State: GUJARAT
Agriculture Contingency Plan for District: SURAT

1.0 District Agriculture profile					
1.1	**Agro-Climatic/Ecological Zone**				
	Agro Ecological Sub Region (ICAR)	Central Highlands(Malwa),Gujarat plain(5.2)			
	Agro-Climatic Zone (Planning Commission)	Gujarat Plain and Hills Region(XIII)			
	Agro Climatic Zone (NARP)	South Gujarat Zone (GJ 2)			
	List all the districts or part thereof falling under the NARP Zone	Surat, Bharuch, Narmada			
	Geographic coordinates of district headquarters	**Latitude**	**Longitude**	**Altitude**	
		21^0 11'42.00" N	72^0 49'10.00" E	39 ft above MSL	
	Name and address of the concerned ZRS/ ZARS/ RARS/ RRS/ RRTTS	Main Cotton Research Station, Navsari Agricultural University, Surat396 001 Main Sorghum Research Station, Navsari Agricultural University, Surat.			
	Mention the KVK located in the district	Krishi Vigyan Kendra, Athwa Farm, Surat			
1.2	**Rainfall**	**Normal RF (mm)**	**Normal Rainy days**	**Normal Onset**	**Normal Cessation**
	SW monsoon (June-Sep):	1078	45	3rd week of June	4th week of September
	NE Monsoon(Oct-Dec):	-	-	-	-
	Winter (Jan- March)	-	-	-	-
	Summer (Apr-May)	-	-	-	-
	Annual	1078	45	-	-

(Source :District Panchayat reports, reports of Agriculture department)

1.3	**Land use pattern of the district** (latest statistics)	Geographical area	Cultivable area	Forest area	Land under non-agricultural use	Permanent pastures	Cultivable wasteland	Land under Misc. tree crops and groves	Barren and uncultivable land	Current fallows	Other fallows
	Area ('000 ha)	431	327	37	39	17	-	-	11	-	-

(Source :District Panchayat reports, reports of Agriculture department)

1. 4	**Major Soils (common names like red sandy loam deep soils (etc.,)**	**Area ('000 ha)**
	Hilly and highly undulating fine texture	67
	Mid plains, fine texture, high rainfall	111
	Mid plains, fine texture, medium rainfall	107
	Coastal plain, deep fine texture, salt affected	42

1.5	**Agricultural land use**	Area ('000 ha)	Cropping intensity %
	Net sown area	327	168
	Area sown more than once	224	
	Gross cropped area	551	

(Source :District Panchayat reports, reports of Agriculture department)

1.6	Irrigation	Area ('000 ha)		
	Net irrigated area	195		
	Gross irrigated area	224		
	Rain fed area	132		
	Sources of Irrigation	Number	Area ('000 ha)	Percentage of total irrigated area
	Canals	1024 km	148.0	66.07
	Tanks			
	Open wells	13164	76.0	33.93
	Bore wells	939		
	Lift irrigation schemes	5456		
	Micro-irrigation	22		
	Other sources (please specify)	204		
	Total Irrigated Area	-	224.0	100.0
	Pump sets	7003		
	No. of Tractors	5341		
	Groundwater availability and use* (Data source: State/Central Ground water Department /Board)	No. of blocks/ Tehsils	(%) area	Quality of water (specify the problem such as high levels of arsenic, fluoride, saline etc)
	Over exploited	-	-	-
	Critical	-	-	-
	Semi- critical	3	25	saline
	Safe	4	65	-
	Wastewater availability and use	-	-	-
	Ground water quality	Medium to good		
*over-exploited: groundwater utilization > 100%; critical: 90-100%; semi-critical: 70-90%; safe: <70%				

1.7 Area under major field crops & horticulture (as per latest figures) (2016-17)

1.7	Major field crops cultivated	Area ('000 ha)							
		Kharif			*Rabi*			Summer	
		Irrigated	Rain fed	Total	Irrigated	Rain fed	Total		Grand total
	Rice	28	7	35	0	0	0	0.1	35.1
	Sorghum	0	9	9	2	0	2	0	11
	Wheat	0	0	0	7	0	7	0	7
	Sugarcane	0	0	0	88	0	88	0	88
	Cotton	0	2	2	0	0	0	0	2

(Source :District Panchayat reports, reports of Agriculture department)

Horticulture crops - Fruits	Area ('000 ha)		
	Total	Irrigated	Rain fed
Banana	7.0	7.0	-
Mango	9.0	9.0	-
Sapota	2.1	2.1	-
Papaya	7.2	7.2	-
Coconut	0.2	0.2	-
Horticulture crops - Vegetables	**Total**	**Irrigated**	**Rainfed**
Brinjal	5.2	5.2	-
Okra	11.6	11.6	-
Tomato	1.6	1.6	-
Cowpea	1.5	1.5	-
Cabbage-flower	2.1	2.1	-

Fodder crops	Total	Irrigated	Rainfed
Total fodder crop area	9.2	1.8	7.4

Source :District Panchayat reports, reports of Agriculture department)

1.8	Livestock	Male (‘000)	Female (‘000)	Total (‘000)
	Non descriptive Cattle (local low yielding)	-	-	289.4
	Crossbred cattle	-	-	-
	Non descriptive Buffaloes (local low yielding)	-	-	300.3
	Graded Buffaloes	-	-	-
	Goat	-	-	150.5
	Sheep	-	-	1.7
	Others (Camel, Pig, Yak etc.)	-	-	-
	Commercial dairy farms (Number)			
1.9	**Poultry**	**No. of farms**	**Total No. of birds (‘000)**	
	Commercial	**903**	**460.1**	
	Backyard	**2000**	**330.6**	

