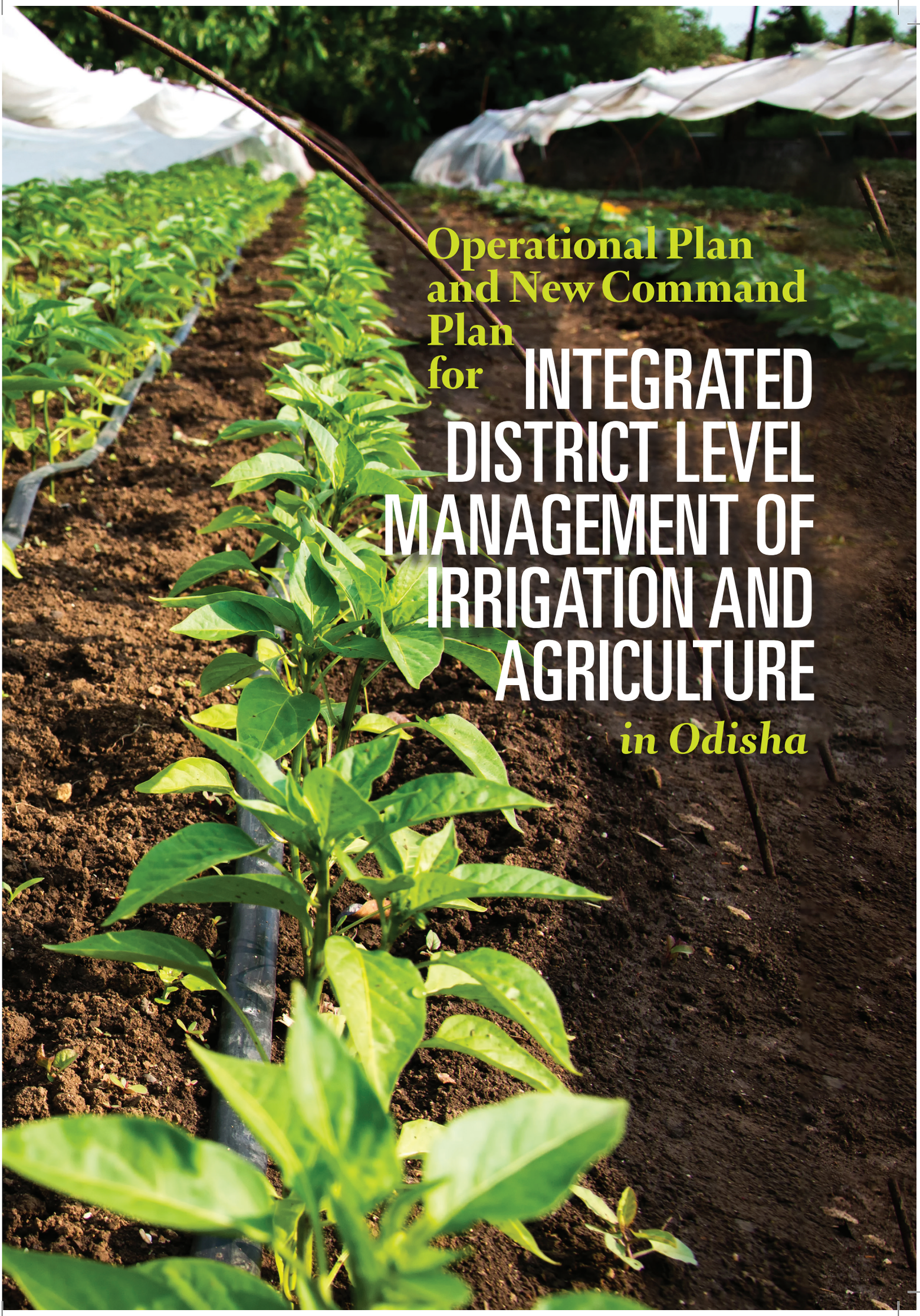

Operational Plan and New Command Plan for INTEGRATED DISTRICT LEVEL MANAGEMENT OF IRRIGATION AND AGRICULTURE

in Odisha

Operational Plan and New Command Plan for Integrated District level Management of Irrigation and Agriculture in Odisha

Disclaimer

ACT (Action on Climate Today) is an initiative funded with UK aid from the UK government and managed by Oxford Policy Management. ACT brings together two UK Department for International Development programmes: The Climate Proofing Growth and Development (CPGD) programme and the Climate Change Innovation Programme (CCIP). The views expressed in this document do not necessarily reflect the UK government's official policies.

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Abbreviations and Acronyms

ACT	Action on Climate Today
AE	Assistant Engineer
ATMA	Agriculture Technology Management Agency
CADA	Command Area Development Authority
CCA	Culturable Command Area
DAO	District Agriculture Officer
DDA	Deputy Director of Agriculture
DDH	Deputy Director of Horticulture
DFID	Department for International Development
DIAP	District Irrigation and Agricultural Plan
DLIC	District Level Implementation Committee
DoWR	Department of Water Resources
DRDA	District Rural Development Agency
EAP	Externally Aided Project
EE	Executive Engineer
ET	Evaporation Transpiration
GP	Gram Panchayat
IPC	Irrigation Potential Created
IPCC	Inter-governmental Panel on Climate Change
IPU	Irrigation Potential Utilized
IWRM	Integrated Water Resources Management
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MIP	Minor Irrigation Project
MOWR	Ministry of Water Resources
NABARD	National Bank for Agriculture and Rural Development
NAC	Notified Area Council
NAPCC	National Action Plan on Climate Change
NIR	Net Irrigation Requirement
OAIC	Odisha Agro Industry Corporation
OFD	On Farm Development
OIIAWMP	Odisha Integrated Irrigated Water Management Project
OLIC	Odisha Lift Irrigation Corporation
PMKSY	Pradhan Mantri Krishi Sinchai Yojana
PP	Pani Panchayat
Warabandi	System of distribution of water allocation to water users by turn

Executive Summary

The Department of Water Resources, Government of Odisha, realizes that climate change-oriented planning for water management is need of the hour. Temperature would breach 2°C barrier by end of the 21st century according to the climate change projection for the region (IPCC). Climate change impacts are already felt in Odisha and climatic variability is affecting water sector and agriculture sector.

Drought is already a serious concern in Odisha. Through proper planning and implementation of infrastructure development and better management plans as climate change adaptation programs, Odisha should move to a situation where impact of drought will be significantly lower. This could be achieved as the state receives sufficient amount of annual rainfall. The drought mainly occurs because of spatial and temporal variation. The rain received is not harnessed adequately and managed appropriately to meet the water requirement of crops and crops are subjected to stress in different years calling for drought relief actions. The variability in monsoon and number of rainfall days potentially creates the problem of too much rainfall in too short time and no or minimum rainfall for longer time-period. This sometimes leads to floods and droughts in same year. An illustration of the present drought scenario can be visualized from the baseline information of the year 2017. The Government of Odisha in 2017 announced drought in 17 districts out of 30 districts in the state. Crops have been seriously affected, and in some places, completely damaged due to non-availability of water to meet the crop water requirements. An amount INR 600.52 crore has been sanctioned by Government of India to minimize the impact of drought on farmers.

Areas under irrigation area also affected by drought. This is inferred from the announcement of the Government of providing compensation of INR 13,500 per hectare in irrigated area and INR 6,800 in non-irrigated areas. It indicates that everything is not well in the irrigation sector. Therefore, a new approach is needed to fill the gap between actual crop utilization and created potential. Water Resources Department of the Government of Odisha is keen to identify an alternative planning process which takes into account the sustainable and equitable use of water resource integrated with the agriculture planning process. Such alternative planning and model irrigation plans will help the Water Resource department to manage the water resources better, keeping in mind the effects of climate change projection in the near future.

This document describes the methods and processes to prepare two model plans for two districts, namely Cuttack and Subarnapur, encompassing activities for increasing water use efficiency, bridging the gap between Irrigation Potential created and what is actually utilized, creation of database and maps needed for planning, strengthening of institutions and capacity building as well as creation of additional irrigated area by developing new commands. This document was prepared under one of the projects agreed by Department of Water Resources (DoWR) under the Action for Climate Today (ACT)

Programme of UK Department of International Development (DFID). Before drafting of this planned document, two other reports have been prepared: i) Water Use Study ii) Strategy for Formulation of Transformative Integrated District Irrigation and Agriculture Plan, based on assessment of current water use. The first report on water use contains findings of extensive field level assessments on water use analysed based on primary data from sample projects and secondary data from all irrigation projects of selected districts. The second report is focussed on strategies for remedial action and improvement needed to address more effective and efficient allocation and management of water for agriculture. Its goal was to recommend implementable action points to achieve targets like bridging gap between Irrigation Potential Created (IPC) and Irrigation Potential Utilized (IPU), Irrigation Efficiency (IE), equitable distribution including gender mainstreaming, crop diversification and enhanced water productivity.

The present study is a plan to be used by the DoWR introducing a transformative planning process for irrigation management in the state. The integrated planning approach does not only look towards building irrigation infrastructure, but focusses on data-centric, demand-driven approach towards matching the agriculture water demand to the water available while trying to integrate water resource planning with agriculture and allied activities within the agriculture plan. Thus, the approach brings together the major stakeholder departments in water management and use and attempts to make a concerted effort to integrate the concerns of all the stakeholders in the planning process. After this plan is accepted by DoWR, a toolkit for guidance of concerned engineers of DoWR will be presented. By referring to the toolkit and this document, DoWR may roll-out the transformative planning process under the heading District Irrigation and Agricultural Plan (DIAP).

While drafting the operational plan, bridging the gap between the irrigation potential created and irrigation potential utilised is a priority focus as it can be considered as a low hanging fruit. In this document, gap refers to the difference between area actually irrigated during the assessment year and area supposed to be irrigated as per the project design. Canals are already laid out, but water is not reaching to the designed area due to constraints/ bottlenecks which are potentially removable. The gap could be bridged by saving avoidable loss in conveyance of water in canals, water application in cropped fields, rehabilitation and modernisation of canal network, creation of water distribution infrastructure below outlet through field channel network, canal operation plans and people's involvement.

Structural measures like construction of on-farm development, work repairing of canal system in tail reaches, infrastructure for micro-irrigation, infrastructure for solar pumping system, land levelling, field drainage have been incorporated. Structural measures are planned to be initiated in 7800 hectares of created irrigation potential in Cuttack district and 9400 hectares of created irrigation potential in Subarnapur district.

Non-structural measures like strengthening of Participatory Irrigation Management (PIM) for sustainable operation and maintenance of irrigation network and incremental improvement in project management, preparation of crop water budget have been incorporated. This is proposed to be taken up in all projects for the pilot districts.

Plans for water distribution in Government controlled canal and canal handed over to Pani Panchayats are to be prepared separately. Two sample distribution plans are prepared and presented in the report. In Cuttack district, there are 97 Pani Panchayats in Major irrigation projects. In Subarnapur, there are 92 Pani Panchayats for which plans are suggested to be prepared based on the model plans furnished in this document.

A new command plan with block wise creation of new command from different sources line extension of existing canal network, river lift, borewell has been formulated for 16 blocks of Cuttack district and 6 blocks of Subarnapur district. A plan for development of new command has been worked out for Cuttack and Subarnapur district for the year 2018-19 and 2030-31. The plan has a target to create new command of 10140 hectares in Cuttack and 1075 hectares in Subarnapur district for year 2018-19. The cumulative targets till 2030-31 have been projected to be 61177 hectares for Cuttack and 42255.7 hectares for Subarnapur.

