

## Chapter - 12

### Cost Estimates, B.C Ratio and Financial Aspects

#### 12.0 General

The Ponnaiyar (Nedungal) - Palar intrastate link project envisages construction of 54.15 km link and 62 numbers CD/CM structures. This chapter has been prepared as per the "Guidelines for Preparation of Detailed Project Report of Irrigation and Multipurpose Projects - 2010" issued by the then Ministry of Water Resources, Government of India. The cost estimate for the project has been prepared based on the quantities worked out from the field survey and designs of the various structures. The rates have been taken from SSR 2017-18 of Government of Tamil Nadu and in absence these rates, Schedule of Rates prepared by Water Resources Department (WRD) / PWD, Govt. of Karnataka pertaining to districts adjoining the link canal, the rate considered in the cost estimate prepared for the road bridge by National Highways Authority of India (NHAI) and the rates considered for the railway bridge near to Jolarpettai by the Southern Railway are adopted. Wherever necessary, the rates have been escalated to the year 2017-18 as per the cost inflation index as notified by the Min. of Finance, Govt. of India.

#### 12.1 Classification of Units

The cost of the project has been worked out under following units:

1. Unit-I: Head works – Existing Nedungal Anicut will be utilized as head work. The proposed head regulator is treated as intake structure and is considered as head work.
2. Unit-II: Canal – Main canal and CD/CM structures.
3. Unit-III: Command Area Development- Additional infrastructure ie drilling/pre drilling of new bore wells for utilisation of groundwater recharge.

**Table 12.1**  
**Cost Estimate of the Project**

**Unit: Rs. in Crore**

Component	Unit-I	Unit-II	Unit-III	Total
	Head works	Canal	Command Area Development	
Ponnaiyar (Nedungal) – Palar link	3.75	627.48	17.00	648.23

Thus, the total cost of the link project works out to be Rs. 648.23 crore at 2017-18 price level which includes provision for Environmental Management Plan (EMP). The details are given in **Annexure 12.1**. The details under various heads are described in the following paragraphs.

## **12.2 Unit-I Head Works**

The Ponnaiyar (Nedungal) - Palar intra-state link canal off-takes from the left bank of existing Nedungal Anicut. The proposed head regulator consists of 5 numbers of vents with a total discharge capacity of 68 cumec. The cost of the head regulator which works out to Rs 374.86 lakh is considered towards the cost of head works under Unit-I. The details are shown at **Annexure 12.2**.

### **12.2.1 A – Direct Charges**

The sub-head wise details applicable under various units are discussed in the following paragraphs.

#### **I-Works**

##### **A – Preliminary**

Provision under this sub-head has been made to cover the actual expenditure incurred on detailed survey and investigation works of headworks, etc. However, for detailed survey and investigations for establishing the final locations of different components of the headworks and its appurtenants at pre-construction stage, a lump sum provision of 2% of I-Works has been made under this sub-head. The provision for preliminary works out to Rs. 6.74 lakh. The details are given in **Annexure 12.2**.

##### **B – Land**

The cost of land to be acquired for the proposed head regulator is nil since it is proposed to be located near the existing head work.

##### **C – Works**

A head regulator is proposed on the left flank of existing Nedungal anicut. An estimate of the head regulator is prepared based on the detailed drawings prepared departmentally. The cost of head regulator at off-take is estimated to be Rs. 311.27 lakh. The details are shown in **Annexure 12.2.1**.

##### **K – Buildings**

The provision under this sub-head has been covered in Unit-II.

### **M – Plantation**

Under this sub-head cost of plantation near the headworks has been provided. A provision of 0.50% of I-Works has been kept under this sub-head which works out to Rs.1.69 lakh as shown in **Annexure 12.2.**

### **O - Miscellaneous**

A provision of 4% of I- Works has been kept under this sub-head which works out to Rs.13.48 lakh as shown in **Annexure 12.2.**

### **P - Maintenance**

Under this sub-head provision has been made to cover the cost of maintenance of headworks during the construction. A provision of 1% cost of I-Works less A-Preliminary, B-Land, M-Plantation, O-Miscellaneous, Q-Special T & P, X-Environment & ecology and Y – Loss on stock has been made. The provision under this sub-head works out to Rs. 3.15 lakh as shown in **Annexure 12.2.**

### **Q - Special Tools & Plants**

Provision under this sub-head has been covered under Unit-II.