1.10	**Fisheries** (Data source: Chief Planning Officer)						
	A. Capture						
	i) Marine (Data Source: Fisheries Department)	No. of fishermen	Boats		Nets		Storage facilities (Ice plants etc.)
			Mechanized	Non-mechanized	Mechanized (Trawl nets, Gill nets)	Non-mechanized (Shore Seines, Stake & trap nets)	
		4309	155	870	-	95942	ICF plant-44 Cold storage-3
	ii) Inland (Data Source: Fisheries Department)	No. Farmer owned ponds		No. of Reservoirs		No. of village tanks	
		45		7		567	

	B. Culture			
		Water Spread Area (ha)	Yield (t/ha)	Production (‘000 tons)
	i) **Brackish water** (Data Source: MPEDA/ Fisheries Department)	19200	15.21	1262
	ii) **Fresh water** (Data Source: Fisheries Department)			1684
	Others			8161

(Source :District Panchayat reports, reports of Agriculture department)

1.11 Production and Productivity of major crops (Average of last 5 years: 2012, 13, 14, 15, 16)

1.11	Name of crop	**Kharif**		**Rabi**		**Summer**		**Total**		**Crop residue as fodder** (‘000 tons)
		Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	
Major Field crops (Crops to be identified based on total acreage)										
	Rice	1150	2682	-	-	341	3460	1491	3071	1850
	Sorghum	196	1180	41	1480	-	-	237	1330	690
	Wheat	-	-	120	2498	-	-	120	2498	175
	Sugarcane	-	-	8212	69150	-	-	8212	69150	-
	Cotton	84	1920	-	-	-	-	84	1920	165
Major Horticultural crops (Crops to be identified based on total acreage)										
	Banana	-	-	-	-	672	62100	672	62100	-
	Mango	-	-	-	-	580	8155	59	8185	-
	Sapota	-	-	212	10335	-	-	212	10335	-
	Papaya	-	-	85	5955	-	-	79	5955	-
	Coconut	-	-	-	-	1.3	7765	1.3	7765	-

1.12	**Sowing window for 5 major field crops**	**Paddy**	**Sorghum**	**Wheat**	**Sugarcane**	**Cotton**
	Kharif- Rainfed	2 nd week of June to 2 nd week July	2 nd week of June to 2 nd week July	-	-	2 nd week of June to 2 nd week July
	Kharif-Irrigated	2 nd week of June to 2 nd week July	2 nd week of June to 2 nd week July	-	-	4th week of May to 2nd week of June
	Rabi- Rainfed	-	2nd week of October to 4th week of October	2nd week of November to 4th week of November	-	-
	Rabi-Irrigated	-	-	2nd week of November to 4th week of November	1st week of October to 4th week of January.	-

(Source :District Panchayat reports, reports of Agriculture department)

1.13	**What is the major contingency the district is prone to?** (Tick mark)	**Regular**	**Occasional**	**None**
	Drought	-	√	
	Flood	-	√	
	Cyclone	-		√
	Hail storm	-		√
	Heat wave	-	√	
	Cold wave	-	√	
	Frost	-		√
	Sea water intrusion	-		√
	Pests and disease outbreak (specify)	-	√	
	Others (specify)	-		√

1.14	**Include Digital maps of the district for**	Location map of district within State as Annexure I	Enclosed: Yes
		Mean annual rainfall as Annexure 2	Enclosed: Yes
		Soil map as Annexure 3	Enclosed: Yes

2.0 Strategies for weather related contingencies

2.1 Drought

2.1.1 Rainfed situation

Condition			**Suggested Contingency measures**		
Early season drought (delayed onset)	**Major Farming situation**	**Normal Crop/ Cropping system**	**Change in crop/cropping system including variety**	**Agronomic measures**	**Remarks on Implementation**
Delay by 2 weeks (July 1st week)	Hilly and highly undulating fine texture	Rice	No Change	Intercultivation Use weedicide	Supply of seeds through GSSC and NAU
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			
	Mid plains, fine texture, high rainfall	Rice	No Change	Protective Irrigation should be given in sugarcane, vegetables if available	Supply of seeds through GSSC and NAU
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			
	Mid plains, fine texture, medium rainfall	Rice	No Change	Intercultivation Use weedicide	Supply of seeds through NFSM Supply of seeds through GSSC
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			
	Coastal plain, deep fine texture, salt affected	Rice	No Change	Intercultivation Use weedicide	Supply of seeds through GSSC
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			

Condition			Suggested Contingency measures		
Early season drought (delayed onset)	**Major Farming situation**	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Delay by 4 weeks 3rd week of July	Hilly and highly undulating fine texture	Rice	No Change	• Wider spacing • Mulching • Micro irrigation	• GSSC • NSC • RKVY • NHM
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			
	Mid plains, fine texture, high rainfall	Rice	No Change	• Wider spacing • Mulching • Micro irrigation • Interculturing	• GSSC • NSC • RKVY • NHM
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			
	Mid plains, fine texture, medium rainfall	Rice	No Change	• Higher seed rate • Higher fertilizer • Moisture conservation • Salt tolerant varieties	• GSSC • NSC • RKVY • NHM
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			
	Coastal plain, deep fine texture, salt affected	Rice	No Change	• Wider spacing • Mulching • Micro irrigation • Interculturing	• GSSC • NSC • RKVY • NHM
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			

