A Case Study on Participatory Scientific Watershed Management in Gujarat State

Background

In India, more than half of the population still depends on agriculture for their livelihood. It is a fact that the first Green Revolution has been limited to the areas with irrigation resources. Despite huge investments and major irrigation projects, only 35% of total cultivable land is under irrigation. As per recent estimate by Government of Gujarat, rain-fed areas of 85 million hectares out of the 142 million hectares of net cultivated area have suffered neglect in the past in-spite of having scope for much higher productivity and income potential through agriculture and allied activities. Rain-fed agriculture is complex, diverse, under invested, risky, vulnerable and distress prone. It is also noted that such areas can be made productive and profitable by devising technologies for rain water harvesting combined with modern agricultural practices.

Against this backdrop, watershed management has emerged as a viable alternative for integrated management of resources to optimize the potential of rain fed areas facilitating improved agricultural productivity leading to poverty alleviation, food security, environmental protection, access to safe energy and drinking water facility as well.

Watershed is defined as a “Natural Geo-Hydrologic entity that covers a specific area expanse of land surface from which the rainfall runoff flows to a defined drain, channel, stream or river at any point.” (Watershed Atlas, 1990) A micro-watershed is a hydrological unit which is often used to identify the area for various land based development programmes. A typical watershed development programme involves holistic natural resource management leading to improved agricultural growth, enhanced livelihood opportunity and better ecological security.

The aims of watershed development programme are to:

(i) restore the ecological balance by harnessing, conserving and developing degraded natural resources such as soil, vegetative cover and water in a holistic and sustainable manner

(ii) initiate demand driven and need based watershed planning with active participation of community members

(iii) preventing soil run-off and regenerating of natural vegetation with low cost technological solution complemented by indigenous knowledge

(iv) recharge the ground water table through rain water harvesting inculcating a sense of conservation among the community.

(v) enable multi-cropping and the introducing diverse agro-based activities, which help to provide sustainable livelihoods to the people residing in the project area

(vi) promote eco-friendly and locally suitable activities with the required capacity building of the stakeholders

(vii)

The present case study depicts the experience on a Participatory and Scientific Watershed Management in the state of Gujarat. It represents synergy and convergence of resources from a range of stakeholders. Traditionally, watershed management was seen as a programme primarily to develop check dams only. The initiatives under Integrated Watershed Management Programme (IWMP) include a much wider perspective driven by watershed plus approach. It is a multi-pronged approach on the basis of viable options. Building Institutions & Partnerships, Scientific Prioritization of Watersheds, Participatory Micro Planning through Scientific Approach, Capacity Building, Livelihood Promotion, Monitoring and Evaluation, Impact Assessment were taken up as part of IWMP.

The IWMP has been taken up through building institutional roles and responsibilities at four different levels of Governance. A separate cell at state level is created to handhold, monitor, and coordinate at four levels of governance i.e. State, District, Project (cluster of villages) and Village. The organisation structure at four levels covering agencies/ committees, cells etc. is given in **Annexure-I, II, III, IV & V**.

This covers:

(i) Gujarat State Watershed management Agency (GSWMA) is the State Level Nodal Agency for Gujarat state. It has a Governing Body chaired by the Principal Secretary, Rural Development Department, a Chief Executive Officer (CEO), and below CEO works a professional team having various expertise like Geographical Information System (GIS) application, Management Information System, water resource engineering, livelihoods, capacity building, and monitoring & evaluation.

(ii) District Watershed Development Unit (DWDU) in each of the districts of Gujarat is chaired by the District Development Officer (DDO) under whom a Project Director is in charge of management of all the watershed projects of the district. The Project Director is supported by Technical Experts, a Multi-Disciplinary Team (MDT) and an Administrative Team. The multi-disciplinary team consists of members from different backgrounds like engineering, community mobilization, livelihood, data entry, accounts, surveying, etc.

(iii) At the project level which includes a cluster of villages, there is a Nodal Officer for each of the project and below him/her works a dedicated Watershed Development Team (WDT), consisting of grass root level experts in the same subjects as the MDT at the district level.

(iv) At village level, there is a Watershed Committee to take care of the project. It works closely with the WDT to implement the project at the village level. The Committee is comprised of a president, a secretary or/and an accountant, and at least 8-10 other members with representation from various class and caste groups and women and is registered under the Society registration Act, 1860. The grass roots institutions like User Groups, Self Help Groups, etc. have played a complementary role to facilitate quality implementation with a strong sense of ownership.

Partnership was developed with various relevant institutions to enable the execution of project components. A consortium of thirty three organizations (**Annexure- VI**) was formed to support capacity building exercise. This consortium brings together a vast array of diverse organizations like government institutes, volunteer organizations, agriculture universities, academic institutes etc.

Scientific prioritization was adopted to identify treatable watersheds and a ranking based on parameters determined by the Department of Land Resources (DoLR) **(Annexure -VII).** The parameters included Natural Resource Indicators, the Socio-Economic Indicators, the Contiguity factor and the Cluster approach. The Poverty Index, percentage of SC/ST and the size of small and marginal farmers has been included to provide focus for better livelihood options to the local population in project area. The Natural Resource Parameters such as moisture index and the productivity potential of the land ensure true representation of the watershed. Contiguity factor and the cluster approach ensure that the watersheds would be treated through holistic area development. e-connectivity at all levels including Village Watershed Committees (VWCs) is used for seamless information flow. Mobile based monitoring through Web- based GIS system is also planned. In the similar fashion, impact assessment is planned using GIS & Remote sensing.

Synergy and Convergence

The Planning of a Watershed Development Project has been initiated with the use of GIS in various aspects of prioritization, development of action plan and monitoring and evaluation of projects. The initial process involves creation of different spatial layers from the non-spatial dataset collected from various sources as shown in the table-1:

Table 1

Various GIS Datasets used and their Sources

	Features	**Source**
Land	Land use	Satellite Data
	Landform (hill, Alluvial, Coastal areas etc.)	Satellite Data
	Soil type	Soil and Land Use Survey of India, National Bureau of Soil Survey & Land Use Planning, Agri. Deptt.
	Slope/Elevation	Satellite Data & Open Source
Water	Surface Water Bodies	Satellite Data
	Ground Water condition	GWRDC, CGWB
	Wells	Revenue Deptt.
	Check Dam	Departmental Data
Vegetation	Agriculture	Agriculture Deptt, Satellite Data
	Forest	Forest Deptt, Satellite Data

Household	Socio-Economic Facilities, SC & ST data, Actual Wages, Drinking Waters, % of SF &MF, % Poverty Index	Deptt. of Rural Development., Bureau of Economic & Statistics
	Village Map	Computerized maps from Revenue Deptt.
Infrastructure	Roads, Canals, Water Supply	Line Departments
Ownership Details	Forests, Government, Panchayat, Private	Revenue Deptt.
Others	Sanctuaries, Mining areas, CRZs, SEZs	Line Departments

The planning exercise is multifaceted and occurs at different levels as elaborated below:

At state level a range of inter-related steps have been initiated covering:

(i) Creation, development and management of geo-spatial data base depicting present conditions of land, water and vegetation with respect to watershed under different ownerships at village level,

(ii) Compatible socio-economic aspects and their analysis,

(iii) Historical perspective of land-water treatment of the area. (**Annexure-VIII**)

(iv) GIS for a) Prioritization of watersheds according to set criteria mentioned in the National Guideline and b) Preparation of the development plan (action plan).

(v) The prioritisation of projects using 13 parameters as suggested by the DoLR- (**Annexure-VII**) reflecting the natural resource base (including the historical data) of the area and the socio-economic aspects. The data sets and images include: Geo-morphology, Soil, Slope, Erosion, Aspects, Drainage, Contour, Geo-hydrology, concentration of BPL and SC/ST population, etc. The satellite image on the same parameters are collected in different sheets and then superimposed to get a composite picture of the priority areas.