### **R – Communications**

Provision under this sub-head has been covered under Unit-II.

### **X - Environment & Ecology**

Provision under this sub-head has been covered under Unit-II.

### **Y - Losses on stocks and unforeseen item**

Provision has been made for losses on stock and unforeseen items @ 0.25% on all sub-heads under I-Works excluding sub-heads A-Preliminary, B-Land, M-Plantation, O-Miscellaneous, P-Maintenance, Q-Special T&P and X-Environment & Ecology. The provision under this sub-head works out to Rs.0.78 lakh. The details are given in **Annexure 12.2.**

### **II-Establishment**

Provision has been made as per norms @ 10% of I-Works excluding B-land towards establishment and pensionary charges which works out to Rs.33.71 lakh. The details are given in **Annexure 12.2.**

### **III-Ordinary T and P**

Provision has been made under this head for ordinary Tools and Plant @ 1% of I-Works. This provision is distinct from the Q-Spl. T and P and is meant to cover the cost of survey instruments, camp equipment and other small tools and plant. Provision under this head works out to Rs. 3.37 lakh. The details are given in **Annexure 12.2.**

### **IV-Suspense**

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**

Under this head, estimated recoveries by way of resale or transfer of temporary buildings, T and P and by resale or transfer of generator sets, electrical lines, telephone lines and other accessories are accounted for, which have been covered under Unit-II. However, a provision of Rs.2.70 lakh has been kept @ 20% of Q- Miscellaneous. The details are given in **Annexure 12.2.**

#### **12.2.2 B - Indirect charges**

Provisions for abatement of land revenue and Audit and account charges are covered under 'Indirect charges' at the following rates.

##### **(i) Audit and account charges**

A total provision of 1% cost of the I-Works has been kept for the audit and accounts charges, which works out to Rs.3.37 lakh.

##### **(ii) Abatement of land revenue**

Provision under this head has been covered under Unit-II.

Thus, the total estimated cost under Unit-I Headworks has been worked out to be Rs. 374.86 lakh.

#### **12.3 Unit-II: Canal**

The total cost of Unit-II canal system is estimated to be Rs.627.48 crore at 2017-18 price level. Details are given in **Annexure 12.3.**

### **12.3.1 A-Direct charges**

The sub-head wise details applicable under various units are discussed in the following paragraphs.

#### **I-Works**

##### **A - Preliminary**

Provision under this sub-head has been made to cover the actual expenditure incurred on detailed survey and investigation works mentioned below for preparation of Detailed Project Report viz.

- Topographical surveys and investigations
- Geological and geotechnical surveys
- Construction material survey
- Vehicle charges for inspection of officers for site investigations
- Survey and camp equipment
- Charges for consultation for various studies
- Actual expenditure on establishment and
- 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 made under this sub-head. The provision for preliminary works out to Rs 1200.67 lakh. The details are given in **Annexure 12.3.1**

##### **B - Land**

Under this sub-head, cost of acquisition of land required for head works, canals and canal structures, borrow areas, compensation for property and standing crops, solatium charges and diversion of communication system etc., have been taken into consideration. The total cost of land acquisition works out to Rs.22751.64 lakh. The details are given in **Annexure 12.3.1.1.**

##### **C – Works**

Already accounted under C-Works in Unit-I.

