

ENVIRONMENTAL STRATEGIES FOR GUJARAT, 2014-2019



**Gujarat Ecology Commission,
Government of Gujarat,**

Concept and Guidance

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Priority Sectors

Urban



Urban Air and Transport
Urban Lakes, Urban Rivers
Peri-Urban Areas, Growth of Small Town,
Urban Slums
Urban Green Spaces
Urban Waste

Water



Water Availability
Water Quality
Ground Water
Water Salinity

Industries



Industrial Effluent
Growth of High Pollution Potential
Industries
Hazards Waste

Coastal



Coastal Water
Coastal Industries
Coastal Bio diversity

Land



Land Quality

Desert



Desertification and Salt Industry growth

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- ✚ 11 Actions to Achieve Sustainable Environment

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- i. Detailed Action plan for Urban Area
- ii. Detailed Action plan for Water Resources
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- iv. Detailed Action plan for Coastal Area
- v. Detailed Action plan for Land
- vi. Detailed Action Plan for *Rann*



CONTEXT

Gujarat is a maritime state having 1660 km long coastline, the longest in the country. It is rich with biodiversity of flora-fauna and natural resources. Natural gems are scattered throughout its lands and along the coastal areas. Considering the importance of conservation of various natural resources, it becomes imperative to ensure sustainability of both, the natural resources as well as developmental activities.

During past one decade Gujarat has achieved remarkable success in industrial development and plays a vital role in India's economic growth. Though Gujarat accounts for only 6% of India's geographical area and 5 % of the population, 21% of the national exports and 6.4% GDP of India are contributed by Gujarat. A rapid industrialization has accelerated urbanization and intensive infrastructure development. It has been realized that rapid development is often accompanied by a host of environmental problems and become a priority concern for the State Government.

Over the years, multifold efforts have been taken by State Government to tackle environment issues and conservation of rich natural resources. Putting forward a concrete step in this direction, Gujarat Ecological Commission (GEC) has recommended Environment Strategies for Gujarat state, directing a path to balance the development and conservation of natural resources.

As a first step in the compilation of the Plan, a rapid assessment of the existing policies and plans of each sector was undertaken. This helped to identify the existing works and activities undertaken across various sectors, as well as gaps where more efforts are required. Our initial assessment identified seven priority focus areas for affirmative environmental actions. These sectors are: Land, Water, Urban, Coastal area, *Rann*, Industry, and Air¹. Action Plan for each focus area sets out key challenges, critical locations, and essential actions.

The priority sectors covered in this report are:

- ✓ **Land Environment**
- ✓ **Water Environment**
- ✓ **Urban Environment**
- ✓ **Coastal Environment**
- ✓ ***Rann* Environment**
- ✓ **Industry Environment**
- ✓ **Air Environment**

¹ Concerned issues related to Air has been covered under urban sector, since it is an integral part of the Urban Environment Strategies



NEED FOR STRATEGIC PLANNING

Isolated pockets of action will not achieve required environment quality goals. The key to protecting environment is to launch concerted and sustained efforts across all spheres of sectors of environment.

This Plan is an effort to offset existing environment issues by integrating environment in development process. In order to support sustainable development, this plan has incorporated seven significant sectors: Land, Water, Urban, Coastal, *Rann*, Industry, and Air. The expected benefits of this action plan include:

✓ **Prioritization of environment issues and Setting up targets**

Prioritization of environment issues was a necessary footstep towards forming robust strategies. Targets have been setup to address specific environmental challenges and gaps, for concerned locations to minimize impacts. This would also help Government to assess the compliance of those particular actions.

✓ **Identification of stakeholders and coordination**

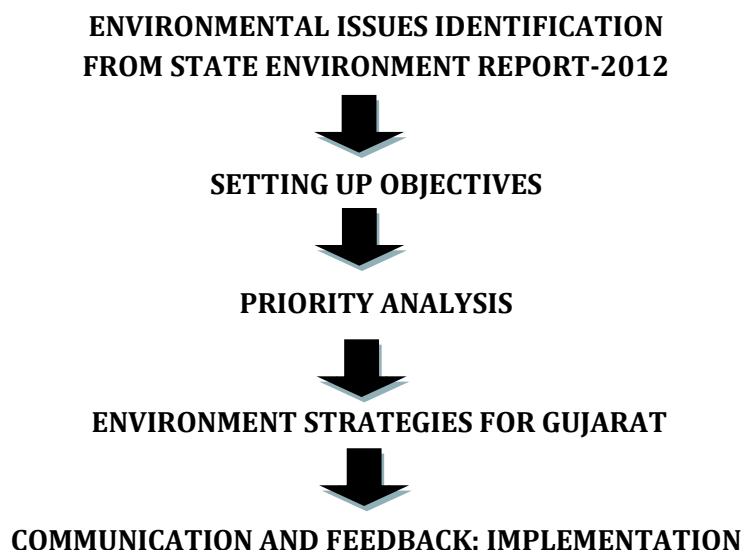
Wide reaching communication, stakeholder participation, and close coordination are the key for effective implementation of the plan. Accordingly, key stakeholders have been identified to ensure their participation in various initiatives.

✓ **Building up necessary resources**

Adequate funding is crucial to achieve the set out objectives in this plan. Funds have been reserved for local and state authorities for various initiatives and this plan would facilitate the stakeholders to access funds for specific actions. However, mentioned budget is indicative and it can be further refined.

APPROACH

SCHEMATIC FRAME WORK OF ACTION PLAN PREPARATION



Various dimensions of the environmental issues and concerned locations have been highlighted to take necessary actions for improving environmental condition. Identification of issues is based on the upcoming State Environment Report-2012 prepared by GEC. Subsequently issues have been prioritized through Delphi method.

Delphi method has been used as tool to structure and prioritized issues, which were identified from State Environment Report-2012. A group of participants have been formed with diverse domains including Social Science, Environment & Urban Planner, Environment Science, and Engineering². Two rounds of surveys have been conducted where experts have asked to rank issues between 0 to 10. Ranking of the issues were based on their impact on Land, Water, Air, Agriculture, Biodiversity and Health. In the first round, experts have ranked the issues and results have been disclosed for further discussion and feedback of the participations. During second round, experts are encouraged to revise their earlier answers in light of the replies of other members of their panel. At the end, weighted averages were computed for given ranking obtained from experts and issues were categorized in scale of high, medium, and low.

