DETAILED PROJECT REPORT

on

Efficient water management and agriculture technology adoption for climate adaptive and resilient farming system in 51 villages of Nandurbar and Buldhana districts of Maharashtra State

Submitted to

Ministry of Environment, Forest & Climate Change
Government of India

Submitted by

Vasundhara Watershed Development Agency (VWDA)

on behalf of

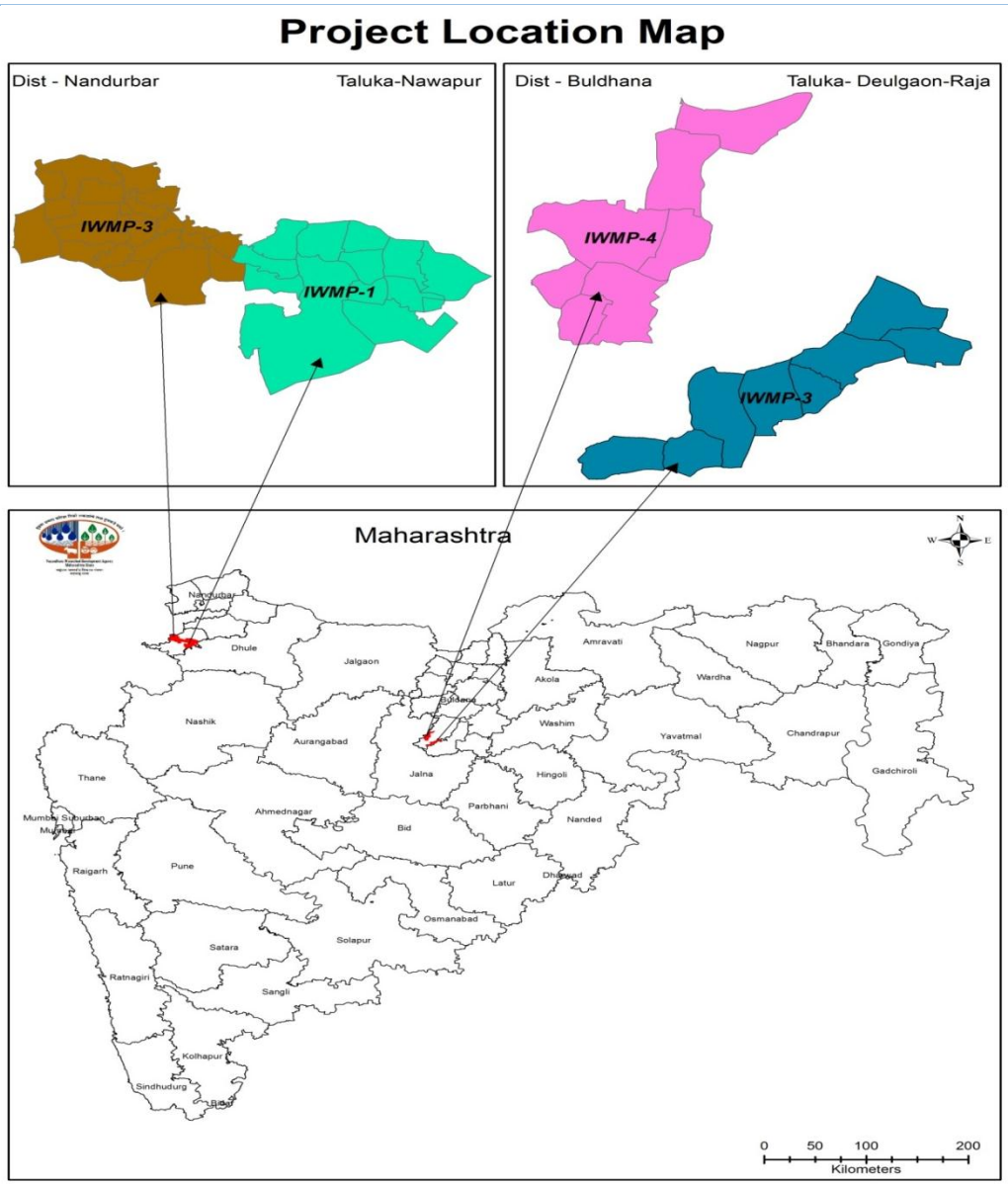
Department of Water Conservation, Government of Maharashtra

Prepared By

NABARD Consultancy Services Ltd.

March, 2016

Project Title :	**Efficient water management and agriculture technology adoption for climate adaptive and resilient farming systemin 51 villages of Nandurbar and Buldhana districts of Maharashtra State**
Project Objectives :	Aims at developing climate adaptive and resilient farming system through efficient water management and technology adoption for adaptive agriculture by rural families associated with agriculture and allied sector in two climate vulnerable and drought prone districts of Maharashtra. Specifically, it would seek to enhance adaptive capacity of farm families by introducing measures to tide over the adverse impacts of climate change on their food and livelihood security. The project will focus on farming communities and communities dependent on natural resources as livelihood options. In these 51 villages water resource development (through water conservation infrastructure) for protective irrigation has been done under PMKSY Watershed development (erstwhile IWMP) and JalyuktaShivarAbhiyan (JSA). Main components of the project are :
	• Baseline Integrated Survey for socio-economic and ecological assessment and planning • Technology transfer for enhancing adaptive capacity and building resilience of the community through efficient water management and agriculture technology adoption • Knowledge Management by documentation and dissemination of learning from the project
Project Sector :	Water and Agriculture
Name of Executing Entity:	Department of Water Conservation, Government of Maharashtra through Vasundhara Watershed Development Agency (VWDA), Pune
Beneficiaries:	1. Farmers and organized User Groups in project area. 2. Women and landless individuals organized as self-help group (SHG).
Project Duration:	4 years
Start Date:	April 2016
End Date:	March 2020
Amount of Financing Requested:	INR 24,99,88,720
Project Location:	37 villages of Nawapur block in Nandurbar district and 14 villages of Deulgaon Raja block in Buldhana district. These are prominently rainfed and drought prone villages covered under PMKSY-Watershed Component (erstwhile IWMP) and 23 villages of these are included in JalyuktaShivarAbhiyan (JSA).

	
State:	Maharashtra
District:	*Nandurbar and Buldhana districts.*
Contact Details of Nodal Officer of the Executing Entity:	1. Chief Executive Officer, VWDA and Commissioner Agriculture, 2nd floor, Central Building, Pune 411 001 2. Additional Chief Executive Officer, Vasundhara Watershed Development Agency (VWDA), 1st floor, Central Building, Pune 411 001
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Abbreviation

CSIS	Climate Services Information System
DoA	Department of Agriculture
DoE	Department of Environment
EDC	Eco Development Council
EE	Executing Entity
GEF-UNDP	Global Environment Facility - United Nations Development Program
GHG	Greenhouse Gas
GIZ	DeutscheGesellschaftfürInternationaleZusammenarbeit
ICAR	Indian Council of Agricultural Research
IITM	Indian Institute of Tropical Meteorology
IMD	Indian Meteorological Department
INCAA	Indian Network for Climate Change Assessment
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
IWMP	Integrated Watershed Management Programme
JICA	Japan International Cooperation Agency
JLG	Joint Liability Group
JSA	JalyuktaShivarAbhiyan
LIT	Line Intercept Transect
M&E	Monitoring and Evaluation
MELD	Monitoring, Evaluation, Learnings& Documentation
MoEF&CC	The Ministry of Environment, Forests and Climate Change
MRV	Measurable, Reportable, and Verifiable
MSCCC	Maharashtra State Climate Change Cell
NABARD	National Bank for Agriculture and Rural Development
NABCONS	NABARD Consultancy Services
NAFCC	National Adaptation Fund for Climate Change
NAPCC	National Action Plan on Climate Change
NRM	Natural Resource Management
PIA	Project Implementing Agency
PMKSY	PradhanMantriKrishiSinchayeeYojana
PMU	Project Management Unit
SAPCC	State Action Plans on Climate Change
SHG	Self Help Group
VWDA	Vasundhara Watershed Development Agency
WCDC	Watershed Cell cum Data Centre
WOTR	Watershed Organisation Trust
WWF	World Wildlife Fund

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1. PROJECT BACKGROUND

1.1. Project / Programme Background and Context:

a) *Provide brief information on the problem the proposed project/programme is aiming to solve.*

Impact of climate change on agriculture is well established and countries like India are expected to be more vulnerable due to high dependence on agriculture, excessive pressure on natural resources and poor coping mechanisms. Warming trend in India over past 100 years has indicated an increase of 0.6^{0}C. Projected impacts are likely to further aggravate yield fluctuations of many crops. There are evidences already of negative impacts on yield of wheat and paddy in parts of India due to increased temperature, increased water stress and reduction in number of rainy days. Negative impacts have been projected with medium-term (2010-2039) climate change, e.g., yield reduction by 4.5 to 9.0 percent, depending on the magnitude and distribution of warming. Since agriculture contributes about 15 percent of India's GDP, a negative impact on production implies a cost of climate change to be roughly at 1.5 percent of GDP per year. Enhancing agricultural productivity, therefore, is critical for ensuring food and nutritional security for all, particularly the resource poor small and marginal farmers who would be affected most. In absence of mitigation and adaption strategies, the consequences of long-term climate change could be even more severe on the livelihood security of the poor.

Maharashtra has been facing water scarcity over a very long period. In Maharashtra, about 84% of the gross cropped area is rain-fed and more than 30% of the State falls under rain shadow area (Economic Survey of Maharashtra 2011-12). About 60% of the total geographical area of the State is under agriculture (net sown area) and a large population is directly dependent on agriculture for their livelihoods(Economic Survey of Maharashtra 2011-12).

About 73% of Maharashtra is classified as semi-arid and of it about half of it falls drought-prone districts, which account for 60% of the net sown area. Maharashtra experienced severe and successive years of drought in 1970-1974 and 2000-2004-05. These regions are generally characterized by extreme aridity, hot climate and water scarcity. More recently, areas in eastern Vidarbha, which usually have assured rainfall, have experienced variable and reduced rainfall. In 2012, many parts of the State faced drought conditions which not only affected the crop productivity but also had an impact on the livelihoods of the people. Currently, the State has faced droughts for two consecutive years. i.e. 2014-15 and 2015-16.

Erstwhile Integrated Water Management Program (IWMP) now PMKSY-Watershed component and JalyuktaShivarAbhiyan (JSA)[1] the State flagship programme ensures availability of water for rain-fed areas and drought prone (dry land) areas of Maharashtra under these ongoing projects has been ensured to a certain section.However, to ensure maximum benefit to the farmers, there is a high need for efficient use of water for farming. Most of the farmers are currently using traditional methods to provide water for their crops. Most often these practices are not efficient. Further, it is driven by water infrastructure availability with the farmers.Current programs are focused on addressing drivers of vulnerability (short term approach) and most often partially not manage risks of climate change (long term approach).

The proposed project will have a scientific base and will be planned in a participatory manner during project planning phase. Vulnerability assessment will be part of the baseline study and tools and methodology by CRIDA and Watershed Organisation Trust (WOTR) shall be used.

Districts selected namely Nandurbar and Buldhana, predominantly comprises agricultural labour with 50% in Buldhana and 55% in the district of Nandurbar. In the district of Buldhana, 75% of the farmers fall under the category of small or marginal farmers and occupy only 46% of the total area. Whereas, in Nandurbar 65% farmers fall under the category of small or marginal farmers and occupy only 37% of total area. Average farm sizes in the districts are 2.01 acres for Nandurbar and 1.62 acres for Buldhana.Average farm size of the blocks in which the village clusters have been identified are: Nawapur block (Nandurbar district) is 1.9 acres and Deolgaon Raja block (Buldhana district) is 1.41 acres. Cropping in Nandurbar cluster is dominated by paddy, cotton, maize, jowar (sorghum) and black gram (udid) as the major crops while, cotton, wheat, soybean, jowar (sorghum) and pigeon pea were major crops in the identified project area in Buldhana district. Most of these crops are of mono-culture type.

Project background

Current project aims at reducing climate risk by having weather advisory services, induce climate adaptive agriculture through efficient water management, water budgeting, technology adoption, crop diversification and creation of alternative livelihoods to make farmers (predominantly small, marginal) climate resilient. Based on the early benefits (after completion of year one) the implementation plan will be fine-tuned further. Secondly,replication strategy for larger outreach will be also formulated. This shall include policy adoption as well as leveraging funds (both National and international).

[1] IWMP is now a component of PradhanMantriKrishiSichayeeYojana (PMKSY). The *JalyuktaShivarAbhiyan* (JSA), State Flagship Program of Maharashtra, aims at conserving the lifeline water for agricultural needs to the selected villages in rainfed areas and drought prone areas of Maharashtra. In line with this, the state also needs to develop efficient ways of farming to optimize water use efficiency. The proposed project aims at identifying and implementing water efficient techniques to increase water conservation & management in the rainfed areas and drought prone areas of Maharashtra.

Project components are:

- Baseline Integrated Survey for socio-economic and ecological assessment and planning
- Technology transfer for enhancing the adaptive capacity and building resilience of the community through efficient water management and agriculture technology adoption
- Knowledge Management by documentation and dissemination of learning from the project

Co-benefits from this project are:

- **Ensure employment**: Employment is a challenge in the villages. Principal occupations of the people in villages are agriculture, animal husbandry and casual labour work. However, due to limited and erratic water availability, most villages have single crop which keep villagers engaged for a maximum of 4 months. Lack of fodder often makes animal husbandry difficult. Hence, animal husbandry cannot keep them employed on a full time basis. Thus most marginal farmers depend on casual labour within or outside the village. The project plans for creation of employment opportunity through various activities to be taken up in the project. The villagers will get employment in project activities in addition to and enhanced agricultural productivity.
- **Seasonal migration**: Seasonal migration is high in Maharashtra due to limited employment opportunity in villages during periods when water availability for agriculture and animal husbandry is low. The project is expected to reduce seasonal migration by addressing root cause issues like water availability and improper usage of scarce water resource.
- **Ground water table**: As discussed earlier, reliance of villagers on ground water is very high in Maharashtra. The demand is increasing and the ground water tables are getting depleted over the years. The project is expected to have a positive impact on ground water level as the project advocates efficient water usage techniques.

b) Outline the economic, social development and climate change in line with the State Action plan on Climate Change and relevant Missions under National Action Plan on Climate Change

Many studies at the national level point that Maharashtra has 30.7% population livingbelow the poverty line as on 2005. The State ranks 6thin terms of social and economic infrastructure, which is higher than the country average. Among Indian states, it ranks 4thin terms of HDI, which takes into account factors of literacy (77%), life expectancy at birth (65.5 years), infant mortality rate (48 per 1000 births) and maternal mortality rate (13.5 per million births) (HDR, 2003). According to the 2011 census, literacy rate for the State stands at 83% - although there is wide disparity by gender (male-90; female-75) - which is above the national average of 74%.

As discussed earlier,

- A large population is directly dependent on agriculture and agriculture related livelihood
- About 60% of total geographical area of the State is under agriculture (net sown area) and contribution of agriculture sector to NSDP/GDP (%) is 8.57%.
- Presently for the State of Maharashtra, about 84% of the gross cropped area is rain-fed and more than 30% of the state falls under the rain shadow area (Economic Survey of Maharashtra 2011-12).

Hence, the agriculture sector is vulnerable to the risk of climate change, which impacts the livelihood of agrarian community and State's rural economy at large.

Following points illustrate the actions proposed by National and State programs to address the development as well as climate risk related to agriculture andwater.

- One of the key areas to be addressed under the National Mission for Sustainable Agriculture (NMSA) includes dry-land agriculture. The NAPCC also mentions one of its objectives as to devise strategies to make Indian agriculture more resilient to climate change by focusing on improving the productivity of rain-fed agriculture.
- National Water Mission seeks to optimize the efficiency of existing irrigation systems, including rehabilitation of systems that have been run down and also expand irrigation, where feasible, with special effort to increase storage capacity. Incentive structures will be designed to promote water-positive technologies, recharging of underground water sources and adoption of large scale irrigation programmes which rely on sprinklers, drip irrigation and ridge and furrow irrigation. Efficient usage of water ensures less exploitation of water resources available in drought affected regions of Maharashtra and will help drought management. If water usage can be optimized through efficient agricultural practices and irrigation system, the additional water available can be utilized for additional area by more marginal farmers. This will help improve social equity.
- Mahatma Gandhi NREGA and Agriculture convergence guidelines assertion that rural poor are most vulnerable to climate change, as their livelihood is directly dependent on environmental resources. As extreme events increase, the potentiality of longer and more severe drought, and increased water stress would be greater. These will have an adverse impact on agriculture, water sources, forest and coastal areas. Several studies have indicated that, as the surface temperature of earth rises, climate change will impact crop productivity; this will be more pronounced in rain fed areas, and would further increase the vulnerability often the rural poor.
    - The State Action Plan on Climate Change of Maharashtra tries to address the water-agriculture related climate change risk through following action plans: Water Resources Action Plan: Promote efficient use of irrigation water in districts with plantation crops, such as Aurangabad, Amravati, Bhandara, Nagpur, Nasik and Jalgaon, through continued subsidies for drip and sprinkler irrigation systems and farm ponds, combined with extensive awareness campaigns for smaller and less educated farmers.

- Ecosystems &Livelihoods Action Plan: Restore wetlands with a focus on tank based irrigation and fishery management system in Vidarbha.
- Energy &Infrastructure Action Plan: Use of innovative applications like solar dryers and solar based pumping and irrigation for agriculture.

c) *Include climate analysis and vulnerability analysis.*

1. Climate analysis - Maharashtra:

Maharashtra is the 3rd largest state of India and is divided into 3 natural regions - Konkan comprising the coastal area, Sahyadri hill ranges known as Western Ghats (hills) and the Deccan plateau. The State has high climate related vulnerability which has a direct impact on agriculture and water usage for agriculture.

Agro and sub agro climatic zone in Maharashtra–

The State is divided into 9 agro-climatic zones based on rainfall, soil type and the vegetation as mentioned below:

1) South Konkan coastal zone	2) North Konkan coastal zone
3) Western Ghat zone	4) Transition zone - 1
5) Transition zone – 2	6) Scarcity zone
7) Assured rainfall zone	8) Moderate rainfall zone
9) Eastern Vidarbha zone	

Climate change projections for Maharashtra were developed. Climate modelling results show that temperature as well as rainfall is projected to increase all over the State though there would be regional variations.

The projected rise in mean temperature is greater for the 2070s (Figure 1c) compared to the 2050s (Figure 1b) and the 2030s (Figure 1a). Amravati division may experience a greater rise in annual mean temperature than other parts of the state.

The projected increase in monsoon rainfall by the 2030s (Figure 2a) and 2050s (Figure 2b) is relatively more for Amravati and Nashik. This overall increase in monsoon rainfall for the state is consistent with the findings of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)[2].

Table 1- Division wise climate change projections

[2] IPCC Working Group 1 Technical Summary Section TS.5.8.1 and Table TS.2

Administrative division	IMD normal: annual mean Tempe-rature (ºC)	Projected increase in annual mean temperature (ºC)			IMD normal: monsoon rainfall (mm)	Projected increase in monsoon rainfall (%)		
		2030s	2050s	2070s		2030s	2050s	2070s
Amravati	27.21	1.44-1.64	2.20-2.35	3.06-3.46	785.3	17.5-30.0	22.5-32.5	15.0-27.5
Nashik	26.79	1.40-1.68	2.00-2.40	2.82-3.30	567.5	17.5-40.0	15.0-40.0	15.0-52.5

Note: Projection for 2030s is average of projections for period 2021-2040. Similarly, projection for 2050s in average of projections for 2041-2060 and that for the 2070s is the average of projections for 2061-2080.

2. Climate analysis – Nandurbar and Buldana:

From State Action Plan for Climate Change of Maharashtraprojected rise in minimum temperature is more than the projected rise in maximum temperature. Projected percent increase in minimum temperature is in the range of 63-68% for Nandurbar and58-63% for Buldana. This could have an adverse impact on crops that are sensitive to high night temperatures in the reproductive phase, e.g. grain growth in rice or tuberization in potatoes.

Normal rainfall actual rainfall of District and block where project is located is presented in following table.

Table 2 - Rainfall (mm) data of the district

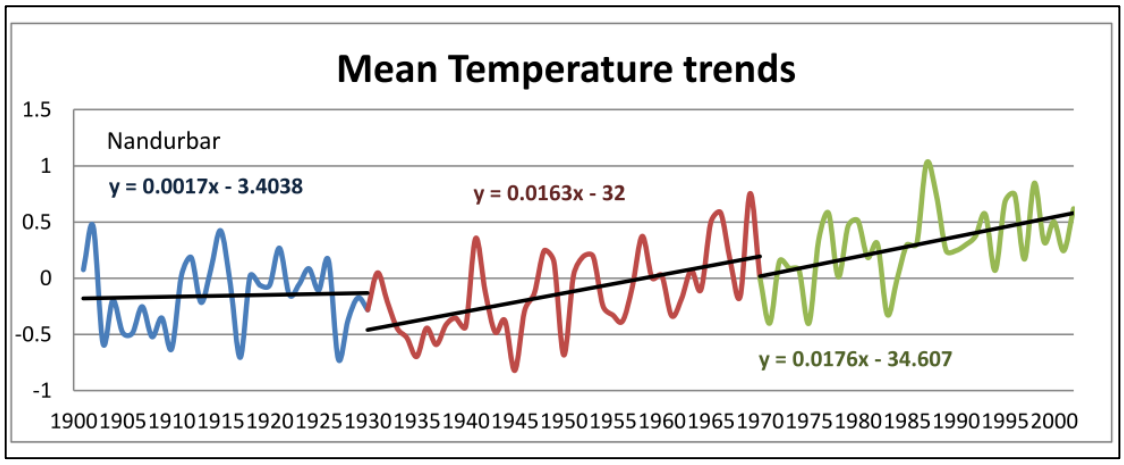
Year	District Nandurbar	TalukaNavapur	District Buldana	TalukaDeulgaon raja
Normal	**888**	**1198**	**668**	**774**
2006	1591	1431	905	751
2007	1173	1475	730	733
2008	1022	1243	626	713
2009	859	747	632	457
2010	742	938	890	982
2011	801	860	625	639
2012	728	860	612	571
2013	1354	1526	968	636
2014	604	656	551	512
2015	726	727	685	986

Projected percent increase in extreme rainfall in 2030s relative to baseline is in therange of 22-26% and Projected increase in number of dry days in 2030s relative to baselineare 5-6 in both thedistricts.

A. NandurbarDistrict climatology & observed climate

Climate of Nandurbar is hot and dry, with large parts of the district characterized as drought areas (almost the entire Akkalkuwataluka and parts of Dhadgaon,Navapur and Nandurbartalukas). Mean temperature trend has been provided in the figure below (Maharashtra District Action Plan). Dataset has been divided into three epochs of around 30 - 40 years each to assess the climatic variability in the past century. Period of 1901 - 1950 shows more negative anomalies indicating a cooler epoch. Period from 1950 onwards shows more positive anomalies, and the recent past (1970 - 2000) shows several years having temperatures that are 0.5-1.0 degree higher than the 100- year mean. All three periods show a positive trend in the annual mean temperature, implying an overall increase for the district in the past 100 years. Similar increasing trends are observed in the maximum temperature and minimum temperature. It is represented ahead.

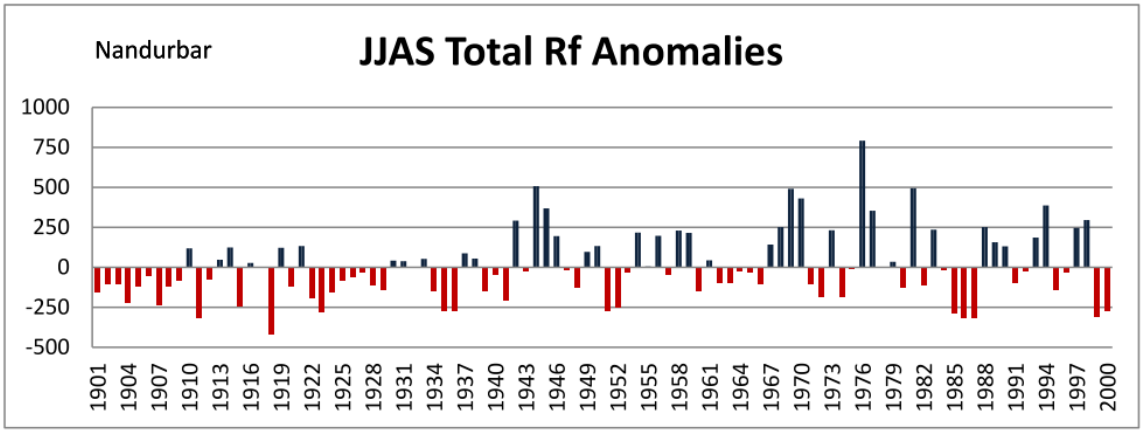
Figure 1Mean temperature trends for Nandurbar



Source: Maharashtra District Action Plan

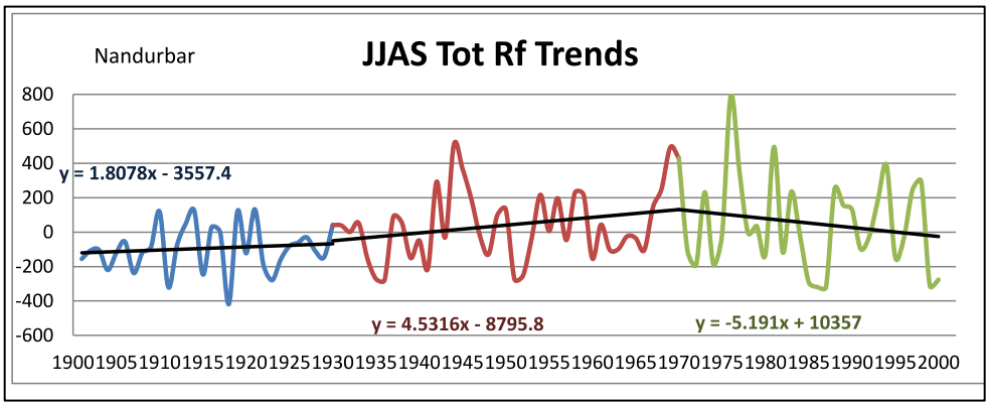
Table 23 and 24 represented as charts show the trend in 100 years of monsoon rainfall data for Nandurbar district. This analysis uses the district-level IMD dataset for total rainfall for the months of June-September during 1901 -2000. Dataset has been divided into three epochs of around 30-40 years each to assess the climatic variability in the past century. Period of 1901-1930 has been primarily a dry epoch with more years showing negative anomalies in monsoon rainfall. From the 1930s onwards, there is an increase in the number of years with positive anomalies, with the most positive anomalies seen during 1970s. This is also seen in the trend plots where the period of 1930 - 1970 shows a clear positive trend. Data for the recent past i .e. 1970- 2000 shows a distinct decreasing trend.

