

Chapter 2

Physical Features

2.1 Geographical Disposition

The Godavari (Inchampalli) – Krishna (Nagarjunasagar) link canal takes-off from the foreshore of the proposed Inchampalli reservoir. The canal runs in dense forests and in naxal affected areas in the head reaches upto 78 km. The remaining length of the canal runs in agricultural and patta lands. The link canal runs for most of its length in southwest direction from Inchamapalli reservoir to Nagarjunasagar reservoir. It negotiates the ridge between the Godavari and the Krishna basins through a tunnel of 9.15 km length. Total length of the link canal from Inchamapalli to its outfall at Nagarjunasagar is 299.25 km. The canal passes through Mahadevpur, Mutharam Mandals of Karimnagar district and Bhupalpalli, Venkatapuram, Regonda, Shayampet, Duggondi, Narasmpet, Chennaraopet, Nekkonda, Kesamudram, Nellikudur, Dhantalapalli Mandals of Warangal district and Nutankal, Jajireddigudam, Suryapet, Ketipalli, Nakrekal, Tiparthy, Nidmanoor, Anumula and Peddavoora Mandals of Nalgonda district.

2.2 Topography of the Basins and Command Area

The link canal project including its command area falls in the basins of the Godavari and the Krishna. The topography of these basins is described briefly in the following sections:

2.2.1 Godavari Basin

The Godavari basin extends over an area of 312813 km² which is nearly 10% of the total geographical area of the country. The basin comprises areas in the states of Maharashtra, Madhya Pradesh, Chhattisgarh, Andhra Pradesh, Karnataka and Orissa.

The Godavari basin is bounded on the North by the Satmala Hills, the Ajanta Range and the Mahadeo Hills, on the South and East by the Eastern Ghats and on the West by the Western Ghats. It is roughly triangular in shape and the main river itself runs practically along the base of the triangle.

Except for the hills forming the watershed around the basin, the entire drainage basin of the river Godavari comprises of undulating country, a series of ridges and valleys interspersed with low hill ranges. Large flat areas which are characteristic of the Indo-Gangetic plains are scarce except in the delta. The Sahyadri range of Western Ghats forms the Western edge of the basin. The interior of the basin is a plateau divided into a series of valleys sloping generally towards the East. The Eastern Ghats, which form the Eastern boundary, are not so well defined as the Sahyadri range on the West. The Northern boundary of the basin comprises of tablelands with varying elevation. Large stretches of plains interspersed by hill ranges lie to the South.

The river Godavari is the second largest in the country and the largest in Southern India. It rises in the Sahyadri hills at an altitude of about 1067 m near Triambakeswar in the Nasik district of Maharashtra state and flows across the Deccan plateau from the Western Ghats to Eastern Ghats. Rising in the Western Ghats about 80 km from the shore of the Arabian sea, it flows for a total length of about 1465 km in a general south-eastern direction through the states of Maharashtra and Andhra Pradesh before joining the Bay of Bengal at about 97 km south of Rajahmundry in Andhra Pradesh.

The major tributaries joining the Godavari are the Pravara, the Purna, the Manjra, the Maner, the Pranhita, the Penganga, the Wardha, the Wainganga, the Indravati and the Sabari.

2.2.2 Command Area

The Godavari (Inchampalli) – Krishna (Nagarjunasagar) link canal proposes to divert a part of the surplus water from the river Godavari for the benefit of command areas in the Warangal plateau, Nalgonda and Khammam districts of Andhra Pradesh and for further transfer of water to water short Pennar and Cauvery basins. It envisages to provide irrigation to areas in Warangal plateau under Kakatiya canal Stage – II of Sri Ram Sagar Project Stage – II and a part of the upland areas in Nalgonda district under Srisailem left bank canal. The CCA of the canal is 411872 ha. The terrain of the command en route is partly rugged and partly plane with numerous streams like Peda vagu, Tummala vagu, Boderu vagu, Sali vagu, Vatti vagu, Akeru, Palleru, Halia, Shesleru and Gudipalli vagu etc. The soils available in the command area are predominantly black cotton, red sandy and red soils. Under red soils, loamy sands, sandy loams, sandy clay, silky soils are covered.

2.2.3 Krishna Basin

The Krishna basin extends over an area of 258948 Km², which is nearly 8% of total geographical area of the country. The basin comprising area in the states of Maharashtra, Karnataka and Andhra Pradesh. The Krishna basin is bounded on the north by the common ridge separating it from Godavari basin, on the south and east by the Eastern Ghats and on the west by Western Ghats. Except for the hills forming the watershed round the basin, the entire drainage basin of the river comprises of rolling and undulating country and a series of ridges and valleys interspersed with low hill ranges. Large flat areas of the type seen in the Indo - Gangetic plains are scarce except in the deltas.

