Chapter 2
Physical Features

2.1 Geographical Disposition

The Cauvery – Vaigai - Gundar link canal alignment takes off from the proposed Kattalai barrage. The alignment passes through the taluks of Krishnarayapuram and Kulithalai of Karur district, Srirangam and Tiruchchirappalli of Tiruchchirappalli district, Kulathur, Pudukkottai, Gandarvakkottai, Alangudi, Arantangi, Thirumayam and Avudayarkoil of Pudukkottai district, Karaikudi, Devakottai, Tirupattur, Sivaganga, Ilaiyankudi and Manamadurai of Sivaganga district, Tiruvadanai, Paramakudi, Kamudi, Ramanathapuram, Kadaladi and Mudukulathur of Ramanathapuram district, Tiruchuli, Kariyapatti and Aruppukkottai of Virudhunagar district and Vilathikulam taluk of Thoothukudi district.

2.2 Topography of the Basins and Command Area

The link project including its command area falls in the basins of the Cauvery, the streams between Cauvery and Vaigai, Vaigai and the streams between Vaigai and Vaippar in Tamil Nadu State. The topography of these basins is described briefly in the following sections:

2.2.1 Cauvery Basin

The Cauvery basin is bounded on the north by the ridges separating it from Krishna and Pennar basins, on the south and east by the Eastern Ghats and on the west by Western Ghats. The upper reach of the basin is covered with hill ranges of the Western Ghats and the sub basins area is broad and open with gently undulating country. In the north – west and south, there are a number of hill ranges which have steep slopes.

The Cauvery is the fourth largest river in the Peninsular India flowing east and draining into the Bay of Bengal. The river rises in the Western Ghats in Kodagu district of Karnataka at an altitude of about 1341 m above mean sea level and flows through the States of Kerala, Karnataka, Tamil Nadu and the Union Territory of Pondicherry. The total length of the river from the source to its outfall in Bay of Bengal is about 800 km of which 320 km is in Karnataka, 416 km in Tamil Nadu and 64 km in the common boundaries between Karnataka and Tamil Nadu. The principal tributaries of the Cauvery are Lakshmanthirtha, Hemavathi, Harangi,

Shimsha, Kabini, Arkavati, Suvarnavathi, Palar, Bhavani, Amaravathi, Noyil and Ponnanaiar.

2.2.2 Basin Area of the Streams Between Cauvery and Vaigai

The basin area of the streams between Cauvery and Vaigai comprises the catchment of seven small to medium streams viz. Agni ar, Ambuli ar, Vellar, Koluvanar, Pambanar, Manimuttar and Kottakaraiar. Out of this, the Vellar and the Manimuttar are the main rivers. This basin is bounded on the north and west by the Cauvery basin, on the south by the Vaigai basin and on the east by the Bay of Bengal. Except for a few hillocks in the extreme west, the basin is almost flat, gently sloping from the west to the sea level in the east. The eastern part of the basin is comparatively wider which gradually narrows down towards the western side.

The east flowing rivers viz. Vellar and Manimuttar joining Bay of Bengal, are the important streams in the area between the Cauvery and Vaigai rivers. The Vellar rises in Velamalai near Marungapuri in Tiruchchirappalli district and the length of this river is 136 km. The Manimuttar River rises in the Karandamalai in Madurai district and the length of this river is 150 km. Virisalar, Palar and Uppar odai are the tributaries of the Manimuttar River.

2.2.3 Vaigai Basin

The Vaigai basin is bounded on the west by the Western Ghats, on the east by the Bay of Bengal, on the north by a group of hills separating it from the Cauvery and other small streams and on the south by the Gundar and Vaippar basins. The Vaigai basin is arch shaped with right side little longer than left side. The basin slopes south easterly and the terrain is of undulating plains with stray hillocks.

The Vaigai rises in the western slopes of the Varushanad hills near Kottaimalai in Periyakulam taluk of Theni district and flows in a northerly and north – easterly direction upto confluence with the Varahanadi. Thereafter it flows through Madurai, Sivaganga and Ramanathapuram districts and falls into the Bay of Bengal close to the Palk Strait. During its course, the river travels over a distance of about 258 km. Suruliar nadi, Varaha nadi, Manjalar and Marudha nadi are the principal tributaries of Vaigai.

2.2.4 Basin Area of the Streams Between Vaigai and Vaippar

The basin area of the streams between Vaigai and Vaippar comprises the catchment of all small to medium streams between Vaigai and Vaippar of which Gundar is the main stream. Two more rivers viz. Uttarakosamangaiar and Vembar also drain this area. They all flow in the south easterly direction and drain into Bay of Bengal. This basin is bounded on the north by Vaigai basin, on the west by the Western Ghats, on the south by the Vaippar basin and on the east by Bay of Bengal. Except for a few hillocks in the extreme west, the basin is almost flat, gently sloping from the west to the sea level in the east.

