Chapter – 2
Physical Features

2.0 General

The Ponnaiyar (Nedungal) - Palar intra-state link project envisages diversion of 86 Mm^3 of flood waters available at Krishnagiri dam across Ponnaiyar river for recharging of ground water in water-short Palar basin for stabilising the existing ayacut presently being irrigated under tanks, open wells/tube wells in water deficit Vaniyambadi taluka of Vellore district in Palar basin and also feeding the system tanks (Eris) enroute the link canal for stabilising enroute command areas in Krishnagiri and Pochampalli talukas of Krishnagiri district and Tirupattur taluka of Vellore district. The project will also provide about 3.882 Mm^3 of water for domestic water supply to enroute villages benefitting about 1.52 lakh people.

The present chapter deals with physical features such as geographical disposition, topography and physiography, geology of the basin areas, river system and of the command area benefitted under the link project.

2.1 Geographical Disposition

The proposed Ponnaiyar (Nedungal) - Palar intra-state link canal off-takes from the existing Nedungal Anicut, located across the Ponnaiyar river near Peruhalli and Nedungal villages in Krishnagiri district of Tamil Nadu. The proposed link canal traverses through Krishnagiri and Pochampalli talukas of Krishnagiri district and Tirupattur taluka of Vellore district of Tamil Nadu. The link canal starts from Peruhalli village and out fall into Godd Ar of Palar near Karuppanur village. The alignment lies between latitudes 12^0 19′ 30″ N and 12^0 35′ 53″ N and longitudes 78^0 16′ 02″ E and 78^0 32′ 01″ E.

The link canal passes through the villages of Peruhalli, Nagarasampatti, Sellampatti, Chinnakaradiyur, Mottupatti, Pattanur, Ramapuram, Nallappanayakkanur, Veppalampatti, Mukampatti, Athiganur, Nayagurugapalli, Kannadahalli, Kottur, Gaddampatti, Andiganur, Rajevanagar, Dakshinamurtivattam, Jinjampatti, Sekkinampatti, Ampalli, Veeraragavanvattam, Panandur, Kodiyur, Punganuru, Kandili, Toppalakavundanur, Gajalnayakkanpatti, Thokkiyam, Kariyampatti, Veeramushtipalli, A.Kothavur, Chandrapuram, Kuppanur, Pudupettai, Mukkanur, Bomminayakanpatti and Karuppanur.

The total length of the link canal is 54.150 km. It off-takes from the left bank of Ponnaiyar river at Nedungal Anicut with a full supply level of 434.450 m and outfalls into Godd Ar of Kal Ar, a tributary of Palar river near Karuppanur village in Palar basin at RD 54.150 km at an FSL of 419.676 m. The canal initially runs in south-east direction and then north-east direction till it outfalls into Godd Ar of Kal Ar. The important rivers that would be crossed by the canal are Mattur Ar, Bargur Ar and Velakkanattam Ar. The command area that would be benefitted by the link canal is in Krishnagiri and Vellore districts of Tamil Nadu State.

2.2 Topography of the Basin, Reservoir and Command Area

The existing Krishnagiri reservoir on the Ponnaiyar river acts as the controlling structure for the Nedungal Anicut as well as for the proposed link canal. The Krishnagiri dam is located near Krishnagiri town in Tamil Nadu at $12^0$28′ North latitude and 78^0 11′ East longitude. The FRL of the reservoir is 483.11 m. The link project including its enroute command area falls in the Ponnaiyar and Palar basins in Krishnagiri and Vellore districts in Tamil Nadu.

The topography of these basins is described briefly in the following sections:

2.2.1 Topography and Physiography

a) Streams between Palar and Cauvery (Including Ponnaiyar)

There are four rivers flowing independently between Palar and Cauvery basins viz., Ongur, Varahanadi, Ponnaiyar and Vellar which outfall into the Bay of Bengal. The total catchment area of the basin comprising of these four river basins is 28278 km^2.

