

Chapter 13

Cost Estimate, Benefit Cost Ratio and Financial Aspects

13.0 General

The Cauvery (Kattalai) - Vaigai - Gundar link project envisages construction of the following components at DPR stage:

- i) A proposed 256.82 km long canal of bed width of 21.5 m with FSD of 5.5 m at offtake and bed width of 7.5 m with FSD of 3.0 m at tail end.
- ii) Tunnels at 4 locations viz. at RD 82.3 km (3.97 km), RD 104.2 km (6.1 km), RD148.1 km (3.65 km) and RD156.2 km (2.0 km) to negotiate continuous deep cut reaches.
- iii) 25 direct sluices and 12 branch canals along the main canal for catering enroute irrigation.
- iv) 464 nos. of Cross drainage / Cross masonry works including cross regulators, canal escapes, branch canal regulators, road/ railway bridges.
- v) Command area development which includes the water supply for irrigation, domestic and industrial purposes to an extent of 448340 ha

The erstwhile 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 the estimate of the link project.

The quantities of materials and works involved in the various components have been worked out based on the engineering drawings. The Standard Schedule of Rates (SSR) 2019-20 of Public Works Department which includes the Water Resources Department, Govt. of Tamil Nadu applicable from 17-6-2019 onwards have been used. The necessary lead, lift and material loading and unloading charges wherever applicable are added suitably. The rates for the items relevant to irrigation component are not found in the Standard Schedule of Rates (SSR) as such the relevant rates for irrigation were considered in the estimate and for remaining items the rate

analysis was carried out. The rate analysis was carried out by considering the available material cost, labour rate and hire charges for machinery from the SSR of Tamil Nadu and for the rates which are not available, the same is taken from the Schedule of rates of adjacent state of Andhra Pradesh. The items considered for cost estimation and rate analysis are shown in **Appendix 13.1**. In respect of cross drainage works and cross masonry works, the cost was computed based on the cost curves prepared for the similar type of link project namely Godavari (Inchampalli/ Janampet) – Cauvery (Grand Anicut) link project during 2018-19 with suitable cost escalation factor.

13.1 Classification of Units

The various components of Cauvery (Kattalai) - Vaigai - Gundar link project has been broadly grouped into the following units for the purpose of cost estimation.

Unit - I: Head works: Includes the cost of construction of head regulator in the foreshore of Kattalai barrage.

Unit - II: Canals: Includes the cost of main canal, canal structures, tunnels, regulators which include cross regulators, canal escapes, branch canal regulators and 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 are proposed in the command area. Water will be supplied through main canals and various branch canals/direct sluices, whose cost is considered under Unit-II. 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 new command area, extension of new command area through the existing tanks and modernisation of existing tanks which are fed by the branch canals. This cost is included in the cost of Unit II- Canal and its sub-heads with piped distribution for U - Distributaries, V - Water courses and field channels and W – Drainage.

The Abstract of cost of the link project is given below.

| Sl. No. | Unit | Amount (Rs lakh) |
|---------|--|----------------------|
| 1 | I - Head works | 2077 |
| 2 | II - Canals | 808905 |
| 3 | III - Hydro power | 0 |
| 4 | IV - Navigation | 0 |
| 5 | V - Water supply for domestic and industrial needs | 0 |
| 6 | VI - Command area development | 16734 |
| | Total | 827716 |
| | Say | 8277.16 crore |

Thus, the total cost of the link project works out to be **Rs. 8277 crore** at 2019-20 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 head regulator.

The sub-head wise details are given below.

13.1.1.1 A. Direct Charges

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. 19 lakh**

Provision under this sub- head has been kept to cover the actual expenditure incurred on topographical surveys and preparation of drawings and preparation of report.

