

## **Chapter 8**

### **Irrigation planning and command area development**

#### **8.1 General**

While planning for a major water resources development project, it is essential to ensure proper utilisation of water resources proposed to be conserved in the storage duly accounting for the prioritization of various demands viz. domestic, industrial, irrigation etc.

The Cauvery (Kattalai) - Vaigai - Gundar link project envisages diversion of 2252 Mcum of water from the available balance in Cauvery basin at Kattalai barrage in exchange to the waters to be received at Grand Anicut from the nine-link system from Mahanadi to Cauvery. The link canal is proposed to take off from existing Kattalai barrage with full supply level of 100.75 m and traverses for about 256.82 km up to Gundar river. The link canal takes care of irrigation requirement of proposed command area en-route, in the basins of Cauvery, streams between Cauvery and Vaigai, Vaigai and streams between Vaigai and Vaippar between Cauvery and Gundar rivers. The link canal will be supported by number of branch canals /direct sluices to facilitate irrigation of command areas.

The water planning for various uses viz irrigation, municipal and industrial purposes is furnished below.

#### **8.2.1 Existing / proposed irrigation facilities in the proposed project command area**

The link canal in its course from Kattalai barrage to Gundar passes through the areas lying between the Cauvery and Gundar rivers, where the existing irrigation facilities are minimal. Hence, it is proposed to provide these areas falling in Karur, Tiruchirappalli, Pudukkottai, Sivaganga, Ramanathapuram, Virudhunagar and Thoothukudi districts of Tamil Nadu with irrigation from the water diverted through the link canal. The gross command area under the link canal has been identified to be 840041 ha.

## 8.2.2 Existing irrigation facilities in the command area

There are no existing projects in the command area. However, there are enormous number of irrigation tanks which needs repair, renovation rehabilitation and augmentation of their capacity. The existing sources of irrigation are mainly tanks and wells. There are about 26504 dug wells, 10344 tube wells and 5825 tanks in the proposed command area. Out of the total area presently being irrigated, 2.8% is by canals, 58.4% by tanks and 38.8% by wells.

The source-wise irrigation in the proposed command area during the year 2017-18 as assessed from taluk-wise statistics are presented in **Table 8.1**.

**Table 8.1**  
**Source-wise irrigation in the proposed command area**  
**during the year 2017-18**

**Unit: ha**

Sl. No.	District	Net area irrigated by				Total
		Canals	Tanks	Wells	Other sources	
1.	Karur	562	3	1342	0	1907
2.	Tiruchirappalli	666	198	637	0	1501
3.	Pudukkottai	3006	13602	25226	0	41834
4.	Sivaganga	0	24208	8306	0	32514
5.	Ramanathapuram	0	46115	20995	0	67110
6.	Virudhunagar	0	4311	1860	0	6171
7.	Thoothukudi	0	127	495	0	622
<b>Total</b>		<b>4234</b>	<b>88564</b>	<b>58861</b>	<b>0</b>	<b>151659</b>

### 8.3.1 Current agriculture scenario and existing cropping pattern

The total area available for cultivation in the proposed command area calculated based on the taluka wise statistics is 620100 ha and the culturable command area considered for irrigation under the link canal is 448340 ha at 100% intensity. The principal crops grown in the area are jowar, maize, pulses, cotton, vegetables and chillies during the Kharif season and paddy, ragi and oilseeds during the Rabi season. Paddy, oil seeds and cotton are the main crops each being cultivated in about 70% of the net sown area in the proposed command.

### 8.3.2 Proposed command area

#### a) Based on remote sensing images

The command area under the link canal is demarcated using USGS-Sentinel 2, March 2019 tiles with 10 m resolution processed with Erdas Imagine software of Hexagon. The command area en route is proposed to be served by 25 direct sluices and 12 branch canals. The land use land cover (LULC) of the gross command area is classified under the following heads and shown in **Table 8.2**.

**Table 8.2**  
**Classification of land use land cover**

Sl.No.	Class name	Area in ha
	Crop land	16739
	Fallows	163048
	Agricultural plantations	152828
	CCA under 25 direct sluices in initial reach of 65.70 km	7457
1	<b>Culturable area</b>	<b>337717</b>
	Dry tanks	293854
	Water bodies	11883
	<b>Total culturable area (337717+293854)</b>	<b>631571</b>
2	<b>Water bodies</b>	<b>305737</b>
	Evergreen	19042
	Plantations	20408
3	<b>Forest area</b>	<b>39450</b>
	Urban	56287
	Mining	27859
4	<b>Built up area</b>	<b>84146</b>
5	<b>Waste land</b>	137326
6	<b>Cloud patches</b>	15756
7	<b>GCA under direct sluices excluding 7457 ha of CCA</b>	<b>36424</b>
	<b>Total area</b>	<b>958911</b>

*Source: Geomatics lab, NWDA, Hyderabad*

## b) Based on the available statistics

The command area is computed based on the taluk wise land use statistics and the same are furnished in **Table 8.3**. The CCA available in the command is 620100 ha and the culturable command area considered for irrigation under the link canal is 448340 ha at 100% intensity. The taluk wise land use particulars in the command area for the year 2017-18 is furnished in **Annexure: 8.1** and the taluk wise / Branch canal wise GCA and CCA are furnished in **Annexure: 8.2**.

**Table 8.3**  
**Classification of Culturable command area**

Sl.No.	Class name	Area in ha
	Misc tree crops	46760
	Current fallows	66453
	Other fallows	157864
	Culturable waste	18342
	Net area sown	330681
1	<b>Culturable command area</b>	<b>620100</b>
2	Source-wise irrigated area (Tanks, wells other sources)	151659
	<b>CCA considered under the link canal</b>	<b>448340</b>

*Source: Computed from Taluk G Return of Directorate of Statistics & Economics*

## 8.4 Soil surveys

The land under existing crops, fallows and the agricultural plantations is treated as suitable for irrigation in the proposed command area. Soil Survey & Landuse Organisation, Department of Agriculture, Govt. of Tamil Nadu prepared soil survey report for land irrigability classification. The land irrigability details of the proposed command area, worked out based on this report are furnished below in **Table 8.4**. Soil map of the command area is at **Plates 4.6.1 to 4.6.2**.

