DETAILED PROJECT REPORT

National Adaptation Fund

Addressing Climate Change vulnerability of water Sector at Gram Panchayat Level in drought prone areas of Sikkim

Submitted to
Ministry of Environment, Forest and Climate Change
Government of India

Through National Implementation Entity
NABARD

Submitted by

Rural Management and Development Department
Government of Sikkim

Brief Profile of the DPR

Title of the Project	Addressing Climate Change Vulnerability of Water Sector at Gram Panchayat Level in drought prone areas of Sikkim
Project/Programme objectives	1. To upgrade Village Water Security Plans for vulnerable GPs through baseline data collection and situation analysis 2. To identify remedial measures to the problem based on the actual ground reality as indicated in Village Water Security Plan
Project / Programme Sector	Water
Name of Executing entity/Department	Rural Management and Development Department, Government of Sikkim
Beneficiaries:	1, 45,358 (Census 2011) people from South and West Districts will be directly benefitted by the intervention
Project duration	*Three Years* *Start Date: To be decided* • *End Date: 36 month since the date of implementation* •
Amount of Financing Requested (Rs.):	*Rs. 2470.04 Lakhs*
Project Location	*State: Sikkim* *District:* South district and 4 blocks from West District
Contact Details of Nodal Officer of the Executing Entity/ies/:	*Mrs. Sarika Pradhan* *Additional Director cum Project Director(MGNREGA)* *Gram Vikas Bhawan, Tashiling Secretariat, Gangtok 737101*
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1.0 Project background

Water is undoubtedly one of the major local, strategic, and geopolitical issues today across the world in the face of changing and unpredictable climatic conditions with greater and conflicting needs of rising population and resource use. The Himalayas of Sikkim is abundant in water resources, yet many parts suffer from acute water scarcity, often intensified by climate change and its triggering factors resulting in over, or under supply of water. Hence lack of supply of optimum quantities of water results in either wastage or scarcity of valuable resource like water.

The primary sources of water in the rural areas of Sikkim Himalaya are springs, streams and small rivers through the surface and sub-surface water flows originating mostly from the unconfined aquifers. Springs occur where sloping ground and impenetrable rocks intersect with the ground water table. Several forms of springs such as *Dhara/Pandhera (pool/fountain)*, *Kuwa*(shallow well) and *Simsaar*(marshy area) are the main sources of water. As per the State Socio-Economic Household Census 2005, nearly 65,000 (80%) of the 80,000 rural households of the State depend on these springs as a source of drinking water[1]. As of today, the dependency of rural households on spring water is nearly 100%[2].

The introduction of piped water supply and services to communities from a distance has shifted the focus from conservation of local springs and water resources. This has made them dependent on the often improper/inefficient, sometimes unreliable and inequitable distribution of piped water, owing to unsystematic pipe networking and storage tanks. The downstream consumers suffer the most in the loop. Over the years many of these springs are drying up in the dry belts of Sikkim especially in the southern part owing to several factors. As a consequence there is a shortage of drinking water in the villages. Local level institutions on water management and conservation of natural resources are lacking. These areas are dry belts and face severe domestic water shortage, and thus conservation of seasonal water sources/natural springs by using traditional/ecological/scientific technologies are the immediate interventions required in the area.

In view of these significantly important challenges, this project aims to address the

drinking water issues in vulnerable blocks of Sikkim through as-is situation assessment, identification of problems, formulation of recommendations and subsequent implementation. The State Rural Management and Development Department in consultation with the German Technical Cooperation, or GIZ has already prepared comprehensive Village Water Security Plan for 14 villages across South and West districts of Sikkim in 2013-14. In continuation with the same activity, this project will envisage the following:

1. Development of Village Water Security Plan for remaining GPs of vulnerable blocks in south and west districts of Sikkim whose objectives will be to:
    i. Identify current issues related to drinking water in each GP
    ii. Assess dependency for drinking water to local springs
    iii. Analyze gravity based water supply systems
    iv. Estimate the current water requirement, state of water governance and sanitation statusin the GPs
2. Formulation of recommendations for each GP as a fallout of Village Water Security Plan
3. Implementation of recommendations (including infrastructural development) in each GP

Technical and financial details of one model spring shed development project and experiences associated with the implementation of similar projects (Dharavikas work in Maneydara ward n0. 1 Deythang GPU) has been provided in Annexure II.

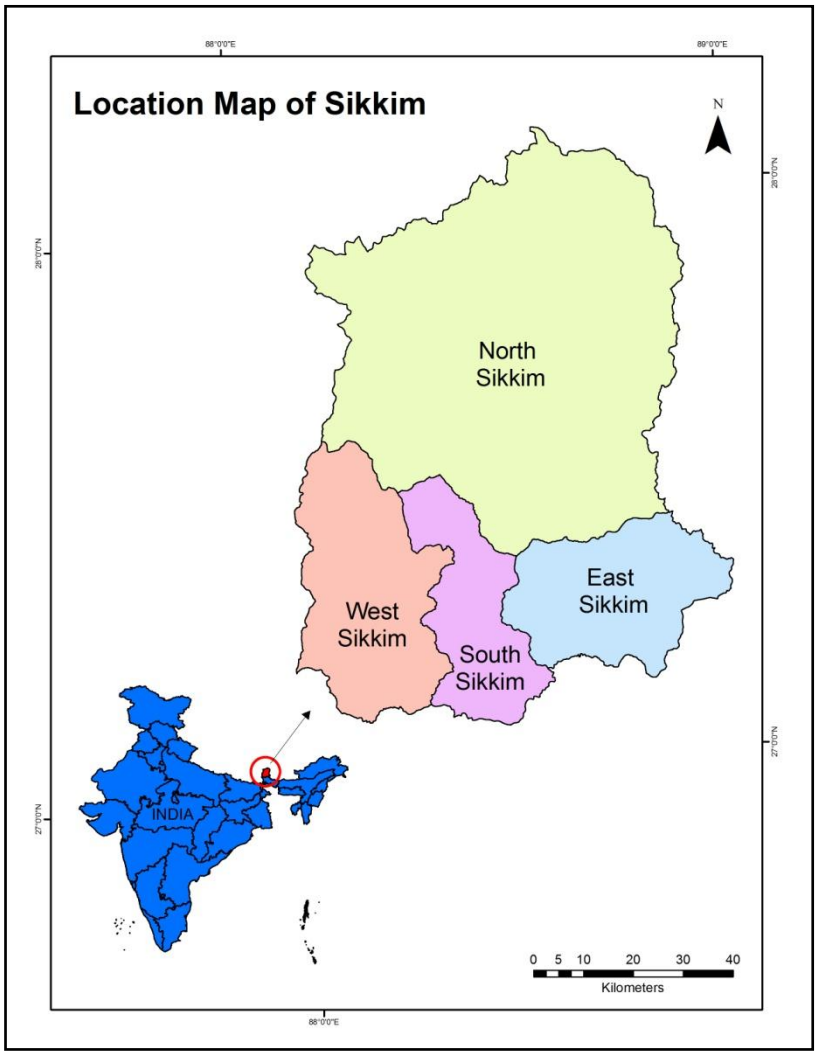
2.0 Sikkim State profile

2.1 Location and Physiography

Sikkim is situated in the eastern Himalaya between 88^{o} 03' – 88^{o} 57' E longitude and 27^{o} 03' – 28^{o} 07' N latitude. It is a small mountain state bounded by Tibet on north, Nepal on west, Bhutan on east and West Bengal on south. The state extends to about 115 km from north to south and 65 km from west to east. It fall in the 1.4 Meso Regions, namely North Eastern Himalayas of the Macro Region 1 the Northern Mountains of the Natural Division of India. Nearly two third of its hilly regions are very high mountains perpetually covered with snow are the sources of glaciers like Talung, Zemu, Lhonak etc. The state being the part of inner mountain ranges of Himalayas, is hilly having varied elevations ranging from 300 meters to 7000 meters. The largest portion of Sikkim is in its North-West, a large number of

mountains having the altitude of about nine thousand meters stand here which includes the famous Kanchenjunga (8598 meters), the third highest peak in the world.

Fig 1: Map of Sikkim



2.2 Hydro-meteorology

For evaluation, planning and development of water resources in a basin, it is most important to have a detailed knowledge of hydro-meteorological characteristics of the basin. Hydro-meteorological parameters include rainfall, temperature, humidity, wind flow, evaporation and duration of sunshine which determine the climate of a region or basin. The hydro-meteorological parameters in turn are greatly influenced by the physical features and the climate of the area. These parameters vary a lot within the state due to the variation in elevation, location, aspect, and slope.

The river Teesta along with its main tributary the Rangit is a perennial river which originates from the snow and glaciers in the upper reaches of the State. It flows through the territories of Sikkim, West Bengal in India and Bangladesh. Most of its tributaries are flashy mountain rivers and carry boulders and considerable quantity of sediment. The flow is turbulent, characterised by high velocities. Throughout its course in Sikkim, the Teesta and its tributaries flow in very narrow and deep valleys having precipitous hill slopes, except where the tributaries join the main stream. The hill slopes are mostly friable and land slips are very common. Access to the river in these reaches is very difficult.

The southwest monsoon season which is the principle rainy period for almost the entire Teesta basin is responsible for more than 80% of the total annual rainfall in these mountainous ecological sites, and significant in controlling the water balance. It is generally observed that the valleys along Teesta river and its tributaries receives good amount of rainfall whereas the valleys of Rangit river and its tributaries receives lesser or scarce rainfall one possible reason for less rainfall or sometimes no rain in the region may be attributed to the shadowing effect exerted by the adjoining Darjeeling hills in this part of the south and west districts. The isohyetal map for non-monsoon period reveals distinctly lesser rainfall towards south Sikkim, varying from 1343 mm in Gangtok to less than 500 mm towards Namchi. Looking at the monthly variation of normal rainfall, it is seen that the month of July receives maximum rainfall of the order of 480 mm and minimum normal rainfall of 19 mm is recorded in the month of December for the Sikkim as a whole. The project area receives much less rainfall compared to other villages of the state.

Table 1: monthly average rainfall for Sikkim

Month	**Month wise Normal Rainfall for Sikkim as a whole in mm / month**
January	37.0
February	53.0
March	104.1
April	151.7
May	287.6
June	442.7
July	480.1
August	440.1
September	331.8
October	156.0
November	30.7
December	19.1
Total	**2,533.9**

The climatologically characteristics like monthly mean values of the maximum and minimum temperatures, mean monthly relative humidity, monthly sunshine hours and monthly mean wind speed are available at Gangtok station. These climatological figures are being taken as representative of the Teesta Basin in Sikkim. The temperature distribution like the mean daily maximum temperature in the sub-basin varies from about 26.8^{o} C in September to 20.7^{o} C in the month of January. Mean daily minimum temperatures are around 7.5^{o} C in January, 10.7^{o} C in April, 14.5^{o} C in July and 13.3^{o} C in October. The districtwise monthly mean temperatures are given at Table 3.5. The Mean daily Relative Humidity varies from 63.8 percent to 88.7 percent over the basin. The mean daily RH is 68.3 percent in January, 66.2 percent in April, 88.7 in July and 68.0 in October. The mean monthly wind speed varies from as low as 43.2 km/day from July to September to high of 98.4 km/day in the month of April.

2.3 Soil

Based on the soil survey conducted by 'National Bureau of Soil Survey of India & Land Use Planning (ICAR)', the state has been classified into three main groups *viz*.

i) Udalf : High base status soil of humid region

ii) Orthants : Recent formed soil

iii) Odhepts : Shallow blocks, brown and alluvial soil

The characteristics of soil vary from place to place due to topographical variations. The soil in general is loamy sand to silty clay loam with a depth of 30 cm to 100 cm and in some cases even more than 120 cm. It has less water holding capacity and is dry in nature. Chemically acidic soil abound resulting from the washing down of the salts in rain water and also on account of leaching effect. The pH value varies from 4.5 to 7.5. The soils are characterized by low to high organic matter (2-5 percent, in some places even more than 5 percent) with low action exchange capacity and high lime requirement. Notwithstanding the relatively high organic matter content, the nitrogen content in the soil is low. Some of the plant nutrient like phosphate gets fixed in soils due to the high acidity and thus does not become available to the growing plants even on application. As such there is remarkable deficiency of micro-nutrients *viz*. zinc, boron, copper, calcium, magnesium, manganese etc in the soils. There is a great deal of variation in the physical properties of the soils. The soils may be classified into following 5 categories:

i) Soils on summit and ridge tops

ii) Soils on side slopes of hills

iii) Soils on valleys

iv) Soils on cliff and precipitous slopes

v) Soils on glacial drift moraines and boulders

2.4 Biodiversity

Sikkim has been identified as one of the HOT-SPOT in the Eastern Himalayas (Out of the 18 bio diversity hotspots in the world and of 2 in India). There are 10 bio-geographic zones & 25 biotic provinces-- which have 16 major forests types & > 200 sub types as per (Champion & Seth 1968). Sikkim falls under Himalayan (2) Bio-geographic zone & Central Himalaya (2c) biotic province-having about 9 types of forests types (Champion & Seth).