Figure 2Monsoon rainfall anomalies for nandurbar



Source:(Maharashtra District Action Plan)

Figure 3Monsoon rainfall trends for Nandurbar



Source: (Maharashtra District Action Plan)

The table below presents monsoon rainfall data for Nandurbar district for the years 2007 to 2011, which indicates that June rainfall has decreased in recent years. This matches with the local perception that the onset of the monsoon has become delayed and uncertain. Average rainfall (in mm) of Nandurbar district in monsoon months June-September) and percentage departures from long-period averages

Table 3Average rainfall (in mm) of Nandurbar district in monsoon months (June-September) and percentage departures from the long-period average

Year	June		July		August		September	
	Rainfall (mm)	% Departure	Rainfall (mm)	% Departure	Rainfall (mm)	% Departure	Rainfall (mm)	% Departure

2007	169.3	33	598	79	206.7	-23	118.2	-27
2008	78.9	-38	263.3	-21	345.2	28	321.3	99
2009	27.3	-79	310	-7	152.8	-43	112.5	-30
2010	94.3	-24	243.5	-23	225.2	-11	116.7	-26
2011	68.3	-50	283.5	-6	330.5	36	117.3	-20

Source:(Maharashtra District Action Plan)

Climate projections:

According to these scenarios, Nandurbar district is projected to experience an increase in temperature (mean, maximum, and minimum) compared to the baseline period (1970-2000). For the near future, i.e. the decade of the 2030s, and the mid-future, i.e. the decade of the 2050s, the temperature increase projected by the model is 1-2 degrees above the baseline. For the decade of the 2070s, the projected temperature increase is 2-3 degrees above the baseline. There is also a projected increase in the rainfall for the decades of the 2030s, 2050s and 2070s with respect to the model baseline (1970-2000). The district is projected to experience an approximately 30% increase in monsoon rainfall by the 2030s. These projections are depicted are summarized in the table below.

Table 4 - Climate projection of Nandurbar

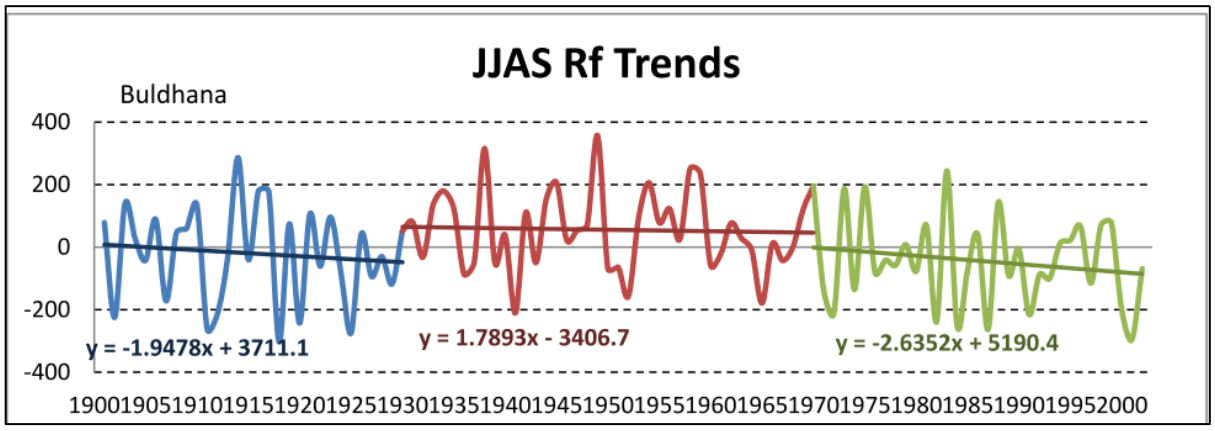
Variables	Model baseline (1970-2000)	Future Projections					
		2030s		2050s		2070s	
		Avg	Range	Avg	Range	Avg	Range
Percentage Precipitation Change (%)	570.6 (mm)	33.83	27.5-37.5	31.43	27.5-37.5	21.01	15-30
Annual Mean Temperature (°C)	25.63	1.28	1.2-1.33	1.86	1.8-1.95	2.72	2.6-2.8
Annual Minimum Temperature (°C)	19.37	1.52	1.44-1.6	2.18	2.05-2.25	3.09	2.9-3.3
Annual Maximum Temperature (°C)	32.79	1.06	0.94-1.14	1.59	1.45-1.7	2.39	2.26-2.5

BuldanaDistrict climatology & observed climate:

Climate of the district is characterized by a hot summer and dryness throughout the year except during the south-west monsoon season, i.e., June to September. Mean minimum temperature is 13°C and, mean maximum temperature is 42.3°C.

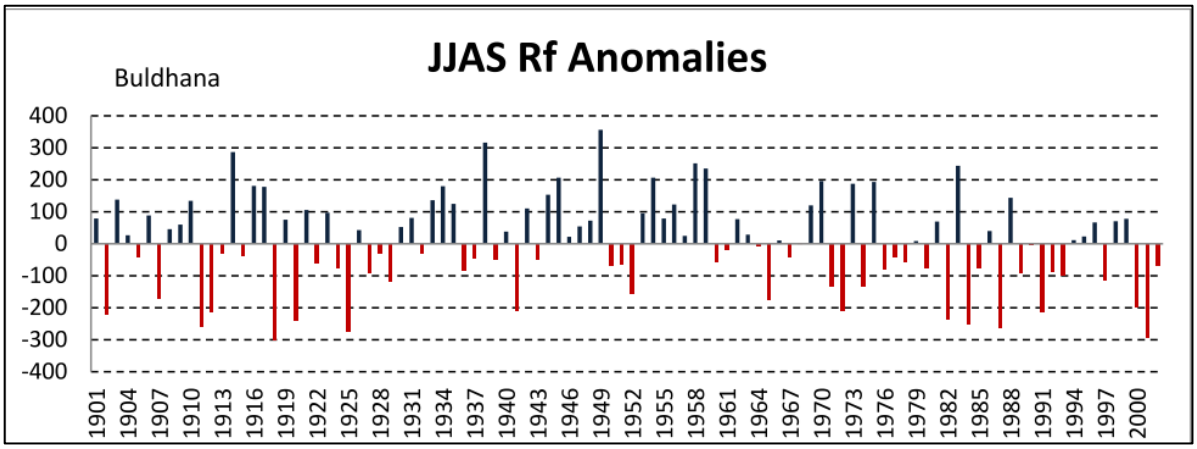
Average annual rainfall for last ten years when compared with normal shows that average rainfall is much less than normal, except during 2002. Thus, the rainfall has decreased in the district over the period of time.

Figure 4Historical rainfall trends for June, July, August & September for Buldhana



Source: Maharashtra District Action Plan

Figure 5Anomaly in observed rainfall for June, July, August & September for Buldhana



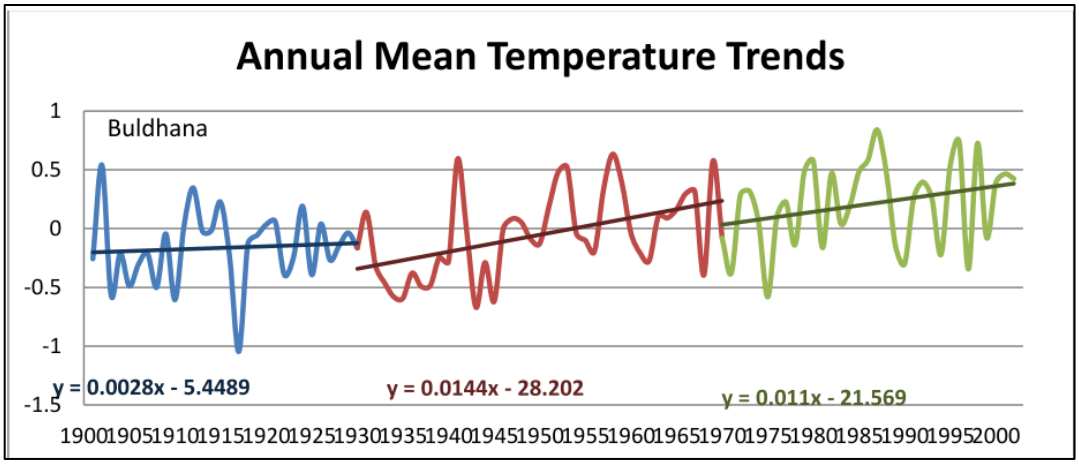
Source: Maharashtra District Action Plan

Observed yearly temperature trends

Period from 1901 to 1950s shows more number of negative anomalies indicating a cooler period. Period of 1950 onwards has shown more number of positive anomaly years with the recent past (1970-2000) showing more instances of temperatures being around 0.5 degree higher than the 100 year mean. All three climate cycles also show a positive trend though not significant

indicating that the annual mean temperature have shown an overall increase over Buldhana in the past 100 year, which has been predominant from 1950 onwards.

Figure 6Historical (1900-2000) Annual Mean Temperature trends for Buldhana



Source: Maharashtra District Action Plan

Future climate projections

Climate projections for Buldhana indicate a 20% to 30% increase in the rainfall for 2030s, 2050s and 2070s time scale. Future projection for temperatures (mean, minimum and maximum) also shows an increase from the baseline period. Value of mean temperature difference (around 2.8 degrees) from baseline as simulated for the future time periods shows that most increase will be in the 2070s (distant future) period. For the near future; 2030s and mid future; 2050s temperature increase projected from the model is between 1-2.2 degrees from the baseline. Minimum temperature values show a comparatively highest increase amongst maximum and mean temperature values for the three future time periods w.r.t. baseline. For precipitation, the model shows an average increase of 26% for 2030s, which further increases to 29% in 2050s and thereby decreases to 22 % in 2070s.

Table 5 - Future climate projections for district of Buldhana

Buldhana Climate Variables	FUTURE PROJECTIONS					
	2030s		2050s		2070s	
	Avg	Range	Avg	Range	Avg	Range
Percentage Precipiration Change (%)	26.23	22.5-30	28.74	25-32.5	21.88	17.5-30
Annual Mean Temperature (°C)	1.32	1.28-1.35	1.96	1.9-2.0	2.88	2.74-2.95
Annual Minimum Temperature (°C)	1.57	1.48-1.64	2.29	2.2-2.35	3.3	3.14-3.38
Annual Maximum Temperature (°C)	1.1	1.06-1.14	1.67	1.6-1.75	2.54	2.4-2.62

Source: Maharashtra District Action Plan

Brief vulnerability analysis – Maharashtra :

Out of total cultivable land in Maharashtra about 60% land is under food grain crops and rest is utilized for cash crops and horticulture. Main staple crops grown in the State are rice, jowar, bajara, wheat, tuar, mung, urad, gram and other pulses. The State is major producer of oilseeds; groundnut, sunflower, soybean are major oil seed crops. Important cash crops grown are cotton, sugarcane, turmeric and vegetables. The State has an area of 10.91 lakh hectares under various fruit crops like mango, banana, orange, grape and cashewnut etc. Many of staple crops (like rice) and cash crops (like cotton and sugarcane) are water intensive and particularly vulnerable to change is availability of agricultural water.

Ground Water

Rural Maharashtra is heavily reliant on ground water – it provides more than 70% of irrigation and 90% of drinking water for State's rural population (CGWB 2004). Average stage of groundwater development (i.e. ratio of extraction to availability) for the State is 48%.

In 2014-15, a decrease in the Ground Water by almost 2 meters and more was observed in 188 Talukas (about 2234 villages). Scarcity-like condition has already been declared in many villages in Maharashtra and a need to recharge ground water and create decentralized water bodies to overcome the water scarcity problem in rainfed areas is identified as an important agenda of the State flagship programme, JalyuktaShivarAbhiyan. With reduced ground water level agriculture sector in particular becomes highly vulnerable to the risk of climate change.

The macro level vulnerability index (MLVI) is based on three contributing factors namely exposure, sensitivity and adaptive capacity.

Table 6 - District wise ranks for macro level vulnerability index and contributing factors

District Name	Exposure	Sensitivity	Adaptive Capacity	Vulnerability Index
Buldhana	8	17	32	3
Nandurbar	5	29	33	1

District-wise vulnerability index ranges from lowest value of -0.45 (Satara) to the highest value of 0.02 (Nandurbar). The district of Jalgaon is found to be the most exposed to climatic risks in the 2030s and Sangli the least. Nandurbar and Buldana rank 5th and 8th in exposure index. While Nandurbar and Buldana have the least adaptive capacity and Sindhudurg the highest, the districts of Gadchiroli and Aurangabad are, respectively, the most and least sensitive to climatic risks.

Vulnerabilities and impacts in the district:Nandurbar

Nandurbar is the most vulnerable district of the State as it scores high with respect to the indicators of exposure & sensitivity to climate change, while it scores very low on indicators of climate change. The most vulnerable regions of the district are the extreme north regions of the district. Due to hilly terrain, poor accessibility to basic services and livelihood opportunities and low ground water potential.

The village names, geographical area, net cropped area, irrigated area and un-irrigated area of the identified project area in Nawapur block of Nandurbar district has been provided in the tables below:

Table 7 - Details of cluster 1 of Nawapur block (Nandurbar)

S. No	Name of villages	Total geographical area (ha)	Net cropped area (ha)	Total irrigated land (ha)	Total un-irrigated land (ha)
1	Khanapur	82.14	82.14	15.99	66.15
2	Bhrdu	181.00	181.00	66.00	115
3	Chitvi	492.54	492.53	105.25	387.28
4	Nimdarda	484.02	484.02	96.85	387.17
5	Deolipada	666.75	666.75	119.25	547.5
6	Wadsatra	449.10	449.10	87.00	362.1
7	Wagdi	1116.64	775.84	147.50	628.34
8	Haldani	223.16	223.16	50.00	173.16
9	Keli	439.17	436.66	74.35	362.31
10	Bandharpada	582.88	579.91	126.85	453.06
11	Tilasar	459.34	427.44	91.15	336.29
12	Navapada	258.86	258.86	79.30	100.26
13	Visarvadi	46.11	290.70	11.60	279.1
14	Khanapur	82.14	82.14	15.99	66.15

TOTAL	5481.71	5350.95	1071.09	4280.05

(Taluka Agriculture Office, Dept. of Agriculture)

Table 8 - Details of cluster 2 of Navapur block (Nandurbar)

S. No	Name of villages	Total geographical area (ha)	Net cropped area (ha)	Total irrigated land (ha)	Total un-irrigated land (ha)
1	Chinchpada	1363.67	1280.30	46.20	1234.1
2	Tinmauli	92.24	529.92	21.50	338.76
3	Kharje	104.68	102.68	26.20	76.48
4	Shetgaon	552.31	86.31	4.60	25.30
5	Deolipada	154.00	175.65	22.40	153.25
6	Bandhare	85.20	240.24	64.40	175.84
7	Bilbare	241.80	95.14	11.50	83.64
8	Dudhave	125.65	73.56	9.30	64.26
9	Vavadi	218.90	231.72	23.40	208.32
10	Navagaon	251.53	352.25	126.00	226.25
11	Sukavel	259.40	260.47	43.40	217.07
12	Dokare	245.59	440.91	53.85	387.06
13	Karanvel	198.10	272.37	43.65	228.72
14	Vatvi	394.04	255.69	30.25	225.44
15	Pachamba	116.67	587.20	72.6	514.6
16	Amlan	617.44	58.24	5.1	53.14
17	Umaran	392.53	386.62	71.84	314.78
18	Varadipada	454.93	154.00	27.8	126.2
19	Kelpada	163.78	91.20	7.8	83.4
20	Bilgavan	23.02	256.87	32.13	224.74
21	Chedapada	213.59	238.97	27.12	211.85
22	Maentalao	61.38	198.10	36.3	161.8
23	Daliamba	257.69	114.02	13.5	100.52
24	Bilipada	283.10	123.30	16.1	107.2
TOTAL		6871.24	6605.73	836.94	5768.79

(Taluka Agriculture Office, Dept. of Agriculture)

National Agriculture Insurance Scheme

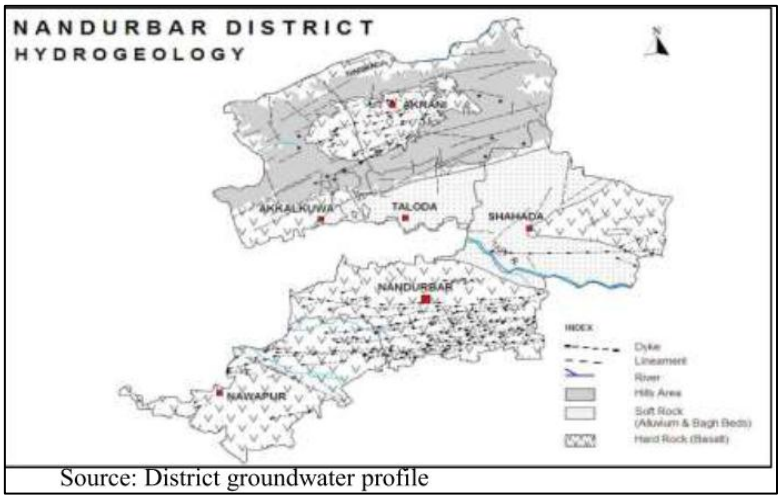
Many farmers in the district have been covered under National Agriculture Insurance Scheme (NAIS).The number of farmers participating in the Crop Insurance scheme in year 2011-12:

Table 9 - Coverage of NAIS in the district

Season	No.of farmers	Area Ha	Insurance premium (Rs. lakh)	Insurance cover amount (Rs. lakh)
Kharif	756	325.25	0.94	29.18

Rabi	110	96.21	0.23	14.97

Figure 7 Geo Hydrology of Nandurbar



Source: District groundwater profile

Irrigation in the district:

Total area under irrigation in Nandurbar district is 46,695 ha. Of the total area under irrigation, 24,420 hectares is under well irrigation, whereas, 22,275 hectares is under surface irrigation.

Land degradation:

Quality of land is deteriorating due to various factors like soil erosion caused mainly due to the rolling topography of the district, deforestation, overgrazing, etc.

Vulnerabilities & impacts in the district :Buldana

Buldhana ranks as the third most vulnerable district in Maharashtra and the most vulnerable district in the Amravati division. This is largely due to high exposure (rank 8) and the least adaptive capacity (rank 33) of the district. Khamgaon block shows a significant increase in temperature and an increase in heat waves in the last few years. Lonar shows an increase in the erratic nature of rainfall. Rainfall is unevenly distributed with heavy precipitation events.

Villages, geographical area, net cropped area, irrigated area and un-irrigated area of **project areas in Deolgaon Raja block of Buldhana district** has been provided in the tables below:

Table 10 - Details of IWMP-3 of Deolgaon Raja block (Buldhana)

S. No	Name of villages	Total geographical area (ha)	Net cropped area (ha)	Total irrigated land (ha)	Total un-irrigated land (ha)
1	BorakhediBawara	521	399	139	260
2	PalaskhedZalata	594	562	195	367

3	ChincholiBurkul	1048	1032	324	708
4	AsolaJahagir	465	458	160	298
5	PimpalgaonBk	503	503	176	327
6	Nimgaon Guru	621	620	217	403
7	SavangiTekale	364	364	127	237
TOTAL		**4116**	**3938**	**1338**	**2600**

(Taluka Agriculture Office, Dept. of Agriculture)

Table 11 - Details of IWMP-4 of Deolgaon Raja block (Buldhana)

S. No	Name of villages	Total geographical area (ha)	Net cropped area (ha)	Total irrigated land (ha)	Total un-irrigated land (ha)
1	Gargundi	941	552	20	532
2	Pangri	697	670	40	630
3	DoifodeWadi	422	360	12	348
4	SingaonJha.	836	605	60	545
5	KhiniPawar	1688	255	15	240
6	KhalyalGhavan	297	176	50	126
7	Chinchkhed	465	426	57	369
TOTAL		**5346**	**3044**	**254**	**2790**

(Taluka Agriculture Office, Dept. of Agriculture)

land degradation

Typological extent of land degradation in Buldhana is furnishedbelow:

Table 12 - Land degradation in Buldhana

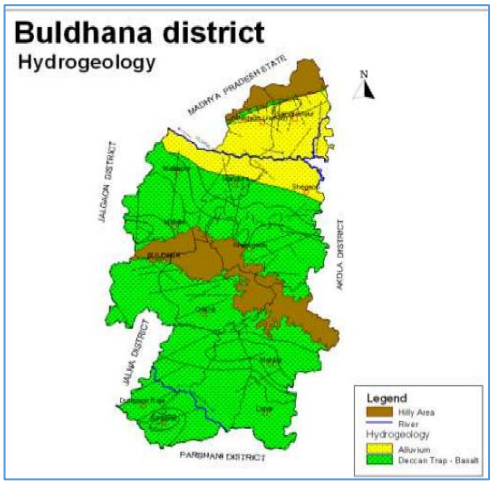
S. N	Particulars	Area affected	Percentage
1	Soil erosion	5.53 lakh ha.	60.73%
2	Saline/Alkaline soils	0.16 lakh ha.	0.17%
3	Waterlogged	1.78 lakh ha.	19.55%
4	Degraded forest area	1.78 lakh ha.	19.55%
Total		9.25 lakh ha.	100.00%

It may be noted from Table 10 that major land degradation has occurred in Buldhana due to soil erosion and it has affected an area of 60.73%.

Figure 8 Hydrology map of Buldana

Irrigation in the district: Normal rainfall in the district is around 713 mm. Net irrigated area at 1.55 lakh ha constitute 21.95 % of the net sown area of 7,06,300 ha, of which, 1,17,100 ha area is cultivated

more than once. The cropping intensity is 116.58%. Ground water (well irrigation) provides irrigation facilities to about 63,689 ha which is 41.09 % of the net irrigated area while canal network and other surface water sources including rivers provide irrigation facilities to about 91280 ha which is 58.91 % of the net irrigated area.



Present status of ground water availability, irrigation projects, energisation, micro irrigation projects are as under:

Table 13 - Block-wise assessment of sub-units in 7th Groundwater Assessment as per GEC 2007 in Buldana District

Sr. No	Block	Net Annual GW. Availability (Ham)	Existing Gross GW Draft for Irrigation (Ham)	Existing Gross GW Draft for Domestic & Industrial Water Supply (Ham)	Existing Gross GW Draft for all uses (Ham)	Allocation for domestic & Industrial requirement supply up to next 25 years (Ham)	Net GW availability for future irrigation Develop-ment (Ham)
1	Buldana	7671	6402	306	6708	529	434
2	Chikhali	11396	7829	382	8211	718	2467
3	Deulgaon	5155	4280	193	4473	197	485
4	Jalaon	6203	6297	191	6488	155	440
5	Khamgaon	9571	5062	388	5450	740	3381
6	Lonar	7579	3729	227	3956	448	3175
7	Malkapur	4676	2883	202	3085	369	1222
8	Mehekar	10677	5379	352	5731	714	4232
9	Motala	5301	3958	289	4247	403	651
10	Nandura	5006	3628	128	3756	273	977
11	Sangrampur	5676	4740	130	4870	161	645
12	Shegaon	3190	1251.00	146	1397	299	1494
13	Sindhkhed R	8417	5682	249	5931	501	1985

Total	90518	61120	3183	64303	5507	20708

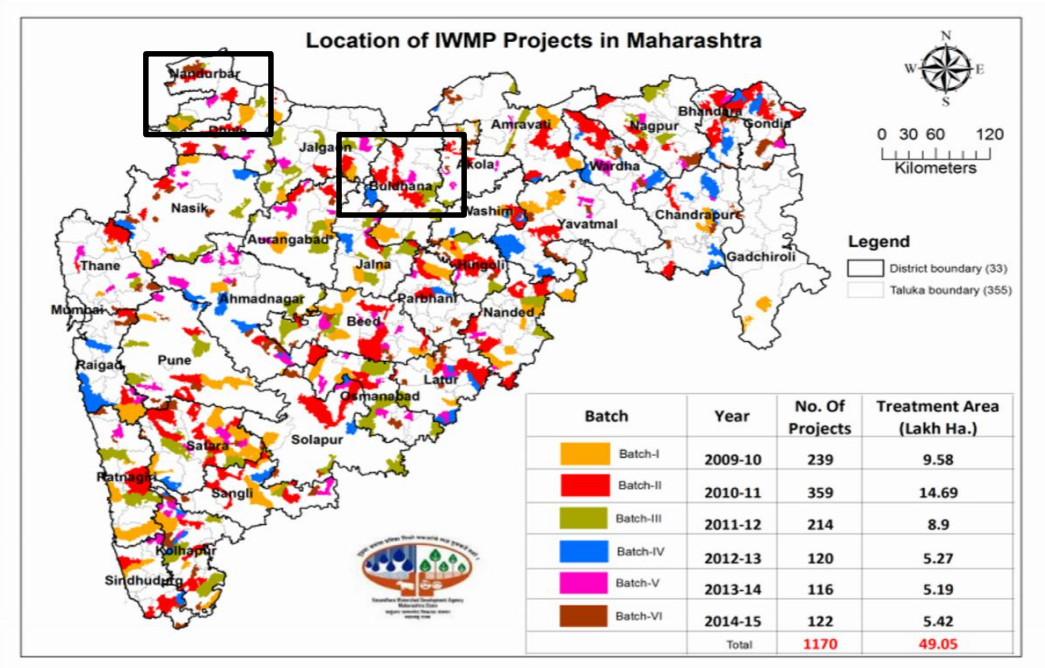
(Source: GSDA)

The major, medium and minor irrigation projects implemented in the district have createdirrigation potential of 1.43 lakh ha,while an area of about 82,280 ha was brought under assured irrigation. Rivers flowing in the district are contributing to irrigation of lands to the extent of 9000 ha. Drip and sprinkler irrigation systems are popular in the district. Drip system is mainly used for development of horticultural crops while sprinkler is used for oilseed and vegetable crops in the district.Under Micro Irrigation Scheme, an area of 82,737 ha has been covered under Sprinkler and Drip irrigation with expenditure of Rs. 16000 lakh as on 31 March 2012. Under the scheme, subsidy was made available to SF/MF and to other farmers.

a) Project Location details – villages, block/ mandal, district.

