Chapter 9
Command area development

9.1 General

It is proposed to provide assured irrigation facility to a new culturable command area of 363959 ha with annual water utilisation of 3790 Mm^3 from the Mahanadi (Barmul) - Godavari(Dowlaiswaram) link canal in its enroute. The development aspects of the proposed command area are discussed in the following sections.

9.1.1 Location and status of land in the command area

The gross command area of Mahanadi (Barmul) – Godavari (Dowlaiswaram) link canal in its enroute is 4.95 lakh ha, of this the culturable command area (CCA) has been assessed to be 3.64 lakh ha. The district wise/state wise details are given in **Table 9.1**.

Table 9.1
District wise/State wise command area and water utilization enroute of link canal

S. No.	State	District	Command area in ha	Utilisation in MCM
1.	Odisha	Nayagarh	28057	348
		Khurda	106317	1318
		Cuttack	20448	254
		Puri	9714	120
		Ganjam	92091	1142
		Gajapati	143	2
	Sub-total		**256770**	**3184**
2.	Andhra Pradesh	Srikakulam	73499	416
		Vizianagaram	15079	85
		Visakhapatnam	18611	105
	Sub-total		**107189**	**606**
	Grand total		**363959**	**3790**

9.1.2 Climate of the proposed command area

There are four IMD observatories in the command area. The average annual rainfall observed at these IMD observatories is shown in the **Table 9.2**. The data is based on the observations by IMD for the period 1981 to 2010.

Table 9.2
Distribution of rainfall in the command area

Season / Month	Monthly normal rainfall in 'mm'			
	Puri	Gopalpur	Kalingapatnam	Visakhapatnam
January	15.3	11.9	9.6	11.1
February	20.7	16.1	20.3	10.5
March	20.9	18.6	7.7	13.0
April	24.9	26.3	21.9	26.2
May	68.7	62.0	65.0	70.5
June	178.1	140.2	146.7	117.0
July	290.5	179.0	147.1	133.3
August	361.0	213.1	177.5	163.6
September	261.4	196.2	190.5	191.1
October	168.9	199.6	230.3	258.1
November	65.9	92.8	104.8	115.5
December	10.7	10.6	5.7	8.8
Total	**1486.8**	**1166.4**	**1127.1**	**1118.8**

The monthly normals of the other climatological data at the IMD observatories located in the proposed command area are given **Annexure 9.1.1 to 9.1.4**.

9.1.3 Topography and soils

The FSL of Mahanadi (Barmul)- Godavari (Dowlaiswaram) link canal varies from 75.060 m at its off take to 14.505 m at its outfall. The ground in the command area slopes down from the link canal to the east coast upto the Bay of Bengal. For a few kilometers adjacent to

the link canal in the upper portion of the proposed command area, the topography is generally undulating and thereafter it gradually slopes down to the east coast. The undulating part of the command area is occupied in patches by reserve forests. The entire area is crisscrossed by many small and medium natural drains. The available soils in the proposed command area are mainly alluvial, laterite, black, red and yellow and coastal sand. The alluvial and laterite soils are more predominant and the other soils cover only smaller areas. The soils are shallow on hill slopes in the undulating upper part of the command, while they are moderately deep to deep in the lower gradually sloping portion of the command area. The lands in the command area are generally fertile and the crop yield is likely to increase substantially under irrigation.

9.1.4 Existing land use

Agriculture is the mainstay of the people in the proposed command area. As per the land use statistics of different districts falling in the proposed command area, the forest area in the command is 92439 ha, and the culturable area is 363959 ha. The net sown area is 253292 ha, which is 51.13% of the gross command area of 495344 lakh ha.

The State / District-wise data on land utilisation for the year 2014-15 as extracted from the district statistical books is already shown in **Annexure 1.6.** Also, land use data in the command area for the year 2014-15 is given in **Annexure 1.7**

9.1.5 Cropping practices

The agriculture in the proposed command area is mainly rain-fed at present. The principal crops grown in the area are paddy, maize, groundnut, cotton, jowar and pulses. **Annexure 9.2** gives the area under principal crops in the districts falling in the command area. **Annexure 9.3** gives the district-wise general statistics of the command area.

