

Chapter - 13

Cost Estimate, Benefit Cost Ratio and Financial Aspects

13.0 General

The Wainganga (Gosikhurd) – Nalganga (Purna Tapi) link project envisages construction of the following components at DPR stage:

- i) Head works at existing Gosikhurd reservoir (FRL 245.5 m) across Wainganga river for a peak discharge of 347.2 cumec
- ii) Link canal of length 426.54 km from Gosikhurd reservoir to Nalganga reservoir, comprising of open canal, pipe lines & tunnels
- iii) Lifting arrangements through 6 stages of lifting 23.25 m (RD 2.4 to 2.9 km), 23.5 m (RD 20 to 20.9 km), 29.25 m (RD 39.9 to 42.7 km), 28 m (RD 169.6 to 170.4 km), 30 m (RD 176.9 to 178.1 km) and 21.25 m (RD 292.85 to 293.7 km) totalling to 155 m of static lift
- iv) Canal falls at two locations at RDs 302.93 km (7 m) and 426.43 km (6 m) to dissipate the available excess head and reduce quantum of filling
- v) Pipelines for 25.98 km length in 11 reaches viz., RD 27.40 km (1210 m), RD 44 km (553 m), RD 49.65 km (1937 m), RD 60.05 km (9783 m), RD 83.6 km (3485 m), RD 87.7 km (1819 m), RD 93.4 km (3551 m), RD 112.45 (1111 m), RD 257.1 km (500 m), RD 363.88 km (1698 m) and RD 370.48 km (331 m)
- vi) Seven tunnels for a cumulative length of 13.826 km located at RD 73.50 km (3317 m), RD 141.45 km (776 m), RD 150.25 km (6489 m), RD 298.98 km (667 m), RD 371.53 km (781 m), RD 406.08 km (948 m) and RD 411.78 km (848 m)
- vii) Out fall structures and Head regulators for integration of existing reservoirs of Lower Wardha and Katepurna
- viii) Raising of six existing storages to accommodate link waters
- ix) Construction of 31 new storages along the link alignment to receive diverted waters
- x) 22 nos. of Feeder canals/Direct sluices for integration of 38 existing/proposed intermittent storages along the alignment

- xi) Subsidiary lift arrangements from main link canal to feeder canals at RD 115.45 km (7 m), RD 147.55 km (5 m), RD 150.00 km (10 m), RD 246.30 km (10 m) and RD 377.13 km (8 m)
- xii) Cross drainage/cross masonry and regulating works across the link canal (582 Nos.)
- xiii) Command area development of about 371277 ha in Nagpur, Wardha, Yeotmal, Amravati, Akola and Buldhana districts
- xiv) Canal top solar power generation arrangement at appropriate reaches along the link canal alignment.
- xv) Outfall structure at existing Nalganga reservoir on Nalganga river, a tributary of Purna Tapi with FRL 294.44 m.

The Ministry of Water Resources has issued “Guidelines for preparation of Detailed Project Reports of Irrigation and Multipurpose Projects” in the year 2010. These guidelines have been followed in preparation of estimate of link project. The data supplied by the Govt. of Maharashtra for head works and command area development have been considered while framing the cost estimate.

The quantities of materials and works involved in the various components have been worked out based on the engineering drawings. The rates of various items provided in the Common Schedule of Rates 2016-17 of Water Resources Dept, (WRD), Govt. of Maharashtra applicable from 1-11-2016 onwards have been used. The necessary lead, lift and material loading and unloading charges wherever applicable are added suitably. The rates for the items of insignificant in nature which are not available in the common schedule of rates of WRD, have been considered from the rates available in the Schedule of rates of PWD, Nagpur region for the year 2015-16 with cost of escalation at 5% per annum to arrive the cost of the project components upto 2016-17. The items considered for cost estimation and rates as obtained from CSR 2016-17 and CSR 2015-16 are shown in **Appendix volume of Design and Cost estimate.**

Further, the percentage of cost escalation from 2016-17 to 2017-18 is attempted by using guidelines of CWC for escalation factor which comes to 2.5 % whereas the cost of inflation index for income tax is found to be 3.03 %. However, both of the values are found to be on lower side. The details of computation of cost escalation by CWC guidelines are available in the Appendix

volume of Design and Cost Estimate. Study and Rate Analysis of Escalation in Construction industry is also published in IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334 X, Volume 11, Issue 2 Ver. V (Mar- Apr. 2014), PP 14-25 www.iosrjournals.org by K. Vamsidhar, D. A. Eshwarswaroop, and K. Ayyappareamkrishna, which show the forecast of cost escalation for the years 2014-15, 2015-16, 2016-17 as 11.85 %, 11.85% and 11.94% respectively considering the basic rate for the year 2008 to 2013 and the article is furnished in **Appendix volume of Design and Cost estimate**. Keeping in view the above projections as well as the Cost of inflation index, 8% cost escalation per annum is considered to arrive the project cost for the year 2017-18.

13.1 Classification of Units

The cost estimate of Wainganga (Gosikhurd)- Nalganga (Purna Tapi) link project has been broadly grouped into following units.

Unit – I: Head works: Includes the cost of off taking Head Regulators at Gosikhurd, Lower Wardha and Katepurna reservoirs. This unit also includes the cost of new reservoirs/Tanks and creating additional capacity in some existing storages to store the diverted water and to use effectively in the command area.

Unit – II: Canals: Includes the cost of main canal, pipe lines, lift components, canal structures, tunnels, cross regulators, canal escapes, outfall regulators, feeder canal regulators/direct sluices and distribution systems.

Unit – III: Hydro power: Hydro power generation is not proposed under this project. As such, no provision is required under this sub-head.

Unit – IV: Navigation: Navigation is not proposed under this project. As such, no provision is required under this sub-head.

Unit – V: Water Supply: Water supply for domestic and industrial needs is proposed in the command area. Water will be supplied through main canal and various feeder canals/direct sluices and this cost is considered under Unit-VI: Command area development. However, water supply network to the local areas

will be the responsibility of the local development body / local administration. Hence, no provision towards water supply works at local level has been kept under this head.

Unit–VI: Command Area Development: Includes the cost of development of command area proposed under the existing/proposed reservoirs which are fed by the feeder canals/direct sluices.

