Effectiveness of LID for mitigating the risk of pluvial flooding
A case study in Trelleborg, Sweden

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INTRODUCTION

The purpose of this study is to explore the potential of utilizing existing biking and pedestrian lanes to retain stormwater and mitigate the risk of pluvial flooding.

Our focus is on a district in Trelleborg, located in the southern region of Sweden, which has been selected for its susceptibility to frequent basement flooding in recent years.

The study investigates the feasibility of implementing low-impact development (LID) solutions within this area, which is characterized by both combined and separate sewer systems.

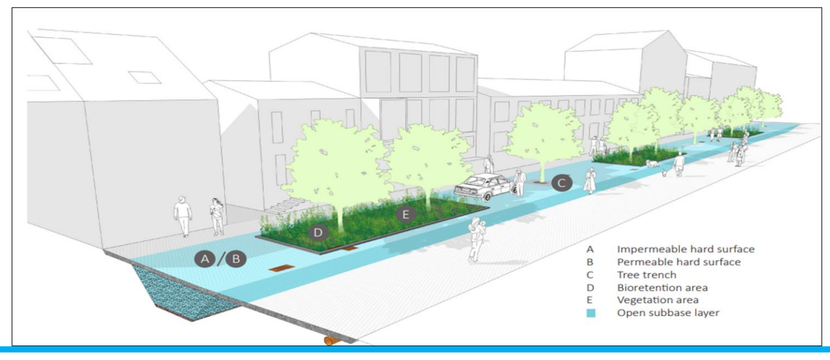

Figure 1 – Conceptual presentation of the proposed LID to mitigate pluvial flood risk for future challenging climate (source: Liveable-Streets-A-Handbook-of-Bluegreengrey-Systems, 2020)

METHODS

Hydrological and hydraulic modeling of the catchment and drainage system was conducted using Mike+.

Two low-impact development (LID) systems—**bioretention cells** and **pervious pavements**—were employed to simulate the proposed concept.

The simulations were tested using a **10-year** synthetic rainfall event (R1) and a **50-year** real rainfall event (R2).

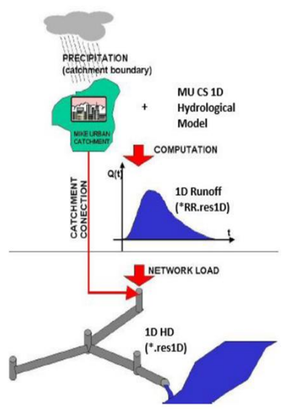

Figure 2: how Mike+ does hydrological and hydraulic modeling. (source: MIKE+ collection system guideline)

RESULT

- The hydrological model results were observed in terms of:
  - Distribution of stormwater in different phases (loss, runoff, and storage).
  - Water level in the pipe network for both the existing drainage system (EDS) and the proposed LID system (PLS).
  - Evaporation and transpiration considered as losses in Mike+.
- Comparison of surface runoff production between EDS and PLS:
  - The proposed LID systems reduced surface runoff by 48% in both scenarios.
  - Significant alleviation of the load on the existing drainage network.
- Additional findings:
  - Replacing current impervious surfaces in the catchment with the proposed LID systems will further decrease surface runoff.
  - Reduced risk of basement flooding in the affected area.

DISCUSSION

The figures below illustrate the reduction in surface runoff for both the R1 and R2 rainfall events achieved with the proposed LID system.

