# Chapter 1
# Introduction

## 1.1 General

Water is the most essential natural resource next to air, required for sustaining life on the earth. It is required for drinking and industrial uses, for irrigation to meet the growing food and fiber needs, for power generation, navigation and recreation. The development, use and conservation of water, therefore, play a vital role in the country's development planning. The water resources in the country are, however, limited, considering the future demands.

The rainfall in the country is mostly confined to monsoon season and is unevenly distributed with respect to both space and time. As a result, some parts of the country are affected by frequent droughts and at the same time other parts are affected by floods. Nearly one third of the country is drought prone. In the very near future, water will become a scarce resource due to increasing thrust of population and increasing demands for various uses. Therefore, it need not be emphasised that water should be harnessed in the most scientific and efficient manner.

The monsoon flood waters should be conserved to the maximum extent possible to meet the demands for irrigation, power generation, domestic and other uses. The water availability and requirements in the various river basins need to be assessed realistically. The reasonable basin requirements should be provided for and the surplus water, if any, should be transferred to the needy areas. The National Water Policy adopted by the Government of India emphasizes that "water should be made available to water short areas by transfer from other areas including transfers from one river basin to another, based on a national perspective after taking into account the requirements of the areas or basins".

## 1.2 National Perspective Plan for Water Resources Development

The erstwhile Union Ministry of Irrigation (now Ministry of Water Resources) and the Central Water Commission in the year 1980 formulated the National Perspectives for Water Resources Development, which comprises two main components, viz. Himalayan Rivers

Development and Peninsular Rivers Development. Himalayan Rivers Development envisages construction of storage reservoirs on the main Ganga and the Brahmaputra and their principal tributaries in India and Nepal alongwith inter-linking canal systems to transfer surplus flows of the eastern tributaries of the Ganga to the West apart from linking of the main Brahmaputra with the Ganga. Peninsular Rivers Development of the National Perspectives Plan includes interlinking of major rivers flowing in the Peninsular India including the southern tributaries of Yamuna. The major parts of this components are (i) interlinking of Mahanadi-Godavari-Krishna-Pennar-Cauvery, (ii) interlinking of west flowing rivers, north of Bombay and south of Tapi, (iii) interlinking of Ken with Chambal and (iv) diversion of west flowing rivers. The interlinking of these rivers will envisage construction of storage reservoirs at potential sites and canal systems for transferring the waters from surplus to deficit basins/areas. The canals will also include tunnels and lifts, wherever necessary.

## 1.3 Almatti-Pennar link

The Almatti-Pennar link forms a part of the scheme of transfer of the surplus of Mahanadi and Godavari rivers to the deficit basins of Krishna, Pennar, Cauvery and Vaigai, an important part of the various proposals for inter-basin water transfer proposals under the Peninsular Rivers Development Component of the National Perspective Plan.

The aim of the Krishna (Almatti) – Pennar link project is to divert 1980 $Mm^3$ of water form Krishna for enroute irrigation in Krishna and Pennar basins. An annual irrigation of 258334 ha is envisaged under this link. This water, so transferred form Krishna river, is in exchange of water received from Mahanadi and Godavari rivers to Krishna basin and beyond through the proposed Mahanadi-Godavari-Krishna link projects. Therefore, the Krishna (Almatti) – Pennar link forms one of the component of the proposals to interlink Mahanadi, Godavari, Krishna, Pennar, Cauvery and Vaigai rivers. The project comprises of the following components:

i) The existing storage reservoir at Almatti across the river Krishna with gross storage capacity of 3439.70 $Mm^3$ and live storage capacity of 3104.70 $Mm^3$ at FRL 519. 6 m. This reservoir is part of the ongoing Upper Krishna Project in the State of Karnataka.

ii) A 587.175 km long link canal, which off take from the right bank of Almatti dam with full supply level of 510.000 m. This canal finally outfalls into Maddileru River, a tributary of Pennar River.

iii) A reservoir across river Pennar near Kalvapalli with gross storage capacity of 83 $Mm^3$ and live storage capacity of 73 $Mm^3$ at FRL 475.00 m to serve as a balancing reservoir for the link canal. It is situated in Anantapur district of Andhra Pradesh. This reservoir is proposed at RD 386.4 km of the link canal.

iv) The existing Bukkapatnam tank across the river Chitravati with a live storage capacity of 15.30 $Mm^3$ at FRL 448.07 m. It is situated near Bukkapatnam village of Anantapur district in Andhra Pradesh. The location of this tank is at RD 536.20 km of the link canal.