(vi) The prioritization covers: equitable distribution among all the districts, identification of watershed areas, convergence of IWMP with other developmental schemes of various Government Departments and a plan for the next 18 years; (**Annexure IX**)

In all, 33 institutional partners were identified and empanelled for the capacity building purpose (**Annexure- VI).** The livelihood opportunities are explored specific to the agro-climatic regions prevalent across the state (**Annexure-X**). At the same time a suggestive action plan matrix (**Annexure-XI**) is developed according to specific themes like agriculture, forest and wasteland by in-house domain experts in consultation with Agriculture Universities, research and academic institutes.

Inter related steps at district level include:

(i) GSWMA provides district wise GIS based priority maps for district level implementation.

(ii) State Perspective and Strategic Plan (SPSP) to specify the annual target for each district.

(iii) Verification of the prioritized maps on field and selection of watersheds/villages as projects on a cluster approach by District Watershed Development Unit (DWDU). One cluster may include a number of watershed/villages totalling round 5000 hectares of land.

(iv) The DWDU selects a number of such projects according to target given in the State Prospective and Strategic Plan (SPSP) for preparation of Preliminary Project Reports (PPRs) in the format as supplied by the DoLR, MoRD for submission to the GSWMA for approval.

The overall responsibility for the preparation of a technically sound and high quality DPR, lies with the Project Implementing Agency (PIA). The DPR in the prescribed format is prepared by the Watershed Development Team (WDT) for integrated development of the watershed area with active participation of the Watershed Committee (WC). The technical inputs like resource maps and cadastral maps are found at local level and project specific GIS maps & indicative action plan generated by GSWMA are made available from state level.

Detailed Project Report (DPR) also requires baseline surveys for the assessment of existing situation, selection of sites and identification of beneficiaries. Three types of baseline surveys are carried out covering: Household Survey, Bio physical Survey and Overall Village Survey. The data is also gender-disaggregated to make a gender sensitive planning that duly recognizes and addresses the priorities of women.

Comprehensive Participatory Rural Appraisal (PRA) exercise is carried out for validating the information gathered through other sources. It includes Historical Transect/Time Line, Resource Mapping, Social Mapping, Seasonal Diagram+ Daily Activity Schedule, Venn Diagram/Chappati Diagram, Livelihood Analysis- Focus Group Discussions, Tree Matrix, Wealth Ranking and Transect walk.

The conclusions and inferences made through this exercise enable the WDT to propose the interventions. PRA is followed by a Participatory Net Planning (PNP) at village level to prepare the physical-financial plans covering technical viability and details, financial estimation and beneficiary identification. Net planning is based on the need assessment. The budgetary gaps are bridged through convergence with other related schemes such as MGNREGA where share of water conservation and harvesting activities outstrips all the other activities. The planning also includes consultation with the community members to harness indigenous knowledge and build sense of ownership among the project area dwellers. Various technical inputs like GPS handset, GIS based thematic maps consisting of various relevant layers and other such materials are utilized for a proper and precise site selection. A complete beneficiary level database separately for private land and community land development is prepared and provided with the Detail Project Report (DPR).

IWMP – 1 (Jetpurpavi) Project – A Case

IWMP-1 project area is located in Jetpurpavi Taluka (21°45'0"N 70°36'35"E,), Vadodara District of Gujarat state. The project consists of 10 villages and an area around 4353.8 ha. is taken into the project as per the GIS priority for treatment. The 10 villages fall under seven gram panchayats. (**Annexure-XII**)

The project implementation started right after the approval from the central government with a preliminary village meeting in the concerned villages. Meetings were followed by baseline survey to have socio economic and bio physical aspects. Surveys and PRA output were shared with Gramsabha and problem analysis was done which has been diagrammatically presented in the **Annexure-XIII**.

The developmental problems identified with Gram Sabha on the basis of problem tree analysis include: water scarcity (drinking & irrigation), low agricultural productivity, encroachment into forest land, lack of alternate livelihoods, indebtedness, poor infrastructure facilities, undulated and fragmented land holding, lack of awareness & availability of improved seed varieties and use of micro nutrients and no land leveling & field bunding.

The objective Tree Analysis Chart (**Annexure-XIV**) was used to address the developmental problems as part of problem tree analysis. Finally a comprehensive participatory net planning was carried out in consultation with the community members to identify the nature and magnitude of interventions. Livelihood activities were finalized after proper consultation with the primary stakeholders, considering interests of the landless, asset-less and women were duly considered.

The measures initiated to address the identified problems and subsequent outcomes are given in Table-2.

Table-2

Problem, Measures and Outcome

S. No.	Problem	Measures	Outcome
1	Drinking Water scarcity	Community Roof Rain Water Harvesting, Pipeline, Repair of hand pumps with recharge structure, Water Purifier.	Availability of Drinking water : Better Health & Hygiene
2	Soil Erosion	Nala Plug, Gully Plug, Loose Boulder Structure, Protection walls, Farm Bunding, Land Leveling, Afforestation	Soil Fertility Improvement
3	Water Scarcity for Agriculture	Renovation of Village Pond, Farm Ponds, Terrace Ponds, Ch.eck dam	Increase in Land under Agriculture

4	Low Agricultural Productivity	Crop Demonstration, Horticulture Plot, Vegetable Nursery using Green/shade Net, Vegetable Seed store, Farm Implements, Drip Irrigation	Increase in production /productivity
5	Dearth of livelihood opportunities	Floriculture, Flour cum Rice Mill, Poultry, Vermicompost, Mahuda Oil Extraction Unit	Sustainable Livelihood
6	Lack of awareness & availability of Improved seed varieties & Technology	Vegetable Nursery using Green/shade Net, Vegetable Seed store	Improved cultivation practices & improved Nutrition level
7	Low dairy Productivity	Cattle Camps, Cattle Feed Store, Fodder Plot, Milk Collection Unit	Improved cattle health & milk production

The resource mobilization for different activities focusing on convergence is given in Table-3.

Table-3

Converged Budgeting

S. No.	Type of Activities	(In Rs. Lakhs)			Scheme/Agency/Deptt.
		Total Funds required as per PNP	Fund available from IWMP	Converged Funds	
1	Entry Point Activity	60.2	20.3	39.9	WASMO
2	Watershed Works	350.61	261.5	89.11	MGNREGS
3	Livelihood	119.87	67.5	52.37	GGRC/KVK/ NHM/RKVY/ Animal Husbandry Deptt./ TASP
Total		530.68	349.3	181.38	

- Converged planning worth Rs. 1213.12 Crores against allocation of Rs. 930.10 Crores during 2009-10, i.e., Rs. 283.02 Crores mobilized from other schemes
- Circular declaring GSWMA as Line Deptt. for implementation of MGNREGS issued by RDD, GoG
- Convergence model of GSWMA has been recognized by DoLR, GoI & circulated to states to follow

Mandatory provision for convergence

The main thrust of the programme has been the in-built convergence which is mandatory and an integral part of every Detailed Project Report (DPR). While preparing the DPR, the project management team studies the total fund requirement of the village or the project area to identify the gap between fund availability and fund requirement. This gap is filled through convergence with other schemes such as Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), Backward Region Grants Fund (BRGF), Tribal Area Sub Plan (TASP), Swarna Jayanti Gram Swarojgar Yojana (SGSY), National Horticulture Mission, Bamboo Mission and Drinking water security scheme by WASMO.

The asset-less, marginalized and women have been given due representation in the Village Watershed Committee. Priority is also given to the disadvantaged while extending benefit. It is mandatory to keep female staff in the WDT.

Progress made

GSWMA is currently implementing 489 projects as given in the Table-4.