The Gundar River is one of the important streams in this area. The Gundar River originates from the foot of the Andipatti hills at an elevation of about 260 m in the west and other streams rise from the plains. The important tributaries of the Gundar River are Terku ar, Kanal odai, Gridhamal nadi and Paralai ar.

2.2.5 Command Area

The command area proposed en route the link falls in the area lying between the streams between Cauvery and Vaippar rivers. The terrain is mostly plain. The soils available in the command area are predominantly red sandy clay loam soils, brown clay loam soils, alluvial soils and black clay soils.

2.3 Geology and Hydrogeology of the Basins and Command Area

2.3.1 Cauvery Basin

The Cauvery basin consists largely of charnockites, high grade schists, migmatites, green stone belts and consolidated gneiss of Archaean age. In the upper part of the basin upto Grand Anicut, sand stone is generally lateritised and ferrugeneous and occurs in wide stretch in southern parts of the basin. Ground water occurs in the hard rocks normally in under water table conditions in the weathered mantle and under semi – confined to confined conditions in fractures, fissures, joints and shear planes. Chemical quality of ground water in some of the areas is good.

2.3.2 Basin Area of the Streams Between Cauvery and Vaigai

Hydro-geological studies carried out by Central Ground Water Board in the districts falling in the basin area indicate that the geological formations in the basin area comprise mainly of the hard rocks of Archaean age and river alluvium. The main rock types found in the basin are charnockites and khondalites of Archaean age. The charnockite group of rocks consists of the acid charnockite and related migmatites with bands of basic granulite and magnetite quartzite. The khondalite group of rocks consist of crystalline lime stone, colegneiss, calegranulite, garnet – sillimanite gneiss, hornblende and biotite gneiss and related migmatites with bands of quartzite. River alluvium of recent age are found in the districts of Madurai, Tiruchchirappalli and Ramanathapuram. The Upper Gondwanas and Cuddalore sand stones capped by laterite are found in the central part of Ramanathapuram district. Ramanathapuram and Pudukkottai districts are chiefly occupied by crystalline rocks in the western part. Ground water occurs in under water table condition in the weathered, jointed and fractured zones of the crystalline rock. The chemical quality of ground water is suitable for both irrigation and domestic purpose.

2.3.3 Vaigai Basin

Hydro-geological investigations carried out by Central Ground Water Board indicate that the area is underlain by geological formations ranging from Archaean to recent. The Archaean formations comprise of khondalite and charnockite group and garnetiferrous granulite biotite gneisses. The charnockites occur as massive out crops in the hills and plains of the area. The garnetiferrous sillimanite gneiss occurs as isolated lenses within the biotite gneiss. Quartzites are found in prominent hills, ridges, low lying mounts in the area. The recent alluvium consists of clay, sand and gravels or their admixture confined to Vaigai river course.

In this basin, ground water occurs in crystalline rocks and in quarternary sediments represented by alluvium and valley filled sediments consisting of sand, kankar and weathered material. In crystalline rocks ground water occurs in under water table conditions mostly in weathered portion and to a lesser extent in the jointed, fractured and fissured zones under semi-confined conditions. In alluvium ground water occurs in under water table condition and at some places under semi-confined conditions.

2.3.4 Basin Area of the Streams Between Vaigai and Vaippar

The basin area is underlain by geological formations ranging in age from the Archaean to recent. The Archaean rocks mainly belong to composite gneisses, quartzites, charnockite, khondalite and unclassified gneisses. The composite gneisses comprise biotite gneisses, hornblende biotite gneisses and garnet biotite sillimanite gneisses.

The geological formations met within the basin in Madurai district comprise of precambrian charnockites. The basin area is chiefly occupied by crystalline rocks in the western, upper gondwanas and Cuddalore sandstone capped by laterites in the central part and alluvium in the eastern part. Recent and tertiary sediments occur along the coast and a narrow belt of alluvium along the river course.

Hydro-geological investigation carried out by Central Ground Water Board indicate that ground water occurs in under water table conditions in hard rock areas and both under water table and confined conditions in the sedimentary. The chemical quality of ground water is suitable for both irrigation and domestic purposes. However, the quality of ground water is highly variable, from fresh to brackish. Poor quality water is seen in black soil areas and in certain coastal tracts.

2.3.5 Command Area

The proposed command area falls within the above four basins and the geological and hydro-geological conditions in the proposed command area of the link are therefore, same as detailed above.

2.4 Basin Characteristics

2.4.1 Cauvery Basin

The Cauvery basin extends over an area of 81155 km^2, which is nearly 2.5% of total geographical area of the country. The catchment area of the river Cauvery lies in the States of Kerala, Karnataka and Tamil Nadu and the Union Territory of Pondicherry.

2.4.1.1 Rainfall

The western side of the catchment mainly experiences the south-west monsoon from June to September and the eastern side the north – east monsoon from October to December. The rainfall during the non-

monsoon period is not significant. The annual rainfall over the catchment varies from 574 to 5411 mm.

