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StoPWa

Stormwater Purification with Construction and Demolition Waste

Life Cycle Assessment of the stormwater filtration configurations

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Background and Objectives

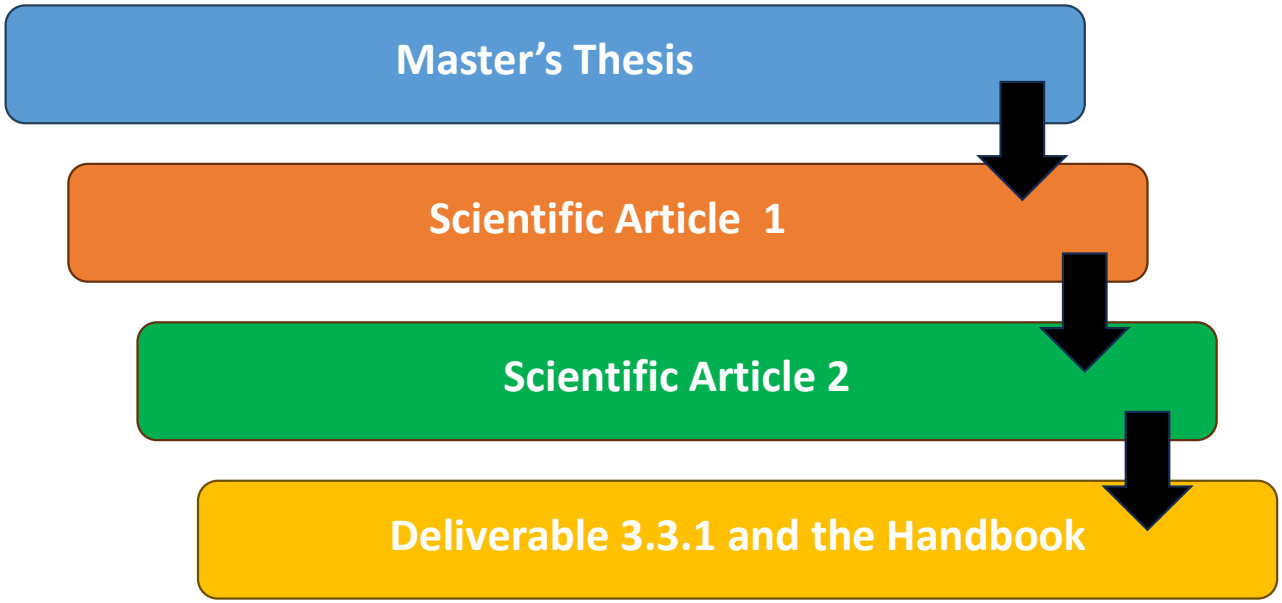
- ❑ Climate change + urbanization → challenges stormwater management
- ❑ Stormwater carries pollutants.
- ❑ Sustainable treatment solutions are needed → Construction and demolition waste (CDW) derived materials
- ❑ Environmental sustainability must be verified.

Life Cycle Assessment (LCA) approach

The role of LCA in the StoPWa

- ❑ Which life cycle stages are most important for environmental performance?
- ❑ How do construction materials, transport, maintenance, and end-of-life management influence sustainability?
- ❑ What are the potential environmental advantages and challenges of using recycled CDW based filter materials?
- ❑ How can future stormwater treatment systems be designed with lower life cycle impacts?