##### **D - Regulators**

Under this sub-head, provision for regulators/outlets and cross regulators at appropriate locations on main canal, service gates with embedded parts, stop logs and

hoisting arrangements, monorail arrangements, etc., at regulators have been made. Estimates of a typical cross regulator, outfall regulator and outlets are prepared based on the detailed drawings and the costs of other similar structures, arrived based on the estimated cost of the typical structure on proportionate discharge basis. The canal escapes is integrated with cross regulator and also a single lane road bridge is integrated with outfall regulator. The estimated cost works out to Rs. 547.93 lakh, which includes cost of a canal escape and a single lane road bridge. The details are given in **Annexures 12.3.2 to 12.3.5.1.**

#### **F - Cross Drainage Works**

The cross drainage works proposed across the main canal are aqueducts, canal syphons, super passages and under tunnels/elevated trough to facilitate the crossing of rivers/streams. The quantity for various components of structures are estimated based on the design drawings. The cost of the structures is worked out as per the detail designs and drawings prepared departmentally. The total cost of CD works is worked out to be Rs 5930.65 lakh. The details are given in **Annexures 12.3.6 to 12.3.10.1.**

#### **G - Bridges**

A number of bridges (major and minor) are proposed to be constructed along the link canal to facilitate crossing of various roads. Necessary provision has been made towards construction of these bridges. The cost is worked out as per the drawings. The total cost of Bridges including a railway bridge is worked out to be Rs 4921.43 lakh. The details are given in **Annexures 12.3.11 to 12.3.14.1.**

#### **H - Escapes**

Under this sub-head, provision has been made for canal escapes at RD 29.55 km where drainage facilities exist to take care of the discharges in the eventuality of canal breaches. The canal escape is integrated with cross regulator as such no cost is accounted separately. The details are given in **Annexure 12.3.3.**

#### **K - Buildings**

Buildings are required at the time of construction of head regulator and link canal. Provision has been made under this sub-head for construction of temporary and permanent buildings for both residential and non-residential for various categories of staff, offices, inspection bungalow, stores, club-cum-welfare hall, laboratory and Research station etc. A provision of 3.5% and 1.5% of cost of I- Works is provided for temporary and

Permanent Buildings respectively in line with the norms prescribed in the guidelines for preparation of DPR of Irrigation and Multipurpose projects-2010. The provision under this sub-head works out to Rs. 3001.67 lakh which is given in **Annexure 12.3**.

#### **L – Earthwork**

The earthwork quantities involved in cutting based on the type of soil and earthwork required for embankment from borrow areas are separately worked out. The quantities are worked out considering the cross sections taken at 50 m interval along the canal. The link canal is proposed to be unlined, however at selected places like cross regulators and vulnerable places, lining is proposed for certain length in U/S and D/S of the structures. The lining cost is included in the cost of estimate of respective structure. The total cost under this sub-head works out to Rs 15061.18 lakh. The details under this sub-head are given in **Annexures 12.3.15 and 12.3.15.1**.

The diversion of water to Palar is routed through the Godd Ar. It was found that the carrying capacity of the river at certain reaches is not adequate and it requires widening of the river course. Hence, a lump sum amount of Rs 1000 lakh is earmarked for widening of the river and any improvement in the existing structures in those reaches.

#### **M - Plantation**

Under this sub-head, cost of plantation in the colony areas and along the main canal on both sides has been provided. The total cost under this head works out to Rs.23.67 lakh. The details are given in **Annexure 12.3.16**.

#### **O - Miscellaneous**

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 and M of above equipments/infrastructural facilities etc.
- R and M of inspection vehicles, inspection bungalow etc.
- Salary for the work charged employee 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., both for construction of head regulator and canal. The total cost under this head works out Rs.2024.23 lakh. The details are given in **Annexure 12.3.17**.

### **P - Maintenance**

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 T & P, X-Environment & ecology and Y – Loss on stock has been made. The provision under this head works out to Rs.302.15 lakh. The details are given in **Annexure 12.3**.