The interior of the basin in its middle reaches is a plateau, the greater part of which is at an elevation of 300 to 600 m. Its general slope is eastwards. Great undulating plains divided from each other by flat-topped ranges of hills are the chief characteristics of this plateau. The hill sides are marked by conspicuous, wide terrain except in the southern part of the plateau where the hills are frequently crowned with great 'tors' or rounded hummocks of bare rock as a result of constant weathering.

The Krishna is the second largest river in the Peninsular India flowing east and draining into the Bay of Bengal. The river rises in the Mahadev range of the Western Ghats near Mahabaleshwar at an altitude of about 1337 m above mean sea level and flows through the states of Maharashtra, Karnataka and Andhra Pradesh. The total length of the river from source to its outfall into Bay of Bengal is about 1400 km of which 305 km is in Maharashtra, 483 km in Karnataka and 612 km in Andhra Pradesh. The important principal tributaries of the Krishna are the Bhima, Ghataprabha, the Malaprabha and the Tungabhadra above the Nagarjunasagar project and the Musi, the Palleru and the Muneru below the project.

2.3 Geology of the Basins and Command Area

2.3.1 Godavari Basin

The main geological rock formations of the catchment are older crystalline rocks of archean age, lower gondwana of lower permian to upper permian age, deccan traps of upper cretaceous to lower eocens age and sub-recent to recent laterite and alluvium.

The crystalline peninsular granites occur as small patches. Pink Granites, Grey Granites, Pegmatites and Quartz veins are also associated. Of these, Perphritic Granites are noticed predominantly in the area.

The sedimentary rock formations belonging to the Gondwanas are reported to overlie with an erosional unconformity. These are in turn overlain by Deccan traps. Recent to sub-recent laterite and alluvium are developed over all these rocks.

Gondwanas are mainly represented by Barakar and Kamthi formations of lower- Gondwanas group. The predominant rocks of Barakar formations are white feldspathic Sandstone, Shales and Clays. Kamthi formations are represented by yellowish brown variegated ferruginous sand stones, silt stones and variegated clays and shales invariably overlying the Barkar formations.

A considerable part of the area is covered by Deccan traps and inter-trappean beds. The Deccan trap consists of layers of basaltic lavas varying from amygdaloidal basalt to massive basalt which are hard, compact and medium to fine grained. The rocks are generally dark gray to dark greenish gray in colour. The vesicular basalts are comparatively soft.

Laterite is seen as capping over the Deccan traps, Kamthi formations and gneisses at places. Generally, it is redish brown in colour. It is hard and the thickness of laterite varied from a few cm to 8 m.

Alluvium consists of gravels, sands, silts and clays which are found to occur only along the nallahs and river courses. The thickness of the alluvium is very limited and varies from place to place.

2.3.2 Command Area

Geologically, the command area falls in Warangal, Nalgonda and Khammam districts. The area falling in these districts consists of oldest rock types of Archean age comprising peninsular gneissic complex. The Granite and Biotite gneiss of the peninsular complex occupies larger part of the area. Bands of relatively younger coarse grained gneiss also occur in small patches. The dyke encountered in the area belongs to dolerite minerals. Major soil types encountered along the alignment and the

command area are black cotton, red, red sandy, red loamy, forest and deltaic alluvium.

2.3.3 Krishna Basin

The Krishna basin consists largely of Archaean formations, part of which are covered by Deccan trap lavas, Cuddapah and Vindhyan series and faulted blocks of Gondwanas. Hydrogeological investigations in the Krishna basin carried out by the Groundwater Departments of the respective states and the Central Ground Water Board indicate that groundwater occurs in all the geological formations and the occurrence and movement of groundwater in these rocks is controlled by the nature and extent of weathering and presence of joints and fractures. In areas underlain by crystalline rocks like granites, the quality of water is unsuitable for domestic purposes due to the presence of fluorides in excess of the prescribed safe limits.

2.4 Basin Characteristics

2.4.1 Godavari Basin

2.4.1.1 Rainfall

Four distinct seasons in the Godavari basin viz (i) the cold weather (ii) the hot weather (iii) the south-west monsoon and (iv) the post monsoon.

The cold weather season in the entire basins, from mid October to mid February is generally pleasant, the western and the north eastern regions being colder than the rest of the basin. In the hot weather, the heat is unbearable in the central, northern and eastern regions. The weather is comparatively hotter in the western most parts of the basin.