Table-4

The Progress of the Project

Sr. No	Details	2009-10 (Batch-I)	2010-11 (Batch-II)	2011-12 (Batch-III)	2012-13 (Batch-IV)	Total
1	No. of projects	151	141	138	59	489
2	Village	1070	1129	907	344	3450
3	PIA Details (GSWMA+ For. Dept.)	151	141	138	59	489
		(51+100)	(123+18)	(115+23)	(45+14)	(334+155)
4	Project Cost(` in Crore)	930.11	917.77	921.84	408.68	3178.4
5	Total Treatable Area (in Lakh. Ha.)	7.08	7.14	7.11	3.18	24.51

Self-help groups and user groups are an integral part of VWC as given in Table-5

Table-5

Sr.No	Batch	Village Watershed Committee (VWC)	Self Help Group (SHG)	User Group
1	Batch –I	1034	2487	3969
2	Batch- II	1097	2605	4158
3	Batch – III	887	1815	2898
	Total	**3018**	**6907**	**11025**

Under entry point activities, specific works have been carried out as given in Table-6.

Table-6

Name of Activities	Units	Physical	Financial (₹ In Lakh)
Drinking water facilities	No	2696	1520.76
Roof Rain Water Harvesting Structure	No	783	298.54
Drainage Systems -Sanitation	No	1447	457.33
Culverts	No	145	234.31
Non-Conventional Energy Sources	No	501	11.28
Cattle Trough	No	970	475.04
Veterinary Health Camps	No	415	156.92

As part of soil-moisture conservation work, following activities have been carried out:

Table-7

Soil Moisture Conservation Works

Name of Activities	Units	Physical	Financial (₹ In Lakh)
Staggered Contour trench	rmt	2350846	307.43
Continuous Contour Trench	rmt	449636	79.44
Waste-weir for field outlet	No	3165	464.32
Land Levelling	ha	6282	800.44
Farm Bund	rmt	1191383	529.11
Gully Plug	no	4999	634.92
Nala Plug	no	823	287.34
Stone Bunding	cmt	133265	283.89
Gabion Structure	No	589	163.76
Protection Wall	No	519	882.32
Afforestation/Plantation	ha	541.47	454.35

Many viable livelihood activities have also been undertaken under IWMP across Gujarat state. Details of the livelihood activities are given in the Table-8.

Table-8

Livelihood Activities

Name of Activities	Units	Physical	Financial (₹ In Lakh)
Agriculture Activities	No	29073	1040.15
Agro-Processing Activities	No	142	226.44
Promotion of Traditional Handicraft	No	58	9.39
Alternative Livelihood Activities	No	2050	161.28
Micro Irrigation System	No	1972	297.57
Establishing linkages	No	67	11.44
Dairy Development Activities	No	4950	294.03

Results Achieved

The stakeholder coverage and geographical coverage in the state is given in Table-9 and 10.

Table-9

Stakeholders Coverage: Gujarat wide

Sr. No.	Category	No.
1	Village Watershed Committee Members (2009-10)	10520
2	Project Team	783
3	District Technical Team	156
4	District level (Admin.)	178
5	GSWMA	15
	Total	***11652****

**** Number of Stakeholders to grow proportionately for ensuing 18 years***

Table-10

Geographical Coverage – Gujarat State

S. No.	Item			Details	
				No.	**Area (Lakh ha.)**
1	Total micro-watersheds (MWS) in the State			13587	196.024
2	Total untreatable MWS (Reserved Forest, Barren Rocky, assured irrigation, etc.)			1005	27.2386
3	Total treatable MWS in the State			12582	168.7854
4. a	Total MWS covered under pre-IWMP schemes of DoLR			3895	31.6302
b	Total MWS covered under schemes of other Ministries			645	6.07954
c	Total MWS covered under IWMP 2009-10 and 2010-11 of DoLR			1507	14.218
d	Total of 4 a to d			6047	51.9277
5	Balance micro-watersheds not covered till date			6535	116.858
6	Plan for covering balance micro-watersheds	11^{th} Plan	2011-12	881	7.12
			12^{th} Plan	1842	39.7477
			13^{th} Plan	1940	37
			14^{th} Plan	1745	33
			Total	**6535**	**116.858**

Some important positive outcomes of the project are:

(i) Improved community participation and ownership of the project where the developmental schemes are suggested and executed by the community itself.

(ii) Quick decisions and corrective measures have been taken with the help of Centralised MIS and GIS based monitoring system, thus saving a lot of time and money.

(iii) The satellite imagery based impact assessment provides tangible proof of the returns of the public investment in the projects.

(iv) The online banking operations ensure transparency throughout at different levels and guarantees accountability.

(v) A comparative analysis of the project before and after the implementation has been provided in the table below: (Table – 11)

Table-11
Situation Before and After the Project

Sr. No.	Result Areas	Before the implementation of the initiative	After the implementation of the initiative
1	Project area selection	Subjective and unscientific, selection made on the basis of instinct of the district authorities & externally influenced	Enabled the identification of most needy areas in the initial years; generation of trust, confidence and ownership among people; excluding external influence in project selection
2	Location of the intervention	Inconsistencies in site selection for construction of physical structures	Technically appropriate selection & location of physical interventions; use of village composite maps and hydrologic modelling (as and when required) for interventions (approx. 35000); feeding co-ordinates of interventions with GPS, generating 1048 action plan maps for 2009-10 projects itself
3	Planning process	Short-term, haphazard and less participatory; Preparation of Detailed Project Report (DPR) was not more than a formality; no convergence	State Perspective & Strategic Plan prepared for 18 Years; Participatory Rural Appraisal (PRA) and Participatory Net Planning (PNP) made compulsory; PNP using thematic maps (1:3000-17000) for 2.3 lakh land parcels (survey number-wise) for 2009-10 projects; convergence with schemes made mandatory
4	Inclusion of Women and Assetless	Minimal	Institutionalised with mandatory inclusion of women members, landless and asset less in the committee; 10% of livelihood fund for asset less
5	Transparency and awareness	Lack of transparency and communication gap	Transparency across board; DPR available online and given to Village Watershed Committees in vernacular; Web based GIS integrated; Online financial transactions; well-designed IEC activities
6	Standardization of Processes	Negligible	State specific Technical, Capacity Building and Human Resource Manuals and Operational Guidelines issued and enforced

7	Institutional structure	Weak; no dedicated institution at state and district levels	Establishment of fully dedicated and professionally strong institutions at all levels: state-district-project-village
8	Capacity Building	Haphazard and irregular	Standardized, phase wise and continuous with regular follow up
9	Monitoring & evaluation	Minimal and subjective	Concurrent monitoring, third party evaluation, provision for social audit, additionally generation of Dynamic maps integrated with mobile software to monitor the progress; Quick and Near-Real Time corrective measures
10	Impact assessment	Empirical and subjective	Scientific assessment with input application of remote sensing

Sustainability

Specific measures have been taken as part of project planning itself to ensure sustainability. These include:

(i) Standardisations of process and procedures covering Operational Guidelines, Capacity Building Manual, Technical Manual, Livelihood Manual and Human Resource Manual

(ii) GSWMA has established effective institutional framework from village to state level.

(iii) Regular capacity building of the users/beneficiaries making them well equipped to handle the technology and take up the operation

(iv) Long term collaboration with the technology partner, Bhaskaracharya Institute for Space Applications and Geo-informatics (BISAG) which is situated in the vicinity

(v) Strengthening and empowerment of VWC for post project maintenance, resource recovery and sustained potential benefit

(vi) Funds have been earmarked and strategy has been developed for post project management.

(vii) Villages are connected on line through e-gram network

Replicability

New watershed development programme being run in Gujarat state is replicable in many ways

(i) The whole planning exercise undertaken in Gujarat state can be adopted in other states as well.

(ii) DPR Model developed here has been acknowledged by Government of India.

(iii) Institutional building is in consonance with the government norms and can be established elsewhere as well.

(iv) Softwares developed for planning, monitoring and other various purposes are tailor made for the project and can be provided to other states.

(v) Manuals and guidelines developed to suit the requirements can be adopted by others with necessary modifications.