2.4.1.2 Temperature

The climate of the catchment remains dry except in the monsoon months. The mean daily maximum temperature in the basin varies from 19.5 to 33.7^{o}C and the mean daily minimum temperature varies from 9.1 to 25.2^{o} C.

2.4.1.3 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 49 to 86 percent.

2.4.1.4 Wind Speed

Winds blow mainly from the directions between the south – west and north – west during the south – west monsoon season. In the post monsoon season, wind blows mainly in the north easterly or easterly direction. During the rest of the year, wind blows from the direction between north and east. The mean wind speed in the basin varies from 5.4 to 18.9 km/hr.

2.4.1.5 Cloud Cover

Sky is generally 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 4.1 to 5.3 oktas.

2.4.2 Basin Area of the Streams Between Cauvery and Vaigai

The total catchment area of the basin is 10040 km2 and lies entirely in Tamil Nadu State.

2.4.2.1 Rainfall

The catchment receives rainfall both during the south - west (June to September) and the north - east (October to December) monsoons. The

rainfall during the non – monsoon period is not significant. The average annual rainfall in the basin varies from 597 to 1167 mm.

2.4.2.2 Temperature

The normal daily maximum temperature in the basin is 34.1^{o}C during May and the normal daily minimum temperature in the basin is 20.9^{o}C during January. The climate in this basin is cool from December to February and the hottest period is from March to May.

2.4.2.3 Relative Humidity

The coastal region is humid throughout the year, while in the interior, the relative humidity is highest during November. The maximum and minimum values of relative humidity observed in the basin are 85 and 61 percent respectively.

2.4.2.4 Wind Speed

The catchment is influenced by winds during south – west and north – east monsoon. A maximum normal wind speed of 17.6 km/hr occurs in June. The minimum normal wind speed of 7.7 km/hr occurs in November.

2.4.2.5 Cloud Cover

The sky is generally heavily clouded to over cast during the south-west monsoon season. There is moderate cloudiness in the north-east monsoon season. In the rest of the year sky is mostly clear or lightly clouded. The cloud cover in the basin varies from 2.9 oktas in March to 6.4 oktas in July.

2.4.3 Vaigai Basin

The catchment area of the basin is 7741 km^2 covering part of Theni, Madurai, Dindigul, Sivaganga, Virudhunagar and Ramanathapuram districts of Tamil Nadu State.

2.4.3.1 Rainfall

The catchment receives rainfall both during the south-west (June – September) and north-east (October – December) monsoons. The

rainfall during the non-monsoon period is not significant. The average annual rainfall varies from 604 mm at Veerapandi to 2848 mm at Devikulam.

2.4.3.2 Temperature

The mean daily temperature is highest during the month of May and it is lowest in the month of January. The mean daily maximum and minimum temperature observed at Madurai IMD station are 37.5^{o}C during the month of May and 20.9^{o}C during January.

2.4.3.3 Relative Humidity

In general, the humidity is high and is highest during the month of November. The relative humidity in the catchment ranges from 37 to 75 percent.

2.4.3.4 Wind Speed

Winds are generally light to moderate with some strengthening in monsoon season. The catchment is influenced by winds from south-west and north-west during June to September and from north-east and south-east during October to April. The average wind speed in the catchment varies from 4.9 to 9.6 km/hr.

2.4.3.5 Cloud Cover

Sky is generally heavily clouded during the monsoon months. In the post-monsoon months, cloudiness decreases. During the rest of the year, the sky is clear or lightly clouded. The cloud cover in the catchment ranges from 3.7 to 6.8 oktas.

2.4.4 Basin Area of the Streams Between Vaigai and Vaippar

The total catchment area of the basin is 5409.40 km^2 and lies entirely within Tamil Nadu State.

2.4.4.1 Rainfall

The catchment receives rainfall both during the south-west (June – September) and north - east (October – December) monsoons. The rainfall during the non-monsoon period is not significant. The average

annual rainfall varies from 635 mm at Vilathikulam to 932 mm at Usilampatti.

2.4.4.2 Temperature

The mean daily maximum temperature in the basin varies from 37.5^{o}C to 29.7^{o}C and the mean daily minimum temperature varies from 26.3^{o}C to 20.9^{o}C observed at Madurai IMD station.

2.4.4.3 Relative Humidity

In general, the humidity is high. The relative humidity in the catchment ranges from 37 to 76 percent.

2.4.4.4 Wind Speed

The catchment is influenced by winds from south-west during the monsoon season. The average wind speed in the catchment varies from 4.5 km/hr in October to 9.6 km/hr in June.

2.4.4.5 Cloud Cover

Sky is generally heavily clouded during the monsoon months. In the post-monsoon months, cloudiness decreases. During the rest of the year, the sky is clear or lightly clouded. The cloud cover in the catchment ranges from 3.7 oktas in February to 6.8 oktas in July.