GOVERNMENT OF KERALA

STATE PLANNING BOARD

THIRTEENTH FIVE-YEAR PLAN
(2017-2022)

WORKING GROUP ON

ENVIRONMENT

REPORT

AGRICULTURE DIVISION

THIRUVANANTHAPURAM

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PREFACE

In Kerala, the process of a Five-Year Plan is an exercise in people's participation. At the end of September 2016, the Kerala State Planning Board began an effort to conduct the widest possible consultations before formulating the Plan. The Planning Board formed 43 Working Groups, with a total of more than 700 members – scholars, administrators, social and political activists and other experts. Although the Reports do not represent the official position of the Government of Kerala, their content will help in the formulation of the Thirteenth Five-Year Plan document.

This document is the report of the Working Group on Environment. The Chairpersons of the Working Group were Shri V S Senthil IAS and Dr Ajaykumar Varma. The Member of the Planning Board who coordinated the activities of the Working Group was Professor T Jayaraman. The concerned Chief of Division was Dr P Rajasekharan.

Member Secretary

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CHAPTER 1
INTRODUCTION

1. The State of Kerala, is rich in natural resources, flora and fauna, which is of considerable economic, social and cultural significance to its people. However, Kerala's environment is under pressure from the rapid changes taking place in the society-nature relationship. Though the population growth in Kerala has shown a declining trend, the population density is high which puts considerable pressure on the environment. A host of investments in expanding irrigation facilities and improving energy supply for agriculture has brought about major changes in the landscape and hydrology of the state. Moreover, certain industrial investments in Kerala have also had an adverse effect of the environment of the state. Overexploitation of natural resources, air and water pollution are some of the other environmental concerns of the state.

2. The boom in the construction sector, fueled by the increasing flow of remittances into the economy, has led to increase in land values, shifts in land use including land reclamation especially of paddy and wetlands and an increase in quarrying and mining activities. Added to this is the increase in waste generation – especially solid waste – leading to a host of environmental problems such as pollution of water, choking of drainages, water logging, increase in the incidence of vector borne communicable diseases which have an adverse impact on human beings. The people worse effected by environmental pollution and degradation are those belonging to the marginalized sector, such as forest-dwelling tribal communities and those who depend on the environment for their livelihood such as fishing communities.

3. Kerala's performance on some of the key indicators of environmental quality (for example water quality, incidences of communicable diseases) has also been poor. Climate change is adding a new dimension and may exacerbate already existing problems of the State. The lack of transparency in natural resource and environmental management has brought about the decline and/or degradation of critical resources like land, water, forests, biodiversity and wetlands. Though there is in place a number of policies, regulations and institutions, pertaining to environment, however, there has been a lack of proper implementation and management of environmental initiatives.

4. Safeguarding and improving the environment in Kerala will require strengthening the legal and institutional framework for environmental governance, enhancing the technical and scientific capacity of institutions working on environmental issues, improving transparency in the work of environmental institutions, increased local participation in environmental management and raising awareness about the importance of environment. Since separate reports are being generated for biodiversity, climate change and forest, these aspects are not dealt with in this report.

Undesirable Land-Use Changes

5. The environmental problems of the state aggravated manifold and their severity is fast increasing due to haphazard and adhoc development programmes being conceived and implemented. The land use pattern has changed significantly over the years. It is indicated from sample studies in high range areas that the forest areas have been reduced from 60% to 30%, Plantation areas increased from 27% to 40% and settlement area increased from 13% to 30% during the period from 1976 to 2010. Similarly in coastal region, open space reduced by around 50%, areas under agriculture/plantation reduced by 30% and settlement area almost doubled during 1960 to 2005. Such drastic changes are there in the midland region of the state as well. The pressure on land for more resources and accelerated interventions in the form of mining, quarrying, filling of low lands etc are much above

the resilience limit of the fragile environment of the state. The land use changes over the years were instrumental in changing the landscape ecology, which has far-reaching consequences on fragile ecosystems such as paddy fields, highlands etc. The terrain modifications and slope alterations consequent to changes in land use and vegetation, at times, lead to catastrophic incidences of landslides and increased recurrence of earth tremors, land subsidence etc. Intensive and random quarrying of rocks and soil is increasingly affecting the biological life systems, in general, and violate the rights of local communities. There is rampant reclamation of paddy and wetland systems of the state. It is reported that 6.8 lakh Ha of paddy land, i.e. 76% of the designated paddy field area in 1980 is not under paddy cultivation at present. The conversion of paddy field is reported to be over 29% over 33 years since 1975. Similarly, other wetlands such as ponds, tanks, canals, lakes etc are also being subjected to widespread conversion. The State had around 3, 28,402 ha of wetlands in 2004 and by 2011, it reduced to 1, 60,590 ha, recording a loss of loss of 49% in 7 years. Another estimate put the loss of wetlands 71,681 ha within the same period indicating a loss is 31%. Therefore, the loss of wetlands could be anywhere between 30 to 50%, which is alarming in any case. Similarly, over a century, the original area of Vembanadlake (363.29 km^2) has now been reduced to about 37 percent (132.24 km^2). The drastic changes in the landform and land use have directly impacted the micro-climate, stream flow, groundwater recharge, water quality and biodiversity and also accentuate the flood and drought scenario of Kerala.

Erratic Rainfall and Declining Water Resources

6. Irrespective of the high and distributive nature of rainfall, the water resource scenario of the state is affected with various problems linked to their adequate availability at place and time and deterioration of quality. The long-term data on rainfall indicates marginal decline, the magnitude of which is found higher in recent years. During the period, 1871-2008 (138 years), the average rainfall during southwest monsoon reduced by 161 mm and that during northeast monsoon, winter and summer increased by 101mm, 10mm and 45mm respectively. During the period, 1982-2008, the annual average rainfall exhibited marginal increase of 17mm, due to the marginal increase of rainfall during northeast monsoon and summer by 10mm and 7mm respectively. However, during the recent years, 2012-2016, the short-period annual average rainfall indicated a reduction of 13% due to the reduction of rainfall during pre-monsoon (January to May) by 12%, southwest monsoon (June-September) by 10% and northeast monsoon (October-December) by 16%. During the current year (2016), the rainfall during pre-monsoon is less by 18%, southwest monsoon is less by 34% and northeast monsoon (excluding December) is 61%. This has created a serious drought situation.

7. Based on the recent data from the Central Water Commission (CWC), it is estimated that the total annual flow in the 44 rivers of Kerala is 57633 Mm^3 and the utilizable resource is only 34375 Mm^3. This is only 74% of the annual average river flow estimated by the PWD in 1974. The river flow from all the rivers within Kerala is only 51922 Mm^3 and the utilizable resource within the state is only 30969 Mm^3. The CWC data also indicates that the non-monsoon flow is declining in all the rivers of Kerala. In the six rivers of Central Kerala, from R Muvattupuzha to R Kallada, the flow is declining even in monsoon. Most of the rivers of the state are not able to maintain critical environmental flow during non-monsoon season. 65% rural households and 59% of urban households are depended on groundwater resources for their domestic water requirement, mostly through dug wells. The groundwater resource potential of Kerala, as per the latest estimate, is 6029 Mm^3 and the stage of development is. 47%. Among the 152 Development Blocks of the State, only one Block (Chittoor) is over exploited (development beyond 100% of replenishment), three Blocks (Kasaragod, Malampuzha and Kodungalloor) are critical (development between 90-100% of replenishment), 22 Blocks are semi-critical (development between 70-90% of replenishment) and the

rest are reported safe. However, it is indicated that almost 48% of the dug wells go dry during summer season, a scenario on the increase during post monsoon season due to the indiscriminate pumping, conversion of local surface water storages such as ponds, tanks, reservoirs, paddy fields etc. The lowering of river bed reversed the groundwater gradient resulting in ground outflow from the nearby aquifers during the lean season resulting in lowering of groundwater table adjacent to the river. Further, the loss of highly porous sand bed depletes the rivers of water storages that otherwise would have enhanced the lean season flow in rivers. There are 53 major reservoirs in the State with a storage capacity of 5500 Mm^3. These reservoirs are subjected siltation due to poor catchment area conservation, depletion of natural vegetation and poor reservoir management to remove the silt. Consequently, the annual rate of siltation in various reservoirs in Kerala varies from 0.25% to 1.66%. As many of the reservoirs are very old, the storage capacity has declined significantly. The storage loss due to siltation is also a serious concern for ponds and tanks.

Deterioration of Water Quality

8. The water quality assessment of major rivers of Kerala indicates that the water quality is fair in the upstream portion and marginal in the downstream portion. The Biochemical Oxygen Demand (BOD) is generally within 10 mg/l. The bacteriological contamination, especially due to fecal coliforms is high in the rivers, particularly near pilgrimage spots and urban centres due to discharge of untreated municipal sewages. For example, River Pamba, at Triveni, indicates a coliform count of 46000 MPN/100 ml against a maximum permitted level of 500/100 ml. In order to improve the assimilative capacity and bring down the pollution load at this spot, the discharge in the main stream has to be increased from the normal flow rate of about 4 m^3/sec during the main pilgrim season to about 28-35 m^3/sec or the pollution load should be reduced significantly through appropriate control measures. The algal community structure and their seasonal dynamics indicated pollution enhancement in rivers after the offset of monsoon. In the post monsoon season, the runoff from tributaries and canals joining the river bring organic matter into the rivers. The groundwater in the state is exploited mostly using dug wells and more than 90% of the open wells contaminated with coliform bacteria. The observations that less than 25% of the wells with lining and less than 16% of the wells located more than 7.5 m from the latrine have the likelihood of presence of *E. coli* indicate the influence of distance of latrine from the well as well as the conditions of wells on the level of contamination. There are also localized problems of groundwater quality associated with excess iron, chloride and fluoride and low pH. In the shallow aquifers of certain coastal areas, salinity problems are reported. In the deeper aquifers, tapping Warkali formations in the Alappuzha town, fluoride content of 1.5 to 2.6mg/l is reported. Some of the deep wells in Palakkad district in Chitoor taluk and a few wells in Kanjikode and Muthalamada have fluoride concentration above 1 mg/l. The deterioration of groundwater quality due to industrial effluents, burial grounds, municipal landfills, municipal sewage etc are also reported from a few locations in the state. Kerala manages human excreta mostly through on-site sanitation by confining the fecal sludge and septage in 44 lakh leach pits and 26 lakh septic tanks. The fecal sludge and septage generation is of the order of 8000 m^3/day, a portion of which is removed and disposed in water bodies or on land in the absence of appropriate treatment facilities which in turn pollutes the water bodies. The water quality in wetlands is also affected by salinity intrusion, municipal waste discharges, agricultural residues etc. An increase in the concentration of heavy metals, calcium, magnesium, sulphate and phosphate is reported. The lakes are also subjected to eutrophication with higher level of phytoplankton growth and increased nutrient load.

Deterioration of Air Quality

9. In Kerala, the assimilative capacity of air environment is generally good due to favourable meteorological factors and high density of trees with superior leaf area index. The annual average concentrations of sulphur dioxide, oxides of nitrogen, carbon monoxide and ozone are never found exceeding the desirable limits. However, fugitive dust emission in terms of PM 2.5 and PM 10 are generally found exceeding the desirable limits, the major causative factor being the burning of hydro-carbons mainly from vehicular movement. In the most industrialized region of the State, Kochi, the emission load from vehicular sources is 4 times higher than that of industrial sources. Historically, the number of vehicles in Kerala was low, only 0.24 lakh in 1960, 0.86 lakh in 1970, 1.75 lakh in 1980 and 5.81 lakh in 1990. Post 1990 period showed a spike in the number of vehicles with 19.1 lakh in 2000 and 53.98 lakh in 2010 and 95 lakh in 2015. While road length in Kerala increased by 66 percent between 2005-06 and 2012-13 (from 1,60,944 km to 2,43,373 km), the number of motor vehicles increased by 157.8 percent, i.e. from 31,22,082 lakh in 2005 to 80,48,673 lakh in 2013. According to latest estimates every day about 3171 vehicles are newly added to the number of vehicles in the state. While the road length increase was only 82,929 km between 2005-06 and 2012-13, the increase in the number of motor vehicle was by a whopping number of 49,26,591. In 2008-09 growth rate of motor vehicle population was only 9.8 percent. But by 2012-13 it increased to 17%. This data talks on the decreasing road safety (102 accidents per day) and increasing number of vehicles on road in Kerala. The consumption of petroleum products in Kerala was 34,85,355tonne per year during 2003-04. Consequent to the increase in vehicles, 40 lakh litres of petrol and 80 lakh litres of diesel are sold through 3100 retail outlets in the state every day. The studies elsewhere indicate that the emission due to private vehicles' (two-wheelers and cars) such as carbon dioxide, hydro carbons, PM10 (particulate matter), carbon monoxide, nitrogen oxide and toxic substances like butadiene, acetaldehyde, benzene, formaldehyde, total aldehyde, and total poly aromatic hydrocarbons have increased up to 16 times in 2015 over 1991 levels. Two-wheelers were found to be the dominant source of emissions of what are termed Mobile Source Air Toxics (MSATs)-formaldehyde (37%), hydrocarbons (35%) and acetaldehyde (64%). Private cars are found to be responsible for majority of the carbon monoxide (34%), benzene (48%), and total aldehyde (40%) emission. Heavy-duty commercial vehicles (HCVs) were found to emit nearly 46% of all particulate pollutants. Studies also show that the cars (30-34%) produce the highest CO_2 emissions. In terms of Green House Gas emission, the vehicles using compressed natural gas (CNG) and liquefied petroleum gas (LPG) emit the least GHGs compared to those using diesel.

10. Society-nature relationship taking place locally, regionally, nationally and increasingly globally and they cannot be addressed through symptomatic and fragmented (and often symbolic) efforts. There are costs associated with the pursuit of sustainable development and the job of the government is to prepare the people and handhold them to pursue such a path, which though more costly in the short term, will turn out to be more sustainable in the long term. Absence of concern for the well-being of the people and environment and the audacity to pursue a myopic agenda at the behest of vested interests.

Environmental Issues in the Mining Sector

11. Blasting in mining activity leads to ground vibrations in and around the quarry site. The localised vibration may trigger landslides or destablise rock boulders on the hill slopes. The houses around the quarry develop cracks of various dimensions due to blasting. The likely hood of accidents during drilling, blasting, transportation and operation of heavy machineries is high. Precautionary measures are not always strictly followed. Continuous high level of noise during blasting, loading operations create tiredness, speedup pulse and respiratory rates and impair hearing of onsite labourers in the long run. The quarry destroys the soil cover, flora and fauna and may also affect the hydrology of the

area. There may be increased run off and turbidity in run-off water during rainy season. There have been reports of death as the top of the quarry face lacks any fence. The dust and fine particles produced during blasting and transportation using heavy trucks pollute the atmosphere and has an adverse effect on the people around. The fly rocks may also travel certain distances and may destroy houses or causes injuries to the people around.

Sand Mining

12. Sand mining from the rivers, river banks and paddy fields of Kerala has become an ecological hazard and has claimed many human lives as well. Rock mining for rubble and sand is also leading to an environmental damage and changing the landscapes.

13. Sand mining is leading to the pollution, and devastation of rivers. Sand mining in rivers will irreversibly destroy the river ecosystem.

Environmental Issues with Respect to Natural Hazards

14. The State of Kerala which is already under geo spatial and socio – economic pressure is vulnerable to a number of natural hazard such as flood, landslides, drought, earth quake, lightning, coastal erosion, storm surges, tsunami, saline water intrusion, forest fire, soil piping, heat wave (suburn/sun strock), meteontic impact, epidemics (KSDMA, 2016). The high density of population, 860 people/km^2 (Census, 2011), narrow roads, high density of road network, high density of coastal population, unscientific land use practice, over exploitation of natural resources and general higher standard of living of the public increase the vulnerability of the population to disasters. Village wise landslide, flood, drought, lightning and earth quake susceptible areas have been identified and the same have been mapped, tabulated and circulated to district administrations by Kerala State Disaster Management Authority (Please see the annexures for a detailed note on natural disasters in Kerela).