Consequently, required necessary actions and strategies were recommended for listed issues. These actions have been further divided in three categories: 1) Policy and Implementation, 2) Planning, Monitoring & Technology and 3) Research and Capacity Building (Refer Annexure I to VI).

² Detail of experts have been provided in annexure VII

CRITICAL ENVIRONMENTAL ISSUES IN GUJARAT

The list of identified issues and associated locations has been provided below:

URBAN

Urban Air and Transport

Issues	Critical location
✓ Heat island effect is increasing in urban areas due to reduction in urban tree cover and high air pollution ³ .	✓ Ahmedabad and Surat may have a high Heat Island. Vadodara and Rajkot also possess moderate Heat Island Intensity.
✓ Air pollution Index of large cities is higher than the permissible limit ⁴ .	✓ Rajkot has maximum Air pollution Index (API) followed by Ahmedabad, Valsad, Vadodara and Surat.
✓ In most of the cities ⁵ , CPCB monitoring stations have recorded higher annual average concentration of Suspended Particular Matter (SPM) and Respiratory Suspended Particular Matter (RSPM) in residential area than the permissible limit.	✓ Ahmedabad, Vadodara, Rajkot, Bharuch, Jamnagar, Surat are above the permissible limit.

Urban Water

Issues	Critical location
✓ Urban Water Bodies are diminishing in many cities.	✓ In Ahmedabad and Vadodara, the area under water bodies has decreased during 1991 to 2005.
✓ Urban lakes are showing high level of Total Dissolved Solid (TDS) and Chemical Oxygen Demand (COD) due to the soil quality of the catchment and settlement of solids ⁶ .	✓ Sursagar, Dobhi, Padara lakes in Vadodara, Chandola, Nalsarovar lakes in Ahmedabad, Monsoor Lake in Viramgam district.

³ The term "Urban Heat Island" indicates increased surface temperature in some pockets of cities, caused by drastic change in micro climate.

⁴ Air Pollution Index (API) has been evaluated based on pressure caused by air polluting industries in each district of Gujarat. Observation has been obtained from State Environment Report, 2012 prepared by GEC.

⁵ Based on the annual mean concentration in microgram per cubic meter of ambient air ($\mu\text{g}/\text{m}^3$); levels of SO₂, NO₂, SPM have been described as Low (L), Moderate (M), High (H) and Critical (C) by CPCB. Concentration of RSPM is $>90(\mu\text{g}/\text{m}^3)$ and SPM is $>210(\mu\text{g}/\text{m}^3)$ in all the monitoring station of the state, which is above critical limit.

⁶ Total Dissolved Solids (TDS) for lakes is $>1000\text{ mg}/\text{L}$ and Chemical Oxygen Demand (COD) varies between 20 to 76 mg/L.

- ✓ Urban portion of rivers have reported very high organic and chemical pollution beyond the permissible limits.
- ✓ Vishwamitri, Sabarmati, Khari, Dhadhar, Amlakhadi rivers

Urban Land

Issues	Critical Location
✓ Peri-urban areas have been facing unregulated growth and, deficiency of basic infrastructure is resulting into poor environmental conditions.	✓ Nearly 70% of the total area of urban growth has been contributed by Ahmedabad, Vadodara, Surat, Rajkot, Bhavanagar, Jamnagar and Junagadh Districts.
✓ Small towns of the State are rapidly growing.	✓ Due to very high growth in last two decades, class-IV and class-V towns have grown to become class-II and class- III.
✓ Out of 106044 sanctioned notified slum housing, 45% slum housing are still not covered under the BSUP scheme of JnNURM	✓ Central Gujarat & Saurashtra region.

Urban Green Spaces

Issues	Critical Location
✓ Urban Green spaces are reducing in big cities due to lack of identification and pressure of new development	✓ All the large (Municipal Corporation) urban areas need to increase green cover

Urban Waste

Issues	Critical Location
✓ 42% (969.23 MLD) of total generation of waste water is untreated. Out of untreated waste water 57% is discharged on land, 29% is discharged in river, 11.5% is discharged in sea and 2.5% in inland tanks/lakes.	✓ Class B and Class D towns are in a deplorable condition having insignificant installed waste water treatment facilities. Class B towns have installed waste water treatment capacity of only 4 % against total waste water generation while class D towns do not have any kind of treatment facility.
✓ There is insufficient sewerage network in most of the cities with an average coverage of only 60% of total urban area.	✓ Kutch and North Gujarat have negligible sewerage network facility.

- ✓ Available treatment facilities for waste water are not fully utilized in urban areas (About 70 percent of the total sewage generated in urban centers can be managed by available treatment facilities with total aggregate installed treatment capacity of 1639.2 MLD of all urban areas).
- ✓ Maximum generation of waste water is in urban areas of Central Gujarat, followed by Saurashtra and North Gujarat.

- ✓ State ULBs do not have adequate solid waste collection and scientific disposal of waste method.
- ✓ Kutch region covers least households under Door to Door collection of waste.

WATER

Water availability

Issues	Critical Location
<ul style="list-style-type: none"> ✓ 71 % of State's total area is water deficient. Per capita availability of water resources in the state has gone down to 830 m³ per annum in 2011 from to 1137 m³ per annum in 2001⁷ 	<ul style="list-style-type: none"> ✓ Majorly Saurashtra, Kutch and North Gujarat region.

Water Quality

Issues	Critical Location
<ul style="list-style-type: none"> ✓ Waste water from industries and cities is used for irrigation which is causing accumulation of heavy metals in agricultural fields near urban areas. 	<ul style="list-style-type: none"> ✓ Vadodara, Ahmedabad, Surat.

Ground Water

Issues	Critical Location
<ul style="list-style-type: none"> ✓ Over exploitation of ground water is coming up as critical issue and level of ground water extraction has reached up to 100 % in few regions 	<ul style="list-style-type: none"> ✓ The most affected region is Kutch where 70 % of talukas are critical, followed by North Gujarat, which has 56 % critical talukas.

⁷Population growth is the major reason behind decreasing per capita availability of water.

- ✓ There are total 5620 villages which are affected by poor quality of Ground water⁸.
- ✓ Central Gujarat has maximum no. of 1735 villages, followed by Saurashtra with 1266 villages and Kutch with 219 villages⁹.

Water Salinity

Issues	Critical Location
✓ Talukas affected by salinity have increased twice from 7 in 1997 to 14 in 2004.	✓ 52 % villages in Kutch and 100% villages in Saurashtra are fully saline.