The State is endowed with rich floral and faunal diversity and the mega-fauna and flora comprises nearly 4500 species of flowering plants, 550 species of Orchids, 36 species of Rhododendrons, 16 species of Conifers, 28 species of Bamboos, 362 species of Ferns and its allies, 9 species of Tree Ferns, 30 species of Primulas, 11 species of Oaks, over 424 species of Medicinal plants, 144+ mammals species, 550 Birds species, 48 Fishes species and over 600 Butterflies species. The tremendous diversity of insects like beetles and moths as well as a host of other life forms is yet to be enumerated. Most of the high altitude medicinal plants are rare and endangered species. Sikkim also has 28 Mountains/Peaks, more than 38 Glaciers, 227 high altitude lakes/wetlands and over 104 rivers and streams.

The forests contain a number of plants whose medicinal values have been well recognized by local people as well as by different pharmaceutical, insecticidal and perfumery sectors.

2.5 Demography of Sikkim

As per details from Census 2011, Sikkim has population of 6.11 Lakhs, an increase from figure of 5.41 Lakh in 2001 census. Total population of Sikkim as per 2011 census is 610,577 of which male and female are 323,070 and 287,507 respectively. In 2001, total population was 540,851 in which males were 288,484 while females were 252,367. Density of population in Sikkim is 86 per sq km which is lower than national average 382 per sq km. In

2001, density of Sikkim was 76 per sq km, while nation average in 2001 was 324 per sq km The total population growth in this decade was 12.89 percent while in previous decade it was 32.98 percent. The population of Sikkim forms 0.05 percent of India in 2011. In 2001, the figure was 0.05 percent. Sex Ratio is 890 i.e. for each 1000 male, which is below national average of 940 as per census 2011. In 2001, the sex ratio of female was 875 per 1000 males in Sikkim.

Literacy rate in Sikkim has seen upward trend and is 81.42 percent as per 2011 population census. Of that, male literacy stands at 86.55 percent while female literacy is at 75.61 percent. In 2001, literacy rate in Sikkim stood at 68.81 percent of which male and female were 76.04 percent and 60.40 percent literate respectively. Nepali, Bhutia and lepcha are the major languages spoken in the State.

2.6 Land-use

The state has a distinct alpine flavour with about 56% (3995 km^2) of the total geographical area above the tree line which is at 3,800 meters. 84% of the land is classified as forest land, and the remaining 16% is privately owned. The average size of land holding is 1.3 ha. Out of the total cultivated land of 1,09,963 hectares, only 11% is irrigated: dry land constitutes 58%, followed by cardamom (19%), paddy (13%) and wasteland (10%). This reflects the cropping pattern in Sikkim where different districts were prominent for each of the above four categories. The maximum dry land area was in the West district (35%), followed by the South district (33%), the East district (21% and the North district (11%). The largest portion of cardamom land was in North (32%), followed by East (29%), South (21%) and West (18%). In case of paddy, the South district ranked first (44%), followed by West (25%), East (23%) and North (8%). It may be noted that Large Cardamom, the most vital cash crop, is predominantly grown in the tribal belt in the North district.

Table 2: Land-use Sikkim

District	Total Paddy Fields	Total Dry Land	Wasteland	Cardamom	Total Cultivated Land
North Sikkim	8.03%	10.96%	8.07%	32.42%	**14.76**
East Sikkim	23.15%	20.73%	52.39%	28.74%	**28.96**

South Sikkim	44.05%	32.90%	15.15%	20.78%	**26.95**
West Sikkim	24.78%	35.41%	24.39%	18.06%	**29.34**
Grand Total	**14,680.6**	**64,739.8**	**11,734.4**	**21,761.7**	**1,09,963.0**

Source: Land Revenue Department, Govt. of Sikkim

2.6 Forest resources

Forest is one of the richest natural resources of Sikkim. With luxuriant forest abounding in all part of state, Forestry has been the major land use in the State and 82.31% of the total geographical area of the State is under the administrative control of the State Forest Department. The total forest and tree cover of the State is 3392 sq. km (47.80% of the total geographical area of the state). The composition ranges from tropical Dry Deciduous Forests with Sal and its associates in the valleys of Teesta and Rangit to the Alpine Scrub and grassland in high altitude.

2.7 Agriculture in Sikkim

Agriculture Sikkim is a hilly State in the Eastern Himalayas where agricultural practices and adaptations are highly variable in time and space due to varying altitudes and agro-climatic situations. Agriculture is the primary activity of the people of Sikkim. About 15.36% of the total geographical area of the land is devoted to agriculture but the actual area available for agricultural purpose is declining due to diversion of cultivable land for non-agricultural purposes like establishment of industries, township expansion, construction of roads, hydel projects, buildings etc. Farming has been considerably handicapped by small and fragmented holdings, limited irrigation, and lack of farm mechanization and frequent occurrence of natural calamities like landslides, floods and earthquakes. In view of these facts, emphasis is being given to intensive and judicious use of limited land so that the per capita land productivity and overall production is maintained at a desired level. Agriculture in an entirely mountainous state like Sikkim operates under many constraints resulting into low average yield per unit area for most of the crops. The low productivity is seriously characterised by two important features, viz. land holding size and socio-economic condition of the farmers. The majority of the farming communities of the state fall in the small and marginal farmers.

Table 3: Cropping pattern in Sikkim

Cropping pattern in Sikkim

Altitude	Zaid/Summer crops	Kharif crops	Rabi crops
1	2	3	4
1500-3000ft	Maize, Vegetables, Paddy, etc.	Paddy, Maize, Millet, Soyabean, Other Pulses, etc.	Wheat, Barley, Buckwheat, Rice-bean, Vegetables, etc.
3000-5000ft	-	Maize, Paddy, Soyabean, Other Pulse, Finger Millet etc.	Wheat, Barley, Buckwheat, Rice-bean, Rape and Mustard.
5000ft and above	-	-	-

Source: Department of Food Security & Agriculture Development.

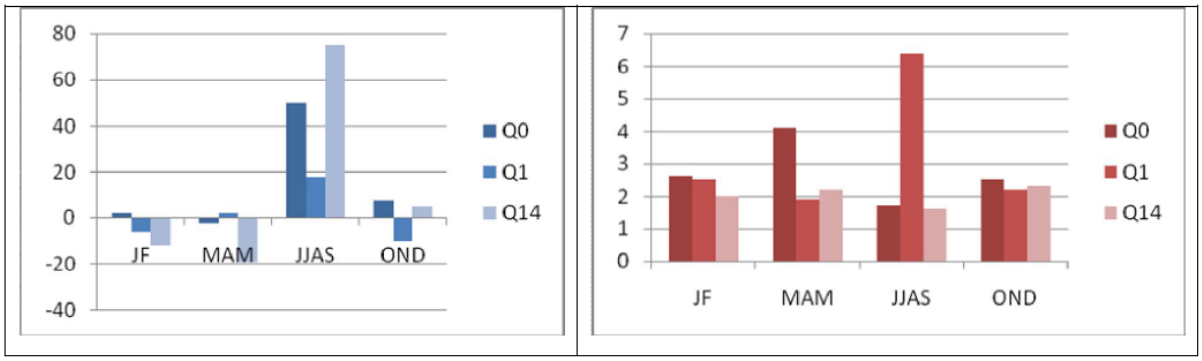
3.0 Climate Change

3.1 Climate Change Scenario in Sikkim

Altitude variation across Sikkim is the main factor controlling climate and weather conditions. Relief features such as high mountains act as barriers for the movement of the Monsoon winds. Low temperature, high rainfall on windward slopes, comparatively dry on the leeward side and heavy precipitation in the form of snow at the mountain tops are the main features of the climate. Analysis of annual average maximum, minimum temperature and rainfall of the two stations indicates that though there is no change in the maximum temperature, but the minimum temperature has increased by almost by 2.5^{o}C between the 1957 and 2009. The total rain fall has decreased by around 250 mm between the period 1983 to 2009. After the drought of 2001, the annual precipitation rose to a maximum of 3700 mm but since then it has been continuously decreasing .However, there exists a spatial variability. Monthly, seasonal and annual analysis of data only for Gangtok station for the period 1957 to 2005 indicates a trend towards warmer nights and cooler days, with increased rainfall except in winter (Seetharam, 2008). The temperature in Gangtok has been rising at the rate of 0.2-0.3^{o}C per decade and the annual rainfall is increasing at the rate of nearly 50 mm per decade. Therefore, the temperature in Gangtok has risen by 1 to 1.5^{o}C since 1957. Comparison of long term meteorological data available for Gangtok station (1957 to 2005) with the trend over the last few years (2006-09), shows an acceleration of these patterns, with winters becoming increasingly warmer and drier. Now winter rains is increasingly becoming scarce. During the year 2008 and 2009, the state witnessed one of the driest winters in living

memory. According to Meteorological Department, Government of India, Sikkim Division, 130 years is the minimum period of observation required to establish the signals of climate change. Also extreme climate events have become more frequent e.g. Cyclone Aliya in 2009. The changes in climate over the long period of observation indicate that the weather patterns have become unreliable. Further, autumn season has extended and winters have become dry. Extreme climate events have become more frequent. Rainfall patterns have become erratic, monsoons are usually late and in general torrential rainfall has replaced the monsoon drizzle. This has increased the surface runoff and dry period during winters, resulting in a higher incidence of forest fires and drying up of springs i.e. discharge of springs has reduced and many of them have started becoming seasonal.

Table 4: Percentage departure of average minimum and maximum temperature and rainfall



Source: SAPCC

3.2 Climate Change projections for Sikkim

The North Eastern region as a whole is likely to experience increase in average annual rain fall in 2030s with respect to 1970s by 3-56 mm with bulk of the contribution from the increase in rain fall during monsoon that is likely to range between 18-75 mm. Further, it has been deduced that the northern western part of the North East region comprising of Sikkim show an overall reduction in winter precipitation by about 3 percent in 2030s with respect to the 1970s. In 2030s, the average annual temperatures are likely to rise by 1.8 to 2.1^{o}C in 2030s with respect to 1970s. On a seasonal basis, there is a significant rise in temperatures in the monsoon period in June, July, August and September. The temperature is this season is likely to rise between 1.6 to 6.4^{o}C in 2030s with respect to 1970s. In March, April and May temperatures are also projected to increase, and the range of increase is likely to be between 1.9 to 4.1^{o}C. Similarly, the winter temperatures, starting from October are also projected to increase by 2 to 2.6^{o}C in 2030s with respect to 1970s.

Fig 1: Projections of seasonal annual average (a) rain fall and (b) surface temperature for the North East including Sikkim in 2030s with respect to 1970s.