The total cost of the project considering all unit heads has been worked out. The Abstract of cost of the Link project unit head wise is given in **Table 13.1**

Table 13.1
Abstract of cost of the Link project

Sl. No.	Unit	Amount (Rs. in lakh)
1	I - Head works	2383348
2	II – Canals including pipe lines	2953115
3	III – Hydro power	0
4	IV – Navigation	0
5	V – Water supply for domestic and industrial needs	0
6	VI – Command area development	38735
	Total	5375198
	Say	53752 crore

The total cost of the link project works out to be **Rs. 53752 crore** at 2017-18 price level, which includes Environmental Management Plan and Socio-economic Survey and Rehabilitation and Resettlement Plan. The general abstract of the cost of the project is given in **Annexure – 13.0**. The details under various heads are described in the following paragraphs:

13.1.1 Unit – I: Head Works: Unit - I includes cost of the following components / structures of project.

- i) Proposed reservoirs/modernisation of existing reservoirs to cater the needs of the command area
- ii) Head regulator at Gosikhurd reservoir.

- iii) Head regulator at Lower Wardha reservoir
- iv) Head regulator at Katepurna reservoir

The Government of Maharashtra had identified the proposed reservoir locations and the existing reservoirs which are to be modernised to increase their storage capacity. The Govt. of Maharashtra has supplied the cost of construction of reservoirs on per unit volume of storage basis and the above rate is considered for estimation of cost of reservoirs. The cost of construction of proposed reservoirs and creation of additional storage capacity in existing reservoirs is found to be **Rs 2381338** lakh. The unit rate of construction of reservoirs on volumetric basis includes all sub heads of cost estimation from A to Y for reservoirs. As such, the detailed sub head wise computation of cost estimation for reservoirs were not furnished. Details are given in **Annexure 13.1**. Total cost of Unit-I Head Works including cost of construction of reservoirs is estimated to be **Rs. 2383348** lakh. The sub-head wise details are given below.

13.1.1.1 A. Direct Charges

The direct charges include the following sub- heads.

- I- Works,
- II- Establishment,
- III- Tools and Plant,
- IV- Suspense and
- V- Receipts and recoveries.

The details are described below:

I-Works:

A- Preliminary: Rs. 18 lakh

Provision under this sub-head has been kept to cover the actual expenditure incurred on surveys and investigations, collection and procurement of data / maps / remote sensing data, cost of consultancy works through various expert agencies, Environmental Impact Assessment etc for preparation of this Detailed Project Report of link project. This sub head consists of many activities of which important activities are given below:

- i) Topographical surveys and investigations,
- ii) Hydrological and meteorological surveys,
- iii) Geological and Geotechnical surveys,
- iv) Construction material survey,
- v) Borrow area survey,
- vi) Seismic studies,
- vii) Morphological studies,
- viii) Sedimentation studies of reservoirs,
- ix) Construction of access roads to facilitate site investigations,
- x) Procurement of data / maps,
- xi) Procurement of Remote sensing data,
- xii) Environmental Impact Assessment study,
- xiii) Charges for consultancy works for various studies and
- xiv) Preparation of Detailed Project Report.

However, for detailed survey and investigations for establishing the final locations of different project components at pre-construction stage, a lump-sum provision @ of 1% of head works has been considered under this sub-head. The details are given at **Annexure 13.1**.

B- Land:

Rs. 0 lakh

The land required for head regulators are accounted in Unit II: Canal. The details are given at Annexure: **13.1**.

C- Works:

Rs.2383128 lakh

Under this sub-head the provisions have been made to cover the cost of various components of Head regulators located at Gosikhurd, Lower Wardha and Katepurna reservoirs. The design of various components of the head regulators are carried out by NWDA. The quantities and the cost of the various components have been evaluated as per the drawings. The computation of cost of head regulators have been appended in **Appendix Volume of Design and Cost Estimate**.

In respect of proposed reservoirs and existing reservoirs for additional capacities, the storage capacity and submergence area have been furnished by Govt. of Maharashtra. The construction cost of reservoirs/ tanks is derived based on the unit rate of construction of storages and storage capacity of reservoirs. The details are given at **Annexures: 13.1., 13.1.1 and 13.1.2.**

K- Buildings: **Rs. 0 lakh**

The cost of K – buildings is included in Works of Unit II. The details under this sub-head are given at **Annexure: 13.1**

M- Plantation: **Rs. 0 lakh**

The cost of M - Plantation is included in Works of Unit II. The details under this sub-head are given at **Annexure: 13.1.**

P- Maintenance: **Rs. 18 lakh**

Provisions have been made under this sub-head to cover the cost of maintenance of all works during the construction period. A provision of 1% of the cost of I works (HR cost) less A – Preliminary, B- Land, O – Miscellaneous, M- Plantation, Q – Special T & P, X – Environment and Ecology, and Y – Loss on stock has been made. The details are given at **Annexure: 13.1.**

Q- Special Tools and Plant: **Rs. 0 lakh**

No provision has been made under this head as the cost of special Tools and Plant will be borne by the contractors.

R- Communication: **Rs. 0 lakh**

The cost of R - Communication is included in Works of Unit II. The details are given at **Annexure: 13.1.**

X- Environment and Ecology:

Rs. 0 lakh

The impact on environment and ecology due to head regulators off taking from existing reservoirs is insignificant and thus is not considered. The details are given at **Annexure 13.1**.

Y. Losses on Stock and Unforeseen Items:

Rs. 4.0 lakh

Provision under this sub- head has been made @ 0.25% of the cost of I-works less A- preliminary, B- land, O- miscellaneous, M- plantation, P- Maintenance, Q- special Tools and Plant and X - Environment and ecology.

The total cost of I –works of Unit – I (Head works) works out to **Rs. 2383168 lakh**.

II-Establishment:

Rs. 144 lakh

The link project is planned to be completed in a period of 5 years. Provision towards establishment charges has been made @ 8% of I-Works considering the cost of Head regulators only excluding B- land. As the unit rate of construction of reservoirs on volumetric basis includes all sub heads, the provision for Environment and ecology for reservoirs is not kept. The establishment charges are kept for head regulators only. The details are given at **Annexure 13.1**.

III-Ordinary Tools and Plant:

Rs. 18 lakh

Provision has been made under this head @ 1.0 % of I-Works towards ordinary Tools and Plant to cover the cost of survey instruments, camp equipment, inspection vehicles and other small tools and plant. This provision is distinct from the Q- special Tools and Plant. The charges are kept for head regulators only. The details are given at **Annexure 13.1**.