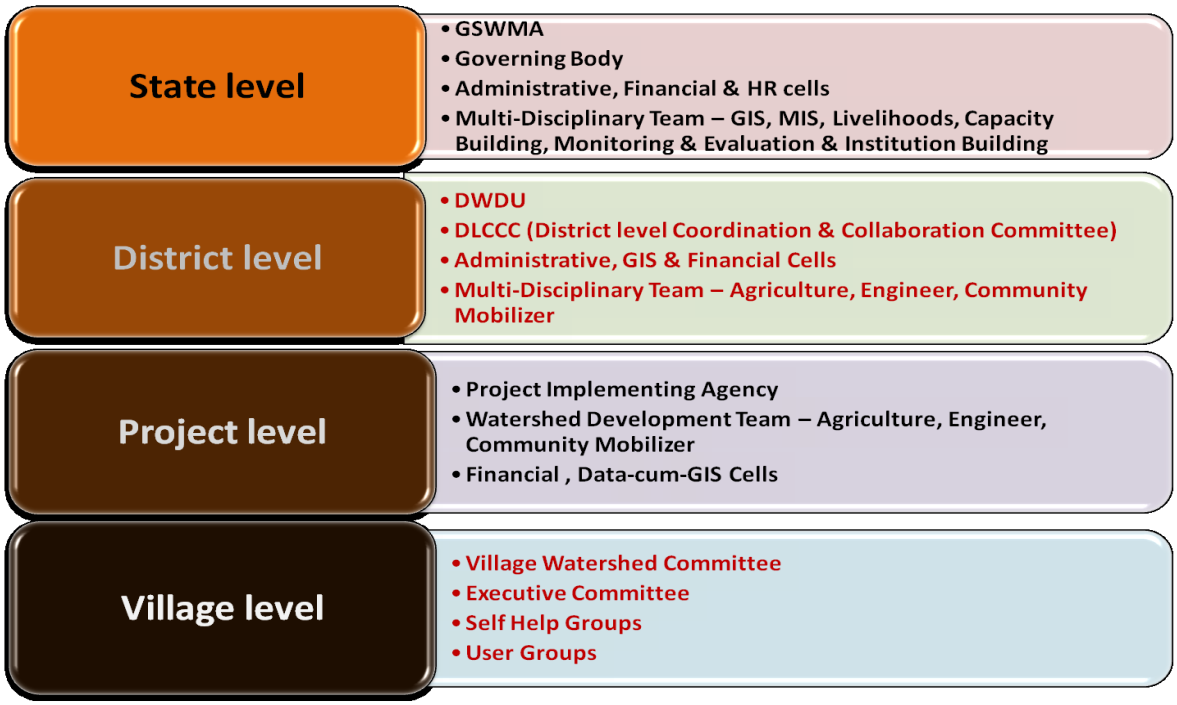
(vi) Convergence is an effective tool in maximizing the benefits under the watershed programme. Gujarat experience is a case in point.

Conclusion

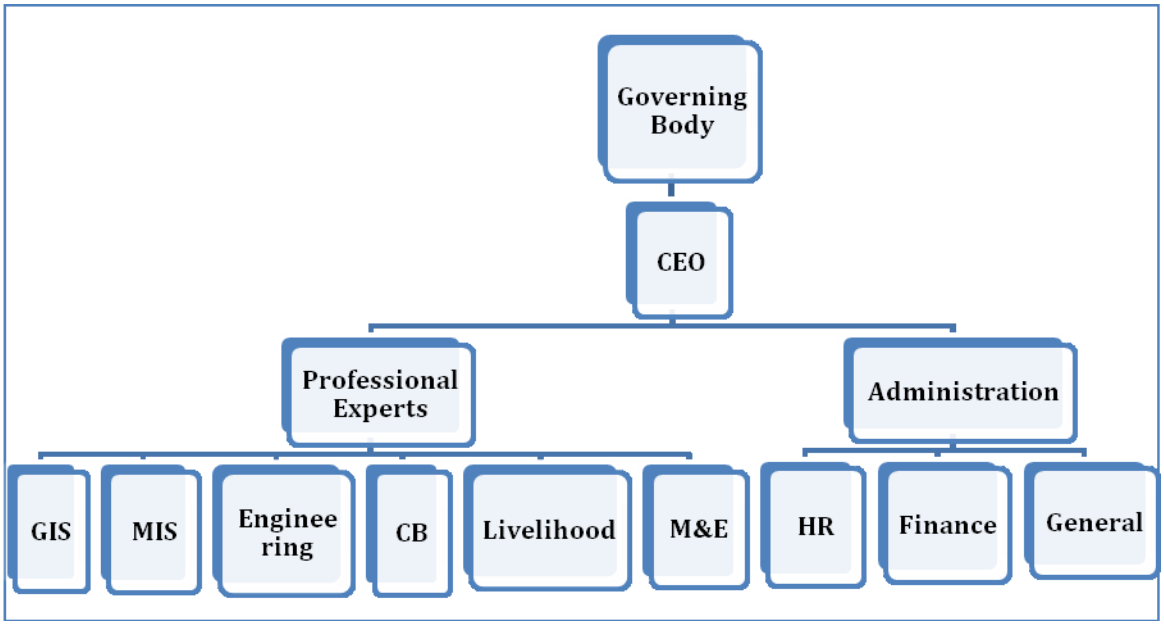
The programme is a unique experiment of synergy and convergence. It also generates a range of 23 activities with basic focus on water conservation to environmental protection, job creation, productivity and sustainability. Watershed programme in Gujarat is a testimony to the assured and positive outcome of a well-designed scheme implemented with active participation of community, using relevant techno-managerial tools towards realizing project objectives. At the same time, the role of leadership in execution of any project cannot be undermined.

The Government of Gujarat also aims to scale up of the programme in the state in a planned manner covering 1842 micro watersheds in the period of XII Plan- 2012-17.This will proliferate the existing activities. The programme with potential outcomes has scope for wider replicability in other states.