Project locations are in Buldhana and Nandurbar districts. In this section, geographical details, land use, irrigation pattern, agriculture in the district, climate analysis and project locations (villages of selected clusters) have been presented.

1. Project area selection :-
   Integrated Watershed Management Programme is being implemented in 1170 projects spread all over Maharashtra with a targeted treatment area of 49.05 lakh ha. Following figure shows the spread and extent in Maharashtra.



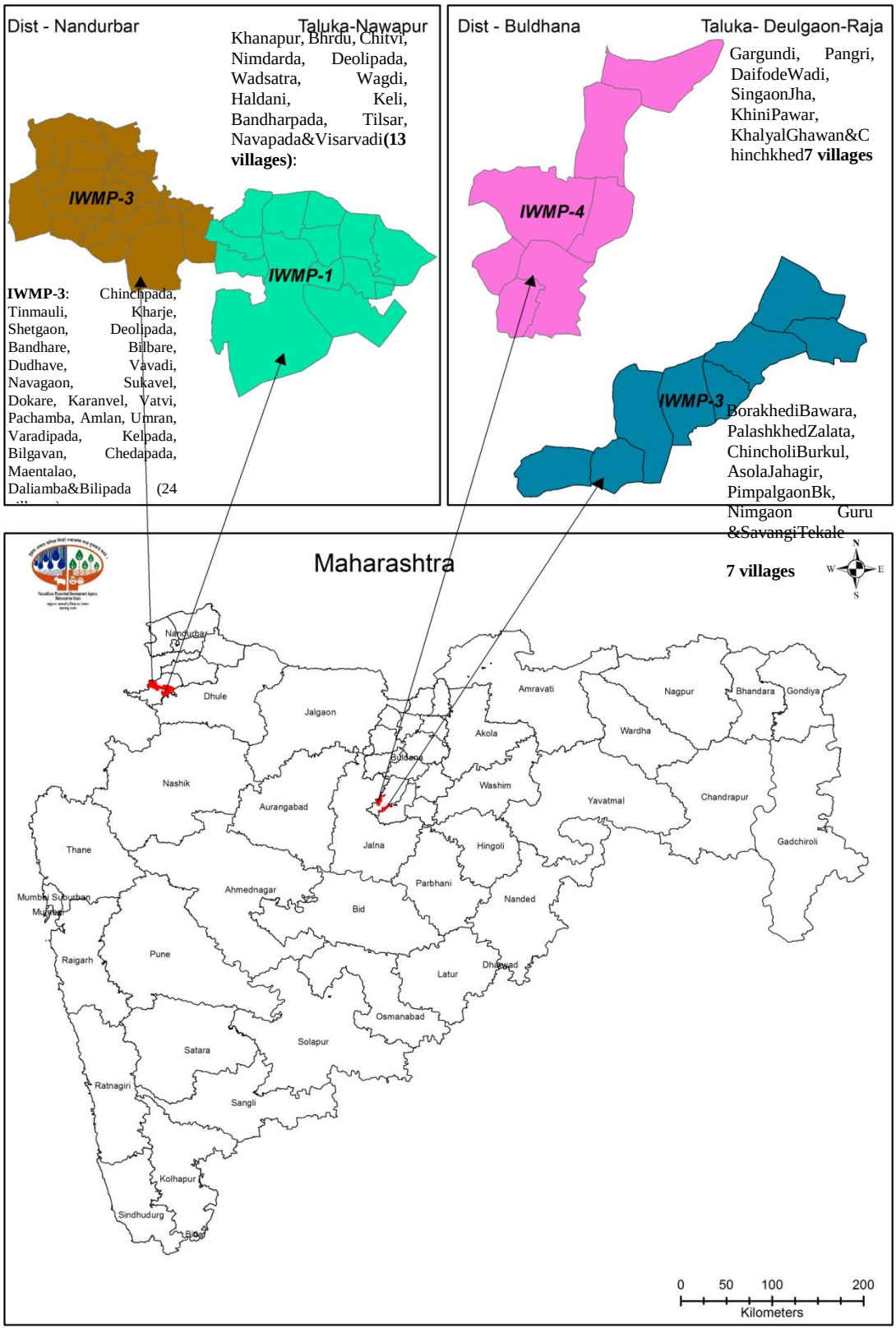
From district-wise vulnerability index of the State along with the districts, Nandurbar ranks high with value of 0.02, followed by Dhule and Buldana. Accordingly, Nandurbar and Buldanaare the two districts identified to be the most vulnerable in different agro-climatic zones. In order to

further narrow down the project locations, the projects approved in Batch I (239) are nearing completion by March 2015 were analysed. The projects from this batch that are having maximum expenditure on NRM works in Nandurbar and Buldana district are selectedviz IWMP-1 andIWMP-3 from Nandurbar and IWMP-3 and IWMP-4 from Buldana. List of villages in these projects is as follows :

1. **BULDHANA/IWMP-3/2009-10** :-7 villages: BorakhediBawara, PalashkhedZalata, ChincholiBurkul, AsolaJahagir, PimpalgaonBk, Nimgaon Guru &SavangiTekale
2. **BULDHANA/IWMP-4/2009-10** :-7 villages : Gargundi, Pangri, DaifodeWadi, SingaonJha, KhiniPawar, KhalyalGhawan&Chinchkhed
3. **NANDURBAR/IWMP-1/2009-10** :-13 villages : Khanapur, Bhrdu, Chitvi, Nimdarda, Deolipada, Wadsatra, Wagdi, Haldani, Keli, Bandharpada, Tilsar, Navapada&Visarvadi
4. **NANDURBAR/IWMP-3/2009-10** :-24 villages :Chinchpada, Tinmauli, Kharje, Shetgaon, Deolipada, Bandhare, Bilbare, Dudhave, Vavadi, Navagaon, Sukavel, Dokare, Karanvel, Vatvi, Pachamba, Amlan, Umran, Varadipada, Kelpada, Bilgavan, Chedapada, Maentalao, Daliamba&Bilipada.

The Natural Resources Management works are almost complete in these projects ensuring that the structures are ready to harvest the rains and recharge ground water. This harvested water has to judiciously usedin order to get maximum benefit in the form of biomass. Following figure shows the exact location of projects.

Project Location Map



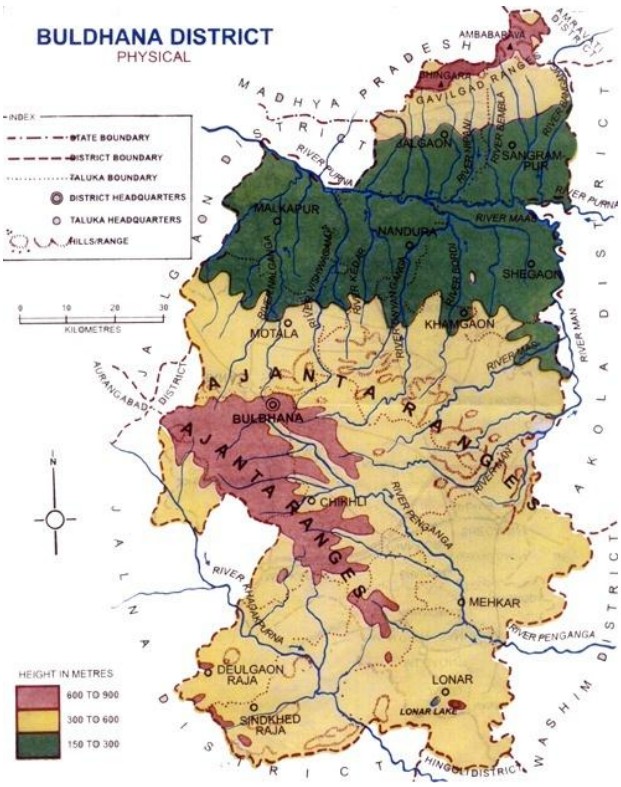
Brief profiles of the two districts are presented in following section.

Buldhana district:

The total geographical area of Buldhana district is 9,661 sq. km, which is 3.14% of the total geographical area of Maharashtra. There are 1,433 villages and 13 semi urban centers and one municipal council in Buldhana district.

The district has predominantly black soil, which is highly fertile having high contents of calcium, magnesium and carbonates. However, the soil is deficient of nitrates, phosphates, potash and also humus. The soil has capacity of retaining high moisture and percolation. Vainganga, Purna, Khadakpurna and Paingangaare the major rivers flowing in the district.

Figure 9 - Physical feature map of Buldhana



a. ***Demography:***Population of the district is around 25.88 lakh as per 2011 census. About 79% of the population of the district resides in rural areas. Average density of population is 268 per sq. km., as against State's position of 365 per sq. km. Percentage of SC and ST population to total population is 10.82% and 5.15% respectively.

b. ***District economy:*** Agriculture is the predominant activity of the district. Major food crops of the district are bajra, jowar, wheat and pulses. Other crops cultivated include cotton, soybean, sugarcane and banana as well as short duration crops like groundnut, sunflower and vegetables. 23% of land holdings are categorized as small that increases the vulnerability.*Other supplementary activities* of the district include dairy, sheep, and goat rearing.During 2009-10 per capita net income of the district was at Rs. 40,332/- as against State's per capita income of Rs. 74,027/-.Buldhana district is industrially backward and placed in D+ zone index by the State Government.

c. ***Agriculture in the district:*** Average net sown area is 706,300 ha while the total gross cropped area is 823,400 ha of which 117,100 ha area is cultivated more than once. Cropping intensity is 116 %. Cotton is the predominant crop grown in the district. Buldana district is known for growing cotton in six blocks while the remaining seven blocks are known for kharif crops, i.e., mung, urad, soybean, til, etc.In addition to aforesaid crops, vegetable crops like cauliflower, cabbage, brinjal, ladies finger, potato, onion, garlic, turmeric, etc. are grown in isolated patches. Details of major crops in the district namely area covered, production and productivity are as under:

Table 14 - Area, Production & Productivity of crops

Crop	Area (ha)	Production (MT)	Productivity (kg/ha.)
Jowar	20600	22100	1071.4
Maize	30000	54400	1815
Tuar	69600	18500	266
Mung	12300	4000	324
Urad	11100	3900	348
Groundnut	1100	600	572
Til	800	200	211
Soybean	352500	189100	536
Cotton	174300	132500	129
R.Jowar	10800	8900	824
Wheat	73500	95500	1299
Gram	57200	36600	640

(Source: Agriculture Dept, 2014-15)

In Buldhana district largest production is of soybean (374,025 MT) followed by maize (130,801 MT) and cotton (110,348 MT). While, productivity of Maize (2779 kg/ha) is the highest, followed by wheat (1762 kg/ha), Jowar(1675 kg/ha) and others (as mentioned in Table 3).

d. Land use in the district: The district is divided into 3 units, the northern hills, the central plains and the southern plateau. Satpuda hills in the north are at an average elevation of 700 to 1000 meters from MSL. The district has 2 main rivers – Penganga and Purna followed by Khadakpurna which flows parallel to Penganga. Large part of the district is covered by basaltic Deccan trap and a few alluvium patches of the Purna- Penganga basin. The trap rocks are usually fine to coarsegrained, dark grey to greenish-black basalts of vesicular and massive types.

Figure 10 – Soil map of Buldhana

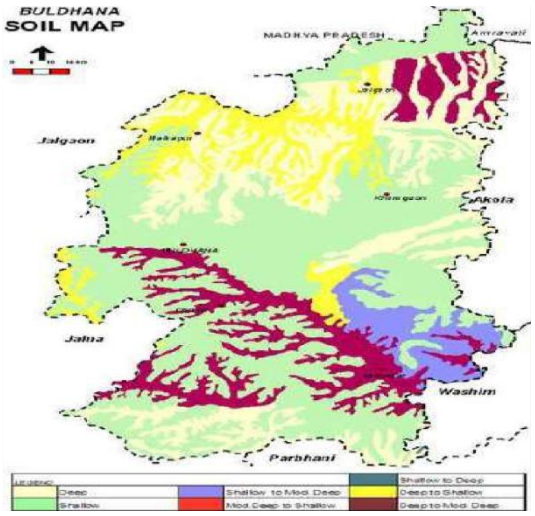


Table 15 - Land use in the district

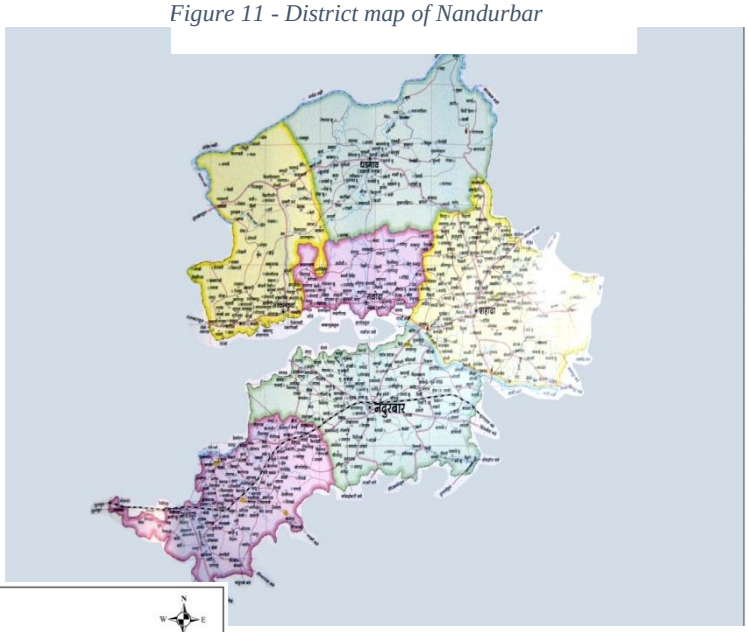
LAND USE CATEGORY	Area (in hectares)
Reporting area for land utilization statistics	967,100
Forests	88,300
Area under non-agricultural uses	51,700
(i)Permanent pastures and other grazing lands	39,200
(ii)Land under other miscellaneous tree crops and groves not included in net area	1,000
(iii) Culturable waste land	26,300
(iv) Fallow lands other than current fallows	27,200
Total area under other uncultivated land excluding fallow land (i+ii+iii+iv)	93,700
Total area under fallow land	27,100
Net sown area	706,300

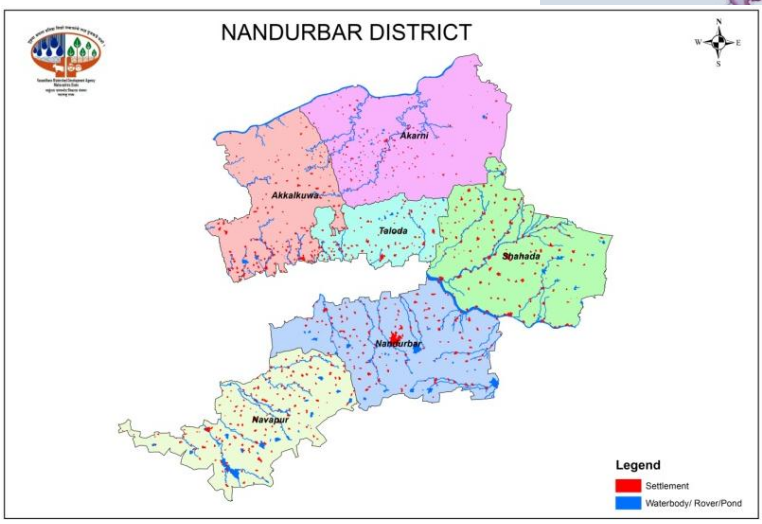
Nandurbar district:

Nandurbar district with an area of 5034.43 sq.km has 6 blocks viz. Nandurbar, Shahada, Taloda, Nawapur, Akkalkuwa and Akrani (Dhadgaon).

Climate of the district is dry and agricultural activities mainly depend upon the rainfall. Nandurbar district falls in the Western Plateau and hill region of the State. The district is situated at upper part of Tapiriver.Out of total cultivated area of 3.97 lakh ha net irrigated area is the district is 46,695 ha (12%) out of which 55% area isirrigated from wells and remaining 45% area from surface sources. The district has 12 medium irrigation projects irrigating 47,000 ha and 42 minor irrigationprojects irrigating 1200 ha land but owing to highly undulated topography there is no major irrigation project.

Figure 11 - District map of Nandurbar





a. ***Demography***:Nandurbarhas a population of 16,46,177 (Census 2011). It has relatively low urban population (16.7%) and low population density (261 persons per square km) (Census 2011). More than half the district's population is tribal – from the Pawara, Bhil, and other communities.

b. ***District economy***: Economy of the district is dependent upon agriculture, which is adversely affected due to recurring drought conditions. Normal rainfall of the district is 888 mm and the climate is hot and dry. Agriculture is the predominant economic activity, followed by dairy, sheep/goat rearing, etc. Non-farm sector activities consist of small units in agro-processing i.e. oil mills, dal mills, etc. Major food crops grown in the district are paddy, jowar, bajra, maize, wheat, groundnut, cotton and sugarcane. Among horticultural crops, ber, guava, pomegranate, papaya, custard apple and mango are main crops.

c. ***Agriculture in the district:*** The land holding pattern in the district indicates that nearly 57% of the farmers are small farmers and they hold about 26% of the land. Production and productivity figures are tabulated below.

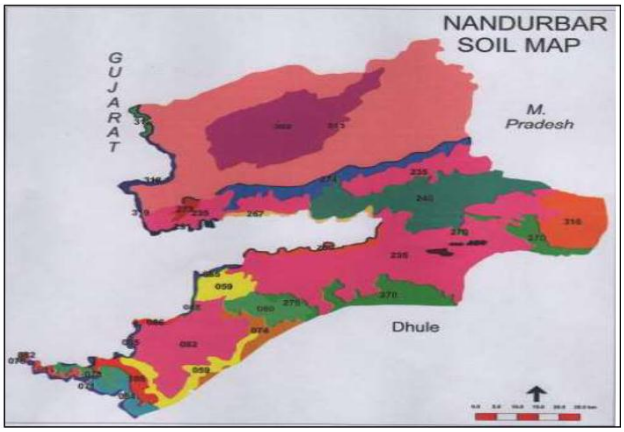
Table 16 - Area, Production and Productivity of major/predominant Kharif crops

Crop	During 2011-12		
	Area	Production (MT)	Productivity (Kg/ha)
Paddy	182	9000	496
Jowar (Kharif& Rabi)	31400 14300	33500 18000	1067 1257
Bajara	6200	3200	524
Maize	209	153	567
Tuar	12600	2800	222
Moong	4900	2100	425
Urad	114	4200	371
Soybean	27500	267	970
Groundnut	2000	1300	669
Cotton	118600	101200	145
Sugarcane	8000	6338	79
Wheat	21900	39100	1786
Gram	18900	13400	708

Source: Agriculture Department

d. **Land use in the district:**

Figure 12 - Hydrogeology map of Nandurbar



Geographical area of district is 5,03,426 ha. of which about 60% area is cultivable. There is good scope to increase area under cultivation. Soil type in the district is 40 % light, 35% medium and 25% are heavy soils.Annual average rainfall of the district is 888 mm. Agro ecologically district is divided into four ecological situation as 42% Scarcity Zone 13% Western Ghat zone 25 % Sub Mountain Zone and 20% Western Maharashtra Plain Zone.

e. Land holding pattern :

Table 17 - Land holding pattern in the district

Particulars (Ha)	No.of farmers	Area (Ha)
0.0 to 0.5	17710	5390
0.5 to 1.0	45694	34776
1.0 to 2.0	103019	152636
2.0 to 5.0	96631	295408
5.0 to 10.0	27725	184948
10.0 to 20.0	3979	50030
20.0 & above	299	10505
Total	**295057**	**733693**

b) Demographic details of the population – total population (for area in operation), Gender-disintegrated data, small and marginal, etc.

In this section, the district wise demography has been presented for both the districts in Table 30. Demography of project area is presented in Table 31.

Table 18 - District wise demographic details of population

District	No of HHs	Total popu-lation	Cultivators (Main worker)		Agricultural labourers (Main worker)		Cultivators (Marginal Worker)		Agricultural labourers (Marginal Worker)	
			No	% of total popu-lation	No	% of total popu-lation	No	% of total popu-lation	No	% of total popu-latio n
Buldhana	5,61,504	25,86,258	3,63,983	14.1	5,37,970	20.8	21,464	0.9	65,257	2.5
Nandurbar	3,23,521	16,48,295	1,92,433	11.6	3,50,630	21.3	19,239	1.2	87,546	5.3

(Primary Census Abstract, 2011)

Household, population, small and marginal farmers' population of the villages in the selected project area are:

Table 19 - Demography of the area of operation

Area of operation	Population	No. of House-holds	No. of Small farmers	No. of marginal farmers	No. of landless house-holds	Women popu-lation
Navapur(IWMP-1)	26,938	5,370	1,307	709	288	13,092
Navapur(IWMP-1)	34,062	9,938	1,822	4,358	327	16,162
Nandurbar Total:	**60,460**	**15,308**	**3,129**	**5,067**	**615**	**29,254**
Buldhana(IWMP-3)	7,304	2,374	521	1,265	224	3,605
Buldhana(IWMP-4)	9,676	2,472	611	1,265	35	4,611
Buldhana Total:	**16,980**	**4,846**	**1,132**	**2,530**	**259**	**8,216**

(Taluka Agriculture Office, Dept. of Agriculture)

Women population in the project area is around 49% of the total population

1.2.Project Objectives:

The project aims at developing climate adaptive and resilient farming systems through efficient water management and technology adoption for adaptive agriculture by rural families associated with agriculture and allied sector in two climate vulnerable and drought prone districts of Maharashtra.This aim is segregated in three objectives. These proposed objectives and activities are explained below.

Objective 1: *To carry out anintegrated socio-economic and ecological baseline survey for assessment ofvulnerability to climate change and planningfor land use and water budgeting*.

Baseline data will provide the basis for adaptation planning, identification of specific locations, farmer householdsfor easy implementation. Specific tools will be used to carry out the baseline survey and assessment.

Objective 2*: Climate resilient technology transfer for enhancing the adaptive capacity of the community*

Based on activities as envisaged under Objective 1 that generates the land use, water budgeting, vulnerability level and intervention requirements based on adaptive capacity, the focus will be on transferring sustainable technologies to the community for increasing their adaptive capacity. In accordance to the plan, following transfer of technology measures will be undertaken. Some of these activities or types are indicative and shall be comprehended based on outcomes of planning exercises.

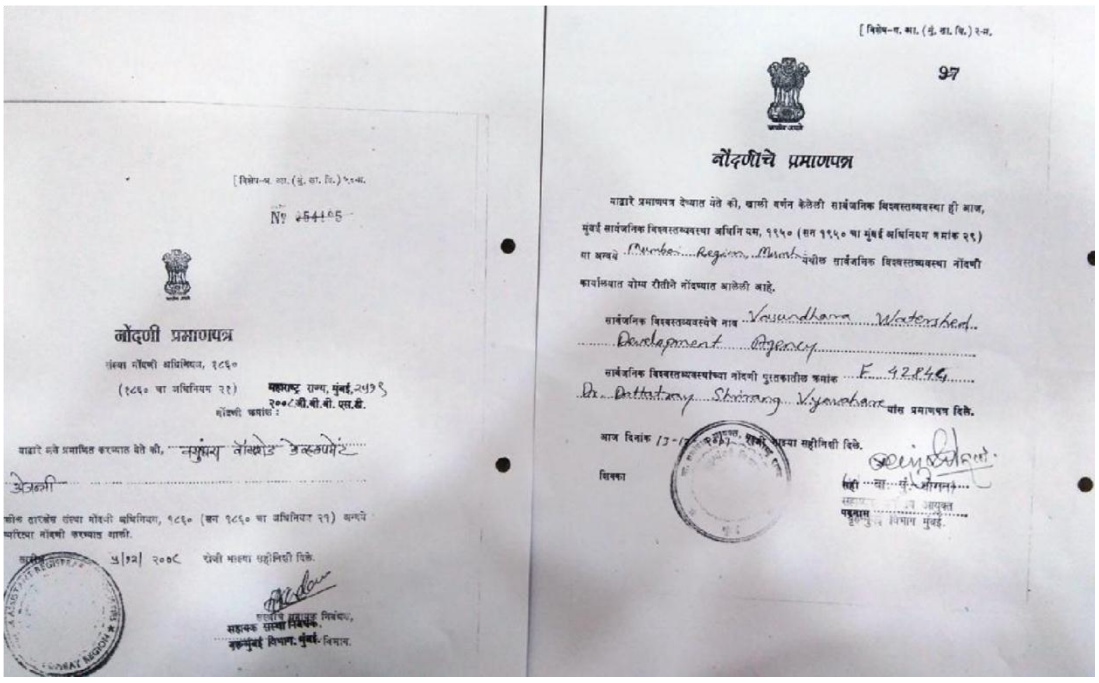
1.3. Details of Project/ Programme Executing Entity:

a) Name Registration No and Date, Registered Address, Project Office address (for the proposed Project)

Vasundhara Watershed Development Agency (VWDA) is government promoted society chaired by Secretary Watershed Conservation and members are from major State departments. VWDA is the State Level Nodal Agency (SLNA) of IWMP. Institutional structure is closely knitted with Agriculture department and VWDA functions in close coordination with the department.

