Green Roofs – a Scandinavian perspective

Bent C. Braskerud

Green Roofs - Part of Scotland's sustainable future

2011 Mars 31

og

Framtidens byers workshop om Grønne tak

29. november 2011

The Interreg IVB North Sea Region Programme

AWA

Green roof examples in Norway, Sweden and Denmark

- Historic view
- Modern green roofs
- Peat grass contra sedum
- Green roof and stormwater
- Green roofs as a BMP in a stormwater strategy
- BMPs and the local community

The way the Vikings made houses

Peat and grass on timber and birch bark

Photo: Dylan Kereluk

Illustration of Arkikon

From old Norwegian farms …

… to cottages in the mountains

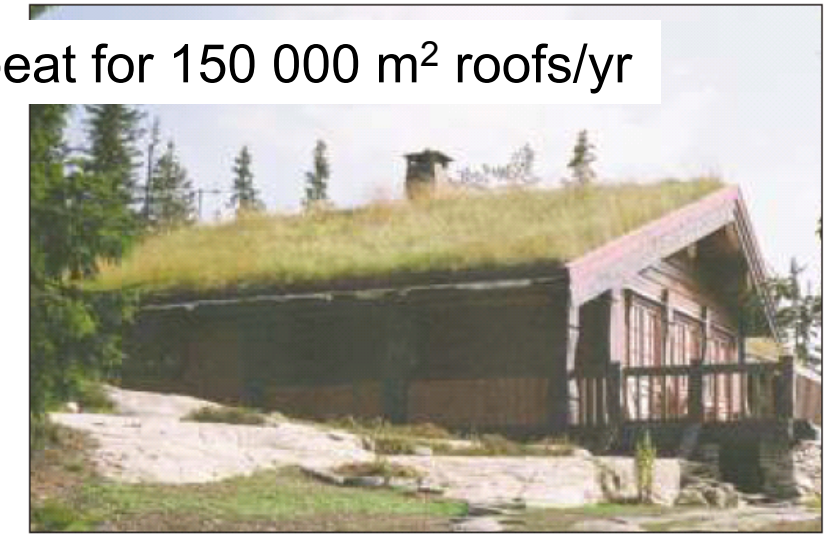
Modern use of peat for green roofing

Lay the mesh bags close together.

At the end the roof is evened with peat before watering.

Nittedal torvindustri sells peat for 150 000 m^2 roofs/yr

Sow evenly with our seeds at a ratio of about 1 kg per 100 m^2.



The result is a beautiful turf roof.

