.300 to Km. 17.500.

To overcome the above mentioned major distress, superintending engineer IWC Moradabad referred the matter to CDD Lucknow. Authorities from CDD Lucknow inspected the dam and remedial measures were given in 1984. Above recommendations were again studied by Irrigation Research Institute Roorkee (IRI) focused on three points :-

- Inspection of actual phreatic line by establishment of Casagrande piezometer .
- Transverse anisotropy of undisturbed sample from dam surface.
- Assuming dam section isotropic and anisotropic, mark the phreatic line considering as present filter is choked,

After studies of above mentioned distress again three alternatives were advised:-

- Construction of new rock toe .
- Provision of filter zone at d/s slope
- Provision of toe drains and counter berms.

This matter again referred to CDD Lucknow and finally suggested that old rock toe will be treated as dam body and new rock toe and toe drains can be proposed. Thus studying and taking all the

discussed points above and major distress of this dam, important remedial measures are adopted in this project estimate ,Some of them are :-

- To activate proper drainage system by construction of cross, long and out fall drains
- Loading of sand to maintain the berms .
- Proper Installation of pressure relief wells.
- Maintaining earthen section of dam.
- Repairing of old damaged riprap pitching.
- Increasing capacities of Dhela and Phika feeder, Maintaining of gates of both barrages and head regulators.
- Maintenance of approach road, service road and top road of dam.



A VIEW OF TUMARIA DAM

SALIENT FEATURES

| <u>S.No.</u> | <u>Particulars</u> | <u>Tumaria Dam</u> | <u>Tumaria Ext. Dam</u> |
|--------------|--------------------------------------|--|-----------------------------|
| 1. | Location of dam | Tehsil Kashipur/ Ramnagar U.S. Nagar | Tehsil Jaspur U.S. Nagar |
| 2. | Year of commencement of construction | 1956-57 | 1960-61 |
| 3. | Year of completion | 1961-62 | 1969-70 |
| 4. | Length of dam | 10.400Km | 10.000Km |
| 5. | Maximum height of Dam | 023.32m (at Km. 9.800) | 15.29m (at Km.11.600) |
| 6. | RL of top of dam | 263.35m | 263.35m |
| 7. | Top width of dam | 6.100m | 6.100m |
| 8. | Latitude &Longitude | 29 ⁰ 20'44" North & 78 ⁰ 55'52" East | |
| 9. | F.R.L. | 261.21m | 261.21m |
| 10. | H.F.L. | 261.98m | 261.98m |
| 11. | Dead storage level | 246.28m | 249.94m |
| 12. | Name of river | Dhela | Phika |
| 13. | Catchment area | 268.8 Sq.m | 130.56 Sq.m |
| 14. | Catchment area Characteristics | Hilly | Hilly |

15. Rainfall based on last 20 years data:

| | | | |
|----|------------------------------|--------------|--------------|
| a) | Normal annual rainfall | 1267mm | 1080mm |
| b) | Minimum annual rainfall | 789 mm(1993) | 647mm (1979) |
| c) | Maximum annual rainfall | 2111mm(1978) | 1951mm(1978) |
| d) | Last year's annual rainfall | 934 mm | 761mm |
| e) | Normal monsoon rainfall | 1053mm | 899mm |
| f) | Minimum monsoon rainfall | 610mm(1979) | 485mm(1979) |
| g) | Maximum monsoon rainfall | 1971mm(1978) | 1720mm(1978) |
| h) | Last year's monsoon rainfall | 851 mm | 650 mm |

| | | | |
|--------|------------------------|----------------------|-----------------------|
| 17. a) | Dead Storage capacity | 2.21Mm ³ | 0.57Mm ³ |
| b) | Gross Storage capacity | 81.22Mm ³ | 69.92Mm ³ |
| c) | Live Storage capacity | 79.01Mm ³ | 69.35Mm ³ |
| d) | Capacity at HFL | 91.05Mm ³ | 80.82 Mm ³ |

| | | | |
|-----|----------------|----------|--------|
| 18. | Submerged area | 2104 ha. | 609ha. |
|-----|----------------|----------|--------|

19. Silting

| | | | |
|----|---|----------------------------------|----------------------------------|
| a) | As per project | 0.18Mm ³ per year | 0.11Mm ³ Per year |
| b) | As par actual Capacity survey done during 06/80 | 0.14 Mm ³ per year | 0.05 Mm ³ per year |
| c) | Evaporation (as Per project) | 11.89 Mm ³ | 14.44Mm ³ |

20. Irrigation

| | | | |
|----|--------------------|----------|----------|
| a) | C.C.A. | 58680 ha | 14164 ha |
| b) | Proposed Rabi | 20538 ha | 4957 ha |
| c) | Proposed Kharif | 22299 ha | 5182 ha |
| d) | Proposed Sugarcane | 5868 ha | 1416 ha |