Registration:

1. Society Registration Act 1860 on Mumbai -2519 registered on 05.12.2008.
2. Bombay Public Trust Act 1950, No. F – 42844.



नोंदणी प्रमाणपत्र

नोंदणीचे प्रमाणपत्र

The proposal submitted by VWDA under NAFCC project was approved on 5 Feb 2016 by passing the resolution no. 281/24

Address :-

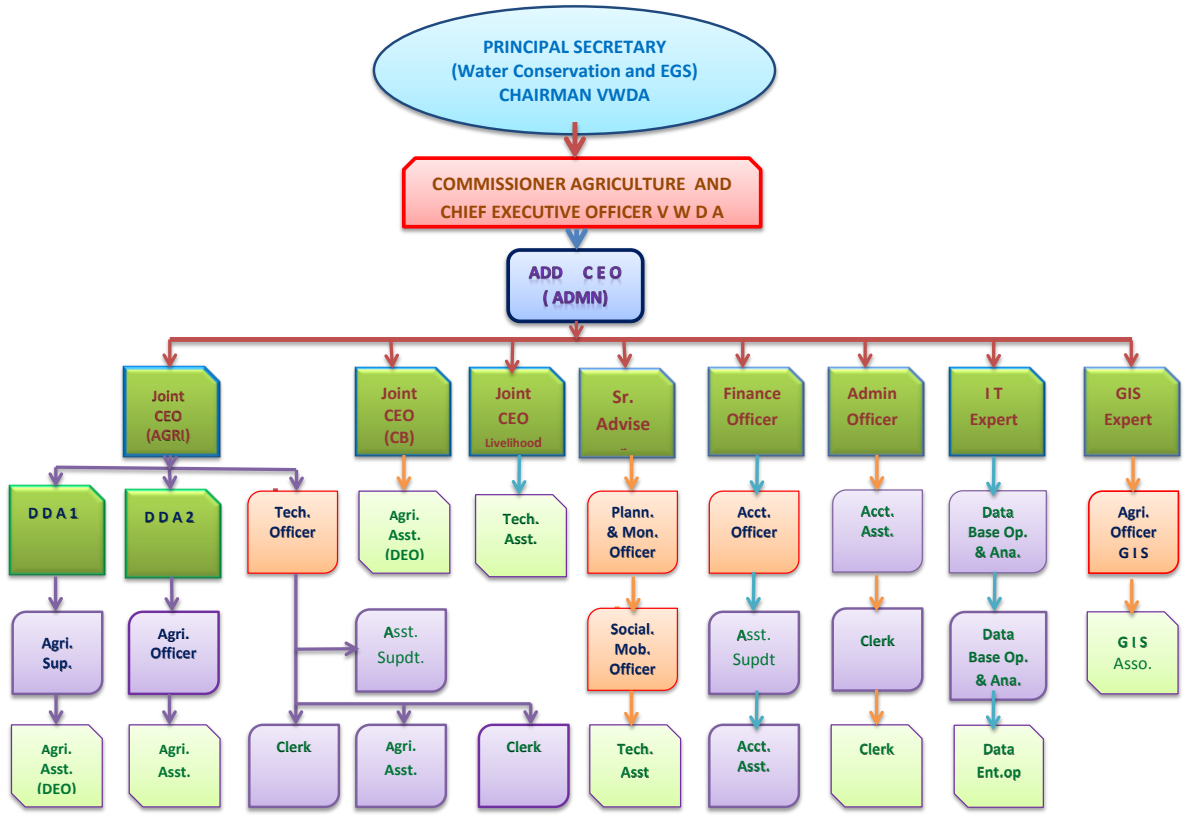
1. Chief Executive Officer and
   Commissioner Agriculture
   Vasundhara Watershed Development Agency
   2nd Floor, Central Administrative Building, Pune - 411001.
2. Additional Chief Executive Officer
   Vasundhara Watershed Development Agency
   1st Floor, Central Administrative Building, Pune - 411001.

b) *Available technical manpower for the proposed project implementation:*

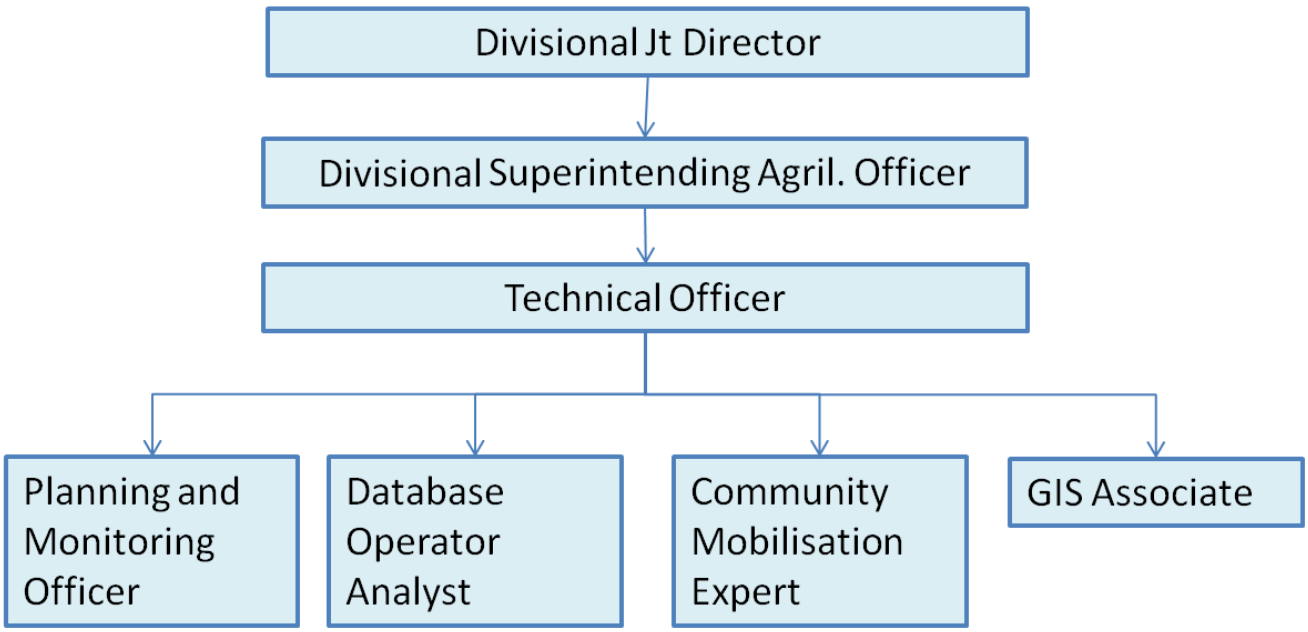
Department of Land Resources Govt. of India has approved the staff of 18 posts to support ongoing Pradhanmantri Krishi Sichai Yojana – Watershed Development (Earstwhile Integrated Watershed Management Programme (IWMP)). VWDA also has approved additional 20 posts to support the said programme. However there is around 50% vacancy. Technical manpower with requisite qualification is available with the Nodal agency to support existing watershed development programme could be spared for the proposed project. Separate manpower would be appointed if required.

The organizational setup of Vasundhara Watershed Development Agency is illustrated as below:

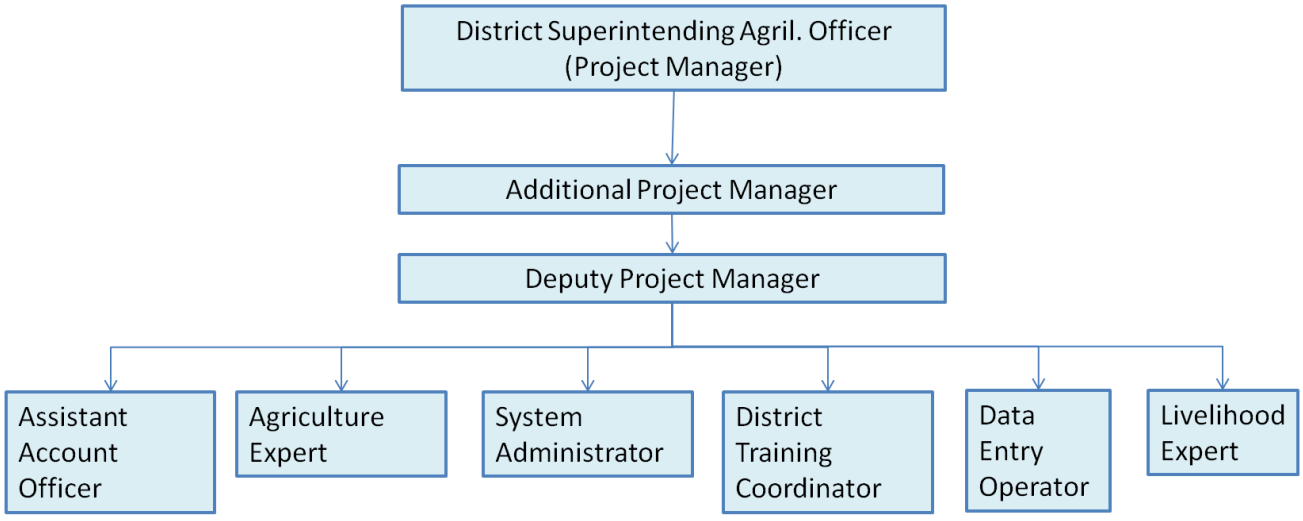
Illustration: Organizational setup of Vasundhara Watershed Development Agency



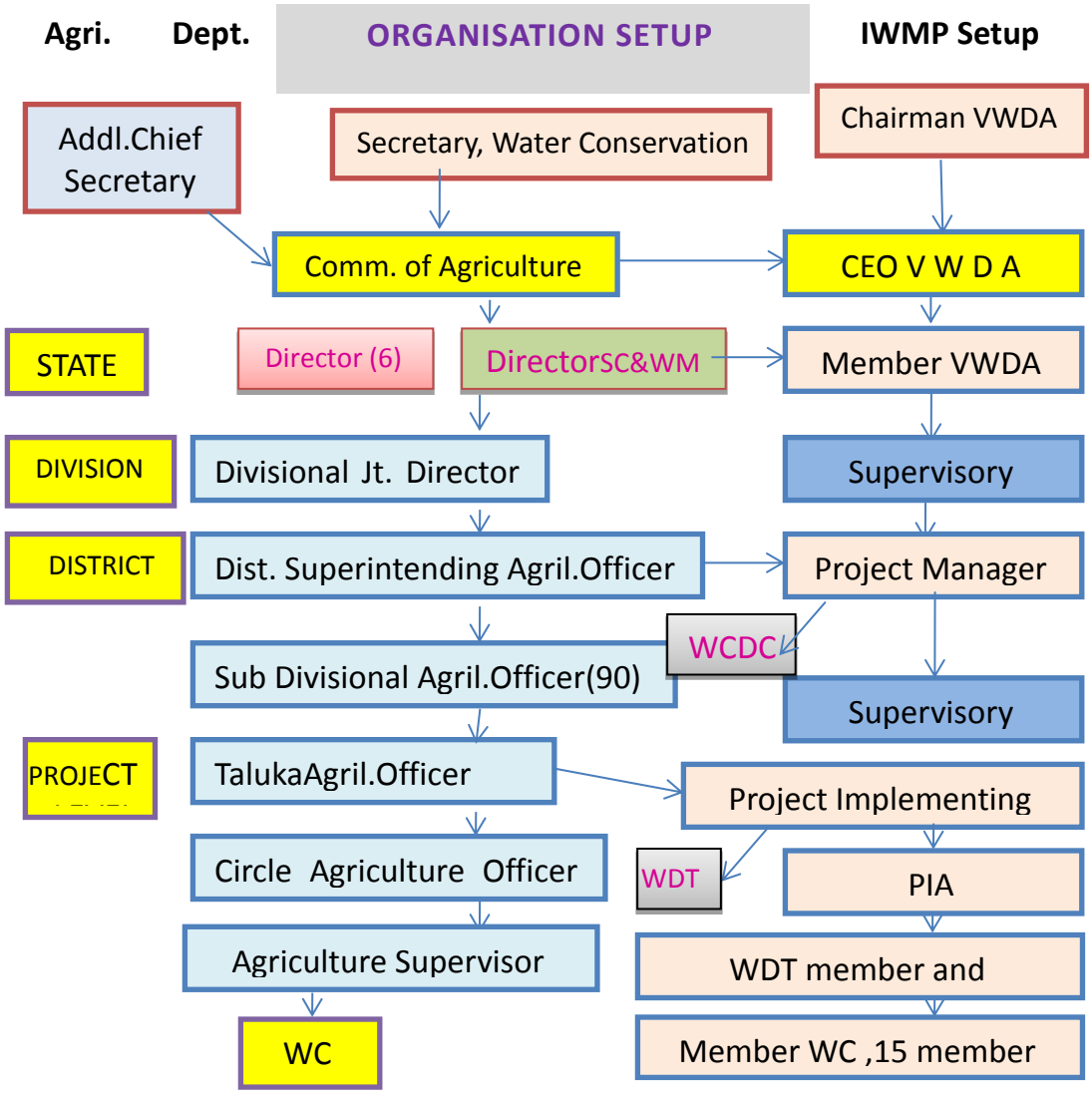
Divisional level Organisational Structure



District level Organisational Structure



Vasundhara Watershed Development Agency and its linkage with Department of Agriculture and Department of Water conservation, Govt of Maharashtra



c) Three largest Climate Change Adaptation Projects handled (if already implemented)

No large scale climate change adaptation project handled by VWDA.

d) Three largest community based NRM based projects handled

i. ***PMKSY-Watershed development*** (erstwhile IWMP) program in Maharashtra is executed by VWDA. The current status of the program is:

Table 20IWMP Project at glance

Batch No.	Project Year	Batch - I to VI number of				Treatment Area (Lakhs Hectares)	Project cost (INR Crores)
		District	Projects	Villages	Micro watersheds		
1	2	3	4	5	6	7	8
I	2009-10	30	239	2117	2858	9.58	1223
II	2010-11	33	359	3278	4621	14.69	1880
III	2011-12	24	214	1765	2794	8.90	1143
IV	2012-13	20	120	1295	1630	5.27	683
V	2013-14	32	116	1051	1634	5.19	665
VI	2014-15	34	122	1124	1398	5.42	697
TOTAL		**34**	**1170**	**10630**	**14935**	**49.05**	**6291**

ii. ***JalyuktaShivarAbhiyan*** *(JSA)* is executed in Maharashtra by Water conservation Department..It is currently covering 6,205 villages including 2175 villages from IWMP in the state. The details of these villages are as follows:

Table 21Criteriawise selection of villages

Agriculture Division	Villages Under JAS	Criteria -1	Criteria -2	Criteria -3	Criteria -4	Criteria -5	Criteria -6	Criteria -7
Thane	203	0	0	0	68	52	83	0
Nasik	662	36	172	280	0	52	118	4
Pune.	757	92	114	165	90	168	110	0
Kolhapur	425	15	102	3	0	161	118	26
Aurangabad	711	74	305	330	0	0	2	0
Latur .	974	94	311	421	52	38	58	0
Amravati	1396	62	186	1148	0	0	0	0
Nagpur	1077	99	20	654	0	0	93	211
State Total	**6205**	**472**	**1210**	**3001**	**210**	**471**	**582**	**241**

1. Villages include in Watershed+ Scarcity Affected Villages+ Tanker fed Villages+ Over Exploited villages
2. Villages include in Watershed+ Scarcity Affected Villages+ Tanker fed Villages
3. Villages include in Watershed+ Scarcity Affected Villages
4. Villages include in Watershed+ Scarcity Affected Villages+ Tanker fed + Over Exploited (last five years)
5. Villages include in Watershed+ Tanker fed Villages (last five years)
6. Scarcity Affected Villages (last five years)

7. Other than these criteria

iii. Pilot project on Climate resilient DPR preparation is taken up in two projects one each in Satara and Beed district in coordination with WOTR

e) Three largest Climate Change Adaptation / NRM projects of State / Central Government

Pilot project on Climate Change Adaptation (CCA) implemented by WOTR and funded by NABARD :Watershed OrganisationTrust (WOTR) launched a large scale pilot project on Climate Change Adaptation in semi-arid and rain-fed regions of Maharashtra, Telangana, Andhra Pradesh and Madhya Pradesh with the aim to develop knowledge systems, strategies, measures and processes, which can up-scaled and widely adopted, to build the resilience and adaptive capacities of vulnerable communities. The project is being implemented in partnership with Swiss Agency for Development and Cooperation (SDC), the National Bank for Agriculture and Rural Development (NABARD), the Governments of Maharashtra, Andhra Pradesh and Madhya Pradesh as financiers and enablers; Indian Meteorological Department (IMD), the Central Research Institute for Dryland Agriculture (CRIDA), World Agro-Forestry Council, Mahatma Phule Agriculture University and BharatiVidyapeeth Institute of Environment Education and Research (BVIEER) as technology and knowledge partners; and WOTR which anchors the project, implements it, generates and validates knowledge for use. The CCA is implemented in 49 villages across four states covering geographical area of over 30,000 hectares and impacting nearly 50,000 people.

f) Comment of availability of suitable infrastructure for implementation proposed projects (vehicles, computers, required software/ tools, etc.)

After managing 2 very large scale NRM programs in Maharashtra (*PMKSY-Watershed development* and JalyuktShivarAbhiyan) the agency has created the suitable infrastructure required to run similar projects. Overall structure of VWDA and Division and District level infrastructure and resources available with VWDA is described under section 1.3 (b).

Vehicles – Fresh procurement not required. Local travel expenses budgeted, Computers – 4 with required software/tools

g) Whether Executing Entity (EE) was blacklisted, barred from implementation of projects, faced any charges / legal cases related to mismanagement of project and funds. (Please list any such incidences and reasons):

No.

1.4.Project / Programme Components and Financing:

S. No.	Project/Programme Components	Expected Concrete Outputs	Expected Outcomes	Amount (Rs)
1.0	Integrated Baseline socio-economic Survey, assessment and planning	•Village wise PRA •Socio Economic HH Survey •Land Use plan and water budgeting •GIS mapping	•Climate change vulnerability at local level •Land use and water management plan •Identification of farmers and extent of adaptation required at Household and Community level	25,03,000
2.0	Climate resilient technology transfer for enhancing the adaptive capacity of the community	• SCI in paddy and wheat for 5500 farmers • Adaptive agriculture practices in pulses • Inter cropping of pulses • Adaptive agriculture for cash crops • Seed & Input • Efficient water conservation measures • Climate resilient appropriate technologies	4500 ha. Sustainable cultivation 4400 ha. sustainable cultivation 5000 ha. sustainable cultivation 2000 farmers practicing Climate Smart agriculture 1660 hectresunder improved varieties Optimal nutrient application by5500 farmers All villages able to cope with droughts 800 ha. Brought under irrigation	21,43,71,720

3.0	Learning and Knowledge Management	• Awareness films • Printing materials, Newsletter, Journals, brochure, pamphlets • Website design & regular updation • Farmers Convention / Melas • Mass Awareness Events	All farmers in the project areas aware of climate adaptation measures and strategies	76,60,000
	Project/Programme Execution cost			**22,20,31,720**
4.0	Project Execution Cost (Capacity Building, M&E Cost and Project Cycle Management Fee charged by Implementing Entity)	• Timely implementation of the project interventions	Monitoring and Evaluation	**40,66,000** **1,63,51,000**
5.0	NABARD Fee			**75,40,000**
6.0	**Total Project Cost**			**24,99,88,720**
	Amount of Financing Required			**24,99,00,000**

The project may allow flexibility of utilising the savings / unused balance, if any, with respect to each of the activities to be used for other activities within the same component. This may also depend on the extent of demand and adoption of the proposed activities by the villagers.

1.5.Projected Calendar:

Indicate the dates of the following milestones for the proposed project/programme (projects which have four or more than four years of implementation period would require to have mid-term review after two years of implementation).

Milestone	Date
Project Start Date	01 April 2016
Completion of First Annual Cycle	31 March 2017
Completion of Second Annual Cycle	31 March 2018
Midterm Review	June 2018
Completion of Third Annual Cycle	31 March 2019

Completion of Fourth Annual Cycle	31 March 2020
Final Review	April 2020

2. Project Justification

a) Component-wise details and justification of the project components

i. What is the business-as-usual development for the targeted sector?

RashtriyaKrishiVikasYojana (RKVY) has been one of the major support for overall development of agriculture sector in the State. Through this scheme, the State has implemented several sub-schemes as under:

- Initiative for Nutritional Security through Intensive Millets Promotion (INSIMP)
- Accelerated Fodder Development Programme (AFDP)
- Rain fed Area Development Programmers (RADP)
- Development of village wise Soil Fertility Index
- Residue Monitoring in Exportable Commodities
- CROPSAP, Horticulture
- Micro-irrigation Scheme
- Onion Storage Structure
- Improving of AI delivery system
- Cultivation of mulberry for development of silk industry
- Mahatma PhuleJalBhoomiSandharanAbhiyan
- Repairs of Malgujari tanks
- Mechanization of harvesting in sugarcane
- Project on vegetable initiatives for urban cluster

Further, the State Government has been implementing a number of projects having thrust on fruit and vegetable production under National Horticulture Mission (NHM), National Mission on Micro-Irrigation (NMMI) etc.

Through theIWMP, several initiatives have been taken for Soil and Water Conservation and promotion of agriculture & livelihood activities; however the coverage under this programme has been able to partially address climate change issues faced in the project areas. This has been strengthened further with the State Flagship Programme 'JalyuktaShivarAbhiyan'.

However, specific focus on climate resilient farming system is lacking whereas focus in the sector has been more on augmenting production and productivity. Use of scientific package of practices in different crops is lacking due to various reasons where capacity gap is prominent. As agriculture sector has become more market driven, focus has shifted from environmental friendly sustainable agricultural practices to commercialization of production system with some unregulated practices that have negative impact on soil and local environment. Integrated farming system and recycling of farm waste is rarely practiced though it is one of the important adaptation mechanism to climate variability situations.

Moreover, scheme coverage is limited to the budget allotment and hence number of famers covered is restricted. Further, scheme coverage does not take into consideration, vulnerabilities of farmers to climate change.

So, it would be appropriate to say that the current level of measures are more focused to improve the agricultural production system which is somehow forced to compromise with the sustainable climate resilient farming system. Recently, the State Government seems initiating different measures to deal with the climate variability and related problems arise out of this under climate change action plan. This project proposed for pilot execution is part of the overall initiative of the State Government to deal with adaptation to the climate variability situations.

i. *What are the specific adaptation activities to be implemented to reduce the climate change vulnerability compared to the business-as-usual situation?*

Baseline Scenario

Adaptation activity

Apart from extreme weather and climate events such as severe droughts, subtle changes like rainfall variability and temperature variations often shock the farming community, leading to decline in agricultural production. In addition, farmers are expected to manage the insidious effects of long term climate change that may now be occurring at an unprecedented rate. These existing pressures demand the development and implementation of appropriate methods to address issues of vulnerability to weather and climate.

Comparison with the business as usual situation

The last baseline data created was in the year 2009-10 while preparation of Detailed Project Report under Integrated Watershed Management Programme (IWMP), however no such baseline data was generated with respect to climate vulnerability.

Adaptation activity

GIS Mapping

Assess the decadal changes in Land Use, Forest and Vegetation Cover, Population GIS Mapping, Socio Economy, Spatial Shifting Pattern of Rainfall and Land Surface Temperature, Subsurface Water Availability and Uses, Water Stress, assessment of agricultural Drought, identification of

water bodies perennial and seasonal, shifting of Drainage Network, Elevation, Slope, Aspect Analysis, Catchment, Basin, Watershed Analysis etc

Comparison with the business as usual situation

Maharashtra Remote Sensing Application Centre (MRSAC) undertakes GIS mapping in the State, but it is confined only upto the scheme directed specifically, IMWP and JSA are under these special directives. Similarly, majority of social programmes which are implemented in the State and uses GIS technology, have a coverage related to other vulnerabilities. This project shall map the individual villages in all the clusters of the programme.

Climate resilient technology transfer

Adaptation activity

- **System of Crop Intensification for paddy in 2 clusters of Nandurbar district** - Paddy is the 2 crops cultivated in 4538 ha in 37 villages of Nawapur block of Nandurbar district. Presently this is cultivated through flood irrigation method. This activity proposes to cultivate paddy and wheat through Systematic Rice / Wheat intensification method in farms belonging to 5500 farmers.

Further for practicing adaptive agriculture 'Urea Deep Placement (UDP)' techniquewill be used wherein **urea is made into "briquettes" of 1 to 3 grams** that are placed at **7 to 10 cm soil depth** after the paddy is transplanted. This technique decreases nitrogen losses by 40 percent and increases urea efficiency to 50 percent. It increases yields by 25 percent with an average 25 percent decrease in urea use.

The integration of bio-fertilisers and bio-pesticides with reduced usage of chemical fertilisers and pesticides has stabilised yields and has also led to increase in yields in some cases.

Establishment of Community paddy nurseries through Farmers Field Schools(FFS)–KVKs have standardised the practice of raising community paddy nurseries. Establishing a staggered community nursery serves as a local adaptation strategy at the village level to combat the problem experienced by farmers during deficit rainfall seasons in lowlands.

Comparison with the business as usual situation

The abovementioned technologies have been demonstrated in one or two villages through NICRA programme, however the same has not been considered for the entire project area. These technologies will serve as effective adaptation strategies

- **Adaptive agriculture for Pulses (Redgram, Blackgram and chickpea) in all 4 clusters of the project area** - This activity proposes cultivation of Redgram, Blackgram and chickpea in 315 ha.,1181 ha.and236 ha.respectively. Field demonstrations will be held in 51 farms. From the second year, assistance as required for cultivation in 1 acre will be provided to all the farmers. Farmers who take up cultivation of these pulses as per the areas envisaged will be provided assistance. The area will be covered in a phased manner in the entire project period.

For promoting crop diversification and minimize climate risks, inter crop promotion support would be extended to farmers (preference would be given to small and marginal farmers who are vulnerable and keen on adaptation). Support for inter cropping would be extended to 300 farmers. Diversifying production system, the produces are distributed over various seasons and space so that if one is lost due to disaster, others can support the livelihood.