Modern green roofs

Sweden

Germany

Sedum-species often used

Keeps more than 50 % of the annual precipitation

8 mill. m2/yr
0.1 m^2/German

Peat roofs contra sedum roofs

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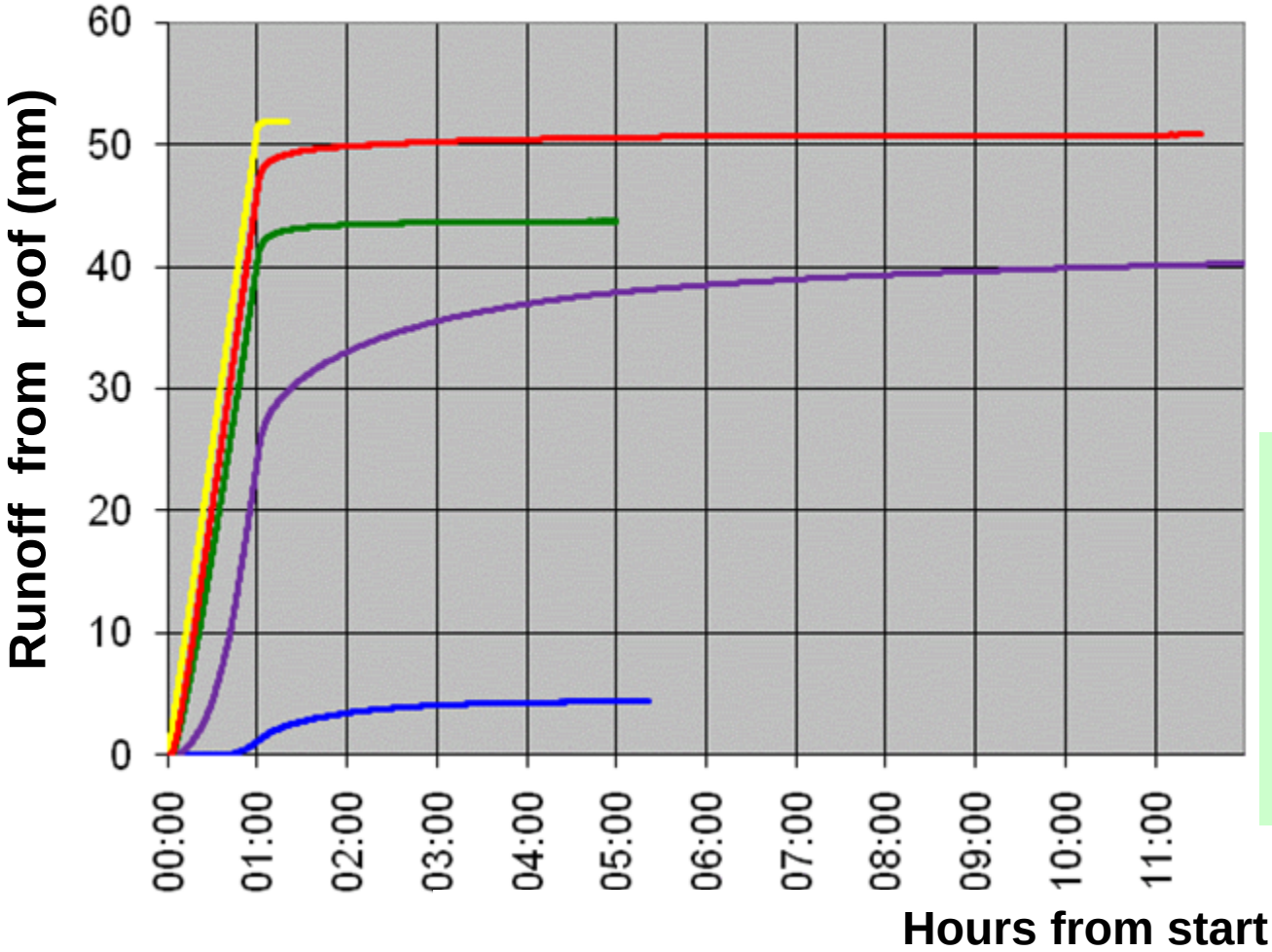
Peat roofs contra sedum roofs

Artificial precipitation: 52 mm in one hour



Runoff from roof

- Black roof
- Sedum 11% av Wmax
- Sedum 61% av Wmax
- Peat 21% av Wmax
- Peat 48% av Wmax