Table 1: Percentage departures of average minimum temperature, average maximum temperature, and average rain fall of the period 2006-2009 with respect to long period average of 1957-2007 for Gangtok, Sikkim

Season	Long Period Av max temp (1957-2005)	Av deviation in Max temp between 2006-200 LPA max temp (%)	Long Period Av min temp in 0C (1957-2005)	Av. deviation in Min temp in oC between 2006-2009 LPA max temp (%)	Long Period Av Rainfall in mm (1957-2005)	Av. Deviation in rainfal in mm between 2006-2009 LPA rain fall (%)
January	12.8	-0.1	4.4	+2.1	32.6	-73
February	14.2	0.3	5.7	+2.0	62.6	-19
March	18.3	-0.3	8.9	+1.5	135.5	-25
April	21.0	-0.6	11.7	+1.4	270.3	7
May	21.7	0.1	13.8	+1.4	523.9	-26
June	22.2	-0.4	16.2	+0.9	630.9	-8
July	22.0	-0.2	16.8	+1.4	658.0	-10
August	22.4	-0.3	16.7	+1.0	578.9	0
Sept	21.5	-0.2	15.6	+1.0	464.6	2
October	20.9	-0.3	2.5	+1.5	175.6	-40
November	17.7	-1.0	8.8	+1.6	40.0	-24
December	14.6	-0.7	5.9	+2.1	21.2	-39

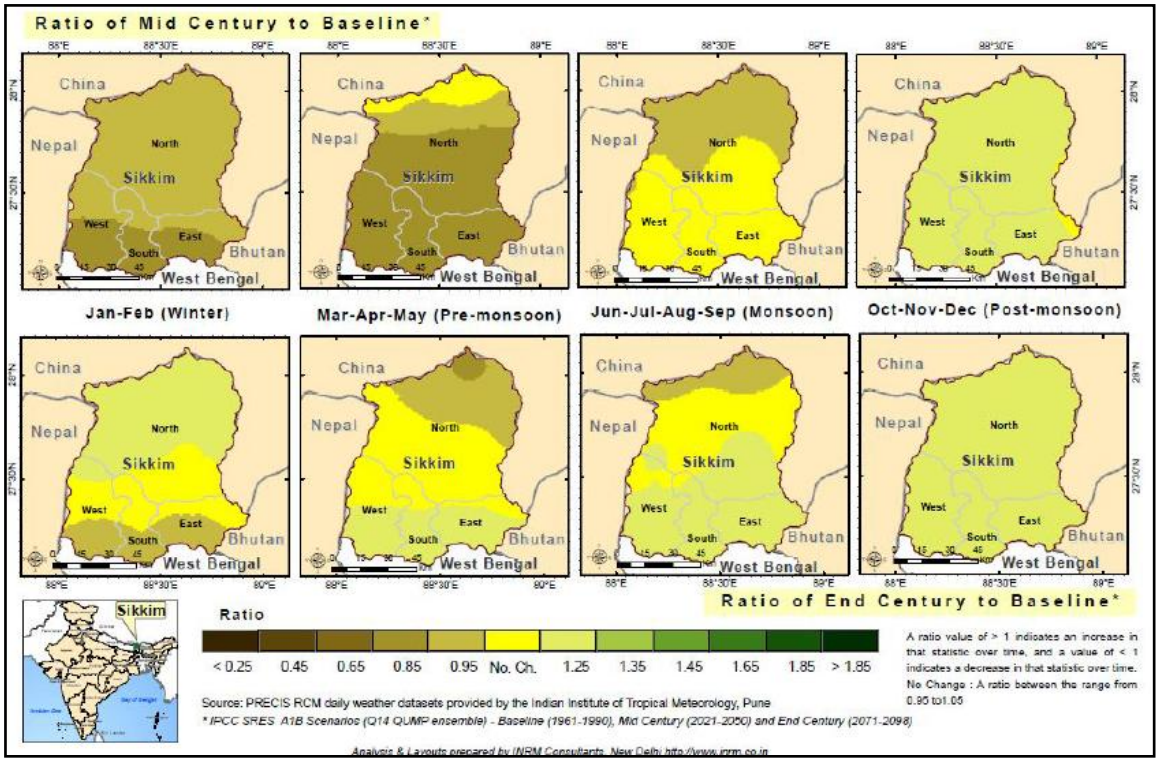
Source: 1. K Seetharaman, 2008. Climate Change scenario over Gangtok. Mausam, 59, 3, July 2008
2. IMD, Sikkim - climate parameters for 2006, 2007, 2008 and 2009

Source: INCCA, 2010

Zeroing in Sikkim during winters, i.e. Oct-Dec there might be increase in rainfall marginally, but in Jan-Feb, the southern part of Sikkim is likely to experience a negative change i.e. the rain fall is likely to reduce with respect to base line by about 25 percent. Towards the end of the century, though summer rain fall is indicating a marked improvement, but the higher altitudes are likely to face lower precipitation with reference to base line. Similarly the Jan-Feb precipitation scenario will improves in most parts of Sikkim, except in southern part, where the precipitation is likely to be still less by 15-20 percent with reference to base line.

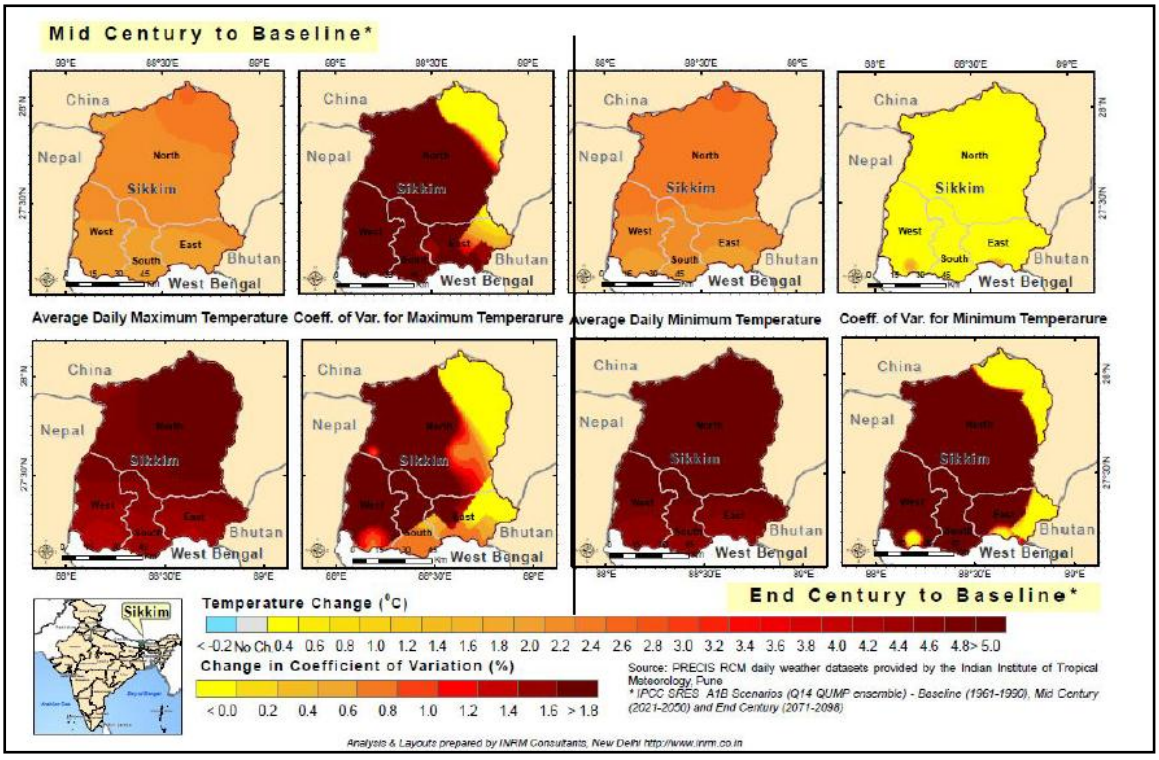
The average maximum temperature in Sikkim is likely to increase by 1.8-2.6^{o}C is 2050s, with temperature change gradually increasing from lower to the higher latitudes (also in this case higher altitude). Similarly, the minimum temperature is also likely to vary within that range. It is to be noted that smaller variations will be in the lower latitudes which will lead to a change in minimum temperature of 1.8^{o}C as compared to a greater area having a change in maximum temperature by 1.8^{o}C.

Fig 2: Change in Average Rainfall during winter, Pre-monsoon, Monsoon & Post-monsoon Seasons across Sikkim State in 2050s (top panel) and 2080s (bottom panel)



Source: SAPCC

Fig 3: Change in maximum and minimum temperatures in Sikkim in mid century (2050s) and at the end of the century (2080s)



3.3 Impact of Climate change on Water Resources

Water is one of the most important sectors on which climate change (increase in temperatures, evapo-transpiration, and spatial variation in rain fall, increase intensity of extreme rain fall and drought events) can have a profound impact, which in turn can have cascading impacts on other sectors. While a consensus exists on the likely impacts of climate change on the water resources of the Himalayas, quantitative analyses of such changes are sparse due to the dearth of baseline data essential for such analysis.

The National Water Mission, which is a part of the National Action Plan on Climate Change (MoWR, 2010), identifies the threat to water resources due to climate change, and the ones that are relevant to Sikkim are as follows:

i. Drinking water dependent on rain fall likely to become more scarce as rain fall may increasingly get restricted to only monsoon period (as is the present situation) and there might be a reduced amount of rain fall as the number of rainy days decrease.

ii. Increase in intensity of rain fall will lead to high run off and less infiltration, and consequently adversely affecting spring recharge;

iii. Increased drought-like situations due to the overall decrease in the number of rainy days;

iv. Warming may lead to a decline in the glaciers and snowfields;

v. Further, increased water temperature also may lead to lower availability of dissolved oxygen, altered ice-free period, increased biological activity exhausting oxygen in water, and changed pattern of thermal mixing in water bodies to create anaerobic conditions leading to eutrophication.

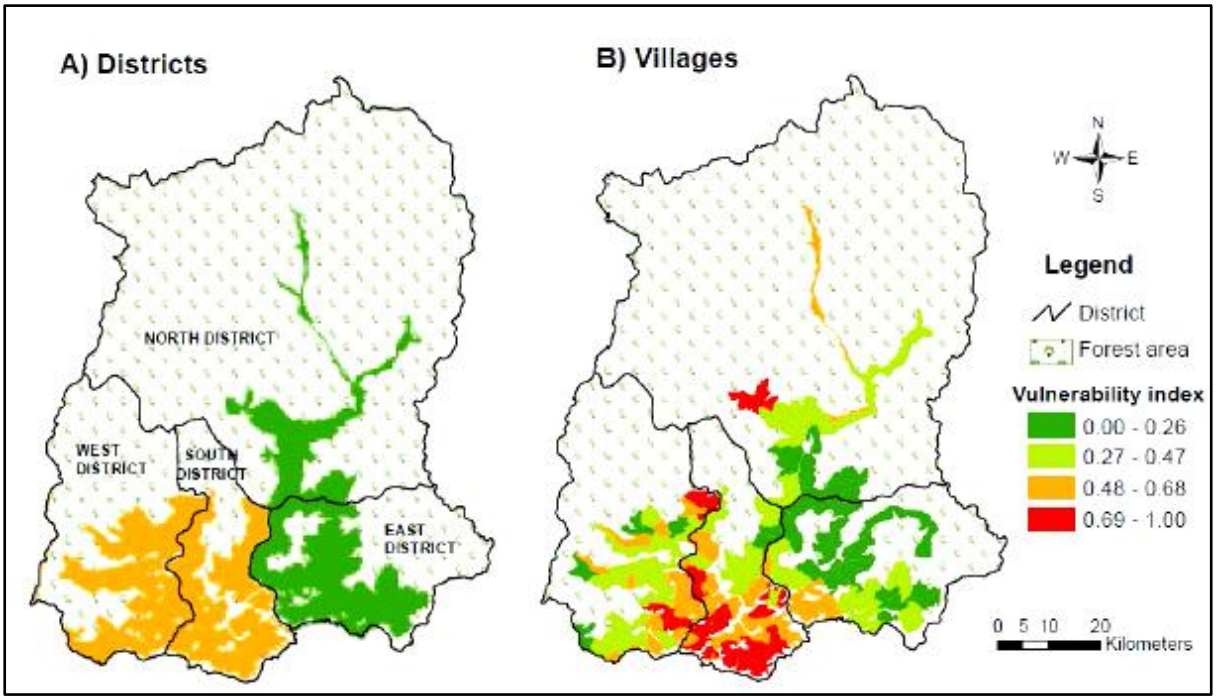
Particularly for Sikkim, the water yield which is a function of rain fall run off and evapo-transpiration is projected to decrease upto 12 percent in 2030s with respect to 1907s (MoEF, 2010). The consequences of these changes for food web interactions, community structure, nutrient dynamics, and water quality are likely to be critical for the ecological health of the wetlands and living communities deriving benefits from them.