**Table 8.4**  
**Irrigability classification**

<b>Sl.No.</b>	<b>Category</b>	<b>Area (Lakh ha)</b>
1	Area of land with moderate limitation for sustained use under irrigation	3.23
2	Area of land with moderate to severe limitation for sustained use under irrigation	0.52
3	Area of land with severe to very severe limitation for sustained use under irrigation	2.59
	<b>Sub-total</b>	<b>6.34</b>

#### **8.4.1 Soil and land irrigability classification**

Soil suitability for irrigation depicts the differentiation of the soils into different classes based on the limitations of physical soil and land properties. Among Land Irrigability classes, Class 1 to Class 4 come under 'Irrigable Land class', Land under Class 5 is 'temporarily non-irrigable' (further investigations needed) and Class 6 is 'land not suitable for irrigation'. The soils belonging to Soil Irrigability Classes from A to D come under Irrigable Land class, while Class E is not suitable for irrigation. The lands having slopes less than 10% and depth of water table more than 1.5 m come under Irrigable Land class. The soils of texture "Sandy loam to clay loam" come under Soil Irrigability class 'A'. The soils of texture "Loamy sand and clay" come under Soil Irrigability class 'B'. The soils of texture "Sand and clay" come under Soil Irrigability classes 'C & D' respectively.

As slope of the land in the proposed command area is mostly less than 5% and ground water depth is more than 1.5 m, the area can be put under irrigation without any major constraints. Out of the above 6.34 lakh ha, an area of 4.48 lakh ha has been considered as command area, which could be provided with irrigation.

#### **8.5 Agro-climatic conditions**

The agro climatic conditions influence the cropping pattern to be adopted and the crop water requirements in the command area. There are six

IMD observations in the vicinity of the project area, viz. Tiruchirappalli, Thanjavur, Kudumianmalai, Adirampattinam, Madurai & Tondi. Based on the data of these stations for the period 1981-2010, the agro-climatic conditions are described as under.

### **8.5.1 Rainfall**

The annual rainfall in and around the command area varies from 1187 mm to 844 mm. The monthly normal rainfalls of IMD observatories (1981-2010) in the vicinity of the command area are furnished in **Annexure: 8.3**.

### **8.5.2 Temperature**

The monthly mean maximum temperature varies between 39.1 °C to 29.5 °C while the monthly mean minimum temperature varies between 27.2 °C to 19.9 °C in and around the command area. **Annexure: 8.4** gives the monthly normal maximum and minimum temperature data (1981-2010) of IMD observatories in the vicinity of the command area.

### **8.5.3 Humidity**

The monthly mean relative humidity varies between 89% and 36% in and around the command area. **Annexure: 8.5** gives the monthly mean relative humidity observed at 0830 hrs and 1730 hrs at various IMD observatories in the vicinity of the command area.

### **8.5.4 Sunshine**

As is typical with peninsular India, the project area is endowed with mostly sunny weather. There will be sunshine throughout the year, its intensity varying from mild in winter to severe in summer. July is the cloudiest month in almost all the districts in the vicinity of the command area with little sunshine.

### 8.5.5 Wind velocity

The annual mean wind speed varies between 10.8 and 6.2 km/hr in and around the command area. The maximum wind speed recorded is about 16.1 km/hr during July. **Annexure: 8.6** gives the monthly mean wind speed of various IMD observatories in the vicinity of the command area.

### 8.5.6 Evaporation

The monthly potential evapo-transpiration of different IMD stations in and around command area is furnished in **Annexure: 8.7**. The annual potential evapo-transpiration varies between 2178 mm and 1703 mm in the region. The PET values of these stations have been used for assessment of crop water requirements in the command area of the link project. Weighted average values of Evapotranspiration and Normal rainfall of Tiruchirappalli, Madurai and Tondi IMD observatories are furnished in **Annexure: 8.8**.

### 8.5.7 Cloud cover

The annual mean cloud cover varies between 4.9 and 3.7 oktas in and around the command area. **Annexure: 8.9** gives the monthly cloud amounts (in oktas) observed at various IMD observatories at 0830 hrs and 1730 hrs in the vicinity of the command area.

### 8.5.8 Frost free days

Generally, this region does not experience any frost conditions.

## 8.6 Proposed cropping pattern

### 8.6.1 Approved cropping pattern

The feasibility report of the Cauvery (Kattalai) - Vaigai - Gundar link project was circulated earlier to all the concerned states and organizations. Observations were received from various states and organizations for which clarifications were sent. The cropping pattern as adopted in the feasibility report have been considered for the proposed new command in the present

report. The cropping pattern in the region is spanned over kharif, rabi and two seasonal.

### 8.6.2 Cropping pattern adopted under the link project

The cropping pattern suggested for future major projects in the preliminary water balance study reports of the basins lying between Cauvery and Gundar rivers prepared by NWDA has been adopted for the proposed command area under the link canal. This cropping pattern has been suggested taking into account the soils available in the basin area and prevailing agricultural/irrigation practices. Mostly, the irrigated dry crops are preferred to the high-water consuming crops in the spirit of extensive irrigation (rather than intensive irrigation). The intensity of irrigation is considered as 100%. The proposed cropping pattern for irrigation of the command area enroute the link canal is given in **Table 8.5**.