INDUSTRY

Industrial Effluent

Issues	Critical Location
✓ Efficiency of existing industrial effluent treatment plant is under-utilized, while at some places it is over utilized.	✓ Bharuch, Ankleshwar, Vadodara
✓ Industrial effluents are directly discharged into water bodies.	✓ Major rivers like Tapi, Sabarmati, Amalkhadi river and Kharicut canal
✓ Ground water is being contaminated by industrial effluents.	✓ About 45 bore wells in Vadodara
✓ Data availability for industrial effluents is very hazy. There is vast data gap for generated effluent and without this data it is not viable to draw future plan for industrial waste management.	✓ State wide all the districts

⁸ Number of villages affected by fluoride and TDS are reducing in number but Nitrate affected villages have increased to 2521 in 2010 from 1335 in 2003.

⁹ Fluoride affected critical district: Kheda, Banaskantha, Vadodara: TDS affected critical district are Kutch and Banaskantha: Nitrate affected critical district: Sabarkantha, Banaskantha, Junagadh, Vadodara

High Pollution Potential Industries

Issues	Critical Location
✓ Out of 27,892 industries registered under Gujarat Pollution Control Board till 2011-12, more than 60 % of industries fall under Red Category.	✓ Rajkot, Vadodara, Ahmedabad, Surat and Valsad

Hazards Waste

Issues	Critical Location
✓ In the year of 2009, Gujarat has generated about 11.07 lakh TPA (tons per annum) hazardous waste out of which 59.62 % waste was not treated. In the same year, only 2.71 % waste has been recycled in 45 recycling units ¹⁰ .	✓ 72 percent of the total industrial units contributing to hazardous wastes come from 5 districts, Ahmedabad (24 percent), Surat (16 percent), Valsad (13 percent), Bharuch (10 percent) and Vadodara (7 percent).
✓ About one third (31.92 %) of the hazardous waste generated in the State comes from miscellaneous sources. Data for these sources are still not identified.	✓ State wide all the districts

COASTAL ENVIRONMENT

Coastal Water

Issues	Critical Location
✓ Estuarine areas are being polluted due to the high input of domestic sewage being released from Ahmedabad city.	✓ Sabarmati estuary has high phosphates levels

Coastal Industries

Issues	Critical Location
✓ Heavy Industrialization and infrastructure is creating pressure on environment	✓ 77% of the total number of mining areas, 61% of total quarries, more than 90 % SEZ, and over 80 % of SIR are located in the coastal region.

¹⁰ From available data for 45 recycling units Only 2.71 percent recycled in year of 2008. Obtained from State of Environment Report 2012

- ✓ Salt Production practices are impacting ecologically sensitive sites.
- ✓ Hadakiya and Chachh creeks near Suarjbari in Gulf of Kutch,

Coastal Bio diversity

Issues	Critical Location
✓ Fish stocks along Gujarat coast are already overfished. The estimates of wastage and trash fishes in the Gujarat range between 30 to 50 % of the catch by trawlers.	Jafrabad (Amreli district), Okha (Dwarka district), Rajpara, Navabandar (Bhavanagar district)
✓ Tourism development is creating pressure on ecologically sensitive coastal areas.	✓ Kutch, Jamnagar, Porbandar, Bhavnagar

LAND ENVIRONMENT

Land Quality

Issues	Critical Location
✓ Soil salinity is causing degradation of soil quality.	✓ Coastal areas of Saurashtra, Kutch
✓ Disposing hazardous waste and liquid waste on land.	✓ Bharuch, Ahmedabad, Surat, Vadodara, Rajkot
✓ Net irrigated area has decreased in the Gujarat state.	✓ Patan, Sabarkantha and Gandhinagar



RANN ENVIRONMENT

Desertification

Issues	Critical Location
✓ Desertification is found in entire Greater <i>Rann</i> of Kutch & Little <i>Rann</i> of Kutch.	✓ Approximately 32% area of Kutch district experiences erosion problems and 7.1% area is affected by very severe water erosion leading to desertification.
✓ Salt production areas do not have any specific location or proper survey number like other revenue areas.	✓ Salt industry – Little <i>Rann</i> of Kutch and its fringe areas
✓ Excess Sodium concentration is resulting into alkali soil condition.	✓ Greater <i>Rann</i> of Kutch and Little <i>Rann</i> of Kutch
✓ Uncontrolled expansions of salt pans are causing serious damages to flora fauna.	✓ Suraj Bari area , Greater <i>Rann</i> of Kutch

PRIORITIZATION OF ISSUES

Identified issues under section II have been assessed against the sectors that could be prominently impacted by them. Though these issues would also have impact on various other sectors but with the limited scope, only six sectors are identified; 1) Land, 2) Water, 3) Air, 4) Agriculture, 5) Biodiversity and 6) Health.

The assessment of severity and magnitude of issues on identified sectors has been done by Delphi method. Experts from Gujarat Ecological team were asked to evaluate on a scale of high, medium, and low. A weighted average was computed and the final output is given in table below:

Issues	Land	Water	Air	Biodiversity	Health	Agriculture
✓ Increasing heat island effect in urban areas	L	L	M	M	M	L
✓ High Air Pollution Index (API) in urban cities	L	L	H	M	H	L
✓ Urban Water Bodies are Diminishing	L	H		H	L	L
✓ Urban lakes are showing high level of TDS (polluted urban lakes)	M	H		H	H	L
✓ Urban portion of rivers have reported very high organic and chemical pollution than permissible limit	L	H		H	H	H
✓ Unregulated growth of small town	H	M	L	M	L	H
✓ Peri-urban areas have been facing unregulated growth	H	H	L	M	L	H
✓ Poor slum environment	M	L	L	L	H	L
✓ Urban Greens are reducing in large cities	M	L	H	H	M	L
✓ In urban areas 42% of wastewater is untreated which is being disposed on land and water bodies.	H	H		H	H	M
✓ Insufficient sewerage network in urban areas	L	H		L	H	L
✓ Insufficient solid waste collection in urban areas	H	H	L	L	H	M
✓ Poor surface and ground water quality in the state. In coastal area 5620 unhealthy villages affected by poor water quality.	M	H		L	H	H
✓ Ground water exploitation	L	H		L	H	H
✓ Talukas infected by salinity have increased twice during 1997 to 2004	H	H		M	H	H
✓ Efficiency of existing industrial effluent treatment plant is under-utilized, while at some places it is over utilized. Very frequently industrial effluent is being discharged into surface water bodies and ground water is also being contaminated by industrial effluents.	H	H		H	H	H
✓ Growth rate of Red industries is very high	H	H	H	H	H	H
✓ Amount of untreated hazards waste is very high in the state	H	H	L	M	H	M
✓ Salt Production practices are adversely impacting ecologically sensitive sites and uncontrolled expansion of salt pans are causing serious damages to flora fauna.	H	H		L	L	L