Itisbasedonlocallyadoptedcropsand varieties,soadaptabilityandtoleranceishigh. Hence300 farmers who are already practicing inter cropping would be encouraged to scale up their activity.

Some of the recommended practices for intercropping are: Intercropping of soybean + pigeonpea (4:2), pearlmillet + pigeonpea (3:3), pigeonpea + green gram (1:2) and cotton + green gram (1:1).Additionally intercropping with pigeonpea (5:1 ratio) sown in Julycan also be promoted.

Efficient water management measures (CommunityLIs&microirrigation) for agriculture productivity and environmental sustainability

Adaptation activity

- **Community Lift Irrigation with Solar Water pump:** A number of streams flow through this region (Khadakpoorna in Deulgaon raja and Rangavali in Nawapur). It is very difficult to access the river water as a source of irrigation for the lands which are situated at a higher point in the gradient. These lands are often left fallow or cultivated only during the monsoon. The project proposes to install Community Lift Irrigation Systems (LI) with Solar Water Pumps and distribute water to the fields through piped channels. 20 such LI systems will be installed as part of project intervention.

Solar pumps can displace fossil fuels, reducing carbon emissions and general pollution while providing a consistent source of energy suited to irrigation pumps.The cost details are given in Annexure.

- **Micro irrigation (Drip and Sprinkler Irrigation)** - Small scale micro irrigation for lifting, conveying and applying irrigation efficiently include gravity fed drip and pressurized sprinkler irrigation used to improve water use efficiency and food production. They may be gravity fed or pressurized system. Water source can be from borehole, reservoirs, field pond or potable source. Unlike surface or furrow irrigation, it improves water use efficiency by 50-70 % under sprinkler and up to 90 % under drip irrigation. Mini sprinkler is used for open field production, while drip and micro-irrigation is used for field crops, greenhouse, nursery, orchards and container plants.Drip irrigation technology uses less water than sprinkler irrigation (30-40 % water saving), / is not affected by wind. It enables to irrigate irregular structured fields (odd-shaped and narrow areas), It optimize the use of fertilizers and water (water-use efficiency exceeds 90% / minimizes crop stress by slow release of water close to the root zone as per the irrigation requirement of the crop. It minimizes wetting of foliage and foliar diseases. It applied water in low volume to plant roots providing optimal growth conditions. Mini-sprinkler irrigation is appropriate for all types of soils and open field vegetables production. It is movable/ requires labour, can be adapted to different field shape. /size. Its efficiency is around 50 to 70 %. It provides efficient coverage for small to large

areas. Both irrigation system may be gravity–fed or pressurised by a pump.Assistance would be extended at the rate of Rs. 21,000/ acre so as to cover 4400 farmers. For farmers requiring more assistance, efforts will be made for convergence with other schemes.

- **Reinforced HDPE Geo-membrane lining for farm ponds –**

  Farm pond is a activity favorite amongst the farmers, as it stores water and serves as source for protective irrigation. Large numbers of farm ponds are taken up in the state. Recently Govt of Maharashtra launched the scheme "Farm pond on Demand" to the farmers in village to affected by scarcity in last five years. Most of the farm ponds are constructed through other govt schemes like MGNREGS, IWMP, RKVY, PM package etc. These farm ponds serve as recharge structure. These existing farm ponds can be converted in to storage tank by lining them with Geo-membrane. This would make the water available for longer period. Thus existing infrastructure could be converted to more productive and efficient use of water. It is proposed to provide geomembrane sheet to those farmers having farm pond in their field.

- **Plastic Mulch**

  Mulching helps to conserve soil moisture besides controlling the weed. It could be in the form of crop residue, saw dust or plastic sheet. It proves to be beneficial to the crops having large spacing. To promote conservation of soil moisture it is proposed to provide the farmers with Plastic film for mulching

Comparison with the business as usual situation

The interventions taken up earlier have been limited and based on programme / project budgets. The requirements of the project area considering the climatic stress have not been fully met. Hence, through this project, the objective will be to ensure sustainable and efficient water use to overcome climaticstress in the entire project area.

Systematic Crop Intensification (wheat, rice, maize) - Using SRI methods, smallholding farmers in many countries are starting to get higher yields and greater productivity from their land, labor, seeds, water and capital, with their crops showing more resilience to the hazards of climate change (Thakur et al 2009; Zhao et al 2009). These productivity gains have been achieved simply by changing the ways that farmers manage their plants, soil, water and nutrients. SRI methodology is based on four main principles that interact in synergistic ways:

- Establish healthy plants early and carefully, nurturing their root potential.
- Reduce plant populations, giving each plant more room to grow and to capture sunlight and obtain nutrients.
- Enrich soil with organic matter, keeping it well-aerated to support better growth of roots and more aerobic soil biota.
- Apply water purposefully in ways that favor plant-root and soil-microbial growth, avoiding flooded (anaerobic) soil conditions. Maintaining sufficient but never excessive soil moisture.

These principles are translated into a number of irrigated rice cultivation practices which under most smallholder farmers' conditions are the following:

- Plant young seedlings carefully and singly, giving them wider spacing usually in a square pattern, so that both roots and canopy have ample room to spread.
- Keep the soil moist but not inundated. Provide sufficient water for plant roots and beneficial soil organisms to grow, but not so much as to suffocate or suppress either, e.g., through alternate wetting and drying, or through small but regular applications.
- Add as much compost, mulch or other organic matter to the soil as possible, 'feeding the soil' so that the soil can, in turn, 'feed the plant.'
- Control weeds with mechanical methods that can incorporate weeds while breaking up the soil's surface. This actively aerates the root zone as a beneficial by-product of weed control. This practice can promote root growth and the abundanceof beneficial soil organisms, adding to yield.

Alongwith SCI as proposed, two more technologies which have been developed and standardised by MPKV, Rahuri, Maharashtra will be demonstrated. These are (i) Urea briquettes Deep Placement (UDP) technique and (ii) Integration with Bio-fertilisers for Biological Nitrogen Fixation (BNF) and bio-pesticides for higher or stabilised yields.

Urea Deep Placement (UDP) technique, developed by the International Fertilizer Development Centre (IFDC), is a good example of a climate-smart solution for rice systems. The usual technique for applying urea, the main nitrogen fertilizer for rice, is through a broadcast application. This is a very inefficient practice, with 60 to 70 percent nitrogen losses contributing to GHG emissions and water pollution. In the UDP technique, **urea is made into "briquettes" of 1 to 3 grams** that are placed at **7 to 10 cm soil depth** after the paddy is transplanted. This technique decreases nitrogen losses by 40 percent and increases urea efficiency to 50 percent. It increases yields by 25 percent with an average 25 percent decrease in urea use.UDP has been actively promoted by the Bangladesh Department of Agricultural Extension with IFDC assistance. In 2009, UDP was used on half a million hectares by a million farmers and there are plans to expand its use to 2.9 million more families on 1.5 million hectares.The widespread adoption of the UDP technique in Bangladesh has had several important impacts.

- Farmers' incomes have increased because of both increased yields and reduced fertilizers use.
- Jobs have been created locally in small enterprises, often owned by women, to make the briquettes. There are now 2 500 briquette-making machines in Bangladesh.
- On-farm jobs have also been created as the briquettes are placed by hand, which requires 6 to 8 days labour per hectare. Higher yields and savings on fertilizer expenditures compensate for the additional field labour expenses.
- At the national level, imports of urea have been reduced, with savings in import costs estimated by IFDC at USD 22 million and in government subsidies of USD 14 million (2008), for an increase of production of 268 000 metric tons.
- At a global level UDP has reduced GHG emissions caused by the production and management of fertilizers.

It also increases the agricultural system's resilience. As fertilizer prices are linked to energy prices, and consequently very volatile, reducing fertilizer use also increases farm and country's resilience to economic shocks. (Source: Roy &Misra, 2003; Singh et al., 2010; Ladha et al., 2000; IFDC, 2011)

Biological nitrogen fixation -Biological nitrogen fixation is the process of capturing atmospheric nitrogen by biological processes. It is accomplished by certain microorganisms and plant-microbe interactions. Legumes are N-fixing systems that have long been used for biological nitrogen fixation in agriculture. In agricultural systems, some types of microbes can carry out biological nitrogen fixation (BNF) as free-living organisms: heterotrophic and autotrophic bacteria and cyanobacteria. Other micro-organisms can only fix nitrogen through a symbiotic relationship with plants, mainly legume species. In agricultural areas, about 80 percent of BNF is achieved by the symbiotic association between legumes and the nodule bacteria, rhizobia. Farmers have some scope to influence BNF, through legume selection, the proportion of legume and grass seed in forage mixtures, inoculation with bacteria such as rhizobia, crop nutrition (especially nitrogen and phosphorous), weed, disease and pest controls, planting time, cropping sequence and intensity, and defoliation frequency of forage swards. However, some factors, including unfavourable temperatures and droughts, that affect BNF cannot be controlled. Also some legume species are better at fixing nitrogen than others. In perennial temperate forage legumes, red clover and lucerne can typically fix 200–400 kg of nitrogen per hectare (whole plant fixation, above and below ground) - Source: FAO, 2009a.

Biological nitrogen fixation (BNF) is the process whereby atmospheric nitrogen (N=N) is reduced to ammonia in the presence of nitrogenase. Nitrogenase is a biological catalyst found naturally only in certain microorganisms such as the symbiotic Rhizobium orthe free-living Azospirillum and Azotobacter. Since nitrogen is commonly the most limiting plant nutrient in arable farming in the tropics and also the most expensive element as a mineral fertilizer, biological nitrogen fixation (BNF) holds great promise for smallholder farmers in Maharashtra. Alley farming systems which use leguminous woody species in the hedgerows can reduce or eliminate farmers' needs for commercial N fertilizer.

Integration of bio-fertilisers and bio-pesticides with reduced usage of chemical fertilisers and pesticides has stabilised yields and has also led to increase in yields in some cases. Package of practices along with costs is given in Annexure. Field demonstrations will be held in 2 farmers' fields per village, wherein entire assistance for cost of cultivation will be provided. From second year, assistance for inputs as required for cultivation in 1 acre will be provided to the farmers.Farmer households will be covered in a phased manner in the entire project period.

Establishment of Community paddy nurseries through Farmers Field Schools(FFS)–KVKs have standardised the practice of raising community paddy nurseries. Establishing a staggered community nursery serves as a local adaptation strategy at village level to combat the problem experienced by farmers during deficit rainfall seasons in lowlands. Through this project, at least 17 nurseries are expected to be developed at a cost of Rs. 43,530/- approx. per nursery.

The technique involves raising a staggered community nursery under assured irrigation in the village at an interval of 2 weeks. In the anticipation of a two weeks delay in monsoon the first nurseryis taken up as a contingency measure by 15 June with the long duration variety (>140 days) in order to transplant 3-4 weeks old seedlings by first fortnight of July. If the monsoon delay extends by 4 weeks, the second nursery is raised with medium duration varieties (125-135 days) by 1st July to supply 3-4 weeks old seedlings for transplanting in the 3rd or 4th week of July. In case of anticipation of further delay or deficit rainfall conditions, the 3rd nursery is raised by mid-July with short duration varieties (<110 days) to take up transplanting of 3-4 week seedlings in the first fortnight of August. Farmers adopted this technique and jointly produced seedlings to ensure timely transplanting of correct age seedlings for higher productivity and reduce the risk associated with deficit/delayed

Adaptive Agriculture for cash crops like cotton, sugarcane, vegetables and horticulture in all 4 clusters of the project area

Similarly, adaptive agriculture is also proposed for cash crops. This activity proposes cultivation of cash crops like cotton, sugarcane, vegetables and other horticulture crops in 5500 acres. From the second year, assistance as required for cultivation in 1 acre will be provided to all the farmers. Farmers who take up cultivation of these pulses as per the area envisaged will be provided assistance. The area will be covered in a phased manner in the entire project period.

Farmer Field School: Field demonstrations will be held in all 51 villages with methodology of farmer field schools (FFS) where a specific area would be selected in each village and Field Level Demonstrations as well as class room presentation will be undertaken on a regular basis. New ideas or technology in specific crops may be discussed and propagated in these schools.

Support services

Pollination services through bee-keeping – In the villages of the project area, assistance would be provided to train bee-keepers, who could provide pollination services at nominal charges to the farmers growing pulses and other crops in the project.

Managing ecosystem services: the case of pollination - Over 75 percent of the leading global food crops are dependent on pollination services provided by animals. Pollinators, especially bees, affect 35 percent of the world's crop production. The global economic value of pollination services is estimated to be US$ 214 billion per year (Gallai et al., 2009). However, pollinators can be sensitive to rising temperatures, and crop growth may equally be affected by high temperatures and drought. These changes can potentially cause dysfunctions in plant-pollinator interactions (Kjøhl et al., 2011). Pollination-friendly management practices contribute building resilience in ecosystems (at the landscape level). In multiple agro-ecosystems and ecologies, pollinator-friendly management practices have been identified that serve to enhance yields, quality, diversity and resilience of crops and cropping systems.

ii. Please justify with regards to components as on the concrete adaptation activities of the project, and how these activities contribute to climate resilience

The components of the adaptation activities have been detailed in the previous section (ii), and the following brings out how these activities contribute to climate resilience.

- The**baseline integrated socio-economic and ecological survey for assessment** ofvulnerability to climate change and planningfor land use and water budgeting will provide the basis for adaptation planning, identification of specific locations, farmer householdsfor easy implementation. Specific tools will be used to carry out the baseline survey and assessment.

- **Climate resilient technology transfer for enhancing the adaptive capacity of the community** - Systematic Crop Intensification, Adaptive agriculture, inter cropping, agro horticulture farming practices will be introduced to improve the total yield, reduce the need for external inputs & seeds as well as improve labour efficiency mainly through popularizing a combination of drought & heat tolerant field crops, fast growing & multipurpose perennials and livestock.

  Using **SRI methods**, smallholding farmers in many countries are starting to get higher yields and greater productivity from their land, labor, seeds, water and capital, with their crops showing more resilience to the hazards of climate change.

  Through **Adaptive agriculture, the integration of bio-fertilisers** and bio-pesticides with reduced usage of chemical fertilisers and pesticides has stabilised yields and has also led to increase in yields in some cases.

  Community paddy nurseries–Staggered community nursery serves as a local adaptation strategy at the village level to combat the problems experienced by farmers during deficit rainfall seasons in lowlands.

- **Effective water conservation measures (Community Lift Irrigation with Solar Water Pumps &micro irrigation) for agriculture productivity and environmental sustainability**–

With respect to Community Lift Irrigation using Solar Water Pumps, experience in several countries shows how solar irrigation pumps can make farmers more resilient against the erratic shifts in rainfall patterns caused by climate change or the unreliable supply and high costs of fossil fuels needed to operate water pumps. Solar pumps can displace fossil fuels, reducing carbon emissions and general pollution while providing a consistent source of energy suited to irrigation pumps.

Because of its high efficiency (less non-beneficial soil-water evaporation, wind drift, evaporation of canopy-intercepted water), microirrigation reduces the irrigation water volume required to grow crops, which can lower the risk of water supply shortages for irrigation.Microirrigation allows for flexibility in the timing and amounts of applied water according to the evapotranspiration/plant demand.Because less water is applied, nutrient leaching is reduced.Nutrient applications can also be better timed to meet plant needs. Application of fertilizers in irrigation water means the nutrients can be delivered directly to the root zone.Microirrigation allows for the use of polyethylene mulch, which helps soil-water conservation and reduces fertilizer leaching from rainfall.Sub-surface Drip Irrigation has been shown to result in substantial decreases in N2O emissions when compared with emissions under furrow irrigation (Sanchez-Martin et al. 2008).

b) Details on Economic, social and environmental benefits project / programme

(Reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations)

Activities	Key benefits		
	Social	Economic	Environmental
Component 1: Baseline Survey and Integrated socio-economic and ecological assessment andplanning			
Baseline Survey& Land use and Water budgeting plan	Micro planning involving scientists, community, Panchayat helps in building the ownership and realization of theplan	Judicious use of natural resources,increasedproductivity, increased income	Assessment of existing resources, water harvesting, improved use of seasonal and permanentfallows, adaptability to climate variability,increased surface waterutilization
Component 2: Climate resilient technology transfer for enhancing the adaptive capacity of the community			
Water conservation	Better management of land & water, vegetative cover increases, work opportunity created for the landless	Increased opportunity of income by increasing the cropping intensity by 200%	Increased water use efficiency, less chemicals in the air due to reduced evapo-transpiration
Support for adaptive farming techniques and promoting intercropping, pollination services.	Sources of income diversified, employmentopportunitycreated, engagement of women increases their contribution in the family thereby increasing their social status and decision-makingpower.	Risks and cost recovery will be distributed over various sub-systems, whereby the wastes of one will be used as input for the other. Total production of the farm willincrease.	Maintainance of nutritional status of soil. Effective pollination resulting into more seed setting naturally
Component 3: Knowledge Generation and Management			
Mass awareness generation aboutclimate change	Ruralcommunity, children, PRI members are better prepared about the climate change impacts Access to projectlearnings	Awareness created about judicious use of resources.	Best practices of sustainablenatural resource management identified for replication and scalingup.

Knowledge generation and dissemination	Recognition of the community as a key stakeholder in policy development for climate adaptation	Priority areas for economic investments identified	Contributes to the development of Sustainable natural resource management practices and policies

c) *Sustainability of intervention*

iii. How will the project assure that the benefits achieved through its investments are sustained beyond the lifetime of the project?

Sustainability of the interventions primarily depends upon three important factors, i.e., Institutional (institutional arrangement), Financial (return to the farmers from the adaptive practices) and Environmental (minimized degradation of local environment and optimal use of natural resources in a scientific manner without over exploitation). For the sustenance of the proposed intervention, beyond the life of the project, current and proposed institutional arrangement will ensure its follow-up under different other schemes.

Project implementation will be mainly through Watershed Committees formed under the IWMP projects. These Watershed Committees are registered and under the purview of Gram Panchayats. These Watershed Committes have had experience in implementation of Watershed development projects and has funds for maintenance of assets created. Further, watershed committees will be responsible for identification of Climate volunteers, who will responsible for dissemination of climate related information. Hence, even after the project comes to an end, if the services of climate volunteers are required those may be maintained by the Watershed Committees through its own funds.

The learning from the project will be documented and shared widely and the present / proposed institutional arrangement will take up such learning in other locations for higher benefit to farming community. Different schemes that are being implemented or will be implemented in future will also be designed strategically from climate resilient perspective. Return to the farmers from adaptive practices is essential and it is expected that with good return from the proposed coping measures, farmers will continue to adapt to the practices for a long-term gain. Apart from that, environmental concerns that are existing at present will reduce further which will act as an input for the farmers and local people to continue such practices for a longer period. The lessons learnt from this pilot will also be an input for the policy makers to make it a part of future action in climate change adaptation.

d) Analysis of the cost-effectiveness of the proposed project / programme:

i. Cost effectiveness will compare alternative options available and how the proposed components/ intervention are best for given climatic conditions. It will also how the community has preferred the selected interventions and their views / concerns are addressed while designing the project/ programme The proposal should compare to other possible interventions that could have taken place to help adapt and build resilience in the same sector, geographic region, and/or community.

Sub-component	Current addressing mechanism and loopholes	How this project trying to address this	Cost effectiveness
Land Use, Water budgeting and planning	Water harvesting ThroughIWMP, MGNREGA etc. hardly considersfutureclimatictrends. Support for bore well, submersible pumps are causing moretrouble.	Including climate perspective in the planning through considered reduction of water foot print, calculate water demand for future and predict suitable location through trend analysis. The focus is more ondemonstrating some small irrigation measures and taking it to the mainstream planning. Cultivation of low water demanding local crops will also be taken up.	When compared, the planning exercise is bringinginvaluable climate resilience factor in the mainstream planning so that all the plans are converged and contextualized - which will make the entire investment, from this project and other schemesbythe mainstream, sustainable and usable in the longer run and addressthewaterstresssc

Efficient Water Managementthrough Community Lift Irrigation using Solar Water Pumps and Microirrigation	Water conservation has been taken-up underIWMP & RKVY.Microirrigation has also been considered under NHM & NMMI. However, Microirrigation has not been considered or implemented in a wider scale and hasnotincludedclimate concerns in the design andimplementationmechanism.	From the baseline survey, specific points would be identified for Community Lift Irrigation. Climate concern as component design, wherein the stored water lifted will reduce the uncertainty of rain-fed farming, improve cropping intensity, productivity. Microirrigation, because of its high efficiency (less non-beneficial soil-water evaporation, wind drift, evaporation of canopy-intercepted water), would reduce the irrigation water volume required to grow crops, which can lower the risk of water supply shortages for irrigation.	Existing learning from community based water conservation based projects / programmes would be incorporated. The stakeholders would be involved in planning, execution and monitoring, use of locally available material would be encouraged.
Technology transfer, Sustainable Crop Intensification, Inter crop Farming System	Efforts are not integrated and holistic. Location specific design are not popularized. Integration of climate concerns in farming systems is lacking	Technology transfer through Sustainable Crop Intensification (SCI), Urea Deep Placement (UDP) technique and Biological Nitrogen Fixation (BNF) will be used. The skill and knowledge of farmers will be enhanced and they will be able to design their production system according to climatic situation.	Creation of models. Use of existing extension channel and network is envisaged under implementation.

Disasterproofing measures like seed banks of local seeds andfodderbanks	Such measures are notavailable due to which availability of seed as well as fodder during stress periods is limited.	To mitigate with the disastersituation the fodder will be stored at low cost at the time of harvest.	The storage structureswill be made using locallyavailable materials so that those can be maintained locally. Farmers will themselves store seed and will be able to sow at proper time. The local methods, practices and materials will be combined with appropriate knowledge to reduce the cost in longterm.
Sharing of best practices	Limited or no Existing channels of knowledge dissemination related to climate change. Non-availability of location specific information related to climate resilient technologies	Information and knowledge dissemination material would be published and circulated. Training and network meetings would be conducted.	The wide range experience sharing will be made through circulation of low cost public education materials. Use of world wide web (www.) through creation of website.Existingextensionchannels would also be used.

A comparison of the chosen options vis-à-vis alternative options has been provided in the table below:

Activity	Proposed Alternatives	Benefits (of Proposed Activity)
Vulnerability analysis, specific to agriculture and allied sectors, including irrigation sector;	General assessment instead of scientific assessment of sector and community vulnerability	Generating Scientific data on climate change and adaptation for future measurement in agriculture sector
Identifying priority interventions within the sector along with target mass, crop specificity etc.;	Taking up all actions in general without specificity of agro-climatic situation and crop.	More localized action in-adherence to adaptation requirements as per the agro-climatic and crop requirement
Introduction of climate adaptive cropping system as per the assessment findings;	General cropping system promotion, does not climate proof investment	More adaptive to climate variability through appropriate crop planning.
Adaptive agriculture with Integrated Nutrition Management and Pest Management for each crop in project locations;	General / common plan or no plan; business as usual	Better and efficient way of input management along with nutrient management pest management along with organic pest treatment methods
Assessment of feasibility of inter-cropping / mixed cropping and its promotion;	Mono-cropping without any inter-mixed cropping	Pest resistance and increased output per unit area; better adaptation to climate variability.
Farm level water management in rain-fed & water stress areas through drip/sprinkler systems;	Common / flood irrigation system	Irrigation management, efficient water use, better yield from marginal land, minimize conveyance loss.
Promotion of climate resilient varieties in specific crops in collaboration with Agriculture University;	Growing common varieties	Better adaptive capacity to climate variability, less production loss and better economic return
Training / Orientation of target farmers on climate resilient agriculture / horticulture;	General training without any reference to climate	Better adaptive capacity, availability of alternatives to cope,

Promotion of Integrated Farming System, taking in to account livestock and agriculture;	Farming as usual, mono cropping	Risk sharing during climate stress situation through supportive livelihood.
Extension services and hand holding support to target farmers from time to time;	Marginal outreach or individual effort and it lowers adaptive capacity	Improved understanding on climate resilient farm practices
Demonstration of different package of practices that are adaptive to climate variability;	General demonstrations that are in practice at present	More scientific understanding of farmers about different applications / practices
Water harvesting structures in the water stress / rain-fed areas;	Using common irrigation system or rain-fed farming does not address climatic stress	Better water availability, soil moisture retention, minimizing dry spell impact.
Documentation of project learning & dissemination;	Usually not recorded systematically	Improved learning of other farmers, dealing with bottlenecks through appropriate strategies.
Institutional Arrangement: Constitution of Steering Committee (PSC) and Task Force for Monitoring	General implementation frame like most of the current schemes	Better technical advice, measurement & tracking of climatic factors, translating adaptation mechanisms in to learning

ii. Weighting of project activities:

How much funding will be allocated to 'investment activities', 'capacity building activities' and 'project management activities' respectively?

Type of Activity	List of Activities	Funding Requirement
Investment Activities	Baseline survey, Assessment & Planning	2503000
	Paddy package, community paddy nurseries & mechanised transplanters. Rabi Jowar	19754010 1782000
	Pulses package	10866710
	Cash crops	17702000
	Support services	1755000
	Support to Drip & Sprinkler	136400000
	Community LI with Solar Water Pumps &Microrrigation	6400000

	HDPE Reinforced Geo membrane fro lining of Farm Pond	9600000
	Plastic filmMulching	3200000
	Sub-total	**21,43,71,720**
Capacity Building Activities	Community Sensitisation, Farmers Orientation and Training of Farmers Farmer's Field Demonstration Managing Operations Learning and Knowledge Management	76,60,000
	Sub-total	**22,20,31,720**
Project Management Activities	• Monitoring and evaluation of the project • Co-ordination between various stakeholders • Supervision of operational activities • Mid-year and Final Review	**1,63,51,000**

e) Alignment with the National and State Action Plans and other Policies / Programmes:

(Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist)

This project is aligned with the Maharashtra's State Action Plan on Climate Change. The recommendations of SAPCC, to which this project is aligned to are as follows:

- Promotion of heat-tolerant and early maturing varieties.
- Measures to conserve soil moisture for winter and summer crops, Preservation of good agricultural land in peri-urban areas through designation of urban food zones around major cities to source the city's food (e.g. vegetables, milk, eggs), reduce its carbon footprint, and secure its food supply chain against climate risks.