IV – Suspense:

Rs. 0 lakh

It is assumed that all the outstanding suspense would be cleared by adjustment to appropriate heads on completion of the project. As such no provision has been kept under this head.

V- Receipt and Recoveries:

Rs. (-) 0 lakh

Under this head, the estimated recoveries is considered as NIL.

13.1.1.2 B - Indirect Charges:

Rs. 18 lakh

Provision for abatement of land revenue and Audit and Account charges are covered under ‘Indirect Charges’ at the following rates:

Abatement of land revenue – 5% of cost of land

Audit and Account charges – 1% of I-Works

As the unit rate of construction of reservoirs on volumetric basis includes all sub heads, the provision for indirect charges for reservoirs is not kept. The charges are kept for head regulators only.

Total cost of Head works (Unit-I) works out to **Rs. 2383348 lakh.**

13.1.2 Unit – II: Canal system:

Unit – II Canal system covers the cost of the following components along with their appurtenant works such as,

- Main canal
- 7 tunnels
- 11 pipeline reaches
- 11 lifts (six in main canal & five from main canal to feeder canals)
- CD/CM structures
- Branch canals and
- Command area development

The cost estimation for the main canal has been made as per the designs and drawings whereas for the branch canal it is taken on proportionate factor of canal discharge and length with main canal. The main canal reach between RD 349.98

km to 399.98 km excluding the tunnel has been considered since the main canal discharge almost matches with branch canal discharges. The total cost of Unit – II: Canal system is estimated to be Rs. 2953115 lakh at 2017-18 price level. Details are shown in **Annexure: 13.2**. The sub-head wise details are discussed in the following paragraphs.

13.1.2.1 A. Direct charges:

I-Works:

A- Preliminary:

Rs. 54330 lakh

Provision under this sub- head has been kept to cover the actual expenditure incurred on various surveys and investigations mentioned below for preparation of Detailed Project Report of this project.

- i) Topographical surveys and investigations,
- ii) Geological and Geotechnical surveys,
- iii) Construction material survey,
- iv) Vehicle charges for inspecting officers for site investigations,
- v) Survey and Camp equipments,
- vi) Charges for consultation for various studies,
- vii) Actual expenditure on Establishment and
- viii) Preparation of Detailed Project Report.

However, for detailed survey and investigations for establishing the final locations of different project components at pre-construction stage, a lump-sum provision @ of 2% of I-Works has been considered under this sub-head. The details are shown in **Annexure: 13.2**.

B- Land:

Rs. 604431 lakh

Under this sub-head, the provisions for cost of acquisition of land for main canal, branch canal and canal structures, compensation for property and standing crops, solatium charges, diversion of communication systems and other immovable properties, rent for use of land prior to acquisition etc., have been considered. The land requirement for the feeder canals has been worked out based

on the proportionate factors of canal length and discharge of main canal for the reach from 349.98 km to 399.98 km excluding the tunnel portion. The village wise land value per ha is obtained from the web site of Revenue Dept. of Maharashtra for different categories of land. A multiplication factor 2 has been considered as stipulated in the land acquisition act 2013 for the private land to be acquired. The computation of land requirement for canal right of way, borrow area, colony etc. are furnished in **Appendix Volume of Design and Cost Estimate**. The details are shown in **Annexures: 13.2.1, 13.2.1.1 & 13.2.1.2**. for main canal and in **Annexure: 13.2.16** for branch canal. The details are also shown in **Annexure: 13.2**.

C-Works:

Rs. 564941 lakh

Under this sub-head, provisions for 7 Nos. of Tunnels, Tunnel portals, lifts at 11 locations which consists of sump, pump house, raising main and delivery cistern are considered. The cost of tunnels, tunnel portals, sump, delivery cistern and cost of raising main are worked out based on Design drawings, quantity estimation and schedule of rates. The civil works pertaining to pump house, electro – mechanical equipments and draft tube gates of lifts are taken as per the cost estimate of Pattiseema Lift irrigation scheme located in Andhra Pradesh state constructed during the year 2015-16. The detailed cost estimate of the above structures are furnished in **Appendix Volume III B of Design and Cost Estimate**. The cost and abstract cost of tunnels are given in **Annexures: 13.2.2 and 13.2.2.1 to 13.2.2.7**. The cost and abstract cost of lift are given in **Annexures: 13.2.3 and 13.2.3.1 to 13.2.3.11**.

D-Regulators:

Rs. 5445 lakh

Under this sub-head, provision for cross regulator at appropriate locations and regulators for feeder canal and direct sluices has been made. Provision for two outfall regulators at canal outfall into reservoirs are also made. The cost of regulators is arrived at from cost curve of regulators derived based on the cost estimate of head regulators located at Gosikhurd, Lower Wardha and Katepurna reservoirs. The detailed cost estimate of the head regulators and cost curve development are furnished in **Appendix Volume III B of Design and Cost Estimate**. The details are shown in **Annexures: and 13.2 & 13.2.4**

E-Falls:

Rs. 176 lakh

There are 2 canal falls in the main canal. The cost of canal falls is worked out based on Design drawings, quantity estimation and schedule of rates. The detailed cost estimate of the canal falls are furnished in **Appendix Volume of Design and Cost Estimate**. The abstract cost of canal falls is given in **Annexures: 13.2.5.1 & 13.2.5.2**. The details are shown in **Annexures: 13.2 & 13.2.5**.

F-Cross drainage works:

Rs. 68859 lakh

The cross drainage works proposed across the main canals are aqueducts, syphon aqueducts, canal syphons and super passages to facilitate the crossing of major/medium rivers/streams. The under tunnels and overpasses are also proposed across the link canal for crossing the minor streams/ canals. The cost curves for each category of structures have been developed by considering the design drawings, quantity estimation and schedule of rates of the year 2016-17 for selected structures of the link project. The costs of the structures have been estimated from the cost curves. The cost of overpasses is estimated based on the double lane bridge cost with appropriate factors. The cost of structures which may come across the feeder canals have been worked based on the proportionate factors of canal length and discharge of main canal for the reach from 349.98 km to 399.98 km excluding the tunnel portion. The detailed cost estimate of the selected structures and cost curve development are furnished in **Appendix Volume of Design and Cost Estimate**. The cost and cost curve details are shown at **Annexures : 13.2.6 & 13.2.6.1; 13.2.7 & 13.2.7.1 ; 13.2.8 & 13.2.8.1; 13.2.9,13.2.9.1 & 13.2.9.2 for aqueducts/syphon aqueducts, canal syphons, super passages and under tunnels/overpass respectively**. In respect of branch canals, the details are shown in **Annexures: 13.2.16 & 13.2.16.1**. Details are shown in **Annexure: 13.2**.

