REPORT ON
PILOT CENSUS OF MANGALAM IRRIGATION PROJECT

Table of Contents

ABBREVIATIONS

AFC	AFC India Limited
BRGF	Backward Regions Grant Fund
CAD WM	Command Area Development and Water Management
CCA	Culturable Command Area
Cumec	Cubic meter per second
cusec	Cubic feet per second
CWC	Central Water Commission
Dn	Division
DPR	Detailed Project Report
DSS	Data Storage System
Dy	Distributory
E	East
ERM	Extension, Renovation and Modernisation
FRL	Full Reservoir Level
GPS	Global Positioning System
Ha	Hectare
IPC	Irrigation Potential Created
IPU	Irrigation Potential Utilized
km	Kilometer
KML	Keyhole Markup Language
L	Left
Lat.	Latitude
LBC	Left Bank Canal
LBMC	Left Bank Main Canal
Long.	Longitude
m	Meter
m^3	cubic meter
MCM	Million Cubic Meter
MDDL	Minimum Draw Down Level
MMI	Major and Medium Irrigation Projects
MNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
Mr	Minor
MW	Megawatts

N	North
NCR	National Capital Region
O & M	Operations and Maintenance
PIM	Participatory Irrigation Management
PSU	Public Sector Units
R	Right
RBC	Right Bank Canal
RBMC	Right Bank Main Canal
RD	Reduced Distance/ Chainage
RFP	Request For Proposal
RL	Reduced Level
SDy	Subdistributory
SLD	Single Line Diagram
SMr	Subminor
Sq. km	Square Kilometer
TAC	Technical Appraisal Committee
UGC	Upper Ganga Canal
UIP	Ultimate Irrigation Potential
WUA	Water Users Association

DEFINITIONS OF TERMS USED IN THE REPORT

AGRICULTURE

Cash Crops

A high value marketable crop such as sugarcane, jute, spices, fruits, tobacco and plantation crops.

Cropping intensity

The percentage of the total crop area during a crop year or season to the culturable command area.

Cropping Pattern

Yearly sequence and spacious arrangement of the crops in a given area.

Gross Cropped Area (GCA) (or Cropped Area)

Gross cropped area is the total cropped area under various crops during the whole agricultural year counting the area as many times as the number of crops grown on the same land. Mixed crops sown simultaneously on the same land are treated as one crop.

Kharif crops

Those crops which are cultivated in the monsoon season. The following are the principal kharif crops: Maize, rice, small millets, peas, groundnut, cotton, tobacco, and sesame.

Mixed Crop

Where more than one crop is raised on the same field in the same season simultaneously, without any definite row arrangement such as gram and wheat.

Net Cropped Area (Net Area Sown)

Net cropped area is the area sown (or cropped) during the agricultural season (July-June), counting the area only once even if two or more crops are grown in different seasons on the same land.

Perennial crops

Crops which last several crop years like plantation or orchard crops.

Rabi Crops

Those crops which are cultivated in the winter season. The following are the principal Rabi crops: Wheat, barley, gram, peas, potatoes, mustard, tobacco and linseed.

Summer Crop

Often represents an intermediate (third) crop between the Rabi and Kharif crops.

HYDRAULIC STRUCTURES

Barrage

A structure built across a river, for diverting water into a canal or for providing a small storage pond. It comprises a series of gates for regulating the river flow and water level, while keeping the afflux during floods within, acceptable limits. The structure may or may not have a raised sill. It is constructed to regulate the water-surface level and to divert the water flow from upstream of the gates.

Composite Dam

A concrete/masonry wall with rockfill or earth-backing in downstream.

Lining

A protective covering (over entire or portion of the perimeter) of a water conductor system or reservoir to reduce seepage losses, to withstand pressure, to reduce and prevent erosion and improve conditions of flow.

Pond Level

The level of water immediately upstream of a structure required to facilitate withdrawal into the canal or for any other purpose.

Sill

a) A structure built under water across deep pools of a river course for counteracting the tendency to excessive scour.

b) A structure built at the outlet of a channel where certain minimum depth of flow is to be maintained in the channel, or a structure built at the head of a channel to prevent flow entering the channel until the main river stage reaches the crest of the structure.

c) The invert of a gate or sluice opening.

Under Sluices

The under sluices are bays in continuation of the weir with a crest at lower level on the same side as the canal to maintain a clear and well defined rives channel towards the canal head regulator, to scour the silt deposlted on the river bed in the pocket upstream of canal head regulator or to pass winter freshness and low floods without dropping the weir shutters.

Weir or Anicut

An ungated barrier across a stream or a river for the purpose of:

a) measuring its discharge, or

b) raising, controlling and maintaining the water level, and/or,

c) diverting part or all the water from the stream/river into a canal or conduit.

Run-of-the River Power Station

A power station utilizing the run-of-the river flows for generation of power with sufficient pondage for supplying water for meeting diurnal or weekly fluctuations of demand. In such stations, the normal course of the river is not materially altered.

IRRIGATION

Classification of Irrigation Projects

The irrigation projects can be classified as:

i. Major Irrigation Scheme - Culturable Command Area (CCA) more than 10,000 hectare (ha)

ii. Medium Irrigation Scheme- Culturable Command Area (CCA) more than 2000 hectare (ha) and upto 10,000 hectare (ha)

iii. Minor Irrigation Scheme - Culturable Command Area (CCA) upto 2000 hectare (ha)

Closure period

The period when the canal is closed for regular maintenance, repairs and other purposes.

Consumptive Use Efficiency

The ratio of consumptive water use by crop and the soil moisture stored in the root zone of the soil during the crop growth period.

Conveyance

The movement of water from its source through the main or secondary canals or conduits to the tertiary or distributary off-takes.

Conveyance Losses or Transmission Losses

Losses of water in transit from the source of supply to the point of field turn out whether in natural channels or in artificial ones, such as canals, distributaries or watercourses. They comprise evaporation from the water surface, seepage and incidental transpiration by vegetation growing in or along the canals network. These also include the operation losses in the canal system.

Crop Water Requirement

The total water needed for evapo-transpiration from planting to harvest for a given crop in a specific climate regime, when adequate soil water is maintained, by rainfall and/or irrigation so that it does not limit plant growth or crop yield.

Culturable Command Area

It is the area which can be physically irrigated from the scheme and is fit for cultivation **or** The difference between the gross command area and the unculturable area falling under the command **or** Total area in which cultivation is possible.

Distributary or Tertiary

Canal or conduit taking water from the conveyance system and supply it to one tertiary unit.

Diversion Structure

The structure that diverts water from the water sources and supplies it to the irrigation system.

Drip/Trickle Irrigation

It comprises the application of water in drops close to the plant. The entire space between the plants is not watered.

Field Channel

Channel usually taking water from the watercourse and supplying it to one or more forms or fields.

Field Irrigation Requirements

The requirements of irrigation water for crops at the diversion point of supply channel.

Flow Irrigated Area

Area which can be irrigated from the source of water, by flow under gravity alone.

Gross Command Area

The total geographical area which can normally be commanded or serviced from a irrigation project without consideration of water supplies available for irrigation. It is the total area covered by an irrigation project including unculturable area under habitation, road, tanks, waste land, forest land etc.

Gross Irrigated Area

The gross irrigated area is the total irrigated area under various crops during the whole agricultural year, counting the area irrigated under more than one crop during the same year as many times as the number of crops grown. Inter-cultured or mixed crops are treated as one crop.

Irrigation

The supply of water by artificial means for raising crops.

Irrigated Area

The area to which irrigation water has been applied.

Irrigation Potential Created - (As per Planning Commission)

a. The irrigation potential created by a project at a given time during or after its construction is the aggregate gross area that can be irrigated annually by the quantity of water that could be made available by all connected and completed works upto the end of the water courses or the last point in the water delivery system upto which the Government is responsible for construction.

b. Before an area is included and reported under 'Potential Created', it may be ensured that the storage, head-works as well as the distribution system including irrigation outlets to serve the area are completed together with necessary water courses covering chaks or blocks upto 40 hectares in area and that works completed will make available the requisite water for the purpose in a design year for the assumed cropping pattern. The irrigation outlets should be of a capacity of about 0.03 cumec. The capacity may, however, vary depending on local conditions relating to topography, crop pattern, etc. but it should not normally exceed 0.06 cumec. The figures of the potential which relate to the gross irrigated 'new area' and 'old area stabilized' should be reported separately. The potential which refers to the 'old areas stabilized' should, however, not be considered as adding to the total irrigation potential created since this area would have already counted earlier once.

Irrigation Potential Utilized - (As per Planning Commission)

a. The irrigation potential utilized is the total gross area actually irrigated by a project during the year under consideration. The figures relating to the stabilization of 'old area' should be furnished separately in this case also since these will not be additive to the gross area irrigated.

b. As, generally, the utilzation of irrigation potential created can take place only in the year following the creation of such potential, it will be appropriate if the irrigation potential utilized in a particular year is considered with the potential created upto the end of the preceding year for the purpose of comparison.

Irrigation System

It includes storage and diversion structure, main canal, distributory, minors, water courses, field channels, and allied structures including head regulator, cross drainage works and control structures.

Irrigation Water Requirement

The amount of crop water requirement that is not provided by effective rainfall, utilization of stored soil moisture or upward flow of water to the root zone from a saturated zone.

Rostering of Channels

It is the sequencing of water delivery in different channels as a part of regulation.

Surface Irrigation

Method of irrigation where the water flows on to the field surface by gravity from the head to the tail end.

Surface Irrigation Method

It is the application of water by surface method such as wild flooding, border strip, check basis, and furrows for raising crops.

