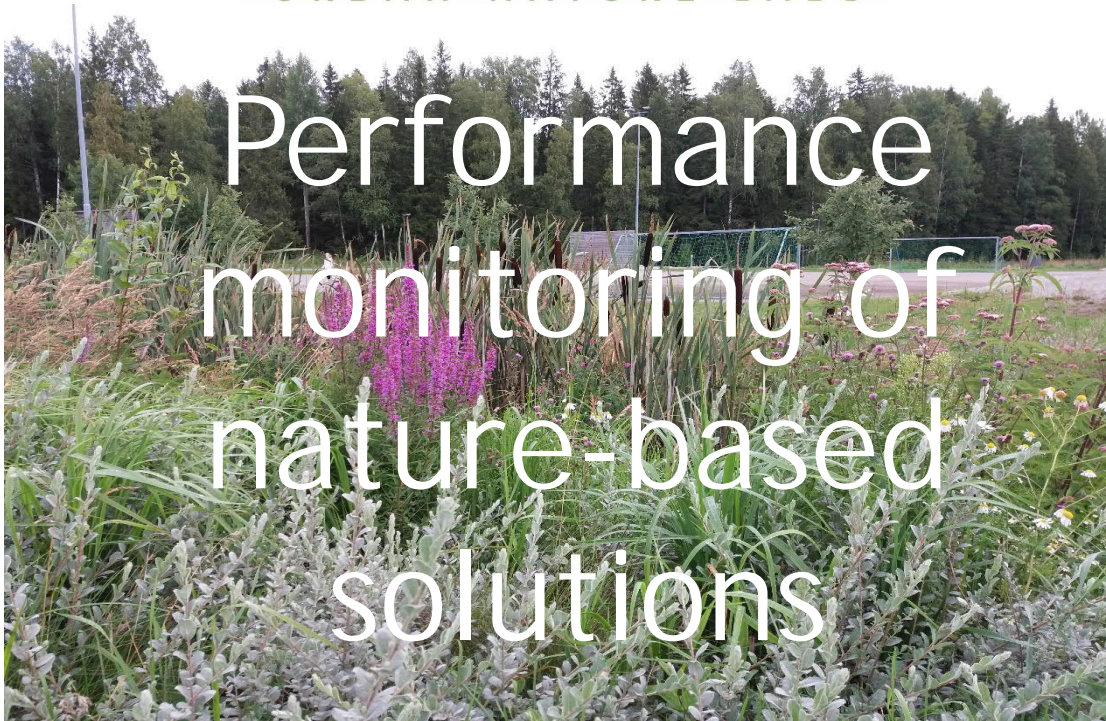




Performance monitoring of nature-based solutions



European
Commission

Horizon 2020
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for Research & Innovation

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Baltic Sea
Cooperation for
Climate Resilience
and Urban Floods
Seminar
16.10.2019

City of
Tampere/Finland/Green
areas & storm water
management/Salla
Leppänen

Tampere

230 000
inhabitants

29
public beaches

45
Nature based
storm water
solutions

160
lakes

100%
urban wastewaters
treated



Stormwater quality challenges



Climate change and densifying cities increase the amount of runoff and weaken the quality!

Treatment is needed!

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Nature-Based Solutions (NBS)

- **Solutions** to solve climate change **related problems**: more rain, densifying city, storm water quality/quantity, biodiversity, well-being
- **Mimicks nature**: biofilters, green roofs/walls, constructed wetlands etc.
- **Replace/complement grey infrastructure**



programme under
based solutions

Financing of NBS

- ▶ Property-specific stormwater fee ~4 million € /year
- ▶ EU funding Urban Nature Labs(UnaLab) project 1,4 million €





Urban Nature Labs project (UnaLab)

- ▶ EU-project 2017-2020
- ▶ 28 partners, Tampere one of frontrunners (Genova, Eindhoven)
- ▶ Main interests of Tampere
 - ▶ Development of innovative nature-based solutions
 - ▶ **Monitoring of NBS performance in Nordic conditions**



2 demonstration areas

Monitored NBS

- ▶ 2 sand-based biofilters
- ▶ 1 biochar-, peat- and light gravel - based biofilter
- ▶ Vuores stormwater system