**Table 8.5**  
**Proposed cropping pattern for irrigation under**  
**the link canal**

<b>Crop</b>	<b>% of CCA</b>
Paddy	15
Jowar	5
Maize	5
Ragi	5
Pulses	10
Oilseeds	20
Cotton	20
Vegetables	10
Chillies	10
<b>Total</b>	<b>100</b>

### 8.6.3 Proposed irrigation facilities

The Cauvery (Kattalai) - Vaigai - Gundar link project takes off from the existing Kattalai barrage across Cauvery river with a full supply level of 100.75 m. The canal runs for a distance of about 256.82 km from Kattalai to



Gundar river with tail end FSL of 72.048. The Tiruchuli branch canal takes off at tail end with full supply level of 72.048 m.

Out of the total diversion of 2252 Mcum of water, about 1931 Mcum will be used for irrigation, 79 Mcum will be used for domestic use and 139 Mcum is proposed for industrial use and the remaining 103 Mcum will be lost in transmission. The abstract of annual irrigation and utilisation from Cauvery (Kattalai) - Vaigai - Gundar link project under different command areas is furnished in **Table 8.6**.

**Table 8.6**  
**Annual irrigation and utilisation from the link canal**

<b>Sl. No.</b>	<b>Name of the branch canal</b>	<b>Annual irrigation (ha)</b>	<b>Annual utilisation (Mcum)</b>
1	Direct sluices	8720	37.56
2	Gandharvakottai	13575	58.47
3	Alangudi	26325	113.39
4	Thirumayam	5623	24.22
5	Pallattur	8411	36.23
6	Karaikudi	4626	19.93
7	Devakottai	18283	78.75
8	Tiruvadani	37746	162.59
9	Kalayarkovil	24233	104.38
10	Manamadurai	74327	320.16
11	Paramakudi	76709	330.42
12	Narikudi	49802	214.52
13	Tiruchuli	99960	430.57
	<b>Total</b>	<b>448340</b>	<b>1931.19</b>

#### **8.6.4 Scope for double & multiple cropping pattern and change in cropping pattern**

##### ***Soils***

As the soils in the command area are mainly red soils medium to heavy in texture, no limitations are anticipated for adopting double and multiple

cropping patterns in the proposed command area as far as soils are concerned. In the present project proposal, double and multiple cropping pattern is not planned. In light of suitable fertile soils associated with favorable agro-climatic conditions in the proposed command area, double and multiple cropping patterns are feasible.

### **8.6.5 Attitude of farmers towards modern irrigated agricultural practices**

As the farmers in the command area will get assured irrigation through the link canal which improves their socio-economic status, most of the farmers may support and adopt modern irrigated agricultural practices, so as to derive maximum benefits.

## **8.7 Assessment of water requirement**

The water requirement needs to be assessed for irrigation, domestic and industrial purposes while providing for transmission losses along the link alignment. This needs proper layout of branch canals, direct sluices, canal majors, distributaries, water courses and field channels.

### **8.7.1 Layout of direct sluices, branch canals/ distributaries and their commands**

Direct sluices at 25 locations are provided in the initial reach from RD 0.00 to 65.70 km keeping in view the small patches of command area available for irrigation. Considering the ground elevation available on the maps, the branch canals network was drawn with the branch canals/distributaries running mostly along the ridges between the local streams, with their commands on both the sides extending up to the streams, which in turn form the exterior boundaries of the command under each of the branches. The layout of the branch canals/distributaries so finalised was then transposed on to the land irrigability maps of the same area in 1:50000 scale. The CCA under each of the branch canals is computed using satellite imageries and Erdas Imagine software. After deducting the forest, scrub and barren land, the net irrigable area is determined to be 448340 ha.

The total command area is proposed to be served under 25 direct sluices and 12 branch canals and the corresponding net irrigable areas are given in **Table 8.7**.

**Table 8.7**  
**Locations of new command area benefited under various**  
**branch canals of the link project**

Sl. No.	Branch canal	RD on Main canal	Length (km)	Command area (ha)	District
				AI	
1	Direct sluices			8390	Karur, Tiruchirappalli, Pudukkottai
2	Gandharvakottai	96.0	43.4	13575	Pudukkottai
3	Alangudi	46.7	46.7	26325	Pudukkottai
4	Tirumayam	116.55	27.0	5623	Pudukkottai
5	Pallattur	142.0	36.6	8411	Pudukkottai, Sivaganga
6	Karaikudi	147.8	25.2	4626	Pudukkottai, Sivaganga
7	Devakottai	158.5	42.8	17447	Pudukkottai, Sivaganga
8	Tiruvadani	177.2	45.9	34852	Sivaganga, Ramanathapuram
9	Kalair kovil	189.9	29.8	23606	Sivaganga, Ramanathapuram
10	Manamadurai	222.5	54.0	70884	Sivaganga, Ramanathapuram
11	Paramakudi	232.65	77.6	76709	Sivaganga, Ramanathapuram, Virudhunagar
12	Narikudi	239.3	61.3	45900	Ramanathapuram, Virudhunagar
13	Tiruchuli	256.8	47.8	111992	Ramanathapuram, Virudhunagar, Thoothukudi
	<b>Total</b>			<b>448340</b>	

The prevailing cropping pattern in the region is judiciously adopted and the irrigation intensity is kept at 100%. The crop water requirements are worked out on climatological basis considering the IMD observatories at

Tiruchirappalli, Madurai and Tondi. The annual utilization works out to 1931 Mcum .

### **8.7.2 Net increase in irrigation facilities due to the link project**

The Cauvery (Kattalai) - Vaigai - Gundar link project envisages to bring new areas under irrigation enroute the link canal. Therefore, the net increase in irrigation facilities due to the link project will be its CCA of 448340 ha.

### **8.7.3 Crop water requirement for irrigation**

The crop water requirement for each crop under the proposed command area has been computed adopting Modified Penman's method. Potential Evapo-transpiration and normal rainfall data of Tiruchirappalli, Madurai and Tondi IMD observatories located in the vicinity of the command area has been considered for working out the crop water needs in the command. The command area of the link project is spread in 7 districts viz; Karur, Tiruchirappalli, Pudukkottai, Sivaganga, Ramanathapuram, Virudhunagar and Thoothukudi of Tamil Nadu.