Further, the Action plangives the following:

- Provide seeds for short duration and improved varieties of crops (e.g. ICRISAT varieties), intercropping with short duration red gram and soybean, drought tolerant variety of Bengal gram (e.g. Drought tolerant Digvijay variety of Bengal gram developed by the Mahatma PhuleKrishiVidyapeethRahuri).

- Develop a network of gene banks to exchange germplasm and establish good practices for maintaining gene bank base collection and seed vault (community level and at state level) and use for isolating resistant traits.
- Educate farmers through KVKs on likely changes in pests and pathogens under climate change scenarios and their prevention/treatment.
- Enhance resilience of farming systems through diversified cropping patterns, soil conservation, and value addition
- Provide start-up funds for community-managed grain banks to supply good drought-resistant seeds and to maintain stocks for food and fodder security.
- Develop village-level drought risk maps showing soil quality, irrigation availability, and zones where drought has greater impact on crops. Such maps can be developed for every village in a participatory manner and digitized in a GIS platform.

The recommendations for the water sector in SAPCC are:

- Enhancement of water storage and groundwater recharge
- Improvement of water use efficiency

The project is also clearly a climate change adaptation project and is aligned with climate change requirements under SAPCC.

Reducing GHG emissions from Indian agriculture is essential and different steps can be taken in this regard. The report of the sub-group on climate change for 12th Five year plan proposes different approaches that have been tested at experimental scale to reduce emissions in Indian agriculture. Some of these that are relevant for Indian conditions, suggested by the sub-group are;

- Improved water and fertilizer management in rice fields could reduce emissions of GHGs. There are possibilities for crop diversification as value added from different crops is gaining importance under globalization and supply chain management
- Improved management of livestock population and its diet could also assist in mitigation of GHGs.
- Approaches to increase soil carbon such as organic manures, minimal tillage, and residue management should be encouraged. These have synergies with sustainable development as well.
- Use of nitrification inhibitors, such as neem-coated urea, and fertilizer placement practices need further consideration for GHG mitigation.
- Improve the efficiency of energy use in agriculture by using better designs of machinery, and by conservation practices.

The National Action Plan on Climate Change (NAPCC) foresees to promote dry land agriculture with particular relevance to adaptation, promotion of drought resistant varieties and improving methods of soil and water conservation.

The proposed project looks at achieving both national and state objectives and also a step towards fulfilling the mandate of 12th plan propositions on climate change adaptation.

f) Component wise technical standards:

(Describe how the project / programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, standards related to pollution control, etc. The details need to be provided for each of the interventions proposed)

S.No.	Activity	Applicable Standard	Application to Project
1	Baseline survey	As done under IWMP and standard vulnerability tools developedby WOTR	As per standard methods
3	Paddy, Pulses, packages	Standardised techniques developed by Mahatma Phule Agriculture University	As per standard methods
4		Standardised techniques developed by KVKs	As per standard methods
5	Inter cropping, Integrated farming & Agro horticulture	Standardised techniques developed by KVKs, MPKV, NABARD and local NGOs	As per standard methods
6	Water Conservation structures	Standardised techniques under IWMP and by local NGOs	As per standard methods

g) Duplication Check:

(Describe if there is duplication of project / programme with other funding sources, if any)

No.	Project Activities	Complementarity	Geographical Coverage/ Agency
1.	Land Use & Water budgeting plan& vulnerability assessment	Complimentary to that done under IWMP	All the 51 villages in 4 clusters of 2 districts viz. Nandurbar&Buldhana
3.	Sustainable Crop Intensification, Adaptive agriculture using Urea Briquettes & Biological Nitrogen Fixation	New to the project area however technology demonstrated by KVKs in 3 villages	Paddy & Wheat in 37 villages of Nandurbar and for the remaining crops in all the 51 villages in 4 clusters of 2 districts viz. Nandurbar&Buldhana

4.	Inter cropping	Complimentary to that done under RKVY, KVK's demonstration plots & NABARD's programmes	All the 51 villages in 4 clusters of 2 districts viz. Nandurbar&Buldhana
5.	Water conservation	Complementary to the measures taken under RKVY, NMMI	At suitable locations in 4 clusters of 2 districts viz. Nandurbar&Buldhana

h) Details on Stake-holder consultation:

(Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations).

Consultation	Date/Place	Participation	Objective	Outcome
Vasundhara Watershed Development Agency (VWDA), GoM	14.01.2016	• Director • Programme Officer	Purpose of Project, workable action plan and Identification of project area	• The agency has identified four clusters in two blocks of Nandurbar and Buldhana respectively. • IWMP interventions have been implemented in these regions but climate change and unseasonal rainfall has led to the need for inclusion of integrated development with more focus on climate smart technology and agronomic practices. • The various sectors identified by VWDA ○ Water Resources ○ Sustainable agriculture ○ Energy Efficiency, Renewable Energy & solar Mission ○ Knowledge Management ○ Weather advisory • Focus of VWDA towards Water resources as the project areas identified are drought prone and highly affected by rainfall variability
Indian Meteorological Department	14.01.2016	Director, IMD	Role of IMD and possible Eco-development activities	• Possibilities of IMD providing support in installation of Automated Weather Stations, calibrations required and cost norms of different equipment's were identified for setting up in the project areas • Different aspects of weather advisory services were discussed and different costing norms and required.
WOTR	14.01.2016	Executive Director	Work undertaken by WOTR on climate change adaptation	WOTR has worked extensively on climate smart agriculture and watershed development projects. The Akole project implemented by WOTR was for Climate Change Adaptation Providing agro weather advisory services was an important part of their programme and working in collaboration with PDKV university, they have created implementable interventions with the objective of making the villagers in Akole adaptive to the changes in climate.

Lupin foundation	15.01.2016	Project Manager	The mandate of Lupin foundation in Nandurbar, The interventions completed and potential of the district	Lupin foundation has identified Nandurbar district as a potential district for implementing their CSR activities. They have mainly focused on watershed development activities with construction of check dams. The foundation also suggested a comprehensive plan which incorporates sustainable agriculture with watershed development in the district.
Indian institute of Tropical Meteorology	15.01.2016	• Scientist, Centre for Climate Change Research , IITM	Obtain Climate data and related studies	• The project has been conceptualised based on the Knowledge Management practices of the state. Major data heads considered while formulating the project are : o Temperature & Rainfall data o Temperature & Rainfall projections o Climate change projections • Weather projections for the project area based on IMD data • Baseline data from 1959-2000 was used for making projections for year 2040, 2070 & 2100. • Projections based of different models to calculate Rainfall, temperature, moisture, solar radiation etc.
CBRTI (Bee research institute)	15.01.2016	Assistant Director	Information on pollination services and technology	• There is scope for pollination services in the project area • List of agencies providing pollination services in the districts • Using of pollination services highly beneficial and cost effective, which also provides for alternative livelihood options for drought affected farmers in the region.
College of agriculture, Pune	15.01.2016	Head of the Department – Department of Meteorology	Advancements in agronomic practices for adaptation to climate change. Identifying model package of practices for farmers	• New technology and package of practices were provided by the department • Support for capacity building may be utilised • Costing of a kits with the suitable package of practices for different crops of the region were provided.
PIA - Buldhana, IWMP	05.02.2016	• Project manager (DSAO) • Additional Project manager • Deputy Project Manager	Understanding the interventions already undertaken and Details about the project area	Buldhana is one of the most climate change vulnerable and affected districts in the state of Maharashtra. The DSAO informed that the rains have been highly variable during the year, and it had recorded rainfalls of more than 10 mm in eight months during the year 2015. Due to the closeness to Khadakpoorna dam, lift irrigation in most of the project villages was possible.
KVK, Buldhana	05.02.2016	Director	Agronomic practices followed in	The KrishiVigyan Kendra and Agriculture Research Centre are the major information and technology training and capacity building institution in the district.

and ARC, Buldhana			the project area and technological advances to adapt to climate change in the district	They are planning to adopt a village in consortium with CRIDA for helping the village adapt to the effects of climate change. The KVK advised on the suitable best practices in the project area and additional agronomic technology to help the farmers in the villages to adapt to the effects of climate change.
NICRA-AICRPAM project, Village Yeolgaon, Buldhana	05.02.2016	Villagers, Research fellows	Understanding the model of operation and its replicability	CRIDA has experimented with climate change adaptation in two villages in the district of Buldhana. The team visited one village and tried to understand the operational model of the project • Major activity was training and capacity building along with providing weekly weather advisories • One Research fellow is placed in each village who tracks the weather pattern and advisory received from the main office. He then advises the farmers accordingly. • They have planned to setup an instrument bank which shall have all the necessary equipment's required for the different crops in the area.
PIA – Taluka Agriculture Officer	06.02.2016	Taluka Agriculture Officer	Identifying potential areas and Collection Taluka / project level data	The IWMP 3 and IWMP 4 clusters in the block Deulgaon raja consists of 7 villages each.
Selected villages	06.02.2016	Villagers /farmers of villages – Pangri, SingaonJahagir, Asola	Identifying issues specific to climate change and to locate potential areas and interventions	Field visit to project area villages – Pangri, Asola, SingaonJahagir • The villages are heavily affected by the climate variability with many farmers losing more than 80-100 percent of their crop during the last season. • Lack of access to water was the major issue raised. • Increased incidence of pests and diseases. Rise in soil borne diseases. • Less than five percent of the farmers use mechanized agriculture techniques with little understanding of climate change adaptability. • Some crops like wheat and soy have minimal mechanization for harvesting and weeding. • Potential areas for watershed interventions: • Cluster 3 – Canal deepening and desilting, well recharge structure, farm ponds, lift irrigation from Khadakpoorna Dam (all the villages except village PimpalgaonBk) • Cluster 4 – Community tank, farm ponds, Deep CCT, Kolhapur bund, Earthen Bunding, lift irrigation from Khadakpoorna Dam (all the villages except villages KhayalGhavan, Chinchkhed)

<table>
<tr><td></td><td></td><td></td><td></td><td>Weekly/fortnightly Weather advisories would be very useful for the farmers, Both in the form of sms and pamphlets was advised by the farmerss</td></tr>
<tr><td>Office of DSAO, Nandurbar</td><td>11.02.16</td><td>DSAO and NGOs working in the district</td><td>Identifying problems related to climate change in Navapur, interventions already taken up in the district & recommendations of activities that may be taken up in Navapur</td><td>

Earlier, the average rainfall in Navapur was 1250 mm. The average rainfall over past two years has decreased to 850 mm. Due to decrease in average rainfall, cropped area under sugarcane has decreased; the productivity of the crop has reduced & rate of sugarcane received by farmers has decreased too. Land has been diverted to paddy crop.
Overall productivity of paddy has also been affected due to poor rainfall.
Due to poor rainfall, fodder availability in the area has decreased too. While, no. of animals have reduced too.
Natural water resources in the region are bore well & percolation tanks. Of the bore wells available in the region, most of them have dried. While, water related problems persist.
The rate of migration in the region is very high

Interventions taken up in the district:
Lead crop scheme- In this scheme, paddy was taken as the lead crop as most of the farmers grow paddy. Instead of sowing method, transplanting method was demonstrated to farmers. This solved the productivity (yield per hectare) related problems of farmers. Also, red gram was taken up for inter-cropping with paddy.
Abiotic Stress Management- Under this initiative, demonstration and training was taken up regarding cultivation practices of crops and vegetables, etc.
Animal husbandry related activities: The population of local variety mulching animals has decreased. The local variety animals are more suitable to the climate in the region as compared to hybrid varieties that are more susceptible to diseases. Local variety may be promoted while milk collection centre may be established. Rate of milk that may be received by farmers is higher in the region.
<table>
<tr><th>Animal</th><th>Rate of milk in the district</th><th>Rate in other di</th></tr>
<tr><td>Cow</td><td>Rs. 28/litre</td><td>Rs. 15 to Rs. 20</td></tr>
<tr><td>Buffalo</td><td>Rs. 42 to Rs. 45/litre</td><td>Rs. 25/litre</td></tr>
</table>
Poultry: Navapur was the hub of poultry related activities prior to bird flu in 2006. Post bird flu the poultry activities in the region have become dormant. Hence, as the rest period of around 10 years is over, poultry related activities may be re-started. Mortality of broiler variety is high and they are more susceptible to diseases. Hence, local varieties may be promoted.
</td></tr>
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				S. No	**Animal**	**Estimated rate of milk in the district**
				1	Broiler	Rs. 100 to 140 per Kg
				2	Local	Rs. 350 to per kg
KVK, Nandurbar	11.02.16	Officer in-charge & other specialist officers	Agronomic practices taken up in the project area and technologies used to adapt to climate change in the district	The KVK had taken up various model practices and have been demonstrating the same to villagers: **Manually operated weather station**: Manually operated weather station was set up in Umrani village where heat stress drought occurred while it was rainfall intensive too. Rainfall readings were taken daily. Other than this voice/text messages were sent to a group of literate farmers who owned mobile phone. The messages were sent from Commissionerate office of Pune or KVK, Nandurbar. Village level climate risk management committee (VLMRC) was set which constituted of 10 to 12 members. **Technology demonstration:** Technology demonstrations were taken up in Umrani village for short duration crops of Maize (a fodder variety, GM 6), spraying of KNO_3, improved variety of lucern RL 88 (fodder variety)etc., were demonstrated. Other than this demonstration of local variety goats (Giriraj, Vanraj&Kadaknath) was taken up. Local variety goats are more suited to the climate of Nandurbar (drought conditions), use of feeding area specific mineral mixture for goat kids were demonstrated too. Around 10 farmers were covered and demonstration was carried out for 20 animals. **De-worming camps**: De-worming camps were taken taken up for ruminants. **ShetkariSuvidha Kendra** (common facility centre) for farmers were formed too. **Automated weather station**: A weather station was established in KVK. Weather related information for around 12 villages were in the radius of 5 to 6 kms was collected by the weather station. **Establishment of custom hiring centres:** Custom hiring centre was established in a village by KVK.Around 29 types of machines were purchased and the total cost of the machines was Rs. 6.10 lakh. Farmers of 16 hutments of a village were covered. **Onion seed production:** KVK had also taken up demonstration of onion seed production. On an average the productivity was 600 kg per hectare. The rate for onion seeds was Rs. 1500 per kg while the expected income per hectare was Rs. 2,50,000 per hectare. Onion seed production is a great opportunity for farmers in the region to earn remunerative income. **Bore-well recharge:** Bore-well recharge system was established in the KVK itself for demonstration. As the district falls in the water stressed zone it becomes imperative to save run-off water. The cost purchase of purchase of round pebbles, cement pipe, etc., was around Rs. 20,000 while other costs associated were cost of			

				labour for digging 300 ft (@Rs. 65 per feet). The radius of the hole was 6 ft. **Preparation of seedlings of vegetables**: KVK had taken up preparation of seedlings of brinjal& tomato in controlled atmosphere using coco-feed. After preparation of seedlings, they are sold to the farmers @ Rs. 104 per crate. This can be used as an important opportunity by youth as recommended by specialist officers.
Seed Bank, Deolipada (Nandurbar)	12.02.2016	TAO & seed bank manager	Understanding the set-up of seed bank	**Seed bank:** Seed banks have been established at villages in Vasarwadi, Deolipada. In some of the villages, farmer level seed banks for chick pea, red gram and paddy have been established. In Deolipada, the seed bank has been privately established by an individual. Seeds of paddy, tuar dal, moong dal, jowar, bajra, ragi, vegetables had been stored.
Selected villages	12.02.2016	Villagers /farmers of villages – Vadsatara&Bandhare	Identifying issues specific to climate change and to locate potential areas and interventions	**Vadsatra village (Cluster 3):** The village has faced drought from past 2 years due to decrease in average rainfall from 1250mm to 850 mm. There are around 350 households in the region while the population of the village was 1600 (approx.). The farmers were majorly small &marginal.The farmers had taken up transplanting method of paddy rather than sowing method. The yield from sowing method was 2 to 3 quintals per acre. While the yield from transplanting method was 10 to 12 quintals per acre. **Soil and water conservation activities taken up in the village:** • Terracing • Compartment bunding • CCT & deep CCT • Repair works of dam • Well recharge **Sources of irrigation in the village:** Bore-well & dug well were the main sources of irrigation. The villagers also took up canal irrigation. **Other livelihood activities:** Poultry, goat rearing and dairy was taken up by around 5% to 10% of the population only. **Weather related information received by farmers:** The mobile numbers of farmers who were literate and owned mobiles were registered by KVK, Commissionerate of Agriculture (Pune) and others.Messageswere sent to the farmers weekly. However, frequency of messages depended on the urgency or sudden change in weather. Scope for weather advisories was felt as weather related information is more reliable at block level **Bandhare village (Cluster 1):** There are around 360 households in the region while the population of the village was 1700 (approx.). The farmers were majorly small & marginal (60%).

				Soil and water conservation activities taken up in the village: • Terracing • CNB • Nala deepening **Sources of irrigation in the village:** River, bore-well & dug well were the main sources of irrigation. The villagers also took up lift irrigation. However, the level of water in the river has decreased. Hence, lift irrigation may not be viable. **Other livelihood activities:** Poultry, goat rearing and dairy was taken up by around 5% to 10% of the population only. **Skill based training were required in the village. Financing of economic activities by FIs was poor in the village.** **Weather related information received by farmers:** The mobile numbers of farmers who were literate and owned mobiles were registered by KVK, Commissionerate of Agriculture (Pune) and others (50 to 60 farmers).Messages were sent to the farmers weekly. However, frequency of messages depended on the urgency or sudden change in weather. Scope for weather advisories was felt here too.

i) Learning and knowledge management component to capture and disseminate lessons learned for the proposed project

The learning and knowledge management component of the project would aim at improving awareness regarding climate change and its impacts, and at increasing popularity of climate resilience practices in the targeted area. For this purpose, various means would be used, such as developing a dedicated website and printed materials, and arranging environment education classes/events in schools targeting direct beneficiary families and indirect beneficiaries. The component would also build networks and partnerships with relevant organisations for strengthening awareness and ownership of adaptation and climate risk reduction processes at local, state and national levels. At the district level, workshops, seminars, meetings, trainings, etc. would be organised with different stakeholders.

The project will take required steps for dissemination of the learnings/ outcomes from the project through films, dedicated website and other printed materials. Mass awareness generation among all the stakeholders including the school children through rallies, Graffiti, village fairs, farmers' convention, days celebration, awareness camps will be given priority. The documentation of best practices, and success stories will help to share the learnings at local, state and national level for wider adoption. Workshops at local, state and national levels will be organised with the participation of PRI members, Block/District/State level officials of different government departments, NGOs, and

Scientists for large scale dissemination of the project outcomes. Technical and policy papers produced as part of the project as well as advocacy films shared in these workshops are expected to include similar approaches in the state and national plans so that the models evolved out of the project could be up scaled in the entire red and lateritic soil zone spread over different states of the country.

j) Sustainability of the project/programme outcomes has been taken into account when designing the project / programme

Sustainability of the interventions primarily depends upon three important factors, i.e., Institutional (institutional arrangement), Financial (return to the farmers from the adaptive practices) and Environmental (minimized degradation of local environment and optimal use of natural resources in a scientific manner without over exploitation). For the sustenance of the proposed intervention, beyond the life of the project, current and proposed institutional arrangement will ensure its follow-up under different other schemes.

Involvement of already functioning Watershed Committees will ensure sustainability. Further, these bodies are elected by the villagers. Maintenance funds at the disposal of these Committees will give them an option of retaining of climate volunteers for dissemination of timely and valuable information.

The learning from the project will be documented and shared widely and the present / proposed institutional arrangement will take up such learning in other locations for higher benefit to farming community. Different schemes that are being implemented or will be implemented in future will also be designed strategically from climate resilient perspective. Return to the farmers from adaptive practices is essential and it is expected that with good return from the proposed coping measures, farmers will continue to adapt the practices for a long-term gain. Apart from that, environmental concerns that are existing are present will reduce further which will act as an inputs for the farmers and local people to continue such practices for a longer period. The lessons learnt from this pilot will also be an input for the policy makers to make it a part of future action in climate change adaptation.

k) Provide an overview of the environmental and social impacts and risks identified as being relevant to the project / programme.

Check-list of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management
Compliance with the Law	The project complies with Environment (Protection) Act, 1986 and Forest Conservation Act,1980	**None**
Access and Equity	The project provides fair and equitable access to the project beneficiaries and will not be impeding access to any of the other requirements like health clean water, sanitation, energy, education, housing, safe and decent working conditions and land	**None**

Marginalized and Vulnerable Groups	The project is basically aimed at providing livelihood and income to marginalised community living in the project area and as such will not have any adverse impact on	**None**
Human Rights	The project does not foresee any violation of human rights	**None**
Gender Equity and Women's Empowerment	The project will ensure participation by women fully and equitably, receive comparable socio-economic benefits and ensure that they do not suffer adverse effect	**None**
Core Labour Rights	Payments to labour under the project will be made as per Government approved norms duly following minimum wage rate and hence ensuring core labor rights.	**None**
Indigenous Peoples	The project will ensure to comply with the rights of the indigenous people set forth by the UN declaration adopted by the Government of	**None**
Involuntary Resettlement	The project does not displace any community and hence no issue ofresettlement	**NIL**
Protection of Natural Habitats	The project does not affect any of the natural habitats but will ensure the conservation and regeneration of biodiversity in the project	**NIL**
Conservation of Biological Diversity	The project does not affect biodiversity in any adverse way.	**NIL**
Climate Change	The project is basically for enhancing the adaptive capacity and is not expected to contribute to GHG emissions	**NIL**
Pollution Prevention and Resource	Many activities suggested in the project will prevent pollution and improve efficiency of resource use.	**NIL**
Public Health	No adverse impact on public health related issues is envisaged.	**None**
Physical and Cultural Heritage	No adverse impact on cultural heritage related issues is identified	**None**

3. Implementation Arrangements

a) Describe the arrangements for project / programme implementation.

iv. Who will implement the project and what are their comparative advantages and capacity compared to other potential implementing institutions?

Department of Water Conservation is the nodal agency for implementation.The overall project guidance will be under the State Steering Committee and the implementation will be done by the Department of Water Conservation through Vasundhara Watershed Development Agency (VWDA).

Key Institutions and their responsibility in project implementation

Institution	Responsibilities
Departmentof Water Conservation, Maharashtra	Nodal Department
Vasundhara Watershed Development Agency	Project coordination, supervision and monitoring Overall implementation
Indian Meteorological Department	
State Agriculture Universities (MPKV and PDKV) DSAOs, Department of Agriculture KrishiVigyanKendras, Nandurbar&Buldhana WOTR (NGO)	Adaptive Agriculture Technology Transfer Input supply arrangement Technical details of structures Crop advisories& Training
Local communities	Provide inputs for baseline study Climate volunteers
SHGs, Local Bodies and other Voluntary Organisations	Assist with implementation and training and capacity building on climate change

v. How will the project be coordinated with (and/or mainstreamed into) related development activities of the targeted sector?

At National Level, the Ministry of Environment, Forests and Climate Change, Govt. of India and Department of Water Conservation, Govt. of Maharashtra will be in charge for the project management and organization. At local level, Vasundhara Watershed Development Agency (VWDA) will be responsible for the project management and organization.

Project Sanctioning & Steering Committee

Project Sanctioning & Steering Committee, Maharashtra headed by CEO, VWDA and Commissioner Agriculture will be fully empowered to take all necessary decisions for effective implementation of the project. The Committee will submit an annual report to Ministry of Environment, Forest & Climate Change, Govt of India and State Department of Water Conservation, Department of Agriculture and Department of Environment, Govt of Maharashtra. Project Sanctioning and Steering Committee will comprise of members from

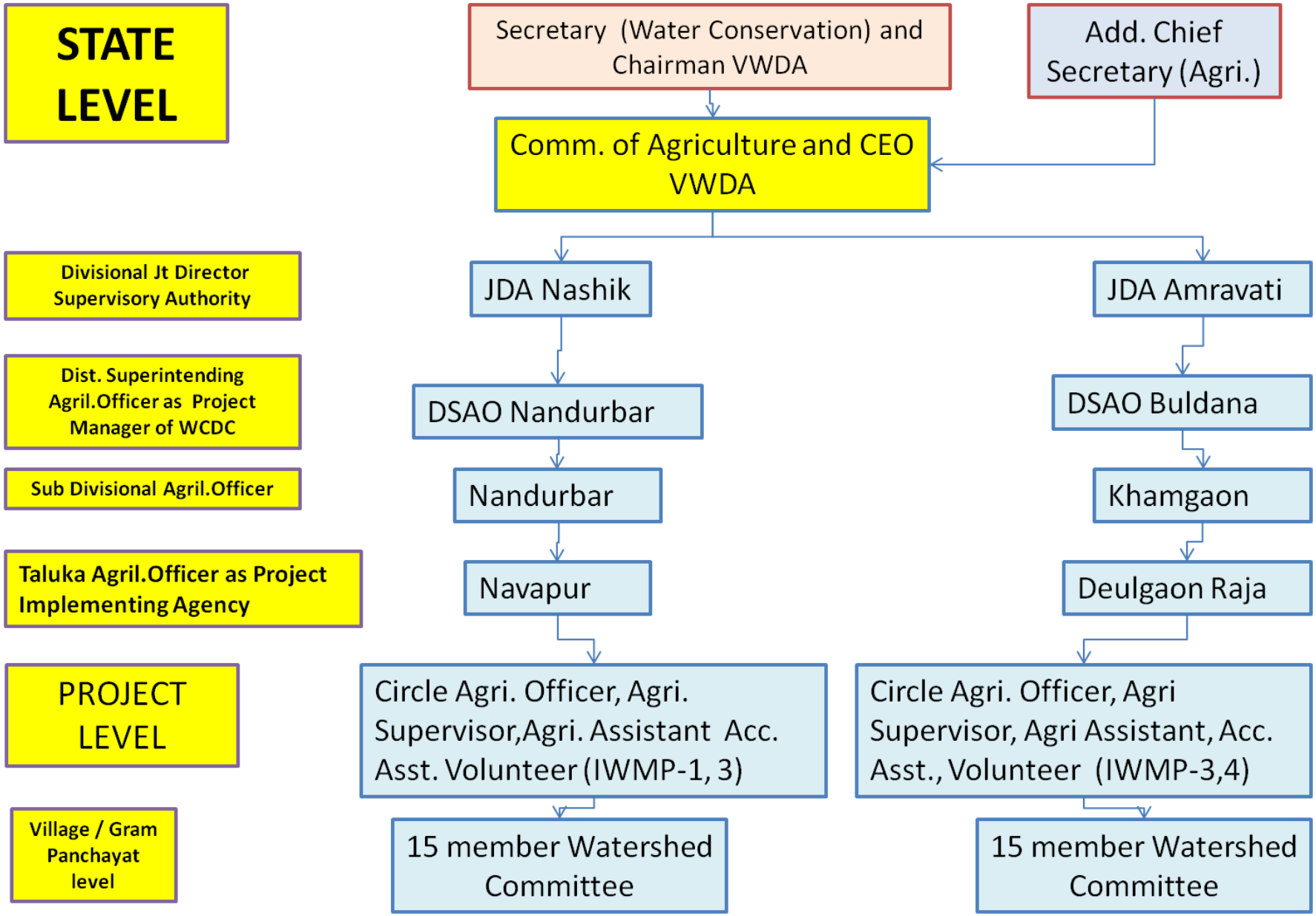
various departments and institutes, shall be empowered to sanction project-wise DPRsand its revisions as well as yearly review of the project activity.