15. Environmental problems are symptoms of the society-nature relationship taking place locally, regionally, nationally and increasingly globally and they cannot be addressed through symptomatic and fragmented (and often symbolic) efforts. There are costs associated with the pursuit of sustainable development and the job of the government is to prepare the people and enable them to pursue such a path, which though more costly in the short term, will turn out to be more sustainable in the long term.

CHAPTER 2
CONSTITUTIONAL AND STATUTORY FRAMEWORK FOR ENVIRONMENTAL PROTECTION AND MANAGEMENT

16. Article 48-A of the Constitution of India mandates the State to endeavour to protect and improve the environment and to safeguard the forests and wild life of the country. Constitution of India provides that Parliament may make laws for the whole or any part of the territory of India, and the legislature of a state may make laws for the state or any part thereof.[1] It also provides for a three-fold distribution of powers as specified in the Seventh Schedule to the Constitution, and the entire legislative field has been drawn out elaborately and exhaustively in three lists.[2] Parliament is empowered to make law exclusively with respect to matters enumerated in List I (Union List).[3] Similarly, the legislature of a state is empowered to make law exclusively with respect to a matter enumerated in List II (State List).[4] Both Parliament and legislature of a state are empowered to make law with respect to a matter enumerated in List III (Concurrent List).[5] The Parliament has exclusive power to make any law with respect to any matter not enumerated in the Concurrent List or State List.[6] There are circumstances under which Parliament is empowered to make a law with respect to a matter enumerated in the State List. First, if the Council of States declares by a resolution supported by not less than two thirds of the members present and voting that it is expedient or necessary in the national interest that Parliament should make a law with respect to any matter enumerated in the State List and the matter is specified in the resolution, it shall be lawful for the parliament to make a law with respect to the matter while the resolution is in force.[7] Secondly, if legislatures of two or more states desire that any of the matters with respect to which Parliament has no power to make a law should be regulated in such states by Parliament by law and if resolutions are passed by the legislatures of these states, it shall be lawful for Parliament to pass an Act for regulating that matter accordingly.[8] Thirdly, Parliament is empowered to make a law for implementing any treaty or convention with any foreign country or any decision made at any international conference.[9]

17. The subject of 'environment' is not explicitly provided in any of the three lists in VII Schedule. *'Regulation of mines and mineral development'*, *'regulation and development of inter-state rivers'*, *'fishing and fisheries beyond territorial waters'* are some of the environment related subjects which are specified in List I (Union List) of VII Schedule. *Water (water supplies, irrigation and canals, drainage and embankments, water storage and water power), fisheries and regulation of mines and mineral development* (subject to the provisions of List I with respect to regulation and development under the control of the Union) are some of the environment related subjects which are specified in List II (State List) of VII Schedule. *Forests, protection of wild animals and birds* are some of the environment related subjects which are specified in List III (Concurrent List) of VII Schedule.

18. The subjects of *'urban forestry', 'protection of the environment', 'promotion of ecological aspects', 'regulation of land use', 'solid waste management'* are found to be explicitly mentioned in Schedule XII to the Constitution of India. Article 243-W of the Constitution of India empowers the State Legislatures to endow the

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1 See Article 245 of the Constitution of India
2 See Schedule VII of the Constitution of India
3 See Article 246 (1) of the Constitution of India
4 See Article 246 (3) of the Constitution of India
5 See Article 246 (2) of the Constitution of India
6 See Article 248 of the Constitution of India
7 See Article 249 of the Constitution of India
8 See Article 252 of the Constitution of India
9 See Article 253 of the Constitution of India

municipalities with such powers and responsibilities so as to enable them to perform the functions and implement the schemes with respect to the subject specified in Schedule XII. According to Article 243-ZD (2) the District Planning Committee shall while preparing the draft development plan have regard *inter alia* to the aspect of 'environmental conservation'.

19. Since the 1970s an extensive network of environmental legislation has grown in the country. The Wildlife (Protection) Act, 1972; the Water (Prevention and Control of Pollution) Act, 1974; the Forest (Conservation) Act, 1980; the Air (Prevention and Control of Pollution) Act, 1981 and the Environment (Protection) Act, 1986, The Biological Diversity Act, 2002 are a few among them.

20. The Water (Prevention and Control of Pollution) Act [hereinafter referred to as the Water Act] was enacted by the Parliament of India in 1974 through the route of Article 252 of the Constitution of India. The Air (Prevention and Control of Pollution) Act [hereinafter referred to as the Air Act] was enacted by the Parliament of India in 1981 through the route of Article 253 of the Constitution of India. The Environment (Protection) Act [hereinafter referred to as the EPA] was enacted by the Parliament of India in 1986 through the route of Article 253 of the Constitution of India. In addition to the above legislations the Parliament has also enacted the Water (Prevention and Control of Pollution) Cess Act [hereinafter referred to as the Water Cess Act] in the year 1977.

21. The Water (Prevention and Control of Pollution) Rules, 1975; the Water (Prevention and Control of Pollution) Cess Rules, 1978 and the Air (Prevention and Control of Pollution) Rules, 1982 have been adopted and notified by the Central Government for the effective implementation of the Water Act, Water Cess Act and the Air Act respectively.

22. The Environment (Protection) Act, 1986 [hereinafter referred to as EPA was enacted to provide for the protection and improvement of the quality of environment and preventing, controlling and abating environmental pollution. The term 'environment' has been defined in the EPA to include water, air and land, and the inter-relationship which exists among and between water, air and land and human beings, other living creatures, plants, micro-organism and property.34 The definition is wide enough to include within its purview all living creatures including plants and micro-organism and their relationship with water, air and land. The Act has given vast powers to the Central Government to take measures with respect of planning and execution of a nationwide programme for prevention, control and abatement of environmental pollution. It empowers the government to lay down standards for the quality of environment, emission or discharge of environmental pollutants; to regulate industrial locations; to prescribe procedure for managing hazardous substances, to establish safeguards for preventing accidents; and to collect and disseminate information regarding environmental pollution. Any contravention of the provisions of the Act, rules, orders or directions made there under is punishable with imprisonment for a term which may extend to five years or with fine which may extend to one lakh rupees or with both.[10] The Act is an 'umbrella' legislation designed to provide a framework for coordination of the activities of various Central and State authorities established under previous laws. Most importantly, the Act empowers the Central Government to make rules for the purpose of protecting and improving the quality of the environment.

23. An updated list of Rules made and notified by the Central Government under the EPA is given below:
    1. Environment (Protection) Rules, 1986.

10 See section 15 of EPA

2. Manufacture, Storage and Import of Hazardous Chemical Rules, 1989.
3. Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Micro-Organisms / Genetically Engineered Organisms or Cells, 1989.
4. Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996.
5. Noise Pollution (Regulation and Control) Rules, 2000.
6. Ozone Depleting Substances (Regulation and Control) Rules, 2000.
7. Batteries (Management and Handling) Rules, 2001.
8. Wetlands (Conservation and Management) Rules, 2010.
9. Construction and Demolition Waste Management Rules, 2016.
10. Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
11. E-Waste (Management) Rules, 2016.
12. Biomedical Waste Management Rules, 2016.
13. Plastic Waste Management Rules, 2016.
14. Solid Waste Management Rules, 2016.

24. Besides the above rules the Central Government has till date issued the following two major Notifications under the EPA
    1. Environment Impact Assessment (EIA) Notification, 2006.
    2. Coastal Regulation Zone (CRZ) Notification, 2011

25. The Kerala Municipality Act, 1994 lists out *'maintenance of environmental hygiene'* as one of the mandatory functions of the Municipalities.[11] *'Inculcating environmental awareness and motivating local action for its upgradation'* has been listed as one of the general functions of the municipalities.[12] One of the duties of the Ward Committees and Ward Sabhas is to adopt moral means for the improvement of environmental cleanliness.[13] The Ward Committees and Ward Sabhas are also duty bound to co-ordinate and implement activities for the protection of nature and to impart knowledge to the people on environmental problems. The Standing Committee for Development of the Town Panchayats, the Standing Committee for Works of the Municipal Council and Standing Committee for Town Planning of Municipal Corporation is to deal with matters of 'environment'.[14] Section 58 of the Kerala Municipality Act, 1994 confers power on the State Government to issue directions to the municipalities in accordance with the national and state policies in the matter of environmental control and the Municipality is bound to comply with such directions.[15] While preparing the Draft Development Plan the District Planning Committee shall have regard to matters of common interest between panchayats and municipalities including *'environmental conservation'.*[16]

26. The Kerala Panchayat Raj Act, 1994 lists out *'maintenance of environmental hygiene'* as one of the mandatory functions of the Village Panchayats[17] *'Inculcating environmental awareness and motivating local action for its upgradation'* has been listed as one of the general functions of the Village Panchayats[18] One of the functions of the Grama Sabhas is to formulate schemes to impart awareness on matters of public interest like cleanliness, environmental protection and pollution control.[19] It is also the responsibility of the Grama Sabha to resort to moral sanction to promote environmental

11 See entry 8 of 'Mandatory Functions' in the First Schedule to the Kerala Municipality Act, 1994.
12 See entry 7 of 'General Functions' in the First Schedule to the Kerala Municipality Act, 1994.
13 See section 46 (1) (v) of the Kerala Municipality Act, 1994.
14 See section 22 of the Kerala Municipality Act, 1994.
15 See section 58 of the Kerala Municipality Act, 1994.
16 See section 243-ZD of the Kerala Municipality Act, 1994.
17 See entry 8 of 'Mandatory Functions' in the Third Schedule to the Kerala Panchayat Raj Act, 1994.
18 See entry 7 of 'General Functions' in the Third Schedule to the Kerala Panchayat Raj Act, 1994.
19 See section 3A (g) of the Kerala Panchayat Raj Act, 1994.

cleanliness.[20] In the Village and Block Panchayats the Standing Committee for Welfare is to deal with the subject of environment.[21] In the District Panchayat the Standing Committee for Public Works is to deal with the subject of environment.[22] Subject to such rules, as may be prescribed by the Government, the District Panchayat or the Block Panchayat may transfer to the Village Panchayat the exercise of any function or the discharge of any duty within the Village Panchayat area.[23] In addition to the powers and functions mentioned in the Kerala Panchay Raj Act, 1994 the Government may by general or special order, and subject to such rules and conditions as may be prescribed authorise a Village Panchayat to exercise any power or discharge any function relating to 'protection of the environment'.[24] Section 189 of the Kerala Panchayat Raj Act, 1994 confers power on the State Government to issue directions to the panchayats in accordance with the national and state policies in the matter of environmental regulations and the panchayats are bound to comply with such directions.

27. The Indian Constitution directs the "State to take measures to protect and improve the environment and to safeguard the environmental quality". It also makes it a fundamental duty of every citizen to protect and improve the natural environment including forests, lakes, rivers and wildlife. As the Constitution provides the framework for creating a welfare state, it is necessary that the finite natural resources of the country be optimally utilized without adversely affecting either the health of the people or the environment. However, the environmental issues over the years are at best addressed only peripherally/superficially. Often policies are formulated to give a feeling that environmental issues are being addressed; but there are other policies – especially dealing with agricultural, industrial and infrastructural development – that seldom take account the environmental aspects and override environmental policies and regulations. Legislation and institutions purportedly aimed to protect the environment are much weaker than the legislation and institutions dealing with mainstream "development". The environmental actions and governance in the state is assessed in this background.

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20 See section 3B (1) (v) of the Kerala Panchayat Raj Act, 1994.

21 See section 162 A (1) (a) (iii) & 162 A (1) (b) (iii) of the Kerala Panchayat Raj Act, 1994.

22 See section 162 A (1) (c) (iii) of the Kerala Panchayat Raj Act, 1994.

23 See section 167 (1) of the Kerala Panchayat Raj Act, 1994.

24 See section 167 (2) of the Kerala Panchayat Raj Act, 1994.

CHAPTER 3
INSTITUTIONAL FRAMEWORK FOR ENVIRONMENTAL PROTECTION AND MANAGEMENT

Department and Directorate of Environment and Climate Change

28. The prime responsibility for the management of environment in Kerala is vested with the Environment Department, Govt. of Kerala which was constituted in 2006. In order to integrate environmental aspects in the development processes and coordinate various initiatives, an Environmental Management Agency Kerala (EMAK) was constituted in 2007 which was subsequently transformed to Directorate of Environment & Climate Change in 2010. This was with a mission to strengthen environmental governance for maintaining environmental sustainability of the state and to enhance investment in environmental management programmes.

29. The system is now functional with the objectives of :
    1. Implementation of the environmental policy of the Government of Kerala for the sustainable development and environment care.
    2. Sustainable and efficient management of natural resource in tune with the developmental needs of the community.
    3. Development and implementation of action plan on climate change.
    4. Perform as a regulatory mechanism for the Wetlands and other special ecosystems.
    5. Act on complaints pertaining to Environmental (protection) Act 1986.
    6. Provide services with integrity, transparency and accountability in the best interest of the State.

30. In accordance with the objectives, the Terms of Reference of the Directorate is to
    1. Conceive and implement state level environmental development programmes
    2. Coordinate the activities related to action on climate change.
    3. Handhold the administrative responsibilities of all the environment related institutes being established in the State.
    4. Carry out the environment appraisal of the developmental schemes of the Government at planning level
    5. Scrutinize the environmental related proposals prepared by Government/non-Governmental organizations.
    6. Develop various environmental technology related activities at Local Self Government level, gather environmental technology know how and generate database systems for environmental policies.
    7. Function as Secretariat of State Wetland Authority (SWAK)
    8. Function as Secretariat of Integrated Coastal Zone Management (ICZMP)

Implementation of Environmental Management Schemes

31. Over the last three years since 2013-14, an allocation of Rs 4410 lakh was provided for Urban Environmental Improvement project (Rs 2305 lakh), Eco-restoration of wetland (Rs 365 lakh), Climate Change actions (Rs 405 lakh), Comprehensive waste management (Rs 150 lakh), Environmental Impact Assessment (Rs 160 lakh), Environmental awareness and education (Rs415 lakh), Environment research and development (Rs 200 lakh), River Action Plan (Rs 45 lakh) and Strengthening of the Department of Environment and Climate Change (Rs 365 lakh). The overall financial performance was 68% and the same programmes continue for the current year with an

allocation of Rs 1475 lakh. During the years 2013-14 and 2014-15, the state received two 100% Centrally Sponsored Schemes (CSS) under National Plan for Conservation of Aquatic Ecosystem (Rs 600 lakh) and Climate Change Action Plan (Rs 310 lakh). Further, during 2015-16, a new CSS for Conservation of Natural Resources and Ecosystem was received for Rs 60 lakh. However, the no financial progress seems to have made on these. Therefore, the overall financial performance during 2013-14 to 2015-16 was only 54%.

32. The Urban Environmental Improvement project was launched to create, preserve and restore the green and open spaces in urban areas sustainably and thereby reduce carbon emission. The project components included Greening the city (Tree planting), Restoration of urban ponds, Promotion of urban agriculture, Conversion of waste to energy, Green technology, Conservation of biodiversity, Rain water harvesting, Awareness, Programmes & development of institutional mechanisms, Innovative environment care, Fish farming etc. The project was aimed at rejuvenating the urban ponds for managing water scarcity and keeping the aesthetic values including biodiversity conservation; effective management of household organic waste by converting the waste to energy through biogas plants; promoting green technologies; urban agricultural aspects utilizing household organic waste to produce safe to eat vegetables and other crops in urban households and promoting reuse of the domestic waste water generated for non-drinking purposes and enhancing rain water harvesting. The project is being implemented with the support of government departments, selected institutions, non-government organizations, Residents Associations and Thiruvanthapuram Municipal Corporation. The Kerala Irrigation Infrastructure Development Corporation (KIIDC), Agricultural Technology Management Agency (ATMA), KarshikaKarmasena, Communication & Capacity Development Unit (CCDU), Forest Department, Bio diversity board, etc are some of the collaborating institutions.