The intensity of irrigation is considered as 100% for the new areas while keeping the designed intensity of irrigation for the existing command areas. The crop calendars and crop coefficients of various proposed crops are considered as adopted in the feasibility study.

The gross irrigation requirement of each crop in the command area is worked out adopting an efficiency of 76%. Detailed computations of crop water requirements in the command area of the link project are presented in **Annexure: 8.10**. The monthly crop water requirement for the enroute command is furnished in **Annexure: 8.10.1**. The computation of branch canal wise GIR are furnished in **Annexure: 8.11.1. to 8.11.13**. The details of district wise irrigation water requirement in the command area are given in **Table 8.8**.

### **8.7.4 Domestic & industrial water supply**

The requirement of water for domestic consumption in the rural and urban areas and for livestock has been computed by projecting the rural and urban human population and livestock population of the proposed command

area to 2050 AD and considering the per capita daily requirement of 70, 135 and 50 litres for the rural, urban and livestock population respectively.

The taluk-wise population for Census 2011 is used for computing the total population lying in the command area on proportionate area basis. The total population has been projected to 2050 AD using compound growth rates as suggested in 'World Population Prospects-2017 revision'. Out of the total projected population, 50.3% is taken as urban population as indicated in 'World Urbanization Prospects-2014'.

The total livestock in the command area is estimated on proportionate area basis from district wise census data of 2012 and it is projected to 2050 AD assuming a uniform annual compound growth rate of 1%.

The water requirement of entire urban and 50% of the rural population is proposed to be met from the surface water resources, which works out to 79 Mcum. In the absence of authentic information on the number and types of existing and proposed industries and their water needs in the project area, a provision equal to the total domestic requirement i.e. 139 Mcum is made towards industrial water supply. Thus, the total municipal & industrial water requirement under the link canal is worked out to be 218 Mcum. The details are furnished in **Annexure 8.12**. The details of district wise water use under the link project are given in **Table 8.8**.

**Table 8.8**  
**District wise Irrigation, domestic & Industrial water use under the link project**

Sl. No.	State/ district	AI (ha)	Water use (Mcum)			
			Irrigation	Domestic	Industry	Total
	<b>Tamil Nadu</b>					
1	Karur	2942	12.67	0.57	1.01	14.25
2	Tiruchirappalli	2917	12.56	0.57	1.00	14.13
3	Pudukkottai	49787	214.43	13.83	24.33	252.59
4	Sivaganga	91805	395.40	17.95	31.59	444.94
5	Ramanathapuram	211193	909.60	34.72	61.08	1005.40
6	Virudhunagar	39922	171.94	5.69	10.01	187.64
7	Thoothukudi	49775	214.38	5.67	9.98	230.03
	<b>Total</b>	<b>448340</b>	<b>1931.00</b>	<b>79.00</b>	<b>139.00</b>	<b>2149.00</b>

### **8.7.5 Transmission losses**

The transmission or conveyance losses i.e. the amount of water lost through evaporation and seepage in the link canal during its course from the Kattalai barrage to Gundar, have been estimated month-wise considering 0.60 cumec per million square meters of wetted area of the canal as per Bureau of Indian Standard Code. The annual transmission losses work out to 103 Mcum.

### **8.7.6 Environmental releases**

The diversion through the Cauvery (Kattalai) - Vaigai - Gundar link canal is proposed in partial exchange to the waters from Phase II of peninsular component, regulated at Somasila reservoir. The Cauvery flows are intact and would still be available in river Cauvery downstream the Kattalai barrage during this period. Moreover, diversion is planned mostly during monsoon period. Therefore, no additional provision is made for environmental flow in Cauvery river in the simulation studies for the transferable quantity at Kattalai barrage.

### **8.7.7 Evaporation losses**

The Kattalai barrage is the diversion structure with just 29 Mcum (1.04 TMC) of storage. The pond will act as balancing reservoir as the actual regulation of flows will be done at Somasila reservoir on river Pennar. As such, no specific provision towards evaporation losses at the barrage site is made.

### **8.7.8 Total water demands of the link project**

The month – wise / branch canal wise distribution pattern of various demands from the link canal is shown in **Annexure 8.13**. The total water demand under the link project is 2252 Mcum.

## **8.8 Water planning**

Water resources development projects should as far as possible be planned and developed as multi-purpose projects. Irrigation and multi-purpose

projects should invariably include a drinking water component. Drinking water needs of human beings and animals should be the first charge on any available water resource. Also, the project should be able to cater to the industrial water supply in the region, wherever possible. The Cauvery (Kattalai) - Vaigai - Gundar link project is conceived as a multi-purpose project envisaging irrigation, domestic and industrial water supply benefits in its command area.

The envisaged water transfer from Kattalai barrage for further transfer through the link canal is 2252 Mcum. The maximum transfer will be 438 Mcum in the month of December through the link canal to meet the enroute irrigation, domestic and industrial water supply requirements in the proposed command areas. The water allocation for various uses is furnished in **Table 8.9**.

**Table-8.9**  
**Water allocation for various uses under the link canal**

**Unit: Mcum**

<b>Sl. No.</b>	<b>Description</b>	<b>Utilisation</b>
1.	Irrigation needs	1931
2.	Domestic & industrial needs	218
3.	Transmission losses	103
	<b>Total</b>	<b>2252</b>

### **8.8.1 Designed head discharge of the link canal**

The capacities of the link canal at the off-take point of Kattalai barrage and at the head of each branch canal/ direct sluice along the link alignment are worked out based on the supplementation to the command areas. The cut-off statement is appended at **Annexure: 6.5**. The designed head discharge of the link canal is 180.3 cumec corresponding to the planned peak demand of 179.84 cumec.