Taking into consideration, the prevailing agricultural practices, soil and other characteristics of the area, the cropping pattern to be followed for the proposed command area has been devised, which is dealt in detail in **Chapter 8: Water and irrigation planning.**

9.1.6 Present sources of irrigation

Small patches of the proposed command area are currently irrigated mainly through wells and tanks. The source-wise irrigation details are dealt in **Chapter 8: Water and irrigation planning.** There are two existing major and four existing medium irrigation projects in the command area, whose particulars are given in **Table 9.3**.

Table 9.3
Existing major/medium irrigation projects in the proposed command area

		← Project as a whole →			
Sl. No:	**Name of the project**	**CCA ha**	**Designed annual irrigation ha**	**Designed annual utilisation Mm³**	**CCA under the proposed command ha**
I	**Major project** Rushikulya system	61231	61231	444	56566

	Vamsadhara	60016	60016	900	60016
	Sub-total	**121247**	**121247**	**1344**	**116582**
II	**Medium**				
	Salia	8094	10825	74	8094
	Jayamangala	7545	7545	72	7545
	Bahuda	8288	8288	71	8288
	Baguva	4047	4047	43	1491
	Sub-total	**27974**	**30705**	**260**	**25418**
	Total	**149221**	**151952**	**1594**	**142000**

The predominant irrigated crop is paddy with other major irrigated crops being groundnut, vegetables, sugarcane, maize and bajra. The suggested cropping pattern for irrigation in the command area has been devised to consist of all these crops traditionally grown in the area.

9.1.7 Groundwater resources

The proposed command area lies in the districts of Nayagarh, Khurda, Cuttack, Puri, Ganjam and Gajapati of Odisha state and Srikakulalm, Vizianagaram and Visakhapatnam of Andhra Pradesh state in the basin area covered between Mahanadi and Sarada rivers. The groundwater potential of the gross geographical area of the command is estimated on pro rata basis from the district-wise ground water resources – 2017 published by CGWB is furnished in **Table 9.4**.

Table 9.4
Groundwater potential in the proposed command area

Unit: Mm³

State/ District	Area of the district (ha.)	Area of the district in the command area (ha.)	Estimated potential	Provision for Drinking Water and Other uses (15%)	Stage of Ground Water Extraction (%)	Net draft	Balance available for exploitation
Odisha							
Nayagarh	389000	47804	49	7	36.51	16	26
Khurda	281300	157554	268	40	49.40	132	96
Cuttack	393200	30530	57	9	42.27	24	24
Puri	347900	13241	25	4	48.62	12	9
Ganjam	820600	134054	153	23	39.55	61	69
Gajapati	432500	496	-	-	31.30	-	-
Sub-total	2664500	383679	548	83		245	224
Andhra Pradesh							
Srikakulam	580000	119191	221	33	48.22	107	81
Vizianagaram	650000	22832	29	4	24.59	7	18
Visakhapatnam	1120000	55616	52	8	21.07	11	33
Sub-total	2350000	197639	302	45		125	132
Total	5014500	581318	850	128		370	356

Source: i) Statistical Abstract of Odisha – 2012
ii) Statistical Abstract of Andhra Pradesh – 2017
iii) Dynamic Ground water resources assessment of India -2017