✓ Fish stocks along Gujarat coast are already fully overfished	L	L		H		
✓ Soil salinity is causing degradation of soil quality	H	L		L	L	H
✓ Desertification is found in almost all of Greater <i>Rann</i> of Kutch & Little <i>Rann</i> of Kutch	H	L		H	L	H
✓ Net irrigated area has decreased in the Gujarat state	M	L		L	L	H

The priority matrix brought the major areas of key concerns given below:

- ✓ High growth rate of Red industries – More than 60 % industries registered under Gujarat Pollution Control Board fall under Red Category with maximum of such industries are located in Rajkot, Vadodara, Ahmedabad , Surat and Valsad
- ✓ Efficiency of existing industrial effluent treatment plant is under-utilized, while at some places it is over utilized. Very frequently industrial waste water is being discharged into surface water bodies and ground water is also being contaminated by industrial effluents.
- ✓ In urban areas 42% of waste water is untreated which is being disposed on land and water bodies. This is a major issue in Class B & D towns.
- ✓ Talukas infected by salinity has been increased twice during 1997 to 2004. The prime locations that need immediate addressing are villages of Kutch and Saurashtra.
- ✓ Urban portion of Vishwamitri, Sabarmati, Khari, Dhahdhar, and Amlakhadi rivers have reported very high organic and chemical pollution than permissible limit.
- ✓ Urban lakes are showing high level of TDS(polluted urban lakes) due to deposition of solids and degraded soil quality
- ✓ High amount of untreated hazard wastes are directly disposed on land & water, severely impacting the biodiversity, health of locals and agricultural crops
- ✓ Insufficient solid waste collection in ULB has impacted the health of people and created unhygienic living conditions
- ✓ Unregulated growth of small towns has led to haphazard development of urban areas
- ✓ Peri-urban areas have been facing unregulated growth due to lack of proper planning impact the natural resources.

Above mentioned areas require immediate attention and actions to limit the severity of the issues and its subsequent impacts. The further section enlists the actions to be taken for the prioritized issues. The actions that have been prioritized need to be implemented at the earliest. However there are other critical issues described in section II that need to be addressed. Required actions for all the issues discussed in section II and III have been provided in the following Annexures I to VI along with estimated budget and stakeholder list.

11 ACTIONS TO ACHIEVE SUSTAINABLE ENVIRONMENT

Policy and Legislation

- ✓ Green Rating Programmes can be introduced for small and medium industries to reward the best performing firms. Companies who would adopt waste minimization technology or cleaner production technologies must be rewarded and tax exemption can be offered to promote such practices.
- ✓ At state level, ambient monitoring needs to be de-linked from compliance monitoring. While the GPCB focuses on compliance monitoring, the Gujarat Environment Management Institute (GEMI) could take up the responsibility of ambient monitoring with the help of university departments, accredited laboratories, and other capable institutions.
- ✓ Water conservation policy should be framed aiming to achieve required level of conservation as well as it should integrate water demands and water resource management within water conservation framework.

Planning, Management and Monitoring

- ✓ Minimum 80 % area should be covered under drainage infrastructure in class B, C and D towns to take advantage of existing liquid waste facility.
- ✓ Large scale fresh water recharges program need to be designed and implemented in coastal areas. More over implementation scale of existing salinity ingress programs need to be increased.
- ✓ Water conservation and water management master plan can be prepared and implemented as pilot in critical taluka for effective improvement in the water situation.
- ✓ Revision of the master plan and City Development Plan should be based on the growth rate of urbanization. Master plan, city development plan must be revised at shorter interval for urban areas with high urbanization growth rate.
- ✓ Industrial effluent (including CETPs and STPs) and hazard wastes inventory should be prepared every year.
- ✓ State level hazards waste transportation and management plan should be prepared and implemented for maximum utilization of existing capacity of TSDF (Treatment, Storage and Disposal Facility).

Future Research and Capacity Building

- ✓ Urgent provision of capacity building, man power provision, and R & D, to improve utilization capacity of waste water treatment plants.
- ✓ Capacity building program should be conducted on land use planning, GIS techniques, integrated physical planning, and conservation priorities. IT and GIS support should be strengthened at district, block, and ULB level of town planning wings.

Annexure I

Issues	Hot spot	Action required			Stakeholder	Budget
		Policy and Legislation	Planning, Management and Monitoring	Future Research, and Capacity building		
Urban Land						
Peri-urban areas have been facing unregulated growth and, deficiency of basic infrastructure is resulting into poor environmental conditions.	Nearly 70% of the total area of urban growth has been contributed by Ahmedabad, Vadodara, Surat, Rajkot, Bhavanagar, Jamnagar and Junagadh Districts.	<ul style="list-style-type: none"> Specific development guidelines integrating environment aspects should be prepared for peri-urban areas and areas not included in development authorities to regulate haphazard, growth. Monitoring mechanism should also be developed for the same. 	<ul style="list-style-type: none"> Revision of the master plan and City Development Plan should be based on the growth rate of urbanization. Master plan, city development plan must be revised at shorter interval for urban areas with high urbanization growth rate. 	<ul style="list-style-type: none"> Capacity building program should be conducted on land use planning, GIS techniques, integrated physical planning, and conservation priorities. IT and GIS support should be strengthened at district, block and ULB level for town planning. 	Lead Stakeholder: <ul style="list-style-type: none"> Urban Development Authority Urban Local Bodies Gram Panchayat Revenue Department Town Planning Department Supporting Stakeholder: <ul style="list-style-type: none"> Agriculture Department 	700 Crores
Small towns of the State are rapidly growing.	Due to very high growth in last two decades, class- IV and class-V towns have grown to become class- II and class- III.					
Out of 106044 sanctioned notified slum housing, 45% slum housing is still not covered under the BSUP scheme of JNNURM.	Central Gujarat & Saurashtra region.	---	<ul style="list-style-type: none"> Majority of the slum redevelopment schemes focus only on provision of basic infrastructure. Slum redevelopment program should consider specific environment and waste management issues with special attention on slums near water bodies (lakes/ rivers/ canals). For stronger maintenance and monitoring system education institutes could be involved. 	---	Lead Stakeholder: <ul style="list-style-type: none"> Gujarat Housing Board Slum Development Board Urban Local Bodies 	

