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Kerala

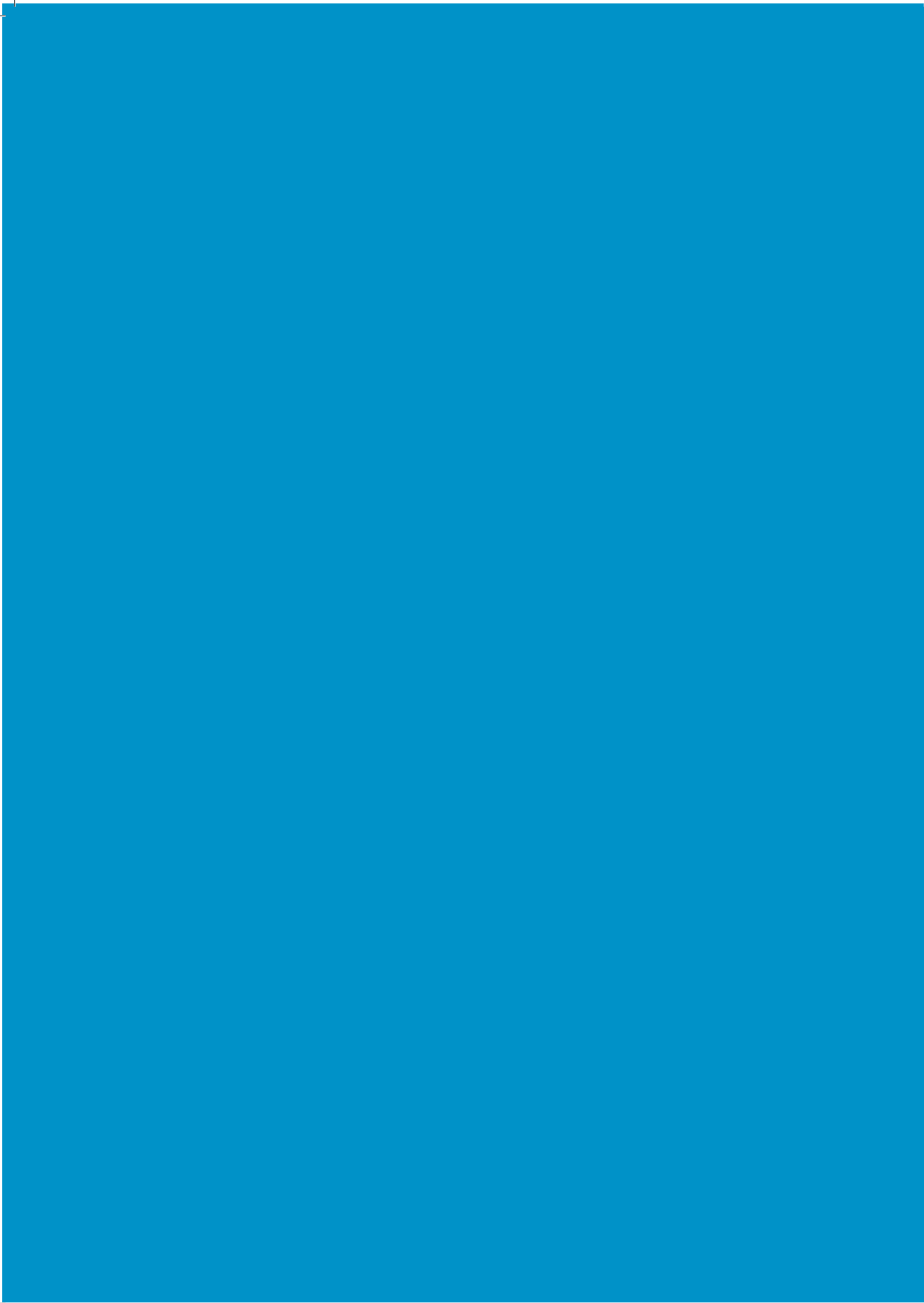
Post Disaster Needs Assessment

Floods and Landslides - August 2018

Executive Summary



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Background

Kerala, with a population of over 3.3 crore, is globally recognised for its impressive achievements in human development. Within India, Kerala ranks first among Indian states on the Human Development Index (HDI). In 2015–16, Kerala was among the top five Indian states in terms of per capita state domestic product and among the top four in terms of growth in per capita income.¹ Many other human development indicators for Kerala are at par with those of developed countries. For instance, the state reported a literacy rate in 2011 of 94%² (as against the national average of 73%), life expectancy at birth between 2011–15 of 75.2 years (the highest among Indian states and higher than the national average of 68.8 years)³, and an infant mortality of 10 per thousand live births (the lowest among Indian states)⁴. The state also reported the lowest proportion of population below the poverty line (7%) as against the national average of 22%.⁵ In 2015–16, 94% of households had access to improved drinking water sources, 98% of them were using improved sanitation facilities, and 99% of the households had electricity.⁶ Human development has also been more equitable in Kerala than in other Indian states. For instance, Kerala is placed first among states in inequality adjusted HDI which indicates the least loss of HDI on account on inequality.⁷

Kerala, however, is highly vulnerable to natural disasters and the changing climatic dynamics given its location along the sea coast and with a steep gradient along the slopes of the Western Ghats. The Kerala State Disaster Management Plan identifies 39 hazards categorised as naturally triggered hazards (natural hazards) and anthropogenically triggered hazards (anthropogenic hazards). Kerala is also one of the most densely populated Indian states (860 persons per square kilometres) making it more vulnerable to damages and losses on account of disasters.

Floods are the most common of natural hazard in the state. Nearly 14.5% of the state's land area is prone to floods, and the proportion is as high as 50% for certain districts. Landslides are a major hazard along the Western Ghats in Wayanad, Kozhikode, Idukki, and Kottayam districts. Seasonal drought-like conditions are also common during the summer months. Kerala experienced 66 drought years between 1881 and 2000.⁸ Dry rivers and lowering water tables in summer have led to water scarcity both in urban and rural areas. Other major natural hazards are lightning, forest fires, soil piping, coastal erosion, and high wind speed. The state also lies in seismic zone III.

Disaster Event

Between June 1 and August 18, 2018, Kerala experienced the worst ever floods in its history since 1924. During this period, the state received cumulative rainfall that was 42% in excess of the normal average. The heaviest spell of rain was during 1–20 August, when the state received 771mm of rain. The torrential rains triggered several landslides and forced the release of excess water from 37 dams across the state, aggravating the flood impact. Nearly 341 landslides were reported from 10 districts. Idukki, the worst hit district, was ravaged by 143 landslides.

