Report of Sub-committee for Development of 'National Sustainable Habitat Parameters on '***Urban Stormwater Management'***

Background

Many cities in India ranging from large metropolitan to small transitional cities lack effective storm drainage systems and face problems due to illegal, unplanned development and encroachment often on natural areas and drainage systems/ways. As the cities develop and grow, benefits from important environmental functions (natural water ways/areas) are often ignored and overlooked as a result of which natural areas are degraded and damaged. This along with increase in built up area results in increase in incidences of flooding and accompanied ill effects. The densification of cities is leading to construction of roads, buildings which has resulted in increase in impermeable areas. As a result, often permanent changes to the catchment are caused, leading to changes in runoff patterns, which affect the magnitude, frequency and occurrence of flooding. This necessitates adoption of sustainable stormwater management practices in cities.

The core of sustainable stormwater management is to consider stormwater as a potential resource rather than as a liability or a waste product. This shift can only be initiated by a visionary stormwater management approach which combines the preventive measures with the traditional curative and reactive measures in appropriate sum so as to minimize negative

impacts on human, property and environmental health. In this respect, environmental health would include preserving and maintaining the natural hydrological cycle, groundwater recharge, natural drainage system etc.

To address such concerns in various important sectors, the Prime Minister released India's first National Action Plan on Climate Change (NAPCC) outlining existing and future policies and programs addressing climate mitigation and adaptation on June 30, 2008,. The NAPCC has set out eight "National Missions" as the way forward in implementing the Government's strategy and achieving the National Action Plan's objective. The focus of these missions is on "promoting understanding of climate change, adaptation and mitigation, energy efficiency and natural resource conservation." The National Mission on Sustainable Habitat is one of them.

The **National Mission on Sustainable Habitat** seeks to promote sustainability of habitats through:

- Improvements in energy efficiency in buildings through extension of the energy conservation building code - which addresses the design of new and large commercial buildings to optimize their energy demand;
- Better urban planning and modal shift to public transport - make long term transport plans to facilitate the growth of medium and small cities in such a way that ensures efficient and convenient public transport;
- Improved management of solid and liquid waste, e.g. recycling of material and urban waste management - special areas of focus will be development of technology for producing power from waste.
- It also seeks to improve ability of habitats to adapt to climate change by improving resilience of infrastructure, community based disaster

management and measures for improving advance warning systems for extreme weather events. It addresses sustainability concerns related to habitats, primarily in urban areas.

- Conservation through appropriate changes in legal and regulatory framework.

The key deliverables of the Mission include **a)** development of sustainable habitat standards that lead to robust development strategies while simultaneously addressing climate change related concerns, **b)** preparation of city development plans that comprehensively address adaptation and mitigation concerns, **c)** preparation of comprehensive mobility plans that enable cities to undertake long-term, energy efficient and cost effective transport planning and **d)** capacity building for undertaking activities relevant to the Mission.

With a view to initiating action in respect of the first deliverable i.e development of National Sustainable Habitat Standards, the Ministry of Urban Development has constituted six sub-committees mandated with the task of identifying standards in six areas i.e energy efficiency in the residential and commercial building sectors, urban transport, water supply and sewerage, urban planning, urban storm water drainage and municipal waste.

The Sub-Committee for Development of "**National Sustainable Habitat Parameters on Urban Stormwater Management**" was constituted by the Ministry of Urban Development vide OM No. A-11019/2/2007-PHE.II/CCC dated 12.8.2010 and subsequently, re-constituted on 11.10.2010 (Annexure-I). List of the members is at Annexure-II.The Sub-Committee met under the chairmanship of JS (UD) three times between October to December 2010 to deliberate and evolve sustainable habitat parameters on "Urban Stormwater

Management". The approach that emerged was that **"What gets measured gets managed"**. The development of parameters is essential for developing legal frame work/regulations to improve urban planning in respect of storm water drainage. Based on detailed deliberations, the following main parameters have been identified, which will enable developing legal frame work/regulations to improve the urban planning in respect of storm water drainage and minimize the incidence of flooding in urban areas.

Development of Indices

To assess and monitor the progress of implementing sustainable stormwater management, there is a need to develop key parameters and indicators. These parameters/indicators are generally in the form of indices, for systematic and scientific assessment of situation, progress and deficit. Therefore, each of the indicators designed for stormwater management should serve the purpose and promote understanding of where we are, where we are going and how far we are from the goal, which can be further aggregated to form complex indices. Based on this approach, a set of parameters/indicators in the form of indices have been developed which need to be considered at all stages of development namely, planning, implementation and operation and maintenance subject to its appropriateness and significance to the specific stage.

1. **Master Plan Index**: Existing storm water drains are provided based on comprehensive planning and designing or in piece-meal manner. The basic assumption is that each city has a basic master drainage plan and where none exists, the master plan would be formulated and the indices would also complement the formulation of

the drainage master plan. This will enable the integration of the city's **drainage master plan** with the CDP.

2. **Natural Drainage System Index**: This index can be defined as the ratio of natural drainage systems up and running to the total natural drainage systems (as existing on a predetermined date) and can be used as an indicator for the sustainability of the natural drainage system.

3. **Drainage Coverage(Constructed) Index**: Level of coverage of an urban area with man-made storm drainage systems. This index can be defined as the ratio of the length of existing constructed drains to the length of total constructed drains required for an area.