Urban waste					
Issues	Hot spot	Action required			Stakeholder
		Policy and Legislation	Planning, Management and Monitoring	Future Research, and Capacity Building	
42% (969.23 MLD) of total generation of waste water is untreated. Out of untreated waste water 57% is discharged on land, 29% is discharged in river, 11.5% is discharged in sea and 2.5% in inland tanks/lakes.	Class B and Class D towns are in a deplorable condition having insignificant installed waste water treatment facilities. Class B towns have installed waste water treatment capacity of only 4 % against total waste water generation while class D towns do not have any kind of treatment facility.	<ul style="list-style-type: none"> Incentive based scheme should be developed for Industrial sector to promote use of recycled waste water. Price of recycled water should be made comparable with alternatively available resources. 	<ul style="list-style-type: none"> Cluster based approach should be taken for small town municipalities and common landfill sites should be identified and developed for class B, C and D town areas within next five years' time. 	---	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Urban Local Bodies Gujarat Urban Development Company Ltd Gujarat Urban Development Mission <p>Supporting Stakeholder</p> <ul style="list-style-type: none"> Gujarat Pollution Control Board
There is insufficient sewerage network in most of the cities with an average coverage of only 60% of total urban area.	Kutch and North Gujarat have negligible sewerage network facility.	<ul style="list-style-type: none"> Policy level provision for utilization of recycled waste water for cityscape activities should be made. PPP model should be encouraged to establish and operate STPs, CETP and sewerage network. 	<ul style="list-style-type: none"> Minimum 80 percent area should be covered under drainage infrastructure in class B, C and D town to take advantage of existing liquid waste facility. 	---	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Urban Local Bodies Gujarat Urban Development Company Ltd Gujarat Urban Development Mission Water Resources Department Forest & Environment Department <p>Supporting Stakeholder</p> <ul style="list-style-type: none"> Urban Development Department
Available treatment facilities for waste water are not fully utilized in urban areas (About 70 percent of the total sewage generated in urban centers can be managed by available treatment facilities with total aggregate installed treatment capacity of 1639.2 MLD of all urban areas).	Maximum generation of waste water is in urban areas of Central Gujarat, followed by Saurashtra and North Gujarat.	---	---	<ul style="list-style-type: none"> Urgent provision of capacity building, man power provision and R & D, to improve utilization capacity of treatment plants. 	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Gujarat Urban Development Mission Urban Development Authorities Gujarat Pollution Control Board <p>Supporting Stakeholder:</p> <ul style="list-style-type: none"> Federation of Indian Chambers of Commerce and Industry Confederation of Indian Industry

State ULBs do not have adequate solid waste collection and scientific disposal of waste method.	Kutch region covers least households under Door to Door collection of waste.	<ul style="list-style-type: none"> Inviting and creating interest among private players for waste treatment and disposal through regulatory mechanism or tax incentive mechanism. 	<ul style="list-style-type: none"> For ULBs generating waste quantity more than 20 MT/day, treatment technology like biomethanation and other advanced technologies should be used. 	<ul style="list-style-type: none"> Waste management and sanitation ethics should be included in primary education course curriculum. Strengthen the existing operation and maintenance arrangement for maximum utilization of vermi-composting technology for waste treatment, in ULBs generating waste up to 20 MT/day. 	Lead Stakeholder: <ul style="list-style-type: none"> Urban Local Bodies Gujarat Pollution Control Board Urban Development Department Gujarat Urban Development Mission Gujarat Urban Development Company Ltd. Urban Local Bodies
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Urban Water

Issues	Hot spot	Action required			Stakeholder
		Policy and Legislation	Planning, Management and Monitoring	Future Research, and Capacity Building	
Urban Water Bodies are diminishing in many cities.	In Ahmedabad and Vadodara, the area under water bodies has decreased during 1991 to 2005.	<ul style="list-style-type: none"> Solid waste dumping near water bodies specifically in peripheries of small urban towns and near slum areas has to be prohibited by proving strong regulatory and monitoring setup. 	<ul style="list-style-type: none"> Attention on the ecological aspects of lake management should be enhanced through integrating all the attributes of lake- such as basin area, water body, and command area in planning of lake management program. Urban water bodies and watershed areas have to be categorized separately in land use planning. To preserve and conserve urban lakes, mechanism for recording & monitoring of hydrological & ecological data base need to be strengthened. This calls for an urgent need of scientific census of lakes, traditional ground water storage system, and open wells. 	Convergence model can be designed and implemented for lake development and management. For example integration of JNNURM programmes, solid waste management and road & building construction with lake management programs.	Lead Stakeholder: <ul style="list-style-type: none"> Urban Development Authority Urban Local Bodies Wetland Management Authority Town Planning Department

Urban lakes are showing high level of Total Dissolved Solid (TDS) and Chemical Oxygen Demand (COD) due to the soil quality of the catchment and settlement of solids.	Sursagar, Dobhi, Padara lakes in Vadodara, Chandola, Nalsarovar lakes in Ahmedabad, Monsoor Lake in Viramgam district.	---	<ul style="list-style-type: none"> Some of pollution load can be controlled by dilution available in a water body, so maintaining minimum flow in the major rivers has to be considered as priority action. 	---	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Urban Development Authority Urban Local Bodies <p>Supporting Stakeholder:</p> <ul style="list-style-type: none"> Gujarat Pollution Control Board Water Resource Department
Urban portion of rivers have reported very high organic and chemical pollution beyond the permissible limits.	Vishwamitri, Sabarmati, Khari, Dhadhar, Amlakhadi rivers	---	<ul style="list-style-type: none"> Capacity of CETP/STP near all the major rivers such as sabrmari, Vishwamitri, Khari, Dhahdhar, and Amlakhadi need to be increased first and zero waste technology needs to be adopted for such critical sites. 	---	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Urban Development Authority Urban Local Bodies <p>Supporting Stakeholder:</p> <ul style="list-style-type: none"> Gujarat Pollution Control Board Gujarat Urban Development Mission