33. Some of the achievements of the scheme includes the renovation and rejuvenation of 54 ponds in urban area thereby facilitating groundwater recharge, improving water table, reducing water scarcity of the surroundings and promoting biodiversity. There are 2858 beneficiaries in urban agriculture who could spread the message of toxic free vegetable. 1515 families in the urban area installed biogas plants who convert their waste to energy. A rainwater harvesting unit is being constructed at Government Hospital, Peroorkada, Thiruvananthapuram. With the assistance of Forest Department, fruit bearing trees & medicinal plants are being planted along the roadside to provide shade. A Bio diversity Park is being developed by the Kerala State Biodiversity Board. The Karshika karma Sena is being supported financially to improve and promote agriculture and the CCDU is entrusted to document all the activities pertaining to this scheme.

34. Under the Eco-restoration of wetland scheme, a management action plan on Kavayi Lake is being implemented. The activities include enhancement of fish resources, water quality monitoring, restoration and afforestation of mangroves, improving ecotourism and cultural tourism. As part of the project, 5 ponds in Kottayam district & 7 ponds in Kannur district have been renovated and restored. An Institute of Climate Change Studies has started functioning at Kottayam and their programs and progress have not been reported. Under the Climate Change Action, various studies are being implemented which includes (i) Study on Carbon foot print in Government Secretariat, Kerala, (ii) Impact of Sea level rise in Kerala Coast and (iii) Projected Climate Change over Kerala using Ultra High Resolution Climate Model. However, no output or outcome of the study is reported. An initiative for developing a new technology for the disposal of solid waste in collaboration with National Institute of Interdisciplinary Science & Technology (NIIST), Thiruvananthapuram has been launched entrusting NIIST with financial support to establish a pilot model, but no progress has been reported. The provision for Environmental Impact Assessment

might have been used for operating the State Environment Impact Assessment Agency and the State Environment Appraisal Committee.

35. Various activities are being organized under the Environment awareness and education programme. There are 285 BhoomotharaSena clubs (BMCs) established in the colleges & higher secondary schools all over the state to promote environmental activities. Under Primary Environment Care (PEC), Venganellor Grama Panchyath, Thrissur has been supported to establish rain water harvesting units in 350 houses with the help of an NGO to enhance the groundwater recharge. Non Governmental Organizations, educational and training institutions, Professional association, scientific bodies, community organizations and also a whole range of other agencies are being supported under a programme namely Paristhithikam to organize activities for creating environmental awareness through field action at local, regional and state level. The theme for the financial year 2015-16 was "Clean Air, Clean Water, Clean food" and 37 projects were supported during the year. A short film of 25 minutes duration on the climate change issues of Idukki district, titled No.40 rain has been made for facilitating awareness generation campaign on climate change.

36. In order to promote R&D efforts in Environmental sciences, Environment Management, Climate Change & related engineering & technology with a focus on problem solving, a fellowship programme is being promoted namely Paristhithi Poshini. 16 research scholars are supported with fellowships and contingency support for undertaking research leading to Ph D in leading R & D institutions. Some of the studies being supported are listed hereunder.
    1. A study on the carbon sequestration status of selected forest ecosystems of Kerala
    2. Development of a native micro algal system for the removal of Green House Gases from flue gas and its optimization studies for bio fuel production
    3. Studies on the effect of plant secondary metabolites on the control of mosquito vectors
    4. A synoptic study on the preparation of sectoral status of liquid waste management in Kerala
    5. Bio-active substance from wetland micro flora along the Vembanadu lake with special reference to thermostable enzymes
    6. Simultaneous generation of electricity with waste water treatment using Microbial fuel cells coupled with flow anaerobic filters
    7. Land use change and soil water degradation of Thrissur kole wetland system, Kerala
    8. Plastic degradation using microbes isolated from dumping areas, Vembanadlake and Mangrove system.
    9. Atmospheric Chemistry of Mercury in Tropical Humid Climate of Kerala"
    10. Exploration and Evaluation of Antimicrobial properties of plants used in tribal medicine
    11. Survival and risk assessment of Biofilm associated Bacteria in various drinking water microcosm and drinking water distribution
    12. An analysis of mass Gathering Associated Risks in Pilgrim Destinations-Particularly the case of Sabarimala
    13. Versatility of forest litter Bacteria isolated from virgin tropical rain forest and their degradation potential of organic debris in grey water.

Some of the other activities reported are:

1. Improvement of sanitation measures in the catchment of Sasthamcotta Wetland through Suchitwa Mission, Govt. of Kerala.
2. Eco restoration programme for Kappithode in Alappuzha district through the Kerala State Pollution Control Board (KSPCB).
3. Enhancement of sustainable fish stock and livelihood improvement of Vellayani Lake through Agency for Developing Aquaculture in Kerala (ADAK).

4. Biodiversity conservation of Kadalundi- Vallikunnu coastal community reserve.
5. Marine Turtle conservation programme and estuary management at Kolavipalam.
6. Construction of Modern abattoirs (slaughter houses) in Kalady and Kumily Panchayat.
7. Construction of a windrow compost plant in RajakumariPanchayaths for the management of Municipal Solid Waste.
8. Preparation of the State Action Plan on Climate Change for which approval obtained from Government of India.
9. Carbon Emission reduction on Industrial PSU's in Kerala.
10. Study on community information based resource maps for Vembanad areas through ATREE.
11. Established Centre of Excellence in Environmental Economics at Agriculture University, Trissur.
12. Conducted studies related to the Livelihood Index at Vembanad through WWF.
13. Conducted study on Carbon footprint at the Govt. Secretariat along with Energy management Center, Govt. of Kerala.
14. Studies on Carbon Sequestration at the Vembanad ecosystem with Cochin University of Science and Technology (CUSAT).
15. Environmental Impact assessment of laterite mining in the state with WWF.

Environmental Pollution Control

37. The Kerala State Pollution Control Board (KSPCB) is the statutory authority for implementing pollution control measures. It was established in 1974 with the objective of prevention and control of water pollution in the State. Over the years, the scope increased with the enactment of new statutes aimed at protecting different aspects of the environment. The Board is now responsible for implementing the following statutes:

	ACT	**RULES / NOTIFICATION**	
1	Water (Prevention and Control of Pollution) Act, 1974	Water (Prevention and Control of Pollution) Rules, 1976	
2	Water (Prevention and Control of Pollution) Cess Act, 1977	Water (Prevention and Control of Pollution) Cess Rules, 1979	
3	Air (Prevention and Control of Pollution) Act, 1981	Air (Prevention and Control of Pollution) Rules, 1984	
4	Environment (Protection) Act, 1986	(i)	Environment (Protection) Rules, 1986
		(ii)	Hazardous and other Wastes (Management, &Transboundary Movement) Rules, 2016
		(iii)	Manufacture, Storage and Import of Hazardous Chemical Rules, 1989
		(iv)	Environment Impact Assessment Notification, 2006
		(v)	Bio-Medical Waste (Management & Handling) Rules, 1998
		(vi)	Plastics Waste Management Rules, 2016
		(vii)	Solid Wastes (Management) Rules, 2016
		(viii)	Noise Pollution (Regulation and Control) Rules, 2000
		(ix)	Batteries (Management & Handling) Rules, 2001
		(x)	E-Waste (Management) Rules, 2016
		(xi)	Contruction and Demolition Waste Management Rules, 2016

38. The present infrastructure of the Board consist of the Head Office at Thiruvananthapuram, three Regional Offices at Thiruvananthapuram, Ernakulam& Kozhikode, 14 District Offices with laboratory, a Central laboratory at Ernakulam and a Regional Laboratory at Kozhikode. Considering the magnitude of potential polluter density in Ernakulam district, there are three district offices in Ernakulam district, one looking after the Kanayannur, Kochi and Aluva Taluks; second looking after Kothamangalam, Kunnathunad, Moovattupuzha Taluks and the third looking after the Environmental Surveillance Centre at Eloor for industries at Eloor-Edayar area and also to deal with North Paravur Taluk. The Board is also the statutory authority for planning, supervising and implementing a comprehensive programme for the prevention and control of pollution in the State of Kerala under following Acts & Rules. The major functions of the Board under various acts and rules are given in Annexure I.

Implementation of Pollution Control Measures

39. The objective of the Board has been to bring all hospitals, industries, municipalities and other establishments in Kerala under the consent regime, create awareness on pollution prevention and ensure environmental improvement of the State. Notwithstanding various infrastructural handicaps, it is pointed out that the Board could bring more than 15,000 industries, 4000 hospitals and 42 municipalities and other establishments under the consent regimes.

40. During the last 4 years, the KSPCB was allotted Rs 2430 lakh out of which 72% was expended. The allocation was for operationalizing the Regulatory mechanism (Rs 300 lakh), Environmental monitoring and management (Rs 1430 lakh), Capacity Building (Rs 55 lakh) and Infrastructure upgradation (Rs 635 lakh). Under regulatory mechanism, incentives have been provided for pollution control, training has been extended to stake holders on rules / environment issues and efforts have been made to generate public awareness on the need for improved environmental upkeep. Under environment monitoring and management programme, various activities such as Periyar river water quality surveillance programme, Environmental upkeep of Sabarimala, Environment management of polluted sites, Impact monitoring of contaminated sites, Improvement of sanitation facilities in and around Veli-Akkulam lake, Ambient noise mapping, Preparation of environment status report, Classification of water bodies in the state, Preparation of water and air quality directory and maintenance of ambient air and water monitoring stations have been done. Incentives have been provided to local self-government and public health care institutions for better management of waste. Further, state share have been provided for establishing common biomedical waste treatment facilities, remediation of hazardous waste contaminated site and setting up of common Effluent Treatment Plant (ETP) at Aroor and Chandiroor. Capacity building programme for the employees have been taken up for improving the performance efficiency. Under the infrastructure upgradation programme, laboratory equipment have been procured, the laboratories of the Board have been upgraded to NABL status, dynamic website has been commissioned and automation has been improved. The overall financial performance achieved over the four years has been 72%.

41. The Integrated Consent to Establish (ICE) for industries/ health care institutions/ other establishments and Integrated Consent to Operate (ICO) for permitting the operation of such units are used as the main tools for monitoring the compliance and enforcement of pollution control rules and guidelines. This has been automated since 15.06.2014 and as on 18.07.2016, 6744 Consent to Establish have been issued and 32541 Consent to operate have been issued. The non- complying units are issued directions for closure as per section 41 of the Water (Prevention and Control of Pollution) Act and under section 31 (A) of the Air (Prevention and Control of Pollution) Act. In

order to speed up the enforcement, the power of issuing direction for closure of non – complying industries/ establishments has been delegated to the District Officer of the Board.

Coastal Zone Management

42. The Ministry of Environment, Forest and Climate Change, Govt. Of India decided to extend the World Bank assisted Integrated Coastal Zone Management Project (ICZMP) to the State of Kerala under phase –II. As per decisions and requremnt, the Govt. of Kerala established an autonomous institutional set up for implementing Integrated Coastal Zone Management Programme (ICZMP) vide order G.O.(Rt) 138/2015 Envt dated 29/09/2015. Accordingly, the Kerala Centre for Integrated Coastal Management (KCICM) has been set up and its Memorandum of Association approved vide Government vide order G.O.(Rt) 12/2016 Envt dated 04.02.2016. This institution will source 90% financial support required for ICZMP from the Govt. of India as received from the external agencies as grant to State Government. The State Government will meet the remaining 10%. The duration of the project is 3 years covering the jurisdiction of 9 coastal districts of Kerala. The project will be implemented by KCICM with the support of competent institutions and in consultation with various Government agencies like Fisheries Department, Kerala State Coastal Area Development Corporation, ADAK, FIRMA, Tourism Department, LSGD etc. The District Monitoring Committee under District Collector will supervise the activities in the district. As per the order G.O.(Rt) No.06/2016 Envt., the responsibilities of Project Director is transferred to Director, Environment & Climate Change. Actions are in progress for furthering the objectives of the project.

Sanitation and Waste Management

43. No detailed information on the programs and their implementation status have been received from the concerned nodal agency, Suchitwa Mission. Hence, the details available in their website have been used to generate this write up. Sanitation and waste management are subjects dealt by the local self-governments, viz., City Corporations, Municipalities and Grama Panchayats with the support from respective Block Panchayats and District Panchayats as well as the District Administration and State Government. In order to facilitate the implementation of sanitation and waste management programmes, the State Government constituted an autonomous organization under the Local Self Government Department, Government of Kerala. The mission provides policy support, evolves implementation strategy, creates enabling environment, offers technical inputs and arranges top-up financial grant for implementation of sanitation and waste management programmes. In order to have focused and integrated efforts to address the emerging challenges in sanitation and to achieve better health and environmental outcome, especially to reduce the disease burden and sustain and improve the assimilative capacity of ecosystems, a comprehensive action plan, namely, Malinya Mukta Keralam (MMK) Action Plan, has been launched. This was to tackle the issues and challenges in the seven components of sanitation accepted universally, i.e., safe disposal of human excreta, home sanitation and food hygiene, personal hygiene, solid waste management, liquid waste management, safe handling of drinking water and community environmental sanitation as a package of practice.

Mandate of Suchitwa Mission

44. The important mandates of the Mission are:
    1. Assist Cities, Municipalities and Panchayats to evolve policies and strategies for implementation of sanitation and solid and liquid waste management programs
    2. Scrutinize the DPRs prepared by Cities, Municipalities and Panchayats and to see whether the DPRs adhere to prevalent Acts and rules.

3. Facilitate the preparation of detailed project reports (DPRs) by providing technical training to concerned staff of LSGIs and by consultations at individual LSGI level
4. Provide technical approvals for the projects of LSGIs for solid and liquid waste management and provide top-up grants allocated by Government from time to time
5. Coordinate various activities under Swatch Bharat Abhiyan sponsored by the Government of India, the Executive Director, Suchitwa Mission being its State level Coordinator.
6. Coordinate various activities under other sanitation and waste management linked programs
7. Organize appropriate Information, Education and Communication (IEC) activities aimed at the attitudinal and behavioral change of people at large and capacity development of all concerned stakeholders
8. Channelize fund from Government of Kerala and Government of India to LSGIs for the implementation of sanitation and waste management projects.

Thrust Areas and Schemes

44. In order to have focus on specific issues linked to various aspects of sanitation, the Mission activities have been planned by giving thrust on total coverage of sanitary latrines, management of household level solid waste, management of wastes generated at community halls, public offices, educational institutions, hospitals, hotels and catering centres, management of wastes at markets, slaughter houses and chicken stalls, management of wastes at streets and public places, management of wastes at tourist and pilgrim centres, management of wastes in water bodies and management of plastics, e-waste, liquid waste including septage. Thrust has also been given on popularizing the legal and institutional arrangements in the sanitation sector. Accordingly, some of the major initiatives undertaken by the Mission are the following:

Schemes under Implementation

Suchitwa Keralam programme.