Ultimate Irrigation Potential -(As per Planning Commission)

i. It is the gross area that can be irrigated from a project in a design year for the projected cropping pattern and assumed water allowance on its full development. The gross irrigated area will be aggregate of the areas irrigated in different crop seasons, the areas under two-seasonal and perennial crops being counted only once in the year.

ii.The following considerations have to be taken into account in estimating the ultimate irrigation potential expected from a project in terms of area:

a. It will not be correct to assume the culturable command area as an arbitrary percentage of the gross command area. The CCA should be assessed from actual and by consulting land records.

b. A part of the area being proposed to be brought under irrigation from a project may be already receiving irrigation from other sources, whether major, medium or minor irrigation works, which might have been commissioned earlier. The benefits from the

new project may be by way of an additional water allowance to irrigation more secure or to stabilize irrigation the area. Such area should not be counted in new irrigation potential but considered only as stabilize of irrigation in an old area. The Ultimate irrigation potential should indicate only figures of gross irrigation of new area whether in the new command area or in the existing command (by increasing the intensity of cropping). The old area stabilized may be reported separately.

FINAL REPORT
PILOT CENSUS OF MANGALAM IRRIGATION PROJECT

1. Background

1.1 The growing gap between Irrigation Potential Created (IPC) and that Utilized (IPU) is becoming a matter of great concern. Though there exists a gap between IPC and IPU, which need to be bridged, but often this gap gets over-estimated since the same command area is counted as potential created under surface water major/medium project and again under supplementary minor project (surface lift/ groundwater project). To assess the actual scenario of irrigation in the country, CWC considered necessary to undertake a census of completed major and medium irrigation projects to collect the following information:

a. Culturable Command Area (CCA) and their geographical extent
b. Irrigated area by season
c. Irrigation Potential created and utilized (IPC & IPU)
d. Cropping pattern
e. Other project related information

1.2 CWC has decided to take up the pilot census for standardizing the methodology for the main census of MMI projects by taking one project (major or medium) from each of different regions namely North, South, East, West, North-West, South-East, South-West & Central. As such about 8 projects would be covered in the pilot census. The Pilot Census is to be covered in two phases described as below:

Phase-I: Collection of data pertaining to inventory detail of 8 selected projects from project authorities.

Phase-II: Collection of data through outsourcing up to outlet level (i.e. data on utilization part) of the 8 projects covered in the Phase-I.

1.3 **Progress achieved by CWC:** CWC has selected 8 projects covered in the Phase-I for collecting inventory-details. The list of 8 selected projects is as below:

S. No.	Name of Project	Type (Major/Medium)	Region	State
1	Upper Ganga Canal	Major	North	Uttar Pradesh
2	Sethiathope Anicut System	Major	South	Tamilnadu
3	Mangalam	Medium	South	Kerala
4	Midnapur Canal	Major	East	West Bengal
5	Damanganga	Major	West	Gujarat

6	Fulzar-I	Medium	West	Gujarat
7	Pairi	Major	Central	Chhattisgarh
8	Sukla	Major	North-East	Assam

1.4 The data pertaining to inventory details had been collected by CWC in a prescribed schedule while executing Phase – I of the Pilot Census.

1.5 CWC has called for expression of Interest in January 2016 and AFC India Limited (AFC) has expressed its interest to carry out the proposed phase- II of pilot census of selected Major and Medium irrigation projects. Thereafter CWC issued the RFP in April 2016 and AFC submitted its offer online on 5th May 2016 for the 8 selected projects. CWC has awarded the assignment of conducting Census survey for the following five projects to AFC.

S. No.	**Name of Project**	**Type (Major/ Medium)**	**Region**	**State**
1	Upper Ganga Canal	Major	North	Uttar Pradesh
2	Midnapur Canal	Major	East	West Bengal
3	Fulzar-I	Medium	West	Gujarat
4	Pairi	Major	Central	Chhattisgarh
5	Sukla	Major	North-East	Assam

1.6 Later CWC has decided to award the assignment of conducting Census survey for another two projects viz., Mangalam Medium Irrigation Project in Kerala and Sethiatope Anicut system in Tamilnadu to AFC.

1.7 A Memorandum of Understanding (MOU) has been signed between CWC and AFC on 9th September, 2016 for carrying out the assignment on the two projects viz., Mangalam Medium Irrigation Project in Kerala and Sethiatope Anicut system in Tamilnadu.

2. Scope of Work

2.1 AFC has to carry out a comprehensive and critical review of the existing irrigation scenario in the field with the following scope of work.

i. To identify the gaps as reported by project-authorities in each project.

ii. To assess the reasons of reported gaps.

iii. To diagnose the constraints and difficulties if any in achieving the targets of achieving IPC as envisaged.

iv. To suggest remedial measures for minimizing the identified gaps of IPC and IPU.

v. To suggest suitable methodology for carrying out the main census of major and medium irrigation projects in the country.

vi. To prepare a command area map including canals.

vii. To prepare Canal Network diagram with attributes attached and types of canal structures marked along with chainage. The output map will be given in *.pdf and *.kmz form.

3. Objectives

3.1 The main objectives of this study are as follows:

i. To develop a command area map including canals;

ii. To develop Canal Network Diagram up to outlet level;

iii. To identify the gap between IPC and IPU.

iv. To suggest remedial measures to bridge the gap between IPC and IPU.

4. Project Details

4.1 Mangalam medium irrigation project is situated in District Palakkad of Kerala State. Palakkad is located in the Kerala State. The location of the project is shown in Fig. 4.1.

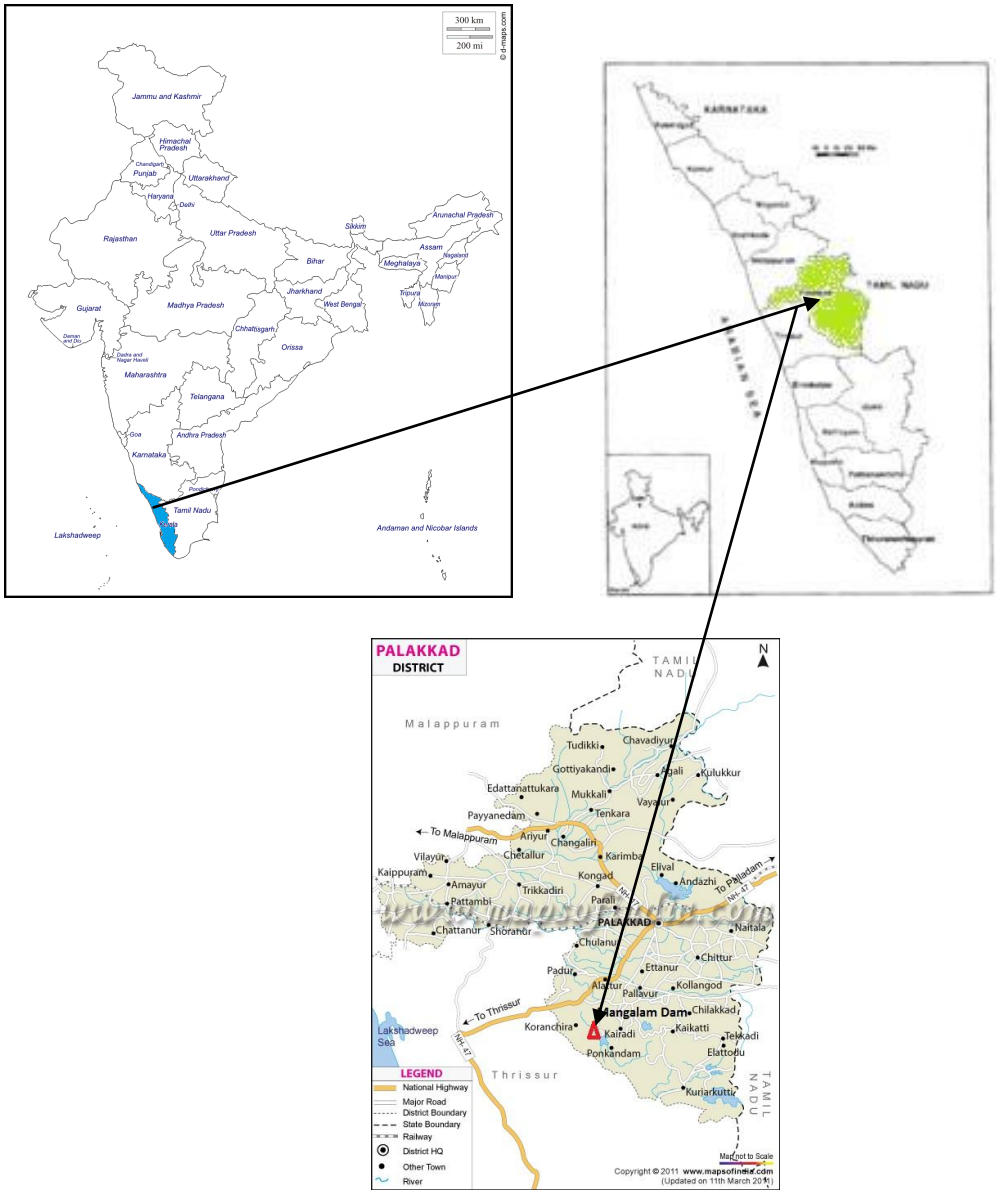


Fig. 4.1 Location of Mangalam Project in Palakkad District of Kerala

4.2 Profile of Palakkad District

Palakkad District is one of the 14 districts of the Indian state of Kerala. The city of Palakkad is the district headquarters. Palakkad is bordered on the northwest by the Malappuram District, on the southwest by the Thrissur District, on the northeast by The Nilgiris District and on the east by Coimbatore district of Tamil Nadu. The district is 24.4% urbanised according to the census of 2011. The district is nicknamed "the granary of Kerala" and "Rice bowl of Kerala". In earlier times, Palakkad was also known as *Palakkattussery.*

The climate is pleasant for most part of the year, exception is on the summer months. There is sufficient rainfall and it receives more rainfall than the extreme southern districts of kerala. The district is blessed with many small and medium rivers, which are tributaries of the Bharathapuzha River. A number of dams have been built across these rivers, the largest being Malampuzha dam. The largest in volume capacity is the Parambikulam Dam. Taluks of the district are Alathur, Chittur, Mannarkkad, Ottappalam, Palakkad and Pattambi.