The Central Ground Water Board has done a pilot study on the hydro geological surveys on the Godavari (Polavaram) – Krishna (Vijayawada) link canal project proposed by NWDA for assessing the possible changes/effects on groundwater scenario in the command area due to introduction of surface water irrigation. As per their recommendations, 20% of the transmission losses and 40% of the water applied will add to the groundwater regime in the proposed command area by way of infiltration, canal seepage and return flow from irrigation. In case of Mahanadi(Barmul)- Godavari(Dowlaiswaram) link canal, the proportional transmission losses are worked out to be 569 Mm^3 against the utilisation of 3790 Mm^3 for the en route irrigation. Since the rock formations in the present link are (hard rocks) different from those in the Polavaram – Vijayawada link (alluvial), the percentage for return flow needs to be modified. Ground Water Estimation Methodology (1997) suggests 30% of water applied as recharge for non-paddy areas where ground water level is less than 10 m. It is 50% for paddy areas. Since the link traverses hard rock area, it is considered that 25% of the water applied for paddy areas and 15% for non-paddy areas may be taken for preliminary assessment for ground water recharge. As per the proposed cropping pattern, 64 % of the command will have paddy. The total water requirement for paddy works out to be 3190.14 Mm^3. The recharge values, therefore, work out to be:

Transmission losses @ 20%	=	113.80 Mm^3
Recharge from paddy fields @ 25%	=	797.54 Mm^3
Recharge from non-paddy areas @ 15%	=	90.00 Mm^3
Total quantum of recharge	=	1001.34 Mm^3

Further refinement for assessment of recharge will be done at DPR stage. Possibility to utilise this additional availability of groundwater may be explored to get an increased annual irrigation based on requirement.

9.2 Socio-economic aspects

The socio-economic aspects of the command area discussed here under are based on the district-wise statistics of the Nayagarh, Khurda, Cuttack, Puri, Ganjam and Gajapati districts of Odisha State and Srikakulam, Vizianagaram and Visakhapatnam districts of Andhra Pradesh State falling in the command area. The district-wise general statistics of the area for the year 2014-15 are presented below.

9.2.1 Population and major occupations

The command area is spread over 6 districts of Odisha state and 3 districts of the Andhra Pradesh state. The population of the command area as worked out on proportionate area basis from the district wise population census 2011 is 37.89 lakh of which the urban population is 23.00 lakh and rural population is 14.89 lakh. Thus the proposed command area is predominantly urban. The occupational distribution of the population for the districts lying in the proposed command area is furnished in **Table-9.5.**

Table 9.5
Occupational distribution of the population

Unit: Percentage of population of districts

S. No	Occupation / Category	Naya-Garh	Khurda	Cuttack	Puri	Gan-jam	Gaja-pati	Sri-kaku-lam	Vizia-nagarm	Visa-Kha-patnam
1	Main workers	66.66	79.86	74.36	72.47	59.98	57.96	72.56	82.31	78.31
2	Marginal workers	33.34	20.14	25.64	27.53	40.02	42.04	27.44	17.69	21.63
3	Non workers	78	76	77	76	80	81	52	50	56
4	Cultivators	24.2	11.7	14.8	27.8	19.0	22.1	12.81	18.33	17.02
5	Agriculture labour	35.0	14.7	26.5	26.4	37.7	52.1	54.71	48.12	30.63
6	Number of cultivators	0.83 Lakh	0.92 Lakh	1.38 Lakh	1.72 Lakh	2.84 Lakh	0.65 Lakh	1.65 Lakh	2.12 Lakh	3.20 Lakh
7	Number of agricultural labour	1.20 Lakh	1.16 Lakh	2.48 Lakh	1.63 Lakh	5.65 Lakh	1.53 Lakh	7.0 Lakh	5.57 Lakh	5.78 Lakh

Source: i) Statistical Abstract of Odisha – 2012
ii) Statistical Abstract of Andhra Pradesh – 2017

The district-wise percentage of the agricultural workers to the total workers to all the districts of the proposed command area are given in **Table 9.6**.

Table 9.6
District-wise distribution of workers

Sl. No.	State/District	Percentage of Total Labour		
		Cultivators	Agricultural Labour	Others
	Odisha			
1.	Nayagarh	24	35	41
2.	Khurda	12	15	73

3.	Cuttack	15	27	58
4.	Puri	28	26	46
5.	Ganjam	19	38	43
6.	Gajapati	22	52	26
	Andhra Pradesh			
7.	Srikakulam	13	54	33
8.	Vizianagaram	18	48	34
9.	Visakhapatnam	17	31	52

Source: i) Statistical Abstract of Odisha – 2012
ii) Statistical Abstract of Andhra Pradesh – 2017

9.2.2 Land holdings

The classification of the farmers of the command area according to the land holdings is presented in **Table 9.7**.