Annexure-I



Annexure-II



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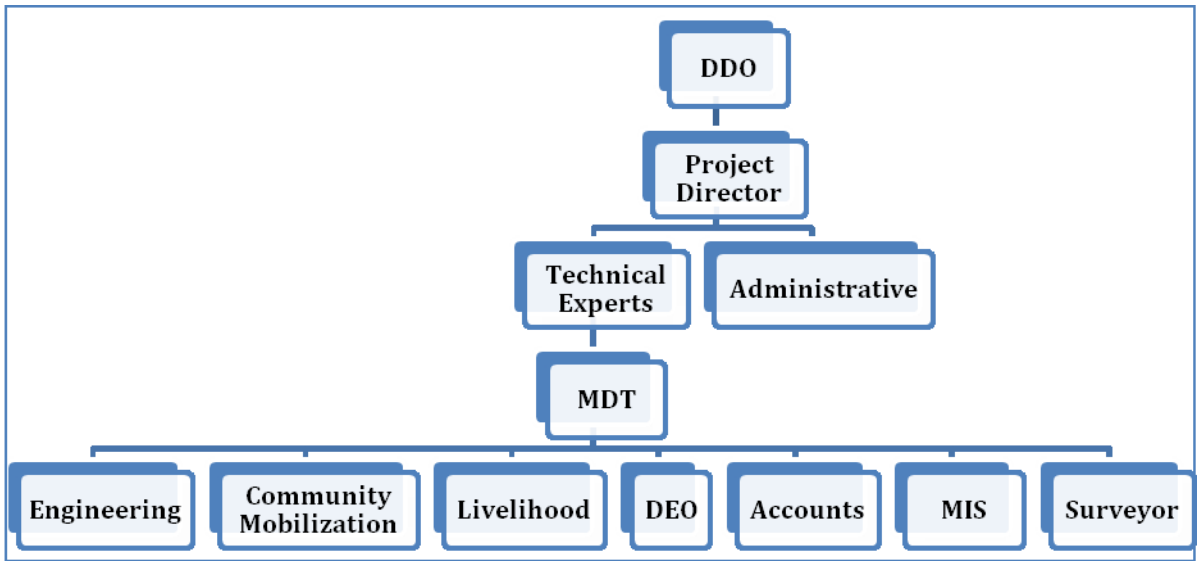
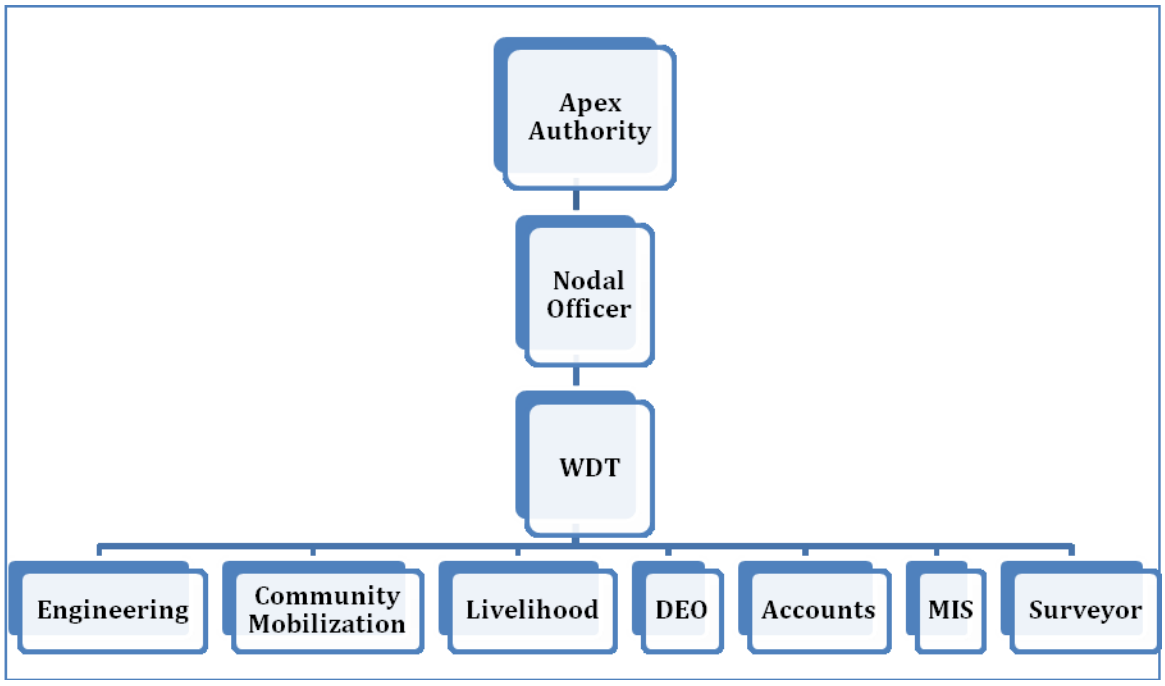
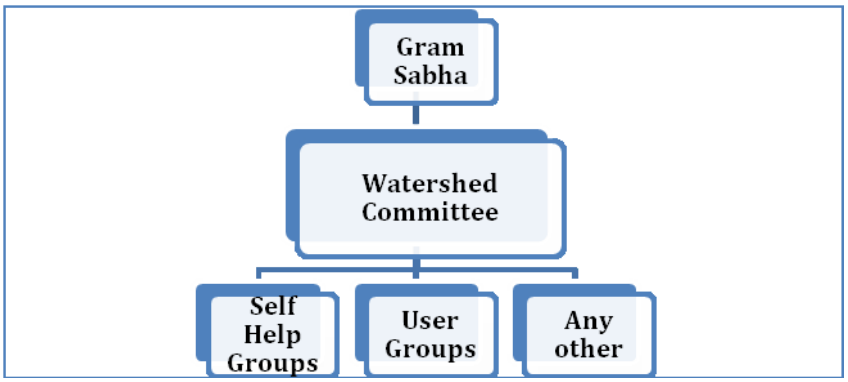


Annexure-IV



Annexure-V


Gram Sabha
Watershed Committee
Self Help Groups
User Groups
Any other

Annexure: VI

List of Institutional Partners

Sr. No.	Name of Instituitional Partner	Type	Location
1	Institute of Rural Management Anand (IRMA)	Academic	Anand
2	Bhaskaracharya Institute of Space Applications and Geo-informatics	Technology service provider	Gandhinagar
3	State Institute of Rural Development, Gujarat	Training Institute	Ahmedabad
4	Development Support Center, Ahmedabad	NGO	Ahmedabad
5	Dantiwada Agriculture University, Banaskantha	Agril.University	Dantiwada
6	National Institute of Rural Development	Training and Academic Institute	Hyderabad
7	Anand Agricultural University	Academic and Research	Anand
8	Junagadh Agricultural University, Junagadh	Academic and Research	Junagadh
9	Krishi Vigyan Kendras of all distrcts	Technology service provider	Respective districts
10	Sadguru Foundation, Dahod	NGO	Dahod
11	BAIF Foundation, Vadodara	NGO	Vadodara
12	VRTI, Kutch	NGO	Mandvi, Kutch
13	Gujarat Institute of Desert Ecology	Training and Academic Institute	Kutch
14	Research Foundation, Department of Forest, Gandhi Nagar	Academic and Research in Forestry Activities	Gandhinagar
15	Central Soil and Water Conservation Training Institute	Research & Training	Vasad
16	GEER Foundation	Ecological Research & Education	Gandhinagar
17	Centre for Environment Education- Ahmedabad	NGO	Ahmedabad
18	Research Centers of Forest Department	Research and Extension	
19	Entrepreneurship Development Institute of India, Gandhinagar	Academic	Gandhinagar
20	National Institute of Design, Gandhiangar	Academic	Ahmedabad
21	International Water Management Institute	Research	Anand
22	National Soil & Land Use Survey of India,	Survey	Ahmedabad
23	Aga Khan Rural Support Programme (I)	NGO	Ahmedabad

24	Mudra Institute of Communication Ahmedabad	Academic Institute	Ahmedabad
25	Foundation for Ecological Security (FES)	NGO	Anand
26	Geological Survey of India	Survey	Gandhinagar
27	SRISTI (Honey Bee Network)	NGO	Ahmedabad
28	Survey of India	Survey	Gandhinagar
29	Navsari Agricultural University	Academic Institute	Navsari
30	Central Ground Water Board (CGWB)	Ground water management	Ahmedabad
31	National Institute of Fashion Technology (NIFT)	Fashion Designing	Gandhinagar
32	Gramin Vikas Trust	NGO	Dahod
33	Anarde Foundation	NGO	

Annexure: VII

Criteria for prioritization

S. No.	Criteria	Maximum score	Ranges & scores			
i	Poverty index (% of poor to population)	10	Above 80 % (10)	80 to 50 % (7.5)	50 to 20 % (5)	Below 20 % (2.5)
ii	% of SC/ ST population	10	More than 40 % (10)	20 to 40 % (5)	Less than 20 % (3)	
iii	Actual wages	5	Actual wages are significantly lower than minimum wages (5)	Actual wages are equal to or higher than minimum wages (0)		
iv	% of small and marginal farmers	10	More than 80 % (10)	50 to 80 % (5)	Less than 50 % (3)	
v	Ground water status	5	Over exploited (5)	Critical (3)	Sub critical (2)	Safe (0)
vi	Moisture index/ DPAP/ DDP Block	15	-66.7 & below (15) DDP Block	-33.3 to -66.6 (10) DPAP Block	0 to -33.2 (0) Non DPAP/ DDP Block	
vii	Area under rain-fed agriculture	15	More than 90 % (15)	80 to 90 % (10)	70 to 80% (5)	Above 70 % (Reject)
viii	Drinking water	10	No source (10)	Problematic village (7.5)	Partially covered (5)	Fully covered (0)
ix	Degraded land	15	High – above 20 % (15)	Medium – 10 to 20 % (10)	Low- less than 10 % of TGA (5)	
x	Productivity potential of the land	15	Lands with low production & where productivity can be significantly enhanced with reasonable efforts (15)	Lands with moderate production & where productivity can be enhanced with reasonable efforts (10)	Lands with high production & where productivity can be marginally enhanced with reasonable efforts (5)	
xi	Contiguity to another watershed that has already	10	Contiguous to previously treated watershed & contiguity within	Contiguity within the microwatersheds in the project but non-contiguous	Neither contiguous to previously treated watershed nor	