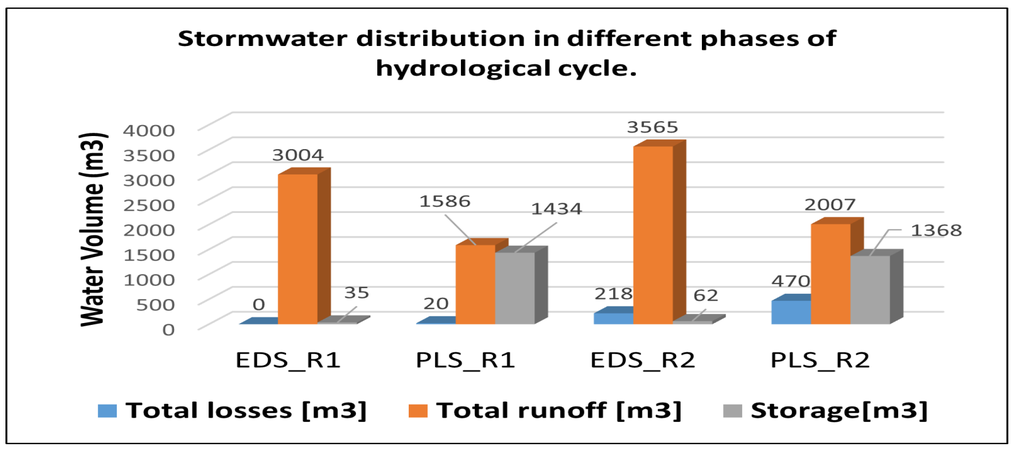

Figure 3. Stormwater distribution in different phases of the hydrological cycle in various scenarios.

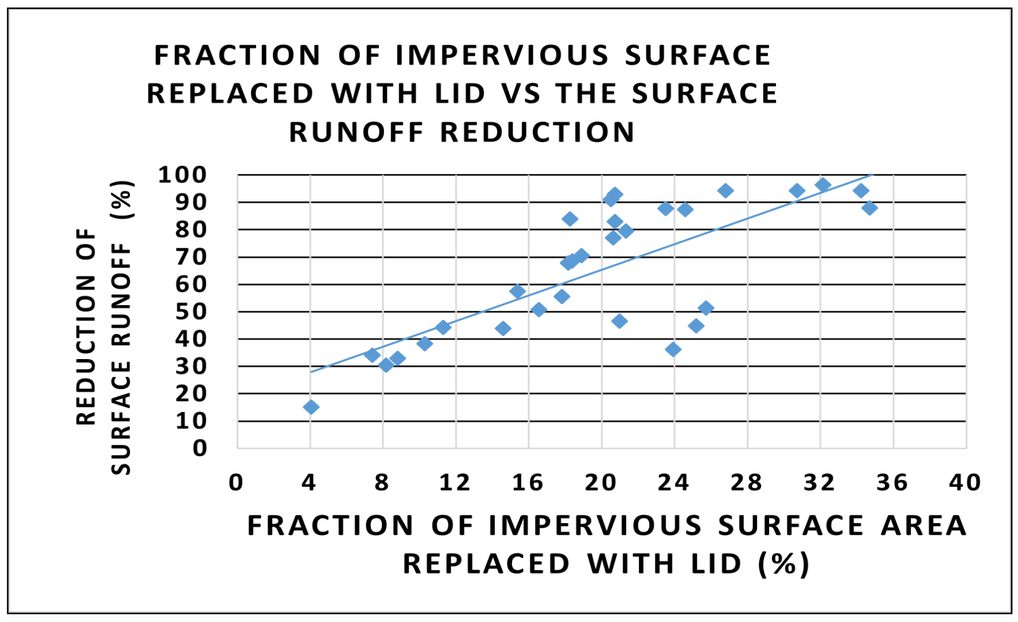

Figure 4. Fraction of existing impervious surface replaced with LID vs Reduction of the surface runoff.

This analysis was conducted for a 10-year synthetic rainfall event. Various fractions of the impervious surface in each catchment were replaced with the proposed LID to observe their corresponding surface runoff reduction capacity. The results indicated that replacing only 14% of the existing impervious surface with the proposed LID reduced surface runoff significantly. Therefore, this proposed LID can effectively eliminate the need for free space in a built-up area.

CONCLUSIONS

- ❖ The proposed LID systems can potentially increase the resilience of urban areas to manage stormwater and prevent pluvial flooding.
- ❖ For both the 10-year synthetic rainfall event and the 50-year real rainfall event, the proposed LID systems reduced surface runoff by almost 48%, significantly alleviating the load on the existing drainage network.
- ❖ The LID system can be implemented without requiring additional free space in urban areas.
- ❖ Existing impervious surfaces, such as pedestrian paths, bike lanes, parking lanes, and lots, can be replaced with the proposed LID system.
- ❖ This approach offers a multipurpose sustainable solution for pluvial flood management, making it both possible and plausible.

References:

Livable-Streets-A-Handbook-of-Bluegreengrey-Systems-version-2.0.pdf. (2020). EDGEs.

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