### **Q - Special tools and plants**

The provision under the sub-head Q-Special Tools & Plants has been made at 25% of capital cost of major construction equipment and 50% of General purpose equipment. Full capital cost of inspection/transportation vehicles has been added to the above cost to arrive the total cost chargeable under this sub-head. The recoveries on account of resale value of Q-Special T&P is considered at 75% of provision kept under major construction equipment and at 50% of provision kept under General purpose equipment and 20% of the cost of inspection/transport equipment chargeable to Q-Special T&P. The total provision under this sub-head works out to Rs. 3243 lakh. The total recoveries to be made works out to Rs. 2391 lakh. Details are given at **Annexure 12.3.18** and **12.3**.

### **R - Communication**

Under this sub-head provision of 0.75% of I-Works has been kept for construction of temporary roads and remodelling of existing roads for approach to canal and regulatory system, quarry sites and other working areas, both for construction of head regulator and canal. The provision under this head works out to Rs.450.25 lakh. The details are given in **Annexure 12.3**.

### **U - Tributaries and Minors**

No provision is made under this sub-head as no new command area is proposed under the project.

### **V - Water Courses and Field Channels**

No provision is made under this sub-head as no new command area is proposed under the project.



## **W - Drainage**

No provision is made under this sub-head as no new command area is proposed under the project.

## **X - Environment and Ecology**

This sub-head includes provision for extensive management measures to sustain environment and ecology such as land management plan (stabilization of muck disposal management), measures to arrest transportation of silt across basins, provision for free fuel to department engaged labourer, Public Health management and Environmental Management Plan (EMP). A provision of Rs.500.00 lakh has been kept in estimate under this sub-head. The details are given in **Annexure 12.3.19**.

## **Y - Losses on Stock and Unforeseen**

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, M-Plantation, O-Miscellaneous, P-Maintenance, Q-Special T & P and X-Environment & Ecology. The provision under this sub-head works out to Rs. 74.97 lakh. The details are given in **Annexure 12.3**.

## **II-Establishment**

Provision has been made as per norms @ 10% of I-Works excluding B- land towards establishment and pensionary charges. The provision under this head works out to Rs. 3728.18 lakh. The details are given in **Annexure 12.3**.

## **III- Ordinary T and P**

Provision has been made under this head for ordinary Tools and Plant @ 1% of I-Works. This provision is distinct from the Q-Spl. T and P and is meant to cover the cost of survey instruments, camp equipment and other small tools and plant. The provision under the head works out to Rs. 600.33 lakh. The details are given in **Annexure 12.3**.

## **IV- Suspense**

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**

Under these head, estimated recoveries by way of resale or transfer of temporary buildings, resale or transfer of generator sets, electrical lines, telephone lines and other accessories and Resale value of Q- Special T & P are accounted for which works out to Rs. 3111.03 lakh. The details are given in **Annexure 12.3**.

### **12.3.2 B - Indirect Charges**

Provisions for abatement of land revenue and Audit and account charges are covered under 'Indirect charges' at the following rates.

#### **(i) Audit and Account Charges**

A total provision of 1% cost of the I-Works which works out to Rs. 600.33 lakh has been kept for the audit and accounts charges.

#### **(ii) Abatement of Land Revenue**

A total provision @ 5% cost of B-land (cultivable area) amounting to Rs.896.60 lakh for abatement of land revenue have been made under this sub-head.

The total estimated costs under Unit-II-Canal have been worked out to be Rs. 62747.86 lakh.

### **12.4 Unit-III: Command Area Development**

The link project is proposed to deliver about 86 Mm<sup>3</sup> of water at Palar river for groundwater recharging. It is presumed that 50% of the groundwater recharged will be utilised by the existing dug/bore wells. Remaining groundwater recharge is available for further utilization for which additional infrastructures are to be developed. Assuming each bore well can cater about 2 ha, the no. of bore holes required are 1995 and the cost for each bore hole is worked out to Rs.85200. Thus the total cost of additional infrastructure is found to be Rs 1700 lakhs. The detail of computation of cost is shown in **Annexure 12.4**.