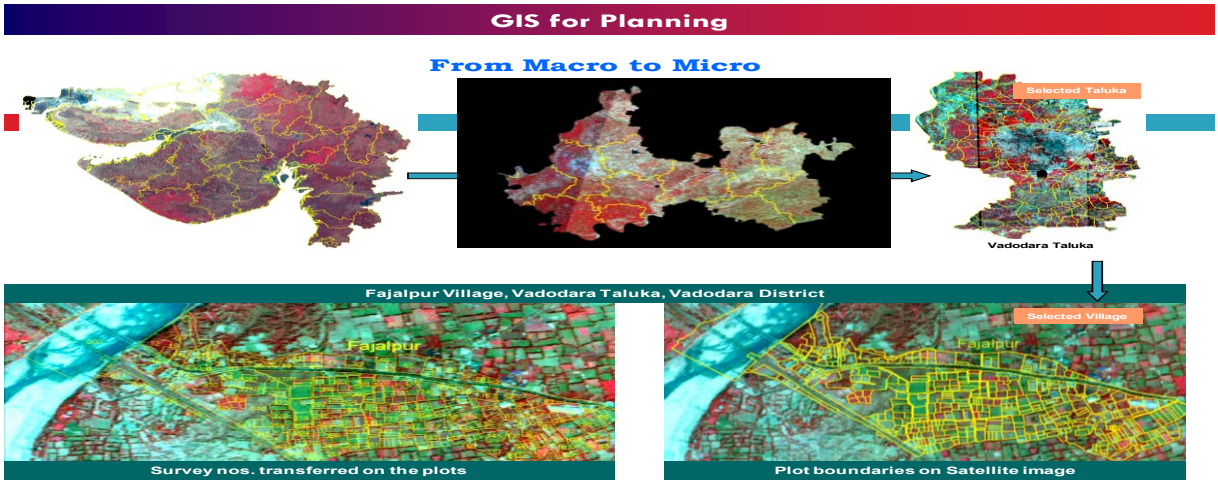
	been developed/ treated		the microwatersheds in the project (10)	to previously treated watershed (5)	contiguity within the microwatersheds in the project (0)	
xii	Cluster approach in the plains (more than one contiguous micro-watersheds in the project)	15	Above 6 micro-watersheds in cluster (15)	4 to 6 microwatersheds in cluster (10)	2 to 4 microwatersheds in cluster (5)	
xiii	Cluster approach in the hills (more than one contiguous micro-watersheds in the project)	15	Above 5 micro-watersheds in cluster (15)	3 to 5 microwatersheds in cluster (10)	2 to 3 microwatersheds in cluster (5)	

Annexure-VIII

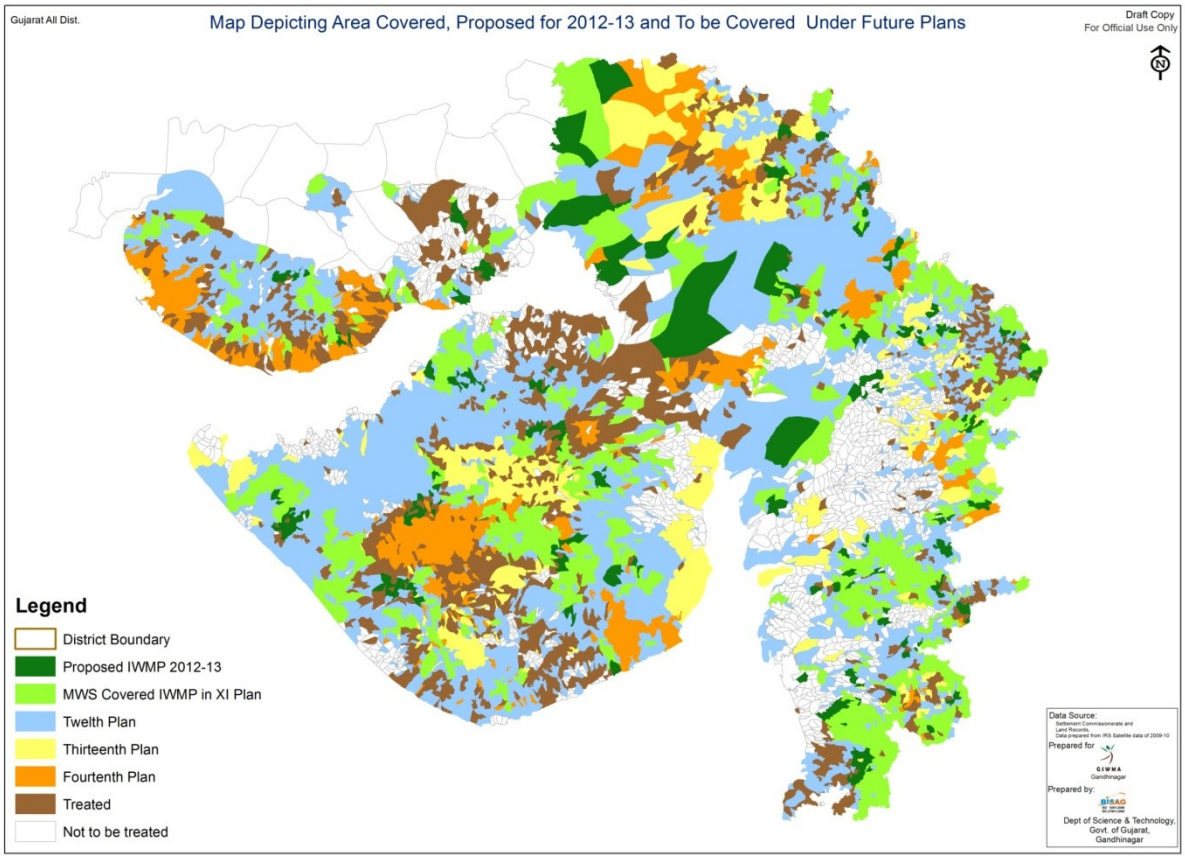
Scientific Prioritization of Watersheds	GIS maps, Satellite Imagery, Spatial & Non-spatial data
Participatory Micro Planning	Thematic Maps, GPS, Hydrological Modeling,
Monitoring & Evaluation	Web-GIS system, Mobile embedded Tracking system, eGram
Impact Assessment	Multi-temporal Remote Sensing

Incorporating historical development works in Watershed area

A simple watershed planning through GIS is illustrated in the picture below:



Annexure-IX


Gujarat All Dist.
Map Depicting Area Covered, Proposed for 2012-13 and To be Covered Under Future Plans
Draft Copy
For Official Use Only
Legend
District Boundary
Proposed IWMP 2012-13
MWS Covered IWMP in XI Plan
Twelth Plan
Thirteenth Plan
Fourtenth Plan
Treated
Not to be treated
Data Source:
Prepared for
GIWMA
Gandhinagar
Prepared by:
Dept of Science & Technology,
Govt. of Gujarat,
Gandhinagar