### **8.8.2 Ground water**

The proposed command area of the link canal lies in districts of Karur, Tiruchirappalli, Pudukkottai, Sivaganga, Ramanathapuram, Virudhunagar and Thoothukudi districts of Tamil Nadu. The groundwater quality in the command area is good and suitable for drinking and irrigation purpose.

Overall, the level of groundwater development in the proposed command area of the link project can be categorized as “Safe”.

### **8.8.3 Conjunctive use / ground water support**

In order to make an economic and efficient use of available water resources, it is essential that a judicious mix of surface and ground water are resorted to for irrigation and other purposes. The Cauvery (Kattalai) - Vaigai - Gundar link canal will provide water for irrigation to the extent of 1931 Mcum through various branch canals. The ground water storage in command area can get recharged through irrigation in the command. Thus, there will be a considerable scope to further extend the irrigation in the command areas by conjunctive use of the available surface and ground water resources. This may inter alia help in checking the hazards of water logging and soil salinity that may crop up in the command, if better water management practices are not followed.

In the present planning of the link project, however, no use of ground water is proposed in the command area. The available ground water resource can be considered for utilization in future for further intensification, extension or augmentation of the irrigation facilities in the enroute commands, particularly to meet the irrigation requirement during the lean season.

## **8.9 Command area drainage**

The command area en-route the link canal is drained by a network of rivers and streams and their tributaries. The commands have quite good draining facilities.

However, with the introduction of irrigation, as the command area gets developed, drainage problem may crop up in the course of time preference for micro irrigation in the command. Suitable provision is, therefore, made in the project estimate towards chalk and collecting drains in the command area.



### **8.9.1 Water course / field channels**

These are small channels to deliver water to each and every field in the command area of an outlet which is approximately 40 ha for a delivery system of one cusec. Capacity of a water course depends upon (a) water allowance (b) running period of outlet and (c) area to be irrigated.

Branch canals/ direct sluices from the link canal, pipe distribution system to the field outlets, water courses /field channels (DI pipes for small field channels) etc., are planned and designed to facilitate in carrying water from the link canal up to the tail end as well as within the commands.

The estimated cost/ ha of CCA works out to Rs 0.54 lakh/- (price level 2019-20), for piped distribution to both U - Distribution system and V-Water courses/field channels as per the case study carried out by Central Water Commission (CWC).

### **8.10 Water management**

Maximum gains in water use efficiency can only be made when these are combined with better water management practices. Keeping this concept in view, the Government of India is focusing on covering maximum possible command area through pipe distribution network to ensure that irrigation water is delivered timely and equitably in the command area and that it be used efficiently preferably under micro irrigation through Participatory Irrigation Management (PIM). Where Water User Associations / Irrigation Co-Operatives maintain the canal network and field channels, it helps in proper distribution among all stake holders their fair and just share of water. Rehabilitation of existing canal network through stakeholders' participation to make water available to tail-enders is given priority.

#### **8.10.1 Proposals for participatory irrigation management including formation of water user's association**

The Government of India is focusing to involve beneficiaries and stakeholders in irrigation management through various State Govts.

The role of water users' association shall be

- to collect, check and either sanction or reject partly or fully water applications or water indents of members based on criteria prescribed;
- to prepare detailed water distribution programme or rotational water supply to the members before every rotation and ensure volumetric supply to all the members as per their entitlement;
- to maintain rotation wise or season wise Water Account in the prescribed form to remit to the canal officer,
- to pay the water charges within the prescribed period against the bills received from the canal officer;
- to regulate and monitor water distribution to the members;
- to assess water charges for the members and send bills in the prescribed form;
- to collect prescribed service charges for operation and maintenance;
- to carry out annual maintenance and repairs to canal system falling under its jurisdiction;
- to resolve disputes, if any, amongst the members;

The same practices can be adopted in case of the link project.

#### **8.10.2 Scope of introduction of modern technology viz sprinklers, drip irrigation etc.**

The pipe distribution network and micro irrigation is being promoted by various States these days. Drip irrigation is being promoted, especially for sugarcane, to manage the water demand with limited water available. Thus, there is adequate scope for introduction of sprinkler and drip irrigation systems in the command area.

#### **8.10.3 Existing practice of department of agriculture for popularizing micro irrigation**

Micro irrigation systems are being encouraged for efficient use of water to increase the irrigated area by the State Govts. The state give subsidy to small & marginal farmers as well as other farmers for purchase of sprinkler and drip irrigation equipments. Similar policy can be adopted for link project.

#### **8.10.4 Facilities for training**

Adequate training facilities are available to the farmers. With latest technology like television and mobile phones available in each house, farmers get to know about the latest developments in the agricultural field level practices as well as about Government schemes, subsidies etc. Training to the farmers at their native villages can be imparted on various crops suitable in area specific agro climatic zone and also on pressurized irrigation practices.

#### **8.10.5 Existing extension activity and proposals for its improvement**

Various schemes are being implemented to improve performance in agriculture in the States which include National Mission on Agriculture Extension & Technology. The State Govt. provides training and extension services to educate the farmers about the use of modern agriculture technology and counseling them on soil health, organic farming, inputs, irrigation etc.

### **8.11 Agricultural support services**

#### **8.11.1 Agricultural marketing**

The State Govt. is focusing on activities such as keeping necessary coordination in working of various market committees, development & promotional activities of Agriculture Produce Marketing Committee (APMC), establishment of agro-export zones, horticultural training centers and grading & packing facilities, etc.

#### **8.11.2 Development of horticulture**

The National Horticulture Mission (NHM) has been launched with the main objective of increasing the area & productivity under horticulture and also to promote post-harvest management. States have established appropriate organizational entities to implement schemes of NHM and National Medicinal Plants Board (NMPB).

### **8.11.3 Organic farming**

For promotion of organic farming, various activities like providing guidance, getting certification, marketing of the organic farm products are included in the National Mission on Sustainable Agriculture (NMSA). “Paramparagat Krishi Vikas Yojana (PKVY)” is an elaborated component of Soil Health Management (SHM) of NMSA. Under PKVY, organic farming is promoted through adoption of organic village by cluster approach and Participatory Guarantee System (PGS) certification.