45. *Solid Waste Management*. The Suchitwa Mission extends technical support to Local Self Government Institutions or identifying issues and for suggesting mitigation measures in the area of Municipal Solid Waste Management. Based on this the Mission helps the Local Self Governments to prepare Detailed Project Reports (DPRs) for the construction of new waste treatment plants as well as modification of existing plants including up gradation of all components of MSW. The Mission scrutinizes the DPRs technically and issues technical approval for the projects. 100% financial support for implementation of these projects is being provided to the LSGIs. The scheme includes construction/modification of waste treatment plants includes establishment of Plastic shredding units, Up-gradation of solid waste management facility, providing green belt for establishing Resource Recovery Centers, Material Recovery Facility (MRF), facilitation for preparation of DPRs, etc. Considering the gravity of the problem, now SM focuses on the missing components in the Solid Waste Management System i.e. Development of Sanitary landfill, Green belt, Resource Recovery Centre/Material Recovery Facility for the Management of non-biodegradables including e-waste. The Resource Recovery Centres/MRF will help the local bodies to collect the non-degradable and to hand over the same to Recyclers/scrap dealers in a massive manner. Community level composting/biogas units of bigger size shall also be promoted in this component. Development of Regional Sanitary Landfill is another area being promoted.

46. *Source level composting facilities*. Suchitwa Mission provides technical and financial support to the local bodies for their projects of households, institutional or community level (source level) composting

facilities such as Ring Composting, Bucket Bin Composting, Pot Composting, Bio-gas plants etc. All composting facilities are eligible for subsidy of 75% from Suchitwa Mission and 50% for bio-gas plants. Local Self Government shall contribute 15% & 25% subsidy respectively for source level composting facilities and bio-gas plants. Encouragement is being given for promotion of source level segregation and source level treatment of bio-degradable fraction of solid waste at households, flats, residential colonies, institutions, hospitals and schools. From this activity, as almost half of the waste generated from these sources can be treated at source itself. At present 75% subsidy is being given for source level treatment for biogas plants (50% by Suchitwa Mission Subsidy to a maximum Rs 5000/- and 25% by the Local Bodies; 25% has to be taken by the beneficiary). In the case of different types of compost systems, 90% subsidy (75% by Suchitwa Mission, 15% by Local Bodies; 10% has to be taken by the beneficiary) is being given. The source level treatment of waste is to be encouraged by giving subsidy for hotels, chicken stalls, hospitals, schools, offices, hospitals are being given a subsidy at the rate of 50% from the Government subject to a maximum of Rs 1 lakh. The proposals of such institution received through local bodies are promoted by giving subsidy. An amount of Rs 100 lakh is earmarked for this purpose for rural areas.

47. *Modern Slaughter house*. A slaughterhouse/abattoir is a facility where animals are scientifically and hygienically killed for consumption as food. Present system of killing animals poses several significant logistical, and public health and pollution problems. Public aversion makes it difficult for find me out location for slaughterhouses. It is the responsibility of LSGs to comply with the rules and regulations with regard to slaughtering activity that comes under their jurisdiction. In this circumstance Suchitwa mission along with urban directorate is providing technical and financial sanctions and assistance to LSGIs for their projects of modern abattoirs. LSGs are eligible for a 50% subsidy for setting up Slaughter house if they come up with good projects.

48. *Crematorium*. Suchitwa mission along with urban directorate is providing technical and financial sanctions and technical assistance to LSGs for their projects of LPG crematorium.

49. *Septage Treatment plants*. Septage treatment plants are the need of the hour and it is the responsibility of the local bodies to establish such facilities in their jurisdiction to control unscientific disposal of septic tank sludge. The septage contains coliform bacteria, pathogens, heavy metals etc. It's unscientific discharge eventually result black water getting mixed with water sources polluting water bodies, increasing communicable disease incidences, work loss and loss of academic days among children etc. The issue needs to be addressed and Suchitwa mission provides all required support to local self-government institutions to come up with viable projects and provides technical sanctions for those which fit good in terms of prescribed specifications

50. *Liquid Waste Management including Septage Management.* Model Liquid Waste Treatment Plants are required to be established in hospitals, Slaughter Houses and residential colonies for treating waste water generated from Slaughter houses, toilets, bathrooms, laboratories, canteens and residential colonies. Technical assistance is being given by the Suchitwa Mission for preparation of model Detailed Project Report for institutional liquid waste management system for different type of institutions such as schools, slaughter houses, residential colonies, hospitals etc. The Mission will support the local bodies in the areas of Technology, design, specification, estimate, operation and maintenance strategy, implementation plan for liquid waste management system to concerned local bodies. Septage Treatment Plants are also need to be established in districts during the year. Therefore, it is required to support Local Bodies for establishing Model Liquid Waste Treatment Plants including septage treatment plants. Project based funding shall be extended under this component. An amount of Rs 300 lakh is earmarked for this purpose for rural areas.

51. *Pre-Monsoon Cleaning Activity*. During Monsoon season contagious diseases usually hit many places in the State. One of the main reasons is blocking of drainage systems with garbage and mud - for the spread of mosquitoes and other vectors. Local bodies need to conduct dry day and need to dispose of the accumulated solid waste prior to monsoon. Suchitwa Mission has been providing an amount of Rs 10, 000/- for each LSG ward for conducting pre-monsoon cleaning activities.

52. Assistance to promote recycling and other eco-friendly industries, business, enterprises, etc.: As most of the non-biodegradable waste has a good recycling value and since recycling is one of the most environment friendly activities, such industries which recycle waste and produce useful products should be encouraged. Likewise production and sales of other eco-friendly products (cloth bags for instance) should also be encouraged. Therefore it is envisaged that such industries and businesses can be encouraged through Capital subsidy and other such instruments of financial assistance to given either directly or through Industries Department. Assistance to Panchayats shall be provided based on projects.

53. *Material Recovery Facilities (MRF).* MRF means a facility where non compostable solid waste can be temporarily stored by the local body or any person authorised by the ULB to facilitate segregation, sorting and recovery of various components of waste by informal sector of waste pickers or any other work force engaged for the purpose before the waste in delivered or taken up for its processing or disposal. Suchitwa Mission provides technical and financial support to Local Self Government Institutions for such units.

Swach Bharath Abhiyan (SBA)

54. In order to address rural and urban sanitation issues appropriately, it being implemented as two Centrally Sponsored Schemes namely SBA (Grameen) and SBA (Urban. Under SBA (G), financial assistance is provided under Individual Household latrines (IHHL), Rural Sanitation Mart (RSM), Solid and Liquid Waste Management (SLWM). In addition, assistance is also provided for Information Education and Communication (IEC) campaign to sensitize the public and create awareness among people on improved hygiene and sanitation, solid and liquid waste management and overall environmental upgradation. The SBA (Urban) supports construction of Household Latrines, Community Toilets, Public Toilets, Solid Waste Management and organize IEC and Public Awareness campaigns and Capacity Building Activities.

Communication and Capacity Development Unit (CCDU)

55. The Government of India has sanctioned a CCDU specifically for sanitation sector with the objectives to develop state specific information, education and communication strategy and provide capacity development of functionaries at all levels. The objective of CCDU is to develop communication strategies for reform initiatives in sanitation sector and also to provide capacity development of functionaries at all levels. The unit is to provide IEC/HRD support to State Suchitwa mission and districts. It will provide HRD/IEC inputs to all Swachh Bharat Mission projects and also to MalinyaMuktha Kerala. The CCDU will also document successful IEC/HRD initiatives in the State and disseminate the same among functionaries at different levels.

Major Achievements

Solid waste management and sanitation.

1. Identified and approved indigenous technologies suitable for the State for source level treatment of waste through national level advertisement, exhibitions and interviews. It include pipe composting, pot composting, bucket composting, bio-bin composting, pedestal composting, etc. in addition to vermin-composting, ring composting and biogas plants.
2. Rs 10,000 each was provided from Suchitwa Mission fund for all the wards of 978 gram panchayats and 65 urban local bodies for pre-monsoon cleaning activities during 2012, which was named as 'MazhayethumMumbe'.
3. Focus was given for establishing solid waste management facilities in 100 Gram Panchayats as part of 100 days programme of the Government. Technical approvals and financial assistance for proposals of 135 Gram Panchayats were provided and Rs 6.46 crore was released from the State and Central Schemes.
4. Technical approvals for DPRs of 38 urban local bodies for source level treatment and 18 urban local bodies for common facilities were given after conducting techno legal feasibility studies.
5. Projects for source level treatment of waste and upgradation of existing common facilities of urban local bodies at a cost Rs 50 crore was implemented.
6. Wide publicity was given to the three-prong approach to waste management – source level treatment, upgradation of existing common facilities using traditional technologies and process for establishing modern waste management techniques.
7. Identified and approved 74 new service providers (earlier approved 21 service providers and three accredited agencies) to facilitate waste management in the rural and urban local bodies, through a process of advertisement, interviews and discussions.
8. Imparted training to engineering and health staff of rural and urban local bodies on modern slaughter houses. DPRs have been prepared for 18 Municipalities and 8 Gram Panchayats. Technical approval for establishing slaughter houses were issued to 12 municipalities and 4 Grama Panchayats and 50% financial support was provided.
9. Under Centrally Sponsored Scheme, Rs 15.43 crore has been spent for school toilets, anganwadi toilets, community sanitary complexes and SLWM projects etc.
10. Under Integrated Low Cost Sanitation programme funded by the Govt. of India, Rs 2.1 crore has been released to selected non-governmental organizations for construction of toilets for urban poor.

Liquid waste management.

1. Identified suitable site at all districts, in association with district administration, for establishing septage treatment facilities in a standalone mode. Finalized design for a feasible standalone septage treatment unit suitable for Kerala.
2. Support of Rs 1 crore was provided to the Kerala Water Authority to provide septage treatment facility in the Elamkulam Sewage Treatment Plant as a co-treatment plant.
3. Sewage treatment plant at Government Taluk Hospital, Sasthamcotta (eco-restoration of Sasthamcotta) is under construction. 322 latrines have been provided to BPL families at Sasthamcotta Lake catchment area. Six girl friendly toilets and nine biogas plants have been constructed as part of school sanitation. As part of public place sanitation Suchitwa Mission constructed two sanitary complexes and biogas plant at Sasthamcotta Lake catchment area.

Legislative framework.

1. Prepared and submitted proposal for amending the Kerala Municipal Act 1994 and Kerala Panchayati Raj Act 1994 for increasing the penalty for throwing away solid waste at public

places and to insist the responsibility of treatment of waste in commercial establishments, chicken stalls, marriage halls etc.

Environmental Knowledge Upgradation

59. The Kerala State Council for Science, Technology & Environment (KSCSTE) is the apex body that promotes R&D programmes in emerging and challenging areas of science and engineering. Accordingly, considerable effort are underway in promoting research activities in the field of ecology, environmental management and eco-system conservation. In addition, the KSCSTE is also promoting various other activities to sensitize the society, in general, and student community, in particular, on the importance of ecology, environmental conservation and judicial use of eco-system resources. Some of the programmes being implemented are detailed hereunder.

Schemes under Implementation

Environment & ecology programmes.

60. The KSCSTE extend support to carry out R&D activities on various ecological aspects and environmental issues with particular relevance to the state of Kerala. The support is provided to faculties and scientists of a universities, colleges and schools, R&D Centres, non-governmental organizations etc. The project which is approved for implementation is provided with financial grant up to Rs 30 lakh for three years subject to certain terms and conditions. In addition, the host institution will be provided with an overhead @ 10% of total expenditure subject to a maximum of 1 lakh.

61. *Environmental Pollution Monitoring*. This programme has been initiated to monitor the state of the environment on a regular basis and detects the trends before they manifest as disasters. Accordingly, two monitoring programmes have been launched, one on Water Quality and the other on Soil Quality. Considering the widespread decline in water quality and the causes thereof to pursue measures to reverse the trend and restore the health of the water bodies, a programme was launched by the KSCSTE to establish a network for monitoring the water quality and develop benchmark data on water quality covering 39 river basins. The programme is implemented by Centre for Water Resources Development and Management (CWRDM) under the coordination of KSCSTE. The results of the monitoring are brought out in the form of reports which was distributed among various agencies. The soft copies made available in the ENVIS website. So far 8 reports were brought out since 2009. The study is scheduled to be completed by 31st March 2017. We have created a database of water quality of river basins including river water, groundwater and sediments. The water quality consists of physical, chemical, heavy metals, biologic and pesticides which can act as a bench mark data for water quality of Kerala. The Soil quality analysis for areas subjected to waste dumping and other anthropogenic interventions were carried out. Areas selected from different agro climatic zones and their analysis are completed. Three Panchayats are included under the study which are Cheruvannur- Nallalam in Kozhikode, Koratty in Trichur and Vilappilsala in Trivandrum

62. *Scientific Management of River Karamana*: The documentation of the water quality of river basins necessitated field trials for scientific abatement actions against pollution which was taken up with the financial support of KSPB. A project for scientific management of River Karamana that drains a major portion of Thiruvananthapuram district including the city of Thiruvananthapuram is taken up with KSCSTE as the coordinating agency, TRIDA as the nodal agency and the project is being

implemented through Irrigation department and other Govt. Agencies in line with the Ganga Action Plan.

63. *Endosulfan Technical Cell***.** The Endosulfan Technical Cell' was constituted in KSCSTE with the support of Health and Family Welfare Department, Govt. of Kerala for monitoring the endosulfan persistence in soil, water and blood samples collected from 11 Grama Panchayats of Kasaragod District affected by the incidence of aerial spraying of endosulfan to safeguard cashew plantations from pest attack. The Cell worked with the support of Centre for Water Resources Development and Management (CWRDM), Salim Ali Centre for Ornithology and Natural History (SACON), Govt. Medical College, Kozhikkode and other non-governmental organizations. The monitoring has been carried out after developing necessary protocols for soil, water and blood analysis and also after inter-laboratory calibrations. Based on the monitoring, appraisal report have been generated ans submitted to the Government.

Environmental Information System (ENVIS)

64. It is a decentralized set up with a network of distributed subject oriented Centres ensuring integration of national efforts in environmental information collection, collation, storage, retrieval and dissemination to all concerned. The ENVIS Centre in Kerala, supported by the Ministry of Environment and Forests (MoEF), Govt. of India deals with the state of environment of Kerala State and is functioning at KSCSTE. It is to create a database on different environment related topics of Kerala by collecting secondary data from Government agencies, R&D Centres, Universities and other NGO's; adopt modern technologies of information acquisition, processing, storage, retrieval and dissemination by creating an exclusive website with the ultimate objective of disseminating information speedily to the users; promote national and international cooperation and liaison for exchange of environment related data and information; use the Indian State Level Basic Information Database (ISBEID) software developed by NIC in the ENVIS Centre website; publish News Bulletin on State of Environment of Kerala; generate State of Environment Report of Kerala on selected topics and Indian State-level Basic Environmental Information Database (ISBEID) development. Database as per the ISBEID format is being prepared mainly using secondary data covering the topics of administrative profile, biodiversity, industry, economics, natural resources, hazardous waste, agriculture, health, demography, institutional framework, energy, ecology, groundwater, climate, infrastructure, environment, tourism, forest resources, surface water, disaster management, air pollution and waste disposal. Environmental newsletters are being published on quarterly basis The ENVIS Centre in KSCSTE was established in 2005 and it is awarded A-Grade from MoEF.