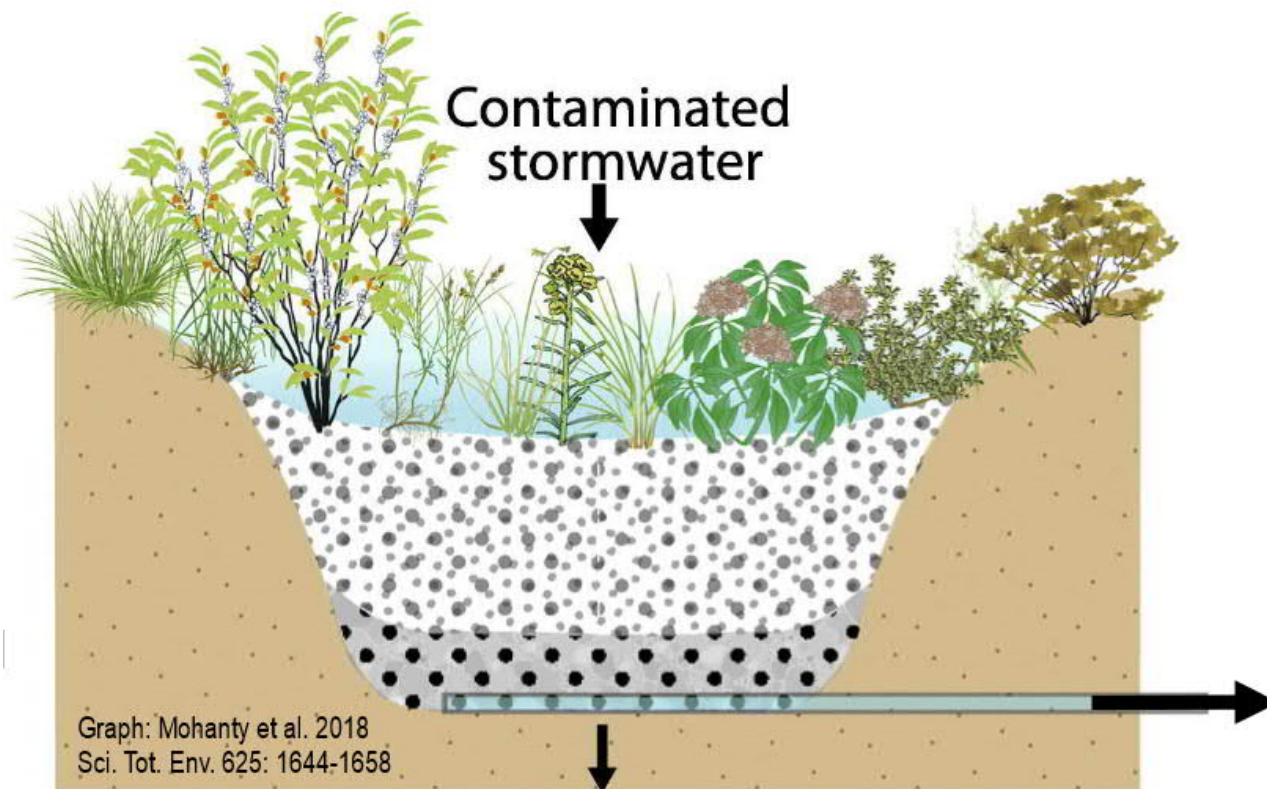
Monitoring in practice

- ▶ Online sensors: water flow, pH, turbidity, conductivity, NO₃-N, COD, temperature
- ▶ Traditional sampling: Cl, SO₄, P_{tot}, N_{tot}, TSS, metals, fecal coliforms etc.
- ▶ Monitoring time 4 years



Biofiltration for waste- and stormwater purification

- ▶ Based on natural biodegradation in soil
- ▶ Area needed 100-800 m²
- ▶ Removal of difficult pollutants such as nitrogen
- ▶ Benefits:
 - water purification
 - water retention
 - habitat for wildlife
 - quality of life, odors removal!
 - reuse of water after treatment