¹ Ministry of Statistics and Programme Implementation, Government of India accessed at mospi.nic.in/sites/default/files/press...statements/State_wise_SDP_31_03_2017.xls

² Census of India 2011, Registrar General of India

³ Office of the Registrar General of India, Ministry of Home Affairs cited as Table 9.1 in the Economic Survey 2017–18, Ministry of Finance, Government of India accessed at <http://mofapp.nic.in:8080/economicsurvey/>

⁴ Sample Registration System accessed at http://www.censusindia.gov.in/vital_statistics/SRS_Report_2016/8.Chap%204-Mortality%20Indicators-2016.pdf

⁵ Press Note on Poverty Estimates 2011–2012, Government of India, Planning Commission, 2013, http://planningcommission.nic.in/news/press_pov2307.pdf

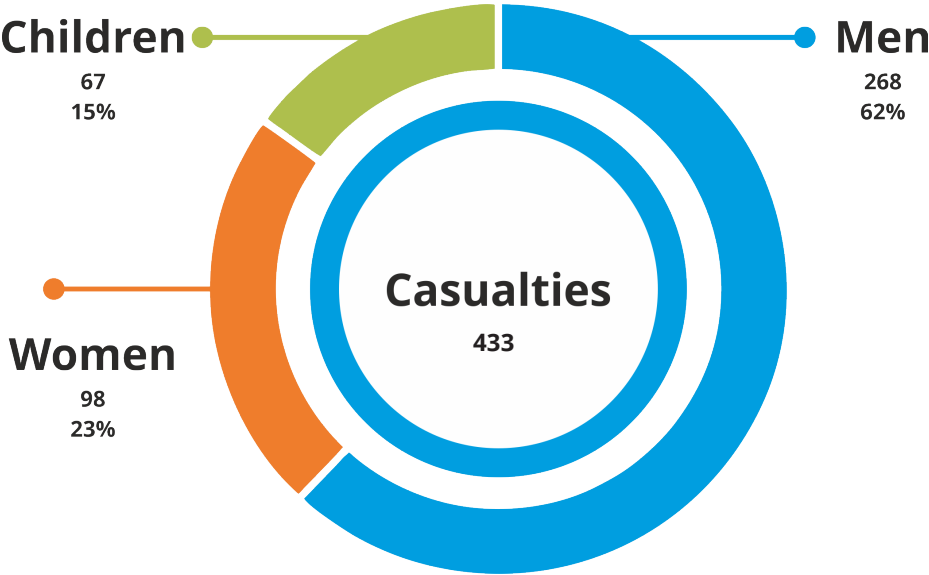
⁶ National Family Health Survey -4 2015–16 State Fact Sheet: Kerala accessed at http://rchiips.org/nfhs/pdf/NFHS4/KL_FactSheet.pdf

⁷ Inequality Adjusted Human Development Index for India's States, M.H. Suryanarayana, Ankush Agrawal and K. Seeta Prabhu, UNDP, http://www.undp.org/content/dam/india/docs/inequality_adjusted_human_development_index_for_indias_state1.pdf

⁸ Page 46, State Disaster Management Plan



Figure 1
Disaggregated Data on Casualties



Source: Kerala State Disaster Management Authority

According to latest reports of the state government, 1,259 out of 1,664 villages spread across its 14 districts were affected.⁹ The seven worst hit districts were Alappuzha, Ernakulam, Idukki, Kottayam, Pathanamthitha, Thrissur, and Wayanad, where the whole district was notified as flood affected. The devastating floods and landslides affected 5.4 million people, displaced 1.4 million people, and took 433 lives (22 May–29 August 2018) (Figure 1).

Immediate Response and Relief Operations

The state government responded swiftly with rescue and relief operations and saved many lives by rapidly mobilising the following national forces:

- Kerala Fire and Rescue Services: 4,100 individuals and the entire rescue equipment deployed
- National Disaster Response Force (NDRF): 58 teams, 207 boats
- Army: 23 columns, 104 boats
- Navy: 94 rescue teams, one medical team, nine helicopters, two fixed wing aircrafts and 94 boats
- Coast Guard: 36 teams, 49 boats, two helicopters, two fixed wing and 27 hired boats
- Air Force: 22 helicopters from Air Force and 23 fixed wing aircrafts
- Central Reserve Police Force: 10 teams
- Border Security Force: Two companies and one water vehicle team.

In addition, the fishing community of the state rendered phenomenal voluntary assistance towards search and rescue in the flood affected areas. Nearly 669 boats

⁹ Government order No. (P)No.05/2018/DMD dated Thiruvananthapuram, 29.09.2018

that went out with 4,537 fishermen are estimated to have saved at least 65,000 lives.

The Government of India announced an additional assistance of INR 600 crore (USD 85 million)¹⁰ which included ex gratia payment of INR 2 lakh (USD 2,800) per person to the next kin of the deceased and INR 50,000 (USD 700) per head to those seriously injured. The Ministry of Rural Development sanctioned an additional INR 1,800 crore (approximately USD 260 million) under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) for 2018–19 for 5.5 crore person days of work.

Relief assistance was provided to people in camps including immediate food supplies (rice, wheat, and pulses), drinking water, kerosene and other life-saving items. Food packets and assistance of INR 10,000 per family to clean inundated houses were also disbursed.

Disaster Effects and Impacts

The devastating floods and landslides caused extensive damage to houses, roads, railways, bridges, power supplies, communications networks, and other infrastructure; washed away crops and livestock and affected the lives and livelihoods of millions of people in the state. Early estimates by the government put recovery needs at about USD 3 billion; however, it was felt that a comprehensive assessment of damage, loss, and needs would amount to much more.

The PDNA estimates the total damages to be around INR 10,557 crore and total losses to be around INR 16,163 crore amounting to a total disaster effects of around

¹⁰ A conversion rate USD 1 = INR 70 is assumed everywhere in this report.



Table 1

Sector-wise Summary of Disaster Effects (Damage and Loss) and Recovery Needs

Sector	Damage	Loss	Total Effect (D + L)		Total Recovery Needs	
	INR Crores	INR Crores	INR Crores	USD Million	INR Crores	USD Million
Social Sectors						
Housing, Land and Settlements	5,027	1,383	6,410	916	5,443	778
Health and Nutrition	499	28	527	75	600	86
Education and Child Protection	175	4	179	26	214	31
Cultural Heritage	38	37	75	11	80	11
SUB-TOTAL	5,739	1,452	7,191	1,028	6,337	906
Productive sectors						
Agriculture, Fisheries and Livestock	2,975	4,180	7,155	1,022	4,498	643
SUB-TOTAL	2,975	4,180	7,155	1,022	4,498	643
Infrastructure sectors						
Water, Sanitation and Hygiene	890	471	1,361	195	1,331	190
Transportation ^{a,b,c}					10,046	1,435

