Abstract

The situation in Gothenburg, which is on the list of Swedish cities at risk of getting flooded, and Mumbai, where parts of the city is flooded every monsoon season, is compared. The sewage systems in Mumbai and Gothenburg were built in the same time period. The system in Mumbai has, more or less, not been developed since it was built. Many parts of both cities were built on former marshland areas, close to the sea. Our recommendation, for both cities, is to develop the storm water systems further with sustainability and resilience perspectives in mind, including to build floodable areas close to the city centre. It is also important to educate leaders and practitioners in both cities about resilience and sustainability perspectives.

1. INSPIRED BY LONDON

The stormwater drainage (SWD) system in Mumbai consists mostly of an open, combined system, while the SWD system in Gothenburg is pipe-bound, mostly separate stormwater system (see Table 1). Development of the sewage system in both cities started around 1860, with inspiration from London, and followed the same pattern until 80 years ago. Since then, the Mumbai system has stagnated in its development. Gothenburg is now heading for Sustainable Urban Drainage Systems (SUDS) and pilot projects have been initiated. Today, Mumbai's system can described as a combination of A to D, and Gothenburg's as a combination of D to F (Figure 1).

2. FLOOD RESILIENCE

Since planners must cope with uncertainty (Godschalk, 2003) and a flood event always can be bigger than what the system is designed for (Liao, 2012), cities must be built resilient prospective. An urban resilience to floods could be conceptualized as the capacity to remain in a desirable regime while experiencing a flood (Liao, 2012). A flood resilient city is flexible and adaptive, and learning from historic events. Floodable areas, where water can be led during storms, are needed in the city (Liao, 2012).

3. SEA LEVEL RISE

Gothenburg struggles with rising sea level in the future and has seen a few severe flood events in the last years, while parts of Mumbai are flooded during the monsoon season every year. Precipitation in Gothenburg is distributed more evenly and with lower intensities.

At the waterfront of the harbour in Gothenburg, low-lying areas will be developed into dense housing areas. This have been criticised, as parts of the area are sensitive to flooding already with present sea level, see Figure 2. (Hjerpe & Glaas, 2012)

4. SITUATION IN MUMBAI

The main problem in the Mumbai drainage system is clogging from solid waste (see Figure 3), with authorities with overlapping roles and responsibilities, low level of awareness among citizens and problem with relocation/rehabilitation of slums (situated in the flood zones). Large areas are under heavy stress, and the situation is especially hard to solve due to high population density and no land to build on. Mumbai's systems will have to be managed keeping the principles of sustainable development in view, and encouraging wide participation through partnerships and networking institutions.

5. CONCLUSION

It seems like Gothenburg is heading for flood resistance, building high floodwalls to prevent from flooding with a certain return period, rather than building a flood resilient city, with floodable areas in strategic places.

In Mumbai, the work for flood resilience and work against poverty must go hand in hand, as the areas along the open stormwater system ( creeks and rivers) are needed as floodable land. People also need a safe, well-functioning sewage system.

References

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