Lump-sum provision @ 1.0% of I-Works has been considered under this sub-head. The details are given at **Annexure: 13.1.**

B- Land: **Rs. 0 lakh**

The land to be used for head works falls within the submergence area of barrage and also within the canal right of way of proposed link canal. Hence no separate provision is kept. The details are given at **Annexure: 13.1.**

C- Works: **Rs. 1861 lakh**

Under this sub-head the provisions have been made to cover the cost of head regulator and approach channel to head regulator. The cost of head regulator is computed from the cost curve of head regulator developed for Wainganga – Nalganga link project on proportionate discharge basis. As the offtake is located in the foreshore, an approach channel is also considered to draw water in the lean season for which a lump- sum provision of Rs 200.0 lakh is kept. The details are given at **Annexures: 13.1.**

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

Provision has been made under this sub-head for construction of temporary and permanent buildings for both residential and non-residential buildings and hostel accommodation for various categories of staff and offices, inspection bungalows, circuit houses, workshops, stores, sheds as well as other service buildings like hospitals, schools, police stations, post offices and welfare centres etc. As the cost of head works is very marginal these facilities can be met from the cost estimate for Unit-II canal. As such,

separate provision is not kept. The details under this sub-head are given at **Annexure: 13.1**

M- Plantation:

Rs. 0 lakh

Under this sub- head, cost of proposed plantation in the colony areas, parks downstream of head regulators, proposed dams and along the approach roads have been considered. It is proposed to raise fruit bearing trees and the cost of maintenance and watch and ward for plants are per the details furnished in Muzaffarpur model on road side plantation under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Min. of Rural Development, Model estimate published in web site on dated 20-9-2012. The head regulator is proposed at the foreshore barrage and plantation in this area is insignificant, as such separate provision is not kept.

O- Miscellaneous:

Rs. 0 lakh

Under this sub-head, provisions are usually made to cover the cost of the following works.

- i) Capital cost of electrification, water supply, purification and distribution system, sewage disposal, medical and firefighting equipments, furniture and crockery for inspection bungalows and circuit houses, recreation facilities, initial camp equipments for hospital, primary and secondary schools, community centers etc.
- ii) Running and Maintenance of above equipments / infrastructural facilities etc and inspection vehicles.
- iii) Provision is also made for other miscellaneous items such as inaugural / foundation stone laying ceremony, compensation to work men, visit of VVIPs / VIPs and other dignitaries, documentation of technical records and project history including photographic records, security arrangements for dam sites, flood lighting, data processing machines etc.

The cost of head regulator is insignificant and the expenditure under this sub-head can be met from the cost estimate for Unit-II - Canal. As such, separate provision is not kept.

P- Maintenance: Rs. 19 lakh

Provision has 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 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

Under this sub-head necessary provision is usually kept to cover the cost of approach roads to the barrage site, quarry roads, temporary roads in the work area, widening of existing roads in the near vicinity of the project area etc. The cost of these facilities can be met from the cost estimate for Unit-II - Canal. As such, separate provision is not kept.

X- Environment and Ecology: Rs. 0 lakh

Provisions under this sub-head are normally made towards the cost of extensive management measures to sustain environment and ecology such as catchment area treatment, compensatory afforestation, soil erosion control and water conservation measures, reservoirs rim treatment / green belt development, land management plan (stabilization of muck disposal sites etc), restoration of quarry sites, tourism development plan, provision for free fuel to labourers, bio-diversity management plan, restoration and land scalping of project sites, fisheries development plan, ground water management plan, public health management, implementation of Environmental Management Plan and Dam Break Disaster Management Plan etc. In the present case as the impact of environment and ecology due to head regulator is insignificant, no provision is considered.

Y. Losses on Stock and Unforeseen Items: Rs. 5.0 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. **1904.0 lakh.**

II-Establishment: Rs. 152.0 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 excluding B- land. Details are given in **Annexure 13.1.**

III-Ordinary Tools and Plant: Rs. 2.0 lakh

Provision has been made under this head @ 0.10% 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. Details are given in **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 estimated recoveries by way of resale or transfer of temporary buildings, generator sets, electrical installation, telephone lines, water supply fittings and other accessories, miscellaneous receipt like rent charges of buildings are usually accounted for. However, no separate provision has been made as the cost of head regulator is insignificant.