Sector	Damage	Loss	Total Effect (D + L)		Total Recovery Needs	
	INR Crores	INR Crores	INR Crores	USD Million	INR Crores	USD Million
Power ^{b,c}					353	50
Irrigation ^{b,c}					1,483	212
Other infrastructure ^{b,c}					2,446	349
SUB-TOTAL	890	471	1,361	195	15,659	2,236
Cross-cutting sectors						
Environment	26	0.04	26	4	148	21
Employment and Livelihoods	881	9,477	10,358	1,480	3,896	557
Disaster Risk Reduction	17	583	599	86	110	16
Gender and Social Inclusion	0.9	0	0.9	0.13	35	5
Local Governance	28	0	28	4	32	5
SUB-TOTAL	953	10,060	11,013	1,574	4,221	604
TOTAL (A)	10,557	16,163	26,720	3,819	30,715	4,389
Integrated Water Resources Management (B)	0	0	0	0	24	3
GRAND TOTAL (A+B)					30,739	4,392
GRAND TOTAL (ROUNDED OFF)					31,000	4,400
^a Recovery costs for roads from urban and rural infrastructure sections are included						
^b In Rapid Damage and Needs Assessment, the cost of damage and loss has not been quantified						
^c Estimates taken from the World Bank–Asian Development Bank Joint Rapid Damage and Needs Assessment (JRDNA)						
Note: Figures are rounded and so column totals may not add up precisely						

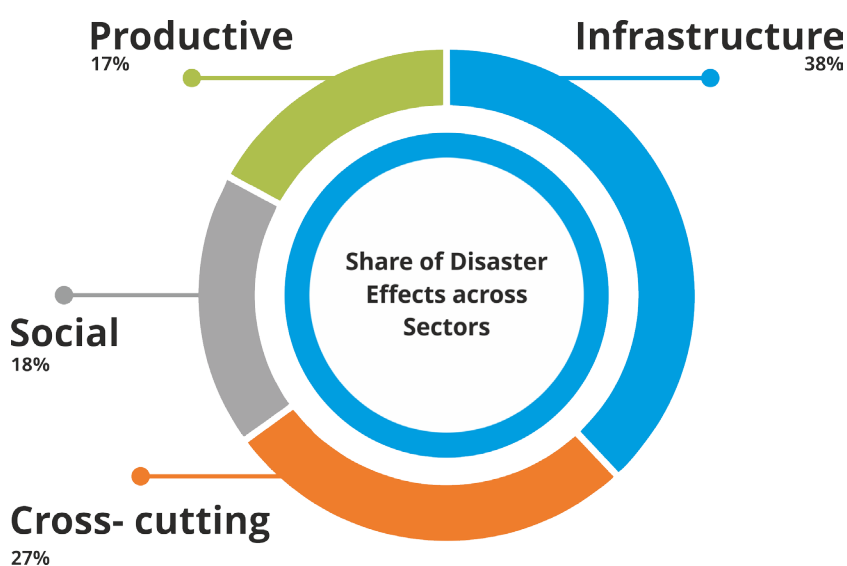
INR 26,720 crore (USD 3.8 billion) without including the damage estimates from the Joint Rapid Damage and Needs Assessment (JRDNA) conducted by the World Bank and the Asian Development Bank (ADB). The total estimated damage does not include damages to private buildings and properties including shops, showrooms, business units, private hospitals/educational institutions and private vehicles. It does not take into account losses incurred by private traders and business units and also damage, and loss suffered by Kochi airport, road transport and waterways. The total damage and loss now estimated at INR 26,720 crore in this report would be much higher, if these were included.

The total recovery needs are estimated at INR 31,000 crore (USD 4.4 billion) including the recovery needs estimated by the JRDNA (Table 1). The assessment, done across social, productive, infrastructure and cross-cutting sectors, estimates both private and public loss.

The share of estimated total disaster effects among the main sectors of social and

economic activity reveals that the most affected are the infrastructure sectors (38% of the total effects), which includes transportation, and water, sanitation and hygiene along with power, irrigation, and other infrastructure sectors. This is followed by the cross-cutting sectors (27%), social sectors (18%), and productivity sector (17%) (Figure 2).

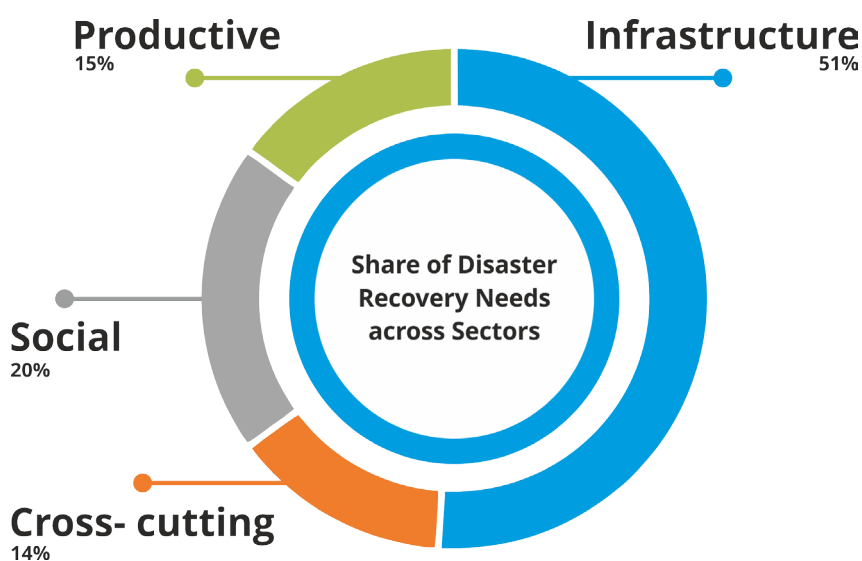
Figure 2

Share of Disaster Effects across Sectors

Source: Based on Table 1

The share of estimated recovery needs among the main sectors of social and economic activity reveals that infrastructure sectors have highest recovery needs (51% of the total recovery needs), followed by the social sectors (20%), productive sectors (15%) and cross-cutting sectors (14%) (Figure 3).

Figure 3

Share of Disaster Recovery Needs across Sectors

Source: Based on Table 1

Human Impact Assessment

Close to 14 lakh people had to be evacuated to relief camps during the floods as their homes were inundated with flood water. Thousands of people also took shelter with relatives and friends. Access to piped water was disrupted for 20% of the state's population (67 lakh people). An estimated 3,17,000 shallow wells were damaged and contaminated in six worst affected districts¹¹ directly affecting 14 lakh people. Over 95,000 household latrines were substantially damaged affecting nearly 4 lakh people.¹²

Over 1.75 lakh buildings have been damaged either fully or partially, potentially affecting 7.5 lakh people. More than 1700 schools in the state were used as relief camps during the floods. Most of the camps closed after 10 days. Floods affected teaching and learning in almost all the districts with institutions being closed from 2 to 23 days. A total of 1613 schools have been affected by the floods. Some schools in Alappuzha were closed for more than a month.

However, even when the schools reopened, the attendance was as low as 20% in many schools. Students are also not attending school owing to trauma and stress because of loss of family/friends and large-scale damage to their homes or neighbourhood. Students, particularly from class X and XII are anxious because of loss of books and notes which may affect their learning. The PDNA sector team reports that there is a danger of children, especially girls dropping out of school unless steps are taken to make the school safe again. Trauma and stress, if left unattended, could affect learning outcomes of the children and have even impact their adult lives adversely.