Organization of 52 trainings for both Cuttack and Subarnapur district have been planned with break-up of 2 for Executive Engineer and Deputy Director of Agriculture level, 2 for Asst. Executive Engineer and District Agriculture officer level, 4 for Asst. Engineer/Junior Engineer and Asst. Agriculture Officer level and 44 of the Pani Panchayat level with target of 6699 participants to be trained by WALMI in one year.

The DIAP planning process at a glance is given below and details are described in respective sections of this report.

Action Points	Purpose/ Activity	Scope for Coverage
River Basin Planning	River basin planning will help in knowing the competing demands	Entire District and part of River basin
	Computation of present demand for industry	
	Computation of demand for industry in 2030	
	Computation of present demand for agriculture	
	Computation of demand for agriculture in 2030	
	Computation of present demand for drinking and other uses in 2030	
	Computation of demand for drinking and other uses in 2030	
	Preparation of district wise river basin plans for 2018 showing demand, availability and action plan for increasing availability	
	Preparation of district wise river basin plans for 2030 showing demand, availability and action plan for increasing availability	
Cascade Planning	Harness all water resources based on catchment area of streams by construction of different type of irrigation structures and interlinking among them	Blocks not having major and medium irrigation projects
	Identification of cascades and their catchment area	
	Marking of existing irrigation structures in the proposed cascade area	
	Preparation of cascade level plan	
Crop water budgeting	For gaining understanding of water availability, requirement of water by Pani Panchayat and prepare crop planning and irrigation scheduling	Pani Panchayat Jurisdiction in all irrigation projects
	Preparation of Pani Panchayat wise soil type information	
	Computation of potential Evapotranspiration	
	Computation of crop Evapotranspiration for crop grown in the Pani Panchayat area	
	Preparation of monthly crop water budget for the cropping period and annual crop water budget	
Canal Operation Plans	Distributing water on equitable basis	Major Project
New Command Plan	Creation of Additional Irrigation Potential by different means	All departments concerned

Chapter 1

1. Introduction

The purpose of this document is to prepare two model plans for two districts encompassing activities for increasing water use efficiency, bridging the gap between Irrigation Potential created and utilized, creation of database and maps needed for planning, strengthening of institutions and capacity building as well as creation of additional irrigated area by developing new commands. This document was prepared under one of the projects agreed by Department of Water Resources (DoWR) under the Action for Climate Today (ACT) Programme of UK Department of International Development (DFID). Before drafting of this planned document, two other reports titled i) Water Use Study ii) Strategy for Formulation of Transformative Integrated District Irrigation and Agriculture Plan, were conceptualised based on assessment of current scenario of water use. The first report on water use contains findings of extensive field level assessment on water use analysed based on primary data from sample projects and secondary data from all irrigation projects of the selected districts. The second report is focussed on strategies for remedial action and improvement in bridging gap between Irrigation Potential Created (IPC) and Irrigation Potential Utilized (IPU), Irrigation Efficiency (IE), equitable distribution (including gender mainstreaming, crop diversification and enhancing water productivity) in order to address the issues of unrealized irrigation potential, low productivity, drought vulnerability, and inequity in distribution of water resources.

The present study is a plan to be used by the DoWR introducing a transformative planning process for irrigation management in the state. After this plan is accepted by DoWR, a toolkit for guidance of concerned engineers of DoWR will be presented. By referring to the toolkit and this document, DoWR may roll-out the transformative planning process under the heading District Irrigation and Agricultural Plan (DIAP).

Water is both an elemental human need and a vital resource for economic and social development, serving everything from household demands to agriculture, industry, and energy production. At current rates, human water use will double every 20 years due to population growth, industrialization, and urbanization. Meanwhile, the gap between supply and demand is widening. By 2030, global water demand is expected to exceed supply by 40 percent[1]. However, similar gap between demand and supply of water can be assumed for the state for various uses.

This report tries to address the issue of improving management of irrigation keeping climate change impacts in view. To address the current gaps in irrigation potential and utilization, this

1 UN World Water Development Report 2015

report provides a revised operational plan and new command plan for the two pilot districts. This report is intended to be a guiding document for bringing in policy changes, transformation in operational aspects of irrigation and agriculture sector. Taking two pilot districts of Odisha, India, for which water use studies were undertaken, contents of the report have been arranged for the stakeholders to understand climate change per se, its impact on the sectors and develop resilience measures. Resilience is the capacity of individuals, communities and systems to survive, adapt, and grow in the face of stress and shocks, and even transform when conditions require it. Building resilience is about making people, communities and systems better prepared to withstand catastrophic events – both natural and man-made and enable them to bounce back more quickly and emerge stronger from these shocks and stresses. The focus of this report is on agriculture and water.

Water management systems around the world are struggling to adapt to changes in water use and availability. Growing water stress is already prompting major transformations in antiquated water policy, creating a rolling series of opportunities to transform water management practices in a way that builds resilience in the freshwater systems themselves, and the communities that depend upon them. Improvement in governance of irrigation and agriculture extension support system through transformative planning, effective monitoring of implementation of plans and building of capacity for taking up multi-pronged approach can be considered as a climate change adaptation programme.

Climate Change and increasing adaptive capacity

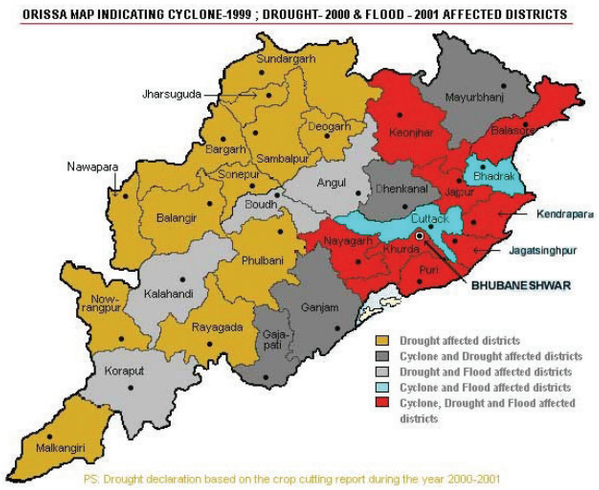
Climate change is the variation in global or regional climates over time. It reflects changes in the variability or average state of the atmosphere over time scales ranging from decades to millions of years (*IPCC Assessment Report 4*). These changes can be caused by processes internal to the Earth, external forces (e.g. variations in sunlight intensity) or, more recently, human activities that has led to higher rate of emissions of greenhouse gases causing global warming.

Climate change is location-specific.

With climate change, storms will come more often with heavier rain, and dry periods and droughts will happen more often or last longer. With increased storm events, water will move through the landscape more quickly and may become destructive, causing severe erosion, mudslides or flooding. More flooding will affect cropland and livestock, as well as downstream areas. Flooding, sea level rise and saltwater intrusion to freshwater wells and aquifers in coastal areas are already beginning to contaminate household and irrigation water sources. With more extreme events and more water lost to evaporation and runoff, deficits in soil moisture will happen more often and last longer leading to frequent and prolonged droughts. This causes problems for crops as well as soil health.

1.1 Vulnerability of Odisha to climate change and drought

The state of Odisha is highly vulnerable to climate change due to high monsoon variability. This has caused drought and flood affecting the food security. Agriculture dependent communities vulnerable to climatic variability and change have been pushed to margin. As per the climate change projection for the region, the temperature would breach 2°C barrier by end of the 21st century. Climate change impacts are already felt in Odisha. Climatic variability is affecting both water sector and agriculture sector.



1.2 Impacts of Recent Droughts in Odisha

In the year 2017, Government of Odisha announced drought in 17 districts out of 30 districts in the state. Crops have been seriously affected and, in some places, completely damaged due to non-availability of water to meet the crop water requirements. An amount of INR 600.52 crore had been released to the state under the National Disaster Response Fund (NDRF) by Government of India, which indicates the gravity of the situation. An agricultural input subsidy is planned to be provided to small and marginal farmers who have suffered crop loss of 33% and above at the rate of INR 6,800 per hectare in rain-fed or non-irrigated areas and INR 13,500 per hectare in areas under assured irrigation. 1.25 lakh pulse minikits, 0.5 lakh oilseed minikits and 0.25 lakh vegetable minikits will be supplied to the farmers for the Rabi programme in drought-affected villages. To help the farmers, the Odisha government will provide 5,000 pump sets at 50 percent subsidy limited to INR 15,000. Odisha Lift Irrigation Corporation (OLIC) will take immediate steps to repair the lift irrigation (LI) points in all the affected villages on priority basis and implement steps to operate all LI points during the Rabi season. Steps will also be taken to energise all pending deep bore-wells on priority.

The pattern of drought in the state is of a varied nature. Sometimes it affects the entire state (most of the districts) and sometimes a few districts are affected. However, the contiguous patch consisting of the subdivisions of Padampur, Bolangir, Titlagarh, Patnagarh, Nuapada, Khariar, Bhawanipatna and Phulbani comprising of 47 blocks have been identified as drought prone zones. To address the drought situation, emphasis has been given in improving irrigation potential in these areas. Different measures such as implementation of irrigation projects, crop diversification, soil & water conservation and rainwater harvesting have been taken.

In the year 2015-16, the state had also faced severe drought during Kharif agricultural season. As per the crop cutting report, 235 blocks in 28 districts were affected due to drought. The total crop area affected was calculated at 21.6 lakh hectare out of which at least 15.36 lakh hectare had suffered losses to the tune of 33% or more. In the final memorandum, submitted by the Government of Odisha to the Central Government for the year 2015-16, cumulative loss at INR 2344.99 crores due to drought was highlighted.

1.3 Rational for district integrated irrigation and agriculture plan

It can be inferred that given the current situation and potential climate change scenarios, the state's operational plan needs to be changed and a transformative planning process is required in irrigation and agriculture sector to focus on data centric, demand driven approach towards matching the agriculture water demand to the water available while trying to integrate water resource planning with agriculture and allied activities from within the agriculture plan. This approach will bring together the major stakeholder departments in water management and use and make a concerted effort to integrate the concerns of all the stakeholders in the planning process.

Integrated District Irrigation and Agriculture Plan (IDIAP) has been prepared with operational plan and new command plan and other relevant contents for management of irrigation and agriculture in Cuttack and Subarnapur districts after due assessment of the ground reality and consultations with the stakeholders.

Integrated district irrigation and agriculture plan document is the outcome of an intensive exercise carried out to understand the present irrigation and agriculture scenario of the districts and propose set of actions/activities to make the districts follow the path of climate resilient irrigation and water management. Prior to this document, two other documents viz. (i) Water use study report and (ii) Report on Strategy for Formulation of Transformative Integrated District Irrigation and Agriculture Plan have been prepared. The contents of the present report are conceptualized based on the assessment of current scenario of water use and strategy evolved through the consultations. Analysis of data, conceptualisation of various aspects, capturing issues and evolving solutions for the identified issues gave us an insight to formulate this plan within the legal and policy framework of the Government of Odisha.