Economy

IIT Palakkad for Kerala started operations in its temporary campus at Kanjikode, Palakkad from 3 August 2015. Many industries are located in the Kanjikode Industrial Area, which is termed as the second biggest industrial area in Kerala, many central government institutions are located in this area Palakkad is the first paperless revenue district by computerizing the Collectorate, five taluks and 156 village offices. It became the first computerized the Collectorate in the country implemented under the ‘DC Suit’ system and the first district where all the five taluk offices are computerized under the ‘Taluk Suit’ and connected with the Collectorate. There are various industries in the district. The Public Sector companies and Instrumentation Limited have plants in Kanjikode, 12 kilometres from Palakkad town. Other large companies are the BPL group, Cocacola and Pepsi. There is an Industrial Area in Kanjikode with a number of medium industries. Palakkad is the one of the most agrarian districts in Kerala. Palakkad is particularly known for paddy cultivation. Paddy is cultivated in around 83,998 Hectares in the district and

occupies the first position in the production of rice in the state. Palakkad also occupies the first position in the state for the production of groundnut, tamarind, turmeric, vegetables, pulses, mango, banana, plantain and cotton. Rubber, coconut, areca nut, black pepper, etc. are also cultivated extensively like other parts of Kerala.

Demography

According to the 2011 census Palakkad district has a population of 2,810,892 roughly equal to the nation of Jamaica or the US state of Utah. This gives it a ranking of 138th in India (out of a total of 640). The district has a population density of 627 inhabitants per square kilometre (1,620/sq mi). Its population growth rate over the decade 2001–2011 was 7.39%. Palakkad has a sex ratio of 1067 females for every 1000 males, and a literacy rate of 89.32%. Palakkad city has a literacy rate of 94.20%. The official language Malayalam is predominantly and widely spoken in the district, while Tamil forms the main language of over 6% of the district's population.

Palakkad has a medium grade network of roads. The Salem-Kanyakumari. National Highway 47 and the Palakkad-Kozhikode National Highway 213 run through the district. Another important road is the Palakkad – Ponnani road which connects NH 47 and NH 17. The nearest Airport is at Coimbatore (Coimbatore International Airport) which is 60 kilometres from the City.

The Project

Mangalam project comprises of a dam across Cherukunnam river, a tributary of Mangalam river which joins the Gayathri river which is a tributary of the Bharathapuzha river, with a network of canal system to irrigate 3440 ha of land in Alathur taluk of Palakkad District of Kerala. The project was taken up for execution in 1953 and was commissioned in 1967. The dam and reservoir are located 13 Km North -East of Vaddakkencherry town which lies close to National Highway 47. The dam is located at latitude 10^{o} 31’ and longitude 76^{o}32’.

The reservoir has a water spread of 396 ha and a live storage of 25.344 MCM at FRL +77.88m. The left and right bank canals share the ayacut equally, 1720ha each with a designed duty of 850ha/cumec with provision of 12.50% transmission loss.

Precipitation and temperature play important role in the development of soils. The average annual rainfall is about 2500m and average annual temperature varies between 19^{o}C to 30^{o}C. The soil do not remain moist throughout the year. This affects the development of soil by lowering the weathering process. Floods are common feature during monsoon which aid in deposition of sediments every year.

Agriculture is the main source of income of the inhabitants of this area. Paddy is the main crop. The crops of paddy are harvested in about 95% of the ayacut area. Crops like pulses, topiaca, ginger, gingellyseeds, arecanut and coconut are grown in the area. There are 84 **Padasekhara Samithies** in the Ayacut area of this project. Water management during distribution time is looked after by project advisory committee which have four members among farmers of LBC and RBC area.

Paddy is grown mainly during the first two season. The first crop (Viruppu or Kanni Crop) is sown in April, May and harvested in August-September under rainfed conditions. The second crop (Mundakan or Makaram) is sown in September- October and is harvested in January- February. The 3rd crop (Punja) is cultivated rarely due to lack of irrigation facilities.

4.3 Salient Features of the Project

Name of the Project	**Mangalam Project**
Type of Project	Storage
Category of Project	Medium
Name of Basin	Bharathapuzha Basin
Name of the River	Cherukumnam River
State	Kerala
Start of Project	1953
End of Project	1966
Districts Benefitted	Pallakad
Address of Project Headquarters	Executive Engineer, Irrigation Division, Malampuzha, Pallakad, Kerala
Purpose	Irrigation
Catchment Area	48.85 Km^2
Mean Annual Rainfall	2110 mm
Stage of Completion	Completed
Reservoir	Mangalam

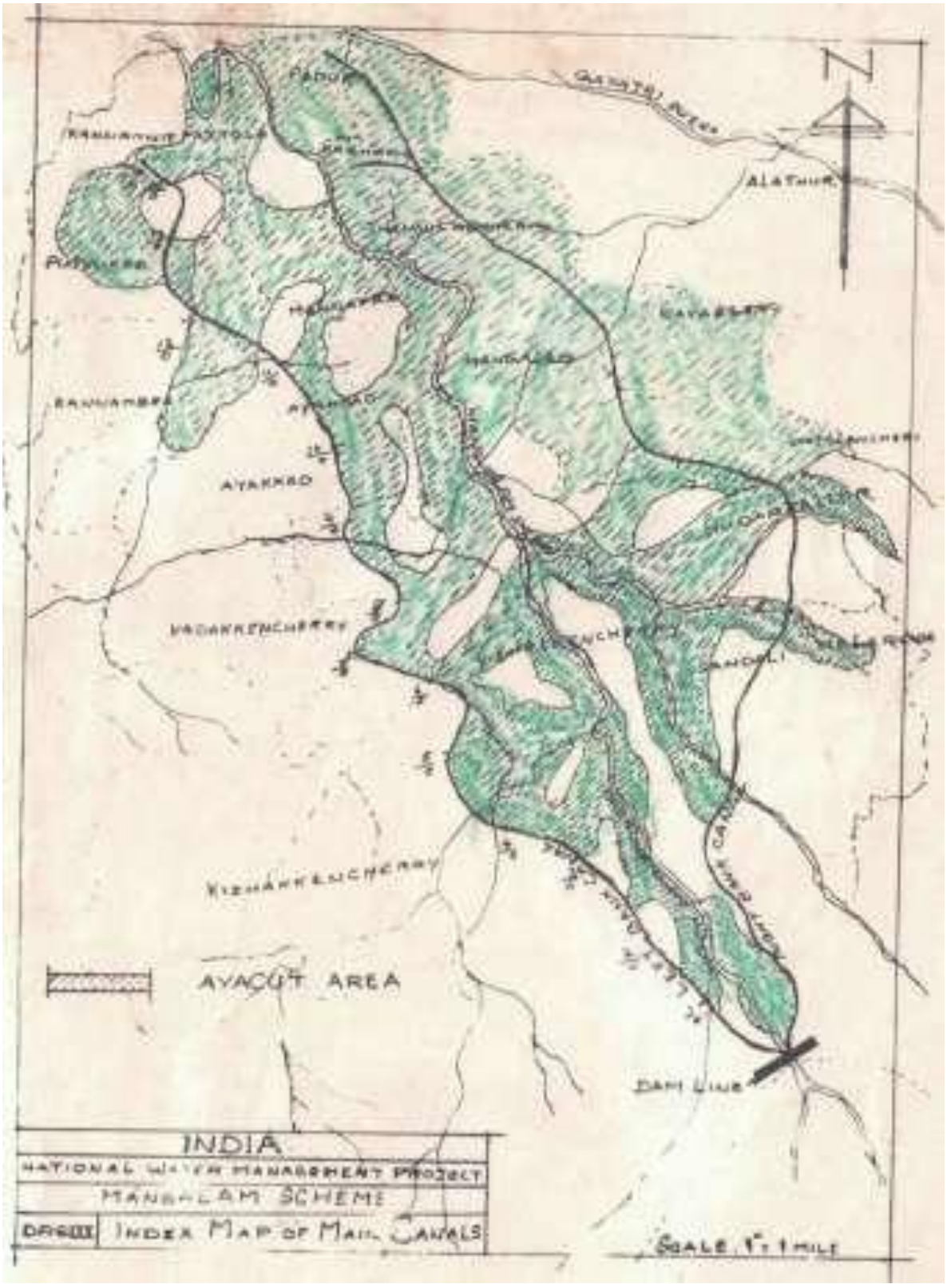
Maximum Water Level	77.88 m
Full Reservoir Level	77.88 m
Maximum Draw down Level (MDDL)	64.00 m
Submergence	396 ha
Gross Storage Capacity at FRL	25.344 MCM
Dead storage	0.15 MCM
Live storage	25.344 MCM
Dam and Spillway	
Length of Masonry Dam	162 m
Length of Earthen Dam	895 m
Total Length of Dam	1057.0 m
River Sluice	One
Purpose of River Sluice	Irrigation
Type of Spillway	Ogee
Length of Spillway	54.86 m
Design Flood	244.795 Cumec
Spillway Capacity	249.88 Cumec
Type of Gates	Vertical Lift
No. of Gates	6
Size of Gate	Width- 8.69m Height – 1.98m x3 No. 1.38m x 3 No.
Mode of Operation	Automatic
Head Regulator	1
Location of Head Regulator	Latitude : $10^{o}31'$ N Longitude: $76^{o}32'$ E
GCA	3440 ha
CCA of Project as per DPR	3035 ha
CCA of Project as on March 2013	2953 ha
Number of Head Regulators	1
Volume of Water Released through head regulators (MCM)	23.237 MCM