### **12.5 Total Cost of the Project**

The total estimated cost of link project works out to Rs.648.23 crore at the price level of the year 2017-18 including the cost of Unit-I Head works, Unit-II Canal and Unit-III Command Area Development.

## **12.6 Benefit-Cost Ratio and Internal Rate of Return**

The Ponnaiyar (Nedungal) - Palar intrastate link project will provide stabilization of tank irrigation as well as provide groundwater recharge on its enroute and along Palar river course. The main objective of the project is to stabilise irrigation through recharge of Groundwater in the water short areas of Ponnaiyar and Palar basins which are facing acute water scarcity and alarming depletion of groundwater level. In addition, the link project will also cater the drinking water need of the enroute villages to a tune of 3.882 Mm<sup>3</sup> annually. The cost of link project comprises the cost of main link canal and enroute structures but does not include the cost of existing anicut and command area development.

### **12.6.1 Construction Duration and Benefits**

The link canal project is proposed to be completed in 4 years. The excavation of canal will be started in 2<sup>nd</sup> year and completed in 4<sup>th</sup> year. The execution of CD/CM structures are also taken up simultaneously in 2<sup>nd</sup> year and proposed to be completed in 4<sup>th</sup> year. The project envisages diversion of flood waters of Ponnaiyar river at existing Krishnagiri dam to stabilise the existing tank command area and groundwater irrigated area, as such it is expected that benefits can be started on completion of project in respect of tank irrigation and over a period of time from groundwater irrigation.

### **12.6.2 Direct Benefits**

The link project envisages stabilization of irrigation in the enroute tank command area and additional groundwater recharge in Ponnaiyar and Palar basin D/S of link alignment. The recharge of groundwater artificially controls the depletion of groundwater levels, obviating the replacement of high head pumping machinery, sustained abstraction of groundwater ensuring long term irrigation with increase in agricultural area and economic cropping pattern, minimization of frequency of re drilling of tube wells over time, changes in the energy consumption scenario due to rise/stabilisation of water levels and restoration of well irrigation in areas where wells become dry.

The groundwater level observed during the year 2005 to 2013 varied from 6.08 m to 10.46 m for Vellore district and from 6.47 m to 12.05 m for Dharmapuri district (includes Krishnagiri district). Also at taluka level, the water level has gone as deep as to about 26.50 m at Tirupattur taluka of Vellore district during pre-monsoon of 2005. This

indicates that the groundwater recharge fluctuation is very high. The details are shown at **Annexure 12.5**.

The release of water in river courses is expected to raise the groundwater levels. For the present study, it is presumed that the rise in groundwater level may be about 10 m parallel to the river course. It is considered that the groundwater irrigated area through dug/bore wells will be replenished due to rise in the groundwater table.

### **12.6.3 Irrigation Benefits**

It is seen from the earlier chapters that the link canal benefits 9850 ha stabilization of Tanks and groundwater irrigation. For assessing net benefits from irrigation the estimated value of agriculture produce, inputs, benefit from the pre-project and post project irrigation scenario in the command areas has been worked out and furnished in **Annexures 12.6 to 12.9** respectively. The net annual benefit due to irrigation is worked out to Rs.140.00 crore.

### **12.6.4 Domestic Water**

The link project will supply about 3.882 Mm<sup>3</sup> of water as domestic purpose to enroute villages. However, the benefit that may accrue from the domestic water supply has not been accounted as is treated as social welfare measures.

### **12.6.5 Indirect Benefits**

In addition to the direct benefit of irrigation, the project will provide additional indirect benefits on account of development of agro based industries bringing economic prosperity and employment opportunities to the people of the region. The project activities will lead to establishment of intensified infrastructural facility like roads, power and communications. Credit arrangements and extensive services would benefit the entire region. The scarcity of drinking water in these areas can also be mitigated to some extent.

### **12.6.6 Annual Benefit**

The irrigation benefits are the only direct benefits considered for assessment of Benefit-Cost ratio. The annual benefits from irrigation have been worked out to be Rs.140.00 crore.