## 1.4 Description of the Project Area

### 1.4.1 Location of the Project Area and Approach to Various Sites

The Almatti dam is located on Krishna River downstream of the confluence of Ghataprabha and Krishna rivers. It is located near Almatti village of Bagewadi taluk of Bagalkot district in Karnataka State. The Almatti dam site is well connected by both roads and railways. National Highway-13 and South-Central Railway connecting Bijapur and Gadag, passes through the Almatti village.

The alignment of the proposed link canal passes through Raichur and Bellary districts of Karnataka and Anantapur district of Andhra Pradesh. Important towns along the canal alignment are Hospet and Bellary in Karnataka and Anantapur in Andhra Pradesh. The proposed canal alignment is accessible through National Highway-13, railway and other State highways/roads. The head works of this link project lies in the Krishna basin while the canals and the command areas lie in Krishna as well as Pennar basins.

### 1.4.2 Climatic Conditions

The general climatic conditions of Krishna and Pennar basins are discussed briefly in the following paragraphs.

### Krishna Basin

The Western Ghats forms the western boundary of this basin. The area adjacent to the eastern side of Western Ghats experiences moderate rainfall. Even though this part of the basin receives rainfall from both south-west and north-east monsoons, the contribution from the latter is comparatively less. This part of the basin experiences normal annual rainfall in the range of 3048 mm to 1016 mm. Moving east, the basin experiences lesser rainfall in the areas around Sangli, Pune, Ahmadnagar, Bijapur, Chitradurga, Raichur and Kurnool where the annual rainfall is less than 600 mm. However, on moving further east, towards the coastal region, the annual rainfall increases to 900 mm. This basin experiences temperatures ranging from 40.4° C to 15.3° C.

### Pennar Basin

The Pennar basin lies largely in the semi-arid region and hence experiences low rainfall and the contribution is from south-west monsoon. The normal annual rainfall decreases from 988 mm at Nellore in the eastern end of the basin to about 508 mm at the western end. A large part of the basin lying in Kolar and Tumkur districts of Karnataka and Anantapur, Kurnool and Cuddapah districts of Andhra Pradesh receives rainfall less than 762 mm. However, part of Nellore and Cuddapah districts adjacent to the sea-coast receive some rainfall from the north-east monsoon also. This basin experiences temperature ranging from a maximum of 40.3° C to a minimum of 16.6° C.

## 1.4.3 Topography, Physiography and Geology

### Krishna Basin

Krishna basin comprises rolling and undulating country barring a series of ridges and valleys interspersed with low hill ranges along the upper reaches of the river. The Western Ghats are well defined and continuous. The middle range of Krishna basin is a plateau, the greater part of which is lying between elevation 300 m and 600 m above MSL. This plateau is sloping eastwards. Great undulating plains divided from each other by flat-topped ranges of hills are the characteristic features of this Plateau. The hillsides are marked by conspicuous wide terraces except in the southern part of the Plateau, where the hills are frequently crowned with great 'tors' or rounded hummocks of bare rocks due to constant weathering. The basin consists largely of Achaean formations,

parts of which are covered by Deccan trap lavas, Cuddapah and Vindhyan basins and faulted blocks of Gondwanas. The delta region along coastal area is of flat terrain.

### Pennar Basin

Pennar basin is fan shaped and is bounded on the north by Erramala range, on the east by the Nallamala and Velikonda ranges of Eastern Ghats, on the south by the Nandidurg hills and on the west by the narrow ridge separating it from Vedavathi valley of the Krishna basin. There are a number of hills and peaks of varying heights in the Pennar basin. A few notable hill ranges are Nallamala on the eastern side of the basin, Erramala on the north and Paliconda ranges on the south of the basin. The highest hill appears to be Horsely hill, with an altitude of 1314 m. Initial reaches of the basin are of crystalline rocks of Achaean age, Dharwar Super group, Cuddapah group of rocks belonging to Proterozoic age and recent to sub-recent soils and alluvium.

## 1.4.4 Human population

The human population in the Krishna basin was 60.24 millions, of which 42.00 millions was in the rural area and 18.24 millions in the urban area as per the 1991 census. The density of population was 232 persons per $km^2$.

The corresponding human population in the Pennar basin was about 10.59 millions of which 7.58 million was in rural area and 3.01 million in urban area as per census 1991. The density of population in this basin was 192 persons per $km^2$.