G-Bridges:

Rs. 13747 lakh

Number of bridges (major and minor) are required to be constructed across the link canal of the project to facilitate crossing of various roads. Necessary

provision has been made towards construction of these bridges. The cost curve for double lane road bridge has been developed by considering the design drawings, quantity estimation and schedule of rate for the year 2016-17 for selected structures. The estimates are prepared based on the cost curves. Single lane/ Four lane bridges have been estimated on proportionate basis of width of carriage way. Cost of railway bridges are taken at 2.5 times cost of double lane bridges per track. The cost of similar structures which may come across the feeder canals have been worked based on the proportionate factors of canal length and discharge of main canal for the reach from 349.98 km to 399.98 km excluding the tunnel portion. The detailed cost estimate of the selected structures and cost curve development are furnished in **Appendix Volume III B of Design and Cost Estimate**. The cost and cost curve of double lane road bridges are shown at **Annexures : 13.2.10 & 13.2.10.1** and for branch canal the details are shown in **Annexures: 13.2.16 & 13.2.16.1**. Details are shown in **Annexures: 13.2**.

H-Escapes:

Rs. 1321 lakh

Under this sub-head, provision has been made for canal escapes at suitable locations where drainage facilities exist to take care of the 50 % of canal discharge in the eventuality of canal breaches. The cost curves developed for regulators have been used to estimate the cost of escapes. The details are shown in **Annexures: 13.2 & 13.2.4**.

K- Buildings:

Rs. 135811 lakh

Provision has been made under this sub-head for construction of temporary and permanent buildings for both residential and non-residential buildings for various categories of staff, offices, inspection bungalow, stores, club cum welfare hall, laboratory and research station etc. Provision of 5 % of I works are considered as stipulated in the guide lines for preparation of DPR of Irrigation and Multi-purpose projects with the ratio of 65 % for temporary buildings and remaining for permanent buildings. The details under this sub-head are given at **Annexure: 13.2**

L- Earthwork and Lining:

Rs. 787482 lakh

The detailed quantity estimates are prepared considering the cross sections taken at 50 m interval along the canals with design drawings. The earthwork quantities involved in cutting based on the type of strata, the soils which can be reused for embankment, the reusable hard rocks for aggregate purposes are quantified separately. The quantities of earthwork required for embankment from borrow areas are worked out. Lining is provided for bed and side slopes in the entire length of canal as per the design and drawings. The cost of earthwork and lining is worked out with the derived quantity and schedule of rates for the year 2016-17 and escalated to 2017-18. The pressure relief valves on deep cut reaches and polythene sheets on high embankment portions are also provided. The cost of earth work and lining for the feeder canals have been worked based on the proportionate factors of canal length and discharge of main canal for the reach from 349.98 km to 399.98 km excluding the tunnel portion. The detailed computations of earth work, canal lining, pressure relief valves and polythene sheet area are shown in **Appendix Volume III B of Design and Cost Estimate**. Details of computation are shown in **Annexures: 13.2.11 & 13.2.11.1; 13.2.16. & 13.2.16.1.**

The pipelines are provided wherever the canal is passing on high embankment. 11 nos. Pipe lines are proposed along the main canal. The cost of individual pipe line is worked out as per design and drawing and schedule of rate for the year 2016-17 and escalated to 2017-18. The detailed cost estimate of the pipelines are furnished in **Appendix Volume of Design and Cost Estimate**. The cost of pipe lines and abstract of pipelines are shown at Annexures: **13.2.11.2.1 to 13.2.11.2.11 and 13.2.11.2.** respectively. The details under this sub-head are given at **Annexure: 13.2.**

M- Plantation:

Rs. 210 lakh

Under this sub- head, cost of proposed plantation in the colony areas, parks, downstream of head regulators, along the canal alignment and along the approach roads have been considered. The details under this sub-head are given at **Annexures: 13.2.12 & 13.2.**

O- Miscellaneous:

Rs. 5916 lakh

Under this sub-head, provision has been made to cover the cost of the following works:

- Capital cost of electrification, water supply purification and distribution arrangements, sewage disposal, firefighting equipment, telephones, wireless sets, equipment for quality control and field labs, initial equipment and other accessories for hospitals etc.
- R & M of above equipments / infrastructural facilities etc.
- R &M of inspection vehicles, inspection bungalow etc.

Provision has also been made for other miscellaneous items such as inaugural foundation laying ceremony, compensation to work men, flood lighting, model exhibits etc. Details are given in **Annexures: 13.2.13. & 13.2.**

P- Maintenance:

Rs. 20119 lakh

Under this sub-head, provision has been made to cover the cost of maintenance of all works during the construction of canals. A provision of 1% cost of I-Works less A-Preliminary, B-Land, M-Plantation, O-Miscellaneous, Q-Special Tools and Plant, X-Environment and Ecology and Y-Loss on stock has been made. Details are appended in **Annexure 13.2.**

Q- Special Tools and Plant:

Rs. 0 lakh

No provision has been made under this head as the cost of special Tools and Plant will be borne by the contractors.

R- Communication:

Rs. 2459 lakh

Under this sub-head, provision for construction of temporary roads and remodelling of existing roads for approach to canal and regulatory system, quarry sites and other working areas has been kept. Details are given in **Annexures: 13.2.14. & 13.2.**

U- Distributaries and Minors:

V- Water Courses and Field Channels: Rs. 408999 lakh

Under this sub-head, provision has been made for providing pipe distribution network directly to the field in place of open canal system such as distributaries and minors, water courses and field channels. The Govt, of Maharashtra has furnished the cost of pipe distribution network as derived from the Trigonid Minor Irrigation project. The cost of pipe distribution network is Rs. 1.02 lakh/per ha and the above rate is adopted for the culturable command area 371277 ha identified for the link canal. The details are shown in **Annexure 13.2**

W- Drainage:

The cost is included in the Environment and ecology. Details are given in **Annexures : 13.2.15. &13.2.**

X- Environment and Ecology: Rs. 34656 lakh

Provisions under this sub-head have been made towards the cost of extensive management measures to sustain environment and ecology such as land management plan (stabilisation of muck disposal management), improvement of existing drain, provision for free fuel to department engaged labour, Public Health Management and Environmental Monitoring Programme (EMP). Detailed Environmental Impact Assessment study of the link project shall be taken up by Govt. of Maharashtra at a later stage. The above provision also includes the improvements made for drainage systems in the command area. The details are given in **Annexures: 13.2.15. &13.2.**

Y- Losses on Stock and Unforeseen: Rs. 4985 lakh

Provision has been made for losses on stock and unforeseen @ 0.25% on all sub-heads under I-Works excluding sub-heads A-Preliminary, B-Land, O-Miscellaneous, M-Plantation, P-Maintenance and X-Environment and Ecology.