Annexure : X

Sr. no.	Zone	District	Livelihood Options
1	Zone I-Maize Zone	Dahod, Panchmahls, Sabarkantha	Promotion of improved varieties of Maize, Processing of Ginger, Turmeric & Maize, Bamboo articles, Vegetable Farming, Nursery raising , Horticulture, Floriculture, Vermicompost, Fodder Development, Cotton seed processing, Processing of mahuva products
2	Zone II-Cotton Zone	Narmada, Vadodara	Cotton based byproducts , Floriculture, Horticulture, Teak Nursery, Vermicompost, Fodder development, Bamboo articles, Medicinal & Aromatic Plantation, Processing of mahuva products
3	Zone III-Paddy Zone	Tapi, Dangs, Valsad, Navsari	Floriculture, Horticulture, Rice, Processing of Rice & Nagli , Mango & Cashewnut processing, Bamboo articles, Teak nursery, Fodder development, Medicinal & Aromatic Plantation, Processing of mahuva products, Eco-tourism
4	Zone IV-Cotton Zone	Bharuch, Surat, Vadodara	Floriculture, Horticulture, Cotton based byproducts, Processing of fruits (Guava, Banana, Peanut, Mango & Sapota), Vermicompost, Nursery, Fodder development, Processing of mahuva products
5	Zone V-Bajra, Tobacco Zone	Kheda, Anand	Banana & Amla processing, Farm forestry for Acacia trees, Vegetable farming, Nursery, Fodder development, Vermicompost
6	Zone VI-Bajra, Cotton Zone	Mehsana, Sabarkantha, Gandhinagar	Cotton by-products, Processing of Cumin, Fennel, Chilies & Mustard, Nursery raising, Fodder development, Vermicompost, incense stick
7	Zone VII-Bajra, Pulse Zone	Kutch, Patan, Banaskantha	Processing of pulses, Medicinal Plantation like Guggal, Aloe vera, Fodder development, Promotion of improved Date palm, Nursery raising, Bee keeping,
8	Zone VIII-Cotton, Dry Wheat Zone	Surendranagar, Patan, Ahmedabad	Cotton based by products, Cumin , Chilly processing, Cowdung brickette for bio energy, Vegetable cultivation/ processing, Vermicompost, Nursery
9	Zone IX-Groundnut Zone	Jamnagar, Rajkot, Surendranagar,	Groundnut, Potato, Chilly, Cumin processing, semolina, pickle, lemon plantation, floriculture, vermicompost,

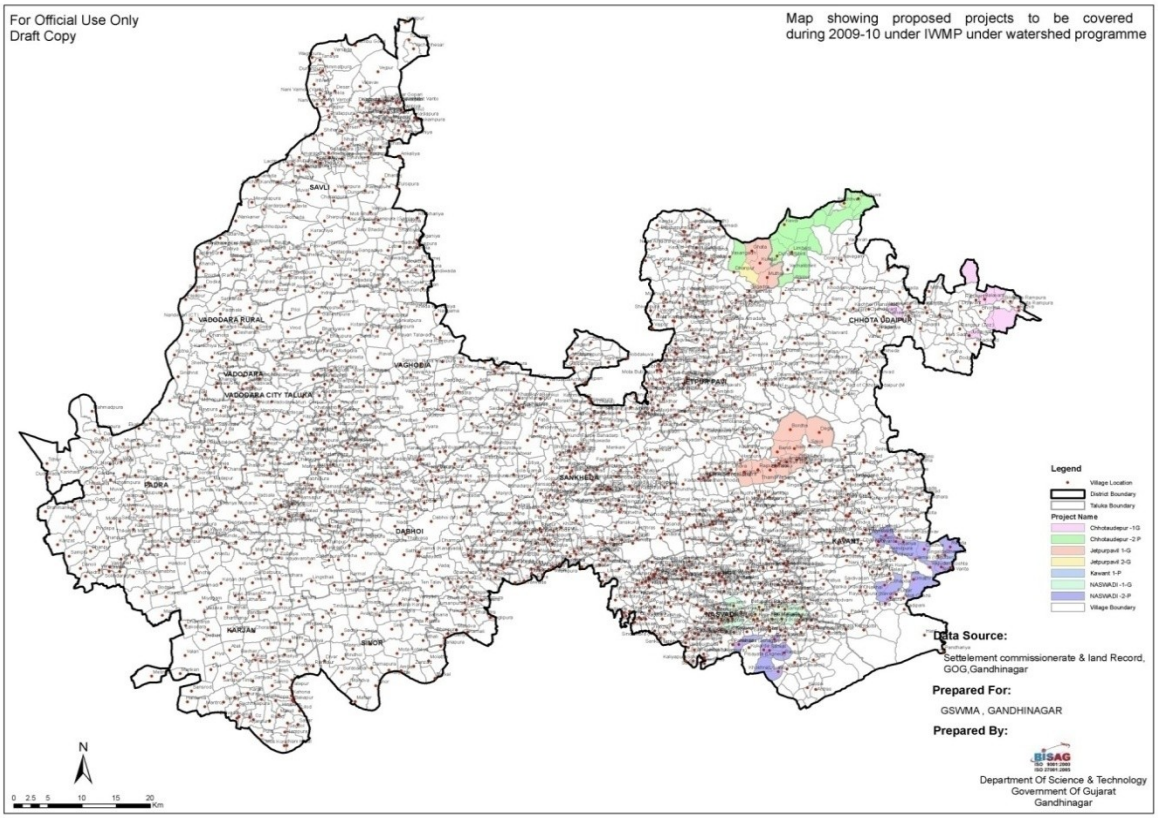
		Amreli, Bhavnagar, Junagadh, Probandar	coir based, charkha yarn, handloom weaving and ceramic articles
10	Zone X- Cotton, Dry Wheat Zone	Bharuch, Surat	Floriculture, Horticulture, Cotton based byproducts, Processing of fruits (Guava, Banana, Peanut, Mango & Sapota), Vermicompost, Nursery, Fodder development, Processing of Mahuva products, Pisciculture, Medicinal & Aromatic Plantation
11	Zone XI- Paddy Wal Zone	Navsari, Valsad	Processing of Mango and Sapota, Nursery raising , Fodder development, Vermicompost, Pisciculture, Aquaculture, Medicinal & Aromatic Plantation
12	Zone XII- Groundnut, Bajra Zone	Bhavnagar, Jamnagar, Probandar, Junagadh	Fruit processing, Groundnut processing, Nursery raising Vermicompost, Fodder development. Vegetable farming, Eco-tourism

Annexure: XI

Action Plan Matrix
For Forest:

Forest	Slope %	Soil Depth	Soil Texture	Erosion	Landform	Measures
	15-35%, 35-50%	Shallow	Coarse Loamy	Moderate	Structural Hill, Residual Hill	Staggered Contour Trenches + Plantation
	10-15%	Moderate	Coarse Loamy	Moderate	Buried Pediment Shallow, Residual Structures, Structural Hill	Contour Trenches+ Plantation
			Fine Mixed			
	5-10%		Coarse Loamy	Moderate	Structural Hill, Alluvial Plain	Small Gradonies+ Plantation
	1-3 %	Moderate to deep	Coarse Loamy	Moderate	Alluvial Plain, Burried Pediment Shallow, Pediment	Pits and Plantation+ Plantation
	0-1%,					