13.1.1.2 B - Indirect Charges Rs. 19 lakh

Provision for abatement of land revenue does not arise as no land acquisition is required for the head regulator. Audit and Account charges are covered under ‘Indirect Charges’ at 1 % of I works.

Total cost of Head works (Unit-I) works out to **Rs. 2077 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
- 4 tunnels
- CD/CM structures
- Command area development

The cost estimation for the main canal has been made as per the design and drawing whereas for the branch canal it is taken on proportionate factor of canal discharge and length with respect to main canal. The cost of CD and CM structures are computed considering the cost curves generated for Godavari (Inchampalli/ Janampet) - Cauvery (Grand Anicut) link project on proportionate basis and applying cost escalation factor @ 8.0 %. The total cost of Unit – II: Canal system is estimated to be Rs. 808905 lakh at 2019-20 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. 14747 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) Consultancy Charges 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 @ 2% of I-Works has been considered under this sub-head.

B- Land: Rs. 80585 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 village wise cost of land value is obtained from the web site of Registration Dept. of Tamil Nadu for different categories of land. The land requirement for the branch canals have been worked out based on the proportionate factors of canal length and discharge with respect to main canal. The cost of land acquisition is found to be Rs. 80585 lakh. The details are shown in **Annexure: 13.2.1 to 13.2.1.1.**

C-Works: Rs. 76829 lakh

Under this sub-head provisions for 4 tunnels and tunnel portals, are considered. The cost of tunnels and tunnel portals are worked out based on Design drawings, quantity estimation and schedule of rates. The abstract cost of tunnels is given in **Annexure: 13.2.2.**

D-Regulator: Rs. 1271 lakh

Under this sub-head, provision for cross regulator at appropriate locations and regulators for branch canals and direct sluices has been made. The cost of regulators is arrived at from the cost curve generated for Godavari (Inchampalli/ Janampet) - Cauvery (Grand Anicut) link project. The details are shown in **Annexure: 13.2.3.**

E-Falls: Rs. 0 lakh

There are no canal falls in the main canal.

F-Cross drainage works: Rs. 29635 lakh

The cross drainage works proposed across the main canal 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 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 similar structures which may come across the branch canals have been worked based on proportionate factors of canal length and discharge with respect to main canal. Details are shown in **Annexure: 13.2.4 to 13.2.7.1 and 13.2.10.**

G-Bridges:

Rs. 18106 lakh

A number of bridges (major and minor) are required to be constructed across the link canal to facilitate crossing of various roads. Necessary provision has been made towards construction of these bridges. The cost of the bridges is computed 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 branch canals have been worked based on the proportionate factors of canal length and discharge with respect to main canal. Details are shown in **Annexure: 13.2.8 & 13.2.10.**

H-Escapes:

Rs. 432 lakh

Under this sub-head provision has been made for canal escapes at suitable locations where drainage facilities exist to take care of the canal discharges 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 **Annexure 13.2.3.**

K- Buildings:

Rs. 36869 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 bungalows, stores, club cum welfare halls, laboratory and research stations etc. Provision of 5 % of I works are considered as stipulated in the guidelines with the ratio of 70 % 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. 159147 lakh**

The detailed earthwork quantity estimates are prepared considering the cross sections taken at 100 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 reusable for embankment, the reusable hard rocks for aggregates purposes are quantified separately. The quantity 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 2019-20. The cost of earth work and lining for the branch canals have been worked out based on the proportionate factors of canal length and discharge with respect to main canal. Details under this sub-head are shown in **Annexure: 13.2.9 to 13.2.9.2 & 13.2.10.**

M- Plantation:**Rs. 5338 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 has been considered. It is proposed to raise fruit bearing trees and the cost of maintenance and watch and ward for plants are considered as per the details furnished in Muzaffarpur model on road side plantation under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Min. of Rural Development, Model estimate dated 20-9-2012 published on web site. The details under this sub-head are given at **Annexure: 13.2.11.**