This plan is formulated with following objectives:

1.4 Objectives

- Access to irrigation by the poor and vulnerable farmers to take up adaptation strategy to negative impacts of climate change
- Farm level water security for the crops grown by the farmers
- Annual assessment of gap between irrigation potential created and utilization in the preceding year
- Bridging the gap between irrigation potential created and actual utilisation in the year of planning
- Improving efficiency of completed or on-going irrigation projects
- Strengthening Water Users Associations (Pani Panchayat) to take responsibility to take over irrigation management and do it properly and distribute water equitably there by trigger increase of productivity from crops and income to farmers
- Computation of crop water requirement and preparation of water budget
- Capacity building of government functionaries for planning and implementation of district level plans every year
- Creation of additional sources of irrigation by adapting various means i.e. new command plan
- Develop climate resilient system of irrigation management and agriculture both at Government level and Community level
- Setting of targets as part of the District plan and plan out activities to meet the target

1.5 Approach and Methodology

Consultations in district level meetings were held 3-4 times in each district in which Executive engineers of different divisions of DoWR, Deputy Director Agriculture, Deputy Director Horticulture, PD Watershed had participated. The team involved in preparing the DIAP had also visited all individual offices like irrigation divisions, CADA, agriculture, horticulture and consulted them and obtained whatever relevant data available. Block wise data for latest available years were analysed to find the current irrigation potential taking this block wise value as baseline in command plans for 14 blocks of Cuttack and 6 blocks of Subarnapur were prepared. Operational plans are prepared comprising of components like bridging the gap meeting potential and actual utilization, canal operation, warabandi. Activities are presented in tabular format with physical targets for the financial year 2017-18 and 2030-31.

As per the present system, creation of additional irrigation potential is being taken up wherever there is scope and it is planned based on budget/fund allocation to an irrigation division for a particular year. But it is not based on actual demand and long-term perspective. In the proposed planning procedure, a longer-term perspective is to be kept and all possible sites/options should be explored for most beneficial use of irrigation. Canal lining and major repairs under capital investment is also undertaken, which is again allotment based and not based on a district level comprehensive planning. New elements of district level planning are crop water budgeting, cascade (watershed) planning (to consider entire stream catchment having medium/minor irrigation projects as planning unit) scientifically worked out canal operation plans, water distribution schedules for supplying water to farmers through turn-outs are to be introduced.

1.6 Limitations

There was constraint of data availability, needed for detailed planning at Pani Panchayat level. Outlet registers were not available. Outlet wise discharge, sill level of outlets and related information like length of lined channels and unlined channels, turn out positions in the field channels which are required for water distribution plans at Chak level were also not available. Distributary wise maps showing command areas for each minors and location of outlets were not available for map-based planning. Non-availability of annual reports depicting activities with targets, achievements and cost in irrigation divisions which could have been a basis for future planning is also a limitation. Meteorological and soil data are also not available in Irrigation and Agriculture department for use in CROPWAT models.

Chapter 2

2. Operation Plan

2.1 Background Information

Before venturing to make an alternative planning process, which may be considered as transformative and aligned to building climate change resilience, it is worth describing briefly the background of present scenario of agriculture and irrigation sector which gives some indication of the baseline situation.

Latest available data about the state reveals that the area under rice during Rabi is 300540 Ha which is 11.10% of area, other cereals occupies 36150 Ha which is 1.34% of area, area under pulse is 1402690 Ha which is 51.84% of the area, oil seeds cover 452760 Ha which is 16.73%, vegetables cover 401350 Ha which is 14.83%, spices cover 75370 Ha which is 2.79%, sugarcane covers 35340 Ha which is 1.31% and tobacco cultivated in 1690 Ha which is 0.06% of area. It is also depicted graphically in Figure 1.

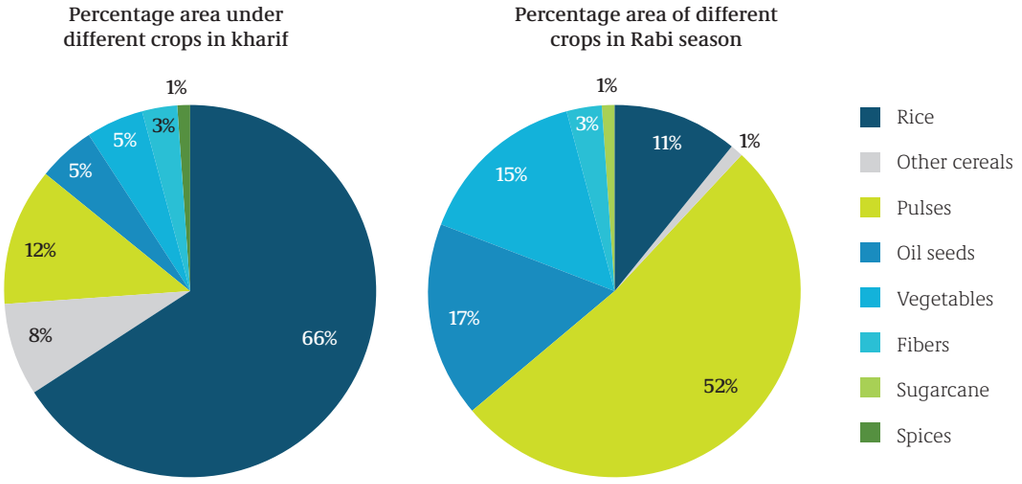


Figure 1: Percentage area under different crops in Kharif and Rabi for entire state
Source: Odisha Agriculture Statistics 2013-14

Odisha has 30 districts. District wise created irrigation potential[2] as on 31st March 2017 for Kharif and Rabi season is available on the website of Department of Water Resources (DoWR), Govt. of Odisha which has been plotted in Figure 2.

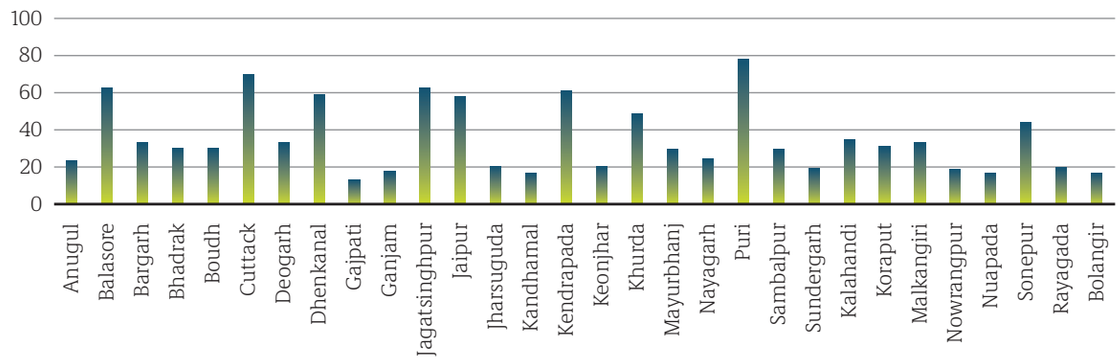


Figure 2: District wise Created Irrigation Potential as % of net sown area in Rabi Season

2.1.1 Potential created from different sources

Available secondary data has been plotted to depict irrigation potential created by sources for the entire state.

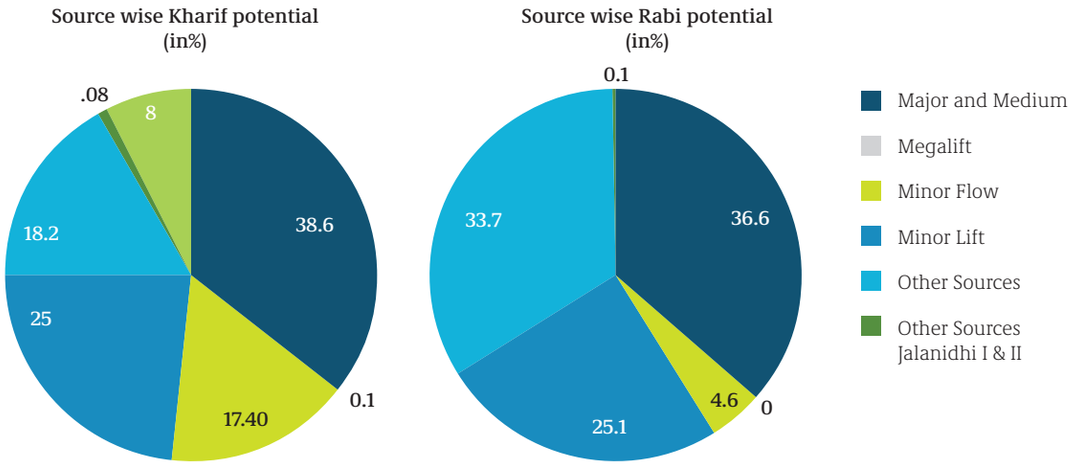


Figure 3: Source wise Kharif and Rabi Potential in (%)

Cuttack district is situated in the mid-eastern part of Odisha. It is a coastal district extending over an area of 3932 km^2, it occupies 2.52% of the State's area. The district has three sub-divisions, which are further sub-divided in 14 blocks. 1740 km^2 of the district is Net Sown Area and 777.6 km^2 is forest area.

Irrigation potential created in the district is 152939 ha. (100326 ha. during Kharif and 52613 ha. during Rabi) which is graphically presented in Figure 4. Irrigation Potential created in the district from all projects is 53.32% of 188150 ha of net sown area in Kharif and it is 27.96% in Rabi.

2 Uploaded in the website of DoWR, Govt. of Odisha

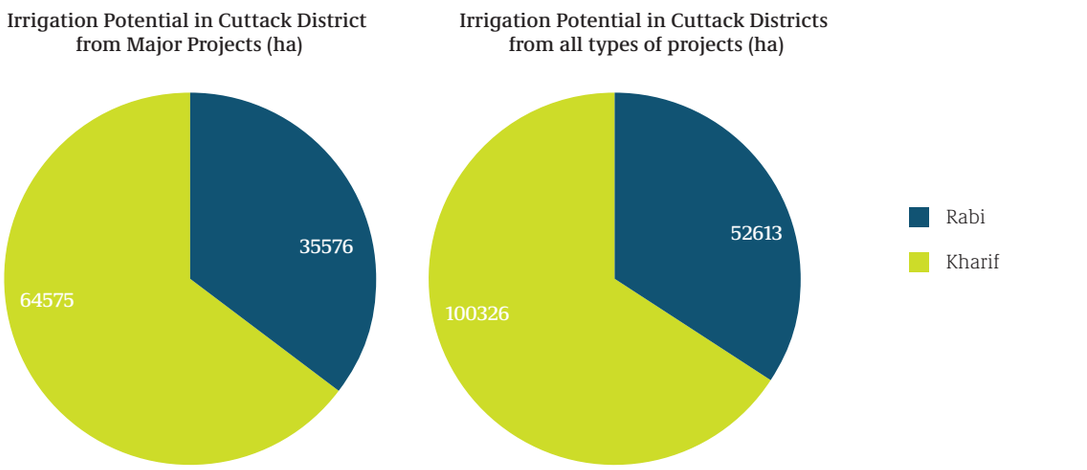


Figure 4: Irrigation Potential in Cuttack district from major projects and all projects

This section of the report covers different operational aspects for better management of existing irrigation projects starting with assessment/diagnosis, prioritizing interventions, increasing resilience to climate change/ adaptive capacity of institutions and individual farmers. While formulating the operation plan, consultation with the stakeholders were made mainly to examine the feasibility of proposed operational procedures. Some details of the consultation are furnished in Annexure 1.

2.2 Mapping System and Services for Canal Operation Techniques (MASSCOTE)

The MASSCOTE has been developed by the Land and Water Division of FAO on the basis of its experience in modernizing irrigation management in Asia. MASSCOTE integrates/complements tools such as the Rapid Appraisal Procedure (RAP) and to enable a complete sequence of diagnosis of external and internal performance indicators and the design of practical solutions for improved management and operation of the system. It has been implemented in Tamil Nadu and Karnataka. It is a well-tested approach and has the ability to bring changes in the attitude and style of functioning of the irrigation bureaucracy. It is proposed to be introduced in pilot districts for which required training can be arranged by Water and Land Management Institute (WALMI), owned and administered by DoWR. It is a management intervention and can be aligned to already on-going ERM (Irrigation Modernization Works). There will not be any high budgetary requirement and the training expenditure can be met from the budgets being allocated by WALMI.