Condition			**Suggested Contingency measures**		
Early season drought **(Normal onset)**	**Major Farming situation**	**Normal Crop/cropping system**	**Crop management**	**Soil nutrient &moisture conservation measures**	**Remarks on Implementation**
Normal onset followed by 15-20 days dry spell after sowing leading to poor germination/crop stand etc.	Hilly and highly undulating fine texture	Rice	Gap filling Thinning Give protective irrigation	Adopt foliar sprays of nutrients Avoid intercultivation	Supply of inter cultural implements through RKVY Seeds supply through NFSM
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			
	Mid plains, fine texture, high rainfall	Rice	Gap filling Thinning Give protective irrigation	Adopt foliar sprays of nutrients Avoid intercultivation	Seeds through GSSC
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			
	Mid plains, fine texture, medium rainfall	Rice	Gap filling Thinning Give protective irrigation	Adopt foliar sprays of nutrients Avoid intercultivation	Interculturing implements through RKVY Seeds from NSC
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			
	Coastal plain, deep fine texture, salt affected	Rice	Gap filling Thinning Give protective irrigation	Adopt foliar sprays of nutrients Avoid intercultivation	Supply of inter cultural implements through RKVY Seeds supply throughNFSM
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			
Condition			**Suggested Contingency measures**		
Mid season drought (long dry spell, consecutive 2 weeks rainless (>2.5 mm) period)	**Major Farming situation**	**Normal Crop/cropping system**	**Crop management**	**Soil nutrient & moisture conservation measures**	**Remarks on Implementation**
	Hilly and highly	Rice	Use antitranspirant chemical	Use plastic or grass	Supply of inter

At vegetative stage	undulating fine texture			mulch.	cultural implements through RKVY Seeds supply through NFSM
		Sorghum	Repeated Intercultivation	Application of foliar nutrients	
		Wheat	Use antitranspirant chemical	Give protective irrigation	
		Sugarcane	Alternate furrow irrigation	Use plastic or grass mulch.	
		Cotton	Alternate furrow irrigation	Application of foliar nutrients	
	Mid plains, fine texture, high rainfall	Rice	Use antitranspirant chemical	Use plastic or grass mulch.	Supply of inter cultural implements through RKVY Seeds supply through NFSM
		Sorghum	Repeated Intercultivation	Application of foliar nutrients	
		Wheat	Use antitranspirant chemical	Give protective irrigation	
		Sugarcane	Alternate furrow irrigation	Use plastic or grass mulch.	
		Cotton	Alternate furrow irrigation	Application of foliar nutrients	
	Mid plains, fine texture, medium rainfall	Rice	Use antitranspirant chemical	Use plastic or grass mulch.	Supply of inter cultural implements through RKVY Seeds supply through NFSM
		Sorghum	Repeated Intercultivation	Application of foliar nutrients	
		Wheat	Use antitranspirant chemical	Give protective irrigation	
		Sugarcane	Alternate furrow irrigation	Use plastic or grass mulch.	
		Cotton	Alternate furrow irrigation	Application of foliar nutrients	
	Coastal plain, deep fine texture, salt affected	Rice	Use antitranspirant chemical	Use plastic or grass mulch.	Supply of inter cultural implements through RKVY Seeds supply through NFSM
		Sorghum	Repeated Intercultivation	Application of foliar nutrients	
		Wheat	Use antitranspirant chemical	Give protective irrigation	
		Sugarcane	Alternate furrow irrigation	Use plastic or grass	

				mulch.	
		Cotton	Alternate furrow irrigation	Application of foliar nutrients	
Condition			**Suggested Contingency measures**		
Mid season drought (long dry spell)	**Major Farming situation**	**Normal Crop/cropping system**	**Crop management**	**Soil nutrient & moisture conservation measures**	**Remarks on Implementation**
At flowering/ fruiting stage	Hilly and highly undulating fine texture	Rice Sorghum Wheat Sugarcane Cotton	Harvest at physiological harvest stage Give protective irrigation Follow proper weeding management practice	Adopt foliar application of nutrients Give protective irrigation Use plastic or grass mulch. Repeated Intercultivation	Supply of inter cultural implements through RKVY Seeds supply through NFSM
	Mid plains, fine texture, high rainfall	Rice Sorghum Wheat Sugarcane Cotton	Harvest at physiological harvest stage Give protective irrigation Follow proper weeding management practice	Adopt foliar application of nutrients Give protective irrigation Use plastic or grass mulch .Repeated Intercultivation	Supply of inter cultural implements through RKVY Seeds supply through NFSM
	Mid plains, fine texture, medium rainfall	Rice Sorghum Wheat Sugarcane Cotton	Harvest at physiological harvest stage Give protective irrigation Follow proper weeding management practice	Adopt foliar application of nutrients Give protective irrigation Use plastic or grass mulch. Repeated Intercultivation	Supply of inter cultural implements through RKVY Seeds supply through NFSM
	Coastal plain, deep fine texture, salt affected	Rice Sorghum Wheat Sugarcane Cotton	Harvest at physiological harvest stage Give protective irrigation Follow proper weeding management practice	Adopt foliar application of nutrients Give protective irrigation Use plastic or grass mulch. Repeated Intercultivation	Supply of inter cultural implements through RKVY Seeds supply through NFSM