21. factors adopted forwater requirement

| | | | |
|----|-----------|---------------------------|--------------------------|
| a) | Rabi | 242.34ha/ Mm ³ | 242.34ha/Mm ³ |
| b) | kharif | 213.81ha/Mm ³ | 213.81ha/Mm ³ |
| c) | Sugarcane | 128.21ha/Mm ³ | 128.21ha/Mm ³ |

22. Length of Dhela Feeder — 5.40Kms.

23. Sill level of Dhela Feeder — 260.45 m.

24. Length of Phika Feeder — 4.100 Km

25. Sill level of Phika Feeder — 259.38 m

26. Barrage Dhela Barrage Phika Barrage

a) Flood discharge 1359 cumecs 1048 cumecs

b) Designed discharge 1048 cumecs 524 cumecs

c) Ever Maximum discharge observed 2294 cumecs 1854 cumecs

d) Water ways 13 nos x 9.14m 10 nos x 9.14m

e) No. & width of piers 12 nos x 1.83m each 9 nos x 1.83m each

f) No & size of under-sluices gates 4 nos(9.14m x 3.81m) 3 nos(9.14m x 4.47m)

| | | | |
|----|-------------------------------|----------------------|----------------------|
| g) | No.& size of other ways gates | 9 nos(9.14m x 3.20m) | 7 nos(9.14m x 3.81m) |
| h) | Sill level of under-sluices | 258.93m | 257.86m |
| i) | Sill level of other ways | 258.93m | 258.47m |
| j) | River slope (U/S) | 4.27m/km | 1.81m/km |

27. Description of escape

| | | |
|----|----------------------|---------------------------|
| a) | Name of escape | Tumaria escape |
| b) | Location | at 7.500Km of Tumaria dam |
| c) | No. & size of gates | 3 nos (3.20m x 3.30m) |
| d) | R.L. of top of gates | 256.85m |
| e) | Capacity of F.R.L. | 283.17 cumec |
| f) | sill level of escape | 279.87m |

| 28. <u>Canal sluice</u> | <u>Location</u> | <u>Sill Level</u> | <u>Discharge</u> | |
|-------------------------|-----------------|-------------------|----------------------------|---------------------------|
| | | | <u>Before Kosi Project</u> | <u>After Kosi Project</u> |
| Tumaria main canal | at 10.20Km | 246.28m | 13.31cumecs | 20.53 cumecs |
| Tumaria Ext main canal | at 15.25Km | 249.94m | 2.61cumecs | 5.66 cumec |

| | | | | |
|-------------|-----------|---------|---|--------|
| T.B. feeder | at 7.20km | 250.60m | - | 21.24 |
| | | | | cumec |
| Tumaria | at 7.50km | 253.82m | - | 283.13 |
| Escape | | | | cumec |



VIEW OF DHELA BARRAGE AND PHIKA BARRAGE

Year wise details of maximum gauge and maximum storage Capacity of Tumaria reservoir.

| Year | Date of maximum Gauge | Maximum Gauge | Capacity |
|---------|-----------------------|---------------|------------------------|
| 1966-67 | 16.09.1966 | 257.19 m | 78.89 Mm ³ |
| 1967-68 | 16.09.1967 | 257.86 m | 90.95 Mm ³ |
| 1968-69 | 01.01.1968 | 256.49 m | 65.38 Mm ³ |
| 1969-70 | 28.09.1969 | 259.61 m | 128.39 Mm ³ |
| 1970-71 | 25.09.1970 | 258.84 m | 110.92 Mm ³ |
| 1971-72 | 04.11.1971 | 259.34 m | 121.96 Mm ³ |