Ponnaiyar is a major river among the above four rivers. The basin is bounded on the north by the Palar river and the west and south by the Cauvery basin and on the east by Bay of Bengal. The catchment area of Ponnaiyar basin spreads over Kolar, Chikballapur and Bengaluru districts of Karnataka; Chittoor district of Andhra Pradesh; and Krishnagiri, Dharmapuri, South Arcot, North Arcot and Salem districts of Tamil Nadu. The total catchment area of Ponnaiyar basin is 15679 km^2. The catchment area of Ponnaiyar basin upto Krishnagiri dam site and Nedungal Anicut are 5428 km^2 and 5694 km^2 respectively. The basin area lies between latitudes 11^0 11′ and 13^0 30′ N and longitudes 77^0 34′ and 80 08′ E.

The shape of this basin area resembles the letter 'L' with a maximum width of 250 km in the western portion and 100 km in the eastern side. The length of the basin is about 300 km. Most of the rivers in this basin flow in the south-east direction and join the Bay of Bengal. This basin has a coastal line extending over 125 km. The catchment area covered by the streams between Palar and Cauvery has been divided into three hydrological zones.

The Zone – I with a catchment area of 4513 km^2 is drained by two streams i.e., Ongur and Varahanadi. This zone is situated in the coastal region with elevation ranging from 0 to 200 m. The two streams draining in this area are non-perennial in nature and flow only during the rainy days. The length of Ongur and Varahanadi rivers from the origin to the outfall are about 42 km and 95 km respectively. These rivers have an average bed slope of 1 in 460 and 1 in 520 respectively.

The Zone – II i.e., Ponnaiyar river basin with a catchment area of 15679 km^2 is drained by the Ponnaiyar and its tributaries viz., Markandanadi, the Pambar, the Vaniyar, the Kallar and the Gadilam river. The Ponnaiyar has its origin near Nandidurg in Kolar district in Karnataka State. The length of this river is about 351 km and its average bed slope is 1 in 390.

The Zone – III (Vellar river basin) with a catchment area of 8086 km^2 is drained by the Vellar river and its tributaries viz., Sweta Nadi, Chinnar river, Anaivari Odai, Manimukhata Nadi etc. The Vellar river originates on the southern boundary of Attur taluka of Salem district. The length of this river is about 181 km and its average bed slope is 1 in 165.

b) Ponnaiyar Basin Area upto Nedungal Anicut

The Ponnaiyar basin area is of undulating terrain with gentle slope towards North-east with rocky terrain in the upper reaches of the off take point of the link canal. The catchment area of Ponnaiyar basin up to Nedungal Anicut is 5694 km^2. Sulagiri, Chinnar and Markandanadhi are the principal tributaries joining Ponnaiyar up to Nedungal Anicut. Nedungal Anicut is located near Krishnagiri town in Krishnagiri district of Tamil Nadu. The length of the river up to Nedungal Anicut is 165 km and its average bed slope upto Nedungal Anicut is 1 in 355. The catchment area of this basin upto Nedungal Anicut is a strip of almost uniform width.

c) Palar Basin Including Poini and Cheyyar Basins

The Palar river originates at an attitude of 900 m from the Nandidurg hill ranges in the neighborhood of Kaivara village in Kolar district of Karnataka state. The river passes though Karnataka, Andhra Pradesh and Tamil Nadu states before joining the Bay of Bengal. The total length of the Palar river is 348 km out of which 93 km lies in Karnataka, 33 km in Andhra Pradesh and 222 km in Tamil Nadu. The major tributaries of Palar are Poini, Malattar, Kavandinya Nadi and Cheyyar of which Poini and Cheyyar are the two main tributaries. The total drainage area of the river is 17871 km^2. The Palar Anicut is the only existing project on the Palar river with assured supply to 324 tanks in Palar basin.