2.2.1. Presentation of the methodology

The first steps of MASSCOTE are conducted for the entire command area of a minor/distributary canal system with the goal of identifying homogeneous managerial units for which specific options for canal operation are further sought by running the various steps of MASSCOTE for each unit taken separately. Then, aggregation and consolidation is carried out at the main system level. Thus, the methodology uses a back-and-forth or up-and-down approach for the different nested levels of management.

MAPPING	1. PHASE A: BASELINE INFORMATION
1. The performance rapid appraisal Process (rap)	Initial rapid system diagnosis and performance assessment through the RAP: the primary objective of the RAP is to allow qualified personnel to systematically and quickly determine key indicators of the system in order to identify and prioritize modernization improvements. The second objective is to start mobilizing the energy of the actors (managers and users) for modernization. The third objective is to generate a baseline assessment, against which progress can be measured.
2. The capacity and sensitivity of the System	The assessment of the physical capacity of irrigation structures to perform their function of conveyance, control, measurement, etc. Assessing the sensitivity of irrigation structures offtakes and cross regulators, identification of singular points. Mapping the sensitivity of the system.

3. The perturbations	Perturbations analysis: causes, magnitudes, frequency and options for coping with stress. Perturbations refer to change in the flows occurring along a canal network. Perturbations can be either positive or negative, representing an increase or decrease in discharge, respectively.
4. The networks & water balances	This entails assessing the hierarchical structure and the main features of the irrigation and drainage networks, on the basis of which partition of the system into subsystems will be made. Water accounting should be undertaken, considering both surface water and groundwater, and mapping the opportunities and constraints related to them.
5. The cost of O&M	Mapping the costs associated with current operational techniques and resulting services, disaggregating the different cost elements; cost analysis of options for various level of services with current techniques and with improved techniques.
MAPPING	**2. PHASE B: IMPROVING CANAL OPERATION, SERVICE ORIENTED MANAGEMENT**
6. The service to users	Mapping and economic analysis of the potential range of services to be provided to users at various levels of the systems. The services should be based on a compromise between the water management strategies, the agriculture objectives and the willingness to pay by users.
7. Partitioning into management subunits	The irrigation system management should be partitioned into few levels of management and the command area should be divided and subunits (subsystems and/or subcommand areas) that are held homogeneous and/or separate from one another by a singular point or a particular borderline.
8. Assessing the demand for operation	Assessing the resources, opportunity and demand for improved canal operation at the different levels of management and within the local management units.
9. Identifying canal operation improvements	Identifying improvement options (service and economic feasibility) for each management unit for (i) water management, (ii) water control, and (iii) canal operation.
10. Integrating and consolidating Management	Integration of the preferred options at the system level, and functional cohesiveness check. Consolidation and design of an overall information management system for supporting operation.
11. A plan for modernization and m&e	Finalizing a modernization strategy and progressive capacity development. Select/choose/decide/phasing the options for improvements. Plan for M&E of the project inputs and outcomes.

2.3 Coverage of irrigation in different blocks in pilot districts

Block wise data on current irrigation development was collected and analysed to understand the scope for further development. The area irrigated in Kharif season (monsoon season) as percentage to cultivable area, geographical area is tabulated in Table 1 and Table 2 for Cuttack and Subarnapur district respectively. In the same table, percentage of cultivable area to geographical area is also presented. The percentage values indicate that multi-pronged approach is required to increase area covered under irrigation in at least 8 blocks for which the percentage in less than 80%. Odisha receives an average annual rainfall of 145 cms. With innovative approaches the precipitation could be harnessed for developing irrigation potential. Check dams, water harvesting, lifting from streams/ rivers and ground water are planned to be constructed. This is presented in New Command Plan in Chapter 3.

Table 1: Overview of Irrigation Development In different blocks of Cuttack district

Block	Geographical area (ha)	Cultivable area (ha)	Net sown area (ha)	Net Sown Area as % of cultivable area	Cultivable area as % to Geographical Area	Irrigated Area during Kharif (ha)	Irrigated Area during Kharif as % of Geographical area	Irrigated Area during Kharif as % of Cultivable area
Cuttack Sadar	18009	11639	10344	88.87	64.63	11018	61.18	94.66
Barang	12541	7818	6973	89.19	62.34	7072	39.27	90.46
Kantapada	11882	7805	7621	97.64	65.69	6942	38.55	88.94
Niali	20720	14000	11865	84.75	67.57	13489	74.90	96.35
T.Choudwar	31051	20063	15857	79.04	64.61	7850	43.59	39.13
Salipur	24729	16440	16060	97.69	66.48	14518	80.62	88.31
N.Koili	21920	13781	13612	98.77	62.87	10158	56.41	73.71
Mahanga	20828	14094	14015	99.44	67.67	11945	66.33	84.75
Athagarh	29580	19966	18403	92.17	67.50	7200	39.98	36.06
Tigiria	10133	6589	5812	88.21	65.03	1650	9.16	25.04
Baramba	22871	13293	13043	98.12	58.12	5959	33.09	44.83
N.S.Pur	34132	19633	18498	94.22	57.52	7884	43.78	40.16
Banki-I	38499	10954	9954	90.87	28.45	3788	21.03	34.58
Banki-II	67613	12075	11950	98.96	17.86	4669	25.93	38.67
Dist. Total	**364508**	**188150**	**174007**	**92.48**	**51.62**	**114142**	**633.81**	**60.67**

Table 2: Overview of Irrigation Development In different blocks of Subarnapur district

Block	Geographical area (ha)	Cultivable area (ha)	Net sown area (ha)	Net Sown Area as % of cultivable area	Cultivable area as % to Geographical Area	Irrigated Area during Kharif (ha)	Irrigated Area during Kharif as % of Geographical area	Irrigated Area during Kharif as % of Cultivable area
Sonepur	32637	19524	18391	94.20	59.82	10968	33.61	56.18
Tarbha	35464	21707	21675	99.85	61.21	5669	15.99	26.12
Binka	29070	19850	19800	99.75	68.28	23565	81.06	118.72
D.Palli	28743	23487	23610	100.52	81.71	26456	92.04	112.64
BMPur	31631	21464	22934	106.85	67.86	7702	24.35	35.88
Ullunda	27864	22286	22278	99.96	79.98	12150	43.60	54.52
District	185409	128318	128688	100.29	69.21	86510	46.66	67.42

Source: Moe Data of DDA, Subarnapur

2.4 Assessment of gap between irrigation potential and actual utilization in a district

Before commencement of the preparation of operational plan, rigorous field work was conducted for field level assessment of performance of irrigation projects in the pilot districts for assessment of the gap which are presented in Table 3. It has been found that, there is a considerable gap in current utilization of created irrigation potential in both the study districts.

Table 3: IPC, IPU and average gap in all types of irrigation projects/schemes in Cuttack district

Type	Kharif			Rabi			Annual		
	IPC	Gap	%age of Gap	IPC	Gap	%age of Gap	Gross Irrigation Potential	Gap	%age of Gap
Major	2871	958	33.37	2871	2254	78.51	5742	3212	55.94
Medium	767	333	43.42	767	767	100.00	1534	1100	71.71
Minor	5199	2685	51.64	221	203	91.86	5420	2888	53.28
River Lift	1912	823	43.04	1912	1097	57.37	3824	1920	50.21
Ground water	842	428	50.83	842	582	69.12	1684	1010	59.98

Table 4: IPC, IPU and average gap in all types of irrigation projects/schemes in Subarnapur district

Type	Kharif			Rabi			Annual		
	IPC	Gap	%age of Gap	IPC	Gap	%age of Gap	Gross Irrigation Potential	Gap	%age of Gap
Major	7155	715	9.99	7155	1400	19.57	14310	2115	14.78
Medium	1836	367	19.99	1836	852	46.41	3672	1219	33.20
Minor	3971	2414	60.79	1414	1390	98.30	5385	3804	70.64
River Lift	2065	875	42.37	2065	1715	83.05	4130	2590	62.71
Ground water	270	86	31.85	270	106	39.26	540	192	35.56

2.5 Bridging the gap

Bridging the gap is a priority operation as it can be undertaken at a lower cost compared to construction of a new irrigation scheme. Canals are already laid out, but water is not reaching to the designed area due to constraints/bottlenecks which are potentially removable. The key operational steps/procedures are listed below:

a. Completion of CADWM works along with correction of system deficiencies in canal network for bridging the gap between Irrigation Potential Created (IPC) and Irrigation Potential Utilised (IPU).

b. Improving the water use efficiency in irrigation and providing assured supply of water to every farm field by adopting water saving technologies and applying water using drip and sprinkler irrigation methods.

c. Transfer of control and management of irrigation system to the Water Users' Associations (WUAs). (According to Incentivization schemes for Bridging Irrigation gap, ISBIG guidelines[3])

As per present formulation of the ISBIG Scheme, the above stated aims will be achieved in about 317 existing water resources projects of 24 States with activities listed in Table 5.

3 Guideline issued to Department of Water Resources of all State Governments by Ministry of Water Resources, River Development and Ganga Rejuvenation, Govt. of India 2017

Table 5: Structural & Non-structural Interventions (Scheme Components)

Aim/ Activity	Proposed Interventions / Scheme Components			
Bridging of the IPC & IPU gap	i	Creation of field channel/ pipe network below the outlets of distribution network	On Farm Developmental Works	Structural Interventions
		Land leveling and realignment of field boundaries		
		Improvement in farm drainage system		
		Reclamation of waterlogged farm areas		
		Construction of farm roads (by convergence through MGNREGA)		
	ii	Correction of system deficiency in canal network		
Improving water use efficiency & providing assured supply of water	iii	Infrastructure for increased coverage of micro irrigation system		
	iv	Installation of solar power system for micro-irrigation		
	v	Infrastructure for conveyance and additional treatment of municipal and industrial waste water for augmenting water for farm use		
	vi	Infrastructure for conjunctive use of groundwater		
	vii	Automation of canal system for control and measurement of irrigation supplies		
Transfer of control and management of irrigation system to WUAs	viii	Strengthening of Participatory Irrigation Management (PIM) for sustainable operation and maintenance of irrigation network		Non-structural
	ix	Modernization and extension of existing WALMIs/IMTIs	Water Education	
		Creation of new WALMIs in States where not in existence		
Project Management		Creation of incremental establishment		
		Capacity building of the PIAs & WUAs		

Source: ISBIG guidelines

Projects and area to be covered are already identified by Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India. Names of the projects and area allocated in Cuttack and Subarnapur District are given in Table 6.

Table 6: Projects and area proposed for implementation of ISBIG in pilot districts

Name of the project	District	Total CCA in ha	Area to be covered in ha
Mahanadi delta Stage-I	Cuttack	167000	14520
Mahanadi delta Stage-II	Cuttack	136000	10000
Hariharjore	Subarnapur	9450 ha	9450 ha
Total Odisha		783270	237780

Source: ISBIG guidelines

2.6 DIAP planning in brief

For the entire district, sub basin level planning, for cluster of minor irrigation schemes, cascade planning, crop water budgeting for PP areas and project areas, canal operation plans for main, branch, distributary, minor, sub-minor canals and water distribution schedule for distribution of water below outlet, creation of additional irrigated area and consumptive use are some of the important elements of this new planning process and its outcome. District Irrigation and Agriculture Plan (DIAP) is an outcome of transformative planning process which is integrated and inclusive. This planning process is proposed to be substituted to the existing planning process after required capacity addition and development of expertise among the staff of irrigation and agriculture department.