Condition			Suggested Contingency measures		
Terminal drought (Early withdrawal of monsoon)	**Major Farming situation**	**Normal Crop/cropping system**	**Crop management**	**Rabi Crop planning**	**Remarks on Implementation**
	Hilly and highly undulating fine texture	Rice Sorghum Wheat Sugarcane Cotton	Harvest at physiological harvest stage Give protective irrigation Follow proper wedding management practice	wider spacing Mulching Life saving irrigation Irrigate at critical stage water saving technique	Supply of inter cultural implements through RKVY Seeds supply through NFSM
	Mid plains, fine texture, high rainfall	Rice Sorghum Wheat Sugarcane Cotton	Harvest at physiological harvest stage Give protective irrigation Follow proper wedding management practice	wider spacing Mulching Life saving irrigation Irrigate at critical stage water saving technique	Supply of inter cultural implements through RKVY Seeds supply through NFSM
	Mid plains, fine texture, medium rainfall	Rice Sorghum Wheat Sugarcane Cotton	Harvest at physiological harvest stage Give protective irrigation Follow proper wedding management practice	wider spacing Mulching Life saving irrigation Irrigate at critical stage water saving technique	Supply of inter cultural implements through RKVY Seeds supply through NFSM
	Coastal plain, deep fine texture, salt affected	Rice Sorghum Wheat Sugarcane Cotton	Harvest at physiological harvest stage Give protective irrigation Follow proper wedding management practice	wider spacing Mulching Life saving irrigation Irrigate at critical stage water saving technique	Supply of inter cultural implements through RKVY Seeds supply through NFSM

2.1.2 Drought - Irrigated situation

Condition			Suggested Contingency measures		
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Delayed release of water in canals due to low rainfall	Canal command area high to medium rain fall area, heavy to	Rice Sorghum	Use rain fed paddy varieties Use rainfed cotton varieties G cot 23	Use mulching Use FYM & compost	Seeds through GSSC and NFSM

Condition			Suggested Contingency measures		
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
	medium textured soil	Wheat	Use castor crop		
		Sugarcane			
		Cotton			

Condition			Suggested Contingency measures		
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Limited release of water in canals due to low rainfall	Canal command area high to medium rain fall area, heavy to medium textured soil	Rice	Use rain fed paddy varieties Use rainfed cotton varieties GJ 35 Use castor crop	Use mulching Use FYM & compost	Seeds through GSSC and NFSM
		Sorghum			
		Wheat			
		Sugarcane			
		Cotton			

Condition					
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Non release of water in canals under delayed onset of monsoon in catchment	**This is not expected in this district**				

Condition					
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Lack of inflows into tanks due to insufficient /delayed onset of monsoon	**This is not expected in this district**				

Condition					
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Insufficient groundwater recharge due to low rainfall	**This is not expected in this district**				

2.2 Unusual rains (untimely, unseasonal etc) (for both rainfed and irrigated situations)

Condition	**Suggested contingency measure**			
Continuous high rainfall in a short span leading to water logging	**Vegetative stage**	**Flowering stage**	**Crop maturity stage**	**Post harvest**
Rice	Resowing Provide drainage	Use early maturity variety GNR 3	Select suitable rabi crop	Shift to safer place
Sorghum	Resowing Provide drainage	Use early maturity variety **GJ42**	Select suitable rabi crop	Shift to safe place dry in shade and turn frequently
Wheat	-	-	-	Safe storage against storage pest and disease
Sugarcane	-	-	-	----
Cotton	Resowing Provide drainage	Use early maturity variety Gcot Hy. 6	Select suitable rabi crop	Shift to safe place dry in shade and turn frequently
Horticulture				
Banana	-	-	-	Shift to safe place dry in shade and turn

				frequently
Mango	-	-	-	Shift to safe place dry in shade and turn frequently
Sapota	-	-	-	Shift to safe place dry in shade and turn frequently
Papaya	-	-	-	Shift to safe place dry in shade and turn frequently
coconut	-	-	-	Shift to safe place dry in shade and turn frequently
Heavy rainfall with high speed winds in a short span				
Rice	Resowing, Gap filling Provide drainage	Use early maturity variety GNR 3	Select suitable rabi crop Indian bean	Shift to safe place dry in shade and turn frequently
Sorghum	Resowing Provide drainage	Use early maturity variety **GJ42**	Select suitable rabi crop	Shift to safe place dry in shade and turn frequently
Wheat	-	-	-	Shift to safe place dry in shade and turn frequently
Sugarcane	Propping &twisting	Propping &twisting	Propping &twisting	Shift to safe place dry in shade and turn frequently
Cotton	Resowing, Gap filling Provide drainage	Use early maturity variety Gcot Hy. 6	Select suitable rabi cropIndian bean	Shift to safe place dry in shade and turn frequently
Horticulture				
Banana	Protect with wind break crop (Shevari,Castor)	-	-	Shift to safe place dry in shade and turn frequently
Mango	Protect with wind break crop	-	-	Shift to safe place dry in shade and turn