National Green Corps (NGC)

65. The solution to many of the environmental problems lie in our attitude towards environment. Be it awareness to keep our surroundings clean or the realization to conserve natural resources by re-using and recycling wherever possible, they all are attitudinal. The best way to attempt to bring about a change in the attitudes in the society is through children. With this realization the Ministry of Environment & Forests, Government of India has launched the National Green Corps Programme (NGC) in all Districts of our vast country. Under this programme, Eco-clubs are being set up in 100 schools of each District and 47,000 Eco-clubs have been set up so far in the country. The objectives of the Eco-clubs are to educate children about their immediate environment; impart knowledge about the eco-systems, their inter-dependence and their need for survival, through visits and demonstrations and to mobilize youngsters by instilling in them the spirit of scientific inquiry into

environmental problems and involve in the efforts of environmental preservation. The KSCSTE is the nodal agency for organizing the NGC in Kerala and the programme commenced in 2001. The programmeis extended to selected 250 eco-clubs per district and total 3500 eco-clubs in the State. The KSCSTE receives an annual financial support of 95.5 lakh for the activities of eco-clubs and KSCSTE provides Rs 2500 to every school. A State level Steering Committee and 14 District level Monitoring and Implementation Committee is constituted for the programme. Training of Master Trainers, teacher training and distribution of resource materials etc are organized as part of the programme. More than 3 lakh students and 7000 teachers are participating in the green movement. The KSCSTE has instituted awards to the best performing Eco-clubs at District and State levels which is of the order of Rs 1 Lakh for the best Eco-club in the State, Rs 50,000/- for the best Eco-clubs in the 14 districts and consolation prizes for best performing eco-clubs. Further to extend the activities to other schools beyond the target set by the NGC, the State is supporting Eco-clubs formed in all the other Government and Aided Schools.

State of Environment Report for Lakshadweep

66. The Ministry of Environment and Forests (MoEF), Government of India has launched a scheme during the 10th Five Year Plan to assist state governments to bring out on a regular basis a status report on the environment of the respective states. The report will enable the state governments for policy/strategy formulation, informed decision making and review. The MoEF provided the necessary financial assistance through The Energy Resources Institute (TERI), New Delhi to the KSCSTE. Accordingly State of Environment Report (SoER) on various environmental aspects of Kerala have been prepared. The DPSIR framework (D- driving forces of environmental change, P-pressures on the environment, S- state of the environment, I- impacts and R- response), which is based on cause-effect relationship between interacting components of the social, economic and environmental systems has been adopted for the preparation. Subsequently, the KSCSTE has also prepared the SoE Report for the islands of Lakshadweep which was published in the year 2013.

Coastal Zone Management

67. The KSCSTE has been providing technical support to the Kerala Coastal Zone Management Authority (KCZMA). It involved technical vetting of the applications and proposals received for clearance from the KCZMA, preparing statement of facts for various resolving concerned legal disputes, carrying out necessary field inspections for ascertaining the CRZ status, awareness building on the relevance of coastal regulations and various provisions under the coastal regulation zones. As per the revised CRZ notification of MoEF in 2011, preparation of survey number based Coastal Zone Management Plan for Kerala has been undertaken with the support of National Centre for Earth Science Studies (NCESS), Govt. of India.

Climate Change Initiatives

68. Since 2011, the KSCSTE has coordinated 5 projects titled (i) Monitoring of sea level rise and impacts analysis (ii) Landuse/Land cover change as linked to Climate Change in Kerala (iii) Solar UV-B Radiati on and Atmospheric Trace constituents in relation to climate change (iv) Monitoring Global Change Impacts in Sahyadri (Western Ghats) (v) Greenhouse gases monitoring the project with the support of NCESS. This was as part of the Kerala initiatives on the National Mission on Strategic Knowledge for Climate Change.

Promotion of Environment Management

69. The KSCSTE has been supporting various training programmes on coastal zone management, wetland management, water quality management. It has also been promoting the observance of World Wetland Day, Water Resources Day, Earth Day, World Environment Day, International Day for Preservation of Ozone Layer, World Forest Day etc., by providing financial assistance to various organizations to conduct befitting programmes.

National Children's Science Congress (NCSC)

70. The KSCSTE is the nodal agency for conducting NCSC since 2012. The primary objectives of NCSC are to (i) make a forum available to children of the age-group of 10-17 years, both from formal school system as well as from out of school, (ii) encourage children throughout the country to visualize future of the nation and help building generation of sensitive, responsible citizens and (iii) stimulate scientific temperament and learning the scientific methodology for observation, collection of data, experiment, analysis, arriving at conclusions and presenting the findings. The KSCSTE has been conducting the district and state level NCSC for selection of child scientist.

CHAPTER 4
ANALYSIS OF THE PLAN SCHEMES

71. During the last five years, there have been various initiatives being implemented for the improvement of physical, biological and socio-economic environment. This was not only to conserve the natural systems, as far as possible, but also to counter the negative environmental externalities caused due to narrow sector focused development initiatives. However, many of the initiatives failed to answer the questions on their viability, equity and sustainability from the socio-economic and environmental angle. More and more, the environmental governance, in practice, is dysfunctional and violations of rules and regulations are rampant. Even judicial interventions at the highest level seems to have little impact especially to arrest violations of various provisions in the existing environmental legislation. The continued degradation in livability clearly demonstrates that there is something fundamentally wrong with the present approach to environmental management. The problems are further aggravated on account of the major uncertainties related to climate change and market vulnerabilities in a globalized environment. Therefore, there is an urgent need to ensure that the investments and efforts in environmental management have beneficial impacts.

72. There are several factors that collectively impact the environment of the state, such as the demographic changes, economic changes, changes in political and social environment, impacting policies, legislation and institutions that govern society-nature relationship and developments in science and technology. As the pressure on the environment increases on account of demographic and economic changes, the governance system – the policies, legislation and institutions – should improve continuously ensuring that the negative externalities on the present and future generations are fully accounted and choices made ensuring that they are avoided or minimised. It requires that the system of governance should improve in terms of accountability, effectiveness, efficiency, equity and fairness, transparency and participation, which should become part of designing policies, legislation, institutions and regulatory framework, development of plans and programmes and finally in implementation, enforcement and compliance. Institutions that are supposed to implement rules and regulations are silent spectators and in effect, they are active accomplices to environmental degradation.

Evaluation of the Schemes for Environmental Management

73. It is not clear whether the output and outcome of the initiatives under environment management have been evaluated for utilizing the results at public interest. The environment management initiatives should include monitoring of the environmental safeguard measures being adopted, if any, under various sectoral programs of development departments and addressing the gaps, if any, through augmentation efforts. Further, the environmental conservation and mitigation agenda should be drawn from the recommendations of the State of the Environment Report on various environmental aspects of the State as well as the environmental policy guidelines. Such a systematic effort is not seen in conceiving the programs. Many of the schemes initiated for environment management is very critical to the sustainable development of the state and therefore, need to ensure flaw-free implementation and follow-up. There is no mechanism in place to review the implementation progress as well as inter-institutional coordination. The Department has a Directorate with Headquarters at Thiruvananthapuram and two regional offices at Kottayam and Kozhikkode. The inadequate infrastructure, lack of manpower etc., is affecting the performance of the system. Though there is a Committee for Wetland Management and Authorities for Environmental Clearance and Coastal Zone Management with very specific terms of reference, there seems to be no provision for obtaining Science & Technology advisories, considering the overall

conservation and development agenda of the State so as to make the programmes more focused, integrated and overarching. All these leads to ad hoc decisions which will not yield results with long-term beneficial impacts on the environmental systems of the State.

Evaluation of the Schemes for Pollution Control

74. The Kerala State Pollution Control Board (KSPCB) has the mandate to prevent and control the water and air pollution and maintain and restore the wholesomeness of water, air, soil and environment. The Board considers the active participation/involvement of all stake holders including industries, hospital, local bodies, residential apartments, public and various State and Central Government departments and agencies as the most important factor to fulfill the mandate. The participation is sought through authorization issued for establishing a facility and later operating it as per the rules under various pollution control acts. However, many of proponents do not take into consideration the criteria set for establishing the respective facilities at the planning stage as pollution control measures are given the least consideration at the project conceiving stage. This has to change and there need to be adequate consideration for environmental aspects during the conceiving and planning stage of the project itself. This is more so in the case of project conceived for public services such as hospitals, waste treatment facility, slaughter houses, crematorium etc. as it would be difficult to incorporate additional land for establishing pollution control measures after procurement of the site. Often the proponents are not sensitized about the need for environmental compliance for achieving environmental sustainability. Though there are efforts to automate the consent administration of the KSPCB, it is not known whether it is automated adequately to address the output and outcome based monitoring and pin-point the violators. The KSPCB has strengthened its initiatives for generating baseline on the air and water quality and periodical monitoring of the air and water quality. But there are various pollution hotspots being reported from the state, the status of which are not decipherable from the baseline and monitoring data being published periodically. The efforts taken for ascertaining the causative factors for the pollution hotspots, if at all there, and the mitigation efforts and their impacts, if any, are not made known to the public. Though there are initiatives for improving the transparency, accountability and efficiency of the performance of the Board, it is not found adequate. It is also not known whether a periodical performance audit is in place as the matter dealt by the Board is very critical in the environmental upkeep of the State.

Evaluation of Schemes for Sanitation & Waste Management

75. Due to the recently augmented initiatives of the Suchitwa Mission with the support of various concerned department and institutions, Kerala has been declared as Open Defecation Free State, a major achievement in the stride for improved sanitation. The Suchitwa Mission was constituted in 2008 by integrating the Kerala Total Health and Sanitation Mission and Clean Kerala Mission for implementing the Malinya Muktha Keralam action plan which was evolved through a series of stakeholder consultations.

CHAPTER 5
RECOMMENDATIONS

Recommendations for Strengthening Environmental Regulation and Governance in Kerala

76. The current process of environmental regulation needs to be strengthened and reformed within the existing legal and institutional framework. The emphasis should be given to make the existing institutions and structures more effective rather than creating and enacting new rules and structures. The perspective/approach of the environmental regulatory authority in Kerala should be directed towards protecting and improving the environment and thereby enabling people to live in a healthy environment. To achieve this objective, there needs to be a multi-pronged strategies. These strategies are outlined below:

Strengthening Environmental Institutions

1. There is an urgent need to **map all the existing institutions** at the state level and their role in compliance and monitoring of environmental rules and regulations. These institutions include pollution control board, rural and urban local bodies, district administration, sectoral departments like public health, sanitation and solid waste management, coastal zone authorities and any other authorities set up by the state government.
2. Identify **overlapping roles and responsibilities of institutions** and their functions. Very often, the overlapping role of different departments makes the system ineffective and public also get confused which authority to be approached.
3. Given the increasing number of litigations filed in different courts, there is an urgent need to **strengthen the legal cell of the pollution control board** with people/lawyers having expertise knowledge and more importantly, the legal cell people should be given a longer tenure and should not be changed regularly. The legal cell has to identify the number of litigations related to pollution and non-implementation/ violation of environmental law from the state at different courts (NGT, HC, SC, DMC), status of litigation: pending, resolved; Court orders against or favour: If against what were the flaws and how to ensure the flaws don't appear again from the regulatory authority side; Identify the nature of cases and sector which gets more litigation and accordingly, strategies need to be evolved to respond to different drafts/rules proposed by the central government?

Enhancing Technical and Scientific Capabilities

77. The requirement of environmental technologies is most essential for the remediation of damages already happened and future damages during the developmental activities. Availability of ready to use technologies is very few in every field of environment including wastes treatment and management. Groundwater pollution is rampant in the state mainly because of the discharge of untreated sewage and wastes. Practically very little effort is made to find solutions for the problem. Technological intervention plan either by introducing latest technologies or by developing appropriate technologies should be accommodated as an important activity in the document. For example on-site and decentralized wastes management or treatment and management are meaningful only when suitable technologies are available or developed. At least technology adaptation may be necessary for its best performance in wastewater and solid wastes treatments. This technology adaptation, quite often needs field tuning and on-site correction that need government support initially. New technology development might be done by the institutions, but further optimizations are hardly possible for final promotion.

78. Several steps can be taken for **strengthening of technical and scientific capabilities** of institutions involved in environmental governance in the following areas:
    1. Determination of standards for emission or discharge of environmental pollutants.
    2. Analysis of samples collected in accordance with the provisions of the Water Act, Air Act and EPA.
    3. Inspection of industries, equipments, processes as well as sewage or trade effluents.
    4. Other inspections necessary for the discharge of responsibilities of the SPCB under the various rules adopted and notified under EPA.
    5. Monitoring, collection and dissemination of information relating to water and air pollution.
    6. Investigation and research relating to problems of water / air pollution and prevention, control or abatement of water / air pollution.
    7. Development of economical and reliable methods of treatment of sewage and trade effluents
    8. Development of methods of utilization of sewage and trade effluents in agriculture
    9. Development of efficient methods of disposal of sewage and trade effluents on land.
    10. Process of considering applications for clearances under the EIA and CRZ Notifications.
    11. Assessment of compliance report submitted by project proponents and Post clearance monitoring of the project sites.

Transparency and Participation

79. The functioning of the regulatory authorities has to be **transparent and participatory**. Starting from consent to operate and establish to environmental statements submitted by the industrial units needs to be uploaded on website. The regulatory authority needs to share information pertaining to every aspect of its functioning especially clearance and monitoring process. People's feedback and regular consultation also needs to be encouraged. Minutes of the pollution control should be uploaded along with the annual report on the website.

80. Involvement of local bodies (PRIs and Municipal Bodies): Given a robust decentralised governance structure, it will be useful to involve local bodies, especially in the implementation and monitoring phase.

Social and Environmental Risk Analysis for Grass-Root Level Projects

81. Social/Environmental Risk Assessment is a tool to ensure the balance between development and social and environmental systems in a complex and interdependent system. It is the ex ante assessment of social/environmental consequences of a project that facilitates project redesign so that the development option under consideration is sustainable. It involves evaluation of environmental implications and incorporation of necessary safeguards for those activities having a bearing on environmental quality. The objective are : Assess the potential social/environmental impacts during planning and design phase of the project ;Facilitate project formulators, planners and implementers to identify and understand the key impacts/issues and formulate the mitigation measures; Explore alternate development options with minimal environmental degradation and negative social impacts; Facilitate communication of the implications and mitigation possibilities of a project to the project proponents, regulatory agencies, stakeholders and other interest groups. This exercise naturally prevents future adverse impacts and resultant potential financial burden and welfare loss. The action ensures successful implementation of the project and ensure the desirable /envisaged outcome, with minimal or nil adverse impacts on the ecosystem. The EIA is, currently taken up as a legal mandatory exercise for specified projects only. Irrespective of the size/volume of the developmental interventions, the interrelations and impacts are manifested. There are large number of reports of

failure to implement the projects, non-functioning of the projects, forced closure due mass public resistance on account of the erosion in ecosystem service quality in the living micro environments. There are projects which are objected due to threat to existing social systems and value judgements. This naturally necessitates the conduct of Social /Environmental Risk Assessment, prior to project/technology adoption, irrespective of the size of the project.

Monitoring Mechanisms

82. Very often emphasis is given more on the clearance process but not on the **post-Project Clearance Monitoring Mechanism**. Various studies have pointed out that the standards are not met by the industries, inspections are not regularly done, liabilities are not fixed in the post-clearance phase. The regulatory authority needs to lay out a framework so that the post clearance process is given equal weightage. In this connection, the existing regional pollution control board needs to be empowered and given more resources. The other authorities like municipal bodies and coastal zone authorities also have to take responsibilities to make the rules are complied with.

83. Procedural requirements under various environmental laws also need to be implemented (regular meetings of authorities, meeting minutes, appointing members having environmental experience and knowledge, regular annual reports, verification of environmental statements of industrial units, allowing members to serve the minimum tenure, strengthening regional offices).