3.4 Overview of the Vulnerability Analysis

The state is administratively divided into four districts, namely North, East, South and West.Climate change related vulnerability studiestaken up in the state at the district level - macro scale, have found South and West districts tobe the most vulnerable (WWF-India 2010, IISc2010). Inspite of being a small state, there is a highvariation in exposure (temperature and rainfall), sensitivity (water, livelihoods and health) andadaptive capacity (poverty, literacy, environment and connectivity) indicators over short distances.

As per the vulnerability assessment studies conducted in 2011, the vulnerability of the rural communities extending over the entire Gram Panchayats in Sikkim, estimated as a combination of exposure, sensitivity and adaptive capacity indices, is found to vary between climate 0 to 1 with the mean being 0.43+0.22[3]. Exposure and adaptive capacity was found to determine the vulnerability to a large extent as sensitivity did not vary much. South district was found to be the most vulnerable followed by West. East and North districts were found to be relatively resilient to climate related change.

Fig 4: Sikkim vulnerability analysis



3.5 Role of Rural Management and Development Department

The mandate of RMDD is to provide clean, safe and adequate drinking water to the rural habitation, improve the sanitation facilities, and ensure rural water security. The function of the RMDD includes assessment of actual ground position of water supply to rural communities in terms of numbers of habitations Not Covered, Partially Covered and Fully Covered. It undertakes, on a regular basis the survey of water availability, i.e. survey of all the available water sources and upgrades water maps for the State; undertakes monitoring and surveillance of water quality and intensification of water testing facilities e.g. establishment of water testing facilities in the Districts and Sub-Divisional Level; completes the incomplete schemes; addresses the coverage of the newly emerged habitations/ reverse coverage habitations. Promotes appropriate alternate technology, viz., roof top collection, rain water harvesting etc. for dry pockets; Works towards integrating Integration of rural water supply programme with other rural development activities and redefining appropriate unit for coverage area. Pilot projects have been taken up for spring shed development (namely Dhara vikas) which aims at artificial spring recharge using rain water harvesting techniques and is funded under MGNREGA. Resource mapping of springs is also underway by preparation of village spring atlas (www.sikkimsprings.org).

4.0 Rationale of the Project

Based on the vulnerability analysis on water sector done by Rural Management and Development Department (Annexure I), the entire south District and 4 blocks of West Sikkim have been identified as water stressed area. The annual rainfall received is less than 150 cm as compared to 300 cm for East and North districts. This is because of the geographical location of these blocks in the rain shadow area of Darjeeling hills.

The area covers the north east-south west running mountain ranges in south western part of Sikkim towards west bank of River Teesta and north bank of River Rangit respectively. The peculiar feature of these mountain ranges is that they do not rise above 3000 m ASL. Therefore, these ranges are devoid of snow covered peaks which supports perennial streams. The discharge of streams varies from huge flash floods in summer to less than 1 LPM water or even dry during the months from Dec to May.

The rural habitations are dispersed between 900 to 3000 m ASL and the perennial river Like Teesta and Rangit flow at almost 1000 m below in the valley. Thus, the people are dependent on small springs which provide very low but continuous discharge throughout the year. The discharge from these springs are collected in storage tanks and distributed to individual households through gravity based piped water system.

Spring water is the rain water which infiltrates the ground during the rainy season and flows out from the cracks, fractures and joints as ground water. The upper catchments and the forested areas in general are the recharge areas for these springs. However, due to reduction in the number of rainy days due to the impact of the climate change, the precipitation which was well distributed in months now comes as heavy downpour in short spell which eventually converts into flash-floods and storm flow. Moreover, this is also aided by the land use changes due to various developmental activities over the decades wherein the ground surface is not conducive for infiltration of water. Thus, most of the rainwater due to steep slope converts into runoff and this has eventually led to reduction in recharge and drying up of the springs particularly during the lean season from December to May.

Thus, there is wide spread water scarcity during the lean season wherein farmers have to spend most of the time carrying water uphill from the downstream sources for meeting their daily domestic and livestock requirements.

Each gram panchayat across the state has constituted village water and sanitation committee (VWSC). The main responsibility of this committee is to ensure the water security at the village level. However, there is lack of expertise to formulate a perspective plan for the water security. The need was felt to strengthen the VWSC and facilitate them to prepare a proper village water security plan (VWSP). A pilot project was launched to upgrade the VWSP across 14 selected GPs in these Gram panchayats. The detail assessment of water situation at the habitation level has been done with site-specific adaptation measures to be followed up (http://www.sikkimsprings.org/dv/villagewatersecurityplans.php).

The present project envisages upgrading the VWSP of 60 Gram Panchayats (of the identified vulnerable blocks) and implementing the follow-up adaptation activities to the extent possible in convergence with MGNREGA and other RD schemes.

5.0 Project objective:

1. To upgrade Village Water Security Plans for vulnerable GPs through baseline data collection and situation analysis

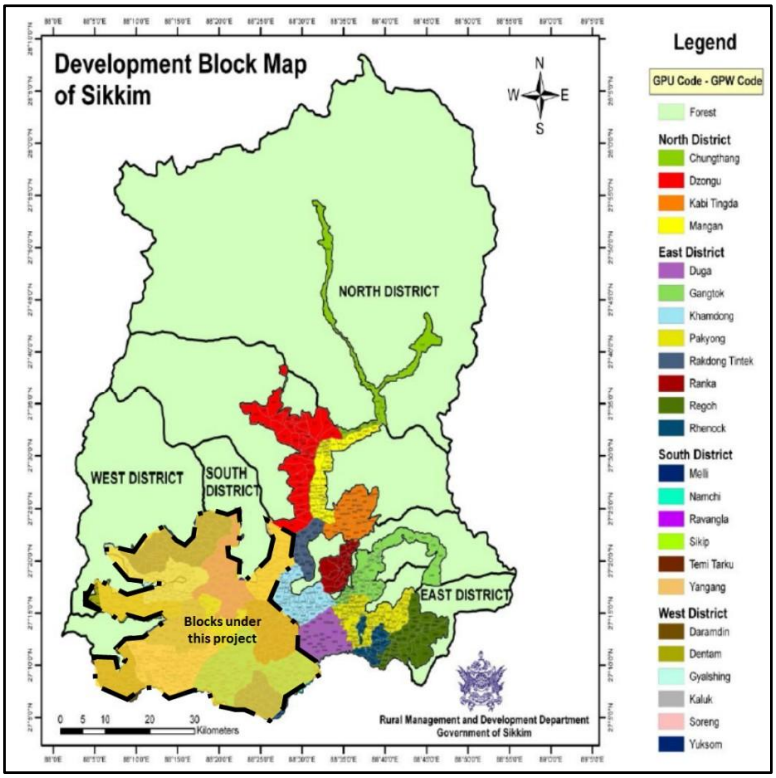
2. To identify remedial measures to the problem based on the actual ground reality as indicated in Village Water Security Plan

6.0 Project Area

The project would be implemented in 74 Gram Panchayats in the following 12 blocks of South and West Sikkim.

South: Yangang, Ravangla, TemiTarkku, Namthang, Melli, Namchi, Jorethang, Sikip
West: Kaluk, Soreng, Gyalshing, Chongrang. Some VWSP of certain areas have already been prepared through support from GIZ in its Project "Climate Change adaptation in the North East Region of GIZ". The detailed list is given below. The areas which have not been covered will be taken up through this project.

Fig 5: Map of project area



. Table 5: Number of Blocks, GPs and Wards and existing VWSPs

Sl. No.	District	Block	GPs	No. of wards	VWSP Prepared with GIZ
1	SOUTH	YANGANG	1/LINGI	05	No
2			2/PAIYONG	07	No
3			3/KOLTHANG TOKDEY	05	No
4			4/NIYA MANZING	05	No
5			5/SRIPATAM GAGYONG	06	No
6			6/YANGANG RANGANG	06	No
7		RAVANGLA	7/RABONG SANGMOO	07	No
8			41/TINKITAM RAYONG	05	No
9			43/LEGSHIP	05	No
10			44/KEWZING BAKHIM	05	No
11			45/BARFUNG ZARONG	07	No
12			46/RALONG NAMLUNG	06	No
13			47/BORONG PHAMTAM	06	No
14		TEMI TARKKU	8/BEN NAMPRIK	07	No
15			9/TEMI	06	No
16			10/TARKU	06	No
17			11/NAMPHING	06	
18			12/BARNYAK TOKAL	05	No
19			13/RAMENG NIZRAMENG	05	Yes
20		NAMTHANG	14/PERBING DOVAN	05	No
21			15/CHUBA PHONG	06	No
22			16/NAMTHANG MANEYDARA	08	No
23			17 NAGI KAREK	06	No
24			18/KATENG PHAMPOK	06	No
25			19/TURUNG MAMRING	06	No
26			20/TANZI BIKMAT	05	No
27			21/RATEYPANI	06	Yes
28		MELLI	22/SADAM SUNTALEY	08	Yes
29			23/MELLIDARA PAIYONG	06	Yes
30			24/TURUK RAMABUNG	07	Yes
31			25/LUNGCHOK KAMAREY	06	Yes
32			26/SUMUK KARTIKEY	05	No
33		NAMCHI	27/RONG BUL	06	No
34			28/MANIRAM PHALIDARA	06	No
35			29/KITAM MANPUR	05	Yes
36			30/MIKHAOLA BOOMTAR	07	No
37			31/SOROK SHYAMPANI	06	No
38			33/ASSANGTHANG	05	Yes
39			36/MAMLEY KAMRANG	05	Yes
40			37/TINGRITHANG	05	Yes
41			38/DAMTHANG	05	No
42		JORETHANG	34/POKLOK DENCHUNG	05	Yes
43			35/TINIK CHISOPANI	05	No
44			32/SHALGHARI	05	Yes
45		SIKIP	39/WAK OMCHU	06	No
46			40/SANGANATH	05	No
47			42/LAMTING TINGMO	05	No
48	WEST	KALUK	27/SANGADORJI	05	No
49			28/TADONG RINCHENPONG	05	No
50			29/SAMDONG	06	No
51			30/DEYTHANG	06	Yes

Sl. No.	District	Block	GPs	No. of wards	VWSP Prepared with GIZ
52			31/TAKUTHANG	05	No
53		SORENG	35/CHOTA SAMDONG ARUBOTEY	05	No
54			41/MALBASEY	06	No
55			42/SORENG	07	No
56			43/SINGLING	05	No
57			44/TIMBERBONG	05	No
58			45/THARPU	05	No
59			46/KARTHOK BOJEK	05	No
60			47/DODAK	05	No
61			48/BURIAKHOP	05	No
62		GYALSHING	10/DARAP	07	No
63			11/SINGYANG CHUMPONG	06	No
64			12/YANGTEN	06	No
65			13/GYALSHING OMCHU	06	No
66			14/YANGTHANG	06	No
67			15/LINGCHOM TIKJYA	05	No
68			16/SARDONG LUNGZIK	06	No
69		CHONGRANG	1/KARZI MANGNAM	05	No
70			2/DHUPIDARA NARKLHOLA	06	No
71			3/KONGRI LABDANG	05	No
72			4/TASHIDING	06	No
73			5/ARITHANG CHONGRONG	05	No
74			6/GERETHANG	06	No
TOT	**02**	**12**	**74**	**421**	

7.0 Baseline Information

7.1 Demography

The Project area is spread across 421 wards, 74 GPs, 12 blocks of South and West districts of Sikkim. The total population is 1, 85,416 persons as per 2011 census with total male population of 96,899 and total female population of 88,517.Total number of households in the project area is 37952 with average family size of 4.94 per household. The sex ratio of the project area is 903 females per thousand males. Percentage of Schedule caste population is 3% and schedule tribe is 31%. The literacy rate of the project area is 79% and average Per-capita land holding is 0.30 hec which implies the area is dominated by small and marginal farmers. The block wise detail demographic characteristics of the project area are given in the table as under:

Table 6: Demography of Project area

District	Block	No of HH	Average family size	Total Population	Total Male	Total Female	% of Female	% of SC	% of ST	Literacy rate	Sex ratio	Percapita land holding
West	Chongrang	1485	5.31	7876	4390	3486	45%	3%	17%	82%	794	0.25
	Kaluk	2978	4.81	14349	7345	7004	49%	2%	45%	76%	954	0.34
	Soreng	3742	4.76	17470	8930	8540	49%	5%	41%	78%	956	0.31
	Gyalshing	4264	4.99	21124	10934	10190	48%	5%	44%	76%	932	0.30
South	Jorethang	1485	5.31	7876	4390	3486	45%	3%	17%	82%	794	0.25
	Melli	3411	4.71	15959	8135	7824	49%	5%	15%	81%	962	0.26
	Namchi	3610	4.75	17117	8766	8351	49%	3%	27%	81%	953	0.40
	Namthang	3515	5.04	17640	9404	8236	47%	5%	33%	82%	876	0.35
	Ravangla	4580	4.87	21946	11795	10151	46%	3%	36%	78%	861	0.37
	Sikip	1070	4.70	5136	2731	2405	47%	1%	37%	77%	881	0.62
	Temi Tarku	4221	4.81	20031	10317	9714	48%	5%	35%	81%	942	0.31
	Ravangla	3591	5.28	18892	9762	9130	48%	3%	29%	79%	935	0.34
Project Area		**37952**	**4.94**	**185416**	**96899**	**88517**	**48%**	**3%**	**31%**	**79%**	**903**	**0.34**

Source: Census of 2011

7.2 Analysis of water sector

The project area is much more drier compared to the state which can be discerned from the fact that more than 60 % of unirrigated arable land or dry land (Suka bari) is in the project area and only 6 % land irrigated which is Paniket existing in the areas with availability of water.