Action points for preparation of DIAP are categorized into 5 heads. Purpose and activities under these 5 heads along with their scope and coverage is presented in a matrix in Table 7. Brief descriptions about these action points are given in subsequent paragraphs. Canal operational plan is described in Section 2.7 and New Command Plan is described in Chapter 3.

DIAP planning process at a glance is given below and details are described in respective sections of this report.

Table 7: Action Points, their purpose and scope of coverage

Sl. No	Action Points	Purpose/ Activity	Scope for Coverage
1	River Basin Planning	River basin planning will help in knowing the competing demands Computation of present demand for industry Computation of demand for industry in 2030 Computation of present demand for agriculture Computation of demand for agriculture in 2030 Computation of present demand for drinking and other uses in 2030 Computation of demand for drinking and other uses in 2030 Preparation of district wise river basin plans for 2018 showing demand, availability and action plan for increasing availability Preparation of district wise river basin plans for 2030 showing demand, availability and action plan for increasing availability	Entire District and part of River basin
2	Cascade Planning	Harness all water resources based on catchment area of streams by construction of different type of irrigation structures and interlinking among them Identification of cascades and their catchment area Marking of existing irrigation structures in the proposed cascade area Preparation of cascade level plan	Blocks not having major and medium irrigation projects
3	Crop water budgeting	For gaining understanding of water availability, requirement of water by Pani Panchayat and prepare crop planning and irrigation scheduling Preparation of Pani Panchayat wise soil type information Computation of potential Evapotranspiration Computation of crop Evapotranspiration for crop grown in the Pani Panchayat area Preparation of monthly crop water budget for the cropping period and annual crop water budget	Pani Panchayat Jurisdiction in all irrigation projects
4	Canal Operation Plans	Distributing water on equitable basis	Major Project
5	New Command Plan	Creation of Additional Irrigation Potential by different means	All departments concerned

2.6.1. River Basin Planning

IWRM is an accepted principle which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. River basins are ideal units for implementation of IWRM. In Odisha, there are basin managers for different river basins and one chief engineer for Basin Planning and Climate Change. Basin plans for development of water resources and its utilization for the geographical area belonging to different districts should be done under their guidance. In this plan present demand and projected demand for 2030 should be computed under their

guidance. The demand should consider water requirements for industry, agriculture, drinking etc. and also take into account the ecological flows necessary to maintain the health of the river and livelihoods of population dependent on the river such as fishermen. The ecological flow is also important to be maintained to control saline ingress at the delta regions of the river, which if not maintained could lead to loss of agriculture productivity due to decline in soil health due to increased salinity. Non-maintenance of ecological flow also affects ground water recharge in the river basins which in effect decreases soil moisture and creates conditions conducive to droughts even in the lower reaches of the river.

2.6.2 Cascade Planning

Cascades are used as units of planning for optimal use of surface water in irrigation tanks and ground water in the influence zone of the tanks. Currently, in World Bank assisted Andhra Pradesh Integrated Irrigation and Agriculture Transformation Project (APIIATP), cascade level planning is emphasized. In Tamil Nadu and Karnataka, tank cascades have been used as planning units since last two decades. It has the advantage of looking at a micro scale in contrast to the river basin planning which is in a macro scale. In Odisha, there are 4152 minor irrigation tanks. During the last five-six years, around 2500 in stream check dams have been constructed in Odisha. Large numbers of bore-wells have been constructed and there is a great demand for bore-wells by the farmers. Planning at the watershed or tank cascade level will be useful for integrated action for use of all types of irrigation sources for development and management. Cascades should be delineated and included in the DIAP with maps showing boundary, natural streams, existing MI schemes, and proposed schemes/structures.

2.6.3 Crop Water Budgeting

Crop water budget is a simple budgeting exercise accounting for different components of water used in cropped fields. Once the crop water budget is prepared, any improvement possible can be attempted that will reduce water use from the irrigation systems. The budget can be prepared with different components of water described in terms of depth units. In Table 7 the components are described with some values for illustration. Though the water requirement is expressed in mm of depth it can be presented in terms of volume i.e. cum or million cubic meter (mcm). Such budgeting can be done for individual chaks, outlet commands, Pani Panchayat jurisdictions (CCA), minor command, distributary commands. This will help the PPs and individual farmers to understand water use pattern and minimize losses. It will also help the irrigation divisions to plan canal operation and optimize water release. It can also be used as a parameter in benchmarking.

Table 8: Crop Water Budgeting

Sl No	Component of Water in cropped fields	Water Depth in mm
	Evapotranspiration (Consumptive use)	480
	Water used in Field Preparation	150
	Percolation loss	360
	Run off losses from field	120
	Total Requirement	1110
	Effective Rainfall	550
	Ground water contribution	110
	Supply from irrigation sources	450
	Total Supply	1100

2.6.3.1 Use of CROPWAT for water budgeting and estimation of irrigation demand

Computing crop water requirement for project operation and development of canal operation plans using crop water requirement data is a new element to be introduced in planning and O&M exercise. As it will be helpful to understand and appreciate the scientifically computed water requirement and is not

going to adversely affect, no political objections are anticipated. CROPWAT is a decision support system developed by the Land and Water Development Division of Food and Agriculture Organization of United Nations (FAO), Rome for planning and management of irrigation. CROPWAT is meant as a practical tool to carry out standard calculations for reference evapotranspiration, crop water requirements and crop irrigation requirements. This tool is used worldwide for better management of irrigation schemes. Outputs from this tool give an idea on irrigation demand during different time periods like month, week, ten daily periods. Based on computed demand, canal operation plans can be prepared. Rotational system wherever necessary in irrigation projects can be introduced in the operational plan in cases where the carrying capacity of canals is a restrictive factor. It allows the development of recommendations for improved irrigation management, the planning of irrigation schedules under varying water supply conditions. From the computations, data on parameters like evapotranspiration, effective rainfall, and special needs can be obtained to be used in Crop Water Budget. For better understanding an illustration is given in Table No. 8.

ETc denotes evapotranspiration for a particular crop and is a consumptive use which accounts for water lost by transpiration from the leaves and evaporation from the soil surface. Kc denotes crop coefficient for a particular crop and is a multiplying factor which is multiplied to the potential evapotranspiration for calculating ETc that is the evapotranspiration for the crop. Potential evapotranspiration is a reference value which is dependent on the climatic conditions and unrestricted moisture availability with fully covered canopy of crops over the field.

The irrigation requirement values are derived from computed values of ETc and effective rainfall. Irrigation requirement is the depth of water needed to be supplied from irrigation projects after deducting water usable from rainfall from the water required by the crops.

CROPWAT tool is an open-ware software and is downloadable free of cost, as it is developed by FAO, an UN organization. Use of this tool can be trained in a two-day training program. Such training can be arranged by Water and Land Management Institute (WALMI), owned and administered by DoWR. There will not be any high budgetary requirement and the training expenditure can be met from the budgets being allocated by WALMI.

Table 9: Computed results of CROPWAT

Month	Kc	ETc Mm/day	Eff. Rain Mm	Irr. Req Mm
Dec	1.20	1.0	0.8	0.3
Dec	1.11	10.8	1.4	86.9
Jan	1.06	14.4	1.7	110.7
Jan	1.09	14.6	1.2	69.2
Jan	1.10	16.9	1.1	15.9
Feb	1.10	16.20	0.8	15.3
Feb	1.11	17.0	0.6	16.4
Feb	1.12	14.9	1.0	13.9
Mar	1.13	20.20	1.5	18.7
Mar	1.13	21.6	1.9	19.8
Mar	1.13	25.2	2.3	22.9
Apr	1.13	24.2	2.8	21.4
Apr	1.12	25.2	3.2	21.9
Apr	1.07	24.7	3.5	21.2
May	1.01	24.0	0.8	23.2
May	0.98	7.1	0.0	7.1
Total		278.1	24.7	484.4

Note: The flow on the project basis has to account for the percolation loss and losses in conveyance and application

2.6.4 New Command Plan

Command plan will comprise of (i) Plan for rotational Water Supply in Main System (Govt. Controlled Canal) (ii) Plan for rotational Water Distribution in Canal System under the Pani Panchayats (iii) Plan for rotational Water Distribution in Outlet Command Area through Field Channels under the PP, besides cropping plans. The data for these plans will be provided by concerned irrigation and CADA officials. Maps of the command area of selected projects/canals/outlets will be prepared by them which are needed for the command plan and will be provided for plan preparation. There may be lack of competency with some officials of CADA and it is better to organise training programs for them. Contents for training sessions to improve competency on this issue is incorporated in Sl. 14 in Table No 12 of Section 2.10.

2.7 Canal Operation Plan

2.7.1 Government Controlled Canals

The main canal comprises of a number of distributaries. Each distributary has certain number of minor and sub-minor canals. The scheduling of water supply is also an important criterion here. Rotational Water distribution schedule for main canal or branch canal will consist of discharge rate for distributaries/minors and duration for which the concerned canal will be opened and operated at full supply level. It will be in a tabular format showing all off-taking canals from the main canal in a template given in Annexure 4.

2.7.2 Canal operation Plan for Minor Canals (Pani Panchayat jurisdiction)

Each Pani Panchayat has a definite jurisdiction of irrigation command area which varies between 500 to 800 hectares in flow irrigation projects. To supply irrigation water to this command area falling under the jurisdiction of PP, certain portion of canal network is transferred to the PP by Government. Mostly, these canal systems are minors and sub-minors.

There are a lot of outlets in a Pani Panchayat and scheduling the water supply to ensure equitable distribution is of utmost importance. In most of the PP areas for equitable distribution, it will be necessary to operate the canals on rotation basis. The rotation will be between minors or group of outlets in a particular minor. For irrigation water distribution among outlets in a minor, the time allotment for each outlet can be computed.

After preparation of the rotational schedule among the outlets, next step is to prepare Warabandi schedule for distribution of water to individual farmers' plots or to plots of a group of farmers from the turn out. For such Warabandi Schedule data has to be compiled in a template given in Annexure 4.

Warabandi means the rotation of water supply amongst the individuals or a group of farmers below each outlet. 'Wara' means rotation and 'Bandi' means fixation. Under this system allocations of available water are made on basis of irrigable area of holding of each farmer under an outlet with choice of crops left to him. The system ensures water to the cultivator of the area regardless of the position of his field in the outlet command or his social or economic status.

It leads to more efficient irrigation practices by the farmers. It stands for equitable distribution of water to larger number of farmers in the command. This results in greatest overall production per unit of available water.

2.7.2.1 Pani Panchayat Institutions in Pilot Districts

Pani Panchayats have been formed in all types of projects in pilot district by the Department of Water Resources. Till 30th November 2017, 1248 Pani Panchayats have been formed in Cuttack district and 1160 Pani Panchayats have been formed in Subarnapur district. Names of Pani Panchayats in different projects have been obtained with their area of jurisdiction. Number of Pani Panchayats in pilot districts in different types of schemes are given in Table No. 9.

Table 10: Number of Pani Panchayats in pilot districts in different types of schemes

Sl. No	Type of Scheme	No of Pani Panchayats		Remark
		Cuttack	Subarnapur	
1	Major	119	92	Jurisdiction is around 500 Ha for each PP
2	Medium	15	30	Jurisdiction is around 500 for each PP
3	Minor	64	16	Jurisdiction is around 60-300 Ha for each PP
4	OLIC	1092	1022	Maximum no of PPs in this category are having jurisdiction around 20 ha

2.7.3 Operation Plan for Field Channels (Outlet command area, chak)

Operation plan for distribution of water to different turn out command areas using field channels should be prepared. For preparing such plans, map of outlet command area showing field channel network, distribution boxes, turn-outs locations, boundary of turn-out command areas is required. Further, data on turnout wise command area, names of group of farmers having land in the turnout command length of lined and unlined field channel and their discharge ratings is required. It is also called Warabandi (explained in the box in section 2.7.2) in western states and this term Warabandi is incorporated to the national guidelines.