## **12.7 Annual Cost**

### **12.7.1 Energy Cost**

As indicated above, the groundwater level fluctuated between 3.0 m to 26.0 m between 2005 and 2013. It is presumed that groundwater level would stabilize at 30 m at present scenario. The annual cost of energy to lift water for irrigation at pre-project and post-project works out to Rs.1.72 crore and Rs.2.36 crore respectively and the same is considered for benefits under irrigation. The details are shown at **Annexure 12.10**.

### **12.7.2 Depreciation**

The total life of the link canal project is assumed as 50 years. The depreciation of the items is considered as 2%. The depreciation cost for replacement of pumping equipment and pipe has also been considered at Rs.50.1 lakh per annum. The details of depreciation of pumping equipment are shown in **Annexure 12.4**.

### **12.7.3 Other Costs**

It is the recurring cost incurred to cover the interest on capital cost, maintenance of link project. The link project is envisaged to stabilize the tank irrigation to a tune of 1900 ha utilizing 17.215 Mm<sup>3</sup> of water and recharge groundwater to a tune of 57.926 Mm<sup>3</sup> benefitting 7950 ha as stabilization through groundwater annually. Thus, 10% of interest on capital cost, 1% of cost of head works, annual maintenance charges for tank command area at Rs.1175/- per ha will form part of recurring cost. After accounting for the above, the annual cost of the project works out to Rs.78.10 crore. The details are shown at **Annexure 12.11**.

### **12.8 Benefit-Cost Ratio**

Annual benefit from the project from irrigation has been worked out as Rs.140.00 crore, whereas annual cost has been worked out as Rs.78.10 crore. Thus, the B.C. ratio for the link project has been worked out as 1.79. The details are furnished in **Annexure 12.11**.

### **12.9 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 4 years as yearly cost. The annual maintenance cost of head works, canal and canalization and command area has been taken from 5<sup>th</sup> year onwards. The full annual benefits will be started from 5<sup>th</sup> year in respect of tank irrigation and 7<sup>th</sup> year onwards in respect of groundwater. IRR has been worked out as 13.32%. Details are shown in **Annexure 12.12**.

## **12.10 Cost of the Project Extended upto Palar**

Govt. of Tamilnadu had an option to extend the intrastate link canal beyond Godd Ar so as to outfall into Palar rather than routing through Godd Ar. During the Chief Engineers level meeting held between officers of NWDA and PWD of Govt. of Tamil Nadu at Chennai on 11.12.2014 a decision was taken that the cost of extended canal beyond Godd Ar upto Palar may be considered on proportionate length basis from the arrived cost of link canal upto Godd Ar. The extended canal length is 11.45 km.

The Godd Ar river course is found to be narrow at certain reaches which needs to be widened to carry link canal discharge. Thus, the cost of main canal between Ponnaiyar (Nedungal) to Godd Ar includes the cost for widening the Godd Ar also. The cost of main canal upto Godd Ar excluding the widening of Godd Ar is worked out to Rs. 62748 lakh. Considering above cost on proportionate to length of the canal, the main canal cost of Ponnaiyar (Nedungal) to Palar link, having total length of 65.6 km, works out to Rs.76016 lakh. Accounting the cost of head works, the total cost link project works out to Rs.78091 lakh.

## **12.11 Schedule of Rates and Rate Analysis**

The schedules of rates have been taken from DSR – 2017-18 of Government of Tamil Nadu wherever available and in absence the Schedule of Rates prepared by Water Resources Department, Govt. of Karnataka for the year 2016-17 (same is continued for the year 2017-18) pertaining to districts adjoining the link canal. The detailed rate analysis of conveyance of material by road, standard schedule of rate for the year 2017-18 have been given in **Annexure 12.13** and **12.14** respectively. Wherever necessary, the rates have been escalated to the year 2017-18 as per the cost inflation index as notified by the Min. of Finance, Govt. of India. The lead statement, rate analysis and the abstract of rate analysis are furnished in **Annexures 2.15 to 2.17**.