Canal Network

Name of Canal	Offtake of the Canal (Chainage)	Length of Canal in Km	Command Area (ha)
Left Bank Canal			
Parassery	844 m	1.243	29.22
Vakkala	2870 m	2.385	66.83
Maniyanchira	3392 m	0.830	32.96
Nagampara	4392 m	0.810	38.84
Kalavappadam	5315 m	1.932	92.19
Vengassery	8159 m	0.700	33.96
Moolankode	8952 m	2.000	43.20
Karumannassery	9342 m	2.000	86.08
Thiruvara	10266 m	1.800	52.03
Vakkode	12600	1.200	46.06
Chekkulam	13190	1.800	31.05
Konnenchery	14990	2.000	103.27
Ayakkad	16193	1.000	44.57
Manjapra	16700	2.800	166.00
Rishinaradamangalam	17382	1.800	51.66
Paruvassery	18474	1.400	94.86
Kannambra	18480	1.600	60.53
Puddukode	20393	1.000	33.40
Thekkeppota	21000	3.360	131.43
Pudukkode (small)	21198	0.300	24.29
Mannapadam	22170	2.400	134.09
Direct Sluices			323.48
		Total LBMC	**1720.00**

Name of Canal	Off-take of the Canal (Chainage)	Length of Canal in Km	Command Area (ha)
Right Bank Canal			
Choorakk	600	1.380	43.07
Elavampadamode	4450	3.550	67.54
Punnapadam	4520	6.050	208.57
Chhorappatta	6290	0.670	25.54
Nellikkode	7140	0.860	19.19
Vendazhy	7300	1.520	58.12
Kizhkkethara	7760	0.570	12.60
Cherumcode	8540	1.230	25.32
Thendalode	8760	1.970	40.48
Chittilenchery	10520	3.200	58.74
Madappallur	10480	3.187	62.34
Mundappallur	11660	1.500	52.19
Moovelikkadavu	13150	3.500	96.29
Mangalam	13340	2.250	95.87
Anchumoorthy	14180	2.250	95.87
Thennilapuram	18500	3.400	14.41
Cheenikkode	20410	1.600	62.38
Padoor	21500	3.900	161.25
Kazhani	21500	3.650	160.13
Direct Sluices			360.10
Total			**1720.00**
Total LBC + RBC			**3440.00**

Command Area of Mangalam Irrigation Project



Command Area Map of Mangalam Irigation Project

5. Approach and Methodology

5.1 Methodology Envisaged

In order to accomplish the task the following methodology was envisaged to be adopted.

i. Constitution and deployment of a Multi-Disciplinary Team of Experts and required field teams;

ii. Orientation and training programme for the Field Teams (Supervisors and Enumerators) for field survey. The Field teams, so deployed, will be working under the overall guidance and supervision of the Core Team deployed at Head Quarters;

iii. Discussions with State Level Departmental Heads as well as CWC Regional Heads by personnel of Core Team and Field Team;

iv. Discussions with Senior Irrigation/Water Resources Department Officials at different levels;

v. Secondary data as available with state Govt. Including area irrigated under each crop, amount of water released in main canal, branch canal, distributary, minor up to outlet level etc. in each crop season was envisaged to be collected. Additionally, the data was proposed to be collected for Head, middle and tail reach of the canal network

vi. Index and Canal Network Map was to be procured. Additionally, list of outlets for entire system of each of the projects along with their chainage/RD was also proposed to be procured;

vii. It was envisaged to collect information on storage versus water released during the year so as to correlate the same with the rainfall, existing cropping pattern to estimate the gap between potential created and potential utilized.

viii. CWC had collected inventory details the project in structured format under Phase I**.** Filled in schedule prescribed for Data Collection by CWC for Phase I is given in (Annexure-1). CWC desired that the information collected by them earlier and supplied to AFC India Limited (Annexure-1) shall be vetted while carrying out the survey. It was also desired by CWC that the data gaps, if any, identified in the project shall be filled in during the interactions and from various records maintained with the project officials at different levels.

ix. However detailed project information including outlet details are to be collected by the consultant during interaction with stakeholders as envisaged by CWC vide their Proforma specifically designed for Phase-II of the study.

x. During interactions with CWC officials it was desired that while carrying out the survey for collection of information as solicited in Proforma -II to identify the gaps as reported by project-authorities and reasons thereof, constraints and difficulties, if any.

xi. The team would visit the project area to get the first-hand information on the status of canal distribution system including outlet details as per Proforma II and have discussions with state govt officials, farmers, water user associations etc., to identify the lacunas in achievement of full utilization of created potential.

xii. During interactions with state govt. officials, efforts may be made to identify remedial measures for minimizing the identified gaps of IPC and IPU;

x. Coordinates (Latitude and Longitude) of the each of the outlets will be recorded by the Field Team at the sill level of each outlets using GPS meters for the respective canal systems;

xi. The collected data will be geo-referenced to get the SLD and KML files for the canal network;

xii. Study teams will interact with the officials/departmental staff as well as group of the farmers in the outlet command villages to identify the gaps as reported by the department and actual ground situation reported by the farmers. The Group of Farmers will be representative of the Head, Middle and Tail reaches of the system, individually (minors/distributary), as well as overall (complete canal system).

xiii. The data collected under Proforma I and II shall be shared by CWC with the key functionaries of the respective project authorities to develop a suitable methodology to carry out the main census of major and medium irrigation projects in the country;

5.2 Methodology Adopted

- CWC provided the project details vide filled up Proforma-I as collected from project authorities by them. The same was examined by the AFC team and shortcomings therein were identified for collection during field visits and interaction with state govt officials.
- A multidisciplinary team visited the senior officer at State level and appraised them about the study being carried out by CWC and the benefits thereof. The senior officials agreed and assured to provide all available information to the team

members and directed the field formations to help the team members during their visit to the project area.

- The core Team comprised of Dr. S.K. Jain, Mr. Deepak Kumar, Mr. Arvind Shukla etc. The core team interacted with Executive Engineer Mr. Shivdasan at Malampuzha.
- The team met with officials at different levels to procure the data and support for field work. The field work continued with the support of departmental officials for data collection.
- The team visited the project area and interacted with the concerned Executive Engineer and his team of officials at Mangalam Project, Kerala. Detailed discussions were held and the data available at the project office was shared with the AFC team. Subsequently, an official was nominated and deputed by Executive Engineer for providing the relevant information and also to accompany the field team for identification of canal network including outlets located thereof.
- Data was also collected from Office of the Mangalam Project, Alathur, Palakkad, Kerala.
- The team along with the nominated official traversed along the whole canal network including main canal, distributaries and minors. Cent- percent tracking along the network was made to identify the outlets including their geo-referencing (latitude and longitude) with a hand-held GPS system. The condition and status of the canal, outlet etc., was observed and recorded.
- The Team had an active interaction with the farmers during the survey along the main canal, distributaries and minors and also discuss the state of affair of irrigation/ water availability in the command area and to identify the constraints.
- The AFC team asked project officials to provide the copy of DPR of the project but it was not available with project officials at different levels.
- The data so collected has been scrutinize at AFC, Delhi office and shortcomings identified for fulfilling the information in Proforma -II prescribed by CWC.
- The AFC team also interacted with the state govt officials to bridge/ procure the deficient information. However, some information was reportedly not available with the department which have been indicated in the filled up Proforma-I as well as Proforma-II also.

- The data collected by the AFC field teams has been entered in a structured database system. Relevant attribute table has been generated.
- Relevant attribute table has been generated.
- The collected data has been geo-referenced for the canal network system for the project.
- After completion of data collection and its analysis the core team interacted with senior project officials to take their views and opinions for consideration in preparation of the report.
- ArcGIS software has been used to create canal network, attachment of attributes and generation of *.kml file to view the network components along with attached attributes on google earth.
- Soft copy of the same is enclosed.

6. Generation of Canal Network

On the basis of field survey using prescribed proforma wherein details of canal network up to outlet level have been captured using the GPS device Zuno- SB of M/s Trimble of USA. The canal network along with command area and the outlets have been shown in **Fig. 6.1 to 6.6.**

Dry outlets have been demarcated in *kml files. All other outlets are wet outlets (liable to receive irrigation water). Farmers also corroborated it during interaction.

Since the command area map based on Google Earth is quite big and when attempted to print on A0 size the map was pixlet and was not readable. Accordingly, efforts were made and Grid has been formed on Command Area Map. The print of each grid is given along with Index map for easy readability.

Since a large number of minor irrigation schemes exists in the command area, the data for them about the location and area covered by them are not available, the same could not be demarcated.

The project DPR is not available with project officials. However, salient features of the project were made available by project authorities. The designed details about IPC, Cropping Pattern, IPU were not available.

Data of Phase I and Phase-II have been collected as per prescribed format and has been given in Annexure-I and II respectively.

The findings are based on field observations and discussions with various groups. The opinion of project officials was also considered while reporting.

The data in the form of network diagram depicting the canal network has been generated on the basis of field survey and geo-referencing of field observations.