Air and Transportation

Issues	Hot spot	Action required			Stakeholder
		Policy and Legislation	Planning , Management and Monitoring	Future Research, and Capacity Building	
Heat island effect is increasing in urban areas due to reduction in urban tree cover and high air pollution.	Ahmedabad and Surat may have a high Heat Island. Vadodara and Rajkot also possess moderate Heat Island Intensity.	<ul style="list-style-type: none"> At present there is no legally binding plan for tree plantation in urban areas. City level plan for landscape with regulation should be developed which can make tree plantation legal obligation. 	<ul style="list-style-type: none"> IT based traffic management plan should be created and implemented in municipal corporations (plan can adopt management options like synchronizing traffic signals, staggering business hours, restricting vehicular movements in certain areas with high pollution levels and fiscal incentives/disincentives). Display of halting time at major traffic intersections should be made mandatory. 	<ul style="list-style-type: none"> Ambient air quality monitoring stations measuring annual averages cover only 9 districts. Urgent need of setting up monitoring stations covering majority of districts. Appropriate sites need be identified at particular critical polluting sites. New monitoring stations also need to include monitoring parameters notified under the Ambient Air Quality norms since 18th Nov 2009. 	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Urban Development Authority Town Planning Department <p>Supporting Stakeholder:</p> <ul style="list-style-type: none"> Gujarat Pollution Control Board Gujarat State Road Transport Corporation

Air pollution Index of large cities is higher than the permissible limit.	Rajkot has maximum Air pollution Index (API) followed by Ahmedabad, Valsad, Vadodara and Surat.	<ul style="list-style-type: none"> Regulation need to be formed and implemented to restrict the registration of two-stroke motored vehicles. 	<ul style="list-style-type: none"> Implementation of ambient air monitoring stations should be based on identification of critical hotspot for the air pollution. 	---		
In most of the cities CPCB monitoring stations have recorded higher annual average concentration of Suspended Particular Matter (SPM) and Respiratory Suspended Particular Matter (RSPM) in residential area than the permissible limit.	Ahmedabad, Vadodara, Rajkot, Bharuch, Jamnagar, Surat are above the permissible limit.	<ul style="list-style-type: none"> Vehicle retirement and scrapping policy has been recommended for implementation under Section 59 of the Motor Vehicles Act, 1999. This policy can be implemented in Ahmedabad/ Vadodara/ Rajkot/ Surat on pilot base. 	<ul style="list-style-type: none"> A program should be implemented for introducing pre-mixed fuels (petrol and oil mixture) for use of two stroke vehicles. This measure would have the desired impact if it is also supported by a ban on supply of loose engine oils for 2 stroke vehicles at retail outlets and service stations. 			
Urban Green Spaces						
Issues	Hot spot	Action required			Stakeholder	
		Policy and Legislation	Planning, Management and Monitoring	Future Research, and Capacity Building		
Urban Green spaces are reducing in big cities due to lack of identification and pressure of new development	All the large (Municipal Corporation) urban areas need to increase green cover	<ul style="list-style-type: none"> Formation of guidelines for private developer to develop and maintain private green spaces which can preserve existing biodiversity and increase carbon sequestration. Urban forestry wing should be initiated by Forest Department. 	<ul style="list-style-type: none"> To emphasize the importance of the green spaces in urban areas, it should be taken as separate category in land use/ physical planning. Even the green spaces with higher bio diversity should be promoted and conserved under local planning practices (Development plan/Master plan/town planning schemes). 	<ul style="list-style-type: none"> Target professional bodies (planners, engineers, developers and surveyors) through seminars and their institutes, to ensure that they understand the contribution they can make in terms of biodiversity 	Lead Stakeholder: <ul style="list-style-type: none"> Urban Development Authority Urban Local Bodies Forest & Environment Department Town Planning Department 	
		---	<ul style="list-style-type: none"> Implement the pilot Biodiversity Parks initiative by integrating good practice and produce a directory of good practice of urban bio-diversity conservation. 	<ul style="list-style-type: none"> Insure involvement of local government and public participation in protection and maintenance of existing habitat by collaborating education Institutes, Local authorities, NGOs and local residence 		

		---	<ul style="list-style-type: none">• Carry out survey work to determine the distribution and status of urban green spaces and urban habitats. Identify areas (Brownfield sites with potential for redevelopment) habitats could be improved with appropriate management.	<ul style="list-style-type: none">• Local ULBs and organizations should disseminate information of grants and assistance available from the various funding bodies for biodiversity conservation and green space development through seminars and workshops.		
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Annexure II

Water Action Plan						
Issues	Hot spot	Action required			Stakeholder	Budget
		Policy and Legislation	Planning , Management and Monitoring	Future Research, and Capacity Building		
Over exploitation of ground water is coming up as critical issue. Level of ground water exploitation has reached up to 100 percent in few regions.	The most affected region is Kutch where 70 % of talukas are critical, followed by North Gujarat, which has 56 % critical talukas	---	<ul style="list-style-type: none"> Ground water extraction regulations have to be strongly enforced and monitoring mechanism for ground water extraction has to be strengthened 	---	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Water Supply Department Water Resource Department Water and Sanitation Management Organization (WASMO) Gujarat Water Infrastructure Limited <p>Supporting Stakeholder:</p> <ul style="list-style-type: none"> Energy & Petrochemical Department Rural Development Department Agriculture Department 	400 Crores
There are total 5620 villages which are affected by poor quality of Ground water	<p>Central Gujarat has a maximum of 1735 villages, followed by Saurashtra with 1266 villages and Kutch has 219 villages affected.</p> <p>Fluoride affected critical district are: Kheda, Banaskantha, Vadodara</p> <p>TDS affected critical district are: Kutch and Banaskantha</p> <p>Nitrate affected critical district are: Sabarkantha, Banaskantha, Junagadh, Vadodara</p>	---	<ul style="list-style-type: none"> Conventional water conservation practices should be documented and implemented in rural areas. Persistent analysis and monitoring of water quality parameters should be done for all the districts of the state, by installation of water quality meters (CPCB Water Quality Management Guidelines should be followed for this monitoring). 	---	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Gujarat Pollution Control Board Water Resource Department Central Ground Water Board <p>Supporting Stakeholder:</p> <ul style="list-style-type: none"> Health Department 	
Talukas infected by salinity have increased twice from 7 in 1997 to 14 in 2004	The coastal villages from Kutch and Saurashtra show that 609 villages out of the total of 1165 villages (about 52 percent villages) are fully saline	---	<ul style="list-style-type: none"> Large scale fresh water recharge program need to be designed and implemented in coastal areas. Moreover implementation scale of existing salinity ingress programs need to be increased Water conservation and water management master plan can be prepared and implemented as pilot in critical taluka for effective improvement in the water situation. 	<ul style="list-style-type: none"> Outreach of capacity building and awareness program for best agriculture practices integrating water conservation need to be continued and increased 	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Agriculture Department Salinity Prevention Cell Water Resource Department <p>Supporting Stakeholder:</p> <ul style="list-style-type: none"> Rural Development Department Gujarat State Watershed Management Agency 	