Human Resources

84. It is important to outline the current gaps (**Human resource, financial resource**, capacity of institutions, absence of rules and institutions that the current regulatory regime doesn't focus). This is an important element to make the regulatory authority more effective. Various studies and members of regulatory authority have time and again reported that the current resource/budget allocation is inadequate to perform a range of functions from giving license to inspection and also reply to RTI application. To emerge as an unique and effective regulatory authority, the state government needs to priortise this aspect. The nature and process of environmental regulatory authorities is closed linked to the kind of resources available for its functions. In this regard, the Staff Strength / Human resource of the SPCBs to be increased particularly with reference to:
    1. Performance of statutory obligations (monitoring, determination of standards, inspections, collection of samples, issuance of directions, initiating steps for prosecution etc. etc.) under the Water Act and Air Act.
    2. Collection and dissemination of information relating to air and water pollution.
    3. Discharge of various responsibilities (particularly those relating to inspections, issuance of directions and initiating steps for prosecution) under the rules made and notified under the EPA.
    4. Analysis of samples (in the respective laboratories) collected in accordance with the provisions of the Water Act, Air Act and EPA.
    5. Process of considering applications for clearances under the EIA and CRZ Notifications.
    6. Assessment of compliance report submitted by project proponents and Post clearance monitoring of the project sites.
    7. Seventh, **capacity building and training** of members of regulatory authority has to be done regularly. The members are required to update their knowledge not only on the rules and regulations but also the importance of new technical and scientific aspects of pollution.
    8. As of now, the members generally attend training programs organized by different institutes and government department bodies. But, it will be useful if there is an in-house training centre

with people having experience and knowledge. The Karnataka State Pollution Control Board had started its own training centre for its staffs and experience suggests that it was very useful. It also reduces cost and timing and allows flexibility to have training program as and when staffs are available and free from inspection and other duties.

9. The in-house training centre can develop a module for different staffs for different requirements. The regulatory authority can also seek the help of Public Institutes and Universities for training its staff members. In addition to this, public institutes can be encouraged to conduct research and identify possible areas for intervention to make the regulatory authority more effective. These institutes should also be involved in creating awareness among people about their rights and duties towards the protection and improvement of environment of the state.

Financial Resources

85. Financial resources to be earmarked for: Facilitating transparency and public participation in environmental governance in the State of Kerala. Increased use of information and communication technologies and mobile applications wherever feasible. The websites of SPCB, Department of Environment (Government of Kerala), Appellate Authorities and other authorities constituted under section 3 of EPA to be upgraded with the following information in an easily accessible and user friendly manner: (a) updated version of all Acts, Rules, Notifications, Standards including Statutory Forms (irrespective of whether they were notified by the central or state institutions); (b) Options for online submission of applications, grievances and appeals; (c) information on list of entities who have been granted consents (including copies of orders granting consents); clearances granted under EIA and CRZ Notifications (including conditions imposed while granting clearances); registered institutions; inspections made; samples collected; results of analysis of samples collected; results of monitoring of air quality, water quality and ambient air quality relating noise etc; directions issued in exercise of statutory responsibilities; violations detected; actions taken on detected violations; prosecutions launched; (d) updated information and notices on various stages of the EIA and CRZ Clearance processes including those relating to public consultations (e) agenda, minutes and decisions of various meetings of the SPCB and other authorities constituted under section 3 of EPA including the Coastal Zone Management Plan prepared in accordance with the CRZ Notification, 2011; (f) compliance reports submitted by project proponents who have been granted clearances under the EIA / CRZ Notifications; (g) Membership of SPCB, Appellate Authorities and other authorities constituted under section 3 of EPA; (h) details of laboratories established under various laws which are available for analysis of samples collected under the relevant laws (h) any other information to be disclosed in a *suomotu* manner under the Right to Information Act, 2005.Making the results of real time monitoring of air quality, water quality and ambient air quality relating to noise available live online through the official website of SPCB.

86. Additional financial resources to be earmarked for:
    1. Encouraging investigation and research relating to problems of water / air pollution and prevention, control or abatement of water / air pollution.
    2. training of persons engaged in programmes relating to prevention, control or abatement of water / air pollution [The expertise and resources available with various scientific / research / technical institutions in the State of Kerala to be used]
    3. Organization of mass education programs on prevention, control or abatement of water / air pollution.
    4. Legal capacity building of staff and other officials of the SPCB and other institutions involved in environmental governance (including members of Appellate Authorities constituted under

the Water Act and Air Act and the other authorities constituted under section 3 of the EPA) [The expertise and resources available with institutions of legal education particularly the National Law University in the State of Kerala in the State to be used]

5. Training of prosecutors who conduct prosecution of environmental offences in criminal courts (particularly in the courts of Judicial Magistrates) [The expertise and resources available with institutions of legal education particularly the National Law University in the State of Kerala in the State to be used]
6. Training of judicial officers (particularly on techno-legal aspects) who are primarily involved in the adjudication of prosecutions under the Water Act, Air Act and EPA.
7. Strengthening the prosecution wing of SPCB and other authorities constituted under section 3 of EPA including provisions for expert legal advice with respect to matters pending in criminal courts / National Green Tribunal / High Court of Kerala / Supreme Court of India. In this context the establishment of a legal cell in the SPCB the Department of Environment and other authorities established under section 3 of EPA may be considered.
8. Periodic review of results / outcomes of regulatory actions and prosecutions/ legal disputes launched by or against SPCB / other authorities so as to take corrective measures for better environmental governance.
9. Though majority of the interventions in the environment sector are made by SPCB and other authorities constituted under the EPA, it may not be forgotten that the Department of Urban Development as well as the local bodies have been assigned significant functions under the Solid Waste Management Rules, 2016; the Plastic Waste Management Rules, 2016 and the E-Waste Management Rules, 2016. Furthermore, as discussed earlier, the panchayats and municipalities have also been assigned the responsibility of performing important roles in the matter of maintenance of environmental hygiene by the Constitution of India and the state laws relating to local self-government institutions. Necessary financial resources may also have to be earmarked to enable these institutions to discharge their responsibilities in an efficient manner.

Recommendations for Improving the Environment

87. The basic principles for managing the environment should be based on sustainability (ensuring that the well-being of present and future generations are fully taken into account), science plan, justice and social equity, democratic decision making and transparency and accountability. These should not be bypassed. The multitudes of efforts taken by various institutions and activists groups for improving the environment and building environmental awareness should be recognized. There are several success stories of local initiatives – especially in water conservation, afforestation, waste management, organic farming, energy production, alternative institutional arrangements etc. which needs to be nurtured and multiplied.

88. Kerala ideally needs development that pays attention to its environmental wealth. Energy production (through photovoltaics and other renewables) and water management (taking advantage the wells and other water sources) can be easily decentralized and done at the household level. Waste management and bio-methanation of toilet waste in addition to the potential to generate energy for cooking and other purposes also have the potential to reduce water contamination and help to enhance soil productivity. Energy, water and waste management issues can be addressed through appropriate decentralized systems, using centralized alternatives only where necessary.

Waste Management

89. An Overflow Management System focusing on the reduction of overflows at the grass-root will be adopted for natural resource conservation, waste management and pollution control. The 'Polluter Pays Principle' will have to be adopted through appropriate mechanisms at all tiers of governance. The problem of solid waste management will have to be addressed by inculcating the habit of reduce-reuse-recycle among the public as a whole. A significant quantum of putrescible waste (biodegradable waste) can be managed through treatment at source itself. It requires massive awareness and public campaigns along with handholding technical support to local governments and public. A campaign drawn out from the successful experience of Thiruvananthapuram Corporation and Alappuzha Municipalities, literacy campaign, total sanitation drive, peoples' plan campaign etc will have to be launched for the purpose. The non-putrescible waste (non-biodegradables and slow-biodegradables) will have to be managed commercially through material resource recovery centres established by local governments under entrepreneurship programmes, drawing from the experiences of various initiatives. The material resource recovery centres will also be used as a platform for commercially marketing the overflow manure from the onsite waste treatment systems and e-waste and also deal with confinement of domestic hazardous waste. With regard to the liquid waste management, especially that of septage and fecal sludge generated while emptying the onsite sanitation systems such as septic tanks and latrine leach-pits, a detailed plan of action, protocols and enforcement guidelines will have to be drawn considering the provision of co-treatment systems for existing and proposed sewage treatment plants of the city corporations, stand-alone systems based on chemical and biotechnological means, replacement or augmenting the onsite sanitation systems with bio-methanation plants and decentralized waste water treatment systems.

Improving Air Quality

90. There are evidences of serious deterioration in indoor air quality due to a number of factors including moulds and allergens; carbon monoxide due to biomass burning without safeguards; ozone from cleaning products based on citrus or turpene compounds that interacts with ozone to generate toxic compounds; volatile organic compounds such as benzene etc. from paint, varnishes, adhesives, organic solvents; bio-aerosols from microbial suspended particles such as bacteria, fungi, spores, pollen; suspended particulates of varying sizes that reaches alveoli and upper respiratory systems etc. These are known to have major roles in increasing the disease burden of the state and will have to be controlled through appropriate ventilation and interior safeguards.

Managing Water Resources

91. The water resource systems in the state are increasingly subjected to declining quantity and deteriorating quality. The pollution of surface and ground water bodies due to organic, inorganic and metallic contaminants are reported to be serious. The poor management of waste, both solid and liquid, has an important role in pollution of water bodies. While the action on pollution control progresses, it is also important to monitor the water quality. Currently, water quality monitoring activities are undertaken by the Pollution Control Board, R&D Centres under the Kerala State Council for Science, Technology and Environment, Kerala Water Authority, Central Groundwater Board, State Groundwater Department, various University Departments etc. However, the data are not available in the public domain for scientifically disseminating the issue and there is no action to use these results for taking corrective measures at appropriate levels. Upkeep of the quality of water is the most important aspect of water security. Considering this, uniform water quality monitoring protocol for all type of water sources and drinking water will have to be designed and an integrated institutional chain mechanism have to be carved out from the existing institutions that could extend support up to the local government level with up-to-date water quality information system. Further,

efforts will also have to be taken for utilizing the chemistry laboratories of Higher Secondary Schools for monitoring the water quality of local sources as an educational programme which will also open up a place for local people for getting their drinking water sources tested and seeking preliminary advices for corrective measures, if any required.

92. The Kerala Water Policy-2008 accepted the concept of watershed and the inevitability of water conservation and management on the basis of watershed for maintaining the health of riverine ecosystem. It envisages the preparation of a comprehensive action plan for water resource conservation, development and management at the micro-watershed level to be integrated at the sub-basin and river basin and at the state level plan. This will ensure availability of adequate water at each micro watershed and the overflow enhances the riverine flow especially enable the maintenance of ecosystem flow during the lean season. It is also an important step for ensuring water security of the state. This is a major initiative to be taken up at the watershed level with the ownership of local governments and technical support of all involved in the governance of water resources of the state. This also need a statewide campaign or mission mode approach and requires the modification of institutional mechanism as well as political will. Such a campaign will also focus on rainwater harvesting over or under the ground by households, industrial establishments, farming systems etc as well as new initiatives on recycling of water in hotels, hospitals, major institutions etc.

93. The reclamation of paddy land and wetlands are now widespread in Kerala and consequently, increasing the flood damages and decreasing the environmental assimilative capacity. These ecosystems have a major role for ensuring food and water security. The National Centre for Advanced Economic Research, in 2014, estimated that the annual requirement of rice in Kerala is 35 lakh tonne, but the production at present is only 5.22 lakh tonne. The paddy lands and wetlands also play a major role in maintaining the local availability of surface and ground water. However, the ecosystem functions of paddy land and wetlands are not well quantified and their environmental cost not estimated. Therefore, the asset value of paddy field and wetlands currently are dependent only the yield of paddy or fish. It is estimated that the annual income from 1 acre of paddy field in Kerala is only Rs 9000/- which is insignificantly low and therefore, the paddy land is not considered as a productive asset. The conversion of paddy field and wetlands for the use of residential and such other purposes increases the yield and asset value and the compulsion for conversion is very high. This will directly affect the food and water security and reduce the livability of the area. Therefore, the retention of remaining paddy field and wetlands are critically important for which provisions of paddy land and wetland conservation act have to be enforced without dilution. While doing so, there is a necessity of extracting production from these lands as well as compensate for the cost of ecosystem services it renders by considering these domains as critically important ecosystem.

94. Some Specific Recommendations for Managing the Water Quality Problem are as Follows:

95. *Data Base*. There is a need for the creation of a rich, reliable database. The present existing knowledge on the natural behavior of chemicals, its pathways, and fate are inadequate from the point of view of academic knowledge and reliable site information.

96. *Water Quality Monitoring*. A continuous water quality monitoring of the surface water and ground water sources may be carried out. The monitoring should be carried out based on a scientifically based monitoring network. More laboratories should be established in Schools and Colleges to test the quality of water. Water quality monitoring may also be done for parameters like selected pesticides, heavy metals, trihalomethanes, microbiological parameters like giardia, cryptospordiaetc in addition to routine physico-chemical and bacteriological parameters.

97. *Development of a Water Quality Information System (WQIS).* The water quality information systems are being developed to manage the water quality from a point or non point source of pollution. The development of a Water Quality Information System (WQIS) aims to incorporate existing knowledge concerning water quality monitoring into practical application for production of usable information to be used in the management of water quality.

98. *Institutional mechanism for water quality management.* Attention is required for a proper institutional mechanism with definite focus on issues, more linkages and communication between institutions, setting adequate laws for setting or enforcing water quality standards.

99. *Integrated river basin management.* Lack of integrated basin planning and management has lead to a number of problems, which have bearings on sustainability and environmental safety. A basin plan is one in which upstream and downstream availability and demand are given weightage; water quality and quantity aspects are to be given due consideration. Studies are required for the optimal and environmentally sound use of river basins.

100. *Modeling studies.* Water quality modeling studies may be conducted to study the fate and transport of pollutants in surface and ground water systems. The assimilative capacity of selected river basins may be assessed using suitable water quality models

101. Water Treatment: In addition to the conventional methods of water treatment techniques, S & T interventions are necessary for the development of nanotechnologies for solving the drinking water quality

102. *Sanitation.* Drinking water supply should be integrated with sanitation. More research inputs may be need for designing septic tanks and latrines appropriate for different soil conditions. Studies may be conducted to establish the linkages between groundwater quality and on- site sanitation

103. Technological Options: Water Quality and Sanitation
    1. Development of appropriate technologies for efficient latrine system and septage management
    2. Development of household, community, integrated sewerage treatment systems
    3. Appropriate methods for treating leachate from solid waste

103. Real time monitoring, modeling and evolving Decision Support System for water quality management
    1. Innovative tools and methods for water quality monitoring
    2. Use of sensors and telemetry systems for forecasting purposes
    3. Delineation of hotspots using spatial platform
    4. Site-specific appropriate technologies for water quality management

104. Cost effective and portable water quality testing devices
    1. Development of sensor based devices for testing water quality parameters
    2. Establishment of mobile water quality monitoring and warning systems
    3. Surveillance and monitoring of water quality through public participation

105. Water and waste water treatment, reuse, and in-situ water purification

1. Development of appropriate techniques using modern approaches such as membrane, nano materials, electrochemical, etc.
2. Validation of traditional knowledge/technologies in water purification

106. Strengthening R&D and academic organizations in the water sector
    1. Introducing core research and academic programmes in environmental sector
    2. Strengthening infrastructure facilities for R&D in environmental monitoring
    3. Establishing river basin authorities for ensuring quantity and quality of water in all rivers and aquatic bodies

Protecting Forest Resources

107. Kerala has 28% of its area under forest as per government records but the area that perform the functions forest ecosystem is now considerably reduced due to encroachments, deforestation and non-forest use. Ecologically the region is extremely significant in terms of biodiversity conservation, climate regulation, river conservation, land fragility etc. necessitating appropriate safeguard measures. The local governments of the region will have to be empowered to deal with the environmental sensitivity of the region. In addition, there will have to be focused conservation measures for mangroves, sacred groves, natural vegetation on the riverine buffer, catchments of water bodies etc. Further, greenbelt development and afforestation in all the land commons will have to be made an agenda of the local governments with the objectives of more carbon sequestration and renewable building materials. The conflicts on the permissible activities in fragile zones of the state are increasing considerably. These are mainly the outcomes of fragmented policies and disintegrated administration under narrowly focused sectoral plans and programmes and lack of awareness. This will have to be corrected through integrated natural resource conservation and management policy so that inter-sectoral conflicts can be minimized and resource management fully takes into account the linkages between land, forests, water, wetlands and so on adopting a landscape approach.