2.7.4 Irrigation Plan for 2017-18

Area that can be irrigated has been worked out from secondary data, obtained from DoWR and agriculture department on consultation with officials of both the districts and is presented as proposed irrigated area block wise in major irrigation project in Table 10. OLIC and other agencies may workout the proposed area before commencement of irrigation season based on the status of their functioning at many scattered locations

Table 11: Proposed Irrigated Area for Kharif and Rabi Season in different blocks of Subarnapur and Cuttack District for 2018-19

Name of the Project/ Canal System	Name of District	Division	Block	Design CCA	Proposed Irrigation programme for Kharif 2018-19	Proposed Irrigation programme for Rabi 2018-19
Hirakud Dam Project	Subarnapur	Bargarh	Binka	20690.0	1242	1242
Mahanadi Delta Stage 1	Cuttack	Mahanadi North	Salipur	18611.6	18612	4653
Mahanadi Delta Stage 1	Cuttack	Mahanadi North	Mahanga	8993.2	8993	2248
Mahanadi Delta Stage 1	Cuttack	Mahanadi North	Nischintkoili	3335.1	1121	478
Mahanadi Delta Stage 1	Cuttack	Mahanadi North	Tangi-Choudwar (HLC)	4707.1	4707	470
Mahanadi Delta Stage 1	Cuttack	Mahanadi South	CMC	105.3	105	98
Mahanadi Delta Stage 1	Cuttack	Mahanadi South	Cuttack sadar	4830.6	4831	2847
Mahanadi Delta Stage 2	Cuttack	Prachi	Baranga	6098.0	6098	1691
Mahanadi Delta Stage 2	Cuttack	Prachi	Cuttack sadar	2739.4	2739	827
Mahanadi Delta Stage 2	Cuttack	Prachi	Kentapada	5010.0	5010	2855
Mahanadi Delta Stage 2	Cuttack	Prachi	Niali	10415.0	10415	3705

2.8 Water Security for Agriculture purpose

In Odisha, many parts of command area of irrigation projects are not assured of having irrigation water available at the desired time and in the required quantity. The operational plan aims at improving water security by benchmarking different parameters concerning irrigation project and command area management.

2.9 Benchmarking

In irrigation projects, benchmarking has been introduced as a tool aimed at performance improvement. Benchmarking is a continuous process of measuring one's own performance and practices against the best competitors, and a sequential exercise of learning from other's experience. It is a fundamental management skill that supports quality and excellence. Benchmarking has broad applications in problem solving, planning, goal setting, process improvement, innovation, strategy setting and in various other contexts. Opportunities for improvement are identified by conducting an internal assessment and making comparative measurements with best practice organizations to determine the performance gaps between current practice and best practice. Selected best practices can then be suitably adopted to fit into organization's need and implemented. The cycle of improvement thus continues.

In irrigation sector, that would mean more productive and efficient use of water, more crop per drop. The benchmarking of irrigation projects is widely accepted world over now. To promote benchmarking in irrigation sector in India, a national level workshop was held at Hyderabad in 2007. Based on the recommendations of the workshop, benchmarking is suggested to be implemented by DoWR with aim to bridge the gap. Benchmarking would help in appropriate interventions in monitoring performance of irrigation projects and help in formulation and implementation of policies for improvement of projects. This would result in bringing transparency in irrigation sector along with many benefits, such as equitable distribution, improvement in irrigation efficiency, help bringing additional area under irrigation lead to diversification of crops, enable putting cap on O&M expenditure, increased per unit of water etc. 20 main indicators have been identified in the Workshop to assist Benchmarking process, which is given in the Table 11.

Table 12: Main performance indicators for benchmarking of irrigation project

Sl. No.	Domain		Performance indicator1
I.	System Performance	1.	Water delivery capacity Index
		2.	Total annual volume of irrigation water supplied/delivered (m3/year)
		3.	Field application efficiency
		4.	Annual Relative Irrigation Supply Index
		5.	Annual Irrigation water supply per unit command area (Cum/ha)
		6.	Annual Irrigation Water Supply per unit irrigated area (cum/ha)
II.	Agricultural Productivity	7.	Output per unit command area (Rs/ha)
		8.	Output per unit irrigated area – Tons / ha crop-wise. (Rs./ha.)
		9.	Output per unit irrigation supply (Rs/cum)
		10.	Output per unit crop water demand (Rs/cum)

Sl. No.	Domain		Performance indicator1
III.	Financial Aspects	11.	Cost recovery ratio
		12.	Total O&M cost per unit area (Rs/ha)
		13.	Total cost per person employed on O&M Works (Rs/person)
		14.	Revenue collection performance
		15.	Revenue collection performance
		16.	Maintenance cost to revenue ratio
		17.	Staff numbers for O&M per unit area (persons/ha)
		18.	Total O&M cost per unit of water supplied (Rs./cum)
IV.	Environmental Aspects	19(a).	Average depth to water table (m)
		19(b).	Land Damage Index
		20(a).	Water Quality: Ph/Salinity/Alkalinity Index
		20(b).	Salt balance (tones)

DoWR, Govt. of Odisha issued an order in 2006-07 to implement benchmarking process in Odisha. During 2006-07, it was decided to use benchmarking in the state for improving the performance of irrigation projects. The work was to be taken up in a phased manner in selected major & medium irrigation projects and programmed to be extended to all major, medium and minor irrigation projects at later stage. Due to non-availability of measurement arrangements and capacity constraints, benchmarking has not been done. In the first phase, 12 medium irrigation projects namely Daha, Ghodahado, Salia, Aunli, Dadaraghati, Derjang, Sunei, Remal, Ramiala Gohira, Salki & Pilasalki were selected. In recent months of 2017-18, concerned officials of DoWR have attended national workshops organised by MoWR, Govt of India. As follow up to the decision and direction of Govt. of India, DoWR has organised training for senior officers and is now set to undertake benchmarking. Data required to evaluate the performance of the projects are being collected from field units. Some data were furnished in 2017-18 by a few irrigation divisions in response to the directions from the state level. These data were found to be inadequate and the training was organised to make all concerned officers competent to collect quality data needed for benchmarking. Through DIAP process, benchmarking framework can now be prepared as the officers are now trained and convinced to take up benchmarking.

2.10 Capacity Building

Implementation of water use strategy outlined in this report, requires orientation of staff and their capacity building. In addition, as the integrated planning will be made taking PP jurisdictions as units, capacity building programmes are also required for Pani Panchayats. There is (nearly always) also the need for follow-on support to ensure training is put into practice – plus, if the training is not happening at the same time as institutional changes that allow the training to be used, the new skill set often just doesn't get used. Hence, it is suggested that the institutional changes should be synchronised with the training. Institutional changes proposed are to make a district level team consisting of district level officers working on irrigation, agriculture, horticulture and state level executive committee to oversee and guide preparation of DIAP in different districts. Assigning new roles to prepare sub basin planning, crop water budgeting, canal operation plan etc. to the irrigation divisions. Training should cover the suggested curriculum in Table 12.

Table 13: Tool kit for Capacity Building

Sl. No	Subject	Session Breakup Theory + Practice	Total Sessions
1	Concept of DIAP and its advantages over the present system water allocation & water distribution in irrigation projects.	1+0	1
2	Climate change and coping mechanism through better water management	1+0	1
3	Crops suitable in the irrigation project and selection of crops and varieties in consultation with Progressive farmers and office bearers of PP	1+0	1
4	Preparation of cropping calendar	0+1	1
5	CROPWAT Conceptual framework	1+0	1
6	Input data for CROPWAT	0+1	1
7	Running the CROPWAT Model and generation of output on ET0, Irrigation requirement and Scheme water supply	0+1	1
8	Preparation of outlet data base	1+0	1
9	Preparation of PP data base	1+0	1
10	Water measurement	1+0	1
11	Development of maintenance plan	1+0	1
12	Development of Operational Plan	1+2	3
13	Water delivery and distribution in canal distribution system	1	1
14	Preparation of chak maps showing turnout locations, turnout wise list of farmers and their area, discharge of outlets and turnouts, discharge rate of different section of field channels	1+1	2
15	Warabandi	0+1	1
16	Parameters for measurement, monitoring and analysis	1+0	1
17	Equitability and Gender mainstreaming	1+0	1
18	Increasing efficiency in irrigation water use and enhancing crop productivity	1+0	1
19	Mobile App	1+0	1
20	Annual District Irrigation and Agriculture Plan	0+2	2
21	Report preparation on achievement on irrigation water use and crop production	1+1	2
	Total	16+10	26

To kick-start the Integrated DIAP in Odisha, a transformative planning process aligned to PMKSY, two-day workshop-cum training should be organised involving senior officials at policy level as well as planning, implementation and monitoring level. The strategy proposed for this workshop-cum training is; out of the two days, in the first half of the first day it will be conducted in workshop mode and rest one and half days shall be conducted in training mode.

For organising training, financial resources are available with WALMI. Training modules should be developed for different categories of training as given below (Table 14). Preparation of training modules can be assigned to WALMI, which is a training institute. WALMI can prepare the required modules through available experts in the state, by hiring them through outsourcing or partnership mechanism.

Table 14: Training plan for Capacity building of stakeholders on DIAP for Cuttack and Subarnapur district for year 2018-19

Sl. No	Target Group	No of participants	Proposed training Institution	Duration	No. of training	Remarks
1	Executive Engineer, Irrigation (Division level) and Deputy Director Agriculture, Horticulture	16	WALMI, at Pratapnagari	2 days	2	1 training and another refreshers training
2	Asst. Executive Engineer (Sub-Division level), District Agriculture Officer	21	WALMI, at Pratap nagari	3 days	2	1 training and another refreshers training
3	Asst. Engineer/Junior Engineer (Section level, Asst. Agriculture officer (Block level)	62	WALMI, at Pratap nagari	4 days	4	Two batches two times training (initial and refresher)
4	VAW, Krishak Sathi of Agriculture Dept, Khalasi of irrigation division, representatives from PP	6600	WALMI at project locations through PPs	1 day	44	In the project village with 150 participants per training
	Total	6699			52	

Target for completion of capacity building and training

All training for concerned persons to prepare DIAP and its subsequent implementation and monitoring should be completed in around one years' time.

Nodal Officer and Inter departmental coordination

The PMKSY Mechanism has already taken care of the issue of inter-departmental coordination both at state and district level. In Odisha, the three-tier structure, i.e. State Level Steering Committee (SLSC), Inter Departmental Working Group (IDWG) and District Level Implementation Committee (DLIC) are constituted for PMKSY by notification of the Government. DLIC is the apex committee at district level and it has adequate powers and authority to bring coordination among departments of agriculture, horticulture and soil conservation. The programs of these departments are to be converged to achieve the goal "Har Khet ko Pani", i.e. "Per drop more crop". The converged integrated irrigation and agriculture plan will be in a template which will be provided in the toolkit prepared for DIAP.

Nodal officer for DIAP for Cuttack district will be Executive Engineer, Mahanadi North Irrigation Division, Jagatpur as maximum irrigation potential is under this division.

Nodal officer for DIAP for Subarnapur district will be Executive Engineer, Minor Irrigation Division, as the divisions for Hirakud Irrigation Project is at Barpalli and for Ong and Hariharjore project is at Balangir whose offices are outside the district boundary.