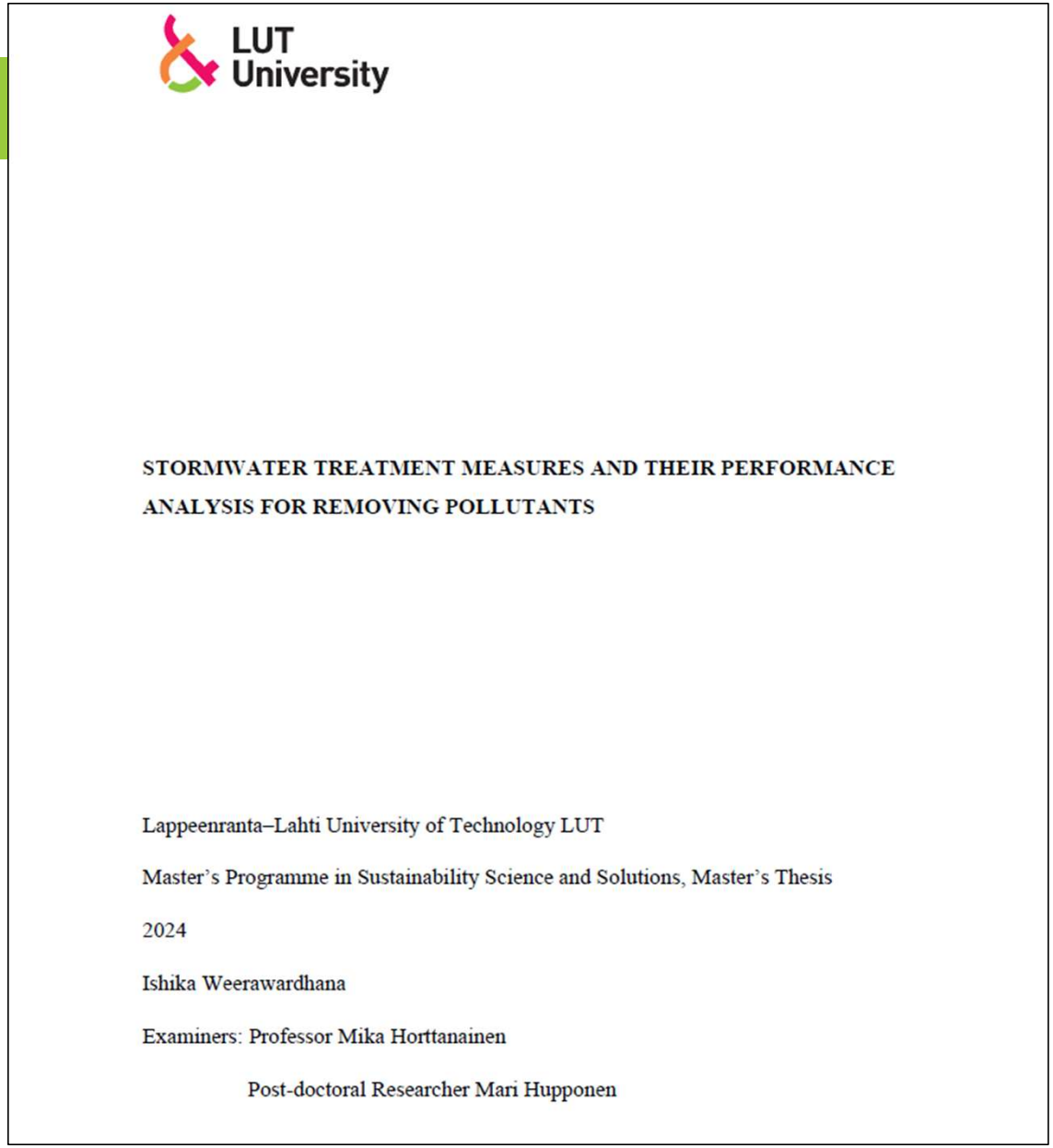
Work Overview



Master's Thesis

- Title: Stormwater treatment measures and performance analysis for removing pollutants (Weerawardhana 2024)

- Thesis available at: https://urn.fi/URN:NBN:fi-fe202401081804



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STORMWATER TREATMENT MEASURES AND THEIR PERFORMANCE ANALYSIS FOR REMOVING POLLUTANTS

Lappeenranta–Lahti University of Technology LUT

Master's Programme in Sustainability Science and Solutions, Master's Thesis

2024

Ishika Weerawardhana

Examiners: Professor Mika Horttanainen

Post-doctoral Researcher Mari Hupponen

Master's Thesis

Objectives

1. Identify different types of stormwater pollutants
2. Examine stormwater treatment methods
3. Analyze the performance of selected methods
    - Pollutant removal efficiency
    - Treatment capacity
    - Environmental impacts
    - Economic effectiveness
4. Identify the most suitable treatment methods.

Key contribution to the StoPWa

- Built the knowledge base for LCA
- Compiled key parameters
- Highlighted promising treatment options

Scientific Article 1

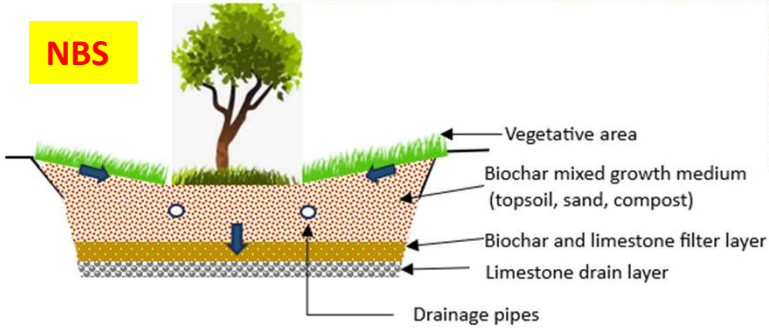
- Title: Environmental sustainability of a biochar integrated nature–based solution in Finland: A comparative LCA with a rain garden and a sand filter (Weerawardhana et al., 2026)
- Authors: Ishika Weerawardhana, Mariia Zhaurova, Mari Hupponen, and Mika Horttanainen
- Status: Published (Journal of Environmental Management)
- Available at: https://doi.org/10.1016/j.jenvman.2026.130133