There are three major topographical divisions in the basin (i) the hilly ranges at the upper reaches separating the Pennar and Ponnaiyar basins (ii) the table land or the plateau region and (iii) the coastal plains. In the upper reaches and the area separating the Cheyyar with Palar the general topography is hilly, rocky and rather rugged with abrupt diverse slopes conducive to appreciable erosion. The plateau has undulating to rolling topography with occasional hillocks while the coastal plains are flattish and even trough shaped at places. Among the hills found in the basin, the Javadi, Elagir and Kalrayan are famous.

The catchment area of the basin is roughly rhombus in shape with broader width in the middle reach and narrow width at the upper and lower reaches. The basin is bounded by Pennar basin and Streams between Pennar and Palar basin in north and Bay of Bengal in the east and by the streams between Palar and Cauvery basin on the west and south.

2.2.2 Topography of the Command Area

The Ponnaiyar (Nedungal) - Palar Link Canal is proposed to divert water for stabilising the existing command area to an extent of 9850 ha lying in Krishnagiri and Pochampalli talukas of Krishnagiri district and Tirupattur and Vaniyambadi talukas of Vellore district.

The Ponnaiyar and Palar are two major rivers, draining in Krishnagiri and Vellore districts, where the command area under the link canal is proposed. Two major tributaries namely Mattur Ar and Bargur Ar and small streams/nallahs/ rivulets are flowing enroute the link command area. At tail end command in Vaniyambadi taluka, the Palar and its major tributaries viz., Godd Ar/ Kal Ar, Cheyyar are main source of natural drainage.

Isolated hill tops/hillocks, continuous hill ranges in small stretches with valleys dominate in the command area. The terrain in the region is very undulating and hence the slope of the land in the command area is not even/uniform. The flat lands are irrigated by leveling/shaping works i.e., by preparing the land into number of small field chalks/blocks and leveled with gentle slopes for each block/chalk.

2.3 Geology of the Basin and Command Area

Ponnaiyar and Palar are two river basins draining in Krishnagiri and Vellore districts where the stabilization of the command area is proposed. The geology of these basins is described briefly in the following sections:

2.3.1 Geology of Ponnaiyar Basin

The geology of the Ponnaiyar basin is rather varied. The main rock types encountered in this basin area are charnokites, Granite gneiss (Peninsular gneiss) of Archaean age, Cuddalore sand stone of miocene and liocene and creataceous age and alluvium of recent age. The widely exposed charnokites is more prominent which is exposed in the hill ranges. It is massive and also well foliated. The gneiss is medium to course grained and generally less massive and is highly prone to weathering. The Cuddalore sand stone occurring in Villupuram and Cuddalore district of this basin includes lignite deposits which are being mined presently by open cast method at Neyveli. They are overlain in the coastal tract and in the river valleys by alluvium and coastal sands.

2.3.2 Geology of Palar Basin

In its upper reaches the Palar basin is predominantly covered by granite gneisses, Gondwanas, Cuddapah formations of Archaeans belonging to Dharwarian system with basic intrusives. The central portion of the basin is covered by Archaean crystalline hard rock and sedimentary rocks. Alluvial deposits are found all along the coastal belt and Palar river course comprising of marine and riverine deposits. Due to uplift of land masses and tectonic activities, the Archaean Dharwarian hard rocks were subjected to deformation into folds and faults and also resulted in shifting of river courses in basin area. The major lineaments do correspond to faults and deep fracture zones. The major and minor streams running parallel to the major faults are controlling the drainage pattern of the basin area. The fault structures also played a major part in the present disposition and set up of the sedimentary Gondwana rocks and Archaean rocks in the basin.