Project Sanctioning and Steering Committee		
Sr. No.	Name and	Designation in Committee
1	CEO, VWDA & Commissioner Agriculture	Chairman
2	Director-SC & WM, Department of Agriculture	Member
3	Director-Horticulture, Department of Agriculture	Member
4	Director-Environment, Department of Environment	Member
5	Deputy Secretary, Department of Water Conservation	Member
6	Collector, Nandurbar	Member
7	Collector, Buldhana	Member
8	Representative, Maharashtra Regional Office, NABARD	Member
9	Representative, Indian Meteorology Department, Pune,	Member
10	Representative, Mahatma PhuleKrishiVidyapeeth, Rahuri	Member
11	Representative, PanjabraoDeshmukhKrishiVidyapeeth, Akola	Member
12	Representative, Groundwater Surveys & Development Agency, Pune	Member
13	Representative, Watershed Organisation Trust (WOTR), Pune	Member
14	Additional CEO, VWDA (Member Convenor)	Member Secretary

At the district level WCDC of PMKSY-Watershed (erstwhile IWMP) will also be functional for the proposed project.

For field Implementation, a separate unit will be formed with 4 Cluster In-charges and each of them will have 1 support staff responsible for maintaining accounts & reporting. At the cluster / village level, field staff would be hired for implementation of various activities. Implementation arrangement is represented by a diagram as shown below:

Project Implementation Arrangements



b) Describe the measures for financial and project / programme risk management (also include environmental and social risk, if any).

Risk	Risk Perception	Response Measure
Local Government fails to prioritize, sustain and upscale support for climate adaptive interventions in their strategies and plans	Medium	Climate change adaptation needs and priorities are reflected in State, National policies and plans, but a void remains at the Block, Gram Panchayat and village level. Inclusion of the learnings and best practices of the project in the future planning at Gram/Block level is
Government officials	Medium	The project will try to conduct awareness sessions continuously with the community as well as with Panchayat and block level officials and also share the project details
Volunteers absenteeism	Low	In each village apart from the responsible volunteers there will be a panel of young people who will also attend the awareness sessions and will be apprised of the tasks of the climate volunteers so that incase of such
Demand for labour near or outside the project area leads to outmigration.	Low	The work opportunity will be created in the villages itself which will restrain the community from outmigration
Major price fluctuation of the recommended commodities	Medium	The project has provisions for converging with different government schemes to counter risks of major
Macro Planning remains in place but participatory planning at local level for adaptive measures is not taken	High	Village-wise plans will be prepared with participatory tools and only these plans will be approved. Village Sarpanchs of respective villages will accompany Taluka Agriculture Officer for presentation of these plans at District as
Policy makers and politicians prioritizeeconomicbenefits over sustainable and resilient ecosystems.	Low	The project will demonstrate cost-effective and economically sound models of adaptation and generate local demand, through communication

Additionaldevelopment (financial and marketing) support for alternate food and livelihoods are unavailable in the project area at the requiredtime	Low	The project has been designed to provide technology and inputs for such climate-resilient livelihoods, in line with the government's national programs for food security, poverty alleviation and village development. All these programs are active in the project areas, further liaison will be made
Groups have been formed but due to difference in economic, social status they are not effective.	Low	The project has been designed in such a way that emphasis will be given towards strengthening of the groups. The quality of the leadership would be made better, so that they themselves will be able to
Lack of awareness among participating communities and local officials on CC and potential impacts	Low	The project aims at working with both the community and the officials. Various awareness and sensitization sessions will be carriedout

c) Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan. (Monitoring and evaluation cost need to be included in executing entity management cost).

Proposed budget for M&E amounts to Rs. 2.20crores approx.(10% of the total project measures cost). The activity wise budget has been worked out.

Monitoring and Evaluation: VWDAshall act as a Monitoring and Evaluation body. Monitoring and Evaluation (M&E) framework is important to assess implementation process with respect to the targets envisioned, financial resources used and strategies accomplished. Further, measurable, reportable, and verifiable (MRV) frameworks for monitoring adaptation and mitigation will be established at the beginning of this project. Monitoring and evaluation system of the project will comprise of following components.

Monitoring & Evaluation Plan Activities	Responsibility	Yr - 1	Yr - II	Yr - III	Yr – IV	Time Frame
Developing M&E framework with indicator matrix and activity scheduling	VWDA, NIE (NABARD) and MELD agencies	↔	↔			1stQuarter, revision required in further quarters
Baseline study and benchmarking	NIE (NABARD) and MELD agencies	↔ 1				1st& 2nd Quarter
Concurrent Quarterly Progress Monitoring	MELD agencies	↔ 4	↔ 4	↔ 4	↔ 4	Each Project Quarters

Annual Monitoring of Physical and Financial Progress	Joint ReviewMission	↔ 1	↔ 1	↔ 1	↔ 1	End of the Project Year
Monitoring & Evaluation Plan Activities	Responsibility	Yr - 1	Yr - II	Yr - III	Yr – IV	Time Frame
GIS mapping of spatial and non-spatial data/ information	GIS Cell of VWDA	↔ 4	↔ 4	↔ 4	↔ 4	Each Project Quarters
Financial Monitoring						
Monitoring of Environmental Parameters and Project Rating against set benchmark	NIE (NABARD) and MELD agencies	↔ 1	↔ 1	↔ 1	↔ 1	End of the Project Year
Joint review						
Mid-Term Evaluation of the Project	NIE (NABARD) and MELD agencies			↔		After 2 Years of Project Execution(Beginning of the Year)
End-Term Evaluation of the Project	NIE (NABARD) and MELD agencies					Within 6 months of project completion

Inception Report: A Project Inception workshop will be held within the two months of the start of the project. The workshop will be attended by the members of the institutions that have been identified as members of the Steering Committee. Inception Workshop will be held for:

(i) Assisting stakeholders to understand the objectives of the project and visualize their respective roles and responsibility in the implementation and results of the project

(ii) Establishing reporting and communication protocols and familiarise with project decision making structure and processes

(iii) Presentation of project activities and major milestones and the expected outcome of the project

(iv) Presentation of the annual work plan to the stakeholders along with the indicators, means of verification, and monitoring and reporting frameworks and schedules. The Inception Report will be submitted within one month of holding the workshop.

Performance Monitoring: Performance monitoring will be done throughout the project period. Monitoring cycle will be quarterly and the report will be shared with the members of the Steering Committees. Performance Monitoring Report will include the following components:

(a) Progress Tracking: Conduct of activities against their time line will be tracked every quarter. The process entails conduct of review meeting and each activity will be tracked in terms of its progress and state of implementation. The review will be followed up with finalizing the next quarter plan of activities that will incorporate spill over and inadvertent delays.

(b) Risk Management: Every quarter the risks will be monitored and the action taken for managing each risk will be reviewed. The exercise will also include identification of new risks and allocation of responsibility for managing it.

(c) Output to Outcome: Tracking Performance monitoring will undertake monitoring and review of output to outcome tracking.

(d) Financial Monitoring: Quarterly financial monitoring will be undertaken in order to review the progress of financial utilization and for ensuring that the expenditure for each head is according to the financial norms specified in the budget and agreed procurement processes. Audits will be done and maintained by the CA firms empanelled by VWDA.

Project Completion Report: At the end of the project a Project Completion Report will be prepared and submitted on an agreed format that will consolidate all the activities carried out during the project, its achievements, and results along with evidence of impact and benefits.

d) Include a results framework for the project proposal, including milestones, targets and indicators

Goal	**Efficient water management and agriculture technology adoption for climate adaptive and resilient farming system in 51 villages of Nandurbar and Buldhana districts of Maharashtra State**				
	Indicator	**Baseline**	**Target**	**Means of Verification**	**Assumptions & Risks**
Objective: To enhance adaptive capacity of climate vulnerable families in Nandurbar and Buldhana districts of Maharashtra	**Percentage of target population adopting risk reduction measures for livelihoods and energy consumption**	**Less than 10% of target 20,000 households practice climate risk reduction measures**	**60% of target 20,000 households continue to practice at least one climate risk reduction measure introduced through project interventions**	**Household survey at the start and end ofproject**	**Assumption**: Climate risk information and livelihood intervention convince farm families to adapt at household and community level **Risk**: Local Government fail to prioritize, sustain and upscale support for **climate adaptive interventions in their strategies and plans**
Component 1: Baseline Integrated Survey for socio-economic and ecological assessment and planning					
Outcome 1 - Communities adopt land use and water budgeting with the help of planning through better understanding of climate change related impacts	**Number of households able to take informed decisions about climate adaptive interventions** **Percentage of planned interventions included as per the Plans**	**Farm families highly exposed to climate change related livelihood insecurity having no definite clue about the reasons or the solutions** **No scientific information and participatory processes are involved in planning land and wateruse**	**At least 60% of 20,000 target households (are able to take informed decision about climate adaptive interventions.** **At least in 90% cases the interventions planned are included in the Plans**	**Household survey at the beginning and end of the project.** **Dialogue with beneficiaries** **Checkingof records, photographs, etc.** **Panchayat records**	**Assumption**: All stakeholders will participate and contribute in the preparation of plans **Risk**: A consensus may not emerge
	Indicator	Baseline	Target	Means of Verification	**Assumptions & Risks**

Output 1.1 Village wise vulnerability levels assessed	**Updated land, agriculture, water resources and health related information**	**Updated Information not available**	**All 51 villages in the project area**	**Photographs of PRA exercises and baseline report covering climate change threats and its impacts**	**Assumption**: PRAs are held **Risk** : Low level of participation
Output 1.2 Socio-economic profile of the people residing in the project area	**Updated status report**	**Updated Information not available**	**Planning of interventions targeted to cover every household**	**Socio-economic status report**	**Assumption**: Survey is done properly **Risk** : Low level of participation
Output 1.3 Land use and water budgeting plan	**Land use and water budgeting plan in place**	**Crop wise water requirement and available water / resource**	**Land use and water management as per plan**	**Village wise consolidated Land use and water budgeting plan**	**Assumption**: Regular meetings are held in the villages **Risk** : information sharing
Component 2 : Climate resilient technology transfer for enhancing the adaptive capacity of the community					

Outcome 3 Livelihoods have become less vulnerable to climate change and have achieved higher levels of productivity	**Number of beneficiaries, particularly women, with improved and diversified livelihoods** **Number of farmers achieving higher level of sustainable productivity** **Status of community with improved food-fodder-fuel reserve as a drought proofing measure**	**Most farm families underrain-fed conditions highly exposed to climate change induced livelihood insecurity.** **Majority of beneficiary farmers depend only on rain- fed farming** **Common properties as reserves are degrading fast** **Families face food-fodder crisis at least for 4 months in year**	**Target 20,000 households of population havedeveloped climate resilient livelihood strategy to diversify their sources of income** **Farm productivity has increased by 30% for at least 25% beneficiary families i.e. 5,000 hhs** **Food-fodder reserve is ensured for 100% targeted families.**	**Field monitoring reports** **Household & market survey reports** **Group discussions & interactions** **End ofproject Survey** **Comparison with cost andprofitability norms as originally anticipated**	**Assumption**: Local government will provide access to commons and agree to negotiate with the groups. Marketing arrangements exist for all recommended commodities **Risk**: Demand for labour near or outside the project area leads to outmigration. Major price fluctuation ofthe recommended commodities
	Indicator	Baseline	Target	Means of Verification	**Assumptions & Risks**

Output 2.1 Systematic Crop Intensification, Adaptive agriculture, mixed cropping, agro-forestry & integrated farming practices are introduced mainly through popularizing a combination of drought tolerant field crops, fast growing & multipurpose perennials and smalllivestock	**Hectares of land brought under adaptivecultivation** **Increase in cropping diversity & intensity** **Increasein cropping monthsand food availability Increase in self supply of seeds & inputs**	**Less than 10% of the farmers in the target area practice Integrated Farming** **A very few targetfamilies have Knowledge about System of Crop Intensification, adaptive agriculture techniques andpractices**	**5500 SF / MF cultivating paddy, wheat through SCI. Soil testing done for these farmers.** **Adaptive agriculture practices brought in for 1732 ha.ofpulses, 400 ha.of sorghum 2200 ha (Cash crops & Veg.) provided input support** **1000 farmers have taken up intercropping & mixed cropping, 1000 farmers have taken up Integrated Farming.** **Food & nutrition security is ensured for at least 60% beneficiaries.** **At least 4,000 target families have reduced their dependency on market for the inputs for agriculture**	**Household level survey before and after the project** **Periodic monitoring report**	**Assumption**: Community shows eagerness to attend training and replace conventional agriculture with adaptive agriculture **Risks**: Farmers disinclination inadoption of recommended farming systems
	Indicator	Baseline	Target	Means of Verification	**Assumptions & Risks**

Output 2.2 Efficient water management measures (Community LIs &micro irrigation) for agriculture productivity and environmental sustainability	**Area brought under irrigation through community Lift Irrigation schemes, drip and sprinkler irrigation** **Increase in area under vegetable cultivation**	**Low water retention capacity of the soil, fertile top soil erosion** **Large area lying fallow (seasonally or perennially)**	**2200 hectares of land brought under double / multiple crop cultivation**	**Drip & Sprinkler irrigation covering 2200 ha,** **20 Community Lift Irrigation systems established** **Group Records, Evaluation Reports, Project Progress Report**	Assumption: Suitable sites are available for the various types of water storage and conservation structures Risk: Overall plan is not developed in time
Component 3: Knowledge Management by documentation and dissemination of learning from the project					
Outcome 3 Various types of materials on processes and techniques are published and measures taken to upscale the interventions to improve climate resiliencein the project areas of the district	**Replication of the interventions in neighboring villages along with the project area** **Govt. adopted the climate resilient models in their policies**	**Local level planning does not consider climate change relatedaspects** **Only few farmers practice ecological farming and livelihoodpractices**	**Climate resilient livelihood strategies adopted by other Gram Panchayat and Blocks** **The project learning documents aligned to the SAPCC are advocated for adoption with relevant government departments at both state and nationallevels**	**Government documents** **Interaction with the community** **External evaluation reports** **Reports and meetings**	Assumption: LocalGovernments, State/National Governments convinced of the approach demonstrated through theproject Risk: Unwillingness of Governments (local/state/national) to accept change in their planningapproach
	Indicator	Baseline	Target	Means of Verification	**Assumptions & Risks**

Output 3.1 Improved access to learnings from the project activities to be ensured through short films, dedicated website and other printedmaterials	Number of audio visual films, awareness materials (e.g. folders, brochures, pamphlets, posters, newsletters, journals, IEC materials) published Dedicated website created and updated regularly Number of mass awareness generation measures (e.g. participation in village fairs, rallies,campaigns)	No appropriate awareness materials available, especially in local language No website at present Limited awareness generated through mainstream mass media e.g. television, radio.	At least 10 audio visual films, 200 types of awareness materials published for wider dissemination in the state A web space is created for regular dissemination of project learnings 3 Melas and at least 45 types of awareness generation campaigns in and aroundthe project villages Sharing of results and awareness creation in 15 other vulnerable districts in the State	Printed and Audio Visual content Photo documentation	

e) Include a detailed budget with budget notes, a budget on the Implementing Entity management fee use and an explanation and a breakdown of the execution costs. *(All amounts in Rupees)*

Components	Activities	Details				Costs (Rs)	
		Unit	Qt.	Sub Unit	Qt.	Unit Cost	Total Cost
1	**Baseline Survey and Integrated socio-economic and ecological assessment and planning**						
1.1	Village wise PRA for assessing Climate change Vulnerability	Clusters	4	Villages	51	15000	765000
1.2	Socio-economic HH survey	Villages	51	HH sample	3000	250	750000
1.3	Land Use, Water Budgeting & Technology adoption possibilities	Villages	51	Gram Panchayat	24	20000	480000
1.4	Ongoing schemes and convergence possibilities	Clusters	4	Cluster	4	25000	100000
1.5	GIS mapping, Data entry, database management & Documentation	Clusters	4	Villages	51	8000	408000
	Sub-Total						**2503000**
2	**Climate resilient technology transfer for enhancing the adaptive capacity of the community**						
	Systematic Crop Intensification, Sustainable Agriculture, mixed cropping, integrated farming practices						
2.1	**System of Crop Intensification for Paddy & Wheat in Nandurbar**						
	Community Sensitisation & Farmers Orientation	Clusters	2	Villages	37	2000	74000
	Demonstrations & Community Nurseries through FFS	Clusters	2	Nurseries	17	43530	740010
	Field Demonstration package (seeds, INM,IPM) to Farmers (CC Adaptation)	Clusters	2	Area (Ha.)	2200	5750	12650000
	Mechanised Paddy Transplanter (to be operated by SHGs)	Clusters	2	Villages	37	170000	6290000
	Sub-Total						**19754010**
2.2	**Adaptive Agriculture for Pulses (Redgram, Blackgram, Chickpea)**						
	Community Sensitisation& Farmers Orientation	Clusters	4	Villages	51	2000	102000
	Field Demonstration package (seeds, INM, IPM) to farmers (CC Adaptation)						
	a. Red gram (Tur) with intercropping	Clusters	4	Area (Ha.)	315	6240	1965600
	b. Black gram (Udid) / Green gram with intercropping	Clusters	4	Area (Ha)	1181	5750	6790750
	c. Chickpea (Chana) with intercropping	Clusters	4	Area (Ha)	236	8510	2008360

	Sub-Total						**10866710**
2.3	**Sustainable Agriculture for Rabi Jowar (sorghum)**						
	Community Sensitisation& Farmers Orientation	Clusters	4	Villages	51	2000	102000
	Field Demonstration package (seeds, INM, IPM) to farmers (CC Adaptation)	Villages	51	Area (Ha)	400	4200	1680000
	Sub-Total						**1782000**
2.4	**Adaptive Agriculture for Cash Crops (Cotton, Sugarcane, Vegetable, Horticulture)**						
	Community Sensitisation& Farmers Orientation	Clusters	4	Villages	51	2000	102000
	Field Demonstration package (seeds, INM, IPM) to farmers (CC Adaptation)	Villages	51	Area (Ha)	2200	8000	17600000
	Sub-Total						**17702000**
2.5	**Support Services**						
	Establishment of bee keeping unit (@ villages level) including training for pollination services	Clusters	4	Villages	39	45000	1755000
	Sub-Total						**1755000**
2.6	**Field Support to village level activities**						
	Honourarium to climate volunteers (including local travel)	GP	24	Months	48	5000	5760000
	Operational expenses for village level committee	GP	24	Months	48	1000	1152000
	Sub-Total						**6912000**
2.7	**Sustainable water conservation measures (small LIs & micro irrigation) for agriculture productivity and environmental sustainability**						
	Community Lift Irrigation with Solar Water Pumps	Clusters	4	Locations	20	320000	6400000
	Support to farmers for drip irrigation & sprinklers and also for enabling convergence	Villages	51	Area(ha.)	2200	62000	136400000
	Lining for farmpond	Clusters	4	Numbers	100	96000	9600000
	Plastic Mulch	Clusters	4	Area(ha.)	100	32000	3200000
	Sub-Total						**155600000**
	Sub Total for 2						**214371720**
3	**Learning & Knowledge Management : Access to learnings from the project activities**						
3.1	Awareness films				12	60000	720000

3.2	Printing materials, Newsletter, Journals, brochure, pamphlets	LS			200	10000	2000000
3.3	Website design & regular updation			Months	48	10000	480000
3.4	Farmers Convention / Melas			Yearly	4	350000	1400000
3.5	Mass Awareness Events	Clusters	4	WC Villages	24	25000	600000
3.6	Sharing & Awareness generation workshops in 15 vulnerable districts			Districts	15	100000	1500000
3.7	Meetings and workshops						
	Inception Workshop (State Level)	State	1	Time	1	75000	75000
	Inception Workshop (District Level)	District	2	Time	1	19000	19000
	Meeting of Project Sanctioning & Steering Committee	Half Year	2	Year	4	9000	36000
	Special Workshops on Project Learning	No.	1	Time	2	40000	80000
	Sharing & Awareness generation workshops in 15 vulnerable districts			Districts	15	50000	750000
	Sub-Total						**7660000**
	Project Measures (1-3)						**222031720**
4	**Monitoring**						
4.1	Concurrent Quarterly Progress Monitoring	District	2	Quarter	16	18000	576000
4.1	Annual Monitoring of Physical and Financial Progress	District	2	Year	4	150000	1200000
4.3	Joint Review Mission	District	1	Year	4	75000	300000
4.4	Financial Monitoring and Audit by empanelled CA firms	Clusters	4	Quarter	16	15000	960000
4.5	Developing GIS Based Project Tracking System	LS					70000
4.6	GIS Associate	State	48	Person	1	20000	960000
	Sub-Total						**4066000**
5	**PROJECT MANAGEMENT**						
5.1	HR Support (Technical) (deputation/ contractual) (1 State & 2 District)	Month	48	Person	3	40000	5760000
5.2	HR Project Development Team (contractual) (3 Nandurbar& 2 Buldhana)	Month	48	Person	5	13000	3120000
5.3	Office staff (contractual) (1 State & 2 each District)	Month	48	Person	5	10000	2400000
5.4	Contingency & Travel	Month	48	Year	4	20000	3840000
5.5	4 computers, peripherals and software	LS			4	65000	260000
5.6	Stationery / Office Management	Month	12	Year	4	6000	288000

5.7	Meeting of Project Sanctioning & Steering Committee	Half Year	2	Year	4	25000	200000
5.8	Incidental expenses (approx 3%)						**483000**
	Sub-Total 5:						**16351000**
	TOTAL (1 to 5)						**242448720**
6	**NIE COMPONENT**						
6.1	Monitoring of Environmental Parameters and Activity Rating against benchmark	No.	1	District	2	255000	510000
6.2	Technical Support to the Project (Quarterly)	Quarter	4	Year	4	50000	800000
6.3	Baseline study and benchmarking by MELD agencies	No.	1	District	2	255000	510000
6.4	Mid-Term Evaluation by MELD agencies	No.	1	District	2	255000	510000
6.5	End Term Evaluation by MELD agencies	No.	1	District	2	255000	510000
6.6	Project Review	Half Year	2	Year	4	50000	400000
6.7	Other Expenses Including HR Cost (Tech. Expert)	Month	12	Year	4	85000	4080000
6.8	Incidental expenses (approx 3%)	LS					220000
	Sub-Total						**7540000**
	GRAND TOTAL (1-6)						**249988720**

Note -1 Care would be taken that the subsidy to individual beneficiaries should not exceed 50 % of total cost.

2. Guidelines of National Food Security Mission and National Mission on Micro Irrigation will be taken into consideration while implementation.