Chapter 3

3.1 New Command Plan

For resilience of the vulnerable farm families, development of new commands is proposed under the district level integrated irrigation and agriculture plan (DIAP). As discussed in Section 4.2 and obvious from data in Table 1 & 2, the irrigated area in many blocks of both the districts is limited (where new irrigation commands need to be developed) and few of them cover less than 30% of the area that could be irrigated. Extension of command in existing irrigation projects by construction of new canal system and covering some non-command areas near to the outlet commands, construction of new surface and ground water schemes, rainwater harvesting, farm ponds are options for providing irrigation to new command which is proposed for both the pilot districts. The proposals are based on some approved plans like Extension of Ong Irrigation Project, with head work in Balangir district and others prepared by consultant as recommendations. The new command plan for Cuttack district for the year 2018-19 and 2030-31 is furnished in Table 14 and Table 15. The new command plan for Subarnapur district for the year 2018-19 and 2030-31 is given in Table 17 & 18 respectively. The targets on area coverage in 2030-31 presented in tables mentioned above are cumulative total figures. From 2019-20 to 2029-30, there will be incremental increase in coverage which will be dependent on fund allocation to the irrigation divisions, readiness in terms of completion of survey, design, estimates and bidding documents which needs efforts. In this document, it has been attempted to illustrate what can be done in the immediate future i.e. 2018-19 and a future perspective for the reference year 2030-31.

Table 15: New Command Plan for Cuttack District for the year 2018-19

Blocks	Major	Area (in Ha)	Medium	Area (in Ha)	Minor	Area (in Ha)	Lift Irrigation*	Farm Pond	Area (in Ha)	Check-dam**	Area (in Ha)	Area (in Ha)
Cuttack Sadar							12					240
Baranga							8					160
Kantapada							10					200
Niali							33					660
Tangi Choudwar							39					780
Salipur							7					140

Blocks	Major	Area (in Ha)	Medium	Area (in Ha)	Minor	Area (in Ha)	Lift Irrigation*	Farm Pond	Area (in Ha)	Check-dam**	Area (in Ha)	Area (in Ha)
N.Koili							9					180
Mahanga							42					840
Athagarh							92			2	10	1850
Tigiria							45			2	10	910
Baramba							60			2	10	1210
Narasing-pur							21			2	10	430
Banki-I							45			2	10	910
Banki-II							81			2	10	1630
Total	10140 Ha											

**Area for each lift irrigation scheme is taken as 20 ha*

****Area of each checkdam is taken as 5 ha***

Table 16: New command plan for Cuttack district for 2030-31

Blocks	Major	Area (in Ha)	Medium	Area (in Ha)	Minor	Area (in Ha)	Lift Irrigation*	Area (in Ha)	Farm Pond**	Area	Check-dam**	Area (in Ha)
Cuttack Sadar							60	1200	2	10		
Baranga							36	720	3	3		
Kantapada							30	600				
Niali							55	1100	6	6	7	35
Tangi Choudwar	1	10144			8	646	90	1800	26	26	48	557
Salipur							17	340	17	216		
N.Koili							20	400			57	285
Mahanga							98	1960	11	11	47	100
Athagarh	1	5953			37	2032	224	4480	73	73	202	202
Tigiria	1	1000			6	281	108	2160	148	148	95	456
Baramba	1	2005			13	2032	137	2740	91	91	21	280
Narasingpur					17	1970	52	1040	798	798	77	400
Banki-I	1	3751			7	123	106	2120	80	240	132	1180
Banki-II					14	1063	192	3840	30	60	50	500
Total	61177 Ha											

**Area for each lift irrigation scheme is taken as 20 ha*

****Area of each checkdam and farm pond is taken as 5 ha***

Table 17: New command plan for Subarnapur district for 2018-19 (In Kharif)

Name of the Block	Major	Area (in Ha)	Medium	Area (in Ha)	Minor	Area (in Ha)	Lift Irrigation*	Area (in Ha)	Farm Pond**	Area (in Ha)	Checkdam**	Area (in Ha)
Sonepur							4	160	5	2.5	3	15
Tarbha							3	120	5	2.5	3	15
Binka									5	2.5		
D.Palli							1	40	5	2.5		
BMPur							10	400	5	2.5	3	15
Ullunda							7	280	5	2.5	3	15
Total	1075											

**Area for each lift irrigation scheme is taken as 20 ha*

***Area of each checkdam and farm pond is taken as 5 ha*

Table 18: New command plan for Subarnapur district for 2030-31 (In Kharif)

Name of the Block	Major	Area (in Ha)	Medium	Area (in Ha)	Minor	Area (in Ha)	Lift Irrigation*	Area (in Ha)	Farm Pond**	Area (in Ha)	Checkdam**	Area (in Ha)
Sonepur			1	119851		912		936				1184.81
Tarbha						1740		204				1696.89
Binka		4276				874		520				
D.Palli	1	3726				603		128				
BMPur				799		1713		941				1944
Ullunda				684		1014		902				5473
Total	42255.7											

[1]*Extension of Ong Irrigation Project with head work in Balangir district.*

**Area for each lift irrigation scheme is taken as 20 ha*

****Area of each checkdam and farm pond is taken as 5 ha**

Chapter 4

4.1 Activities for Operational plan and New Command Plan (DIAP) for both the districts and Proposed Institutional Mechanism for approval

Different activities proposed under irrigation sector have been formulated taking into consideration the length of canal network in major medium projects, no of minor irrigation projects, Pani Panchayats to be formed, institutional capacity building of the department. For preparation of irrigation plans at Pani Panchayat level, canal level and project level, required data and maps are not readily available in the desired format. This is essential for formulation of annual plans each year. It is proposed to prepare data sets and maps of some canal system in 2017-18 and continue the same to cover the entire command area in 5-7 years period. The activities are aimed at bridging the gap between IPC and IPU, efficiency improvement and better equity in water distribution. The activities for the year 2018-19 for Cuttack district with physical target are given in Table 18 and for Subarnapur district in Table 19.

Table 19: Activities under irrigation sector for Cuttack district with targets for the year 2018-19 and cumulative targets upto 2030-31

Activity	During 2018-19	Cumulative from 2018-19- 2030-31
	Physical	Physical
Renovation of MIPs	3	9
Construction of new MIP	0	5
Lining of main canal and distributaries	15km	100
Repairing of minors and sub-minors	100	500
Construction of field channels and OFD works	500 ha	50000
Micro irrigation Infrastructure	50ha	10000
Bore-well	20	1000
Shallow Tube-well	100	10000
Solar Power pumps	30	500
Check dams	10	300
Capacity building of Pani Panchayats	100	3000
Understanding Gender issues and gender equity at Pani Panchayat level (Meeting of women farmers)	400	4000

Activity	During 2018-19	Cumulative from 2018-19- 2030-31
	Physical	Physical
Preparation of datasets	5000	100000
Preparation of maps	5000	100000
Preparation of Canal Operational Plans	5000	80000
Institutional Capacity building of DoWR	LS	LS
Capacity building of DoWR and Agriculture Dept on gender mainstreaming	4	40

Table 20: Activities under irrigation sector for Subarnapur district with targets for the year 2018-19 and cumulative targets upto 2030-31

Activity	During 2018-19	Cumulative from 2018-19-2030-31
	Physical	Physical
Renovation of MIPs	3	9
Construction of new MIP	0	5
Lining of main canal and distributaries	15km	100
Repairing of minors and sub-minors	100	500
Construction of field channels and OFD works	500 ha	50000
Micro irrigation Infrastructure	50ha	10000
Bore-well	20	1000
Shallow Tube-well	100	10000
Solar Power pumps	30	500
Check dams	10	300
Capacity building of Pani Panchayats	100	3000
Preparation of datasets	5000	100000
Preparation of maps	5000	100000
Preparation of Canal Operational Plans	5000	80000
Institutional Capacity building of DoWR	LS	LS

4.2 Institutional Mechanism

Integrated District Irrigation and Agriculture plan preparation and subsequent implementation is envisaged to align works and activities of DoWR and DoAFE, Govt. of Odisha and enhance engagement with communities through Pani Panchayat institutions. The goal of this planning process is ultimately to improve access to irrigation and thereby increase agriculture production leading to farmers' empowerment. At the national level, PMKSY has similar goal and is currently in operation. Keeping district level mechanism of PMKSY intact, the state level arrangement may make marginal modification to the current institutional arrangement as it is a pioneering program of Govt. of Odisha with DoWR as the nodal department but with equal participation and contribution of Agriculture Department. Accordingly, the following institutional mechanism is proposed for approval of DIAP and suitable policy guidance.

State Level Executive Committee (SLEC): There is a National Executive Committee for PMKSY with Vice Chairman, NITI Aayog as the Chairman. The SLEC meetings are proposed to be chaired by Agricultural Production Commissioner. The constitution of SLEC is proposed as follows.

i. Agricultural Production Commissioner – Chairman

ii. Principal Secretary, DoWR to Govt. of Odisha – Member

iii. Principal Secretary, AFE to Govt. of Odisha – Member

iv. Secretary, Department of Panchayati Raj (In charge MNREGA) – Member

v. Engineer-in-Chief (WR) – Member

vi. Engineer-in-Chief (P&D) – Member

vii. Director of Agriculture and Food production – Member

viii. Director of Horticulture – Member

ix. Director (PPSU), DoWR – Member

x. Additional Director, CADA, DoWR – Member

xi. Chief Engineer, MI – Member

xii. MD, OLIC – Member

xiii. Director, Monitoring DoWR, Office of EIC – Member Secretary

This committee should meet twice in a financial year. Since this is a committee consisting of government officials to deliberate on a government program, there is no need for any yardstick for quorum as required in statutory bodies, societies. Normally, when a meeting is chaired by Principal Secretary to the Government, all members usually attend unless they are on leave or assigned some other duty.

District Level Implementation Committee (DLIC) - There is already a DLIC under PMKSY with Collector and District Magistrate as Chairman. Same committee will function for overseeing the preparation of integrated DIAP and given approval. DLIC should meet 4 times in a year. The constitution of DLIC is as follows:

i. Collector and District Magistrate – Chairman

ii. Deputy Director, Agriculture – Member

iii. Executive Engineers, DoWR, MI, OLIC – Members

iv. Deputy Director, Horticulture – Member

v. Project Director, Watershed – Member

vi. Executive Engineers, DRDA – Member

vii. District Level Nodal Officer, PMKSY – Member Secretary

Chapter 5

5.1. Conclusion and Outcomes

Transformative district level planning for water management and agriculture is an innovative concept to be introduced not only in Odisha but in the entire country. Through adoption of this strategy, objectives like adaptation to climate change, improvement of efficiency in irrigation projects, enhancement of agriculture production and doubling the income of farmers in the coming five years can be targeted. In this document, activities, fund requirement and other key interventions are incorporated for Cuttack and Subarnapur districts only. Government of Odisha should introduce this planning process in all 30 districts.

The DIAP process includes field level assessment of existing water use, identification of gap between potential and utilization in all projects of the districts, prioritization of activities which will enable a reducing gap, demand side management and supply side management of irrigation water. Scientific determination of crop water requirement based on actual cropping pattern, development of canal operation/scheme operational plans and their implementation as well as maintenance of canal system through Pani Panchayats, required capacity building activities for them and institutional capacity building of the departments for smooth preparation of DIAP are key elements of this transformative proposition. Projections for 2030 are incorporated to ensure farm level water security, minimize impact of drought on crops and farmers and thereby reducing vulnerability to climate change. In other words, activities of the departments are to be aligned to climate change adaptation. This projection needs to be converted as targets for all 30 districts.