## 1.5.5 Water Resources

### (a) Surface Water

Surface water balance studies have been carried out up to Almatti dam site in Krishna basin and up to Somasila dam site (Terminal reservoir in Pennar basin) in Pennar basin. The water balance has been worked out after considering the future upstream demands up to 2050 AD. Details are given in Table 1.1.

**Table 1.1**
**Surface water balance**

| Name of the diversion point | Water balance ($Mm^3$) | |
|---|---|---|
| | At 75% Dependability | At 50% Dependability |
| Krishna basin up to Almatti dam | (+) 5611 | (+) 8247 |
| Pennar basin up to Somasila dam | (-) 3820 | (-) 3590 |

It can be seen that the total surplus water balance available at Almatti at 75% dependability is 5611 $Mm^3$ out of which the proposed diversion is 1980 $Mm^3$. However this diversion is in exchange for the water brought from Mahanadi and Godavari basins to Krishna basin.

### (b) Ground Water

The link canal traverses through Bijapur, Bellary and Raichur districts of Karnataka and Anantapur district of Andhra Pradesh. The ground water particulars of the districts through which the link canal traverses are given in Table 1.2.

**Table 1.2**
**Ground water particulars**

| State/ District | Utilizable groundwater $Mm^3$/ year | Net draft $Mm^3$/Year | Balance $Mm^3$/ year | Level of Ground water development (%) |
|---|---|---|---|---|
| **Karnataka** | | | | |
| Bijapur | 970.0 | 422.0 | 548.0 | 44 |
| Bellary | 596.0 | 145.0 | 451.0 | 24 |
| Raichur | 910.9 | 133.0 | 777.9 | 15 |
| **Andhra Pradesh** | | | | |
| Anantapur | 1061.6 | 391.2 | 670.4 | 37 |

*Source: Ground Water Resources of India 1995, by Central Ground Water Board.*

### 1.5.6 Soils

The proposed link canal lies in Krishna and Pennar basins. The soil in the catchment of Krishna basin can be broadly classified into ten main groups (1) Deep black soil, (2) Medium black soil, (3) Coarse shallow

soil, (4) Mixed red and black soil, (5) Red earth, (6) Red loamy soil, (7) Red sandy soil, (8) Reddish brown soil, (9) Lateritic soil and (10) Forest loam soil.

The classifications of soil types in Pennar basin are (1) Black soil, (2) Red soil, (3) Lateritic soil and (4) Forest loam soil.

## 1.6 Fitment of the Scheme in the Overall Development of the Region

Under this proposal no separate head-works are proposed across Krishna River. The ongoing Almatti dam is planned to be utilized for conservation and diversion of water for irrigation. Hence, the existing or proposed system of planning would not be affected and the proposed scheme could be easily fitted to the present environment. The quantum of water so proposed for diversion is a part of the surplus water available at Almatti dam and hence this proposal would not have any influence in the other project proposals in the Krishna basin.

The command area of the proposed link project is located in the drought prone areas of Raichur and Bellary districts of Karnataka and Anantapur district of Andhra Pradesh. There is no alternative source of water supply to meet the demand of this area. The area lying downstream of Srisailam dam, which is a major project located downstream of Almatti dam, is well served by various projects. As the proposed utilization is through exchange of water, the area lying downstream of Almatti dam would not be affected by the proposed diversion of water from Almatti reservoir. The proposed command area is in the vicinity of the command area of schemes like Upper Krishna Project, Tungabhadra dam and hence integration of the present proposal with other schemes is possible.

This link canal is proposed to irrigate 146299 ha in Krishna basin and 112035 ha in Pennar basin annually, in the drought prone areas in Karnataka and Andhra Pradesh. This development would surely be a welcome proposition and is expected to aid industrial growth as well. Fitting this scheme in the overall development of these river basins and inter basin net work is quite affirmative.

## 1.7 Inter-state Aspects

The only inter-state aspect involved in this link project is regarding sharing of water of Krishna basin. The provisions under the Krishna

Water Dispute Tribunal are elaborated in Chapter on "Interstate Aspects". No water of Krishna river is proposed for diversion through this link and instead, only 1980 $Mm^3$ of water out of 19128 $Mm^3$ released to Krishna river through the preceding links is proposed to be further diverted for irrigation. This diversion is therefore planned as an exchange to the water so received downstream.

## 1.8 Cost and Benefits of the Scheme

The total cost of the link project works out to about 6600 crores. The total cost of head works, canal system and powerhouse are estimated as Rs. 52.43 crores, Rs. 6519.51 crores and Rs 27.86 crores, respectively. The cost estimates are based on 2003-04 price level. The B.C. ratio of the project works out to 1.20.