The south west monsoon sets in by mid June and ends by mid October. During this period, the basin receives about 88% of its total annual rainfall.

The Godavari Basin receives the maximum rainfall during the months of June to September due to southwest monsoon. The southwest monsoon establishes itself over Godavari basin by around 2nd week of June and withdraws towards the end of September. Southwest monsoon rainfall accounts for about 80% of the annual rainfall. The Godavari Basin receives annually a rainfall of about 1062 mm on an average. The normal rainfall over the basin has a minimum of the order of 500 mm over parts of Nasik and Ahmednagar districts of Maharashtra, the area

being far away from the Bay of Bengal and the Western Ghats posing a barrier for moisture inflow from the Arabian Sea. Westward of Nasik, the annual normal rainfall increases progressively and is about 1600 mm over extreme western parts of the basin. Eastward of the line connecting Ahmednagar to a point about 40 km west of Aurangabad, the normal annual rainfall again increases gradually to more than 1500 mm over extreme eastern parts of the basin.

2.4.1.2 Temperature

At all the IMD observatories the temperature is maximum in May and minimum in December except for Jagdalpur observatory. For Jagdalpur observatory the temperature is maximum in May and minimum in January. The Godavari basin has a tropical climate. The mean annual surface temperature in the Western Ghats area is about 24° C, and it increases gradually towards the East and attains a maximum of 29.4° C on the East Coast. During January, which may be taken as a typical winter month, the mean daily minimum temperature going from West to East, increase from 15° C, on the Western Ghats to about 18° C on the East Coast. The mean daily maximum temperature generally exceeds 30° C in the western part of the Godavari basin and it is only slightly less than 30° C in the Eastern part.

2.4.1.3 Wind Speed

Winds are generally light to moderate with increase in speeds in the later part of summer and in the southwest monsoon season. Wind blows mostly from southwest to northwest during the monsoon season and in post monsoon season wind blows from the northwest to north direction. In the cold season the wind blows from northwest to southwest. Maximum wind speed in the basin varies between 10.6 kmph and 22.5 kmph, the average maximum wind speed being 14.7 kmph over the basin. The minimum wind speed varies between 1.3 kmph and 5 kmph, the average being 3.2 kmph.

2.4.1.4 Relative Humidity

The relative humidity is high in the basin during the southwest monsoon season. With the withdrawal of the monsoon, humidity gradually decreases and in summer the air is generally dry. The climate generally remains dry for about 7 months in the year from November to May. The maximum relative humidity is generally recorded during July / August

and the minimum during April / May. The maximum relative humidity in the basin varies between 60% and 89%, the average being 83.3%. The minimum relative humidity ranges from 15% to 29.5%, the average being 22%.

2.4.1.5 Cloud Cover

The skies are heavily clouded and overcast during the southwest monsoon season. During the rest of the year clear and lightly clouded skies prevail. The maximum cloud cover in the basin varies from 6.9 to 7.7 oktas, the average being 7.3 octas. The minimum cloud cover ranges from 0.5 to 1.5 oktas, the average being 1.0 octas. Clouds in the atmosphere reduce the amount of sunshine that reaches the vegetation and evaporation losses are also reduced.

2.4.2 Krishna Basin

2.4.2.1 Rainfall

The catchment mainly experiences the southwest monsoon from mid June to mid October. The rainfall during the non-monsoon period is not significant. The annual rainfall over the catchment varies from 377 to 3048 mm.

2.4.2.2 Temperature

The climate of the catchment remains dry except in the monsoon months. The mean daily maximum temperature in the basin varies from 27.7 to 40.4°C and the mean daily minimum temperature varies from 20.6 to 27.2° C.

2.4.2.3 Wind Speed

Winds are generally light with some increase in speed during the later half of the summer. The catchment is influenced by winds from the southwest during the monsoon season. In the post-monsoon season, they blow from northwest to north direction. In the winter season the winds blow from northwest and southwest directions. The mean wind speed in the basin varies from 4.0 to 21.7 kmph

2.4.2.4 Relative Humidity

The mean relative humidity is high during the monsoon period and comparatively low during the post-monsoon period. In summer the weather is dry and the humidity is low. The relative humidity in the basin ranges from 17 to 92 percent.

2.4.2.5 Cloud Cover

Sky in general is heavily clouded during the monsoon season. During the post-monsoon months cloudiness decreases. During the rest of the year, the sky is clear or lightly clouded. The cloud cover in the basin varies from 0.8 to 8 oktas.