### **8.11.4 Minimum support price**

To make the agricultural activity viable as well as to protect the farmers’ economy from natural calamities and low prices offered by traders, Govt. of India declares Minimum Support Price (MSP) for selected crops. Under this scheme, procurement in the States is undertaken by the National Agricultural Co-operative Federation and State level Marketing Federation/Corporations.

### **8.11.5 Crop insurance**

The crop insurance schemes are useful to overcome the uncertainties in agriculture. Under the National Agricultural Insurance Scheme (NAIS), 16 kharif and eight rabi crops are covered. The GoI is also aiming to cover about 50 per cent of farmers in the country in the next 2-3 years through its ambitious crop insurance scheme viz. ‘Prime Minister Fasal Bima Yojana’.

### **8.11.6 Agricultural credit**

Agricultural credit is one of the key inputs for improving production & productivity and reducing farmers’ distress. Financial assistance is provided to farmers by way of short-term loans, credit, etc. by government through various banks and co-operative agencies. The loans are disbursed through Commercial Banks (CB), Regional Rural Banks (RRB), District Central Co-operative Banks (DCCB) and Land Development Banks (LDB).

The financial institutions directly associated with agricultural finance at grass root level in the State are Primary Agricultural Credit Co-

operative Societies (PACS) which provide short-term crop loans to their cultivator members.

### **8.11.7 Use of improved seeds**

The GoI has fixed seed replacement targets of 35 per cent for self pollinated crops (like paddy, wheat, tur, moong, urid, etc.), 50 per cent for cross pollinated crops (like maize, jowar, bajra, sunflower, etc.) and 100 per cent for hybrid crops.

## **8.12 Command area**

### **8.12.1 Location**

The entire command area proposed under Cauvery (Kattalai) - Vaigai - Gundar link canal lies in the State of Tamil Nadu. The command area under the link canal lies in the basins between Cauvery (Kattalai) and Gundar. The culturable command area (CCA) of the link project is 448340ha. Maps showing en-route command area are given at **Plates 8.1.1 to 8.1.3**.

### **8.12.2 Classification of land (Forest, grass land, cultivable land, cultivable waste, barren land)**

The newly proposed command area is about 4.48 lakh ha all along the alignment. The command area is identified using ERDAS Imagine software on USGS\_ Sentinel satellite images and correlating with the available taluk wise land use statistics. Sample surveys in small patches of the command area are surveyed to design distributaries net work and to find the cost of command area development were also carried out during feasibility stage. It is observed that most of the command area is cultivable land. The maps illustrating branch canal wise land use/land cover details are appended at **Plates 8.2.1 to 8.2.12**.

### **8.12.3 Size of land holding**

Agriculture is the main occupation of the people in the command area. The number and area of land holding by size group in the command area is given in **Table 8.10**.

**Table 8.10**  
**Land holdings in the ccommand area**

Sl.no	Category	Size of holding (ha)	Number of holdings	% to the total holdings	Area (ha)	% to the total area
1	Marginal	0.00 to 1.0	1457420	78.20	550531	36.29
2	Marginal	1.0 to 2.0	251270	13.48	353265	23.29
3	Small	2.0 to 4.0	110966	5.95	301764	19.89
4	Medium	4.0 to 10.0	38540	2.07	221093	14.57
5	Large	10.0 and above	5495	0.30	90488	5.96
			<b>1863691</b>	<b>100.00</b>	<b>1517141</b>	<b>100.00</b>

The land holding pattern indicates that the number of holdings and area of holdings is predominantly owned by marginal farmers to the extent of 78.2% and 36.29% respectively.

#### **8.12.3.1 Climate of command area**

The climate of en-route command is discussed in para 8.5 : Agro - climatic conditions.

#### **8.12.4 Irrigation**

##### **a) Present sources of irrigation in command**

The present source of irrigation in the proposed command area is mainly wells including tube wells and irrigation tanks. Out of the total area presently being irrigated, 2.8% is by canals, 57.3% by tanks and 39.9% by wells.

##### **b) Methods of irrigation followed**

At present, the conventional method of applying water through minor irrigation channels, distributaries and water courses is being followed in these areas. Electric/ diesel pump sets are used to lift water from the streams and wells.

**c) Status of land development for irrigated area**

**(i) Condition of channels**

The condition of existing irrigation channels in the command area is generally satisfactory except in some reaches where proper maintenance is required.

**(ii) Longitudinal slope of field**

The slopes in agricultural fields where irrigation channels are located, are adequate and irrigation water reaches almost every nook and corner of the fields.

**(iii) Status of field channels**

The status of field channels is satisfactory. However, proper drainage network needs to be built after introduction of canal irrigation in the area.

**(iv) Assumed field application efficiency with justification**

As per the latest guidelines approved by the Task Force on ILR, the specified irrigation efficiency for major and medium projects is 65%. This includes conveyance efficiency through conventional open canal as well as field application efficiency.

**(v) Record of water logging, salinity and flooding**

The proposed command area is mostly rainfed and is devoid of surface water irrigation facilities. At present, there is no instance of water logging, salinity and flooding occurring in the area.

### **8.12.5 Socio-economic aspects**

The Comprehensive Environmental Impact Assessment (CEIA) and socio-economic studies of Cauvery (Kattalai) - Vaigai - Gundar link canal will be carried out during pre-construction stage. The socio - economic aspects of the command area discussed hereunder are based on the district wise statistics

of Karur, Tiruchirappalli, Pudukkottai, Sivaganga, Ramanathapuram, Virudhunagar and Thoothukudi.