Table 7: Land-use project area

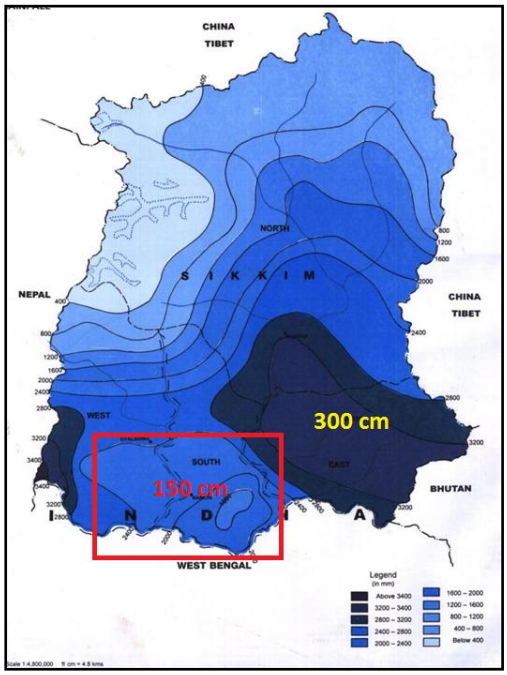
Districts	Blocks	Total Irrigated/ Pani Khet (ha)	Unirrigated/ Suka bari (ha)	Culturable wasteland (ha)	Area not available for cultivation (ha)	Total Area (ha)
West	Chongrang	147.69	3505.35	2784.28	301.03	6738.35
		2%	**52%**	**41%**	**4%**	
	Galshing	701.19	4364.91	847.78	385.88	6299.76
		11%	**69%**	**13%**	**6%**	
	Kaluk	139.86	3223.93	1017.11	453.8	4834.7
		3%	**67%**	**21%**	**9%**	

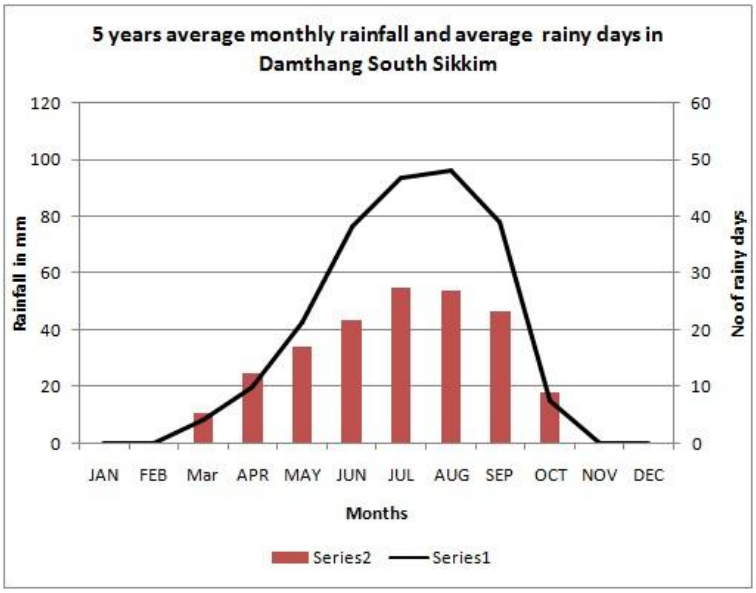
	Soreng	485.16	2425.855	911.51	706.51	4529.04
		11%	**54%**	**20%**	**16%**	
South	Jorethang	91.29	1237.95	437.66	92.07	1858.97
		5%	**67%**	**24%**	**5%**	
	Melli	297.09	2193.71	1262.49	249.22	4002.51
		7%	**55%**	**32%**	**6%**	
	Namchi	59.79	4127.95	2050.46	480.65	6718.85
		1%	**61%**	**31%**	**7%**	
	Namthang	182.72	3595.24	1859.07	180.51	5817.54
		3%	**62%**	**32%**	**3%**	
	Ravangla	242.21	5260.75	1423.18	334.5	7260.64
		3%	**72%**	**20%**	**5%**	
	Sikip	40.51	1762.19	999.62	101.31	2903.63
		1%	**61%**	**34%**	**3%**	
	Temi Tarku	367.56	3301.12	1433.56	162.81	5265.05
		7%	**63%**	**27%**	**3%**	
	Yangang	743.77	3888.62	1219.31	164.27	6015.97
		12%	**65%**	**20%**	**3%**	
	Project Area	**3498.84**	**38887.575**	**16246.03**	**3612.56**	**62245.01**
		6%	**62%**	**26%**	**6%**	

Source: Census 2011

Further, the rainfall distribution map of Sikkim shows that project area receives the annual rainfall of 150 cm compared to 300 cm in the East and some part of the north district. The pattern of rainfall distribution clearly indicates the drought prone areas in the south central part; this forms the rain-shadow area of Darjeeling Himalaya (ICAR, 2000). Moreover, the analysis of 5 years rainfall from 2010 to 2014 and average rainy days of Damthang hills which receives highest rainfall in the project area suggest that most of the rainfall is received from May to first week of September over the average slope of more than 40%. Since the area doesn't have high density forest cover in upper catchment 80% of the rainfall is converted into runoff.

Fig 6: Rainfall map of Sikkim





Source: ICAR 2000

The current estimates by the Agriculture Department, Government of Sikkim, suggest that the present water demand for water for domestic uses is 0.18 BCM, Crop- 0.21 BCM, livestock- 0.008 BCM and Industrial uses- 0.0003 BCM. The current total water demand in the project area is 0.244 BCM. However, it has been projected that by 2020 the additional 0.015 BCM water would be required for domestic uses and 0.002 BCM water for crops. Therefore, there would be requirement of additional 0.017 BCM water to meet up the demand for various sectors.

Table 8: Present water demand of the project area

District	Block	Domestic	Crop	Livestock	Industrial	Power generation	Total
West	Chongrang	0.0004	0.063801	0.0002	0	0	0.064
	Gyalshing	0.0007	0.048528	0.0002	0	0	0.049
	Kaluk	0.0005	0.045273	0.0003	0	0	0.046
	Soreng	0.0006	0.057924	0.0002	0	0	0.059
South	Namchi	0.0035	0.000033	0.0012	0	0	0.005
	Namthang	0.0022	0.000002	0.0006	0.0002	0	0.003
	Jorethang	0.0009	0.000001	0.0001	0.0001	0	0.001
	Sikkip	0.0006	0.000013	0.0002	0	0	0.001

	Sumbuk	0.0020	0.000002	0.0005	0.00003	0	0.003
	Temi	0.0021	0.000019	0.0024	0	0	0.004
	Rabong	0.0023	0.001100	0.0013	0	0	0.005
	Yangang	0.0025	0.000007	0.0012	0	0	0.004
Total		**0.0183**	**0.216704**	**0.0085**	**0.0003**	0	**0.244**

Table 9: Projected water demand of the project area for 2020 in BCM

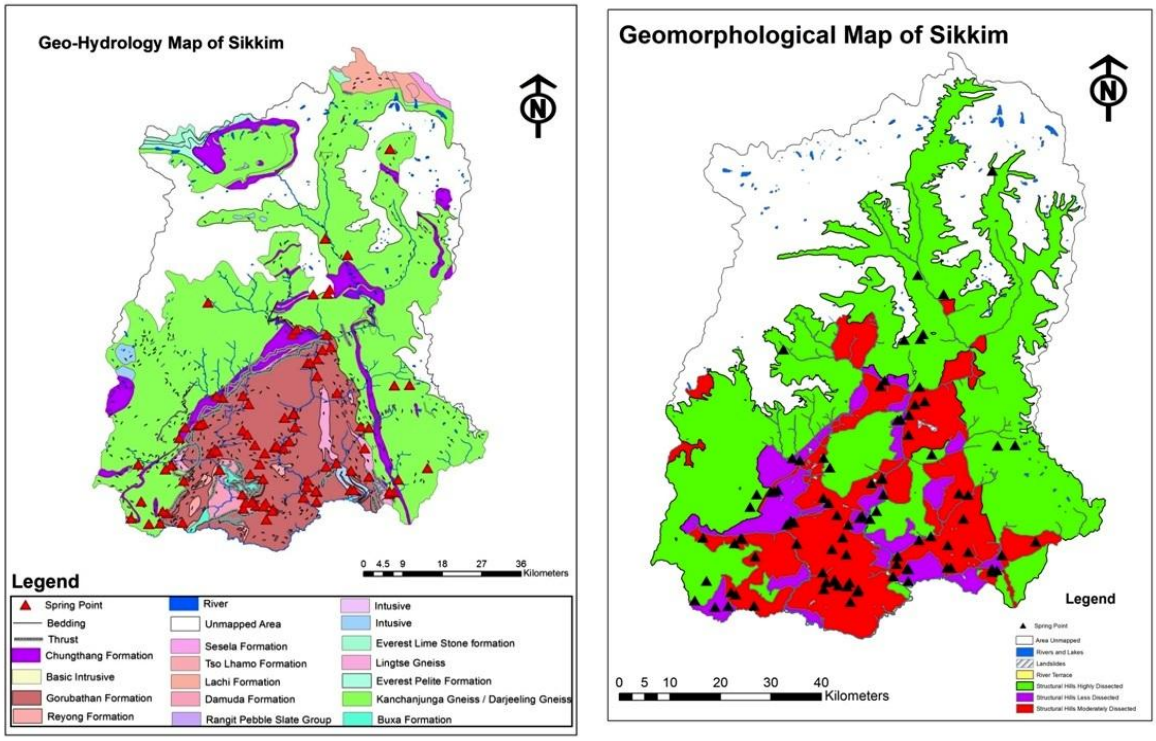
Block	Domestic	Crop	Livestock	Industrial	Power generation	Total
Chongrang	0.0004	0.063690	0.00002	0	0	0.064
Geyzing	0.0008	0.048350	0.00004	0	0	0.049
Kaluk	0.0005	0.045250	0.00005	0	0	0.046
Soreng	0.0006	0.057880	0.00005	0	0	0.059
Namchi	0.0188	0.000032	0.00131	0	0	0.020
Namthang	0.0023	0.000002	0.00064	0.0002	0	0.003
Jorethang	0.0010	0.000001	0.00015	0.00007	0	0.001
Sikkip	0.0006	0.000013	0.00023	0	0	0.001
Sumbuk	0.0021	0.000002	0.00057	0.00003	0	0.003
Temi	0.0022	0.002217	0.00248	0	0	0.005
Rabong	0.0025	0.001100	0.00133	0	0	0.005
Yangang	0.0027	0.000007	0.00123	0	0	0.004
Total	**0.034**	**0.219**	**0.008**	**0.0003**	**0**	**0.259**

Source: Department of Agriculture, Government of Sikkim

7.3 Geomorphology and Geo-hydrology

Geohydrology map of Sikkim suggest that the project area falls under the Gorubathan, Reyong and Buxa formation and also deposits from the Damuda group. The geomorphological map of the state indicates that the project area falls under moderate to less dissected hill segments. Dissection index helps to understand the probability of ground water occurrences in the Himalaya. Areas with high dissection and greater slopes have lesser chances of ground water occurrences. These are mostly the higher elevation areas. Most of the rain water converts into runoff due to steeper slopes creating higher density of drainage. However, in the areas having low to moderate dissection the probability of occurrence of ground water is more. However, the valley floors and river banks also have higher probability of ground water occurrences.