<p>71 percent of State's total areas is water deficient. Per capita availability of water resources in the state has gone down to 830 M³ per annum in 2011 from to 1137 M³ per annum in 2001.</p>	<p>Primarily Saurashtra, Kutch and North Gujarat region</p>	<ul style="list-style-type: none"> Water conservation policy should be framed aiming to achieve required level of conservation as well as it should integrate water demands and water resource management within water conservation framework. 	<ul style="list-style-type: none"> To boost the conservation and improve quality of ground water time based targets should be set and commensurate conservation activities should be implemented. Water conservation on farms need to be included in the irrigation survey and should also be encouraging implementation. 	<p>---</p>	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Agriculture Department Gujarat Pollution Control Board Water Resource department Central Ground Water Board 	
<p>Waste water from industries and cities is used for irrigation which is causing accumulation of heavy metals in agricultural fields near urban areas.</p>	<p>Vadodara Ahmedabad, Surat</p>	<ul style="list-style-type: none"> Special program for the effluent minimization should be created for the areas where high metal content in crops have been found. 	<p>---</p>	<p>---</p>	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Gujarat Industrial Development Corporation Industry Department Agriculture Department Water Resource Department Gujarat Pollution Control Board <p>Supporting Stakeholder</p> <ul style="list-style-type: none"> Environment Department 	

Annexure III

Industry Action Plan						
Issues	Hot spot	Action required			Stakeholder	Budget
		Policy and Legislation	Planning , Management and Monitoring	Future Research, and Capacity Building		
In the year of 2009, Gujarat has generated about 11.07 lakh TPA (tons per annum) hazardous waste out of which 59.62 % waste was not treated. In the same year, only 2.71 % waste has been recycled in 45 recycling units ¹ .	72 percent of the total industrial units contributing to hazardous wastes come from 5 districts, Ahmedabad (24 percent), Surat (16 percent), Valsad (13 percent), Bharuch (10 percent) and Vadodara (7 percent).	---	<ul style="list-style-type: none"> State level hazards waste transportation and management plan should be prepared and implemented for maximum utilization of existing capacity of TSDF (about 80% hazards waste can be dispose with existing TSDF capacity²). 	---	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Forest & Environment Department Gujarat Pollution Control Board Gujarat Industrial Development Corporation Gujarat Urban Development Mission <p>Supporting Stakeholder:</p> <ul style="list-style-type: none"> Urban local bodies Industrial associations Gram Panchayat Financial Institutions Gujarat Cleaner Production Center 	800 Crore
Out of 27,892 industries registered under Gujarat Pollution Control Board till 2011-12, more than 60 % of industries fall under Red Category.	Rajkot, Vadodara, Ahmedabad, Surat and Valsad	<ul style="list-style-type: none"> Green Rating Programmes can be introduced for small and medium industries to reward the best performing firms. Companies adopting waste minimization technology, cleaner production technologies must be rewarded and tax exemption can be offered to promote such practices 		---		
About one third (31.92 %) of the hazardous waste generated in the State comes from miscellaneous sources. Data for these sources are still not identified.	State wide all the districts	<ul style="list-style-type: none"> Gujarat Pollution Control Board (GPCB), in consultation with urban local bodies, Gujarat Industrial Development Corporation (GIDC) and Industrial Associations needs to stipulate the parameters for monitoring and the pollution charges to be levied. Charges could even vary by district or urban area, depending on local ambient conditions. The revenue collected could be utilized for providing financial incentives to industries for pollution control measures. 	<ul style="list-style-type: none"> Capacity of existing recycling units need to be increased by 30% within next 2 years and minimum 20 % of the hazardous waste should be recycled within next five years. 	---	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> Forest & Environment Department Gujarat Pollution Control Board Gujarat Industrial Development Corporation Gujarat Urban Development Mission Industrial Department 	

¹ From available data for 45 recycling units Only 2.71 percent recycled in year of 2008. Obtained from State of Environment Report 2012

<p>Data availability for industrial effluents is very hazy. There is vast data gap for generated effluent and without this data it is not viable to draw future plan for industrial waste management</p>	<p>State wide all the districts</p>	<ul style="list-style-type: none"> • Even at the state level, ambient monitoring needs to be de-linked from compliance monitoring. While the GPCB focuses on compliance monitoring, the Gujarat Environment Management Institute (GEMI) could take up the responsibility of ambient monitoring with the help of university departments, accredited laboratories, and other capable institutions. 	<ul style="list-style-type: none"> • Industrial effluent (including CETP and STPs) and hazards waste inventory should be prepared every year 		<p>Supporting Stakeholder:</p> <ul style="list-style-type: none"> • Urban Local Bodies • Industrial Associations • Gram Panchayat • Financial Institutions • Gujarat Cleaner Production Center 	
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Annexure IV