Although there was no epidemic outbreak following the floods, health impact was substantial as close to 332 health facilities were fully or partially destroyed. Furthermore, 61 ayurveda institutions and 59 homeopathic institutions were damaged as a result of the floods.

Among the worst affected were workers in the informal sector who constitute more than 90% of Kerala's workforce.¹³ It is estimated that nearly 74.5 lakh workers, 22.8 lakh migrants, 34,800 persons working in micro, small and medium enterprises, and 35,000 plantation workers (majority being women), have been displaced from employment. Thousands of casual workers and daily wage earners such as agriculture labourers, workers in the coir, handloom, and construction sector and in the plantations have experienced wage loss for 45 days or more.

Interviews at relief camps revealed that families in Kerala were paying an enormous non-quantifiable emotional price in the aftermath of the floods in the form of shock, psychosocial damage, distress, trauma, and insecurity from loss of home, livelihood, assets, possessions, and most importantly death of close friends and relatives. Besides loss due to fatalities and destruction of homes, people were grieving over the loss of precious jewellery, family photographs, and religious objects. The loss of essential documents including birth certificates, graduation certificates, ration cards, and land records was adding to the stress burden significantly.

Macroeconomic Impacts

Kerala has suffered huge economic losses on account of the floods. According to a conservative estimate, close to 2.6% of Kerala's gross state domestic product (GSDP) got washed away by the floods instantly. The damage to agriculture and allied activities was immense. It included damage to crops not only in flood hit areas but also in other areas due to incessant rains followed by high temperatures leading to destruction of seasonal crops and reduction in yields of tree crop. The estimated



¹¹ Additional Memorandum on Kerala Floods by State Relief Commissioner, Disaster Management, Government of Kerala, p. 32

¹² Suchitwa Mission Damage Assessment – 13.09.2018

¹³ Kerala State Planning Board, "Economic Review 2016" accessed at http://spb.kerala.gov.in/EconomicReview2016/web/chapter03_08.php

loss in primary sector alone is INR 26,850 crore.

Many small traders suffered loss of stocks held in anticipation of Onam sales. While some of them are regular GST assesseees, there are others who have opted for the composition scheme. The former category faces a serious problem. They had already paid input tax on their stock and had the right to claim credit for the same when the output was sold and return filed remitting the output tax collected. Since the stock for which they had paid input tax has been damaged in the floods, the input tax paid by them has become irrecoverable. The Government of Kerala could consider compensating the business community without changing the GST procedure and GSTIN platform by (i) starting with the valuation of individual loss and determination of compensation, (ii) developing a compensation package for the loss (both direct and consequential loss); and (iii) offering subsidised finances to business persons.

These losses and damages are likely to slow down Kerala's economic growth. According to conservative estimates, Kerala's growth rate could slip by around 1.2% in 2018–19. This loss could however be mitigated by the multiplier effects of an increase in (i) public expenditures and (ii) private consumption expenditures on account of remittances.

The loss of income and slowing down of economic growth are likely to reduce revenue collections. At the same time, public expenditures on disaster relief, reconstruction, and recovery are likely to rise substantially. It is estimated that, without factoring in additional resource mobilisation, the revenue deficit could rise to INR 31,332 crore, which would be nearly two-and-a-half times the budget estimate of INR 12,860 crore for 2018–19 before the disaster.



The state needs to have a medium-term expenditure restructuring plan (for the next five years) so as not to deviate from the fiscal consolidation path for a longer period. The state should target containing the revenue expenditure growth to close to 14% annually while maintaining growth of revenue receipts at 17% per annum after the liability for post-flood rehabilitation and reconstruction has been completed. A detailed plan would have to be envisaged to reach these targets.

Nava Keralam: Building a Green and Resilient Kerala

Nava Keralam is the government's vision of converting the crisis into an opportunity by more explicitly embedding the idea of building a green and resilient Kerala into the Approach Paper to the Thirteenth Five-Year Plan, the Disaster Management Policy, the State Water Policy, and the Gender Equity and Women's Empowerment Policies of Kerala.

The recovery policy framework for building a Green Kerala committed to: (i) the Chief Minister's vision of a Nava Keralam (New Kerala), and (ii) the concept of 'build back better and faster' rests on four pillars:

- Pillar 1: Integrated water resources management (IWRM)
- Pillar 2: Eco-sensitive and risk-informed approaches to land use and settlements
- Pillar 3: Inclusive and people centred approach
- Pillar 4: Knowledge, innovation, and technology

Pillar 1: Integrated Water Resources Management

At its core, IWRM calls for internalising the themes of 'room for the river' and 'living

with water'. It emphasises cross-disciplinary coordination of water, land, and related resources in a river basin, watershed or catchment to achieve long-term sustainability. With IWRM in place, it is possible to make proper plans for water safety and water security based on actual and planned land use resulting in multiple basin plans. Coordinated land and water use demands inter-sectorality at the level of policy, planning, and implementation. IWRM aims to break existing inter-sectoral barriers to establish a holistic framework for coordination. This is in line with the State Water Policy's directive to 'revamp the present piecemeal approach, which is mostly based on engineering solutions'.

River basin management with a 'room for the river' approach emphasises ecological conservation and restoration. This approach aims to lower flood levels in the rivers by increasing the wet areas of the rivers, giving them more room and space. Upstream river basin management with a focus on the conservation of forests assumes particular significance as all the short, fast-flowing, monsoon-fed rivers originate in the Western Ghats that have witnessed serious forest degradation. Equally important is the issue of coastal zone management.

An important prerequisite for IWRM is the availability of sufficient and reliable data and state of art hydrological models to support environmental and social impact assessments including mitigating measures to arrest environmental deterioration. This needs to be accompanied by a process of citizen education and democratic dialogue, such that the need for integrated water resource planning is communicated and appreciated at all levels.

Recommendations for recovery centre around protecting natural river flows and giving room to the river—concepts that inform the citizen education programmes. Preparation of basin-wide master plans linking upstream, and downstream zones should be prioritised.

Pillar 2: Eco-sensitive and Risk-Informed Approaches to Land Use and Settlements

An eco-sensitive and risk-informed approach needs to ensure that buildings are reconstructed using disaster resilient techniques, at the right location, away from flood plains and slopes. According to the Kerala State Disaster Management Policy, physical reconstruction must take into account the hazards of the particular location, resources and capacities people involved in the rebuilding, and the adoption of designs that offer resilience against floods, cyclones, earthquakes, and droughts.¹⁴

Additionally, for designing 'green buildings' to make Kerala a green state, it needs to capitalise on its experience and capacity to deploy alternative construction technologies with low carbon footprint including expertise drawn from Laurie Baker, Habitat Technology Group, Centre of Science and Technology for Rural Development (COSTFORD), People's Movement for Sustainable Architecture, and government sponsored Nirmiti.¹⁵

The reconstruction of houses and public building using appropriate technologies offers a major opportunity for the skilling and green job creation in the sector. It is recommended that an Integrated Strategic Environmental Assessment be applied to mitigate the negative impact of the surge in construction activities. This approach developed by the UN Environment has been implemented during the post-conflict reconstruction of Sri Lanka and the post-disaster reconstruction of Nepal.