The total cost of I –works of Unit – II (Canals) works out to Rs. **2713887** lakh.

II- Establishment: Rs. 210946 lakh

Provision has been made as per norms @ 10% of I-Works excluding B-Land towards establishment and pensionary charges.

Ordinary Tools and Plant: Rs. 1000 lakh

Provision has been made under this head for ordinary Tools and Plant. This provision is distinct from the Q-Special Tools and Plant and is meant to cover the cost of survey instruments, camp equipment and other small Tools and Plant and a lumpsum amount of Rs 1000 lakh is kept. The details are given in **Annexure: 13.2.**

III-Suspense: Rs. 0 lakh

It is assumed that all the outstanding suspense would be cleared by adjustment to appropriate heads on completion of the project. As such, no provision has been kept under this head.

IV-Receipt and Recoveries: (-) Rs. 13242 lakh

Under this head, estimated recovery by way of resale or transfer of temporary buildings, special Tools and Plant and by resale or transfer of generator sets, electrical lines, telephone lines and other accessories are accounted for and provision has been made accordingly. The details are given in **Annexure 13.2.**

13.1.2.2 B - Indirect Charges: Rs. 39241 lakh

Provision for abatement of land revenue and Audit and Account charges are covered under 'Indirect Charges' at the following rates:

- Abatement of land revenue – 5% of cost of land
- Audit and Account charges – 1% of I-Works

The details are given in **Annexure 13.2.**

Total cost of Canals (Unit-II) works out to **Rs. 2953115 lakh.**

13.1.3 Unit – III: Hydroelectric Installation:

Hydro power installation is not proposed under this project and hence, no provision is required under this sub-head.

13.1.4 Unit–IV: Navigation:

Navigation is not proposed under this project and hence, no provision is required under this sub-head.

13.1.5 Unit–V: Water Supply Works:

Water supply network to the local areas will be the responsibility of the local body / local administration. Hence, no provision towards water supply works at local level has been kept under this head.

13.1.6 Unit–VI: Command Area Development: Rs 38735 lakh

Provision for expenditure towards command area development such as OFD works, drains, underground pipelines etc is made. The total cost of command area development is estimated to be Rs. 34157.48 lakh at 2015-16 price level and Rs 38735 lakh at 2017-18 price level. The rate mentioned below is taken from the DPR of Par – Tapi- Narmada link project for the year 2015-16. The details are given below:

- | | | |
|-------|---|------------------|
| (i) | Survey, planning and designing of OFD works
(Rs.1200/ha) for 371277 ha | Rs 4455.32 lakh |
| (ii) | Land levelling (Rs 2000/ ha) for 371277 ha | Rs 7425.54 lakh |
| (iii) | Construction of field, intermediate and link drains
(Rs.6000/ha) for 371277 ha | Rs 22276.62 lakh |

The cost of command area development for the culturable command area of 371277 ha works out to Rs 38735 lakh at 2017-18 price level. The details are also shown in **Annexure : 13.3.**

13.2 Revenues

13.2.1 Yearly Programme of Development with respect to the Date of Starting of Construction of the Project

The link project is scheduled to be completed in 5 years. Yearly programme of construction of the project has been discussed in detail in Chapter - 10 “Construction Programme, Manpower Deployment and Plant Planning”.

13.2.2 Sources of Revenue

The link project has been planned to feed existing/proposed reservoirs to create new command area in the vicinity. The following would be the source of revenue from the link project.

- Irrigation benefits
- Water charges (irrigation service fee)
- Sale of water for domestic water supply and industrial use
- Pisciculture
- Canal plantation
- Animal husbandry

13.2.2.1 Irrigation benefit:

The link canal will benefit 371277 ha of area with irrigation. For assessing net benefits from irrigation, the estimated value of agriculture produce, inputs, benefit from the pre-project and post-project scenarios in the command area are made available by the State Agriculture Department for districts Nagpur and Wardha districts covering 149572 ha. The above irrigation benefits have been considered for the remaining area in absence of details from other districts. The computation of pre-project and post-project irrigation benefits taluk wise in the districts of Nagpur and Wardha are furnished as **Annexure: 13.4 & 13.5** respectively. The abstract of pre-project and post project irrigation benefits of the link project is shown as **Annexure: 13.4.1 & 13.5.1** respectively. The net irrigation benefits on implementation of the link project is found to be 213381 lakh at 2017-18 price level.

13.2.2.2 Water charges (irrigation service fee)

A large infrastructural network is being created for making water available in the proposed command area for irrigation and water supply purposes to be self-sustainable. Therefore, appropriate water pricing is quite necessary, so that cost of operation and management of project could be recovered from the beneficiaries of the project upto some extent. Water Charges may be different for irrigation and non-irrigation uses. The Maharashtra Water resources Regulatory Authority, which is the nodal agency to fix water rates for bulk users has fixed water charges on volumetric basis for irrigation vide its Order no 1/2018 dated 11-01-2018 which is shown in **Table 13.2** below.

Table 13.2
Season wise water cess

Sl. No.	Season	For Registered Water User Associations (Paisa per cum)	For individual beneficiary (Paisa per cum)
(1)	(2)	(3)	(4)
1	Kharif	3.38	4.50
2	Rabi	6.75	9.00
3	Hot Weather	10.13	13.50

The Irrigation Commission had suggested that water charges should be fixed at around 5 percent of gross income for food crops and 12 percent for cash crops. At present, the actual gross receipts per ha of area irrigated by major and medium projects is barely 2 percent of the estimated gross output per ha of irrigated area, and less than 4 percent of the difference between output per ha of irrigated and unirrigated areas. Most states have fixed very low Irrigation Service Fee which have not been revised for years. In states with rapidly growing industrial economy, Irrigation Departments are able to generate substantial revenue by selling a small portion of reservoir storage to industries and municipalities. This is often used to justify low Irrigation Service Fee and their low recovery. The 12th Finance Commission recommended O&M cost norm of Rs. 600 per hectare for utilised potential and Rs. 300 per hectare for unutilised potential based on normative expenditure requirements for maintenance of irrigation works of major and medium irrigation projects. The 13th Finance Commission has adopted

the norm of Rs. 1175 per hectare for the utilised potential and Rs. 588 per hectare for the unutilised potential for major and medium irrigation schemes respectively. After adjustment for inflation, with an annual growth of 5 per cent thereafter, these would reach the level of Rs. 1500 per hectare for utilised and Rs. 750 per hectare for unutilised potential in the terminal year.