| | | | |
|---------|------------|-----------|-------------------------|
| 1972-73 | 01.01.1972 | 258.96 m | 110.35 Mm ³ |
| 1973-74 | 12.08.1973 | 259.96 m | 137.39 Mm ³ |
| 1974-75 | 01.01.1974 | 257.22 m | 79.37 Mm ³ |
| 1975-76 | 05.10.1975 | 256.76 m | 71.39 Mm ³ |
| 1976-77 | 11.09.1976 | 257.80 m | 88.72 Mm ³ |
| 1977-78 | 03.10.1977 | 257.40 m | 81.38 Mm ³ |
| 1978-79 | 03.09.1978 | 258.84 m | 110.21 Mm ³ |
| 1979-80 | 18.08.1979 | 253.53 m | 29.68 Mm ³ |
| 1980-81 | 15.09.1980 | 257.37 m | 70.11 Mm ³ |
| 1981-82 | 04.08.1981 | 253.47 m | 23.98 Mm ³ |
| 1982-83 | 12.09.1982 | 258.47 m | 89.57 Mm ³ |
| 1983-84 | 23.09.1983 | 260.76 m | 151.05 Mm ³ |
| 1984-85 | 19.09.1984 | 258.01 m | 80.11 Mm ³ |
| 1985-86 | 15.10.1985 | 259.75 m | 115.73 Mm ³ |
| 1986-87 | 07.01.1986 | 256.79 m | 60.40 Mm ³ |
| 1987-88 | 09.09.1987 | 255.21 m | 39.81 Mm ³ |
| 1988-89 | 03.10.1988 | 258.59 m | 91.07 Mm ³ |
| 1989-90 | 22.09.1989 | 258.35 m | 80.34 Mm ³ |
| 1990-91 | 26.08.1990 | 259.02 m | 109.67 Mm ³ |
| 1991-92 | 23.09.1991 | 255.06 m | 41.17 Mm ³ |
| 1992-93 | 15.09.1992 | 256.89 m | 68.54 Mm ³ |
| 1993-94 | 20.11.1993 | 258.47 m | 99.63 Mm ³ |
| 1994-95 | 05.09.1994 | 258.348 m | 97.230 Mm ³ |
| 1995-96 | 17.09.1995 | 258.99 m | 110.077 Mm ³ |
| 1996-97 | 25.09.1996 | 257.556 m | 82.069 Mm ³ |
| 1997-98 | 14.01.1998 | 257.251 m | 76.078 Mm ³ |
| 1998-99 | 19.10.1998 | 258.775 m | 105.335 Mm ³ |
| 1999-00 | 25.09.1999 | 258.379 m | 97.831 Mm ³ |
| 2000-01 | 11.10.2000 | 258.470 m | 99.633 Mm ³ |
| 2001-02 | 24.08.2001 | 257.19 m | 75.023 Mm ³ |
| 2002-03 | 22.09.2002 | 254.508 m | 36.762 Mm ³ |
| 2003-04 | 05.11.2003 | 259.019 m | 110.621 Mm ³ |
| 2004-05 | 10.11.2004 | 258.836 m | 106.690 Mm ³ |
| 2005-06 | 10.11.2005 | 259.080 m | 111.530 Mm ³ |
| 2006-07 | 11.09.2006 | 256.306 m | 58.165 Mm ³ |
| 2007-08 | 15.11.2007 | 258.928 m | 108.722 Mm ³ |
| 2008-09 | 04.11.2008 | 259.080 m | 111.530 Mm ³ |
| 2009-10 | 04.12.2009 | 258.562 m | 111.345 Mm ³ |

Year wise details of maximum discharge in Dhela and Phika River

| S.No. | Year | Date | Dhela River (cusec) | Phika River (cusec) |
|-------|---------|------------|------------------------|------------------------|
| 1. | 1982-83 | 12.07.1982 | 22547 | |
| 2. | 1983-84 | 23.09.1983 | 80999 | |
| 3. | 1984-85 | 27.04.1984 | 61226 | |
| 4. | 1985-86 | 13.10.1985 | 33202 | |
| 5. | 1986-87 | - | - | |
| 6. | 1987-88 | - | - | |
| 7. | 1988-89 | - | - | |
| 8. | 1989-90 | 01.09.1989 | 40292 | |
| 9. | 1990-91 | 09.07.1990 | 79877 | |
| 10. | 1991-92 | - | - | |
| 11. | 1992-93 | - | - | |
| 12. | 1993-94 | - | - | |
| 13. | 1994-95 | 07.08.1994 | 31589 | |
| 14. | 1995-96 | 14.08.1995 | 46283 | |
| 15. | 1996-97 | 31.07.1996 | 7837 | |
| 16. | 1997-98 | 17.09.1997 | 2405 | |
| 17. | 1998-99 | 18.10.1998 | 25782 | |
| 18. | 1999-00 | 20.09.1999 | 38065 | 7080 |
| 19. | 2000-01 | 30.08.2000 | 25603 | 6285 |
| 20. | 2001-02 | 17.07.2001 | 38348 | 6036 |
| 21. | 2002-03 | 11.08.2002 | 5401 | 6106 |
| 22. | 2003-04 | 14.08.2003 | 16898 | 7449 |
| 23. | 2004-05 | 23.09.2004 | 52245 | 9885 |
| 24. | 2005-06 | 25.09.2005 | 35975 | 7159 |
| 25. | 2006-07 | 26.08.2006 | 45783 | 6108 |
| 26. | 2007-08 | 13.08.2007 | 29090 | 9942 |
| 27. | 2008-09 | 08.07.2008 | 10108 | 6981 |
| 28. | 2009-10 | 09.09.2009 | 43316 | 7870 |
| 29. | 2010-11 | 18.09.2010 | 41000 | 21000 |

A VIEW OF DHELA FEEDER