***Similar Action Plan Matrix prepared for wasteland, agricultural land**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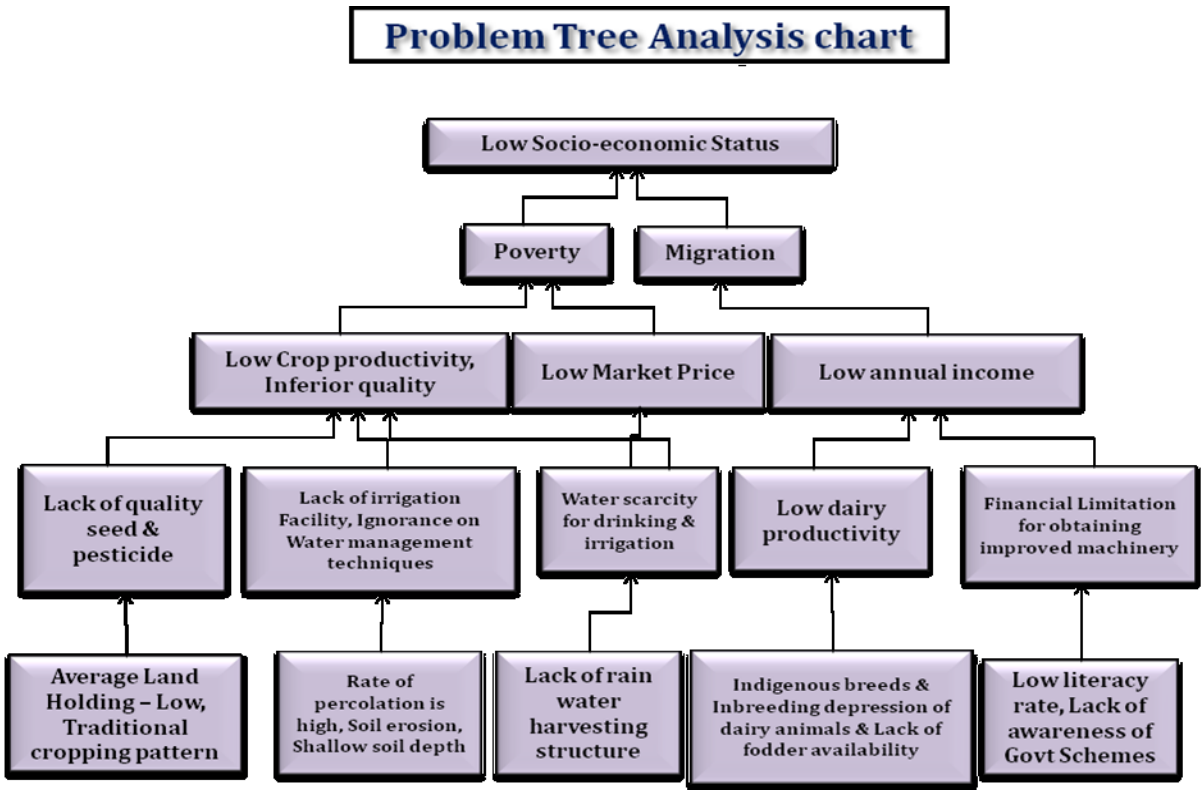
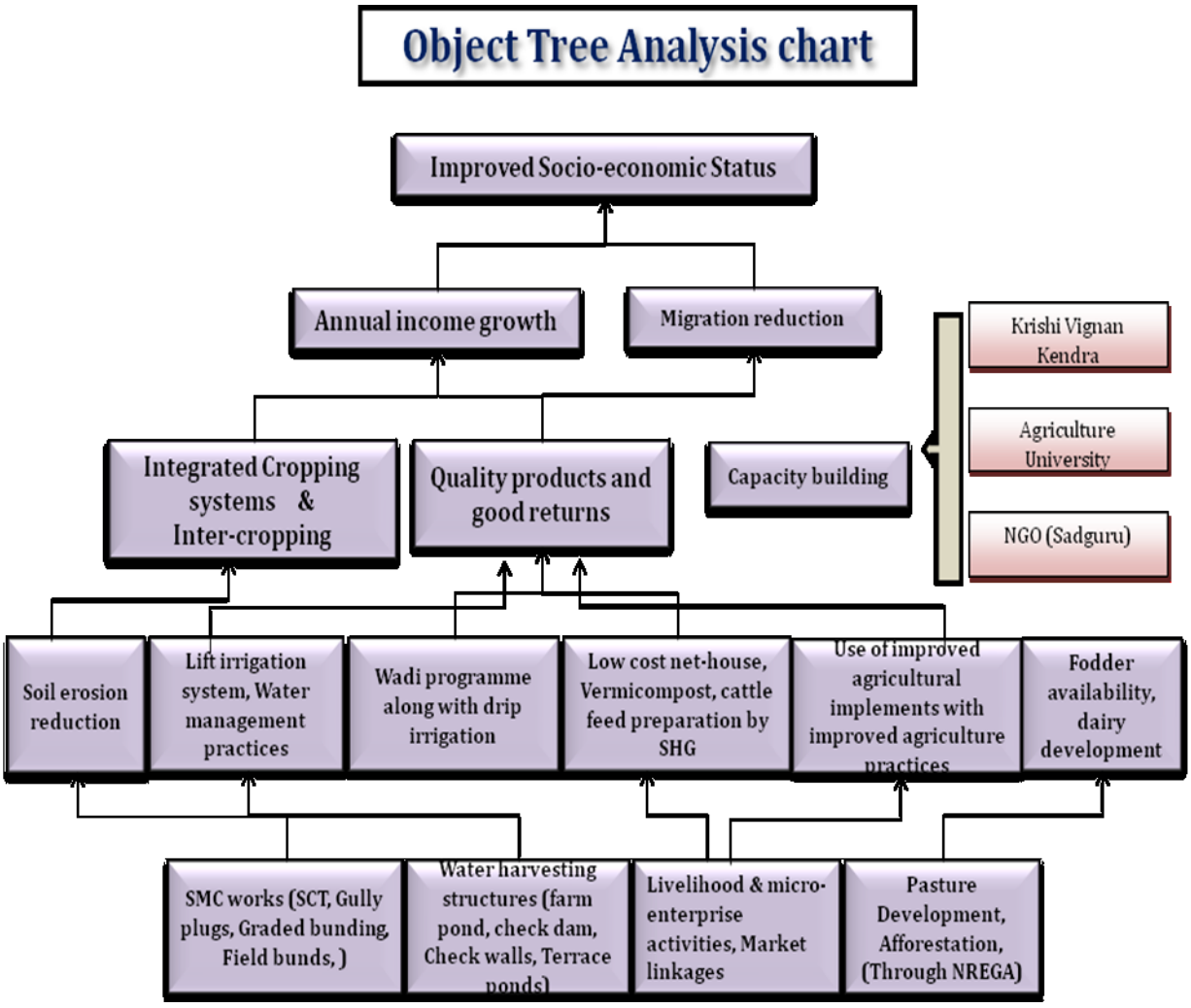
Draft Copy
Map showing proposed projects to be covered during 2009-10 under IWMP under watershed programme
SAVLI
VADODARA RURAL
VADODARA
VADODARA CITY TALUKA
VAGHODIA
PADRA
DABHOI
SANKHEDA
CHHOTA UDAIPUR
CHHOTAUDEPUR
KAWANT
NASWADI
KARJAN
SINOR
Legend
Village Location
District Boundary
Taluka Boundary
Project Name
Chhotaudepur -1G
Chhotaudepur -2 P
Jetpurpavi 1-G
Jetpurpavi 2-G
Kawant 1-P
NASWADI -1-G
NASWADI -2-P
Village Boundary
Data Source:
Settelement commissionerate & land Record, GOG,Gandhinagar
Prepared For:
GSWMA , GANDHINAGAR
Prepared By:
BISAG
Department Of Science & Technology
Government Of Gujarat
Gandhinagar
N
0 2.5 5 10 15 20
Km

Annexure-XIII



Annexure-XIV



Abbreviations

AAU	Anand Agriculture University
AKRSP	Agha Khan Rural Support Programme
BISAG	Bhaskaracharya Institute of Space Applications and Geoinformatics
CEE	Centre for Environment Education
CGWB	Central Ground Water Board
CPRs	Common Property Resources
CSWCRTI	Central Soil & Water Conservation Research & Training Institute
DoLR	Department of Land Resources
DPR	Detailed Project Report
DSC	Development Support Centre
DWDU	District Watershed Development Unit
EDI	Entrepreneurship Development Institute
GIS	Geographical Information System
GPS	Global Positioning System
GSWMA	Gujarat State Watershed Management Agency
GUIDE	Gujarat Institute of Desert Ecology
IEC	Information, Education and Communication
IRMA	Institute of Rural Management, Anand
JAU	Junagadh Agriculture University
KVKs	Krishi Vigyan Kendras
LFA	Logical Framework Analysis
MDT	Multidisciplinary Team
NGO	Non-Governmental Organization
NID	National Institute of Design
NIFT	National Institute of Fashion Technology
NIRD	National Institute of Rural Development
NRAA	National Rainfed Area Authority
PE	Professional Expert
PIAs	Project Implementing Agencies
PRA	Participatory Rural Appraisal
PRI	Panchayati Raj Institution
SHGs	Self Help Groups

SIRD	State Institute of Rural Development
SLNA	State Level Nodal Agency
SLUSI	Soil and Land use Survey of India
TE	Technical Expert
UGs	User Groups
VRTI	Vivekanand Research and Training Institute
WC	Watershed Committee
WDF	Watershed Development Fund
WDT	Watershed Development Team