108. Indiscriminate constructions, unscientific extraction of rock, soil and river sand and extensive felling of trees for timber have severely impacted the terrain, rivers and other ecosystems. The demand side of building materials is quite high and it increased multifariously in the absence of a consensus and policy on material use and infrastructure development. Considering the increased impacts and conflicts at the local level and low extraction efficiency of small and localized quarries, a policy and action plan has to be evolved considering appropriateness of sites and mode of extraction based on scientific master plan. There will have to be consideration on transporting sand from distant areas such as Gujarat, Rajasthan etc. Large scale open cast or deep mines for extraction of rocks will facilitate improved extraction efficiency and environmental safeguard. This should be based on comprehensive master for the state as a whole considering all the scientific aspects and demand for all type of construction materials. In addition, there needs to be serious and sensible efforts for promotion of the use of recyclable building materials as well as recycling of demolished building materials.

Promoting Small Scale High Tech Enterprises

109. Taking advantage of the widely distributed human capital, there is immense potential for small scale high tech enterprises, catering to local, national and global demands. With targeted investments in infrastructure – especially enhancing connectivity – and providing a favourable environment for nurturing enterprises, Kerala could become a large conglomeration of knowledge enterprises. There are several natural resources based activities that could be undertaken sustainably at the local level.

This includes organic agricultural production (adopting integrated practices – for example rice-fish-poultry in Kuttanad) which could be easily integrated with home-stay based agri-tourism enhancing income to the farm households. In fact every effort is to be made to promote agri- based tourism helping to enhance rural income and to overcome the challenges stemming from uncertainties in agriculture.

Urban Air Quality

110. The urban air quality is deteriorating due to increased vehicular emission especially where the traffic density is higher. This has serious adverse impacts on human health and this has reached threatening dimensions. The increase in vehicular emission is attributable to increased consumption, use of fuel with higher emission load such as diesel, poor road conditions and increased traffic density, age of the vehicles etc. The improvement in traffic plans, road conditions, public transportation etc are unavoidable and therefore, a comprehensive motor vehicle control strategy and traffic plan will have to be planned and adopted to mitigate air pollution, especially in urban areas. Replacement of old vehicles, reformulating diesel fuel, discouraging diesel cars, introduction of liquid petroleum gas (LPG) and compressed natural gas (CNG), massive improvements in infrastructure and radical traffic management measures are among the actions that will need to be brought together to achieve this objective.

111. The density of population in our coastal tract is very high and most of our urban centers and many industrial establishments and major infrastructure investments are in the coast. Similarly the change in climate will also impact the agricultural crops and productivity, water resource sector, fisheries wealth, ecological cycles, biodiversity etc. Though the change is progressing slowly, it is necessary that we take steps to mitigate the intensity and magnitude of climate change impacts.

Spatial Planning

112. Spatial planning – zoning – is an unavoidable option in any densely populated area or region with enormous variation in ecological conditions. The basic principle is that land and other natural resources should be put to the optimum use appropriate to their characteristics under which each unit of land produces the most on a sustainable basis and causes no negative impacts. The State introduced the novel programme of Panchayat level resource mapping programme for natural resources and infrastructure planning at the grass-root level as part of its decentralization effort. Subsequently, these maps were not found used adequately for developing master plans especially integrated land use plan clearly indicating where different activities may be undertaken such as housing, infrastructure development, mining, quarrying, agriculture, forestry, industries – what may be permitted without any restrictions, activities permitted under certain conditions and what may be totally prohibited etc. This could further be integrated at the district and state level for giving due consideration to social, economic and ecological aspects. There is also need to revamp the existing line departments so as to ensure adequate provisions for technical guidance to the local self-government institutions and assume oversight responsibilities.

Science in Public-Decision Making

113. Considering the complexities of natural resource management, especially in the context of climate change, there is a need to strengthen science inputs – including social sciences – in public decision making. Although the State has been a pioneer in investing in the development of science and

technology, there has been a significant erosion in its capacity to improve the science base of public policy making. There are many segments of the activities in the state that remain un-impacted by science. On the whole there is a visible decline in political commitment to improve science and technology capacity. Also there is no interest in using scientific knowledge in public decision making. Transforming the state as a knowledge economy is an important environmental agenda which requires need based and demand driven R&D system. Therefore, there is a need for totally revamping the science and technology institutions to ensure that they are at the cutting edge of developing knowledge relevant in dealing with the complex interaction between society and nature.

Green Technologies

114. There is an urgent need to popularize a wide range of green technologies – in renewable energy, construction, waste management, water conservation, agriculture, industries and so on. Every Panchayat should establish a "Green Technology Centre (GTC)" to provide necessary support the transition towards a low-carbon economy. These "green technology centres" could become the nucleus of an environment friendly society enabling the shift from an economy that has increased production and employment through resource depletion, degradation and waste generation. Being a local initiative, it can recognise the significant differences in local conditions and identify what is required and feasible in the local context. For example, the socio-economic and ecological conditions in the coastal panchayats will be very different from those in the hilly forested areas. The green technology intervention packages will be geared to the specific conditions in each Grama Panchayat as also to the needs of the households. It will also be an institutional system for commercialization and better delivery of technologies at the grass root level as well as for transferring the knowhow developed in the R&D institutions at the national and state levels.

Monitoring

115. It is necessary that wealth accounting including accounting of natural capital be incorporated as an integral part of monitoring the progress. It is also important that every local body should have a system of tracking the changes in its capital stock – natural (which should include land, forests, water including changes in their quality) human, social and physical – and how the local bodies have helped to maintain and enhance the different kinds of wealth should be systematically monitored and made public. This will have to be part of the system of local level income and wealth accounting and efforts will have to be initiated for incorporating such aspects along with periodical environmental audit.

Tourism

116. Since tourism is an important sector for the economy of Kerala, building on existing programs, institutions and capabilities, a number of sector specific recommendations can be worked out to safeguard the environment. Of particular importance is the disposal and management of solid and liquid waste and energy usage.

Mitigation and Management of Natural Hazards

1. As a multihazard prone state, Kerala is to strengthen the network of emergency operation centre at district level.
2. Decentralised disaster mitigation and emergency response mechanism proposes a net work of early warning and monitoring system.

3. Panchayat level land use plan and Disaster management plan is to be prepared in disaster sensitive areas. Land use planning and zonal regulations to be reviewed and zoning regulations need to be enforced.
4. Fully equipped mobile hospital with trained personnel with all medical and emergency equipments may be set up in most vulnerable areas, attached to Government Hospital.
5. Community involvement and awareness generation, particularly that of the vulnerable sections of population and women has to be emphasised for sustainable disaster risk reduction. This must be the critical component of the policy since community is the first responder to disasters and they must be empowered.
6. Hazard Zonation and vulnerability assessment may be carried out for different type of hazards in detail. The reports of the study by various agencies must be made available to respective LSG's. No developmental plans shall be approved without considering the hazard prone area map published by SEOC.
7. Disaster management plan must be prepared at ward level in high hazardous zones. A disaster management team should be constituted in ward level and provide them training in basic requirements such as first aid, rescue, evacuation and related issues.
8. Carry out awareness programmes in vulnerable areas, and make the public understand the specific do's and don'ts at different disaster situation.
9. A separate centre for training, research and awareness may be opened in KILA, Thrissur.

Landslide Reduction Strategies in Land Slide Prone Areas

1. A micro scale landslide hazard mapping and estimation of vulnerability and risk in the major /minor community settlement.
2. Site specific geological and geotechnical studies of important critical hill slopes, particularly transportation corridor is to be carried out.
3. Regulation for quarrying, settlement, construction must be enforced in the critical sites. If needed ban any kind of human interventions. As part of Environmental management plan impose building codes (Maximum height, floor area) in high hazardous zones (eg. Wayanad).
4. Establish real time monitoring by instruments (rain guages) in high risk zones so as to arrive at thresholds and indirect warning. Network of rain guages must be installed in high risk zones where the event is repeated.
5. Creation of rain pits, natural channel diversion in hill slopes greater than 200 will increase the vulnerability of slope failure and hence shall be banned.
6. Building construction close to first order second order stream (ephemeral) shall not be allowed. A distance of 50 mtr to be considered as the minimum required.
7. Disaster Management team consisting of trained personnels for search, rescue first aid in ward level.
8. Blasting and quarrying shall be banned by during continuous rain fall period in moderate hazard zones and high hazardous zones (HHZ). Quarrying operation in HHZ where the risk is less may be permitted. It must be monitored by Geologists. Quarry shall be permitted only after getting aprroval from the disaster level crisis management committee for mining constituted. In high ranges for quarrying NOC from District Disaster Management Authority is to be made mandatory.
9. LSG's and Civil societies in the prone areas shall be trained and equipped for rescue operation. Financial provision for the same shall be given in the annual plan of the LSG.

Flood Risk Reduction Strategies

1. Implement wetland Act, 2008 without fail.

2. Conservation of ponds and open wells.
3. Rain water harvesting on hill slopes may be permitted only after investigation by a hydrogelologist.
4. NOC must be obtained from Ground Water Board before excavating laterite mounds. Permission may be given only after peacebility study.

Earthquake Risk Reduction Strategies

1. LSG's must ensure that all public places (hospitals, schools, auditorium in their jurisdiction are disaster resilient and having constructed following all required safety conditions under Kerala Municipal Building Rules, and Kerala Panchayath Building Rules. All life line public buildings in the area where seismic tremors are recurring (eg: Vadakkanchery, Thrissur) need to be evaluated and if necessary, retrofitted.
2. Restrict the quarrying practices in HHZ. Limit the use of explosives in quarries and monitor the blasting procedure by a team of geologists.

Mining and Environmental Management

117. Indiscriminate constructions, unscientific extraction of rock, soil and river sand and extensive felling of trees for timber have severely impacted the terrain, rivers and other ecosystems. The demand side of building materials is quite high and it increased multifariously in the absence of a consensus and policy on material use and infrastructure development. Considering the increased impacts and conflicts at the local level and low extraction efficiency of small and localized quarries, a policy and action plan has to be evolved considering appropriateness of sites and mode of extraction based on scientific master plan. There will have to be consideration on transporting sand from distant areas such as Gujarat, Rajasthan etc. Large scale open cast or deep mines for extraction of rocks will facilitate improved extraction efficiency and environmental safeguard. This should be based on comprehensive master for the state as a whole considering all the scientific aspects and demand for all type of construction materials. In addition, there needs to be serious and sensible efforts for promotion of the use of recyclable building materials as well as recycling of demolished building materials.
    1. Implement the Kerala Minor Mineral Construction Rules, 2015 strictly.
    2. Depth up to which excavation can go must be specified in the permit/license and geologist must see that natural beauty of the area is not damaged.
    3. Once permit or lease is granted there is no system presently to monitor the quarry operation and verify whether the mining is in accordance with mining plan approved by the competent authority. The department of geology must be equipped to monitor the working of the quarry.
    4. Presently no qualified mine managers are visiting the quarry or supervising the mining operations. Ensure that a qualified mine manager visit the quarry site at least thrice a week.
    5. Conduct at least diploma programme for mining engineering in poly technics of Kerala. Presently we are depending on people from other states.
    6. Ensure that no temporary labour shelters are built very close to the quarry face. It must be constructed at least 100 mts from the site.
    7. In high lands, NOC from District Disaster Management authority shall be obtained for quarry permit.
    8. For the excavation of laterite mounds, NOC from Ground Water Department shall be made mandatory.
    9. Immediate measures should be taken to provide permanent fencing of the quarry with barbed wire, especially at the ridge portion.

10. There must be clarity regarding machinery and mechanical devices to be used in higher elevation and ecologically sensitive areas. The number of vehicles carrying load along the village roads should be regulated.
11. Strictly enforce Kerala protection of river bank regulation of removal of sand act, 2001. Also strictly enforce wetland act 2008.
12. A Grama panchayat should not allow operation of more than one quarry within an area of two square kilometer distance between 2 operational quarries should not be less than 1 kilometer.
13. Mining and Geology department should identify and demarcate few quarry sites in each district for mining after proper studies instead of allowing quarries at highly hazardous zones. Delineation of prospective zones for rock quarrying/clay/sand mining in each district is to be carried out after geo environmental appraiser and public hearing to be conducted by a team of experts to be appointed by the Government.

ANNEXURE 1

Water (Prevention and Control of Pollution) Act, 1974

- advise government, plan programs, collect & disseminate information, conduct and participate in research to prevent or control pollution
- inspect plants for treatment of sewage and trade effluents and review plans, specifications or other related data in connection with the grant of consent as required by this Act
- lay down, modify or annul effluent standards for effluents and classify water bodies of the State
- evolve economical methods of treatment of effluents
- perform such functions as may be prescribed or entrusted by the Central Board or the Government
- establish laboratories for analysis of samples of water or effluents

Water (Prevention and Control of Pollution) Cess Act, 1977

- assess water consumption of establishments liable to pay cess and collect cess accordingly

Air (Prevention and Control of Pollution) Act, 1981

- Functions are similar to those under Water Act but related to prevention, control and abatement of air pollution

Environment (Protection) Act, 1986

- implement measures for the protection of environment and take remedial measures to prevent environmental pollution by conducting inspections to check compliance
- carry out investigations to lay down standards, to monitor and to enforce standards
- conduct and furnish report to Ministry on public hearing of projects requiring environmental clearance

Hazardous and other Wastes (Management, & Transboundary Movement) Rules, 2016

- Issue consent to establish to occupiers engaged in handling, generation, collection, storage, packaging, transportation, use, treatment, processing recycling, recovery, pre-processing, co-processing, utilisation, offering for sale, transfer or disposal of the Hazardous and other wastes.
- issue and monitor compliance with 'authorisation' issued for handling generation, collection, storage, packaging, transportation, use, treatment, processing, recycling, recovery, pre-processing, co-processing, utilisation, offering for sale, transfer or disposal of the Hazardous and other wastes.
- Issue passbook to authorised actual user of hazardous and other wastes
- preparation of inventory of hazardous and other wastes
- preparation of inventory of hazardous waste generators, actual users and common and captive disposal facilities
- Monitoring of compliance of various provisions and conditions of permission issued by Ministry of Environment ,Forest and Climate Change for exports and imports
- Examine the applications for imports submitted by the importers and forward the same to Ministry of Environment ,Forest and Climate Change
- Issue approval for design and layout of Treatment, storage and disposal facility for Hazardous and other wastes
- Monitor setting up and operation of the common or captive treatment, storage and disposal facility regularly
- Verify annual returns of the occupier managing hazardous and other wastes and of the operator of the common facility or occupier of the captive facility

- Issue NOC for transportation of Hazardous and other wastes to a final disposal facility in another State
- Furnish annual inventory of the waste generated; waste recycled, recovered, utilized including co-processed; waste re-exported and waste disposed to CPCB

Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989

- enforce directions and procedures on isolated storage of hazardous chemicals, import of hazardous chemicals
- issue of direction to importer to take appropriate safety measures, for stoppage of import and serve improvement notice on persons contravening the rules

Biomedical Wastes (Management) Rules, 2016

- issue and monitor compliance of authorisation issued to institutions generating, collecting, receiving, storing, transporting, treating, disposing and/or handling biomedical wastes
- furnishing annual reports to Central Pollution Control Board

Plastics Waste Management Rules, 2016

- issue and monitor compliance of permit issued to produce, manufacture or recycle plastic carry bags and containers
- issue of authorization to manufacturers and recyclers
- furnishing annual reports to Central Pollution Control Board

Solid Wastes (Management) Rules, 2016

- Monitor environmental standards and adherence to conditions for waste processing and disposal sites.
- Issue authorizations to the local body or an operator of a facility or any other agency authorized by local body stipulating compliance criteria and environmental standards
- Monitor the compliance of the standards as prescribed or laid down and
- treatment technology as approved and the conditions stipulated in the authorization and the standards specified under these rules .
- Directions to local bodies for safe handling and disposal of domestic hazardous waste deposited by the waste generators at hazardous waste deposition facilities.
- Regulate Inter- State movement of waste.
- Monitor the environment standards of the operation of the solid waste processing and treatment facilities.
- Furnish annual report to Central Pollution Control Board
- Grant permission for waste energy process.