Pillar 3: Inclusive and People-Centred Approach

The recovery strategy for Nava Keralam will be premised on comprehensive vulnerability mapping (including inter-sectional vulnerabilities) to inform all stages



¹⁴ Government of Kerala, Kerala 2000 State Disaster Management Policy, Kerala State Disaster Management Authority

¹⁵ There are about 40 such organisations working on alternative housing technologies in Kerala. If each of these organisations is entrusted with the task of constructing 500 houses, the required 18,000 houses can be constructed within the next six months, i.e. before the next south-west monsoon.

of disaster recovery. During the recent rescue and relief operations, the extreme vulnerabilities of the elderly and persons with disabilities in the state became conspicuous. It was realised that the requirements of excluded groups need to be prioritised across all aspects of disaster mitigation and resilience building—early warning systems, relief operations, design and construction of buildings and community infrastructure, psycho-social interventions, livelihood enhancement measures and so on.

Mechanisms should be instituted for including the socially excluded in all aspects of the recovery strategy. Additional livelihood opportunities should be offered to women while simultaneously reducing their care burden by extending the working hours of anganwadi centres and setting up day care homes for the elderly. It is recommended that the MGNREGS be used to fill in the livelihood deficit in the aftermath of the floods. Furthermore, there should a focus on re-skilling of women and workers from scheduled castes and tribes, so as to engage them in climate-resilient agricultural work and natural resource protection under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) 2005.

Men and women should be given joint title deeds for the newly constructed homes and proactive measures should be taken to include people who are conventionally excluded by the state's social security programmes such as migrant workers and transgenders.

Strengthening the grama sabha, concurrent monitoring social audit and redress of grievances should be made an integral part of all programmes aimed at recovery.



Pillar 4: Knowledge, Innovation, and Technology

Knowledge, innovation, and the appropriate technology are vital in addressing the sustainable development and climate change challenges that Kerala faces. The Kerala floods illustrated the potential of information technology in both rescue and relief operations. The web-based application keralarescue.in as well as the use of social media including WhatsApp by voluntary groups and government officials helped to identify victims, camp locations, requirements in the camps, volunteer registration, and facilitate both rescue and relief operations. In many locations, these WhatsApp locations functioned as virtual 'control rooms'. Social media was also used to mobilise thousands of volunteers for one-time cleaning operations. Web-based applications were also used to assess damages to houses and buildings (Rebuild Kerala app), forming the basis for compensation packages, as well as to mobilise financial resources for recovery through the Chief Minister's Disaster Relief Fund portal. Information technology can also be used to re-coup lost documents, geo-tag beneficiaries, conduct social audits and help with redress of grievances.

The magnitude of the floods and landslides has underscored the need for research and knowledge generation activities. While downstream conditions hampered discharge of water, flooding was also a result of inappropriate human interventions in the middle and upper parts of river basins. There is a need therefore, for research on the role of deforestation, quarrying, unscientific road construction, slope modification, sand mining from river beds, construction on stream channels, narrowing and blocking of drainage channels and so on, in aggravating landslides and flooding. Such research outcomes can inform land-use maps for recovery and reconstruction projects, in particular road construction, location of hospitals and schools, and also for regular development planning.

The availability of state-of-the-art geographic information system (GIS) technologies facilitates the creation of such maps, as well as in their dissemination to local government agencies. Given Kerala's decentralised governance architecture,

there is a need to enhance the knowledge base of local government with such maps, at appropriate scales, to improve understanding at the micro-level of the interconnectedness of risk factors and their cumulative impact. This understanding also needs to be imparted to citizens through grama sabhas and other forums. The student community and the youth, who proved their ability to respond to the crisis, need to be roped in as agents of knowledge generation and dissemination.

Knowledge generation and effective dissemination can help in early warning and risk information communication to the last mile. Knowledge generation and innovation also assume critical importance in the production of green technologies particularly in the context of housing and sanitation, as well as in expanding the scope of livelihood activities that carry a low carbon footprint.

Essential Building Blocks

Priority actions areas to build a green and resilient Kerala are:

Reviewing Land Use Patterns: Profitability of farming in Kerala has been adversely affected by the fragmentation of agricultural lands, dramatic reduction in land used for paddy cultivation, rising agricultural wages and globalisation of supply chains. The recovery period offers an opportunity to create a new land-use policy which enables the re-deployment of available land to maximise its natural ecosystem functions. Paddy lands could be conserved and managed as wetlands for ground water recharge, biodiversity conservation, and greenhouse gas emission reduction. It will also be possible to acquire and use land for ecosystem services such as biodiversity conservation and disaster risk reduction (DRR).

Changing Consumption Patterns: Fuelled by remittances and growing incomes, Kerala's environmental footprint of consumption transcends state or even national boundaries. The government can and should systematically analyse its consumption pattern and see how its environmental footprint both locally and outside the state can be controlled and minimised. Kerala should aspire to become not only 'locally' green but should also begin to care about environmental destruction everywhere.

Sustainable Building Guidelines Kerala should reverse the trend of constructing 'modern' buildings that are not suitable for local weather conditions and encourage high energy consumption. Instead, it should adopt a locally 'sustainable building guidelines', similar to the one in the United Kingdom, whereby each building is systematically analysed for its carbon footprint based on its construction and operation. Use of material locally available is maximised and need for energy for cooling and lighting is minimised. This will also create thousands of new 'green jobs' in the state.

Maximise Use of Solar Energy: Given the potential for solar energy generation round the year, Kerala should aspire to be fully solar powered at least in housing, offices, and commercial establishments by 2030. As an interim measure, the government may stipulate that all new building construction, including buildings with aluminium roofs, have built in solar panels. Similar guidelines have been created in France which has much less potential for solar energy generation.

Green Technology Centres: Every household in Kerala has many opportunities to apply green technologies in household composting, domestic sewage management, solar energy, and resource recycling. Young people from villages can be trained in green technology installation and maintenance and hired at 'green technology centres' developed as cooperative societies in villages. In addition to improving environmental quality, these centres can create thousands of high skilled jobs in the community.



Environment and Natural Resource Managers: Even though environmental guidelines exist for quarrying or sand mining, there is no local capacity to implement them. Kerala can be the first Indian state to employ an Environment and Natural Resources Manager in every local government body to map the valuable natural resources within the jurisdiction of the local body (rivers, ponds, streams, hills, sacred groves etc.) and advise the local administration on how they can be managed effectively.