4. **Permeability Index-** This index can be defined as the percentage of the catchment which is impervious. (Note - Attempts should be made through sustainable drainage practices to restore the permeability index of the catchment to pre-development levels).

5. **Water bodies Rejuvenation Index**: This index is to define the sustainability of the water bodies (past and present). For the rejuvenation of water bodies, the ratio of total area under water bodies planned for rejuvenation to the total area of water bodies including those encroached upon may be used as an indicator.

6. **Water body Vulnerability Index**: In regard to the habitations in the existing water bodies/flood prone areas, it was proposed that the ratio of total area under water bodies encroached (present date) to the total area under water bodies (on a datum date) may be used as an indicator.

7. **Water logging Index**: This index is to reflect the sustainability of an area to incidences of water logging. Presently, the area inundated for four hours or more and having water depth more than 6" are considered as affected by water logging. However, to make our cities more sustainable and disaster resistant, the duration of 4 hours should be reduced to 1 hour based on experiences in cities like Delhi and Mumbai. (Flood prone area is categorized as one having 15 houses or more which are affected by flood).

8. **Area Vulnerability Index**: In regard to the habitations in low lying areas / flood prone areas, it is proposed that the ratio of total flood prone as area (present date) to the total city area (on a datum date) may be used an indicator.

9. **People Vulnerability Index:** Identify vulnerable points in the slums -Number of people affected in vulnerable area with or without drainage divided by total number of people staying in the vulnerable area (with or without drainage) may be an indicator.

10. **Flood Moderation Index**: Lakes/ponds are the best moderators. The index may be defined as the ratio of area not flooded due to moderation to the area that would have been flooded without moderation.

11. **Drainage Cleaning Index**: This is a very important parameter as regards, routine operation & maintenance / cleaning of drains. It is opined that cleaning should be done at least three times a year. (i) First, the process must start by 31st March each year and be completed one month before the normal arrival of monsoon each year. (ii) The drains should also be thoroughly cleaned after first heavy shower,

(iii) subsequently, after retreating of rain i.e. in the post monsoon, the cleaning of drains is essential. In addition, the ULBs may clean drains regularly, as per requirement. The availability of trained manpower and O & M Manual for operating and maintaining drainage system also need to be ensured.

12. **Complaint Redressal index:** A certain eligible category of complaints registered and those addressed may be considered as an indicator of the efficiency of stormwater O & M. The index may be defined as the ratio of drainage-related complaints addressed satisfactorily to the total number of drainage-related complaints.

13. **Climate Change Stress Index**: The matter regarding the overstressing of existing drainage infrastructure due to climate change was also considered. As per the recommendations of International Conference on Urban Drainage in 2008, 20% increase in calculated discharge suggested for designing for future storm water drains was agreed. The index may be defined as the ratio of the projected rainfall intensity for a city to the present rainfall intensity being used for design for that city.

14. **Stormwater discharge quality Index**: This may be defined as the ratio of the measured value of Total Suspended Solids (TSS)/Bio-chemical Oxygen Demand (BOD) of the storm drain water to the prescribed limits of TSS/BOD.

15. **Sewage Mixing Index**: Incidences of mixing of sewage with storm water to be avoided / prohibited. The index may be defined as the ratio of the volume of sewage flows entering the storm water drainage system to the total volume of flows in the storm water system.

16. **Preparedness Index/ Early Warning Index:** This index would enable the quantification of the preparedness of the city/community and can be defined for each point on the drainage system as the **ratio of lead time to the flow time at the point.** Radar based advance warning system of rainfall as well as one based on real time rainfall intensity viz. critical rainfall intensity causing flooding /real time rainfall intensity likely to cause flooding in flood prone areas.

17. **Rainfall Intensity Index:** can be defined as the ratio of the observed rainfall intensity to the rainfall intensity which causes flooding in that particular area. It will enable the determination of the sustainability of an area to flooding.

18. **System Robustness Index** - for areas dependent on pumping, the index can be defined as the ratio of rate of incoming storm flow to rate of pumping.

19. **Tidal Index**: Parameter based on cycle of high and low tide for coastal areas. The index may be defined as the ratio of tidal level for which the present protection is adequate to the maximum tidal level observed for that area/city.

20. **Rain water Harvesting/Artificial Ground water Recharge Index:** With reference to the encroachment of natural streams passing through urban, it was observed that on one hand, the pathway / water line of natural streams are being blocked / constructed and on the other hand, more and more developments are coming on by paving the way in enhancing the run-off causing increased peak flow and frequent inundation in urban area. To overcome this, rain water harvesting to be made mandatory, while following building bye-laws and at suitable

places, considering the overall suitability, artificial ground water recharge also to be encouraged. The recharge index may be defined as the ratio of the rainwater volume stored/harvested to the ratio of the measured rainfall volume. In the planning level itself, 2 to 5% of urban area should be reserved for water bodies to work as recharge zone.

Way Forward

These indices will enable quantification of the sustainability of the present status of the drainage system as well as sustainability of urban habitat from drainage point of view. Once these are quantified, these indices will be very useful in determining the appropriate sustainable drainage practices to be implemented in a particular area/ward/city. Above measures should be implemented by integration of drainage system with natural drains, natural water bodies / ponds / streams in the catchments, so as to achieve the sustainability of habitats in urban area, in true spirit, in respect of storm water drainage.

****