Noise Pollution (Regulation and Control) Rules, 2000

- regulate and control noise of industrial origin and monitor ambient sound levels
- advise the State Government on all aspects relating to noise pollution control

Batteries (Management & Handling) Rules, 2001

- ensure compliance with the rules by verifying half yearly returns on sale of new batteries and collection of old batteries
- verify half yearly returns from importer of lead acid batteries and verify annual returns from recyclers of used batteries

- file compliance status to Central Pollution Control Board
- issue registration to dealers

E-Waste (Management) Rules, 2016

- ensure compliance of the Extended producer responsibility plan, producer of electrical and electronic equipments, collection centres, consumer or bulk consumer, dismantler, recyclers with the rules
- issue Consent to Establish to Dismantlers or recyclers, refurbisher
- maintain online register of authorizations granted to manufacturers
- ensure compliance of manufacturers, Dismantlers or recyclers, refurbishers with the rules by obtaining authorisation from State Pollution Control Board
- verify annual returns of Dismantlers or recyclers and refurbishers
- furnishing annual reports to Central Pollution Control Board

Construction and Demolition Waste Management Rules, 2016

- issue and monitor compliance of authorisation issued to the operator for storage and processing or recycling facilities for construction and demolition waste, construction and demolition waste processing facility
- furnish annual report to CPCB.

ANNEXURE 2

Note on Natural Disasters in Kerala

Floods

Floods are the most common of natural hazards that affect people, infrastructure and economy in Kerala. Riverine flooding is a recurring event consequent to heavy or continuous rainfall. Flood plains are vulnerable to inundation and the risk increases if the developmental activities along the river banks are not regulated. The anthropogenic factor that make the risk more is the wrong land use practice such as reclamation and settlement in flood plain areas, loss of vegetation in upper catchments. The reports says that 5642.68 km^2 of the area which is 14.52% of the total area of the state is prone to flood. In Alappuzha district more than 50% of the area is identified as flood prone. These are mostly confined to Kuttand region. The Kole lands of Thrissur district, the coastal tracts of Ernakulam, Malappuram districts and western part of Kottayam district flanking Vembanadlake are other major areas prone to failure. In Wayanad district areas adjacent to Mananthavadi River is categorised as flood prone.

Frequency and loss due to floods in the state seems to be on the rise. Factors contributing to the increase in magnitude of floods are reclamation of wetland and water bodies increase in impermeable built up area, dense network of roads, with impervious surfaces, deforestation in the upper catchment, population pressure and flood plain occupancy has resulted in exposure of life and property to floods. It has been estimated that 38% of total wetland are no longer available to hold the spill water during excess rain in many parts of the state. It is mainly due to heavy rain fall and poor drainage. The drains are often choked due to various reasons and lack of annual maintenance. Flash floods are common in the hill district of Kerala. Most often flash floods are triggered by occurrence of debris flows during intense rainfall conditions.

27 taluks of Kerala is highly vulnerable to riverine flood. Major cities lke Thiruvananthapuram, Kozhikkode and Cochin frequently experience Urban flooding.

The vulnerability to flood hazard can be mitigated through changing or regulating land use, through flood warning and effective emergency response. For controlling flooding in urban area, land use planning and implementation of adequate capacity drainage network is essential. Drainage improvement shall be integrated in to the master plan for water management. Discourage inappropriate development within flood plain.

Landslides

The high land of Kerala experience several types of landslides, of which debris flows are the most common. Between 1961 and 2016 a total of 295 lives were lost in 85 major landslides in the state. The most severe, in terms of fatalities, was the Amboori landslide (Thiruvananthapuram) of 9th November 2011 that resulted death of 38 people. Population of 10 taluks of Kerala is highly vulnerable to landslides in terms of population density. Susceptible area for landslide is calculated as 5607.4 km which is 14.4% of the state's total area. Wayanad and Kozhikkode districts are prone to deep seated landslide while Idukki and Kottayam are prone to shallow landslide. Many of the hill areas are highly prone to landslide because of several natural factors. However the events were accelerated by anthropogenic activities such as deforestation, terracing and obstruction of ephimeral streams and cultivation of shallow rooted trees on

steep slopes. Many settlements are located in a highly vulnerable area. The quarrying practices using high explosives near settlements make the situation worse.

Drought

About 95% of the annual rainfall is confined to a six-month monsoon period between June and November, leaving the remaining six months practically dry. The analysis of rain fall trend over the last 100 years reveals that there is significant (99%) decreasing trends in most of the region of Kerala especially in the month of January, July and November. In the recent past, until 2012, the state had not experienced severe metorological, agricultural and hydrological drought. A 29% deficit in the pre-monsoon season (June to December) in 2012 lead to agricultural and hydrological drought which peaked during the period August 2012 to May 2013. For the first time, Kerala was mapped as mild to moderately arid by IMD in December 2012. Drought happened in some region in March 2010, December 2003. Other known meteorological drought years were 1983, 1986, 1987, 1992, 1997, 1998, 2002 and 2004.

Based on the analysis, it is evident that more than 50% of the land area of the state is moderately to severely drought susceptable.

Natural forests, wetlands and paddy fields in the state served as a natural water harvesting system since ages. With the increase in population and associated developmental pressure. These natural systems are gradually replaced by different agricultural systems. The laterite mounds which are good aquifers are dredged and removed thereby reducing the total surface area to recharge ground water storage. The rice cultivation, which facilitated ponding of water in the low land fields contributing to ground water recharge has declined by 68% for a period from 1970 to 2004 (Economic Review, 2005).

Forest Fire

Natural forest fires are reported in Kerala. It is usually the dry and moist deciduous forests of the state which experience forest fire. From 2009 to 2014, 18,170 hectares of forests land were destroyed by recurring forest fire. Over 500 ha of forest in Idukki experienced forest fire in April 2016. Most of the forest fire occur in the months from March to May.

Lightening

Kerala is prone to high incidence of lightening, especially during months of April, May, October and November. According to the study report of NCESS, Cumulonimbus clouds produce lightening. Typical topography of Kerala favour frequent Cumulonimbus cloud formation especially during the month of April, May, October and November. The mid lands of Kerala are more prone to lightening.

Lightening fatalities in Kerala (2010-14) is 110. It was noted that most of the demised and the injured due to lightening were belonging to poor families. District wise distribution of lightening incidents shows that highest number of fatalities occurred in Malappuram district, Injuries reported from Thiruvananthapuram district and highest number of lightning events are reported from Kannur district. Property damage, agricultural cash crops, due to lightning is also very high in the state.

Coastal Erosion

The 570 km coastal stretch of Kerala is thickly populated land area of the country. The coast line is exposed to high waves, storm surges and Tsunami. The natural phenomenon in turn results in rampant coastal erosion and consequent beach loss. The fact sheet of shore line changes – Kerala, National Assessment of Shore line change published by the MOEF, G.O.1 shows that a major stretch of Kerala coast line is eroding rapidly. Saline water intrusion during summer season due to over exploitation of ground water and tidal effects also affect the coastal community. It causes the shrinkage of dwelling spaces, of the fisherman population and loss of property. The studies revealed that 215.5 km (36.6%) of the total coastal stretch is prone to high erosion. A coastal stretch of 263.7 km^2 is prone to storm surge & Tsunami. About 310 km of the coastal stretch of Kerala is protected by engineering structures such as sea walls rip rap revetments, groynes etc.

Earth Quake

India has been divided in to five seismic zones, Zone I, Zone II, Zone III, Zone IV and Zone V. according the maximum intensity of earth quake expected. The state has been categorised in the earth quake Zone III, where the maximum expected magnitude is 6.5 (Natural hazard and management strategies, compendium, KSCSTE, 2006) The historical as well as recent (post1950) events compiled from various sources record the occurrence of approx. 60 earth quakes (KSCSTE, Environment report, 2007) The studies show that most of the well- defined earth quake have definite spatial association with some known faults/ lineaments.

A large number of micro earthquakes or mild tremors have been recorded many parts of the state. It is well known that almost all the micro tremors have spatial association with lineaments in the vicinity of many river channels.

Major earth quake in the last 20 years was felt in Erattupetta (5M) on 12th December 2000.

Cyclones

Cyclones have not affected Kerala in the recent past. However historical records indicate that high velocity wind due to localised cyclonic or convective systems have caused damage to life and property in the coastal area of the state. Although cyclones have not occurred in the state, Gustnadoes are recurrent. Gust nadoes typically appear as a swirl of dust or debris along the 'gust front' of a thunder storm.

They are most directly linked with notation in the thunderstorm itself and can from a considerable distance away from the parent storm (KSDMA, 2016).

Ground Subsidence

Soil piping or tunnel erosion is the formation of sub surface tunnels due to sub surface soil erosion. They initially start as small conduits but grow into larger one due to sub surface erosion leading to roof collapse and subsidence features on ground surface. Well like features developed on ground surface due to vertical subsidence and will render the fertile agricultural land unproductive. During the last decade many piping incidences were reported from different places of Kerala (NCESS).

ANNEXURE 3

PROCEEDINGS OF THE MEMBER SECRETARY
STATE PLANNING BOARD
(Present: Sri V S Senthil IAS)

Sub: Formulation of 13th Five Year Plan – Constitution of Working Groups – reg.

Ref: Note No. 260/2016/PCD/SPB dated 06.09.2016 of the Chief (i/c), Plan Co-ordination Division, State Planning Board

Order No. 300/2016/AGRI (W8)/SPB **Dated: 19.09.2016**

As per the reference cited, State Planning Board has constituted Working Group on 'Environment' to formulate the draft proposals in the sector for inclusion in the Thirteenth Five Year Plan.

The Working Group on **'Environment'** is hereby constituted with the following members.

Co-chairperson

Sri V S Senthil IAS, Additional Chief Secretary, Department of Environment and Climate Change

Co-chairperson

Dr Ajaykumar Varma, Former Group Head, National Center for Earth Science Studies (NCESS), Thiruvananthapuram

Members

1. Sri K Sajeevan, Chairman, Kerala State Pollution Control Board, Thiruvananthapuram
2. Dr K Vasuki IAS, Executive Director, Suchitwa Mission, Thiruvananthapuram
3. Smt Padma Mahanti IFS, Director, Environment Department, Thiruvananthapuram
4. Dr Kamalakshan Kokkal, Joint Director and Head, Coastal and Environment Division, STEC, Thiruvananthapuram
5. Dr V B Manilal, Senior Principal Scientist, Environmental Technology Division, NIIST, Thiruvananthapuram
6. Dr S Sreekumar, Department of Geology and Environmental Science, Christ College, Irinjalakuda, Thrissur,
7. Dr K M Sreekumar, Professor, Entomology, Horticulture college, Kasargod
8. Dr C . Joy, Rtd. Professor and Consultant, Wins Dale, Cheenikkal, CUSAT P.O, Kochi
9. Dr PS Harikumar – Head, Water Quality Division, CWRDM, Kozhikkode
10. Dr Srikumar Chattopadhyaya – Former Scientist, NCESS, TC 3/1360/2, LIC lane, Pattom, Thiruvananthapuram.
11. Dr D Raghunandan, Centre for Technology and Development, New Delhi.
12. Dr Indira Devi, Professor of Agricultural Economics, Kerala Agricultural University, Trissur
13. Dr GeetanjoySahu, School of Habitat Studies, TISS, Mumbai.
14. Dr Jacob Joseph, Centre for Law and Agriculture, NUALS, Ernakulam.

Convener

Dr P Rajasekharan, Chief (Agriculture), State Planning Board.

Co-Convener

Smt Lijamol M David, Research Assistant, State Planning Board

Terms of reference

1. To review the development of the sector with emphasis as to progress, achievements, present status and problems under its jurisdiction during the 11th and 12th Five Year Plan periods.
2. To evaluate achievements with regard to the plan projects launched in the sector, both by the State Government and by the Central Government in the State during these plan periods.
3. To list the different sources of data in each sector and provide a critical evaluation of these data sources, including measures for improvement.
4. To identify and formulate a set of output and outcome indicators (preferably measurable) for each sector and base the analysis of the previous plans on these indicators.
5. To outline special problems pertaining to the implication of the CRZ norms and suggestions for implementation in the State,

(a) To examine and suggest schemes and measures to mitigate the problem of water pollution at various scales, from local supply to river basins and/or watersheds,

(b) To suggest measures for urgent action to improve general health and well-being through pollution control, especially by curbing specific pollutants including vehicle emissions, excessive sound, and uncleared waste and

(c) To examine and suggest schemes and measures for the supply of reliable scientific information to the public on environment related issues to enable informed stakeholder participation. In this connection, the Working Group may examine the role of various agencies/departments/local self-governments in the implementation of Environment related programmes and assess the present status of education and research in the area of environment in the State.

6. To suggest, in particular, a set of projects that can be undertaken during the 13th Plan period in the sector.
7. The Co-Chairperson is authorised to modify terms of reference with approval of State Planning Board. The Co-Chairperson is authorised to invite, on behalf of the Working Group, experts to advise the Group on its subject matter. The non-official members of the Working Group will be entitled to travelling allowances as are applicable to class I officers of the Govt. of Kerala. The class I officers of GoI will be entitled to travelling allowances as per rules if reimbursement is not allowed from Departments.
8. The working group will submit its draft report by 1st December 2016 to the State Planning Board.

Sd/-
Member Secretary

To

The Person concerned
The Sub treasury Officer, Vellayambalam

Copy to:-

The Accountant General, Kerala (A&E) with C/L
All Divisions, State Planning Board
PS to VC
PA to Member Secretary
Stock file

Forwarded by order
Sd/-
Chief (Agriculture)

PROCEEDINGS OF THE MEMBER SECRETARY
STATE PLANNING BOARD
(Present: Shri VS Senthil, IAS)

Sub: Formulation of 13th Five Year Plan – Constitution of Working Group on **Environment** – Revised order - issued – reg.

Ref: 1.Order No. 300/2016/AGRI(W8)/SPB dated 19.09.2016
2. Email message dated: 24.09.2016

Order No. 300/2016/AGRI(W8-R)/SPB dated 27.09.2016

As per order under reference first cited, State Planning Board has constituted Working Group on **'Environment'** to formulate the draft proposals in the sector for inclusion in the Thirteenth Five Year Plan. Dr D Raghunandan, Centre for Technology and Development, New Delhi is included as one of the Member in the above Working Group.

Dr D Raghunandan as per the reference second cited has requested to change his organizational affiliation as Delhi Science Forum instead of Centre for Technology and Development.

In the above circumstances, revised order is hereby issued by changing organizational affiliation of Dr D Raghunandan as Delhi Science Forum instead of Centre for Technology and Development, in the Working Group on Environment constituted as per reference 1st cited.

Order under reference first is modified to this extend.

Sd/-
Member Secretary

To

The Person concerned
The Sub treasury Officer, Vellayambalam

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Sd/-
Chief (Agriculture)