Integrate Solid Waste Management Centres: Solid waste management in Kerala is not modern or well managed. Currently solid waste management is the responsibility of the local government bodies. However, they are unable to exercise this mandate correctly due to shortage of funds and expertise. It will be more appropriate to look at it as a state-wide issue and see what waste streams would need centralised solutions (waste-to-energy plants, incinerators, or landfills), which waste streams could be locally managed (household level, ward level composting etc.), and which waste streams should be addressed by extended producer responsibility.

Greening the Tourism Sector: Revenues from tourism, if used creatively, can bring in funds and reasons for maintaining environmental resources in a better manner. Management of solid and liquid wastes, for instance, is a major issue in most places of tourist attraction. A comprehensive approach to greening the tourism sector, including an eco-tax for tourists could be a major step towards making Kerala's tourism green. Similar measures could also apply to major pilgrim destinations.

Creating Green Jobs: Making Kerala a 'green state' could create new jobs locally, and also make the state a hub for green technology advisory services nationally and internationally. To give one example, the Cochin International Airport Limited is the first international airport in the world to go fully solar. Such expertise can be built in many other areas including waste management, ecotourism, and organic farming. Kerala should not just aspire to be a green state, but also a provider of such expertise to the rest of the world.

Climate Change Resilience: Improving climate literacy and promoting decentralised action for adaptation and mitigation are critical for building climate change resilience. Every local government should have a climate change adaptation plan and private individuals should be educated on the climate footprint of their personal actions from the food they eat to the mode of transport they use and the lifestyle choices they make. Kerala, with the highest forest cover of 52.3% among big states in India and increased focus of local self-governments on climate change adaptation, can emerge as a world leader in community-based climate resilience actions.¹⁶

Innovations for Greening Kerala

The PDNA has identified several innovative ideas across sectors for the greening of Kerala as it starts building back better and faster.

Integrated Water Resource Management: Learning from the international best practice of water resource management from the Netherlands, Kerala can promote best practices like 'room for the river', 'living with water', and 'building with nature'. An analysis of the sector proposes that the state should launch a Hydrological Crash Programme for collecting available data using state-of-the-art hydrological software and build a hydrological model for a pilot basin. The government should also prepare a master plan for the Kuttanad area, start an awareness programme on living with water in flood prone areas, and set up a Kerala Water Partnership to organise dialogues and promote communication for behaviour change.

Housing, Land, and Settlements: In line with the state government's vision of a 'Nava Keralam', the reconstruction processes envisage an eco-sensitive approach using

¹⁶ MOEFCC (2018), *India State of Forest Report 2017*, Ministry of Environment, Forest, and Climate Change, Government of India.

construction technologies based on local materials, fulfil the aspirations of the public, reduce the carbon footprint, and create more local green jobs. To achieve this, it is proposed to set up 70 housing facilitation centres to assist the house-owners choose designs appropriate to the location, procure materials and provide technical support to construct houses. Over 17,000 houses will be reconstructed and 2.17 lakh dwelling units repaired over a period of three years. Nearly 2,800 masons will be trained in disaster resilient construction technologies and 140 units of small scale building materials production centres will be established to rebuild and repair the 2.17 lakh houses that were affected by the floods and landslides. In the long term, it is proposed to review the existing building codes and bylaws for urban and rural areas. Kerala could emerge as the pioneer state to develop separate guidelines for construction on highlands and slopes for inclusion in the National Building Code.

The recovery strategy proposes to empower the Local Self Government Department (LSGD) offices to facilitate the adoption of risk resilient housing designs. The LSGD will also function as a regulatory body, guiding house-owners on appropriate structures for specific sites. It will work in close coordination with the Livelihood Inclusion and Financial Empowerment (LIFE) Mission.¹⁷

Health: Kerala is encouraged to transition to a 'safe and green hospital' concept through the allocation of adequate resources to health facilities that are most at ecological or hazard risk. Multiple gains are possible by integrating DRR with low carbon energy use, water conservation, sustainable consumption, and environmental protection. The green hospital approach could be extended beyond the 482 damaged allopathy hospitals to the reconstruction of the 1219 anganwadi centres. In the short-term, the recovery plan is to target life-saving interventions through curative and preventive approaches. The emphasis in the medium term is on improving health care access by restoring health facilities, improving capacities of the health workforce, and promoting DRR. The long-term plan is to promote ongoing health sector reforms, strengthen health facilities, and the health information system.

Education: The education sector proposes green schools that create a healthy environment conducive to learning and environmental protection. Efforts will be made to strengthen existing biodiversity parks in all schools and develop green-building infrastructural designs for schools and educational centres suitable to the topography, climate, and local conditions. About 1767 schools, education centres and child care institutions affected will be repaired and reconstructed. About 1990 school toilets will be repaired. The recovery and reconstruction strategy will focus on ensuring uninterrupted continuation of education service delivery. School buildings will be constructed or refurbished keeping in mind the notion of green and safe schools.

Medium term needs in the sector will be dominated by the reconstruction of damaged buildings and allied services. It is proposed that specially designated medical facilities for children with special needs be established in the community health centres. The Department of General and Higher Education will establish timelines for educational institutions to complete basic infrastructural reconstruction as per the Kerala Education Rules, 1958. It is suggested that steps be taken to strengthen existing disaster preparedness strategies and develop new ones. Children's Committees and Home Committees should be established and local governments should receive support for drawing up timelines for building back safe and violence free schools with participation from the community and the children.

¹⁷ The LIFE Mission of the Govt of Kerala aims to provide safe housing to nearly 4.30 lakh of homeless persons and households living below the poverty line within a period of five years.

Cultural Heritage: Kerala's cultural heritage has suffered four types of damage and loss: monetary loss, an indirect loss of income to the state and the sector, socioeconomic utility loss to thousands of tourists, pilgrims and local residents, and the location-specific tangible as well as intangible damage and loss. In the short term, focus will be on debris clearance, de-silting and repairs for quick resumption of livelihoods. In building back better for tangible, intangible, and movable heritage, it is proposed that Kerala will (i) introduce damage prevention measures on archaeological sites and develop risk management plans for built heritage sites; (ii) involve local communities in the recovery process; (iii) adopt a holistic approach in dealing with damaged structures and use eco-friendly material and resources; (iv) use traditional vernacular principles that respect nature, and are climate conscious and user-friendly; (v) establish a state level inventory of intangible cultural heritage; and (vi) develop databases for storing and documentation.

Agriculture, Livestock, and Fisheries: The recovery vision for the sector is to develop sustainable, responsible, integrated, inclusive, eco-friendly, and resilient agriculture (crop, livestock, fisheries/aquaculture) consistent with the policies of Government of Kerala and Government of India. In the short term, focus will be on restoration of the three subsectors, through the provision of inputs and restocking, replacement or repair of assets and infrastructure, reviving economic activity, strengthening farmers' capacity, and finding alternative income sources for the population. Special efforts will be made to target the most affected population irrespective of gender or age.