	(Shevari,Castor)			frequently
Sapota	Protect with wind break crop (Shevari,Castor)	-	-	Shift to safe place dry in shade and turn frequently
Papaya	Protect with wind break crop (Shevari,Castor)	-	-	Shift to safe place dry in shade and turn frequently
coconut	-			
Outbreak of pests and diseases due to unseasonal rains				
Rice	Need based Plant protection IPDM	Need based Plant protection IPDM	Need based Plant protection IPDM	Safe storage against storage pest and diseases
Sorghum	Need based Plant protection IPDM	Need based Plant protection IPDM	Need based Plant protection IPDM	Safe storage against storage pest and diseases
Wheat	Need based Plant protection IPDM	Need based Plant protection IPDM	Need based Plant protection IPDM	Safe storage against storage pest and diseases
Sugarcane	Need based Plant protection IPDM	Need based Plant protection IPDM	Need based Plant protection IPDM	Safe storage against storage pest and diseases
Cotton	Need based Plant protection IPDM	Need based Plant protection IPDM	Need based Plant protection IPDM	Safe storage against storage pest and diseases
Horticulture				
Banana	Need based Plant protection	Need based Plant protection	Need based Plant protection IPDM	Safe storage against storage pest and diseases

	IPDM	IPDM		
Mango	Need based Plant protection IPDM	Need based Plant protection IPDM	Need based Plant protection IPDM	Safe storage against storage pest and diseases
Sapota	Need based Plant protection IPDM	Need based Plant protection IPDM	Need based Plant protection IPDM	Safe storage against storage pest and diseases
Papaya	Need based Plant protection IPDM	Need based Plant protection IPDM	Need based Plant protection IPDM	Safe storage against storage pest and diseases
coconut	Need based Plant protection IPDM	Need based Plant protection IPDM	Need based Plant protection IPDM	Safe storage against storage pest and diseases

2.3 Floods

Condition	**Suggested contingency measure**			
Transient water logging/ partial inundation[1]	**Seedling / nursery stage**	**Vegetative stage**	**Reproductive stage**	**At harvest**
Rice	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage
Sorghum	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage
Wheat	-	-	-	-
Sugarcane	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage
Cotton	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage
Horticulture				
Banana	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage
Mango	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage
Sapota	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage

Continuous submergence for more than 2 days				
Rice	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage
Sorghum	Provide proper drainage	Provide proper drainage	Provide proper drainage	
Wheat	-	-	-	-
Sugarcane	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage
Cotton	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage
Horticulture				
Banana	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage
Mango	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage
Sapota	Provide proper drainage	Provide proper drainage	Provide proper drainage	Provide proper drainage
Sea water intrusion[3]	Not expected			

2.4Extreme events: Heat wave /Cold wave/Frost/ Hailstorm /Cyclone

Extreme event type	**Suggested contingency measure**			
	Seedling / nursery stage	**Vegetative stage**	**Reproductive stage**	**At harvest**
Heat Wave				
Rice Sorghum Wheat Sugarcane Cotton	Application of irrigation Protection with wind break crop Use mulching	Application of irrigation Protection with wind break crop Use mulching	Application of irrigation Protection with wind break crop Use mulching	Application of irrigation Protection with wind break crop Use mulching
Horticulture				
Banana Mango Sapota	Application of irrigation Protection with wind break crop	Application of irrigation Protection with wind break crop	Application of irrigation Protection with wind break crop	Application of irrigation Protection with wind break

	Use mulching	Use mulching	Use mulching	crop Use mulching
Cold wave	Not Observed			
Horticulture				
Frost	Not Observed			
Horticulture				
Hailstorm	Not Observed			
Horticulture				
Cyclone	Not Observed			
Horticulture				

2.5 Contingent strategies for Livestock, Poultry & Fisheries

2.5.1 Livestock

	Suggested contingent measures		
Drought	**Before the event**	**During the event**	**After the event**
Feed and fodder availability	• Insurance • Encourage perennial fodder on bunds and waste land on community basis • Establishing fodder banks, • Encouraging fodder crop in irrigated area • Silage-using excess fodder for silage	• Utilization of perennial tree and fodder bank reserves • Utilizing stored silos • Transporting excess fodder from adjoining districts • Use of feed mixture	• Availing insurance • Culling unproductive livestock
Drinking waters	• Preserving water in the tank for drinking purpose • Excavation of bore wells	• Using preserved water in the tanks for drinking wherever ground water resources are available priority for drinking purpose	
Health and disease	Veterinary preparedness with medicines	• Mass animal heath camp and treatment of affected animals once in campaign	• Culling of sick animals

management	and vaccine		
Floods			
Feed fodder availability	• Feeds and fodder should be transported to adjoining well protected areas. • Village or Taluka level feed and fodder bank with facilities like TMR machine/ feed block machine should be developed. • Prepare balanced feed formulations using available feed resources.	• Transportation of fodder especially dry fodder should be done to affected area. • Use of Total Mixed Ration (TMR)/ feed block should be encouraged. • Use of unconventional feed like tree leaves etc. in ration may be incorporated.	• Culling of unproductive animals
Drinking Water	• Preserving water in water tank for drinking purpose.	• Using preserved water for drinking • Avoid wastage of water	• Repair damaged water sources like tank, pond, wells etc.
Health and disease management	• Veterinary preparedness with medicines and vaccine • Availing Insurance of animals and farm equipments	• Mass animal heath camp and treatment of animals • Ring vaccinations like FMD, HS should be conducted.	• Culling of sick animals • Proper burial of carcass using disinfection
Cyclone			
Feed and fodder availability	• Feed and fodder should transport to safe area. • Use of curtails to avoid splashing of water in feed storage • Prepare balanced feed formulations using available feed resource	• Keep fodder in closed area so it does not get wasted. • Use of **toxin binders in feed**	• Use balanced ration to restore normal production. • Use feed additives like probiotics, prebiotics, enzymes etc. to encourage overall health status.
Drinking water	• Keep eye on water sources/stock	• Use of electrolyte/ coccidiostats/ antidiarrhoeal in water	• Repair damaged water resources.
Health and disease management	• Veterinary preparedness with medicines and vaccine • Insurance of animals	• Isolate affected animals	• Proper burial of carcass using disinfection