N- Tanks and reservoirs:**Rs.10000 lakh**

The existing tanks are numerous in the proposed command area. The command area lying in Pudukkottai and Sivaganga districts are mostly covered within old existing tanks. Some of the tanks are getting water from the river through anicut channels and some of the tanks are in series in nature. The new area under irrigation can be covered by extending the tank irrigation to the new command which is more affordable and economical. Thus, the existing tanks are to be modernised and strengthened to store additional water. In the absence of relevant details of storage capacity of tanks, a lump-sum provision of Rs 10000 lakh is kept. The details under this sub-head are given at **Annexure: 13.2.**

O- Miscellaneous: Rs. 1927 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 **Annexure: 13.2.12.**

P- Maintenance: Rs. 6270 lakh

Under this sub-head provision has been made to cover the cost of maintenance of all works during the construction of canal. 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 sub-head as the cost of special Tools and Plant will be borne by the contractors.

R- Communication: Rs. 3657 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 **Annexure 13.2.13.**

U- Distributaries and minors &

V- Water courses and field channels: Rs. 242104 lakh

Under this sub-head, provision has been made for distribution network of open canal system such as distributaries, minors, water courses and field channels to the new command area. The rate assumed in the Revised Interim

Guidelines of Command Area Development and Water Management (CAD&WM) Programme for the XII Plan, dated 17th September, 2015 is taken with suitable cost escalation. The details are shown in **Annexure: 13.2.14.**

W- Drainage: Rs. 40746 lakh

Under this sub-head, provision has been made at the rate of Rs. 8000/- per ha for new command area for field drainage. The above cost is included in the Environment and ecology. Details are given in Annexure **13.2.15.**

X- Environment and ecology: Rs. 8160 lakh

Provisions under this sub-head have been made towards the cost of extensive management measures to sustain environment and ecology such as compensatory afforestation, green belt development, catchment area treatment plan, Public Health Management, Bio diversity plan etc. Detailed Environmental Impact Assessment study will be taken up at a later stage. The details are given in **Annexure 13.2.15.**

Y- Losses on stock and unforeseen: Rs. 1551 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. 737373 lakh.**

II- Establishment: Rs. 65679 lakh

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

III-Ordinary tools and plant: Rs. 2000 lakh

A lump sum 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. The details are given in **Annexure 13.2.**

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. 4756 lakh

Under this head, estimated recovery by way of resale or transfer of temporary buildings, special and ordinary Tools and Plant, generator sets, electrical lines, telephone lines and other accessories is accounted for.

13.1.2.2 B - Indirect Charges: Rs. 8609 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

Total cost of Canals (Unit-II) works out to **Rs. 808905 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 supplies for domestic and industrial needs are proposed in the command area of the project. Water will be supplied through main canals and various branch canals/direct sluice, whose cost is considered under Unit-II: Canal system. 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.

13.1.6 Unit–VI: Command area development**Rs. 16734 lakh**

Provision for expenditure towards command area development such as field channels, OFD works is made. The rates as per the Revised Interim Guidelines of Command Area Development and Water Management (CAD&WM) Programme for the XII Plan, dated 17th September, 2015 have been considered and escalated @8% to 2019-20 to estimate the cost of command area development of the link project as detailed below:

| On farm development | Rate for ha as per CAD&WM | Applied rate for C-V-G link |
|---|--------------------------------------|------------------------------------|
| Survey, Planning and designing of OFD Works | 1000 | 1360 |
| Correction of system deficiencies in systems of capacity up to 4.25 cumec | 1745 | 2372 |
| | | 3732 |
| For CCA of 448340 ha | | 16734 |

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 12: Construction Programme, Manpower Deployment and Plant Planning.**

13.2.2 Sources of revenue

The link project has been planned to create new command area. The following would be the source of revenue from the link project.

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

13.2.2.1 Irrigation benefits.

The link canal will provide irrigation to an area of 448340 ha. For assessing net benefits from irrigation, the estimated value of agriculture produces, inputs, benefits from the pre-project and post project irrigation scenario in the command areas are made available by the State Agriculture Department for Karur and Pudukkottai districts only. The above irrigation benefits have been considered for the remaining area in the absence of details for other districts. The computation of pre-project and post-project irrigation benefits and its abstract are furnished as **Annexure: 13.3.1 & 13.3.2** respectively. The net irrigation benefit on implementation of the link project is found to be Rs 515981 lakh.