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The sector recovery priorities in the short term are to address immediate needs by restoring crops production through land clearance, preparing the paddy land and sowing, bailing out water and planting paddy, distribution of agro-inputs, land preparation, clearing existing drainage systems, and restoring farm machinery and equipment. In the medium to long term, further resources will be required for restoring the crop economy, soil health, and plant protection monitoring. In the case of livestock, short term measures will be taken to improve the provision of feed and fodder and veterinary drugs. In the medium to long term, further resources will be required for restoring the livestock economy, promoting traditional breeds, developing area specific action plans for natural calamities, strengthening value chain systems, and developing veterinary healthcare centres. For the recovery of fisheries, short term focus will be on the revival of aquaculture and fisheries system, immediate mitigation measures, and the cleaning of water bodies. In the medium term, it will be necessary to strengthen the Kerala Inland and Aquaculture Act, develop fisheries co-management, systematic management of aquafarms, insurance compliance, and de-siltation of water bodies.

It is proposed that Kerala adopt an integrated flood resilient approach and community-based water resource management practices. The state should develop early warning systems and effective communication with enhanced GIS/tech-backed capabilities. Traditional drainage systems should be protected and developed. Efforts should be made to enhance and reinforce integrated farming systems, and promote ecologically and environmentally sustainable integrated agriculture.

Water, Sanitation and Hygiene: The damage and loss in the water, sanitation, and hygiene (WASH) sector is across water supply, sanitation, and solid waste management. The immediate needs are the repair and restoration of damaged infrastructure, debris clearance, improving shallow wells, raising awareness on the need to upgrade wells, and strengthening the water quality surveillance systems. The long term vision of the state government is to overhaul the infrastructure in the sector ensuring wider access of water supply services and move to Open Defecation Free status.

Cross-Cutting Themes:

Environment and Climate Change: The recent disasters demonstrated the link between environment and disaster risk. While the floods cannot be exclusively attributed to climate change impact, climate change predictions do indeed forecast increases in rainfall intensity in Kerala in the years to come. Furthermore, coastal cities in Kerala are prone to waterlogging and flooding due to increased water inflow as well as sea level rise. The agriculture and related activities in Kuttanad, which is a below sea level area, are expected to be severely affected by climate change. So, regardless of whether the present event is linked to climate change, the floods of 2018 and the tropical cyclone Okhi before that serve as warnings about the extreme events which Kerala may expect more frequently in a world with changing climate. Therefore assessment of vulnerabilities and actions in climate change adaptation and mitigation should be integral to the 'New Kerala' being envisaged in the post-disaster setting.

In addition to the environmental issues created by the disaster in its wake, the recovery strategy must address the underlying problems of environmental degradation and abuse that exacerbated the impact of the floods through a 'comprehensive post-disaster environmental assessment'. Conscious effort will be made to minimise the environmental footprint of post-disaster reconstruction. Kerala should adapt international best practices in managing asbestos, and develop a comprehensive plan to raise awareness about the adverse health impact of asbestos and increase local government capacity to deal with it. It is proposed that the state establish a comprehensive plan for regular monitoring of all its water bodies (both in terms of quality as well as quantity). Approaches such as 'room for the river' and 'making space for water' may be adopted to enhance flood protection instead of creating dams and embankments. Removal of sand deposited in rivers and river banks should be undertaken only after site-specific studies have been conducted and expert suggestions taken on board.

Employment and Livelihoods: The idea of 'build back better' needs to be rooted in environmental sustainability, cost effective technologies, green job creation, skill development, climate resilient livelihoods via decentralised planning, and social-cum-gender inclusion. Kerala should create 'green jobs' (with low carbon footprint than at present) based on the principles of environmental sustainability and cost effectiveness. Skill development would be a critical component in the recovery period and beyond. Kerala's ecological endowments along with its habitat pattern provide a solid foundation for much of its economic activities—agriculture, livestock, fisheries, agro-processing industries, sourcing construction materials, water transport, or the much acclaimed tourism. In the short and medium term, the government can consider creating emergency employment through cash-for-work and other quick employment projects, developing special compensation packages for Kudumbashree members, and introducing appropriate insurance packages for climate resilient agriculture. The focus over the medium term will be on the restoration and regeneration of natural capital, promotion of alternative technologies in building construction, and promotion of climate resilient agriculture.

Disaster Risk Reduction: The vision set out for Nava Keralam is to ensure zero mortality due to disasters with minimum economic losses and disruption of services. To achieve it, the principles of risk-informed programming will be embedded across all the sector recovery plans with additional investments for disaster preparedness and response. This includes the revival of the State Disaster Response Force, enhancing the operational efficiency of the fire and police personnel, setting up robust early warning mechanisms, employing effective risk and behavioural change communication strategies, and implementing community-based disaster risk

management approaches. It is proposed that Kerala integrates DRR across key sectors with the necessary technical guidance from training institutions and the academia. Important measures proposed in this regard include the development of a comprehensive land-use management policy and Act, necessary amendments in the existing building regulations, ensuring environment impact assessment, and the formulation of special development control regulations for hills and coastal areas.

Gender Equality and Social Inclusion: This PDNA seeks to assist the Government of Kerala in strengthening the development trajectory of the state by ensuring that no vulnerable group is left behind, thereby helping fast-track the building of Nava Keralam in a sustainable, eco-sensitive, inclusive, and empowering manner. A recovery strategy should necessarily factor in the specifics of geography, culture, and context to develop differentiated strategies to address the needs and priorities of vulnerable groups.

Considerations of class, caste, gender, and age as well as unequal access to and control of resources has particularly affected the socioeconomically disadvantaged in Kerala. These include the poor particularly the multi-dimensionally poor; vulnerable women including widows, household heads and pregnant women; vulnerable children especially those traumatised by the loss of lives and destruction; Scheduled Castes and Scheduled Tribes; the elderly; fishing communities; people living with disability; and 'invisible' populations such as lesbian, gay, bisexual, queer, inter-sex, and asexual persons; the destitute, the homeless poor, and those living on and off the street. The PDNA underscores the critical need to 'reach the last mile' of these affected population. These groups are particularly vulnerable given the risks of over-reliance on unpaid work carried out especially by women, the risk of unequal access to essential services and resources, and emerging psycho-social needs.

This disaster is an opportunity to establish a robust human rights-based approach across all phases of the recovery cycle, based on the principles of non-discrimination, participation, and 'leaving no one behind' imbedded in Agenda 2030.

Local Governance: The PDNA recognises that leadership of the local governments is paramount in achieving the vision of a Nava Keralam. In that context, the panchayats' role in restoring services, reconstructing houses, supporting local economic recovery and other public services will go a long way not only in restoring normalcy but also in rebuilding a resilient Kerala. To enable local governments to play this critical role in recovery and reconstruction, the capacity of local governments should be enhanced by (i) ensuring participation of people through gram sabhas and other platforms; (ii) disseminating information on recovery assistance packages; (iii) addressing grievances of the affected population; (iv) maintaining transparency and accountability in use of the funds for recovery; and (v) integrating recovery needs in their annual plans. To enable this, local self-governments will have to augment their capacity with technical experts to support their role in recovery. Local self governments may also need to revise their annual plans and develop a separate recovery plan for next three to five years.