Heat wave and cold wave			
Shelter and environment management (**For heat wave)**	• Install foggers/sprinklers in house having timer to avoid overuse of water • Tree plantation on both the side of shed • Keep drinking water available whenever needed and use electrolytes in water.	• Use of silage feeding encouraged. • Increase feeding frequency and feeding during night hours • Use of water bodies like pond for wallowing of animals • Increase energy density of diet by incorporating **bypass fat.**	• Use of cooling mechanisms to maintain house temperature on comfort zone for better production.
Shelter and environment management **(For cold wave)**	• Keep calf below 1 year age in separate shed that protects animals from direct cold.	• Use of bedding materials like paddy straw should be done for Calves. • Use of lamp/bulb to increase the temperature of shed during night hours. • Increase use of dry fodder and urea treated straw.	.
Health and disease management	• Veterinary preparedness with medicines	• Use of electrolytes in drinking water	Isolate affected animals and give special concern

2.5.2 Poultry

	Suggested contingency measures		
	Before the event	**During the event**	**After the event**
Drought			
Shortage of feed ingredients	• Purchase sufficient quantity of ready feed /raw feed ingredients as per storage facilitiesand requirement. • Indentify and test available alternative lowcost feed resources in feed testinglaboratories for their exact composition forformulating balanced feed. • Prepare balanced feed formulation usingavailable feed resources.	• Feed formulations using low costfeed ingredients in case of non-availability of high pricedconventional ingredients. • Keep check on productionperformance and modify ration consulting poultry specialist.	• Shift over to good quality feed foroptimum production performance.

	• Create alternative power generating facilitiesi.e. Generator set. Take insurance of poultry sheds, equipmentsand feed factory well in advance may be inthe starting phase of opening the farm.	• Nutrient density should beincreased in proportion to feedconsumption. • Avoid feed wastage	
Drinking water	-	-	-
Health and disease management	• Use of anti-stress vitamins (AD_3ECB_{12}-Vimeral / Famitone / Stressvell etc.) in feed and drinking water. • Use of adaptogenetic herbal medicines (Zetress / Zist etc). • Use probiotics (Protexin / Biovet-YC) in feed. • Vaccinate birds against important diseases like R.D., IBD, I.B., Fowl pox according to age as per scheduled programme.	• Use anti-stress, vitamins and adaptogenetic herbal drugs. • Perform vaccination for Ranikhet Disease & Infectious Bronchitis . • Prophylactic medication for important diseases like E.coli & CRD. • Use of electrolytes in feed and drinking water.	• Vaccinate birds as per vaccination schedule. • Perform deworming with Levamisole / Albendazole / Piperazine etc) and use antibiotics, vitamins as per monthly health calendar programme
Floods			
Shortage of feed ingredients	• Purchase sufficient quantities of ready feed / raw feed ingredients. • Store feeding material in suitable houses which should be leak proof and without dampness. • Store feed on iron stands away from the wall to avoid increase in moisture & mould growth. • Road repairing for transporting feed and farm products. • Take insurance of poultry sheds, equipments, feed factory and mortality of birds due to drowning in flood water well in advance may be in the starting phase of opening the farm.	• Use of toxin binders (Chek–O-Tox/ UTPP etc.) in the feed. • All electric connections should be in good condition to avoid shock and accident.	• Use of Toxin binder should be continued to avoid development of mycotoxins in the feed
Drinking water	-	-	-
Health and disease management	• Complete vaccination as per the programme for various categories of the birds i.e. Layers & Broilers. • Poultry sheds should be constructed at high raised land/or go for raised platform poultry sheds especially in flood affected areas. (conceptional biosecurity)	• Use of probiotics / or antibiotics in feed to protect birds from bacterial infections like E.coli, CRD, Enteritis etc.	• Use of probiotics should be continued in feed for 10-15 days.

Cyclone	Not Observed		
Shortage of feed ingredients			
Drinking water			
Health and disease management			
Heat wave and cold wave	Not Observed		
Shelter/environment management			
Health and disease management			

2.5.3 Fisheries / Aquaculture

	Suggested contingency measures		
	Before the event	**During the event**	**After the event**
1) Drought	When the drought condition arise at that time available irrigation canals can be connected to the affected reservoir and village ponds to defend from drought condition of particular zone.		
A. Capture	Marine sector couldn't effected directly but estuarine biodiversity will effected (some fresh water fish migrate to marine or vice versa for breeding, feeding etc. & it will be effective)		
Marine	Prepare fish database of particular zone	Catadromus fish stock affected due to scarcity of river water (fresh water).	Developed the stock by stocking of fishes during favorable condition, it will auto stock fish in natural condition
Inland	Inland sector will be affected most during the drought condition. Indian Major Carp (Catla, Rou, Mrigal etc.), Exotic Carp (Silver carp, Grass carp, Common carp etc.), Cat fish and other biodiversity will either migrate or not survive.		
(i) Shallow water depth due to insufficient rains/	1. Provide water through cannel and pipeline from	1. Migration of fish stock	Transplant the fish stock and breed the fish in hatchery to stock the fish