The water charges as per volumetric basis computed for the deliverable quantity at field considering the registered society works out to 592.6 lakhs which appears to be very low and non-sustainable. Keeping in view to sustain the O&M cost of project, Rs 1500 /ha as recommended by the 13th Finance Commission is considered for the water charges (irrigation service fee) for this link project. The new area likely to be benefitted by the link project is 371277 ha and the corresponding water charges @ **Rs 1500/ha** (irrigation service fee) will be Rs 5569.16 lakh.

13.2.2.3 Sale for Drinking and industrial water supply

The Maharashtra Water resources Regulatory Authority which is the nodal agency to fix water rates for bulk users has fixed water charges on volumetric basis vide its Order no 1/2018 dated 11-01-2018 which are shown in **Table 13.3** below.

Table 13.3
Standard Rates for Domestic Water Use

Sl. no	Category	Source & Type of Supply	Standard Rates for Domestic Water Use (Rs. per m ³)		
			Gram panchayats	ULBs	Municipal Corporations
1	Assured Water Supply	Water Supply from Reservoir	0.15	0.18	0.25
2	Regulated water supply with conveyance loss	River reach downstream of dam, canals & K.T weirs	0.30	0.36	0.50

3	Partly assured water supply	Water use through natural stream without any releases from upstream reservoir, canal etc.	0.08	0.09	0.13
4	Water use entity has constructed a storage of at least 8 months of its water use and is also maintained at its own cost	water supply through water user entity's own dam or has shared the cost in proportion to its water use	0.02	0.03	0.04

Standard Rates fixed for Industrial Use:

Sl.no	Category	Water supply and source	Standard Rates for Industrial Water Use (Rs. per m ³)	
			Process	Raw material
1	Assured Water Supply	Water use from Reservoir	4.80	120.00
2	Regulated Water Supply with conveyance loss	Water use from regulated river reach below dam, canal/ K.T. weirs with backup	9.60	240.00
3	Partly Assured Water Supply	Water use from exclusively unregulated rivers without releases from	2.40	60.00

		any reservoir/ canal		
4	Reservoir constructed for capacity of at least 8 months requirement by the water use entity at its own cost and maintained at its own cost	Water supply from a private reservoir or from reservoir proportionate cost of which infrastructure and management has been shared by the water user entity	0.77	19.20

The domestic water supply to command area is mostly covered by the grama panchayats and rarely with municipal councils and hence an average rate of Rs 0.35 per m³ of water is considered as benefit from the domestic water supply. The domestic water requirement as per prevalent norms of NWDA in the command area works out to 32 Mm³ and the corresponding benefit to be accrued will be Rs 112.0 lakh.

The industrial water supply to command area is mostly covered by the grama panchayats and rarely with MIDC area. The water supply to industrial use is regulated either from the canal directly or from the reservoirs on the enroute and hence the rate of Rs 240 per m³ of water is considered as benefit from the industrial water supply. The industrial water supply to be provided in the command area is 397 Mm³ and the corresponding benefit to be accrued will be Rs 952800 lakh.

13.2.2.4 Pisciculture

The link project is proposed to provide water for 40 existing/proposed storage reservoirs enroute (including the existing Lower Wardha, Bembla & Katepurna) and Nalganga reservoir. The submergence area of the 37 existing/proposed reservoirs excluding the existing Lower Wardha, Katepurna and Bembla reservoirs is in the order of 19818 ha. The State Government policy for transfer of fishing rights of all tanks constructed by Irrigation department to the Fisheries department has come into effect since 1966. This policy has been put

into practice to generate employment through development of pisciculture in the Irrigation Tanks and Reservoirs by the local Fisheries Co-operative Societies. This policy for transfer of fishing rights of all tanks constructed by Irrigation department to the Fisheries Department is determined by various Government Resolutions from time to time. The fishing rights of Irrigation tanks below 200 ha. are leased to local Fisheries Co-operative Societies by negotiation for 5 years. The fishing rights of Irrigation tanks not leased by negotiations to the Fisheries Co-operatives are auctioned by tender bids. The lease amount likely to be received by Irrigation department based on the above policy is Rs 11.48 lakhs. The details are shown in **Annexure 13.6**. The optimum Fish Seed Stocking in Tank and Reservoir and Lease Amount at present charged by Govt. of Maharashtra is given in **Table 13.4** below.

Table 13.4
The optimum Fish Seed Stocking in Tank and Reservoir
and Lease Amount

Water Spread Area (Ha)	Optimum Fish Seed Stocking (Lakh)	Lease Amount Rs.
0-20	5000/ha.	300/ha.
20-60	1.00 lakh + 2000/ha for area above 20 ha.	6000 + Rs.120/ha for above 20 ha.
60-300	1.80 lakh + 1000/ha for area above 60 ha.	10,800 + Rs.60/ha. for above 60 ha.
300-1300	4.20 lakh + 500/ha for area above 300 ha.	25,200 + Rs.30/ha. for above 300 ha
1300-5000	9.20 lakh + 500/ha for area above 1300 ha.	55,200 + Rs.20/ha. for above 1300 ha.
Above 5000	27.7 lakh + 500/ha. for area above 5000 ha.	1,29,200 + Rs.10/ha. for above 5000 ha.

The manmade open waters, the reservoirs offer great potential for fisheries development. These form one of the most important untapped fisheries resources. Their area is bound to increase with commissioning of new projects over time. A production of 50-100 kg/ha/year can easily be realised from large and medium reservoirs by adoption of scientific management practices. The small reservoirs have the potential to yield 200 – 300 kg/ha/year. The fisheries development of

reservoirs requires proper documentation of area under reservoirs, assessment of their production potential, introduction of improved technology and strengthening the infra-structural, institutional support and HRD programmes. This may lead to improvement in the socio-economic status of the poor reservoir fisher folk.