Coastal Action Plan						
Issues	Hot spot	Action required			Stakeholder	Budget
		Policy and Legislation	Planning , Management and Monitoring	Future Research, and Capacity Building		
Fish stocks along Gujarat coast are already overfished. The estimates of wastage and trash fishes in the Gujarat range between 30 to 50 % of the catch by trawlers	Jafrabad (Amreli district), Okha (Dwarka district), Rajpara, Navabandar (Bhavanagar district)	<ul style="list-style-type: none"> • Fishery sector need to be given more emphasis though improving current fishing practices, innovative schemes and conservation of traditional practices. 	<ul style="list-style-type: none"> • Regulations for fishing area/ overfishing practices need to be strengthened and enforced. • Conduct critical habitat vulnerability studies and prepare coral reefs management plans. 	<ul style="list-style-type: none"> • Conduct an inventory of the coastal islands and marine resources so as to obtain baseline data on current state of the islands resources and be able to monitor the evolution of their status. • Capacity building of local and commercial fishery communities on restoration and promotion of traditional values and practices that ensure exploitation of resources. 	Lead Stakeholder: <ul style="list-style-type: none"> • Fisheries Department • Forest & Environment Department Supporting Stakeholder: <ul style="list-style-type: none"> • Gujarat Fisheries Central Co-operative Association Limited • Gujarat Ecology Commission 	450 Crores
Estuarine areas are being polluted due to the high input of domestic sewage being released from Ahmedabad city.	Sabarmati estuary has high phosphates levels	---	---	---	---	
Tourism development is creating pressure on ecologically sensitive coastal areas.	Kutch, Jamnagar, Porbandar, Bhavnagar	---	---	<ul style="list-style-type: none"> • Undertake carrying capacity studies on the impact of the tourism sector, particularly environment sensitive coastal regions, so as to determine the degree to which coastal tourism can be promoted. 	Lead Stakeholder: <ul style="list-style-type: none"> • Tourism Department Supporting Stakeholder: <ul style="list-style-type: none"> • Gujarat Ecology Commission • Forest & Environment Department 	
Talukas affected by salinity have increased twice from 7 in 1997 to 14 in 2004	The coastal villages from Kutch and Saurashtra show that 609 villages out of the total of 1165 villages (about 52 percent villages) are fully saline	---	<ul style="list-style-type: none"> • Change in irrigation practices need more focus in coastal area; therefore scheme for drip and sprinkler irrigation should be enhanced in coastal areas. Such schemes should include special consideration for small land holding farmers to enable small farmers to take the advantage of drip irrigation schemes. 	---	Lead Stakeholder: <ul style="list-style-type: none"> • Agriculture & Irrigation Department • Salinity Prevention Cell • Water Resource Department Supporting Stakeholder: <ul style="list-style-type: none"> • Land & Revenue Departments 	

<p>Heavy Industrialization and infrastructure is creating pressure on environment</p>	<p>77% of the total number of mining leases and 61% of total quarries in the State are located in coastal districts. More than 90 percent SEZ and over 80 percent of SIR are in the coastal region. Port Led development has increased port traffic, which has increased by 41% in 2010-11.</p>	<ul style="list-style-type: none"> • Incentive based scheme should be developed for Industrial sector to promote use of recycled waste water. Price of recycled water should be made comparable with alternative available resources 	<ul style="list-style-type: none"> • Develop new innovative ways of funding CZM related actions and programmes. • Management and monitoring plans for ports and harbours should be developed addressing pollution issues • Rather than defining No Development Zone, identification of high Development Zone should be done. This identified zone should include regional land use planning with special guidelines integrating environment and development aspects 	<p>---</p>	<p>Lead Stakeholder:</p> <ul style="list-style-type: none"> • Industries Department • Gujarat Maritime Board • Forest & Environment Department • Gujarat Coastal Zone Management Authority <p>Supporting Stakeholder:</p> <ul style="list-style-type: none"> • Urban Development Authorities • Gujarat Ecology Commission • Town Planning Department • Gujarat Pollution Control Board 	
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Annexure V

Land Action Plan						
Issues	Hot spot	Action required			Stakeholder	Budget
		Policy and Legislation	Planning, Management and Monitoring	Future Research, and Capacity Building		
Soil salinity is causing degradation of soil quality.	Coastal areas of Saurashtra, Kutch	---	<ul style="list-style-type: none"> Land use planning should include conservation, land erosion, and drinking water for critical areas 	---	Lead Stakeholder: <ul style="list-style-type: none"> Agriculture & Irrigation Department Agriculture University and Other Research Institution Supporting Stakeholders: <ul style="list-style-type: none"> Gujarat Pollution Control Board Krishi Vigyan Kendra Rural Technology Institute 	200 Crores
Disposing hazardous waste and liquid waste on land.	Bharuch, Ahmedabad, Surat, Vadodara, Rajkot	---	---	---		
Net irrigated area has decreased in the Gujarat state.	Patan, Sabarkantha and Gandhinagar	---	<ul style="list-style-type: none"> Along with the forest, high potential agriculture areas also should be conserved. Such areas can be demarcated with coordination of Environment, Agriculture, Industry, and Urban Development agencies 	---	Lead Stakeholder: <ul style="list-style-type: none"> Agriculture & Irrigation Department Watershed Department Supporting Stakeholders: <ul style="list-style-type: none"> Energy and Petrochemical Department 	

Annexure VI

Desert Action Plan						
Issues	Hot spot	Action required			Stakeholder	Budget
		Policy and Legislation	Planning , Management and Monitoring	Future Research, and Capacity Building		
Desertification is found in entire Greater <i>Rann</i> of Kutch & Little <i>Rann</i> of Kutch.	<ul style="list-style-type: none"> Approximately 32% area of Kutch district experiences erosion problems, 7.1% area is affected by very severe water erosion leading to desertification. 	---	<ul style="list-style-type: none"> Large scale Afforestation program have to be implemented following shelter belt plantation/wind break plantation and grassland development in fringe areas. 	<ul style="list-style-type: none"> Promotion of productive dry land agriculture based on soil, water, climate factors 	Lead Stakeholder: <ul style="list-style-type: none"> Environment & Forest Department Gujarat Institute of Desert Ecology Gujarat Ecology Commission Supporting Stakeholders: <ul style="list-style-type: none"> Agriculture & Irrigation Department 	100 crore
Salt production areas do not have any specific location or proper survey number like other revenue areas.	<ul style="list-style-type: none"> Salt industry – Little <i>Rann</i> of Kutch and its fringe areas 	<ul style="list-style-type: none"> Conservation priorities have to be set for desert flora and fauna and for existing conservation and management programs 	<ul style="list-style-type: none"> Data base including spatial location information for existing salt industries/ salt pans has to be prepared and updated yearly 	---	Lead Stakeholder: <ul style="list-style-type: none"> Land & Revenue Department Industry Department Supporting Stakeholders: <ul style="list-style-type: none"> Salt Industry 	
Uncontrolled expansions of salt pans are causing serious damages to flora fauna.	<ul style="list-style-type: none"> Suraj Bari area , Greater <i>Rann</i> of Kutch 					
Excess Sodium concentration is resulting into alkali soil condition.	Greater <i>Rann</i> of Kutch and Little <i>Rann</i> of Kutch	---	---	---		
TOTAL BUDGET						2650 crore

Annexure VII

List of participants contributed in Delphi Method

- A. K Verma ,IFS, Member Secretary, GEC
- Nischal Joshi, Sr. Manager (Projects),GEC
- Krupa Jha, Project Officer, GEC
- Ishwar Desai, Social Scientist, GEC
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