Proposed Institutional Arrangements for Recovery

The PDNA recommends the setting up a new agency with a mandate for five years along the lines of Badan Rehabilitasi dan Rekonstruksi (BRR) in Indonesia and Canterbury Earthquake Recovery Authority (CERA) in New Zealand. Such an agency should be appropriately resourced to deal with the scale of the disaster, planning, implementation and financial management, and service delivery within a tight timeframe. Adopting a mission approach, the agency could be well placed to take forward the vision of Nava Keralam based on principles of sustainable development.



Financing for Recovery and Reconstruction

The state government requires INR 31,000 crore (USD 4.4 billion) for recovery and reconstruction. The following are some options for mobilising the required resources for recovery and reconstruction over a timeframe of five years:

Increase Borrowing: The state government can use the market instruments and borrow from national and international financial institutions. For instance, with the approval of the Government of India, the Government of Kerala may issue Reconstruction Bonds. The state could also borrow from the World Bank and ADB to support recovery and reconstruction by seeking permission from the central government to enhance its borrowing limit from the current 3% as stipulated by the Fiscal Responsibility and Budget Management (FRBM) Act in India to 4.5%. Overseas development assistance could be secured in terms of budget support or pooled basket funds or for specific projects for flood recovery.

Additional Funds from Centrally Sponsored Schemes (CSS): The state government may get additional funds from the central government under CSS like the MGNREGS for livelihoods, Pradhan Mantri Awas Yojana, (PMAY) for housing and other central schemes. While the National Disaster Response Fund (NDRF) does not typically support recovery and reconstruction, a part of the cost could be funded through the NDRF. The cost of the repairs, which is allowed through NDRF, could be utilised for supporting the reconstruction component.

Chief Ministers Disaster Relief Fund & Lottery: The Government of Kerala can consider raising additional resources, over and above INR 1,740 crore already mobilised through the Chief Minister's Disaster Relief Fund. The new lottery scheme floated by the state government is expected to mobilise about INR 80 crore.

Augmenting Resources Through Taxes: The Government of Kerala can consider augmenting resources through taxes. The possibilities for additional resources through taxation can include (i) widening the tax base: to bring additional business units in the state under the commercial tax net of the state government; (ii) introducing new taxes such as a tax on vacant houses, or a tax on construction of large houses of more than 3,000 square feet area. The state government may consider introducing carbon tax on motor vehicles and building materials with high carbon footprint such as cement, steel, glass, aluminium, and so on.

Others: The state government may request additional statutory block revenue deficit grant under Article 275 of the Constitution. For this, Kerala may need to submit a revised revenue receipt and expenditure statement to the Commission. Among other possibilities are tapping Corporate Social Responsibility (CSR) Funds, crowd-funding through digital platforms, seeking grants from NGOs and international NGOs for recovery and reconstruction, and setting up Voluntary Reconstruction Funds attract contributions from the Malayali diaspora including alumni of educational institutions.

The people of Kerala have demonstrated extraordinary resilience in coping with the unprecedented disaster. The state has also demonstrated the power of public action in dealing with the aftermath of the floods. The potential exists for Kerala to tap the wealth of its traditional knowledge, the wealth of green ideas, the minds of its diaspora, and the spirit of volunteerism to demonstrate cost-effective ways of ensuring equitable and sustainable development. The disaster presents a new opportunity for Kerala to lead the world in establishing a green and resilient state.

PDNA Process and Methodology

Following the devastating floods and landslides in Kerala, the state government commissioned the United Nations to conduct a Post Disaster Needs Assessment (PDNA). The PDNA was led by the Government of Kerala under the guidance of the Ministry of Revenue and Disaster Management and Directorate of Fisheries. The PDNA aimed to assess the damage, loss, and recovery needs across key affected sectors of the state economy. A first in India, the Kerala PDNA is unique as it also offers policy recommendations, suggestions for appropriate recovery-related institutional arrangements, and options for financing recovery. The Government of Kerala sees the flood recovery as an opportunity to rebuild a New Kerala and in that context this PDNA identifies four pillars for recovery focused on approaches that are green, sustainable, inclusive, participatory, and innovative.

The PDNA methodology, developed in 2008 by the European Union, the World Bank and the UN system represents a tool for a harmonised assessment and recovery strategy. It is a standard methodology which is used internationally to assess damage, loss, and recovery needs of any disaster. It presents a consolidated report based on sector analysis and priorities for recovery. The PDNA report also includes an assessment of the macroeconomic and human impact of the disaster. The methodology is adapted to local context before being applied in any country.

The PDNA in Kerala was initiated on 18 September 2018, engaging over 100 people from the government and international agencies. It complements the Joint Rapid Damage and Needs Assessment conducted by the World Bank and the ADB which assessed the damage and recovery needs of 12 sectors and social impacts.

The Kerala Ministry for Revenue and Housing appointed the Director of Fisheries as the State Coordinator for the PDNA. The Kerala State Disaster Management Authority (KSDMA) was closely engaged in the coordination and review of the PDNA process. The UN PDNA Coordination Team was represented by UNDP and UNICEF. Sector teams included representatives from line ministries, district officials, the European Civil Protection and Humanitarian Aid Operations (ECHO) and 10 UN agencies: Food and Agriculture Organization (FAO), International Labour Organization (ILO), United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Population Fund (UNFPA), United Nations Children's Fund (UNICEF), UNWOMEN, World Food Programme (WFP) and World Health Organization (WHO).

The PDNA covers the following sectors:

- Social Sectors: Housing, Land and Settlements; Health and Nutrition; Education; Cultural Heritage;
- Productive Sectors: Agriculture, Fisheries and Livestock;
- Infrastructure Sectors: Water, Sanitation and Hygiene; and
- Cross-Cutting Sectors: Environment; Employment and Livelihoods; Disaster Risk Reduction; Gender and Social Inclusion; and Local Governance.



The PDNA includes a special report on Integrated Water Resources Management and a diagnosis of the floods and landslides, given its significance in the state of Kerala.

The Kerala PDNA started with an orientation on the methodology and agreements on the scope of the assessment. Data was collected over a 10-day period with field visits by all sector teams to the 10 most affected districts. The field visits were held to gather first-hand information on the extent of damage as well as to validate data given by the various government departments. Meetings were held with district and panchayat officials, members of various local associations, women's groups and affected people. These visits helped to assess the human impact of the disaster and develop recovery strategies focused on helping the most vulnerable people recover. A civil society expert group consultation was also held to gather views of diverse groups on rebuilding Kerala. The first draft of the PDNA report was presented to the Chief Secretary and Secretaries of the Line Ministries on 11 October 2018 and revised with inputs and feedback from relevant ministries and KSDMA. The final report was submitted to the Chief Minister of Kerala on 26 October 2018.