13.2.2.2 Water charges (irrigation service fee)

A large infrastructural network is being created for making water available in the proposed command areas for irrigation and water supply purposes and it needs 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 up to some extent. Water charges may be different for irrigation and non-irrigation use.

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, during recent years 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 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.

However, 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 448340 ha and the corresponding water charges (irrigation service fee) will be Rs 6725 lakh.

13.2.2.3 Revenue from drinking and industrial water supply

The rates may be applied on the basis of unit volume of water supplied. The water rates for the rural and municipal towns lying in the command area are not available. The Chennai Metro Water supply and Drainage Board have fixed the water tariff for supply of residential, commercial and industrial uses. The rate is for supply of potable water for residential and commercial whereas it is for supply of raw water for industries.

The domestic water supply to command area is mostly covered by the Grama panchayats. A rate of Rs 2.0 per m³ of water is considered as benefit from the domestic water supply. The domestic water supply to be provided in the command area is 79 Mm³ and the corresponding benefit to be accrued will be Rs. 1580 lakh.

The industrial water supply to command area is mostly covered by the Grama panchayats and rarely with Small Scale Industrial Corporation (SIDCO) area. The water supply to industrial use is regulated one either from the canal directly or from the existing tanks in the command area. A rate of Rs 73 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 139 Mm³ and the corresponding benefit to be accrued will be Rs 101470 lakh.

13.2.2.4 Pisciculture

The link project is proposed to provide water for existing tanks. The manmade open waters, the reservoirs offer great potential for fisheries

development. These form one of the most important untapped fisheries resources.

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 tanks in Krishna basin in Maharashtra under three regions.

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 furnished in **Table 13.1**.

Table 13.1

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 |
| | Net profit | |
| 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 2019-20, the profit will be Rs 23210 per ha. In the absence of DSL of the tanks, the utilisable submergence area for pisciculture is taken as marginally 1000 ha. and the corresponding net profit will be Rs 232 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 3 ha of irrigated land to feed 3 nos. of cows. It is presumed that about 20% of farmers who hold 3 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: 13.4**. The benefits likely to be accrued due to establishment of mini dairy farms is Rs. 42024 Lakh. The animal husbandry being the secondary benefit, is not considered while computing benefit - cost ratio.

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 this link project.

13.2.2.8 Auction of Ferry Service, Inundated Land Lease, Auction for Fruit Bearing Trees along Canals, Lease of Land for Shops in Colony Area, Navigational Permits

Vacant lands on either side of canals may be leased for plantation of fruit bearing trees. Similarly, in project colony areas, land for shops may also be leased. The expenditure for rising the fruit bearing trees in the vacant land on either side of canal and project colony is considered in the project estimate. The benefits from this activity however have not been quantified. As such, the likely benefits have not been considered in the benefit-cost analysis of the project.

13.2.2.9 Canal bank plantation

The length of canal after accounting the CD/CM structures and Tunnels will be 234 km. Canal plantations can be resorted along the canal banks, side slopes of road and spoil and within canal right of way. Assuming about 40 m wide strip of land is available for plantation along the canal, the area likely to be available is 936 ha. Similarly, the borrow area to be acquired to a tune of 298 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:

1. Fruits and nuts
2. Round wood species and plywood
3. Non-timber forest products and oil seeds
4. Paper and pulpwood
5. Forage and fuelwood

The above preference is based on current profitability and 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 various species is given in **Table 13.2**.

Table 13.2
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 | 973 | 2.54 | 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 | 48.67 | 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

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 barrow 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 13.3**.

Table 13.3
Annual income generated from various species of trees

| Sl.No. | Common Name | Area (ha) | Net/Tree/Year | Net/ha/year | Annual Income (Rs lakh) |
|--------|--------------|-------------|---------------|-------------|-------------------------|
| 1 | Sesbania | 400 | 4.80 | 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 | 80 | 10000 | 40 |
| 6 | Mango | 200 | 100 | 10000 | 20 |
| 7 | Cashew | 200 | 125 | 19500 | 39 |
| 8 | Tamarind | 420 | 463 | 20835 | 88 |
| | Total | 3387 | | | 725 |

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 1641 lakh per annum as on 2016-17. Thus, the net profit from the canal bank plantation after accounting the cost escalation at 8 % during the year 2019-20, the profit will be Rs. 2035 lakh per annum.