A study was carried out on Economics and marketing of fish farming considering the data for the year 1991 to 2004. The study had highlighted the detailed benefit cost analysis on fisheries on dams and Tank in Krishna basin in Maharashtra for three regions. The central region as it is similar in nature of the project area is considered for computing the benefit for pisciculture.

The central part of the region is physiographical plain and drains river Krishna and their tributaries. The water bodies and village tanks are distributed on a lease period for the fish farming by fishery department only to the fishing co-operative society. The Economics of the fish farming in the central part of the region is given in **Table 13.5** under.

Table 13.5
Upper Krishna Basin: Average Cost of Production and Returns per Hectare from Dams and Tank Area in Central Part

Sl.no	Cost of components	Expenditure (Rs)
	Cost of production	
1	Cost of Lease, Contract	380
2	Cost of Fish Seeds Including Transportation Charges	2000
3	Cost of Fertilizers Including Organic and Inorganic with Food Material	2500
4	Transportation Charges for Marketing of the Products	500
5	Cost of harvesting including Diesel, Packing and Maintenance of Tools etc.	775
	Grand total	6155
	Cost benefit ratio	

1	Total Production of major Carps In Rupees 350 x @Rs. 50	17500
2	Probable Price Fluctuation (About 10 %)	1750
3	Share of Co- operative Fishing Society (About 5 %)	875
4	Net Returns (Output) (1-2+3)	14875
5	Total Cost of Production Expended (Input) From Table -A	6155
6	Net Profit (4-5)	8720

Source: shodhganga.inflibnet.ac.in/bitstream/10603/7143/11/11_chapter_5.pdf .

The net profit of fish farming is found to be Rs 8720 per ha with the price level of 2005-06. Considering the consumer price Index during 2005-06 as 353 and during 2016-17 as 870, the cost in escalation is found to be Rs 21491 per ha. as on 2016-17. Thus, the net profit from the pisciculture after accounting the cost escalation at 8 % during the year 2017-18, the profit will be Rs 23210 per ha. In absence of DSL of the enroute reservoirs made available by Govt. of Maharashtra, the utilisable submergence area for pisciculture is taken as 70 % is 13870 ha. i.e. 70% of 19818 ha and the corresponding net profit will be Rs 3219 lakh.

13.2.2.5 Animal husbandry

On introduction of irrigation in the command area, the availability of fodder crops would increase substantially. Also, the agricultural industry shall get boost due to increase in agricultural produce. There is scope for additional revenue for dairy development and poultry. It is considered that mini dairy units can be established by the farmers in addition to farming to generate additional revenue. The mini dairy units can be sustained with 2 ha of irrigated land to feed 3 nos. of cows. It is presumed that about 20% of farmers who hold 2 ha and above can opt for mini dairy farm. The details of the revenue likely to be generated by one Mini dairy farm is shown in **Annexure: 13.7**. The benefits likely to be accrued due to establishment of mini dairy farms is Rs. 56135 lakh at 2016-17 price level. However, since augmentation of income of the farmers from animal husbandry as a result of introduction of irrigation is difficult to estimate, this benefit is not considered for evaluating the economic viability of the link project as per the guidelines for preparation of DPR of irrigation and multipurpose projects-2010.

13.2.2.6 Revenue from Hydro-power

There are no power houses proposed to generate the hydropower.

13.2.2.7 Navigation

Navigation facilities are not envisaged in link project.

13.2.2.8 Canal bank plantation

The length of canal after accounting the cross drainage and cross masonry structures and tunnel will be about 405.05 km. Canal plantations can be resorted along the canal banks, side slopes of road and spoil and within canal right of way. Assuming about 30 m wide strip of land is available for plantation along the canal, the area likely to be available is 1220 ha. Similarly, the borrow area to be acquired to a tune of 2167 ha for the project will be also be used for plantation. It is proposed to opt for different types of tree species in the following order of priority:

Preference for tree species in the order of priority:

- Fruits and nuts
- Round wood species and plywood
- Non-timber forest products and oil seeds
- Paper and pulpwood
- Forage and fuel wood

The above preference is based on current profitability and is subject to availability of good soil, assured soil moisture and easy availability of inputs. The priority may change for different sites, based on adaptability of the species to local agro-climatic conditions, infrastructure for backward and forward integration, investment capabilities, etc. While calculating the profitability of different tree species, it is necessary to take their entire life cycle and convert into annual returns. For instance, teak and many timber trees mature after 60-100 years, while the round timber species are ready for harvest at the age of 15 to 30 years. Pulpwood will be ready in 4-6 years and fuelwood can be harvested in 2-5 years. In case of fruit trees, tamarind has a productive life of over 80 years,

while mango and cashew have a productive life of 40-50 years. However, fruit trees start generating income from an early age and contribute to profit every year. In case of timber species, income is generated after a long gestation and only when trees are cut. The net annual income likely to be available from various species is given in **Table 13.6** below:

Table 13.6
Analysis of Income (in Rs.) from different Species

Sl.no	Common Name	Duration	No. of trees/ Ha	Net/Tree/ Year	Net/ha/ year
1	Sesbania	2	5000	4.80	24000
2	Chinaberry	9.	974	24350	2500
3	Subabul	9	2500	13.88	34575
4	Eucalyptus	9	2500	9.24	23100
5	Bamboo	10	625	23.33	14581
6	Portia	10	625	83.93	52456
7	Teak	20	625	80.00	50000
8	Neem	75	200	50.00	10000 *
9	Drumstick	10	400	124.00	49600 *
10	Custard apple	10	400	29.69	11876 *
11	Jujubee	10	400	48.52	19568 *
12	Mango	50	100	100.00	10000 *
13	Cashew	50	156	125.00	19500 *
14	Tamarind	50	45	463.00	20835 *

* Income from wood not included According to prices of 1989-90

Source: Commissioned Paper. 2010. Western Ghats Ecology Expert Panel (WGEEP). Constituted by the Ministry of Environment and Forests, Government of India, New Delhi. www.westernghatsindia.org

It is proposed to rise Sesbania, Subabul and Eucalyptus in the borrow area as the area will be in the ditches whereas Tamarind, neem, cashew and Mango tress along the canal. The annual income to be generated from various species of trees under the link project is given in **Table 13.7**.