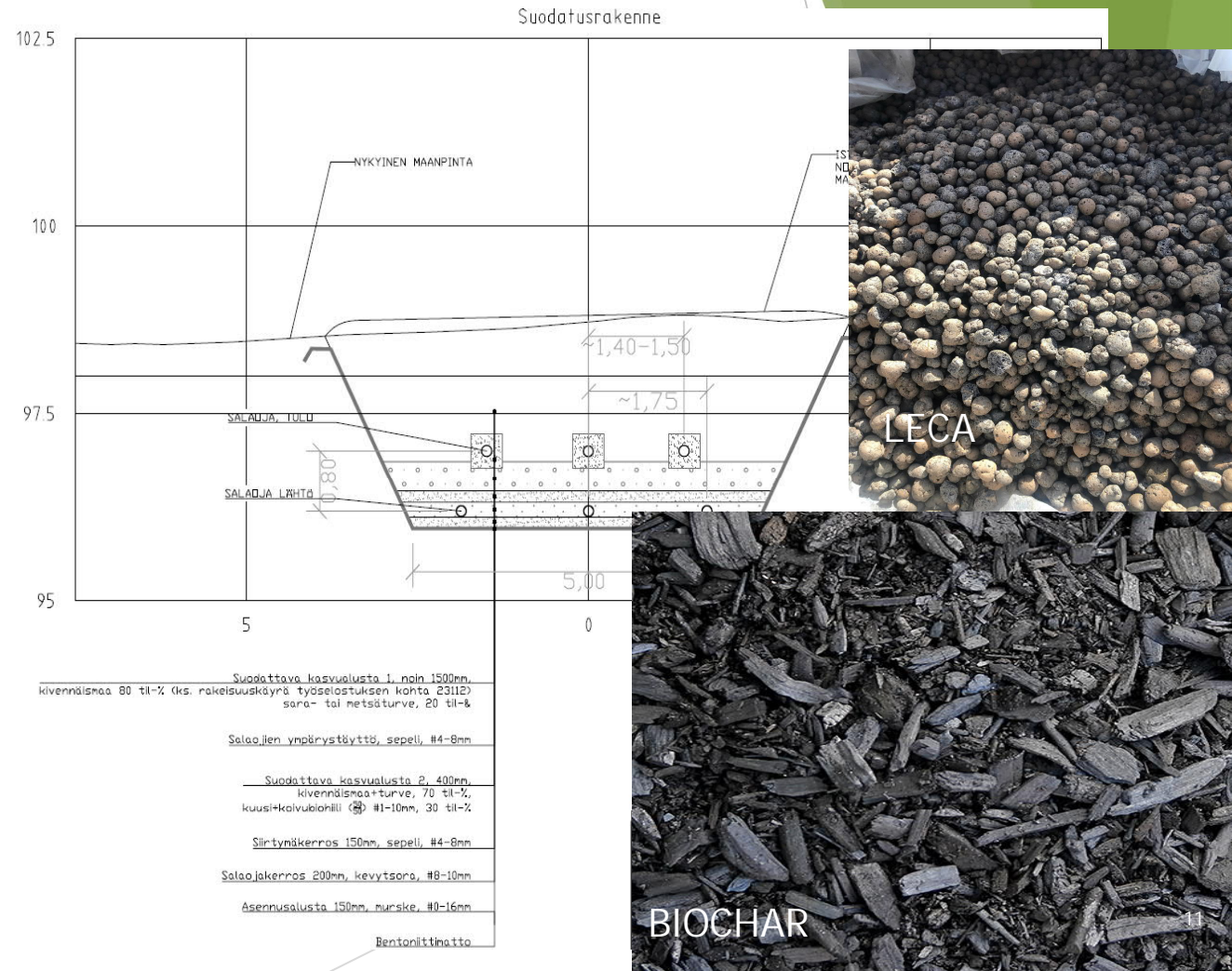
Results sand-based biofiltration

- ▶ Reductions:
 - ▶ TSS ~80%
 - ▶ P ~50%
 - ▶ COD ~46%
 - ▶ Fecal coliforms 90%-100%
- ▶ No effect on N, Cl or SO₄
- ▶ Life cycle 5-7 years for P (after 7 years P removal only 25%) -> more data needed