Fig 7: Hydro-geology and Geomorphological map of Sikkim



Source: DST, Sikkim

8.0 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 having mid-term review after two years of implementation).

Table 10: Milestones and expected dates

Milestones	**Expected Dates**
Start of Project/Programme Implementation	To be Decided once the concept is approved
Mid-term Review (if planned)	18th Month since the date of project inception
Project/Programme Closing	36th Month since implementation
Terminal Evaluation	3 months before the closing of the project

9.0 Project Components and Financing

Table 11: Project Components and Financing

No.	Project Components	Expected Concrete Outputs	Expected Outcomes	Amount (lakhs)
1	Training and Capacity Building	Community mobilization on water conservation and climate resilient activities Training on preparation of Village Water Security Plan Training on implementation of Village Water Security Plan	To develop knowledge of local people on water conservation and its need To train people on development of VWSP and understand the recommendations of the Plan To train people on how to implement the different recommendations under the VWSP	**27.92**
2	Planning	Preparation of Village Water Security Plan (VWSP) of Gram Panchayat Units and collection of baseline data Hydrogeological study of the springs Feasibility assessment and budget estimation of the suggested measures in VWSP Updation of village springs atlas	Assess current issues and water requirement in GPs Geohydrology assessment to identify the recharge area using scientific study Technical, financial assessment of suggested measures in Plan and evaluate nature of climate resilient activities Village spring atlas to do resource mapping of springs	**66.1**
3	Implementation of suggested activities under Village water Security Plan - Construction of infrastructure	Roof top water harvesting structures for harvesting roof water during rainy season Community water storage reservoirs to store night discharge of the springs and excess monsoon discharge of the springs Construction of solid waste recovery	Increase water storage capacity in villages located on top of hills with perennial water shortage Household level tanks can be constructed to store the perennial spring water overnight, and this stored water can be used during the day for household as well as minor irrigation works	**1544.63**

No.	Project Components	Expected Concrete Outputs	Expected Outcomes	Amount (lakhs)
		centre		
4.	Support Services	► Fodder development ► Horticulture development	► Plantation of saplings	**646.66**
5.	Project Execution Cost (INR 50,00,000 set aside against project management by DST and remaining for RMDD)			**116.17**
6.	Total Project Cost			**2401.48**
.	Project Cycle Management Fee charged by the Implementing Entity (3%)			**68.56**
Amount of Financing Required				**2470.04**

10.0 Project Justification

10.1 Component-wise details and justification of the project components

(i) Planning

Baseline Scenario-Presently, there is dearth of technical studies and needs assessment on the water availability and requirement in the villages of Sikkim. Without an in-depth technical review of the same, no feasible technical intervention can be carried out to yield measurable results. Hence, it is imperative for the state to carry out a detailed technical study on water security to address drinking water issues in the villages.

Adaptation Activities-In order to improve the baseline scenario, a thorough review of the project sites will be carried out during the planning phase to determine infrastructure needs. This will be done through preparation of Village Water Security Plans for GPs, Hydrogeological study of the springs to identify the recharge area using scientific study, and updation of Village Spring Atlas.

Contribution to climate resilience-The conduction of such studies will aid in assessment of the present scenario and development of recommendations, or action points for achieving resource security and climate resilience. At a later stage, infrastructure will be created as per these plans to ensure water security in villages.

(ii) Construction of infrastructure

Baseline Scenario-Currently there is a lack of physical infrastructure for providing clean drinking water to the villages in the project locations. The introduction of piped water supply from distance has led to reduced conservation of local springs and inequitable distribution of piped water, owing to unsystematic pipe networking and storage tanks. Hence, there is a need to create suitable infrastructure for appropriate water storage and harvesting. An example of the baseline scenario can be ascertained from the following Table 12.

Table 12: baseline information on water storage infrastructure in Upper and Lower Sadam

Details of water storage infrastructure in Upper Sadam and Lower Sadam wards of SadamSuntalay GP										
GP Ward	No of HH	Funding Agency/ Dept.	Total No. of Tanks	Functional	Defunct	Reasons	Capacity/ tank (ltrs)	Functional	Total capacity (ltrs)	No of HHs without water storage medium
Upper Sadam	96	NREGA	20	15	5	Under construction	10,000	150000	200000	25
		RMDD	5	5	0	NA	10,000	50000	50000	
Lower Sadam	114	NREGA	20	20	0	NA	30,000	600000	600000	60
		Horticulture Dept.	2	2	0	NA	34,000	68000	68000	
		RMDD	3	3	0	NA	10,000	30000	30000	
		RWSS	3	3	0	NA	10,000	30000	30000	

Source: http://www.sikkimsprings.org/dv/vwsp/VWSP%20Sadam%20Suntaley-Final.pdf

Adaptation Activities-In order to improve the baseline scenario, the activities suggested in the study documents prepared as a result of the planning stage would be implemented. Specific strategies like roof top rainwater harvesting and community water storage reservoirs to store night discharge of the springs and excess monsoon discharge of the springs. Apart from this, adequate fodder and horticulture development activities will also be carried out.

Contribution to climate resilience-Creation of such infrastructure will aid in addressing drinking water issues in the villages, hence contributing to ensuring water security in the vulnerable villages of the state. Plantation of saplings will have a major role to play in combating climate change impacts.

(iii) Training and Capacity Building

Baseline Scenario-Currently there is very less training and awareness on water conservation and other associated climate resilient activities, hence local people will have to be trained for

the project. There is also currently no local capacity to prepare and execute village water security plans.

Adaptation Activities-Wide-spread training programs for local villagersto ensure community mobilization on water conservation and climate resilient activities. They will also have to be trained on how to properly collect baseline data and prepare water security plans. People who will be engaged in such activities will also be trained on how to technically implement the recommendations of such plans.

Contribution to climate resilience-Issues like wastage of water and benefits of storage can be addressed which in turn will bring water conservation. Capacity building of people helps in behavioral changes which in turn helps in reduction of water usage and its benefits in the long run.

10.2 Details on Economic, Social and Environmental benefits of the project

Table 13: Details on Economic, Social and Environmental benefits of the project

No.	Components/ Activities	Key Benefits (Direct)		
		Social	Economic	Environmental
	Planning and Construction of infrastructure	► Improved basic infrastructure in villages by installing rooftop rainwater harvesting in 1,263 units, 74 community water storage reservoirs, 10,20,000 saplings ► Improved standard of living by ensuring provision of basic amenities ► Involve local villagers in the region's development	► Lead to more livelihood opportunities and job creation ► Reduced economic loss in unplanned pipe repair works	► Reduce wastage of resource (water) and improved resource efficiency ► Plantation of trees to contribute in betterment of environment ► Involve local villagers in water conservation efforts thereby reducing their conflict with conservation

No.	Components/ Activities	Key Benefits (Direct)		
		Social	Economic	Environmental
		Water is directly linked with the economic condition of the households in rural areas as majority of them are dependent on agriculture and animal husbandry. The artificial interventions on the recharge areas will have enormous contribution to local fauna as it enhances the soil moisture.		
	Training and Capacity Building	► Improved capacity of local youths and villagers ► Improved project management capacity	► Improved knowledge of people and creation of job opportunities.	► This will allow for collection of baseline data which help monitor long-term climate change impacts

10.3 Sustainability of intervention

RMDD personnel will be the agency primarily responsible for setting up the infrastructural systems under this project. They would also oversee operation and maintenance of the rainwater harvesting systems, with key involvement from local people.

The operation and maintenance cost of these types of projects are very low. Hence the project is expected to continue without much difficulty even after the life term of the project. Capacity building of the beneficiaries is essential in this case to ensure sustained use of these installations.

Sustainability would also be ensured through use of low emission materials and processes (including low emissions across life cycle). To ensure sustainability after completion of project, the local villagers would be involved in meeting the operation and maintenance costs and activities.

10.4 Analysis of the cost-effectiveness of the proposed project

i) A comparison of the chosen options vis-à-vis alternative options has been provided in the table 14:

Table 14: Analysis of the cost-effectiveness of the proposed project

No.	Activity	Proposed Alternatives	Benefits
1	Conservation of water by construction of rainwater harvesting facility and reservoirs in Sikkim for 74 GPs	An alternative to the project proposed under NAF can be the concerned Municipality water supply project which will pump and provide continuous supply of water to these GPs.	The rainwater harvesting and reservoirs project is more cost effective compared to the alternative project as the project size is smaller and the project duration is shorter in comparison. It will start supplying water to the vulnerable communities immediately after its implementation. Also, the O&M costs of such systems are very low compared to the pumped water supply systems. The benefits of the rainwater harvesting project compared to the alternative project are as follows: 1. The rainwater harvesting and reservoirs project will conserve the natural rainwater and reduce surface run-off. 2. It is a climate adaptation project that converts the future climate risk of increased precipitation to future gain by providing water storage to the local vulnerable communities. 3. The rainwater harvesting and reservoirs project will provide a sustainable supply of water to the households even if the pumped water is not available.

ii) The funding allocation for investment activities, capacity building activities and project management activities has been provided in the table 15.

Table 15: funding allocation for activities

Type of Activity	List of Activities	Funding Requirement

Type of Activity	List of Activities	Funding Requirement
Investment Activities	► Preparation of Village Water Security Plan (VWSP) of Gram Panchayat Units and collection of baseline data ► Hydrogeological study of the springs ► Feasibility assessment and budget estimation of the suggested measures in VWSP ► Updation of village springs atlas ► Roof top water harvesting structures for harvesting roof water during rainy season ► Community water storage reservoirs to store night discharge of the springs and excess monsoon discharge of the springs ► Construction of solid waste recovery centre ► Fodder development ► Horticulture development	**2257.10**
Capacity Building activities	► Community mobilization on water conservation and climate resilient activities ► Training on preparation of Village Water Security Plan ► Training on implementation of Village Water Security Plan	**27.92**
Project Management Activities	► Monitoring of the project ► Coordination between various stakeholders ► Oversight of operational activities ► Nodal point for Mid-year Review and Final Review	**184.97**

10.5 Alignment with the National and State Action Plans and other Policies/Programmes

This project is aligned with both the National Action Plan on Climate Change (NAPCC) as well as Sikkim's State Action Plan on Climate Change (SAPCC). Under the NAPCC this

activity would fall under The National Water Mission. Under the SAPCC, this activity is aligned with the focus given to the water security water resources in Sikkim and concerns of water security. The project is also clearly a climate change adaptation project and is aligned with climate change requirements under both the NAPCC and SAPCC.

10.6 Component-wise technical standards

Table 16: Component-wise technical standards

No.	Activity	Applicable Standard	Application to Project
1	Water Supply	CPHEEO	Applicable
2	Ensuring Water Quality	BIS, CPHEEO	Applicable
3	Structural Stability	IS Code	Applicable

10.7 Duplication check

Table 17: Duplication check

SNo.	Project	Objectives	Complementarities	Geographical Coverage/ Agency
1	Spring-Shed Management/Dhara-vikas	Recharge Aquifers	For Sustainable spring flow	514 hectares/ RMDD

10.8 Details on stakeholder consultation

Village Water Security Plans have already been prepared for 12 villages of West and South Sikkim. Therefore, there will be definitely no concerns regarding the acceptability of the project from the potential beneficiaries. However, since exact project site selection and components will take place only once the project begins, a thorough stakeholder consultation will be conducted during the planning phase of the project. This consultation will not only re-confirm the buy-in from the local population but will also identify the exact project boundaries, livelihood options for the selected sites and will familiarize the beneficiaries with the organizational and implementation mechanism to be used.

10.9 Learning and knowledge management

- Capacity building and knowledge sharing workshops and sessions will be held for the ULBs to capture and disseminate the lessons learnt during the project implementation phase. During these workshops, the ULBs will also be prepared for the operation and maintenance of the installed systems. The sessions will also empower the ULBs to replicate similar project in other areas.
- Capacity building sessions will also be held for the beneficiaries - local communities so that the installed systems can be used in an efficient manner.