While working on this approach, it was observed that there are some anomalies on data particularly on irrigation potential created, crop productivity, cropping pattern which has to be revisited by the concerned district level officials and state level officials. It is highly desirable that in all public domain like websites, annual reports, one single realistic data for each parameter should be provided.

The intended outcome of this exercise is to prepare a new planning procedure. The planning procedure for Integrated DIAP at a glance is depicted in Table 20.

Table 21: Operation Plan at a Glance

Action needed	Tentative time	By whom	Involvement
Inception meeting for DIAP	Last week of April	Nodal officer DIAP	Executive engineers all divisions (DoWR), District level officers (Agricultire, DRDA, Watershed, OAIC)
Sending of formats to Pani Panchayats for area irrigated in the previous year, gap and reasons for gap	First week of May	Asst. Engineer/ Junior Engineer of DoWR.	Pani Panchayats' water management committee, Asst. Agriculture officer, JE
Preparation of Pani Panchayat wise cropping plan	First week of May	Asst. Agriculture officer	Pani Panchayats' executive committee, chak committee, VAW, Krishak Saathi
Consolidated report on gap for each division	Last week of May	Executive Engineer, Irrigation divisions	AE, JE, Estimator of the Irrigation divisions
Assessment of water availability and command area that can be irrigated	Last week of May	Executive Engineer, Irrigation divisions	AE, JE, Estimator of the Irrigation divisions
Computation of crop water requirement	First week of June	Water management specialist (Agriculture)/ Asst. Engineer (Irrigation)	Agronomist (Agriculture), Deputy Director Horticulture
Water allocation plan for distributary commands and PP commands	Second week of June	Asst. Engineer (Irrigation)	PP, Asst. Agriculture officer, Tahasildar,
Canal Operation Plan and Water distribution schedules	Third week of June	Asst. Engineer (Irrigation)	PP, Khalasis
Benchmarking	Throughout the year	Executive Engineer, Irrigation divisions	Asst. Engineer, JE, Khalasi
Assessment of crop productivity (Crop cutting)	During harvesting	Asst. Agriculture officer	VAW, Krushak Saathi, farmers
Identification of source and sites for new irrigation project	First week of April	Executive Engineer, OLIC, District level officer OAIC, PD watershed, Executive engineer MI, PD, DRDA and irrigation divisions	Asst. Agriculture officer, field level staff under the divisions
Tabulation for new projects block wise for the entire district	First week of June	Executive Engineer, OLIC, District level officer OAIC, PD watershed, Executive engineer MI, PD, DRDA`and irrigation divisions	Staff of the respective offices
Preparation of activity list with physical and financial targets	First week of July	Executive Engineer, OLIC, District level officer OAIC, PD watershed, Executive engineer MI, PD, DRDA` and irrigation divisions, DDA, DDH	Concerned staff, district collector (only for approval), controlling officers at the state headquarters (for guidance and approval)

Annexures

Annexure 1:
Summary of consultations and their outcome

Stakeholders	Issues of Consultations	Outcomes	No of consultations
Executive Engineers of different divisions of DoWR, Deputy Directors of Agriculture and Horticulture, PD (Watershed), Technical PD/ APD (DRDA)	Data collection, operation of different major & medium, minor, river lift, ground water, functioning of Pani Panchayat, present operational practices, gender issues	Insight was gained on present practices. Help and support was received for field level assessment	7
Pani Panchayat office bearers and farmers	PP involvement in deciding cropping patterns, maintenance of canals and field channels, crops grown, productivity, water availability, participation of women in decision making at family level and PP level on agriculture activities	Water equity, availability was understood. Present functioning of PPs was understood Crop productivity and crop varieties were determined	25
Superintendent Engineer, DoWR and Nodal officer for DIAP	Preparation of DIAP and conduct of previous studies as well as preparation of reports	Water use report was completed. Strategy report was completed Operation plan and new command plan was completed Toolkit is under preparation	4
District Collector	Chair the meetings of the consultation meetings and coordination among concerned departments	Meetings were held. Coordination could be done.	4

Annexure 2:
Format for assessment of gap through PPs

Name of PP:_____

Name of the Canal:_____

Name of Distributary:_____

Name of Project:_____

Name of GP and Block:_____

Sl. No	Name of the outlet	Total no of plots	Total area (CCA) in hectares	Plot Nos as per village map not getting assured water supply	Total Area of all plots as mentioned in Column 5.
1	2	3	4	5	6
Total		Total			

Total gap:_____

% of gap:_____

Causes for gap (Describe specific reasons with location details):_____

Suggestions for bridging the gap:_____

Signature:

(President PP) (Secretary PP) (JE/AE, Irrigation Section) (Asst. Agri Officer, Block)

Annexure 3:
Canal Operation Plan for Govt. Controlled Canals

Distributary	CCA (ha)	Depth of Irrigation (m)	Volume (ha-m)	Discharge (cumecs)	Time of flow in days
Disty 4A	78.914	0.1	7.8914	0.055	16.606
Disty 4B	531.885	0.1	53.1885	0.372	16.549
Disty 4C	678.282	0.1	67.8282	0.474	16.562
Disty 4E	156.61	0.1	15.661	0.11	16.478
Disty 4F	515.5	0.1	51.55	0.36	16.573
Disty 4	3059.3	0.1	305.93	2.42	14.632
1L	10	0.1	1	0.007	16.534
2L	11.55	0.1	1.155	0.008	16.710
3L	15.99	0.1	1.599	0.011	16.824
Pattamundai Canal	7090.97	0.1	709.097	43.65	1.880
K. Canal	23895.38	0.1	2389.538	133	2.079
MCIP	19542	0.1	1954.2	29.7	7.616

Annexure 4:
Template for data to be used for preparation of Warabandi Schedule for Water Distribution in the field channel

Outlet No.	Sl. No.	Khata No.	Name of beneficiary	Village	Plot No.	Area (Ha)
30L UR	1	61	Gopala Sahoo, S/O- Mahi	Sajaniajpur	625	0.018
	2	239	Bishnu Sahoo, S/O- Gopala	-do-	626	0.024
	3	97	Chaitana Behera, S/O- Panu	-do-	627	0.041
	4	61	Gopala Sahoo, S/O- Mahi	-do-	628	0.036
	5	239	Bishnu Sahoo, S/O- Gopala	-do-	629	0.016
	6	78	Gobinda Sahoo, S/o-Mahi	-do-	634	0.095
MR (Middle Reach)	7	273	Muralidhara Mishra, S/o-Harekrushna	-do-	641	0.052
	8	195	Baishnaba Swain, S/o- Raghu	-do-	642	0.110
LR (Lower Reach)	9	32	Krushna Chandra Mishra, S/o-Krupadindhu	-do-	637	0.080
	10	24	Kinu Mallick, S/o- Pari	-do-	639	0.135
	11	164	Ch. Nityananda Mishra, S/o-Golakha	-do-	640	0.620

Annexure 5:
Agriculture Activity of Cuttack District

Sl. No	Activity	During 2018-19	Cumulative from 2018-19 to 2030-31
		Physical	Physical
1	Line Transplanting in chaks of irrigation command	2025 Ha	24300
2	Introduction of better varieties in direct seeded crop	106.94	891000
3	Introduction of stress tolerant varieties	15	21870000
4	Cropping system-based demonstration	1000	21870000
5	Production of certified seeds	4500	109656300
6	Distribution of certified seeds	20000 Quintals	108780
7	Application of Micronutrient	8200 ha	78984
8	Application of Bio Fertilizer	8400 Ha	21600
9	Application of Gypsum	940 Ha	11280
10	Application of PP chemicals & Bio Pesticides/Bio Agents	52000	74172
11	Application of weedcides	8500	12864
12	Seed drill	35	420
13	Tractor	225	2700
14	Power tiller	1800	12240
15	Rotavator	1125	13500
16	Self-Propelled Paddy Transplanter	200	2160
17	Reaper/Reaper Binder	210	840
18	Equipment (Tractor/Power tiller operated)	565	6780
19	Spl Power driven equipment	675	8100
20	Combine Harvester	25	840

Sl. No	Activity	During 2018-20	Cumulative from 2018-19 to 2030-32
		Physical	Physical
22	Distribution of sprinkler sets	150ha	1380
23	Dug well	300	3600
24	Bore-well	300	0
25	Community Cluster Bore Well	100ha	36
26	Community Cluster Deep Bore Well (Solar Energised)	12	36
27	Training of farmers interstate	2	300
28	Training of farmers within state	14	960
29	Training of farmers within district level residential	170	300
30	Training of farmers within district level Non-Residential	15	540
31	Interstate Exposure Visit of farmers Maximum 7 days	11	960
32	Exposure Visit of farmers within the state	9	5700
33	Exposure Visit of farmers within the district	20	5940
34	Capacity Building, skill development and support services	220	4080
35	Seed money or revolving fund to farmer group	17000	180
36	Food security group	nil	180
37	Farmer Scientist Interaction at Dist. Level	6	72
38	Farm School	27	324
39	Scientific Storage Godown (5000 MT)	20	36
40	capacity building	23	
41	Collection of soil sample & provision of Soil health card	14000	135000

Annexure 6:
Agriculture Activity of Subarnapur District

Sl. No	Activity	During 2018-19	Cumulative from 2018-19 to 2030-31
		Physical	Physical
1	Line Transplanting in chaks of irrigation command	900 Ha	10800
2	Introduction of better varieties in direct seeded crop	180 Ha	2200
3	Introduction of stress tolerant varieties	900 Ha	10800
4	Cropping system-based demonstration	900 Ha	10800
5	Production of certified seeds	2015 Qt	24180
6	Distribution of certified seeds	4030 Qt	48360
7	Application of Micronutrient	2925 Ha	35100
8	Application of Bio Fertilizer	799 Ha	9588
9	Application of Gypsum	417 Ha	5000
10	Application of PP chemicals & Bio Pesticides/Bio Agents	2747	32964
11	Application of weedcides	477	5724
12	Seed drill	15	180
13	Tractor	100	1200
14	Powertiller	450	5400
15	Rotavator	500	6000
16	Self Propelled Paddy Transplanter	80	960
17	Reaper/Reaper Binder	30	360
18	Equipment (Tractor/ Power tiller operated)	250	3000
19	Spl Power driven equipment	300	3600
20	Combine Harvester	30	360
21	Manual Sprayer	150	1800

Sl. No	Activity	During 2018-20	Cumulative from 2018-19 to 2030-32
		Physical	Physical
22	Distribution of sprinkler sets	50	600
23	Dug well		
24	Bore-well		
25	Community Cluster Bore Well	1	12
26	Community Cluster Deep Bore Well (Solar Energised)	1	12
27	Training of farmers interstate	10	120
28	Training of farmers within state	30	360
29	Training of farmers within district level residential	10	120
30	Training of farmers within district level Non-Residential	20	240
31	Interstate Exposure Visit of farmers Maximum 7 days	35	420
32	Exposure Visit of farmers within the state	210	2520
33	Exposure Visit of farmers within the district	220	2640
34	Capacity Building, skill development and support services	150	1800
35	Seed money or revolving fund to farmer group	6	72
36	Food security group	6	72
37	Farmer Scientist Interaction at Dist. Level	2	24
38	Farm School	12	144
39	Scientific Storage Godown (5000 MT)	1	12
40	Institutional capacity building in agriculture Department	L.S	60
41	Collection of soil sample & provision of Soil health card	5000	60000

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ACTION ON CLIMATE TODAY

Department of
Water Resources,
Government of Odisha