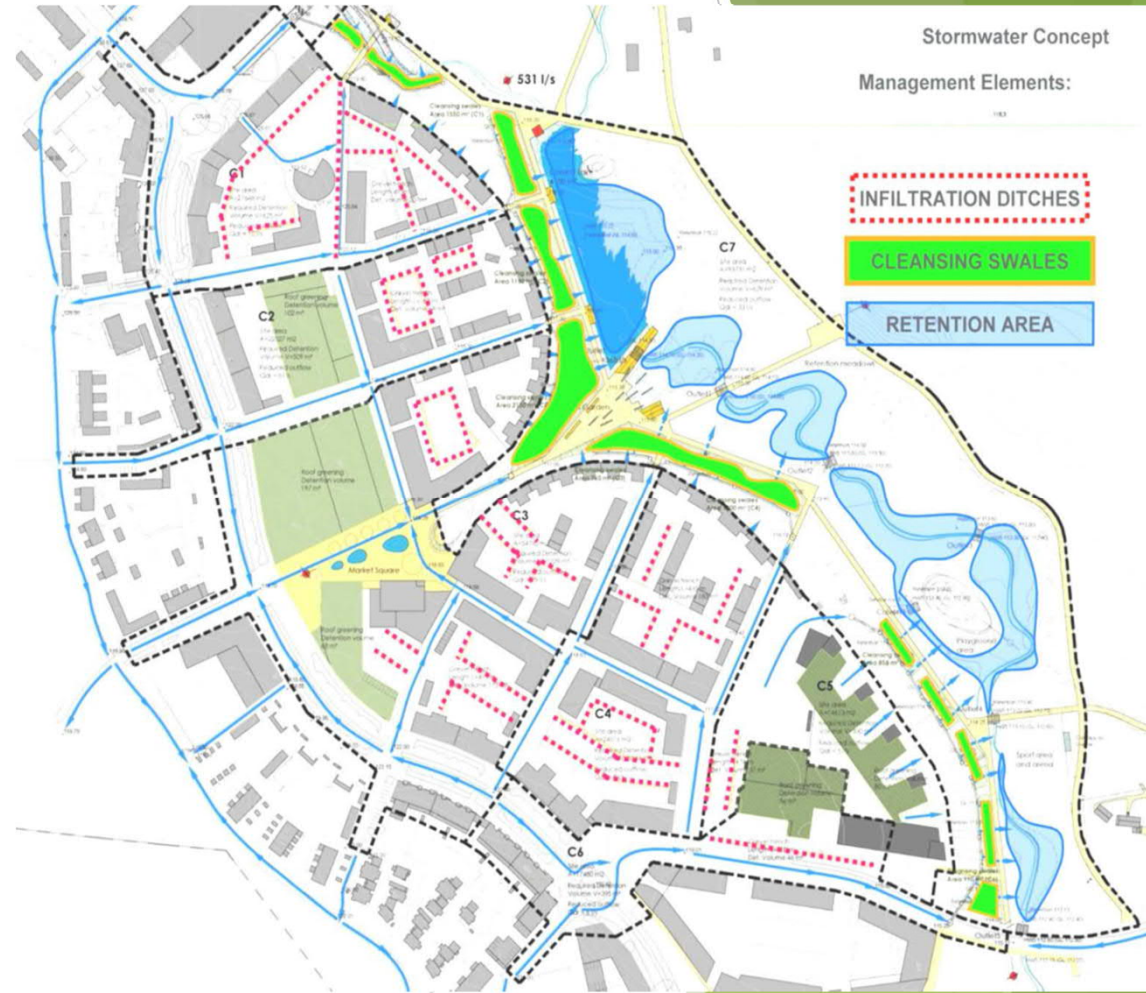
Results "advanced" filtration materials

- ▶ Spruce biochar, peat and LECA-gravel are tested
- ▶ Reductions at best N 80 %, P 90 % and TSS 90 %
- ▶ Works also in the winter
- ▶ Relatively small amounts of water can be treated, capacity problems faced -> failure in sizing, blocking, unsuitable materials, plants?



Results Vuores NBS

- ▶ Decentralised system
- ▶ Performance is challenging to measure->no starting point, many inlets
- ▶ Comparing end points of the system to measurements done before construction
- ▶ Nutrient and solids concentrations are low
- ▶ Flow rates in streams are lower than before construction->good retention capacity



School kids as scientists

- ▶ Fourth graders participate in water monitoring (quality & water insects)
- ▶ Measurements twice a year in streams and lakes nearby
- ▶ Teachers leading and reporting results
- ▶ Awareness raising!



Take home- message

- ▶ Runoff from construction sites must be treated
- ▶ Sand-based biofiltration is a cost-efficient solution for storm water purification
- ▶ For wastewater and polluted water use biochar or other advanced filtering materials
- ▶ Decentralized storm water system improves reliability and size of a single system decreases
- ▶ NBS are efficient in preventing flooding and purifying stormwater -> climate change resilience
- ▶ Involve kids in NBS performance monitoring -> awareness raising and appreciation of nature



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A photograph of a small, clear stream flowing through a lush forest. The water is surrounded by dense green ferns and moss-covered rocks. Sunlight filters through the trees, creating a dappled light effect on the foliage.

Kiitos!
Thank
You!

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