	Suggested contingency measures		
	Before the event	**During the event**	**After the event**
inflow	major reservoirs to maintain sufficient water depth 2. Taxonomic fish data collection & Preserved fish stock (gene)	2. Conservation of breeders/ fish stock at unaffected area	seed in affected area
(ii) Changes in water quality	Migration of fish due to change of water quality	-	-
(iii) Any other	-	-	-
B. Aquaculture	"Culture of aquatic organisms in confined water body", so this sector will affected most incase of either non availability of water or mismanagement.		
(i) Shallow water in ponds due to insufficient rains/ inflow	1. Lower the stocking density by harvest the big size (500 gm) fish and place in market. 2. Transfer of under culture fishes to abundance water zone	Pre- harvest all the materials (fish and prawns) & preserved by freezing	Sanitize the dead fish biomass.
(ii) Impact of salt load build up in ponds / change in water quality	Protect the water and use of lime and other probiotics	Cover the pond with plants (duckweed etc) to protect from evaporation.	Flush the pond with fresh water and manure before the next stocking of fish to maintain the food chain
(iii) Any other	-	-	-
2) Floods	Flood are generally predicted and early warning will protect the lives and livelihood		
A. Capture	Change of breeding grounds, migration of fish against and with the water and increase of fish stock etc, so positive effect on capture fisheries.		
Marine	All the fishermen must call	No fishing	

	Suggested contingency measures		
	Before the event	**During the event**	**After the event**
	back from fishing		
Inland	All the fishermen must call back from fishing	No fishing	
(i) Average compensation paid due to loss of human life	1. Recognizing the risk of flood & making the people aware of it 2. Migrate the people at safe place 3. Collect the details information of swimmers & life savers appliances.	Send the rescue teams to protect the lives of the most vulnerable peoples.	1. Measure social impact of losses risks of diseases, loss of employment. 2. The most vulnerable fishermen be taken care of first and fast
(ii) No. of boats/ nets/ damaged	Transfer boats/nets at safe places	If possible protect boats during rescue operation	Identify the damages according to assessment & compensate
(iii) No. of houses damaged			
(iv) Loss of stock			
(v) Changes in water quality			
(v) health and diseases	Prepared the medical rescue team	-	1. Proper hygiene & sanitation 2. Send the medical rescue team with drugs.
B. Aquaculture	Flood affects the culture ponds which are situated near the river. It demolished the pond dyke, overflows the pond and contaminated the culture.		
(i) Inundation with flood water	1.Transfer of aquaculture farmers to protected places 2. Harvest fish from culture		1. Harvest the culture fish as well as wild fish which came with flood water.

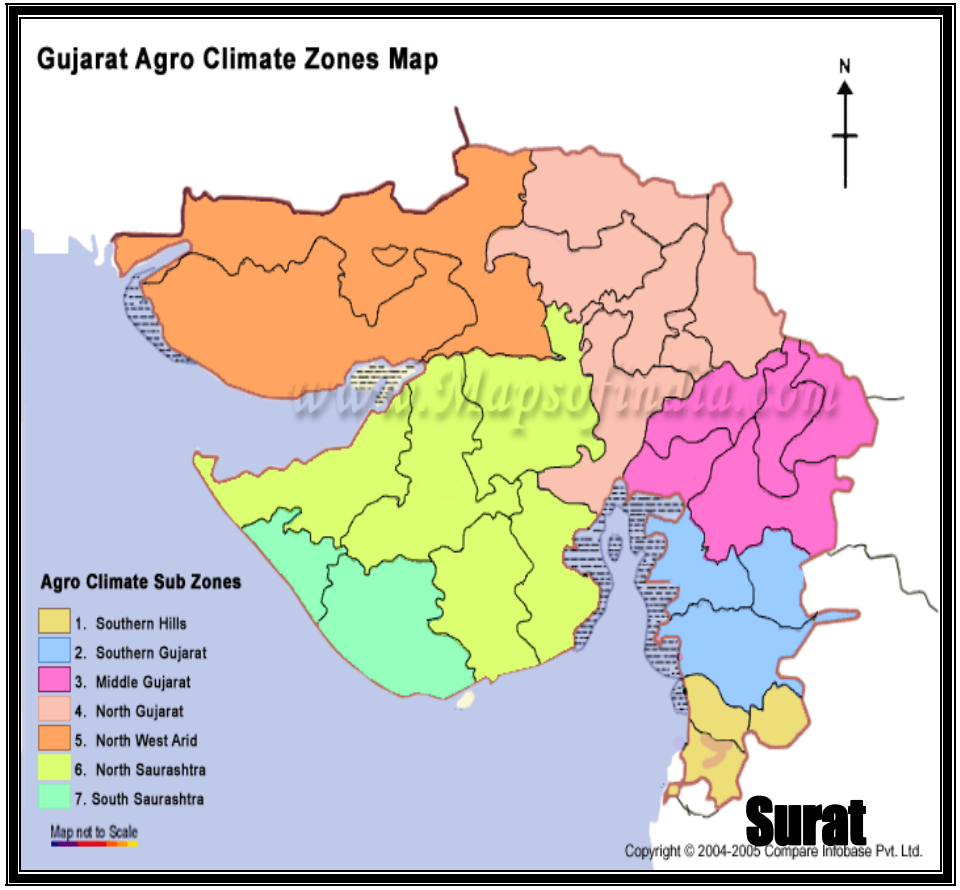
	Suggested contingency measures		
	Before the event	**During the event**	**After the event**
	ponds and preserved or sale at market 3. Protect the pond dykes with sand bags.		2. Disinfect the ponds with chemicals
(ii) Water continuation and changes in water quality	Reduced water level of culture pond.	Flood water fills the pond if empty or reduced before the flood.	Exchange water with fresh water to maintain the water quality.
(iii) health and diseases	Take preventive measures		Destroy the dead fish with disinfectant
(v) Loss of stock and inputs(feed etc)	Transfer the stock and inputs at safe places	-	Demolish the wet & spoiled feed
Infrastructure damage(pumps, aerators, huts etc)	Transfer the detachable infrastructure at safe places	-	Measure impact of losses of infrastructure and provide assistance for rehabilitation
(vi) Any other			
3. Cyclone / Tsunami	Cyclone, heavy rain and flooding are generally predicted and early warning are issued by the concern agencies, while Tsunami, Oil spill etc. cannot be forewarned		
A. Capture	Capture fishery affected due to cyclone, as current pattern change & upwelling cause the migration of some fish species, so it will either affect to stock or species variation.		
Marine	On the costal region, fishermen staying away from the vulnerable zone is one of the way of prevention		
(i) Average compensation paid due to loss of fishermen lives	1. Recognizing the risk of cyclone and making the people aware of risk 2. migrate the fishermen at	Protecting the lives and livelihood of the most vulnerable fishermen	1. Measure social impact of losses risks of diseases, loss of employment. 2. The most vulnerable fishermen be taken care of first and fast