10.10 Sustainability of project outcomes

Table 18: Sustainability of the project

No.	Expected outcomes	Expected concrete outputs	Sustainability Mechanism	Responsible party/ies
	▸ Assess current issues and water requirement in GPs ▸ Geohydrology assessment to identify the recharge area using scientific study ▸ Technical, financial assessment of suggested measures in Plan and evaluate nature of climate resilient activities ▸ Village spring atlas to do resource mapping of springs	▸ Preparation of Village Water Security Plan (VWSP) of Gram Panchayat Units and collection of baseline data ▸ Hydrogeological study of the springs ▸ Feasibility assessment and budget estimation of the suggested measures in VWSP ▸ Updation of village springs atlas	Local villagers would be involved in implementation, operation and maintenance of the created assets under this project	RMDD, Govt. of Sikkim
2.	▸ Increased water storage capacity in villages located on top of hills ▸ Household level tanks can be constructed to store the perennial spring	▸ Roof top water harvesting structures for harvesting roof water during rainy season ▸ Community water storage reservoirs to		

No.	Expected outcomes	Expected concrete outputs	Sustainability Mechanism	Responsible party/ies
	water overnight, and this stored water can be used during the day for household as well as minor irrigation works	store night discharge of the springs and excess monsoon discharge of the springs ▸ Construction of solid waste recovery centre		
3.	▸ To develop knowledge of local people on water conservation and its need ▸ To train people on development of VWSP and understand the recommendations of the Plan ▸ To train people on how to implement the different recommendations under the VWSP	▸ Community mobilization on water conservation and climate resilient activities ▸ Training on preparation of Village Water Security Plan ▸ Training on implementation of Village Water Security Plan		
4.	▸ Plantation of saplings	▸ Fodder development ▸ Horticulture development		

10.11 Overview of the environmental and social impacts and risks identified as being relevant to the project

Table 19: Environmental and social impacts and risk

No.	Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks- further assessment and management required for compliance
1.	Compliance with the Law	√	
2.	Access and Equity	√	
3.	Marginalized and	√	

	Vulnerable Groups		
4.	Human rights	√	
5.	Gender Equity and Women's empowerment	√	
6.	Core Labour Rights	√	
7.	Indigenous People	√	
8.	Involuntary Resettlement		NA
9.	Protection of Natural Habitats		NA
10.	Conservation of Biological Diversity	√	
11.	Climate Change	√	
12.	Pollution Prevention and Resource Efficiency	√	
13.	Public Health	√	
14.	Physical and Cultural Heritage	√	
15.	Lands and Soil Conservation		NA

11.0 Implementation Arrangements

11.1 Arrangements for Project implementation

Table 20: Arrangements for project implementation

Hierarchy	Charge	Responsibility
State	State Nodal Officer/Joint Secretary/ Additional Director - DST	Co-ordinate with funding agency
		Receive funds and disburse it to the district as per the district plan
		Ensure accountability and transparency in the Scheme at all levels
		Regular review, monitoring and evaluation of processes and outcomes
		Establish a network of professional agencies for training, technical support and for quality-control measures
District	DPC (District Planning Committee)/ADC (Dev) Autonomous district Council	Receive funds and disburse it to the district as per the block plan
		Ensure timely release and utilization of funds
		Review, monitor and supervise the performance of the POs
		Conduct and cause to be conducted periodic inspection of the works in progress
Block	Programme Officer/Block	Monitoring and supervising implementation of works taken up by GPs and other implementing agencies within

Hierarchy	Charge	Responsibility
	Development Officer/ Additional Director - DST	the Block
		Maintaining proper accounts of the resources received, released and utilized
		Ensuring conduct of social audits and following up on required actions.
Gram Panchayat	GRS (Gram RozgarSevak)/ Additional Director - DST	Identification and planning of works, developing shelf of projects including determination of the order of their priority. Assist the technical team in preparation of VWSP
		Executing works that shall meet the required technical standards and measurements
		Prepare annually a report containing the facts and figures and achievements relating to the implementation of the Scheme within its jurisdiction and, copy of the same to be made available to the public on demand and on payment of such fee as may be specified in the Scheme
		Awareness generation and social mobilization
		Make available all relevant documents including the Muster Rolls, bills, vouchers, measurement books, copies of sanction orders and other connected books of account and papers to the GS for the purpose of conducting the social audit
		Monitoring implementation at the village level

Description of the measures for financial and project risk management including environmental and social risk

Table 21: Measures for financial and project risk management

No.	Risk	Rating (High/Medium/Low)	Mitigation Measure
1.	Financial	Medium (project implementation can stop in the middle of construction due to natural calamity like flood, land slide)	Timely completion of construction and having prior database about landslide prone zone to minimize the risk
2.	Environmental	Low (minimum impacts of micro ecosystem for building harvesting tanks or sudden seismic activities occurred)	- Setting up the tank in a relatively less ecologically active areas - Conducting proper seismic analysis and follow seismic resistant construction technique
3.	Social	Low (minimum impact as people will be involved in	- Capacity building of people and importance of water

No.	Risk	Rating (High/Medium/Low)	Mitigation Measure
		implementation)	conservation to be disseminated.

11.2 Monitoring and Evaluation Plan

Organizational Responsibility: Please refer to Section 2a (implementation arrangement)

Monitoring Plan: Please refer to Section 2a (implementation arrangement)

Evaluation Plan: Please refer to Section 2a (implementation arrangement)

The state has award winning independent social Audit unit which is effectively evaluating the performance of MGNREGA works till date.

- The Mid-Term and Final Evaluations will be conducted by third-parties selected after a competitive bidding process. The parameters that will be evaluated will include efficiency, effectiveness, relevance, sustainability and impact.
-

12.0 Project activities

The project activities comprises mainly of three major components. The Capacity building and community consultation, planning and preparing the Village Water Security Plan and implementing the recommendations of the plan.

12.1 Capacity Building

Water has been the centre of the debate in the villages and mostly among the drought prone villagers of South and West District. There have been several efforts to create awareness by government and non – government agencies. The RMDD initiated Dhara Vikas initiatives have been high in demand in these villages. Hence this project aims to build on the integrated plan for these villages, build the capacity of the local functionaries, villagers, Gram Panchayat Members and train them on water management, conservation.

To begin with, a community consultation shall be conducted in the project villages to raise awareness on the water conservation issues and to mobilize them to participate in the project aimed at securing water for the village. A cadre of local people including the field functionaries shall be sensitized on the project activities such as the village waster security plan and the spring shed development works. This will be followed by capacity building of the selected team to update and prepare the Village Water Security Plan. This training shall be provided by a team of trained Resource Person who are conversant with PRA exercises

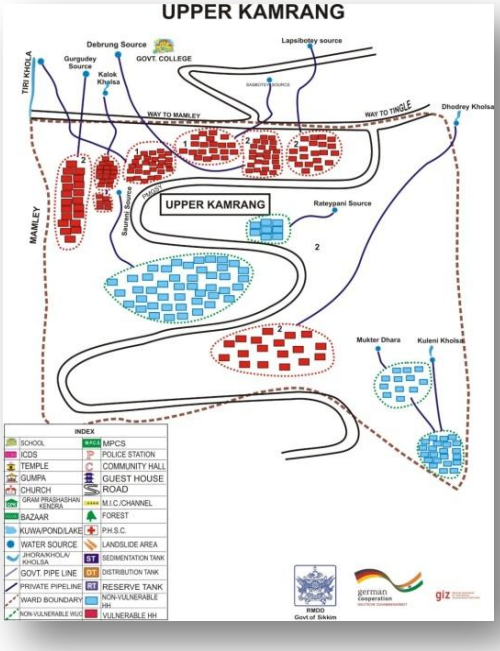
and have been working on our Spring Shed development project for the last several years. Further, the training will also be imparted for implementation of VWSP adaptation measures.

Photo 1: Community consultation for preparing the village water security plan

12.2 Planning

Once the sensitization program and training of the block / GP level VWSP team is completed, the team will prepare a village Water Security Plan for the Gram Panchayat which will involve series of activities like

- Collection of baseline data
- Community consultation
- PRA Exercises
- FGDs with women and other members
- Preparing village water resource map
- Water distribution maps
- Assessing demand and availability of water in the village
- Assessing the existing infrastructure and its status
- Field survey, inspection with Technical team of experts including Engineers
- Door to door visit and interaction with villagers



After completing the entire assessment and field surveys, inspection and collection of baseline data, a comprehensive Water Security Plan will be prepared with the help of the Gram Panchayat members, villagers and various stakeholders including the officials of the various government departments. This set of plan shall be then forwarded to the block development office for preparing detail technical report such as estimates and plan. The plan will take into consideration the activities needed to be taken up on short, medium and long term basis.

Simultaneously, a team of experts on Hydro-geological shall carry out the study of the potential recharge area of the village. The Hydro-geological assessment shall further strengthen the plan with technical knowledge and provide a scientific basis for implementation of the spring shed development works in adaptation measures wherever it is feasible.

All springs, steams and lake shall be surveyed, their historic trends shall be recorded, and their current status, discharge rate and dependency shall also be recorded. These springs shall also be mapped in the spring's atlas using a google platform.

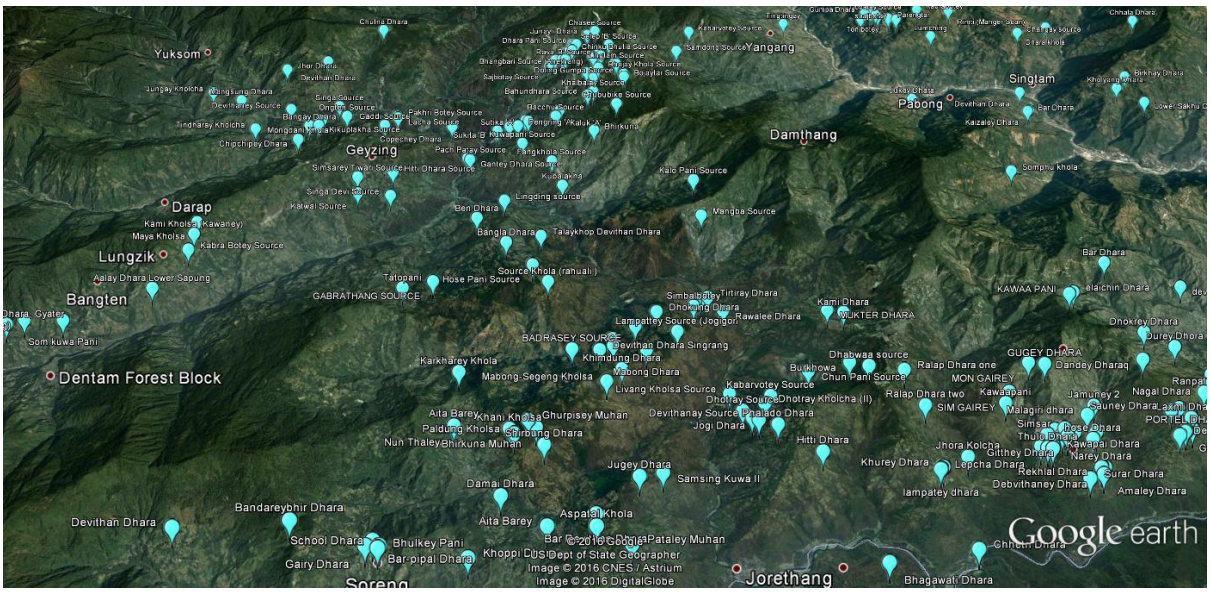


Photo2: Mapping of recharge area on google map

12.3 Implementation

The recommendation and the action plan on Village Water Security Plan after due approval shall be implemented in a phase manner through various schemes and projects. The NAF project funded by NABARD shall be utilized to fill in the critical gap are in the project activities while subsequent amount of investment shall be channelized through various

ongoing central and state schemes. MGNREGA convergence on unskilled labour shall be utilized toward taken up various water related and NRM projects in the village as per the plan. The Village Water Security Plan shall be integrated with the MGNREGA Labour Budget plan from the subsequent year to ensure enough convergence in the project.