2.3.3 Geology of Command Area

The command area to be benefitted under the link canal in Ponnaiyar and Palar basins falls in Krishnagiri and Vellore districts of Tamil Nadu state. The rock types observed along the canal alignment includes charnokites, granite gneiss/grey migmatite, pink migmatite, epidote hornblende gneiss, pyroxenites, quartz veins and pegmatites. In general various geological sub-surface details encountered along the canal alignment consist of the top soil (red sandy soil and sandy clayey soil of thickness of about 1 m), a highly weathered zone and semi-weathered/fractured formation below top soil with basement as hard rock.

The district-wise geology of Krishnagiri and Vellore districts (in which the command area under the link canal falls) is furnished in the following sections:

2.3.3.1 Geology of Krishnagiri District

The geological formations of the district mainly belong to Archaean age along with rock of proterozoic age. The former is represented by Khondalite group of rocks, Charnockite group of rocks, migmatites complex, Sathyamangalam group of rocks, Bhavani group of rocks and Kolar group of rocks, while the latter is represented by alkaline rocks. The Khondalite group includes garnet sillimanite gneiss and quartzite which occur as small patches. The Charnockite group occupies a major part of southern portion of this district and with some small bands of pyroxene granulites and magnetite quartzite. Two small patches of pyroxenite and gabbro are seen to occur in the pyroxene granulite near about 10 km NE of Harur. The migmatite complex includes garnetiferous quartzofeldspathic gneiss and hornblende biotite gneiss, the former exposed on the western part of the district. The Sathyamangalam group of rocks includes fuchsite quartzite, sillimanite mica schist and amphibolites. The Bhavani group of rocks in this area includes fissile hornblende biotite gneiss, granitoid gneiss and pink migmatite. Amphibolites with banded ferruginous quartzite and associated quartzo-feldspathic rocks (Champion Gneiss) represent the Kolar group and are found west and southwest of Veppanapalli. Following this there are basic intrusions occurring as dykes. The alkaline complex is presented by epidote-hornblende gneiss, ultramafic, syenite and carbonatite and these are distributed in the eastern part of the district. Innumerable basic dykes and felsite, quartz, barites and pegmatite veins form part of the Alkali Complex.

2.3.3.2 Geology of Vellore District

The major part of the district is covered by metamorphosed crystalline rocks of the charnockite group and the migmatite complex of Archaean age. South of Palar river the area where the Charnockite group of rocks comprises charnockite, pyroxene granulite, magnetite quartzites and younger basic dykes intruding into them. The migmatite complex comprising biotite gneisses, agmatitic gneisses, sub-augen gneiss, quartzofeldspathic gneisses and gneissic granites with pink permeation is seen around Elagiri and Koratti hills. The peninsular gneissic complex consisting of fissile hornblende gneiss, granitoid gneiss and younger granites are seen north of Palar river. Younger dykes are profusely noted in these gneisses. The proterozoic alkaline group of rocks are seen in the Koratti and Elagiri hills. The alkaliine carbonatite complexes located in a 250 km long and 25 km wide belt, trending NNE-SSW, extend from Gudiyattam in the north to Bhavani in the south. The complexes are emplaced into the charnockite group of rocks and their migmatitic equivalents of amphibolites facies grade. These complexes have formed the loci of mineralization. The major lithounits forming the alkaline group are epidote hornblende gneiss, pyroxenite, gabbro, anorthosite, syenite, carbonatite with lamprophyre dykes and quartz-barytes veins. Banded magnetite quartzite, charnockite and pyroxene granulite occur as enclaves. The Koratti syenite-carbonatite complex is an inverted pear shaped body extending into Dharmapuri district.

2.4 River System and Basin Characteristics

2.4.1 Ponnaiyar River

The Ponnaiyar river is known as Dakshina Pinakini in Kannada and Thenpennai in Tamil. The river Ponnaiyar has its origin at an elevation of 900 m near Nandidurg in Kolar district of Karnataka state. The river enters into Tamil Nadu at Sakkarasampalli near Bagalur village of Hosur taluka. The total length of the river is 351 km. The river joins Bay of Bengal near Cuddalore. The main tributaries of Ponnaiyar are Chinnar-I, Chinnar-II, Sulagiri Chinnar, Markandanadhi, Pullampattiyar, Pambar, Vaniyar, Kallar, Pambanar, Aliyar, Musukundanadhi and Thurinjalur.