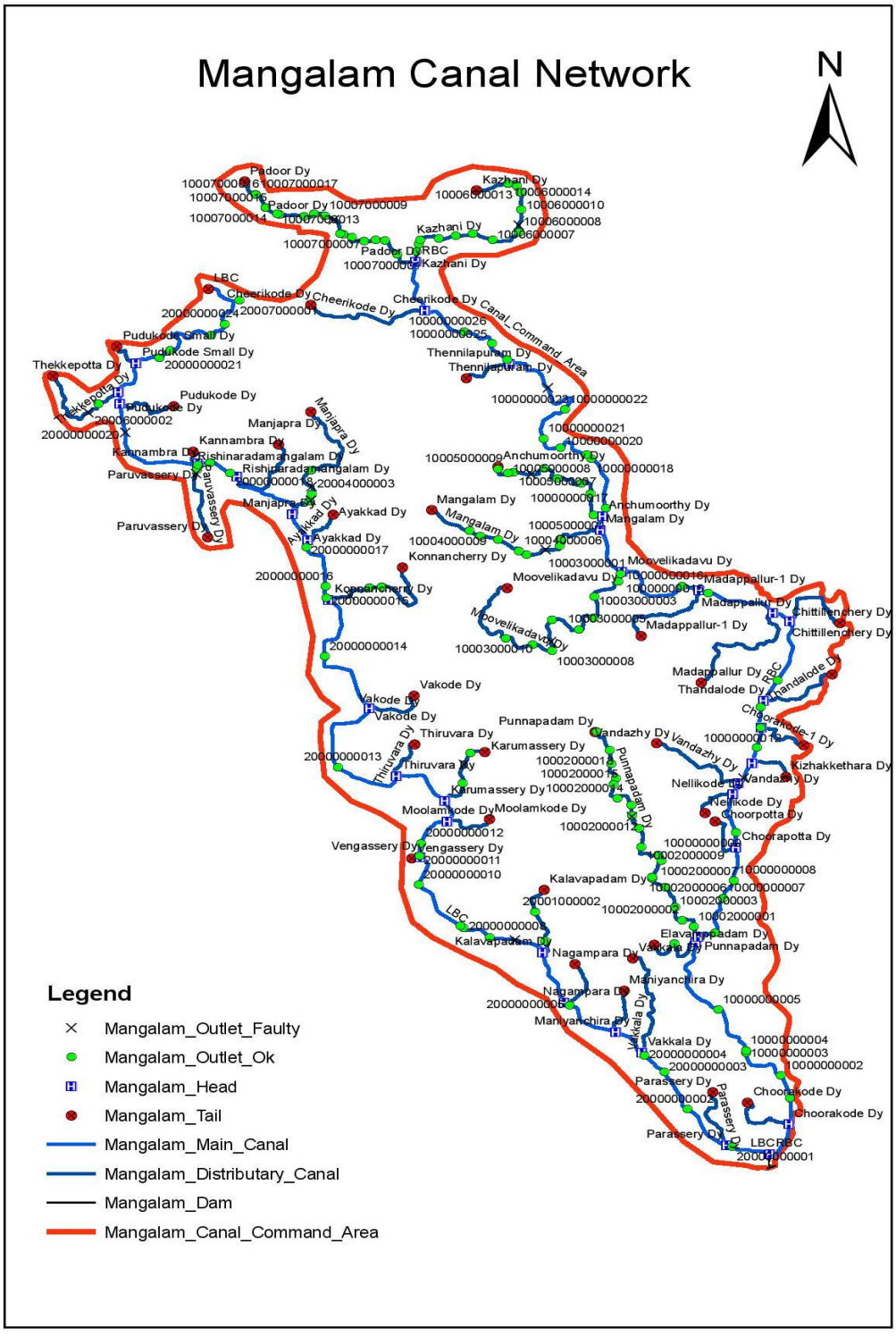


Fig. 6.1 Command Area Map of Mangalam Irrigation Project

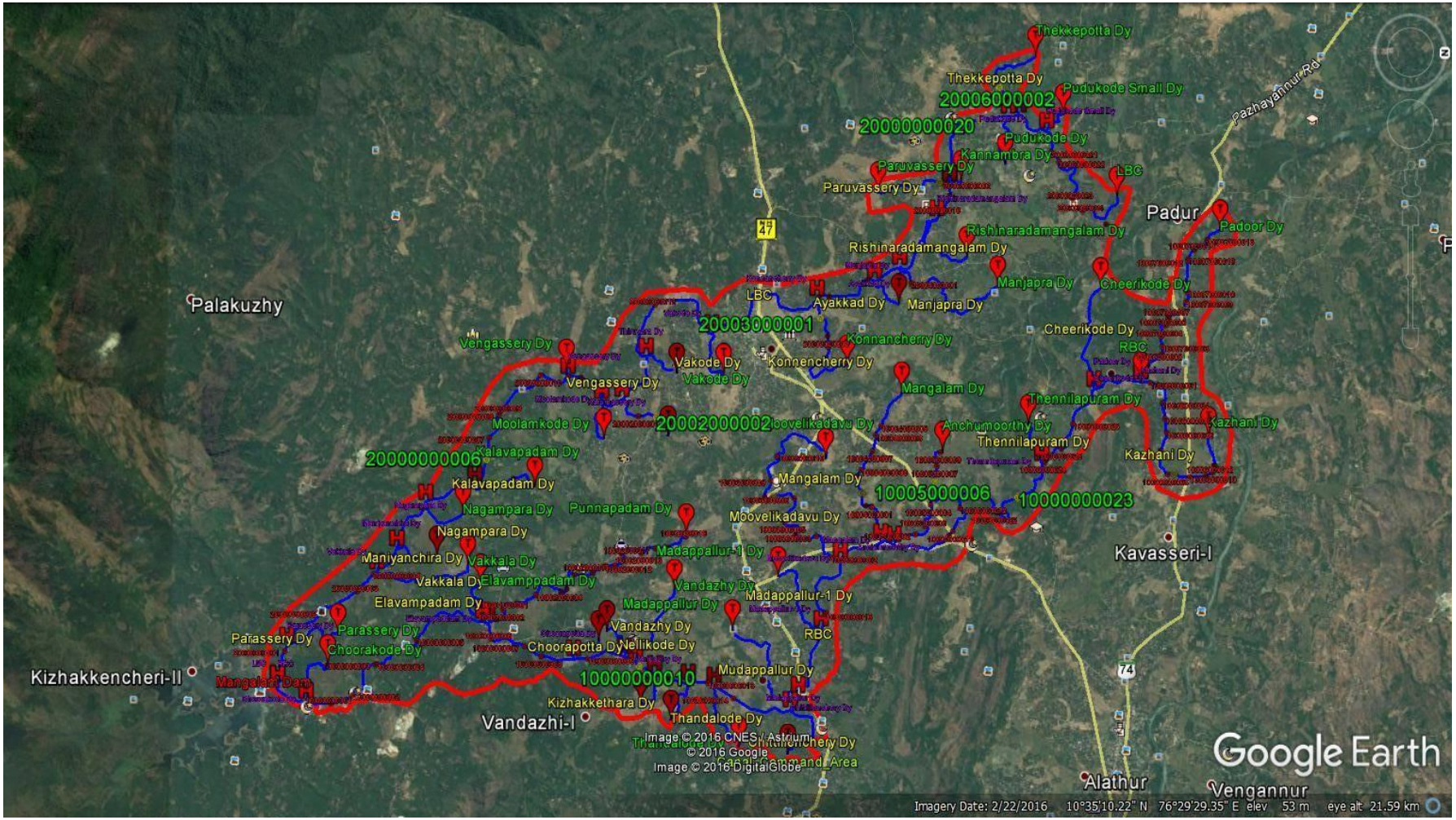


Fig.6.2 Command Area Map of Mangalam Irrigation Project

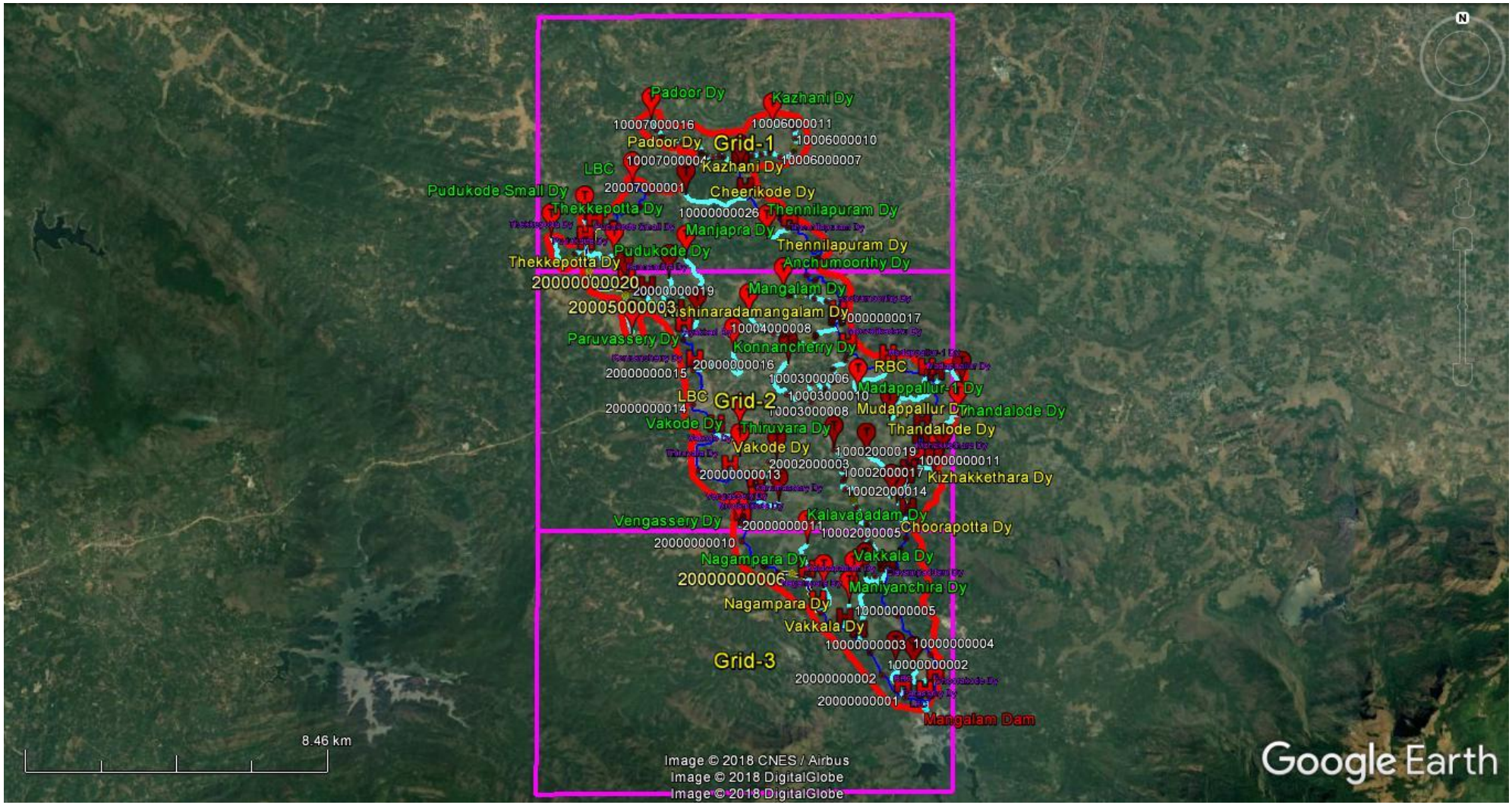


Fig. 6.3 Index Map of Command Area of Mangalam Irrigation Project

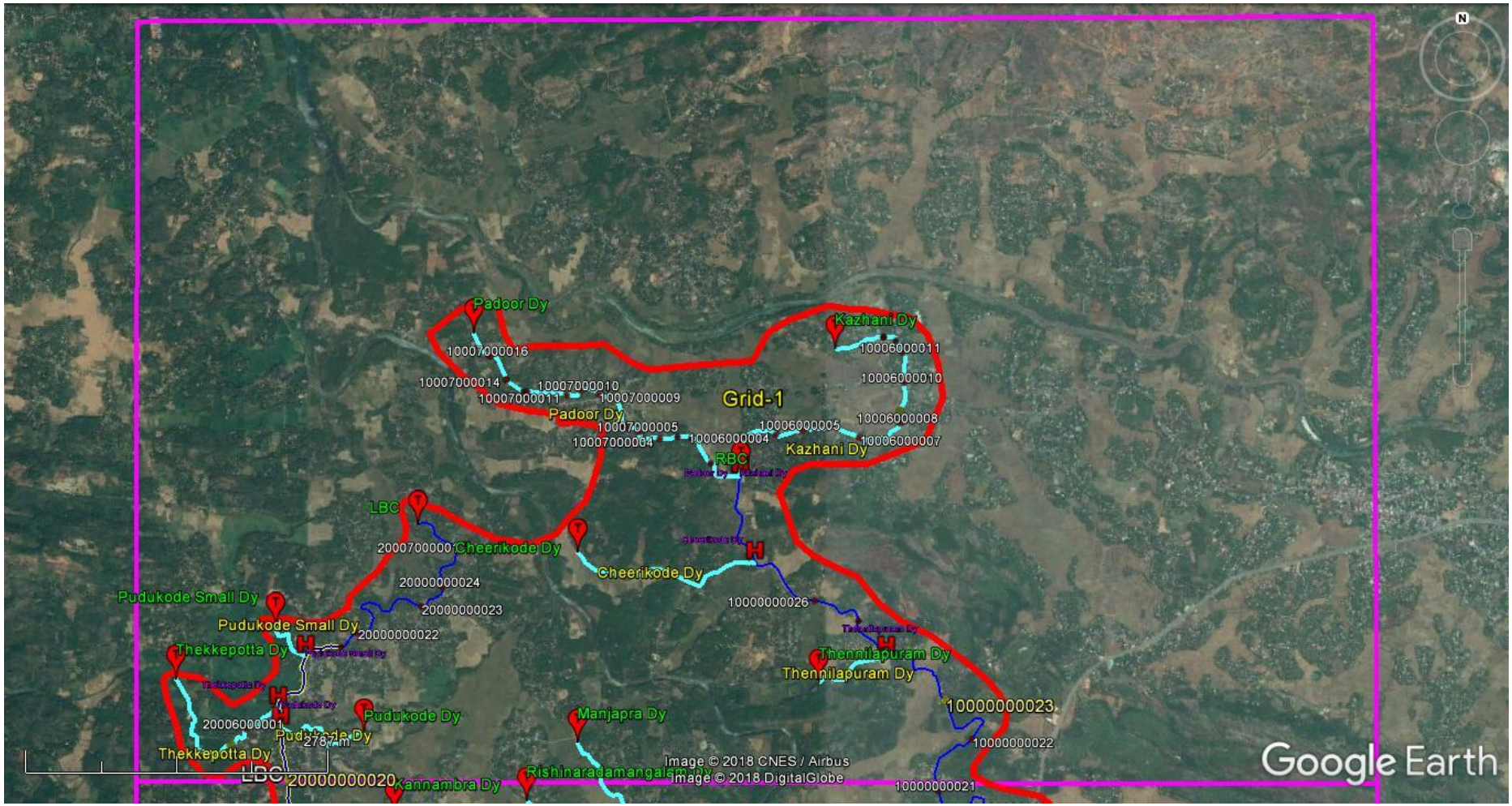


Fig. 6.4 Mangalam Project Command Area- Sheet 1

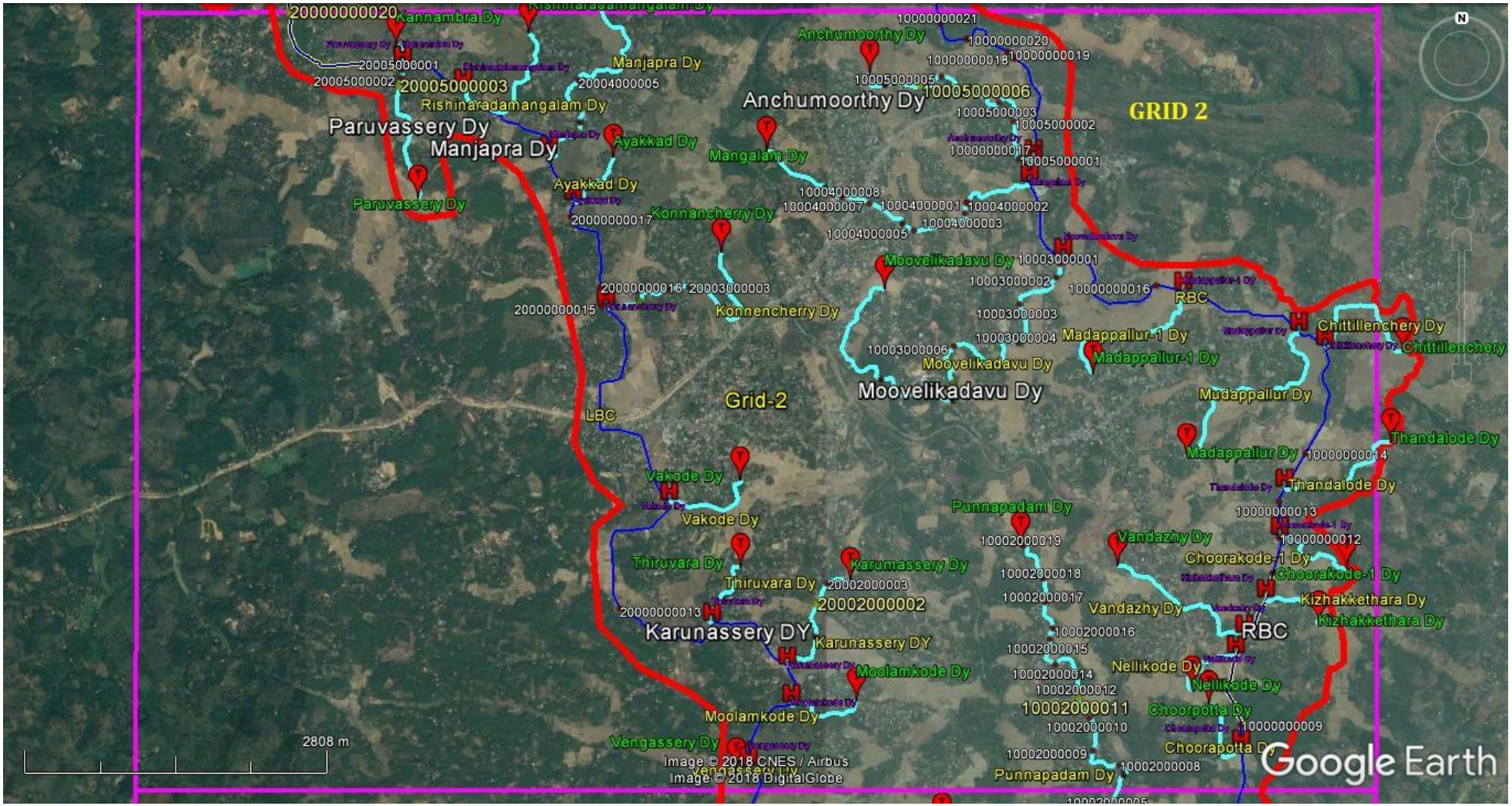


Fig. 6.5 Mangalam Project Command Area- Sheet 2

Fig. 6.6 Mangalam Project Command Area- Sheet 3

7. Results and Findings

- The Gap between IPC and IPU has been found to be 153.27 ha in the year 2013-14 which is about 5.19 % of IPC.
- Cropping Pattern in the command area of the project is following:

Season	**Crop**	**Area in ha (2015-16**
Kharif	NA	0
Rabi	Paddy	2287
	Topioca	5
	Coconut	440
	Turmeric	7
	Arecanut	10
	Coco	5
	Banana	20
	Vegetables	18
	Ginger	8
Total		**2800**

- Untimely maintenance of canals due to shortage of funds had resulted in abnormal deviation of canal cross sections. This has resulted in increase of canal bed width, change in bed slope which had resulted in non-supply of designed discharge in the canals.
- The data on IPU has been collected from the project officials on the basis of their records. It was reported that field functionaries of the project note down the area irrigated in their jurisdiction which is then aggregated at higher levels and the figures for the project level is worked out by them.
- In the absence of DPR, designed cropping pattern was not available. However actual cropping pattern as ascertained from the project has been reported in Annexure-I.
- The naming of the canals, distributaries, minors and outlets have been made by project officials as per their own norms.