### 8.12.5.1 Population and major occupation

The command area is spread over Krishnarayapuram and Kulithalai taluks of Karur district; Srirangam taluk of Tiruchchirappalli district; Kulathur, Pudukkottai, Karambakudi, Gandharvakottai, Alangudi, Aranthangi, Avudaiyurkoil, Thirumayam taluks of Pudukkottai district; Thiruppattur, Karaikudi, Devakottai, Sivaganga, Manamadurai, Ilayangudi taluks of Sivaganga district; Aruppukottai, Kariyapatti, Tiruchuli taluks of Virudhunagar district; Kadaladi, Kamuthi, Mudukulathur, Paramakudi, R S Mangalam, Thiruvadana, Ramanathapuram, Keelakarai taluks of Ramanathapuram district; and Ettayapuram, Vilathikulam taluks of Thoothukudi district of Tamil Nadu State.

The population of the command area as worked out on proportionate area basis from the taluk-wise population census 2011 is 26.18 lakh of which the urban population is 6.97 lakh and rural population is 19.20 lakh. Thus the proposed command area is predominantly rural. The occupational distribution of the population for Karur, Tiruchchirappalli, Pudukkottai, Sivaganga, Ramanathapuram, Virudhunagar and Thoothukudi districts is furnished in **Table 8.11**.

**Table-8.11**  
**District-wise socio-economic aspects**

Sl. No.	Description	Karur	Tiruchirappalli	Pudukkottai	Sivaganga	Virudhunagar	Ramanathapuram	Thoothukudi
1.	Population density/km <sup>2</sup>	367	604	348	316	458	330	369
2.	Sex ratio (Female to 1000 male)	1015	1013	1015	1003	1007	983	1023
3.	% of SC population	20.79	17.14	17.60	17.01	20.59	18.40	19.88
4.	% of ST population	0.05	0.67	0.08	0.06	0.12	0.08	0.28
5.	Major Occupation	Distribution of total Workers in each district in four categories of economic activity						
(i)	Cultivators (%)	15.81	14.06	27.47	22.74	6.02	28.2	6.49
(ii)	Agricultural	36.97	31.20	40.06	32.18	21.96	25.52	26.82



	labourers (%)							
(iii)	Household Ind. workers (%)	2.09	2.0	1.83	2.36	3.71	4.18	3.06
(iv)	Other workers (%)	45.14	52.24	30.63	42.72	68.31	41.48	63.64
6.	Land holdings	Maximum number of holdings belongs to marginal & small farmers owning 0-2 ha						
7.	Literacy rate (%)	75.60	83.23	77.19	79.85	72.02	80.72	86.16
8.	No. of Schools	1044	1833	1764	1458	1738	1315	1806
9.	No. of Medical and health facilities	442	661	387	427	400	352	432
10.	Drinking water supply	All the villages in the district are provided with any one source of viz., Tap water / wells / hand pump / tube well / bore well						

*Source: District Census Handbooks & Census of India -2011*

### 8.12.6 Infrastructure facilities

Development and management of infrastructure are key aspects for sustainable development and prosperity of the society.

#### (a) Roads and railways

A well-knit transport and communication system bring people of different villages/towns within the command area closer to one another. It also facilitates movement of goods and services from their locations of supply and demand. The transport routes are, thus, the main arteries of the economy. The national highway connecting Madurai - Rameswaram and the broad-gauge line connecting two district headquarters of Tiruchirappalli and Madurai, Tiruvarur – Madurai and Tiruchirappalli - Rameswaram pass through the command area. All the districts in the command area are endowed with a network of state highways and good all-weather roads which render them easily accessible both within the district and from one another.

#### (b) Marketing facilities

Good marketing facilities are available for the people of the command area. In addition, numerous fair price shops within reasonable distances are available in almost all villages. There are several big towns including Ramanathapuram, Pudukkottai having good marketing facilities with communication network. These places have enough facilities to sell

agricultural and nono - agricultural produce. Besides this, there are good number of outlets for supplying agro - inputs like seeds, fertilisers and pesticides to meet the requirements of the farmers.

**(c) Agro-industries**

The state of Tamil Nadu where in the proposed command area of the link project lies is considered as highly industrialized state. There are a number of agro-based industries based in the state. There will be ample scope for coming up of a greater number of such industries on implementation of the link project due to the likely spurt in agricultural production.

**(d) Banks/ credit societies etc.**

Financial institutions provide financial support to all sections of society and also to infrastructure projects. Banks are prime financial institutions. Scheduled Commercial Banks (SCBs) comprise of the State Bank of India (SBI), other nationalized banks, private banks, Regional Rural Banks (RRBs) and foreign banks. There is number of such banking facilities in the command area.

**8.12.7 Topography and soils**

**i) Topography and relief**

Topography of the command area is undulating and is of moderate slope. Isolated hill tops/hillocks and continuous hill ranges in small stretches with valleys dominate the command area that is spread in about 7 districts located in Tamil Nadu.

**ii) Land slopes**

Slopes of the lands in the command are generally moderate, neither steep nor flat.

### iii) Soils

The details of soils present in the command area are already given under para 8.4. The area has high productivity potential due to inherent fertility of soils. The soils of the area are fine to moderately fine in texture and are mostly free from salinity. However, proper water management practices need to be adopted to prevent the development of water logging, thereby salinity and alkalinity on introduction of irrigation.

#### 8.12.8 Ground water and drainage

Ground water assessment has been made for the districts in the proposed command area based on ‘Dynamic Groundwater Resources of India, June, 2017’ publication of Central Ground Water Board (CGWB). Details are furnished in **Table-1.7 of Chapter 1: Introduction**. The annual replenishable ground water resource of various districts falling in the command area is 4765 Mcum out of which the ground water draft is 1895 Mcum and allocation for domestic use is 185 Mcum which indicates about 54% of average ground water development in the region..

As the slope of the land is less than 5% and groundwater depth is more than 1.5 m in most of the command area, no drainage problem is anticipated. The command areas of the link canal are drained by a network of rivers, their tributaries, small streams and nallas. Thus, the command area naturally provided with good draining facilities.