	Suggested contingency measures		
	Before the event	**During the event**	**After the event**
	safe place		
(ii) Avg. no. of boats/nets/ damaged	1. Identify the boats and convey messages of disaster in the sea. 2. Birthing the boats at safe place	1. Warning signals, use of flares, seeking help by attracting attention. 2. Prevent the lives among damaged boats	Compensation of damages should be provide after real assessment of damages (boat/net)
(iii) Avg. no. of houses damaged			As above
Inland	1. Recognizing the risk of cyclone and making the people aware of risk 2. migrate the fishermen at safe place	Protecting the lives and livelihood of the most vulnerable fishermen	1. Measure social impact of losses risks of diseases, loss of employment. 2. The most vulnerable fishermen be taken care of first and fast
B. Aquaculture	Most of coastal aquaculture farms (shrimp culture) will affect most due to cyclone & tsunami, as sea water intrusion, high current & tide & high wind velocity will affect the dyke and infrastructure of aquaculture units.		
(i) Overflow/ flooding of ponds	1.Pre- harvest the materials (fish and prawns) 2. Protect the dykes by putting soil bags. 3. Place the iron screen on inlet and outlet	In case of over flooding open outlet of the pond	1. Measure impact of losses and risks of diseases 2. Provide better hygienic sanitation, disinfected the ponds.
(ii) Changes in water quality (fresh water/ brackish water ratio)			
(iii) Health and diseases			
(iv) Loss of stock and inputs (feed, chemicals etc)	Transfer the stock and inputs at safe places	-	Destroy the decomposed feed
(v) Infrastructure	Transfer the detachable	-	Measures impact of losses of

	Suggested contingency measures		
	Before the event	**During the event**	**After the event**
damage(pumps, aerators, shelters/ huts etc)	infrastructure at safe places		infrastructure and provide assist for rehabilitation
(vi) Any other	-	-	-
4. Heat wave and cold wave	This factor will affect indirectly to the fish stock.		
A. Capture	Due to heat and cold wave some fishes migrate to offshore as well as non affected area so, it will affect the fish catch.		
Marine	Assessment of capture fish catch	Study the impact of heat and cold wave on fish capture and biodiversity.	Established the fishery
Inland	Assessment of capture fish catch	As above	As above
B. Aquaculture	Due to these factor, fish growth will affect, change in feeding, breeding and rearing of fish larvae.		
(i) Changes in pond environment (water quality)	Exchange of water to maintain the water temperature and water parameter	Use equipment to protect the fish from drastic change in temperature as well as depletion of oxygen, i.e. use of thermostat heater to maintain constant pond temperature & use of aerator to maintain dissolve oxygen in pond.	Acclimatize the fish stock in natural condition and reduced the used equipments from the ponds. Maintain the feed ration accordingly.
(ii) Health and Disease management	Take some preventive measures to protect from disease	Use of probiotics as well as fresh and live feed	
(iii) Any other	-	-	-

Annexure I

Location map of district within state


Gujarat Agro Climate Zones Map
N
Agro Climate Sub Zones
1. Southern Hills
2. Southern Gujarat
3. Middle Gujarat
4. North Gujarat
5. North West Arid
6. North Saurashtra
7. South Saurashtra
Map not to Scale
Surat
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Annexure II

Mean annual rainfall

Sr. No.	Year	Rainfall in mm
1	2006	3653
2	2007	1766
3	2008	1550
4	2009	1352
5	2010	1278
6	2011	1165
7	2012	1350
8	2013	986
9	2014	1013
10	2015	989
11	2016	1078

Annexure III

Soil map of Surat district