SUMMARY OF PROPOSED BUDGET:

Components	Activities	Costs (Rs)	
		Total Cost	Percentage
1	Baseline Survey and Integrated socio-economic and ecological assessment and planning	2503000	1.00
2	Climate resilient technology transfer for enhancing the adaptive capacity of the community	214371720	85.75
3	Learning & Knowledge Management : Access to learnings from the project activities	7660000	3.06
	Project Measures (1 to 3)	222031720	88.82
4	Monitoring	4066000	1.63
5	PROJECT MANAGEMENT	16351000	6.54
	TOTAL (1 to 5)	242448720	96.98
6	NIE COMPONENT	7540000	3.02
	GRAND TOTAL (1-6)	**249988720**	**100.00**

f) Include a disbursement schedule with time-bound milestones at the component level

Instalment	Percentage	Amount	Year	Milestones
First	20%	49960760	April, 2016	Project Initiation, inception workshop, etc.
Second	40%	99921520	April, 2017	Progress implementation, monitoring&review by steering committee
Third	25%	62450950	April, 2018	Project implementation, monitoring&review by steering committee
Fourth	15%	37470570	April, 2018	Project implementation, monitoring & review by steering committee, Final report, workshop and completion
TOTAL		**249988720**		

S.	Major Activities	Year 1				Year 2				Year 3				Year 4				Yr 5
No	Quarterly milestones	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
1	**Baseline Socio-economic survey, assessment & planning**																	
1.1	Village wise PRA for assessing Climate change Vulnerability																	
1.2	Socio-economic HH survey																	
1.3	Land Use, Water Budgeting & Technology adoption possibilities																	
1.4	GIS mapping, Data entry, database management & Documentation																	
3	**Climate resilient transfer of technology for enhancing adaptive capacity of farmers**																	
3.1	System of Crop Intensification for Paddy in Nandurbar																	
3.2	Adaptive agriculture for Pulses																	
3.4	Adaptive farming of cash crops																	
3.5	Support Services (Bee Keeping)																	
3.7	Efficient water management measures (conservation wherever necessary, small LIs &micro irrigation)																	
3.8	Climate Resilient appropriate technologies																	
4	**Learning &Knowledge Management : Access to learnings from the project activities**																	

Annexure I –Cost estimates of different activities

Paddy

Package Details	Amt
Seed (@ 20 kg /ha)/ planting material from nurseries	900
Azotobacter + PSB (each@250 g /10kg seed)	300
DAP : Urea Bricquettes (@ 68 kg / acre)	1200
IPM & weed management package incl Pheromone trap and trichocards	1200
Implement on rent	1400
Per hectare	5000
Cost escalation average 15%	5750
Per Acre i.e. per 0.40 hectare	2300

Green gram (Mung)/ Black gram (Udid) with inter-cropping

Package Details	Amt
Seed (@ 15 kg /ha.)	1575
Azotobacter + PSB (each@250 g /10kg seed)	300
INM (micro-nutrient, gypsum, etc)	1200
IPM & weed management package incl Pheromone trap and trichocards	1000
Inter-crop	925
Per hectare	5000
Cost escalaltion average 15%	5750
Per Acre i.e. per 0.40 hectare	2300

Redgram (Tuar) with inter-cropping

Package Details	Amt
Seed (@ 15 kg /ha.)	1875
Azotobacter + PSB (each@250 g /10kg seed)	300
INM (micro-nutrient, gypsum, etc)	1250
IPM & weed management package incl Pheromone trap and trichocards	1200
Inter-crop	800
Per hectare	5425
Cost escalaltion average 15%	6240
Per Acre i.e. per 0.40 hectare	2500

Bengal gram (chana/ harbhara) with inter-cropping

Package Details	Amt
Seed (@ 80 kg /ha)	5200
Azotobacter + PSB (each@250 g /10kg seed)	300
INM (foliar spray of 2% urea twice)	100
IPM & weed management package incl Pheromone trap and trichocards	1000
Inter-crop	800
Per hectare	7400
Cost escalaltion average 15%	8510
Per Acre i.e. per 0.40 hectare	3400

Cash crops (cotton/ vegetables/ sugarcane/ chilli/ others)

Package Details	Amt
Seed	2550
Azotobacter + PSB (each@250 g /10kg seed)	300
INM (foliar spray of 2% urea twice)	2200
IPM & weed management package incl Pheromone trap and trichocards	1000
Inter-crop/ implement/ etc	950
Per hectare	7000
Cost escalaltion average 15%	8050
Per Acre i.e. per 0.40 hectare	3220

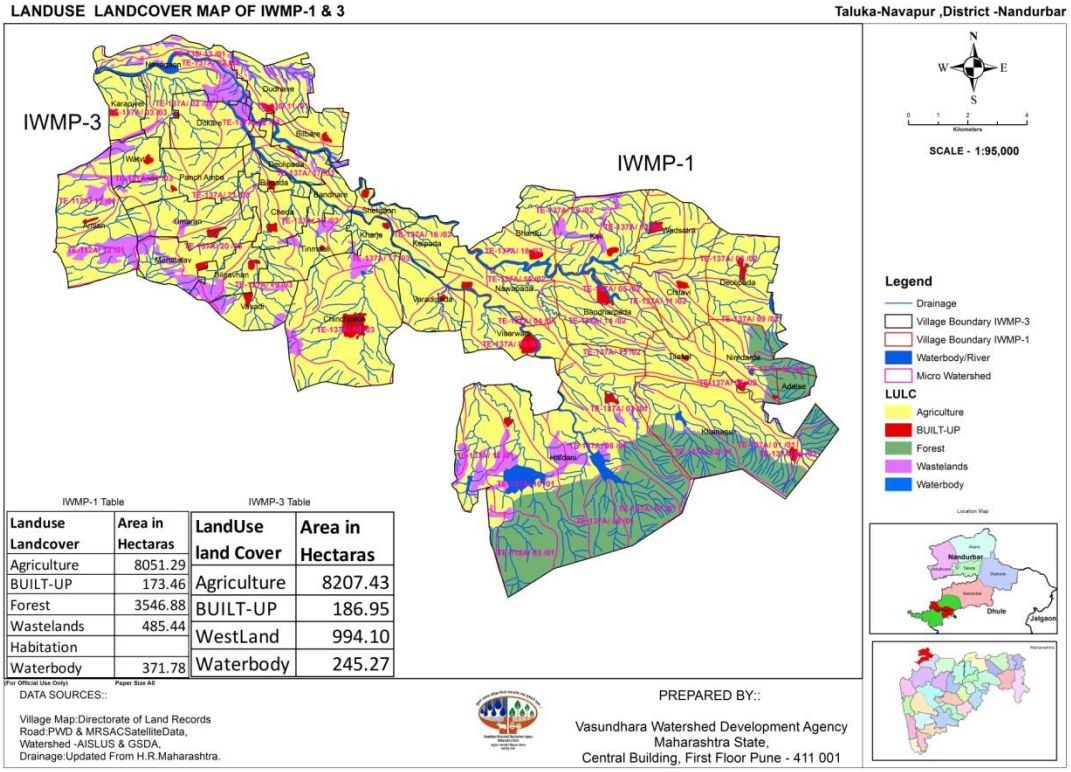
Note: Rates may vary in accordance with location

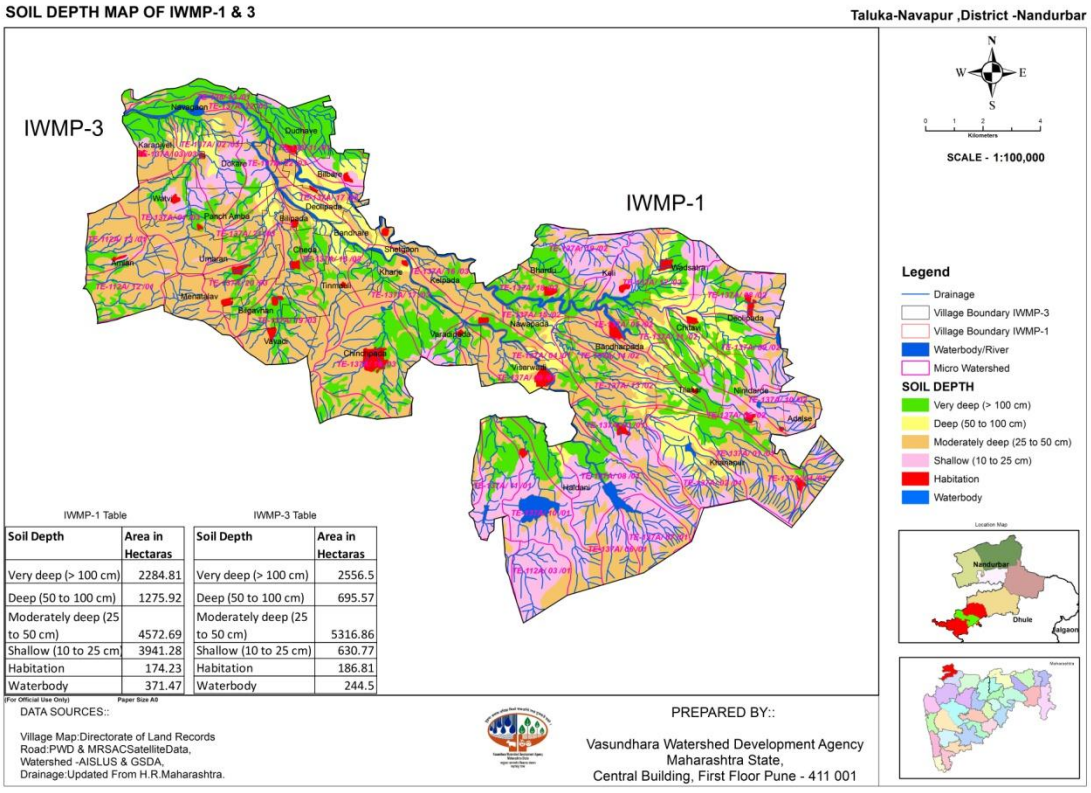
Community Lift Irrigation system with Solar Water Pump			
Items	**Unit**	**Rate**	**Total Cost**
Parapet well and lining	Cum	12000	60,000
Solar Water Pumpsetwith accessories (5 Hp)	Nos.	2,00,000	2,00,000
Pipeline with 2.5" dia (Average requirement – 200 pipes)	Pipe nos.	235	60,000
Total			**3,20,000**

Establishment cost of Community paddy nursery

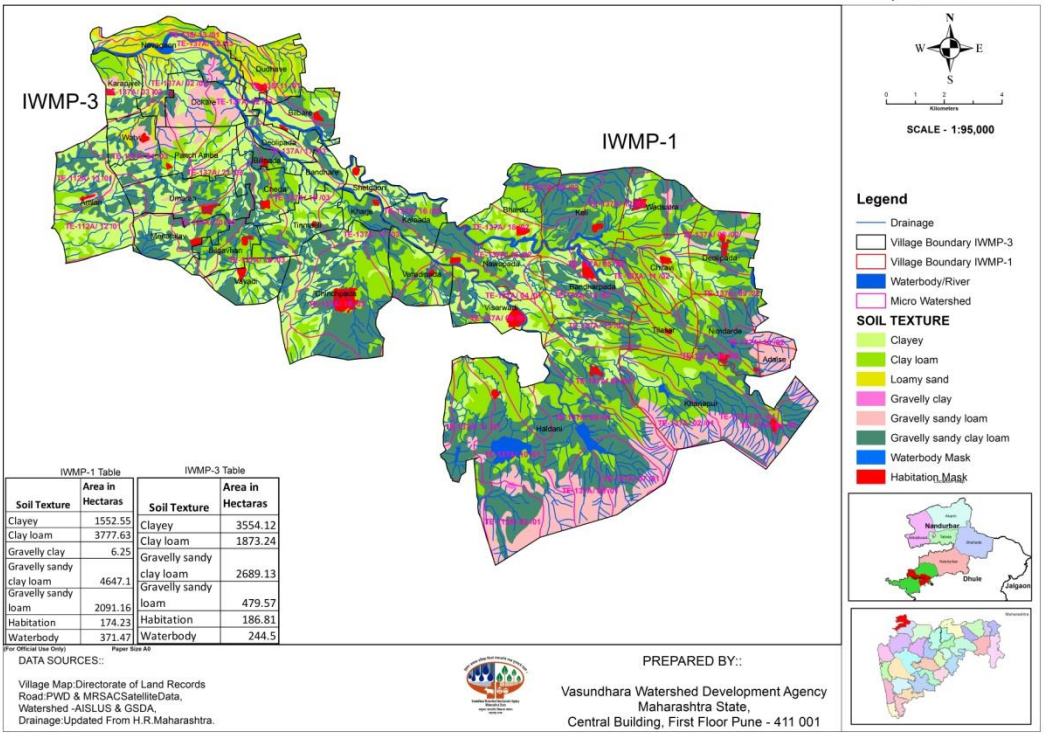
S. No	Component	Quantity	Total Cost (in Rs.)
1	Vermicompost	10 kgs (Rs. 5/Kg)	50
2	Seed processing	-	10
3	Seed	5 Kgs(Rs. 35/Kg)	175
4	Irrigation facility	-	100
5	Crop protection	-	100
6	Amount for promotion	-	130
Total		-	730
7	Developing Nursery in 1 hectare	Labour costs	42,800
Total			43,530

4. Annexure II Maps





SOIL TEXTURE MAP OF IWMP-1 & 3 — **Taluka-Navapur ,District -Nandurbar**



IWMP-1 Table

Soil Texture	Area in Hectaras
Clayey	1552.55
Clay loam	3777.63
Gravelly clay	6.25
Gravelly sandy clay loam	4647.1
Gravelly sandy loam	2091.16
Habitation	174.23
Waterbody	371.47

IWMP-3 Table

Soil Texture	Area in Hectaras
Clayey	3554.12
Clay loam	1873.24
Gravelly sandy clay loam	2689.13
Gravelly sandy loam	479.57
Habitation	186.81
Waterbody	244.5

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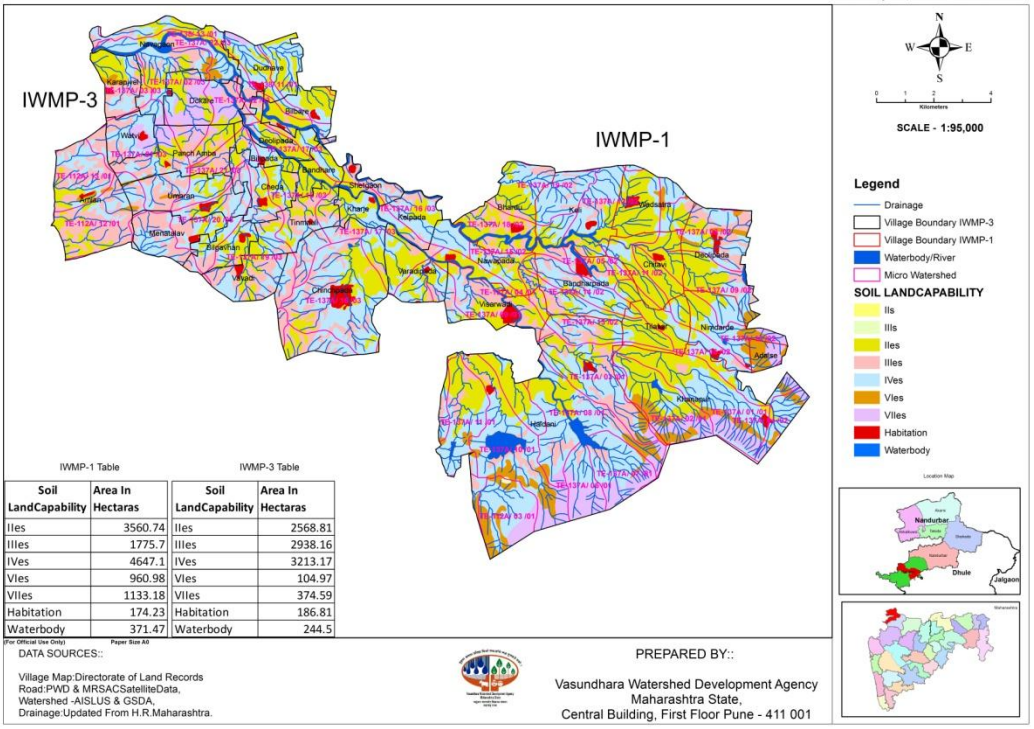
DATA SOURCES::

Village Map:Directorate of Land Records
Road:PWD & MRSACSatelliteData,
Watershed -AISLUS & GSDA,
Drainage:Updated From H.R.Maharashtra.

PREPARED BY::

Vasundhara Watershed Development Agency
Maharashtra State,
Central Building, First Floor Pune - 411 001

SOIL LANDCAPABILITY MAP OF IWMP-1 & 3 — **Taluka-Navapur ,District -Nandurbar**



IWMP-1 Table

Soil LandCapability	Area In Hectaras
IIes	3560.74
IIIes	1775.7
IVes	4647.1
VIes	960.98
VIIes	1133.18
Habitation	174.23
Waterbody	371.47

IWMP-3 Table

Soil LandCapability	Area In Hectaras
IIes	2568.81
IIIes	2938.16
IVes	3213.17
VIes	104.97
VIIes	374.59
Habitation	186.81
Waterbody	244.5

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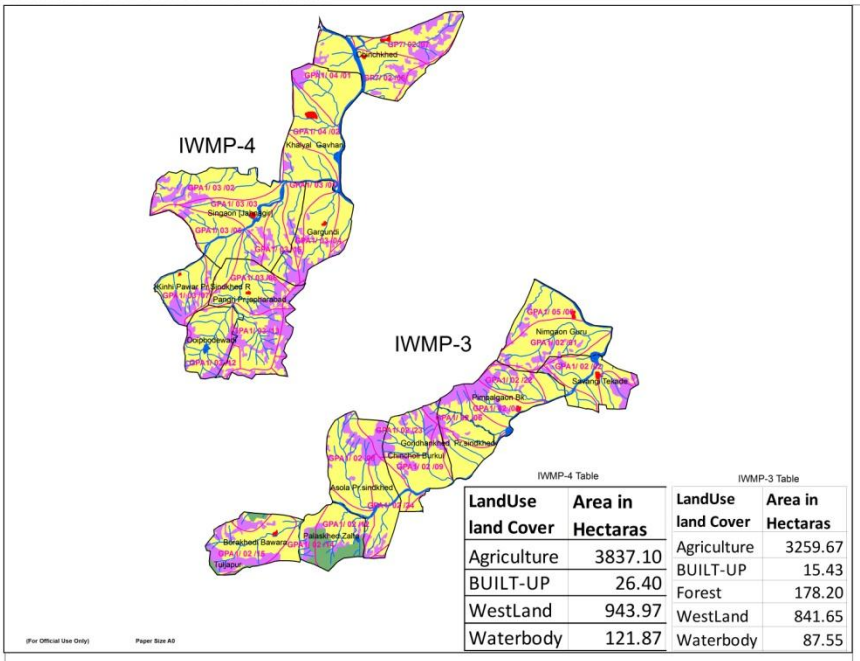
LANDUSE LANDCOVER MAP OF IWMP-3&4 — **Taluka-Deulgaon-Raja ,District -Buldhana**

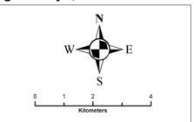


IWMP-4 Table

LandUse land Cover	Area in Hectaras
Agriculture	3837.10
BUILT-UP	26.40
WestLand	943.97
Waterbody	121.87

IWMP-3 Table

LandUse land Cover	Area in Hectaras
Agriculture	3259.67
BUILT-UP	15.43
Forest	178.20
WestLand	841.65
Waterbody	87.55



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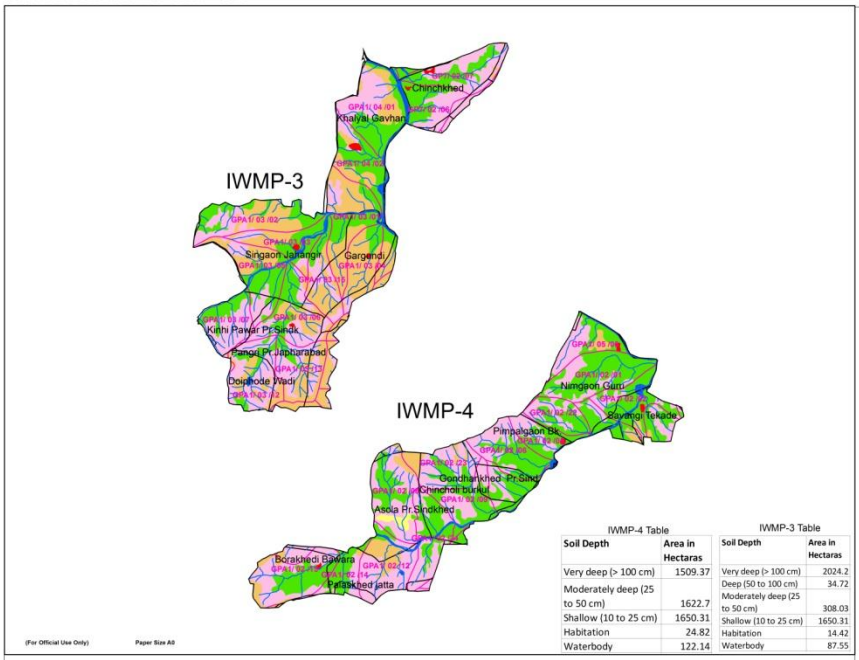
SOIL DEPTH MAP OF IWMP-3&4 — **Taluka-Deulgaon-Raja ,District -Buldhana**

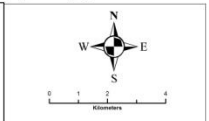


IWMP-4 Table

Soil Depth	Area in Hectaras
Very deep (> 100 cm)	1509.37
Moderately deep (25 to 50 cm)	1622.7
Shallow (10 to 25 cm)	1650.31
Habitation	24.82
Waterbody	122.14

IWMP-3 Table

Soil Depth	Area in Hectaras
Very deep (> 100 cm)	2024.2
Deep (50 to 100 cm)	34.72
Moderately deep (25 to 50 cm)	308.03
Shallow (10 to 25 cm)	1650.31
Habitation	14.42
Waterbody	87.55



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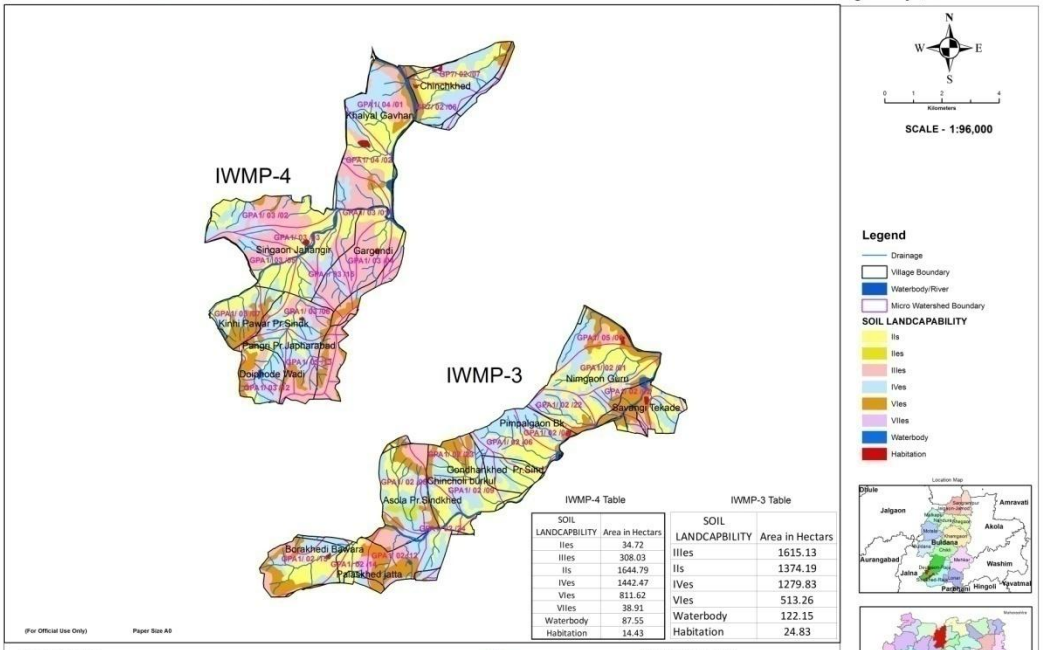
SOIL LANDCAPABILITY MAP OF IWMP-3&4 — **Taluka-Deulgaon-Raja ,District -Buldhana**



IWMP-4 Table

SOIL LANDCAPBILITY	Area in Hectars
IIes	34.72
IIIes	308.03
IIs	1644.79
IVes	1442.47
VIes	811.62
VIIes	38.91
Waterbody	87.55
Habitation	14.43

IWMP-3 Table

SOIL LANDCAPBILITY	Area in Hectars
IIIes	1615.13
IIs	1374.19
IVes	1279.83
VIes	513.26
Waterbody	122.15
Habitation	24.83

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DATA SOURCES::

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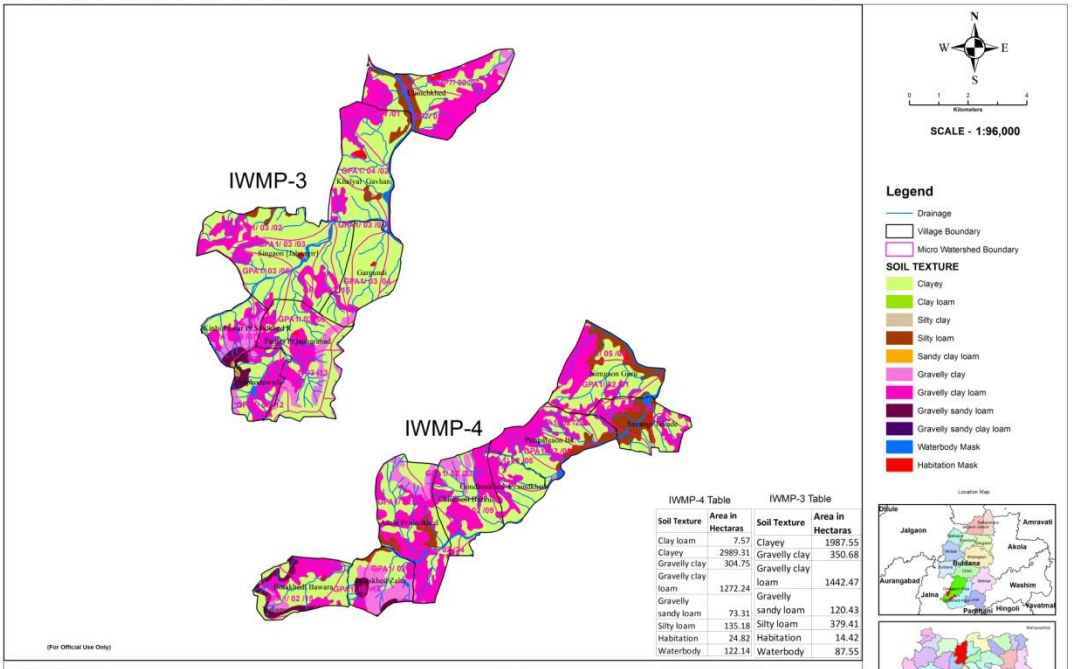
SOIL TEXTURE MAP OF IWMP-3 & 4 — **Taluka-Deulgaon-Raja ,District -Buldhana**



IWMP-4 Table

Soil Texture	Area in Hectaras
Clay loam	7.57
Clayey	2989.31
Gravelly clay	304.75
Gravelly clay loam	1272.24
Gravelly sandy loam	73.31
Silty loam	135.18
Habitation	24.82
Waterbody	122.14

IWMP-3 Table

Soil Texture	Area in Hectaras
Clayey	1987.55
Gravelly clay	350.68
Gravelly clay loam	1442.47
Gravelly sandy loam	120.43
Silty loam	379.41
Habitation	14.42
Waterbody	87.55

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