#### 8.12.9 Agriculture

The cropping pattern is adopted as per the circulated feasibility report of the link project. The average yields for pre-project (rainfed) and post-project (irrigated) scenarios in the command area are made available by the State Agriculture Department for Karur and Pudukkottai districts only. The same irrigation benefits have been considered for the remaining area in the absence of details from other districts. Proposed land use will change due to increase in cultivated area and a spurt in developmental activities due to the link project.

### **8.12.10 Farmers' attitude towards improved agricultural practices**

The increase in intensity of irrigated crops in the command area leads to increase in the agricultural production which in turn makes agriculture remunerative. Therefore, the farmers will have a positive attitude towards improved agricultural practices, which are being duly promoted by the state.

#### **a) Use of improved implements and seeds**

Nearly 85 percent of agricultural holdings in the districts lying in en-route command area are marginal (less than 2 ha). Among all groups of holdings in which Tractors, Tractor drawn Seed Drill Cum Fertilizer Drills, Power Threshers were used in the districts pertaining to command area, more than 90% of them were used in small & marginal holdings for agricultural purposes. Similarly, among all groups of holdings in which Sprinklers and Drip Irrigation Sets were used, most of them were used in small & marginal holdings. Among all groups of holdings in which certified, notified and hybrid seeds were used, about three fourths of these were used in small & marginal holdings. This clearly shows that farmers are well aware of the advantage of using improved implements and quality seeds for better agricultural production and are actively using them.

#### **b) Use of fertilizers, insecticides, pesticides, etc.**

In the districts pertaining to the command area, usage of fertilizers & pesticides is very common among the farmers. Farmers in the command area are very much inclined to use fertilizers, insecticides, pesticides, etc. in their farms.

### **8.12.11 Identification of problems in en-route command area**

#### **(i) Physical problems (Including hazards)**

**(a) Land slopes:** The land is generally undulating; therefore, canal distribution system has to be aligned accordingly.

**(b) Soil depth:** There may not be any problem on this account, as sufficient soil depth is available in the area for providing canal irrigation.

**(c) Salinity/ alkalinity:** No salinity/alkalinity problem is expected in the command Area.

**(d) Water logging:** No water-logging problem of any serious nature is reported in the command area. After introduction of irrigation, the command area shall, however, be monitored for water logging.

**(e) Drainage:** As area is undulating with moderate slopes, no drainage problem as such is anticipated. However, keeping in view the soil types present in the command, suitable drainage network shall be provided.

## **(ii) Financial problems**

Financial assistance is provided to farmers by way of short-term loans, credit, etc. by government through various banks and co-operative agencies. The loans are disbursed through Commercial Banks (CB), Regional Rural Banks (RRB), District Central Co-operative Banks (DCCB) and Land Development Banks (LDB). The State Co-operative Banks and Regional Rural Banks issue Kisan Credit Cards (KCC). The financial institutions directly associated with agricultural finance at grass root level in the State are Primary Agricultural Credit Co-operative Societies (PACS) which provide short-term crop loans to their cultivator members. Since these institutions meet the credit needs of the farmers, no financial problems are expected to be faced by the farmers for carrying out their agricultural operations.

### **8.12.12 Proposed cropping pattern with justification based on land irrigability classification, agro climatic conditions developed, irrigated cropping pattern in adjoining projects / areas etc.**

The cropping pattern as adopted in the feasibility report is considered in the DPR also which is based on the land irrigation capability classification along with agro climatic conditions of the region. The details of proposed cropping pattern for the command area have been discussed in **para 8.6**.

### **8.12.13 Land development work proposals**

Since the command area is already under cultivation, no major land development works may be required. However, appropriate provision has been kept in the estimate for land development works. At the time of implementation of the link project, detailed survey of each command will be done and based on the actual requirement, appropriate land development works will be taken up.

### **8.12.14 Ayacut roads**

There are several cart tracks connecting villages and village roads across the proposed command area. These cart tracks and village roads will be interconnected with the major roads so as to develop an integrated transport network of the region.

### **8.12.15 Benefits**

#### **(i) Crop-wise increase in yield per ha and total estimated output from the command**

The irrigation under Cauvery (Kattalai) - Vaigai - Gundar link project has been planned in such a way that the diverted water will be utilized judiciously and optimally to bring more area under irrigation for benefitting as many farmers as possible. To achieve this objective, an intensity of irrigation of only 100% is adopted for the entire new command area of the link project.

The cropping pattern is proposed keeping in view the existing crop practices in the command area and the need for optimum utilization of water for obtaining better yields and returns. A cropping pattern with a good mix of food and commercial crops in each command has been adopted based on the prevailing cropping pattern in the region in order to maximize crop yields and returns in the post project scenario.

The likely crop-wise yields per ha under pre and post project scenarios in the reach-wise command areas are furnished in **Annexures: 13.3.1 and 13.3.2.**

**(ii) Estimated value of increased production**

The net annual value of crop production under the link project is assessed as Rs. 428064 lakh as derived from **Annexures: 13.3.1 and 13.3.2.**

**(iii) Likely socio-economic aspects**

The project area is purely agro-based and agriculture development in the region through the proposed Cauvery (Kattalai) - Vaigai - Gundar link canal project may bring economics into fast track. The agriculture development increases the food grain production and thereby improves financial resources of the farmers which inter alia increase the scope for investment opportunities by them. There is a scope for set up of agro-based industries in large scale and consequent demand for more marketing facilities in the region. There are a number of technical institutes and well qualified youth in the region, apart from the agricultural labourers who can be effectively absorbed in this development process. This will improve financial condition of the respective families and the society as well. Due to improved economic condition of the families, the health conditions/facilities too will improve in the region. Further, due to supply of clean and assured drinking water, the sanitation facilities also will improve. Thus, the socio-economic conditions in the command areas will improve significantly due to the implementation of the link project.