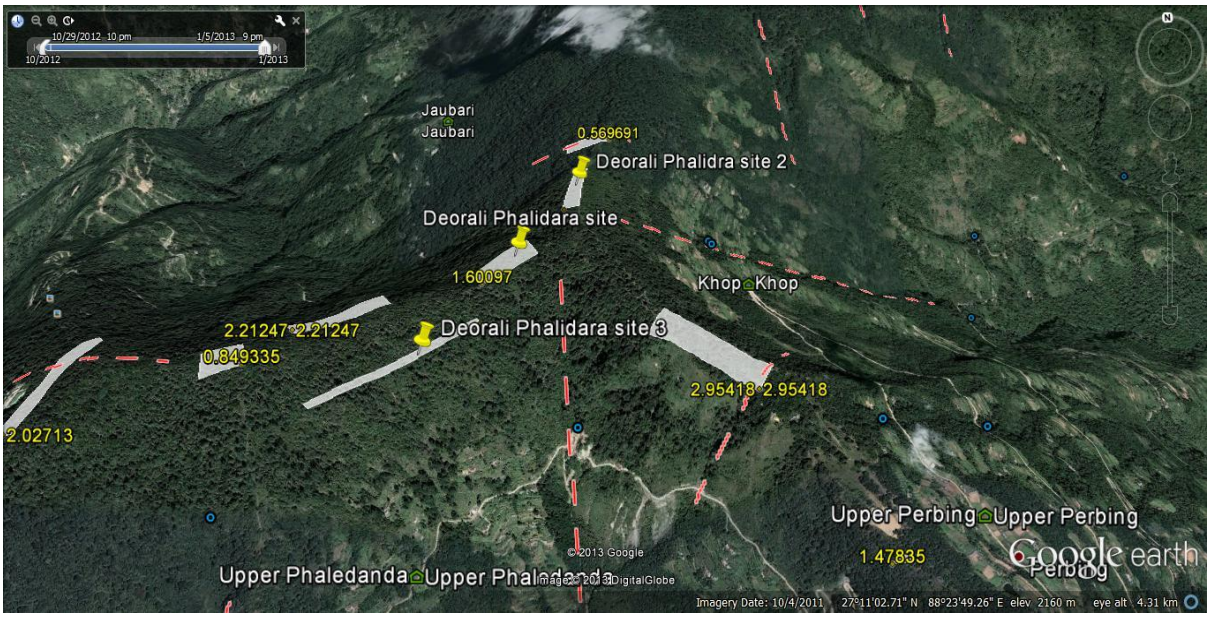


Photo3: Identification of recharge area on google map

Photo 4: trenches on recharge area

12.4 Key focus area for the project

Reviving of springs, streams and hill top lakes through various artificial recharge activities shall be the top most priority. Major part of this work shall be taken up under MGNREGA since its does not involve much material while the technical assessment, study for identifying the recharge area shall be taken up under the NAF project. Priority of the project shall be to revive the dried up springs, increasing the discharge of the spring during lean season (Nov-April) and ensuring that the surface runoff during monsoon are fully harnessed to recharge the underground aquifer / water table.

Subsequently, in order to ensure that every drop of water is conserved and wisely utilized, a series of storage facilities like roof rain water harvesting structures, community water tanks and Individual Household water storage tanks shall be constructed. This will ensure that every drop of water is conserved, stored and not wasted. This will ensure that the night time discharge of waters is taped into these large water reservoirs to meet the water need throughout the year. The hamlets or cluster which are the most vulnerable and have acute water shortage shall be target first with this interventions. The Project will also seek convergence with other national flagship program like Pradhan Mantri Krishi Sechai Yojana (PMKSY) and Integrated Watershed Management Programme.

Photo 3: Off season organic vegetable farming in South Sikkim

Similarly, in order to promote greening of the village, fodder and horticulture plantation shall be taken up simultaneously in this village. This will help in green covering the village and also shall provide additional livelihood benefits. The fodder plantation will strengthen the dairy development in the village. MGNREGA is already constructing animal shelters like cowshed, goat shelter in huge numbers in the village. Some village is on the way to saturation

and has covered more than 50% of the poor and marginal farmers in the village. This will boost the dairy development while provide additional income of about Rs. 12,000 – 20,000/ household per annum.

12.5 Construction of solid waste - Resource Recovery Centre

Solid waste management has become a growing problem with increase number of population and urbanization. This problem have reached far nock and corner of the village, the increasing waste and lack of proper management is further leading to contamination of water source and agriculture field. In most cases the garbage find their way into stream, river and Jhoras, often pollution the head water of the spring for many downstream villages. Thus a small part of the investment shall also be utilized to address this Solid waste management problem in the project area in partnership with Swatch Bharat Mission (Gramin). The funding available under this project shall be used to supplement their infrastructure and IEC need for the ongoing SBM (Gramin) programmes, thus directly addressing the issues of water contamination and pollution.

Photo 4: Plastic / Pet bottles graded and shredded into pebbles at a processing plant at Singtam

SBM (Gramin) – Sikkim has implemented some successful project on Solid, Liquid Waste Management and they already have a model developed for rural area. The model of Melli Dara Gram Panchayat shall be replicated to this NAF project sites. Source segregation shall be promoted in the centrally located place in the GP, where all kind of waste shall be segregated into different component. The waste shall be graded into colors, types and its resalable market values. This shall be further compressed and shredded into pebbles and shall be sold as raw materials to plastic factories outside the state. So a unique waste management model shall be developed and upscaled to all 12 project blocks.

13.0 Budget breakup (NAF + MGNREGA)

Table 22: Budget breakup (NAF+ MGNREGA)

Sl. No	Activities	Unit	Unit cost (in INR)	Total Units	NAF Cost (In lakh)	Co-funding from MGNREGA	Total Cost (In lakh)
1	**Capacity Building**						
1.1	Community mobilization on water conservation and climate resilient activities	Numbers	14,000.00	74	10.36	0	10.36
1.2	Training on preparation of Village Water Security Plan	Numbers	12,000.00	60	7.2	0	7.2
1.3	Training on implementation of Village Water Security Plan	Numbers	14,000.00	74	10.36	0	10.36
				Sub total	**27.92**	**0**	**27.92**
2	**Planning**						
2.1	Preparation of Village Water Security Plan of Gram Panchayat Units and collection of baseline data	No. of GP	50,000.00	60	30	0	30
2.2	Hydrogeological study of the springs to identify the recharge area using scientific study	Numbers of landscape level studies	Lump Sum	1	20	0	20
2.3	Feasibility and budget estimation of the suggested measures for climate resilient activities	Numbers	15,000.00	74	11.1	0	11.1
2.4	Updation of village springs atlas		Lump Sum		5	0	5
				Sub total	**66.1**	**0**	**66.1**

3	**Implementation**						
	Implementation of suggested activities under Village Water Security Plan						0
3.1	Implementation of suggested activities under Village Water Security Plan like roof top water harvesting structure for harvesting roof water during rainy season	Nos	1,13,000.00	1263.00	999.03	428.157	1427.19
3.2	Implementation of suggested activities under Village Water Security Plan like community water storage reservoir to store night discharge of the springs and excess monsoon discharge of the springs 50,000 litre	Nos	350000.00	148.00	362.60	155.4	518.00
3.3	Dhara Vikas	Hec	30000.00	300.00	27.00	63	90.00
3.4	Fodder Development- cost of saplings	Hec	36000.00	1684.00	242.50	363.744	606.24
3.5	Horticulture Development- cost of saplings	Hec	64000.00	1684.00	404.16	673.6	1077.76
3.6	Construction of solid waste recovery centre	Nos	15,00,000.00	12.00	156.00	24	180.00
				Sub total	**2191.29**	**1707.901**	**3899.19**
A	**Total of project cost (NABARD project only) (SL-1+ SL-2 + SL-3)**				**2285.31**		
B	**Project execution cost (5%) which includes 50 lakh for DST project execution charge**				116.17		
C	**Project Cycle Management Fee charged by the Implementing Entity (3% of total project cost) in lakh**				68.56		
D	**Total funding sought from NAF**				**2470.04**	MGNREGA cost in %	
E	**Total MGNREGA Investment in Lakh**				1707.901	**40.87%**	
F	**Total project cost (NAF + MGNREGA) in Lakh**				4177.94		

13.1Year wise Budget Break up

Table 23: Year wise Budget Break up

Sl. No	Activities	Unit	Unit cost (in INR)	Total Units	YEAR 1	YEAR 2	YEAR 3
1	**Capacity Building**						
1.1	Community mobilization on water conservation and climate resilient activities	Numbers	14,000.00	74	10.36	0	0
1.2	Training on preparation of Village Water Security Plan	Numbers	12,000.00	60	7.2	0	0
1.3	Training on implementation of Village Water Security Plan	Numbers	14,000.00	74	10.36	0	0
				Sub total	**27.92**	**0**	**0**
2	**Planning**						
2.1	Preparation of Village Water Security Plan of Gram Panchayat Units and collection of baseline data	No. of GP	50,000.00	60	30	0	0
2.2	Hydrogeological study of the springs to identify the recharge area using scientific study	Numbers of landscape level studies	Lump Sum	1	20	0	0
2.3	Feasibility and budget estimation of the suggested measures for climate resilient activities	Numbers	15,000.00	74	11.1	0	0
2.4	Updation of village springs atlas		Lump Sum		5	0	0
				Sub total	**66.1**	**0**	**0**
3	**Implementation**						
	Implementation of suggested activities under Village Water Security Plan						0

3.1	Implementation of suggested activities under Village Water Security Plan like roof top water harvesting structure for harvesting roof water during rainy season	Nos	1,13,000.00	1263.00	0.00	999.03	0.00
3.2	Implementation of suggested activities under Village Water Security Plan like community water storage reservoir to store night discharge of the springs and excess monsoon discharge of the springs 50,000 litre	Nos	350000.00	148.00	0.00	362.6	0.00
3.3	Dhara Vikas	Hec	30000.00	300.00	0.00	13.5	13.50
3.4	Fodder Development- cost of saplings	Hec	36000.00	1684.00	0.00	121.25	121.25
3.5	Horticulture Development- cost of saplings	Hec	64000.00	1684.00	0.00	202.08	202.08
	Construction of solid waste recovery centre	Nos	15,00,000.00	12.00	156.00	0	0.00
	Sub total				**250.02**	**1698.46**	**336.83**
A	**Project execution cost (5%) which includes 50 lakh for DST project execution charge**				**46.46**	**46.46**	**23.25**
B	**Project Cycle Management Fee charged by the Implementing Entity (3% of total project cost) in lakh**				**27.52**	**27.52**	**13.76**
C	**Total Year wise break including admin cost**				**324.00**	**1772.44**	**373.84**

Total NAF fund sought for 3 year	**2470.28**	**%**
Year 1	**324.00**	**13.12**
Year 2	**1772.44**	**71.75**
Year 3	**373.84**	**15.13**

14.0 Work plan for 3 year with quarterly breakup

Table 24: Work plan

Sl. No	Activities	YEAR 1				YEAR 2				YEAR 3			
1	**Capacity Building**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
1.1	Community mobilization on water conservation and climate resilient activities												
1.2	Training on preparation of Village Water Security Plan												
1.3	Training on implementation of Village Water Security Plan												
2	**Planning**												
2.1	Preparation of Village Water Security Plan of Gram Panchayat Units and collection of baseline data												
2.2	Hydrogeological study of the springs to identify the recharge area using scientific study												
2.3	Feasibility and budget estimation of the suggested measures for climate resilient activities												
2.4	Updation of village springs atlas												
3	**Implementation**												
	Implementation of suggested activities under Village Water Security Plan												
3.1	Implementation of suggested activities under Village Water Security Plan like roof top water harvesting structure for harvesting roof water during rainy season												
3.2	Implementation of suggested activities under Village Water Security Plan like community water storage reservoir to store night discharge of the springs and excess monsoon discharge of the springs 50,000 litre												
3.3	Dhara Vikas												
3.4	Fodder Development- cost of saplings												
3.5	Horticulture Development- cost of saplings												
3.6	Construction of solid waste recovery centre												

15.0 Expected outcome of the project

- Vulnerability in water sector due to climate variability will be reduced by enhancing the availability of water
- 1, 85, 416 (Census 2011) will be directly benefitted by the intervention
- Co benefits of carbon sequestration shall be ensured in the state