Table 9.7
Classification of farmers based on land holdings

Sl. No.	Category of farmers	Size of land Holding	Percentage
1.	Marginal	Below 2 ha	91.85
2.	Small	2 to 4 ha	6.67
3.	Medium	4 to 10 ha	1.36
4.	Large	Above 10 ha	0.12
		Total	**100%**

Source: i) Statistical Abstract of Odisha
ii) Statistical Abstract of Andhra Pradesh – 2017

9.2.3 Land tenure

Agriculture is the mainstay of the population of the proposed command area. The land ownership status of the house holds of districts falling in the proposed command area is furnished in **Table 9.8**.

Table 9.8
Land ownership status of house holds

S. No.	State/District	No. of households (lakh)	No. of land holdings (lakh)	Percentage
	Odisha			
1.	Nayagarh	1.72	1.12	65
2.	Khurda	3.22	1.19	37
3	Cuttack	2.61	1.65	63
4	Puri	4.05	1.63	40
5	Ganjam	4.94	2.95	58

6.	Gajapati	3.37	0.69	20
	Andhra Pradesh			
7.	Srikakulam	5.72	5.25	92
8	Vizianagaram	4.63	4.46	96
9	Visakhapatnam	5.79	4.74	82

Source: i) Statistical Abstract of Odisha – 2012
ii) Statistical Abstract of Andhra Pradesh – 2017

9.2.3 House hold income

Major portion of the population of the command area is dependent on agriculture. Among the population engaged on agriculture, nearly 36% are agricultural labour. Among the cultivators owning lands also, the marginal farmers holding less than 2 ha are in majority (i.e. 91.5%). From the above, it is clear that the present levels of house hold income is marginal in case of many households. The introduction of irrigation in the proposed command area could be expected to boost the household income. This is discussed in detail under **Section 9.7**.

9.2.5 Availability of agricultural labour

About 36% of the workforce available in the proposed command area are agricultural labourers and would be adequate even after introduction of irrigation.

9.3 Identification of problems in the command area

a) Physical problems

There are no significant physical problems in the command area. The soils in the command area are suitable for growing the crops proposed. As the area is well drained by the existing natural drainages and the groundwater table fluctuates sufficiently below the root zone of the crops, the drainage and water logging problems are anticipated to be minimal.

b) Financial problems

No financial problem could be foreseen. The farmers are already in the field of agriculture. With the introduction of assured irrigation water supplies due to implementation of the link project, more in puts have to be put in to achieve greater yields. This may call for more finances. Since the present policy of the government both at central and state levels is aimed at growing more food and achieving self-sufficiency by providing every conceivable assistance to the farmers, the locally available banks and other financial

institutions would be expected to be geared-up to provide the increased timely financial assistance to the farmers.

9.4 Infrastructure facilities

a) Railways and roads

The command area is well connected by roads and railways. The National Highway No. 16 and a broad gauge railway line connecting Howrah and Chennai passes through the command area. The National highway 43 connecting Vizianagaram and Raipur in Chhattisgarh also passes through the command area. A good network of state highways, major district and other roads connecting the district head quarters, mandal head quarters and other smaller towns is already available in the command area.

b) Marketing facilities

There are 31 big towns including Bhubaneswar, the capital of Odisha, Berhampur, Srikakulam, Vizianagaram, Visakhapatnam and Anakapalli are located in and around the proposed command area, having very good marketing facilities with communication network for transport. These places have enough market yards and Ryth bajars to sell their agricultural food and non-food produce. Besides this, good number of outlets for the supply of the agricultural inputs like seeds, fertilizers and pesticides to the farmers to meet their requirements are already in existence in the command area. In addition, the Visakhapatnam sea port and Paradeep sea port are also in the vicinity of command area.

c) Financial institutions

There are number of financial institutions in and around the command area which include the nationalised banks, rural and commercial banks and co-operative banks. These institutions provide the financial assistance to the farmers for meeting their agricultural expenses, purchase of livestock, acquisition of new lands, improvement of land and drainage and other necessities.

d) Medical facilities

There are adequate number of public health centres in and around the proposed command area.