- The field channels were constructed as earthen channels during the commissioning of the project. Many field channels were lined under CADA programme for improving the water supply in 1988. Due to lack of maintenance the lined portions also have damaged.
- Due to lack of effective control of water at control levels, breakage of structures and untimely opening and removal of shutters resulted in unregulated free flow of water.
- Lack of awareness and interest among farmers for participation in running of irrigation water and rational use of the same led to deterioration of productivity.
- During the survey, it was noticed that the canal/ distributary in general are having weed growth, siltation and broken outlets on canal resulting in leakage and seepage of water.
- It was reported that due to canal being mostly unlined there is problem of seepage all along the canal.
- Outlets are broken at many places (some typical illustrations are given in photograph section) due to which water divert and do not flow in the direction it was planned.
- There is no incentive to save precious water.
- Canal maintenance is not there so siltation, weed growth and breakage occur leading to obstruction in water reaching tail end. Water reaches up to tail when it is not required by farmers at higher reaches.
- Neglect and lack of annual budget for operation and maintenance (O& M) so the system deteriorates.
- Shortage of manpower and resources was also reported to be a major reason for gap in maintenance of canal system.
- Farmers reported that their main crop was paddy.
- Functional Water User Associations (WUA) not found during survey.
- There is lack of monitoring of canal operations.

Table 7.1 Details of Deteriorated Outlets on the Canal Network

S.No.	Main Canal	Distributary	Chainage	Latitude	Longitude	Remark	Outlet ID
1	RBC	NA	7670	76.529	10.573	Broken	10000000010
2	RBC	NA	18050	76.503	10.631	Siltation	10000000023
3	RBC	Moovelikadavu Dy	2408	76.504	10.593	Broken	10003000007
4	RBC	Anchamoorthy Dy	1845	76.501	10.618	Broken	10005000006
5	RBC	Padoor Dy	1680	76.475	10.656	Broken	10007000008
6	LBC	NA	5621	76.499	10.549	Broken	20000000006
7	LBC	NA	19805	76.447	10.624	Broken	20000000020
8	LBC	Karumassery DY	799	76.492	10.575	Broken	20002000002
9	LBC	Konnancherry Dy	323	76.477	10.600	Broken	20003000001
10	LBC	Manjapra Dy	400	76.472	10.614	Broken	20004000002
11	LBC	Manjapra Dy	670	76.472	10.616	Siltation	20004000004
12	LBC	Paruvassery Dy	301	76.457	10.618	Broken	20005000003
13	LBC	Thekkepotta Dy	604	76.443	10.627	Broken	20006000002

Out of 148 outlets 13 outlets have been found to be broken and damaged accounting for about 8.78% outlets. The canal network has also been found to be damaged at different locations which have been summarised below:

Table 7.2 Details of Damage of Canal Network

S.No.	Distributory/FB	Chainage
1.	Parasserry FB on LBMC	844 m
2.	Nagampara FB on LBMC	4350 m
3.	Vakkode FB on LBMC	12700 m
4.	Pudukkode FB on LBMC	20390 m
5.	Vandazhy FB on RBMC	7500 m
6.	Mudapallur FB on RBMC	11700 m

Gap between IPC and IPU

The IPU data for outlet level was not available in the project. There are no minors in the project and outlets are located on the distributaries. Therefore, The Gap between IPC and IPU has been worked out on distributary level and given in **Table 7.3**.

Table 7.3 Gap between IPC and IPU at Distributary Level

Canal Name	IPC Ha	IPU Ha	Gap (IPC-IPU) Ha
Right Bank Main Canal	360.10	360.10	0
Choorakode Dy	43.00	43.00	0
Elavamapadam Dy	67.00	67.00	0
Punnapadam Dy	250.00	200.00	50
Choorpotta Dy	25.00	25.00	0
Nellikode Dy	18.00	18.00	0
Vandazhy Dy	45.00	45.00	0
Kizhakkethara Dy	11.00	11.00	0
Choorakode-1 Dy	24.00	24.00	0
Thandalode Dy	39.00	39.00	0
Chittillenchery Dy	55.00	55.00	0
Madappallur Dy	58.00	58.00	0
Madappallur-1 Dy	50.00	50.00	0
Moovelikadavu Dy	80.00	80.00	0
Mangalam Dy	80.00	80.00	0
Anchumoorthy Dy	79.00	79.00	0
Thennilapuram Dy	12.00	12.00	0
Cheerikode Dy	50.00	50.00	0
Padoor Dy	80.00	90.00	0
Kazhini Dy	90.00	80.00	0
RBMC Total	**1516.10**	**1466.10**	**50**
Left Bank Main Canal	323.48	323.48	0
Parassery Dy	29.22	29.22	0
Vakkala Dy	66.83	66.83	0
Maniyanchira Dy	32.96	32.96	0
Nagampara Dy	38.84	38.84	0
Kalavapadam Dy	92.19	26.92	65.27

Canal Name	IPC Ha	IPU Ha	Gap (IPC-IPU) Ha
Vengassery Dy	33.96	33.96	0
Moolamkode Dy	34.00	34.00	0
Karumassery Dy	76.00	56.00	20.00
Thiruvara Dy	43.00	43.00	0
Vakode Dy	46.00	46.00	0
Konnancherry Dy	90.00	90.00	0
Ayakkad Dy	44.00	44.00	0
Manjapra Dy	150.00	150.00	0
Rishinaradamangalam Dy	50.00	50.00	0
Paruvassery Dy	90.00	90.00	0
Kannambra Dy	55.00	55.00	0
Pudukode Dy	30.00	30.00	0
Thekkepotta Dy	68.00	50.00	18
Pudukode Small Dy	24.29	24.29	0
Manappadam Dy	20.00	20.00	0
LBMC Total	**1437.77**	**1334.50**	**103.27**
Total	**2953.87**	**2800.60**	**153.27**

8. Constraints/ Reasons for the Gap

Following are the major reasons for gap between IPC and IPU for the Mangalam Project:

- Non-maintenance of water courses/ distributaries, growth of weed, collapse of side slopes, damage to sides and bed, reduced waterways, seepage and leakages of canal waters etc are responsible for gap between IPC and IPU.
- Water supplied once is considered for IPU while Farmers resort to groundwater to supplement water needs for crop. This is disguised gap in IPC and IPU.
- Excessive use of irrigation water many a times results in water-logging
- Deliberate damage to water outlets
- Deliberate utilization of area under field channels by farmers
- Farmers resort to flood irrigation.
- Lack of cooperation among farmers, villages, blocks and departments.
- Often minor disputes related to distribution are blown out of proportion
- Wastage on account of over irrigation
- Water not released at the time of requirement
- Non-existence of effective functional WUAs
- Low technical exposure of the officials of Irrigation Department at grass root level.
- Modern Managerial capabilities of the Irrigation Department staff for conflict resolution is lacking
- Lack of staff
- Lack of Operation & Maintenance Budget
- Low motivation of Irrigation Department staff
- Lack of supervision by Irrigation Department staff
- Lack of facilities for Movement along canal network for staff and officers of Irrigation Department
- Lack of administrative powers to Irrigation Department staff
- Number of watering not accounted for IPU computation
- Lack of coordination between line departments including CADA, Agriculture, Revenue etc.

9 Recommendations:

- The Mangalam irrigation project was commissioned in 1967. The system is in a dilapidated condition and needs restoration in the distribution system, outlets etc. Since almost 5 decades have elapsed the data is also not maintained systematically.
- It is recommended that suitable data acquisition system along with proper data storage system (DSS) may be evolved for the project to keep track of the precious water resource storage and distribution through the system.
- Canal cross sections to be restored to carry the design discharge in entire reach.
- Proper monitoring system also needs to be evolved.
- Capacity building for field functionaries is required together with adequate staff to keep the system in order.
- Adoption of PIM is suggested. It is suggested that the Padasekara Samitis/ WUAs shall be revamped revitalised so that they could take the responsibility.
- Enhance role of Women in water management. It is essential for survival.
- Renovation of system is required. Selective lining of canal may be undertaken to reduce seepage. Silt removal is an essential part of canal maintenance which shall be undertaken frequently.
- Night irrigation shall also be propagated to minimize losses.
- Practice of giving incentive for less water consuming crop cultivation.
- Proper monitoring shall be enforced.
- Conveyance efficiency shall be enhanced by adopting selective lining of canal.
- Adequate budget and manpower should be provided for maintenance of the system.
- Proper third party monitoring system also needs to be evolved to keep a track of leakage and theft of water along with reach-wise performance at an interval of three years.

10 Photographs of Damaged/ Broken Outlets

		
Photograph Outlet No :RBC-10(Broken)		Photograph Outlet No : RBC-23(Siltation)
		
Photograph Outlet No : Punnapadam Dy-11 (Condition is Good).		Photograph Outlet No : Moovelikadavu Dy-07(Broken)

		
Photograph Outlet No : Mangalam Dy-04(Good)		Photograph Outlet No : Anchamoorthy Dy-06(Broken)
		
Photograph Outlet No : Kazhani Dy-09(Good)		Photograph Outlet No : Padoor Dy-08(Broken)

		
Photograph Outlet No : LBC-06(Broken)		Photograph Outlet No : LBC-20(Broken)
		
Photograph Outlet No : Karumassery DY02(Broken)		Photograph Outlet No : Konnencherry Dy-01

		
Photograph Outlet No : Manjapra Dy-02 (Broken)		Photograph Outlet No : Manjapra Dy-04 (Siltation)
		
Photograph Outlet No : Paruvassery Dy-03 (Broken)		Photograph Outlet No : Thekkepotta Dy-02 (Broken)

Appendix-I

Farmer Interaction Format

Name:

Father's Name:

Village:

Canal Details:

Other Irrigation Source:

Crops Cultivated: Rabi:

Kharif

How many times you get canal water: Rabi

Kharif:

Timely availability of water:

Adequate Availability of Water:

Has any official of Irrigation/ Agriculture:

Appendix -II

Compliance of CWC Comments

S.No.	Comments	Compliance
1	The report should give a detailed diagnostic of the canal network. Gap reporting needs to be done RD/Chainage wise in the complete network with specific reasons for the gap supported by Satellite imagery/ Google Earth. The gap should be clearly marked on T diagram in red and the T diagram should have all the attributes like structures, etc.As per Scope of Work, the Agency has to give Command Area Map including canals, Canal Network diagram with all attributes attached and types of canal structures marked along with chainage. The Agency may be therefore, advised to reflect all items as per scope of work agreed upon.	Detailed command area and canal network map has been prepared by georeferencing canal network as *.kml file which is based on Google earth. The broken/ affected outlets and canal network have been demarcated by different colours at their geographical location. All the attributes of canal network have been attached in *.kml file.
2	The status of outlets needs to be clearly mentioned (dry or wet). This needs to be corroborated with farmers interaction.	Dry outlets have been demarcated in *kml files. All other outlets are wet outlets (liable to receive irrigation water). Farmers also corroborated it during interaction.
3	Details of constitution of the core team that went to the field along with the State govt officials with whom the meeting was conducted needs to be incorporated in the report along with photographs.	Please refer to para 5.2 of the report for details. The relevant photographs have been given in para 8 of the report.
4	The methodology to assess the IPU should be given.	The data for IPU has been collected from the project officials on the basis of their records. Field functionaries record the area irrigated under his jurisdiction which is aggregated at higher levels upto project level.
5	Detailed command area map in Ao size clearly excluding the area/CCA being served by other Minor irrigation schemes within the command should be given.	Since the command area map based on Google earth is quite big and when attempted the print on A0 size it was pixlet and was not readable. Accordingly efforts were made and Grid has been formed on Command Area Map. The print of each grid is given alongwith Index map for easy readability. Since a large number of minor irrigation schemes exists in the command area, the same could not be demarcated

6	Designed IPC vs actual IPC achieved alongwith reasons should be given.	Old DPRs could not be traced. As such designed IPC could not be sacertained. The IPC details as provided by project officials have been considered and indicated in the report.
7	Filled in schedules of Phase-I and Phase-Il should be parts of the reports.	The filled in schedule of Phase I and Phase II with relevant data are given as Annexure I and Annexure II in the report.
8	It is observed from initial 4 to 5 pages of the reports, the Agency is focussing on the Approach & Methodology etc rather than giving details of the project concerned. It would be better that these reports start by giving highlights on features of the project concerned along with agriculture & irrigation profiles of the districts/states being benefited by the project.	Project details including location, salient features, districts benefitted, command area map etc have been indicated in para 4 of the report.
9	It is noted that the most of the findings stated in the reports are based on the opinions taken from the State-Govts officials concerned instead of their own.	The findings are based on the field observations and discussions with various groups. The opinion of project officials was also considered while reporting.
10	Hydrologic analysis scenario may be carried out by collecting storage position of water for the five year under reference to correlate the same with the potential utilised and findings based thereon may be given.	Potential utilized during last five years are given in Annexure-I however storage position in the reservoir and utilization was not available . As such simulation study could not be carried out.
11	The Agency has reportedly met farmers but nothing has been pointed about their interactions/views in regard to potential utilized/working conditions in regard to availability of water to their fieids.The format devised by AFC for interaction with the farmers should be given.	Farmer's Interaction format has been given in Annexure-III. Outcome of discussions and interaction with the farmers has been considered while reporting. Broadly the farmers opined that timely adequate water is not available and the condition of distribution need improvement
12	It is observed that in some cases, the data of IPC & IPU at outlet level has been indicated as not maintained. In such cases, the Agency may be advised to give detail at least at Minor Level.	Data at outlet level is not available. The IPC data at Minor level is available and given in Annexure I. Consolidated IPU data is available. It indicates a gap of 153 ha which is 5.18%.

13	The designed v/s actual cropping pattern should be given in the project command. The Agency may be advised to point out whether any change in the cropping patterns has occurred in the absence of nil/scanty rainfall (as stated in case of Fulzar-l project).	Designed cropping pattern is not available in the absence of DPR. Actual cropping pattern as provided by project officials on the basis of their records have been reported.
14	The Agency may be asked to give photographs of headworks/canal/distributary/minors wherever conditions are in dilapidated states.	Photographs are given in Para 8 of the report
15	Names of the two projects that were awarded later on to the Agency have not been mentioned correctly in draft reports of Sukla and Midnapur Canal (vide page 4 and page 3 respectively). These names should be (i) Sethiathope Anicut System and (ii) Mangalam.	NA
16	The general status of O&M of the project, funds being made available to the project authorities and expenditure being made may be provided.	Project officials reported that they are short of funds for O & M. Financial details not collected as per TOR
17	Abbreviations should be given in the beginning. Units in tables are missing.	As suggested, Symbols and Abbreviations have been given. Units in tables have been indicated appropriately.
18	Bed slope should be 1 in 500 instead of 500.	NA
19	Units in tables are missing.	Units in tables have been indicated appropriately.
20	The basis for naming the canals, distributaries, minors and outlets has not been given	The naming of canals, distributories, minors and outlets have been done by project officials as per their own norms
21	Para-wise description of scope of work should be given.	The uderstanding of Scope of work by AFC and the brief details are given in para 2 of the report

APPENDIX-II

भारत सरकार Government of India
केन्द्रीय जल आयोग Central Water Commission
परियोजना प्रबोधन संगठन Project Monitoring Organisation
आयोजना एवं प्रगति निदेशालय Planning and Progress Directorate
*****
कमरा नं0 411 (एस), सेवा भवन Room No. 411(S), Sewa Bhawan,
रामाकृष्णपुरम, नई दिल्ली - 110066 R.K. Puram, New Delhi-110066
फोन / फेक्स नं0. 011-26109425
इमेल: ppdtecwc@gmail.com, ppdte@nic.in

To,
G.S.Yadav
AFC India Ltd.
B-19, Community Centre,
Janakpuri, New Delhi-110058

This has reference to your submission of the draft reply of Fulzar-I, Sukla, Pairi and Midnapure projects. The said reports were discussed in the meeting of Monitoring Committee for Pilot Census and many short comings were observed. The same are annexed as Annexure I.

You are requested to kindly submit the draft final report accordingly.

एस. के. राजन
14/3/17
(एस. के. राजन)
निदेशक (आ0 एवं प्र0)

संलग्नक : यथोक्त

भारत सरकार Government of India
केन्द्रीय जल आयोग Central Water Commission
परियोजना प्रबोधन संगठन Project Monitoring Organisation
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एस. के. राजन
14/3/17
(एस. के. राजन)
निदेशक (आ0 एवं प्र0)

संलग्नक : यथोक्त

Annexure I

i. The report should give a detailed diagnostic of the canal network. Gap reporting needs to be done RD/Chainage wise in the complete network with specific reasons for the gap supported by Satellite imagery/ Google Earth. The gap should be clearly marked on T diagram in red and the T diagram should have all the attributes like structures, etc.As per Scope of Work, the Agency has to give Command Area Map including canals, Canal Network diagram with all attributes attached and types of canal structures marked along with chainage. The Agency may be therefore, advised to reflect all items as per scope of work agreed upon.

ii. The status of outlets needs to be clearly mentioned (dry or wet). This needs to be corroborated with farmers interaction.

iii. Details of constitution of the core team that went to the field along with the State govt officials with whom the meeting was conducted needs to be incorporated in the report along with photographs.

iv. The methodology to assess the IPU should be given.

v. Detailed command area map in Ao size clearly excluding the area/CCA being served by other Minor irrigation schemes within the command should be given.

vi. Designed IPC vs actual IPC achieved alongwith reasons should be given.

vii. Filled in schedules of Phase-I and Phase-II should be parts of the reports.

viii. It is observed from initial 4 to 5 pages of the reports, *the Agency is focussing on the Approach & Methodology etc rather than giving details of the project concerned.* It would be better that these reports start by giving highlights on features of the project concerned along with agriculture & irrigation profiles of the districts/states being benefited by the project.

ix. It is noted that the most of the findings stated in the reports are based on the opinions taken from the State-Govts officials concerned instead of their own.

x. Hydrologic analysis scenario may be carried out by collecting storage position of water for the five year under reference to correlate the same with the potential utilised and findings based thereon may be given.

xi. The Agency has reportedly met farmers but nothing has been pointed about their interactions/views in regard to potential utilized/working conditions in regard to availability of water to their fields.**The format devised by AFC for interaction with the farmers should be given.**

xii. It is observed that in some cases, the data of IPC & IPU at outlet level has been indicated as *not maintained.* In such cases, the Agency may be advised to give detail at least at Minor Level.

xiii. The designed v/s actual cropping pattern should be given in the project command. The Agency may be advised to point out whether any change in the cropping patterns has occurred in the absence of nil/scanty rainfall (as stated in case of Fulzar-I project).

xiv. The Agency may be asked to give photographs of headworks/canal/distributary/minors wherever conditions are in dilapidated states.

xv. Names of the two projects that were awarded later on to the Agency have not been mentioned correctly in draft reports of Sukla and Midnapur Canal (vide page 4 and page 3 respectively). These names should be (i) Sethiathope Anicut System and (ii) Mangalam.

xvi. The general status of O&M of the project, funds being made available to the project authorities and expenditure being made may be provided.
xvii. Abbreviations should be given in the beginning.
xviii. Bed slope should be 1 in 500 instead of 500.
xix. Units in tables are missing.
xx. The basis for naming the canals, distributaries, minors and outlets has not been given.
xxi. Para-wise description of scope of work should be given.

Fulzar I

i. Storage position of the reservoir for the year in which maximum IPU was achieved should be given.
ii. In the column of location, what is the meaning of B.
iii. How volumetric measurement has been done for ungated outlets.

Midnapore

i. On page 15 and 59 CCA given is different.
ii. Cropping pattern is not given.
iii. It is not stated whether the river is perennial or not.

Besides, you are also requested to do the verification of the data presented after carrying out the necessary arithmetical checks in Block No 7 of Phase I of the Schedule so that it is ensured that the data presented are internally consistent. This is required for payment of submission of data for Phase I.