13.2.2.10 Other sources: Tourism

Tourism activities will also increase in the project area due to formation of canal and filling of existing tanks. 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 a precious commodity and is proposed to be diverted from long distance. Therefore, it should be used judiciously and in order to curb the wastage of water, no concession of the rates in the project commands 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 area along en-route of the link canal which needed assured water supply as it is presently dependant on vagaries of rainfall.

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. 540106 Lakh. The details are furnished in **Table 13.4**.

Table 13.4
Revenue generation from link project

| Source of Revenue from | Revenue (Rs lakh) |
|--|--------------------------|
| Agricultural produce | 428064 |
| Water charges (Irrigation service fee) | 6725 |
| Domestic water supply | 1580 |
| Industrial water supply | 101470 |
| Pisciculture and lease amount | 232 |
| Canal plantation | 2035 |
| Total | 540106 |

13.2.8 Details of staff proposed for collection of revenues and its basis

The revenue will be collected by the District / Taluk administration through their existing system / staff. Hence, no provision for additional staff 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. 540106 Lakh excluding the secondary benefit from animal husbandry.

13.3 Annual costs

It is the recurring cost incurred to cover the interest on capital cost, maintenance of the project and depreciation of the project component. The details are shown in **Table 13.5**.

Table 13.5
Details of Annual Cost

| Sl.No. | Component | Apportioned cost of component (Rs lakh) | Annual cost (Rs lakh) |
|--------|--|---|-----------------------|
| 1 | Interest on Capital @ 10 % (Estimated total cost of the project including cost of land development) | | 82772 |
| 2 | Depreciation of the project for | | |
| | a) Head works @1% (100 years) | 2077 | 21 |
| | b) Canal Civil works @ 1 % (100 years) | 543315 | 5433 |
| | c) Pipe distribution system @ 3% | 265590 | 7968 |
| 3 | Annual operation and maintenance charges for head works @ 1 % | | 21 |
| 4 | Annual operation and maintenance charges at Rs. 1500/- per ha. for 4484340 ha | | 6725 |
| | Total annual costs (1 to 4) | | 102940 |

13.4 Benefit-cost ratio

Annual benefit from the link project has been worked out as Rs. 540106 lakh, excluding secondary benefit from animal husbandry whereas annual cost has been worked out as Rs. 102940 lakh. Thus the B.C. ratio for the link project has been worked out as 5.25. The details are furnished in **Annexure: 13.5**. The benefit cost ratio of the link project is considered in isolation, however, the availability of water for diversion entirely depends upon the upper links and any apportioned cost of the upper links if considered, the benefit cost ratio may reduce to that extent. The project is feasible and techno-economically viable only when surplus water from Godavari, Mahanadi and further north is available for transfer under Phase-II.

13.5 Internal rate of return (IRR)

The IRR 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 annual maintenance cost of head works, canal and canalization and command area has been taken from 3rd year onwards. The annual benefits will accrue from 3rd year partly and full from 6th year onwards. The internal rate of return is found to be 38.18 % which is found to be most attractive, since the cost of the link project is considered in isolation. The details are furnished in **Annexure: 13.6**. As the availability of water for diversion through C-V-G link project entirely depends upon the upper links and any apportioned cost of the upper links if considered, the IRR may reduce to that extent.

13.6 Benefit-cost ratio for flood control component of projects

The head work is barrage as such no cushion for flood control is provided. Hence, in Benefit-Cost Ratio flood control component is not considered.

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

Benefits from Irrigation, water supply, 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 barrage.
- Children parks in the township.
- Tourist spot with boating facilities.
- Guest house, inspection bungalow and dormitory accommodation.

These facilities will ensure tourism development in the area.