Command area development works

a) Land development

The terrain of the proposed command area is mostly plane with small undulations. The land levelling and its preparation to receive the irrigation supplies may have to be taken up with active participation of the beneficiary farmers. The cost of levelling and the preparation of land could be borne by the farmers themselves, and for land development, banks can provide the required loans to be recovered in easy installments.

b) Field channels

Field channels will have to be constructed through the entire ayacut of the canals to carry the irrigation supplies to the fields. Again active participation of the farmers for the work is called for, which could be planned simultaneously with the land levelling works.

c) Field drainage to prevent water logging

The command is very close to the sea coast in its lower portion. The pre-monsoon groundwater table is about 5 m below the ground level. The average post- monsoon water table is around 2 m below the ground level. Hence, any rise in the water table in the command area will have to be thoroughly watched after introduction of irrigation. However, to avoid the possibility of water logging in the command, a well drainage system is to be provided besides to resort to conjunctive use of surface and ground waters to enhance the irrigation intensity and also to bring down the groundwater level below the root zone of the crops.

d) Farm roads

The existing road network to reach various parts of the command is sufficient. However, after introduction of irrigation, some new farm roads will be required to be constructed and old village roads will have to be realigned for better accessibility to the villages and agricultural fields.

e) Other facilities

In addition to the above development works, marketing and ware housing facilities, credit facilities from banks, easy availability of agriculture inputs, consolidation of land holdings will have to be thoroughly planned and developed / organised for proper command area development. It is also pertinent to develop other facilities concerning the health, education,

protected drinking water supply, communications etc. for the general betterment of the living standards of the population of the command area.

9.6 Awareness and people's participation

Most of the agriculturists in the proposed command area are aware of the link proposal through the local newspapers. During the field surveys and investigations for the link canal, the local people were found to be curious about the scheme and they were made specifically aware of the details of the scheme and the benefits from the same. The local community being mainly dependent on agriculture and the area being devoid of any worthwhile irrigation facilities, the link scheme is widely welcomed by the people. They are found to be very enthusiastic of the project and demanding for speedy implementation of the project. Hence the co-operation of the local people and their active participation in implementing the project could be taken as more or less assured. Water Users Associations can be formed and their services could be utilised for works like command area development and better water management.

9.7 Assessment of likely economic impact

With the introduction of irrigation in the command area, the total produce is expected to increase. A direct benefit of Rs. 69859 per ha (price level 2018-19) of the proposed command area is estimated against Rs. 19407 per ha in the present un-irrigated condition. The increase in income is Rs. 50452 per ha. The details showing agricultural production before and after introduction of irrigation are given in **Annexure 13.1 and 13.2**.

From the annual irrigation of 624894 ha, an additional employment of about 18 million man days are expected to be created in agricultural activities. Due to increase in production of food grains and oil seeds, more rice mills and oil mills are likely to come up in the area. Further, higher production of fodder crops will result in an increase in livestock. As a result of this, dairy farms are likely to come up, which will further increase the income of the households in this area. Small scale agro-industries under self-employment scheme will have brighter prospects due to the increase in agricultural activities.

After introduction of irrigation, the income from agricultural and allied industries will increase and standard of living of people in the area is expected to improve substantially with the anticipated increase in the per capita income. Tremendous socio-economic development with improvement in literacy, communications, economic activities, public health, protected drinking water, employment potential etc. in the area could be foreseen. In

short, the link scheme could be a boon not only to the people of the command area but to the whole peninsular India as about 6500 MCM (5046 MCM of additional water from Mahanadi surplus and 1454 MCM from MSTG link contribution reaching Mahanadi) could be provided to the water short Krishna, Pennar, Cauvery basins etc., due to the taking up of this link canal.