Considering the consumer price Index during 1989-90 as 140 and during 2016-17 as 870, the cost in escalation is found to be Rs 4545 lakh per annum as on 2016-17. Thus, the net profit from the canal plantation after accounting the cost escalation at 8 % during the year 2017-18, the profit will be Rs 4866 lakh per annum.

Table 13.7
Annual income generated under link canal

Sl.no	Common Name	Area in ha	Net/Tree/Year	Net/ha/year	Annual Income (Rs in lakh)
1	Sesbania	400	4.8	24000	96
2	Subabul	600	13.88	34575	207
3	Eucalyptus	767	9.24	23100	177
4	Bamboo	400	23.33	14581	58
5	Neem	400	50	10000	40
6	Mango	200	100	10000	20
7	Cashew	200	125	19500	39
8	Tamarind	420	463	20835	88
	Total				725

13.2.2.9 Other Sources: Tourism

Tourism activities will also increase in the project area due to formation of water bodies. The benefits from these activities have not been quantified. As such, the likely benefits have not been considered in the benefit-cost analysis of the project.

13.2.3 Concession in Water Rates (Irrigation), Cargo and Passenger Rates, etc.

The water is precious commodity and is diverted from long distance. Hence, it should be used judiciously. In order to curb the wastage of water, no concession of the rates in the project command is considered.

13.2.4 Administrative Charges for Supply of Water and Collection of Revenues etc.

Suitable provision has been made for running and maintenance of the canals, which include administrative charges for supply of water.

13.2.5 If the Area to be Irrigated is Prone to Scarcity, the Expenditure Normally Incurred to Redress the Scarcity

The main aim of the link project is to provide irrigation in the water short Tapi basin and Godavari basin at high altitude en-route of the link canal which needed assured water supply.

13.2.6 Year in which Revenue Would Start Accruing from Various Sources Counting from First Year of Construction

The construction of project is scheduled to be completed in 5 years. The irrigation development in all the commands is also expected to be completed by then. Revenue from irrigation is expected to start accruing in full from beginning of 6th year i.e. after completion of the project.

13.2.7 Total Income from Various Sources

The total revenue from various sources will be Rs. 11800 crore. The details are furnished in **Table 13.8** below.

Table 13.8
Revenue Generation from Link Project

Source of Revenue from	Revenue (Rs. in lakh)
	Domestic water supply 32 Mm ³ + Industrial water supply 397 Mm ³
Agricultural produce	213381
Water charges (Irrigation service fee)	5569
Domestic water supply	112
Industrial water supply	952800
Pisciculture and lease amount	3230

Canal plantation	4866
Tourism	0
Total	1179958
Say	11800 crore

13.2.8 Details of Staff Proposed for Collection of Revenues and its Basis

The revenue will be collected by the District / Tehsil administration through their existing system / staff. Hence, no provision has been made.

13.2.9 Net Revenue Expected from Different Components of Project

The total net amount of income / benefit from various sources is estimated to be Rs 1179958 lakh considering domestic water supply of 32Mm³ and industrial water supply of 397 Mm³ as being proposed by NWDA.

13.3 Annual Cost:

It is the recurring cost incurred to cover the interest on capital cost, maintenance of project, depreciation of project and power cost to lift the water. The details are shown in **Table 13.9** below:

Table 13.9
Annual cost of the link project

Sl.no	Component	Apportioned cost of component (Rs in lakh)	Annual cost (Rs in lakh)
1	Interest on Capital @ 10 % (Estimated total Cost of the project including cost of land development)	5375198	537520
2	Depreciation of the project		
	Head works @1% (100 years)	2383348	23833
	Canal		
	Civil works @ 1 % (100 years)	2249677	22497

	Pipeline/rising main @ 2.78% (36 years in conjunction with electrical and Mechanical equipment)	425759	11836
	Electrical and Mech equipments @ 8.33% (12 years)	277679	23131
3	Power Charges at Rs 1.80 per unit for 851.3 MU		15323
4	Annual operation and maintenance charges for head works @ 1 %		23833
5	Annual operation and maintenance charges at Rs. 1500/- per ha. For 371277 ha		5569
6	Annual operation and maintenance cost of pump houses @ 5% cost of E & M works		13884
	Total annual cost (1 to 6)		677426
	Say		6774 crore

13.4 Benefit-Cost ratio

Annual benefit from the link project has been worked out considering 32 Mm³ of domestic water supply as per NWDA norms and 397 Mm³ of industrial water supply. The annual cost of the project will be Rs. 677426 lakh, whereas the total annual benefit of the project will be Rs 1179958 lakh. The B.C. ratio for the link project has been worked out as 1.74. The details are furnished in **Annexure 13.8**.

13.5 Internal rate of return (IRR)

The internal rate of return is that rate of discount at which the net present value of the project is equal to the net present benefit. For working out the IRR, the capital cost of the project has been distributed over 5 years as yearly cost. The cost of replacing the electrical and mechanical equipments, and the pipeline & rising mains have been accounted at interval of 12 years and 36 respectively. The annual maintenance cost of head works, canal and command area has been taken from 3rd year onwards. The full annual benefits will accrue from 3rd year partly

and full from 6th year onwards. The internal rate of return is found to be 9.5 % considering the domestic water supply of 32 Mm³ and industrial water supply of 397 Mm³. The details are furnished in **Annexure 13.9**.

13.6 Benefit-Cost Ratio for Flood Control Component of Projects:

No cushion in the reservoir storage is provided exclusively for flood control. Hence, no Benefit-Cost Ratio for flood control component of the project is worked out.

13.7 Benefits other than those considered in the Benefit- Cost Ratio and Internal Rate of Return:

Benefits from Irrigation, Domestic & Industrial water supply, Canal Plantation and Fisheries have been considered for assessing the Benefit-Cost ratio. The project will go a long way by enhancing the socio-economic status of the people of that area. It would provide the impetus to industrialization and overall economic development of the region. In addition to above benefits, lot of employment will be generated during construction period which will enhance the socio-economic conditions of the people living in the nearby area. So many new secondary and tertiary economic activities will be generated in that region due to coming up of this project, which will lead to overall development of that area.

In addition to this, following recreational facilities will be available on completion of the project.

- Parks/gardens in downstream of dams.
- Children parks in the township.
- Tourist spots with boating facilities.
- Guest house, inspection bungalow and dormitory accommodation.

These facilities will ensure tourism development in the area. The water-fall located just downstream of the dam site may further enhance the tourism potential.