The basin is bounded in the north by Palar basin, on the west and south by Cauvery basin and on the east by Bay of Bengal. The geographical coordinates of this basin are latitude 11^0 45′ N to 13^0 14′ N and longitude 77^0 45′ E to 79^0 45′ E. There are seven reservoirs and seven Anicuts located on Ponnaiyar river to harness its water.

The basin has four distinct seasons viz., dry period from January to February, hot period from March to May, south-west monsoon from June to September and north-east monsoon from October to December. The basin experiences hottest period during March to May and cool during December to February. In general the basin enjoys a pleasant climate. The river is dry for the most part of the year. Water flows during the monsoon season when it is fed by the south-west and north-east monsoons. During rainy spells there are flash flood in the Ponnaiyar river. This has optly given rise to a proverb in Tamil Language "The Ponnaiyar rises and falls even before the butter melts". The sand build of the river is quite impressive, suggesting that it may have been a perennial river with much large water flow in the past. The monsoon period is considered from June to December.

2.4.2 Palar River

The river Palar is one of the 17 major rivers of Tamil Nadu. The Palar river originates in Kolar district of Karnataka state near Kaivara village at an altitude of about 900 m, to the west of Ambojidurga and Rahamankhar peaks. It flows as a Guptagamini (underground course) for a long distance and emerges near Bethamangala town, from where it flows eastward down the Deccan Plateau. The river basin lies between the latitudes 12^0 15′ N and 13^0 37′ N and longitudes 77^0 53′ E and 80^0 10′ E. The total length of the river is 348 km. The total catchment area of the basin is 17871 km^2. The tributaries of Palar are Poini, Malattar, Kavandinya Nadi and Cheyyar, of which Poini and Cheyyar are the main tributaries. Poini joins from the left side of the river near Ranipet and Cheyyar joins from the right side near Gurumancheri.

Palar river flows south-east wards through Kolar and Bangarpet talukas for about 93 km and enters in Kuppam taluka of Andhra Pradesh. It flows about 33 km in Kuppam taluka of Chittor district and then enters Vellore district of Tamil Nadu near Undalapattu village. Running southwards, the Palar turns to north near Vaniambadi and passes upto Vellore town and turns east-wards upto Kancheepuram and further traverses in south easterly direction before its confluence into the Bay of Bengal.

The Palar basin covers Bengaluru, Chikballapur and Kolar districts of Karnataka; Chittoor district of Andhra Pradesh; Vellore, Thiruvannamalai, Kancheepuram and Thiruvallur districts of Tamil Nadu. The basin is bounded by streams between Palar and Cauvery in the west and south, Pennar basin in the north and streams between Pennar and Palar and also the Bay of Bengal in the east.

The climate of the basin area is pleasant throughout the year except during summer. The climate of the basin is characterized by 4 distinct seasons viz., south-west monsoon from June to September, north-east monsoon from October to December. The winter period is during the months of January and February and hot weather period from March to May. The basin receives most of the rainfall from the south-west and north-east monsoons as such, June to December is considered as monsoon period and January to May as non-monsoon period.

2.5 River System Enroute the Link Canal

The link canal while traversing from Ponnaiyar river to Palar river, crosses two major tributaries namely Mattur Ar and Bargur Ar and many other small streams/ rivulets, on its way. Many tanks (Eris) being maintained by the PWD, Govt. of Tamil Nadu are constructed on these streams in series and well connected by intermittent supply/feeder channels in the command area with regulating structures/check dams, having good drainage facility. In general, the drainage pattern is dentrtic but locally trellis and asymmetrical pattern is also observed.