Scientific Article 1

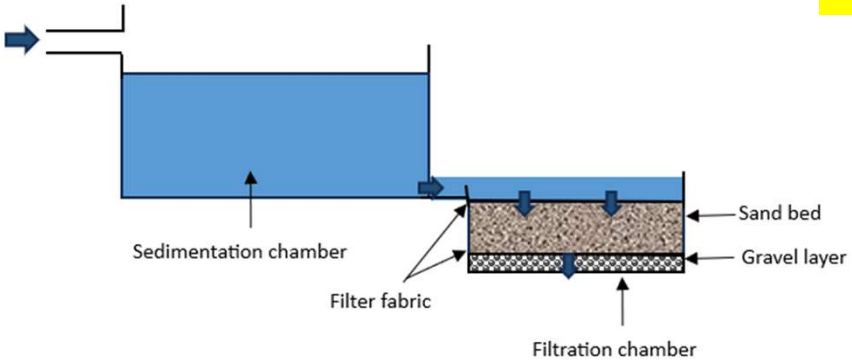
- Aimed to identify environmental hotspots of widely used stormwater treatment systems to support the development phase of the actual StoPWa case sites in Finland, Estonia and Latvia.

- Compared cradle-to-grave impacts of 4 scenarios over a 30-year lifetime
  - Baseline (No treatment)
  - Nature-based solution (NBS)→ real case study in Lappeenranta
  - Rain garden (RG)
  - Sand filter (SF)

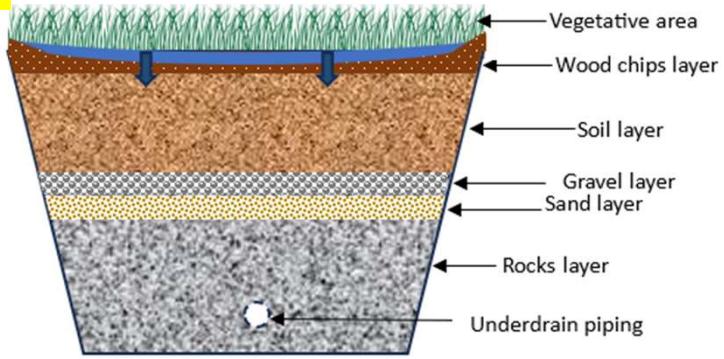
NBS



SF



RG



Scientific Article 2

Title: Environmental sustainability of utilizing construction and demolition waste for a stormwater treatment train system in Finland: LCA approach

- Authors: Ishika Weerawardhana, Mari Hupponen, Mika Horttanainen

- Status: Will be submitted to the Journal of Environmental Management by the end of June

Scientific Article 2

- Compared cradle-to-grave impacts of 4 scenarios over a 30-year lifetime
  1. No treatment
  2. Rain garden (from the 1st article)
  3. StoPWa (pilot site in Lahti)
     (a) Treatment train with commercial lightweight aggregate filter media (**Commercial filter**)
     (b) Treatment train with recycled CDW agglomerate filter media (**CDW filter**)

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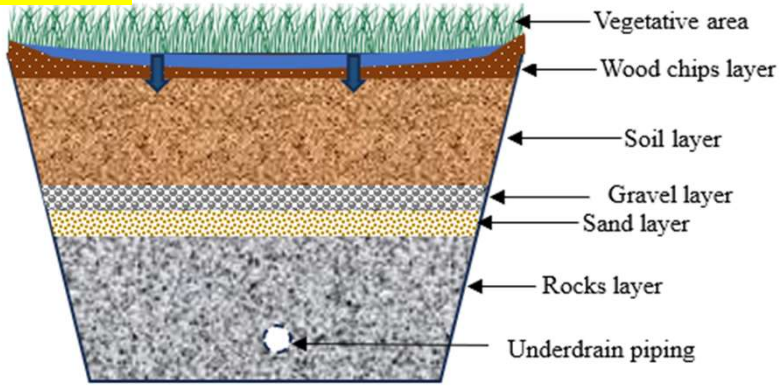
Rain garden



Deliverable and Handbook

Deliverable 3.3.1

• Summarizes our department's (Sustainability Science, LUT) contribution to the StoPWa project by compiling the LCA-related work conducted during the project.

Handbook-Key lessons learned

- Focus should not be just on pollutant removal efficiency.
- A full life cycle perspective is needed.
- Site-specific stormwater quality data should be used where possible
- Design choices (materials, transport, maintenance) matter
- Recycled materials require careful evaluation.
- Importance of considering long-term performance, durability, and potential leaching effects

WASTE MANAGEMENT GROUP

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Thank you!