Wmax = maximum watercontnet compared to dry matter

Sedum: 302 %
Peat: 978 %

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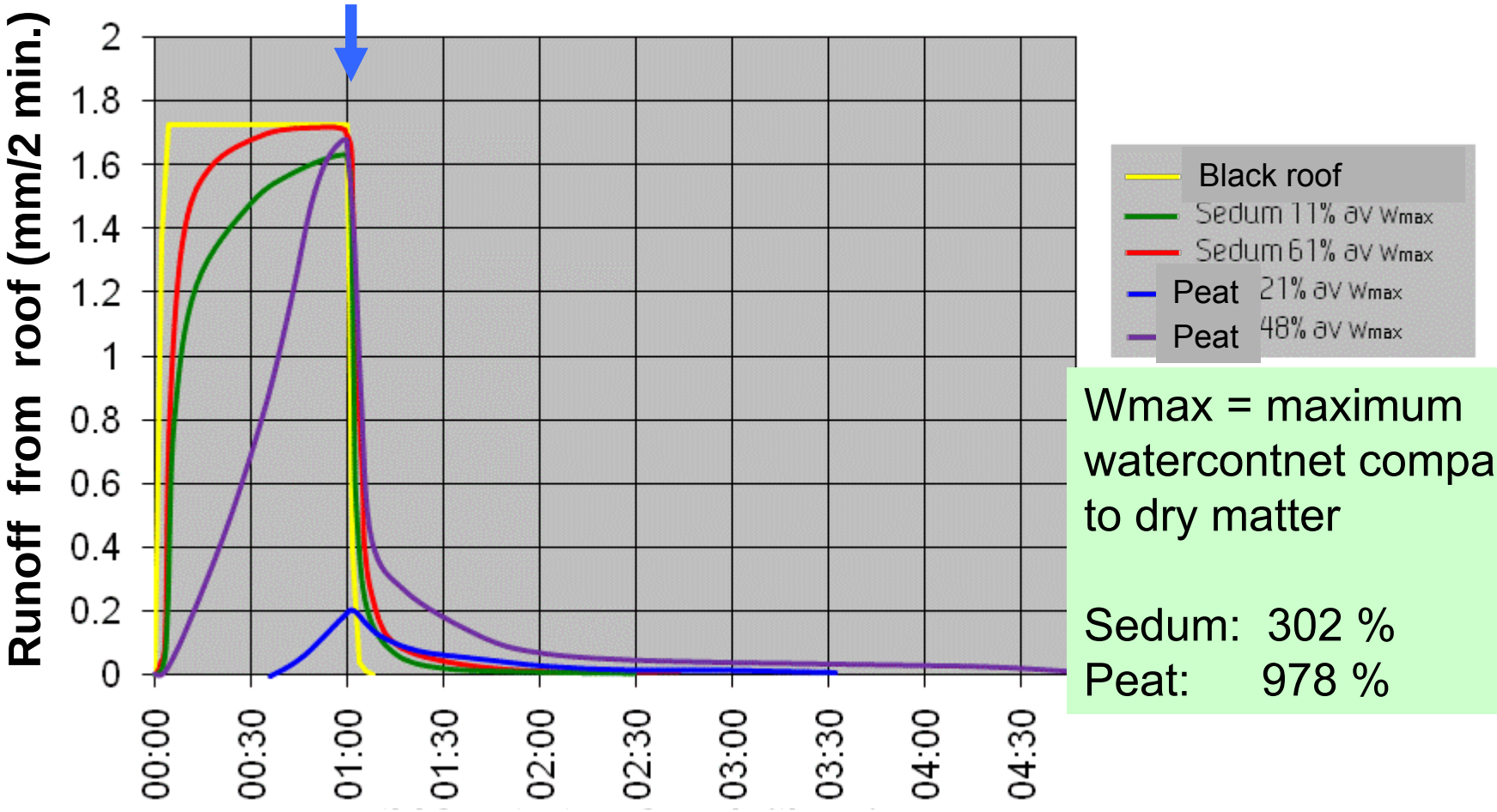
Peat roofs contra sedum roofs

Artificial precipitation: 52 mm in one hour, then drainage



Wmax = maximum watercontnet compared to dry matter

Sedum: 302 %
Peat: 978 %

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Modern use of peat for green roofing

- Peat has a very large water holding capacity
- Suitable for roof gardening

- It oxidizes to CO_2 and H_2O
- Peat recourses is only slowly renewable
- Grass needs irrigation if the summer is dry

- Is the total positive effect of peat > than the negative?

Modern green roofs

Sweden

Germany

Sedum-species often used

Keeps more than 50 % of the annual precipitation

What about cold climate?

Tools for a rough climate

NVE

SAWA

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Green roof experiment

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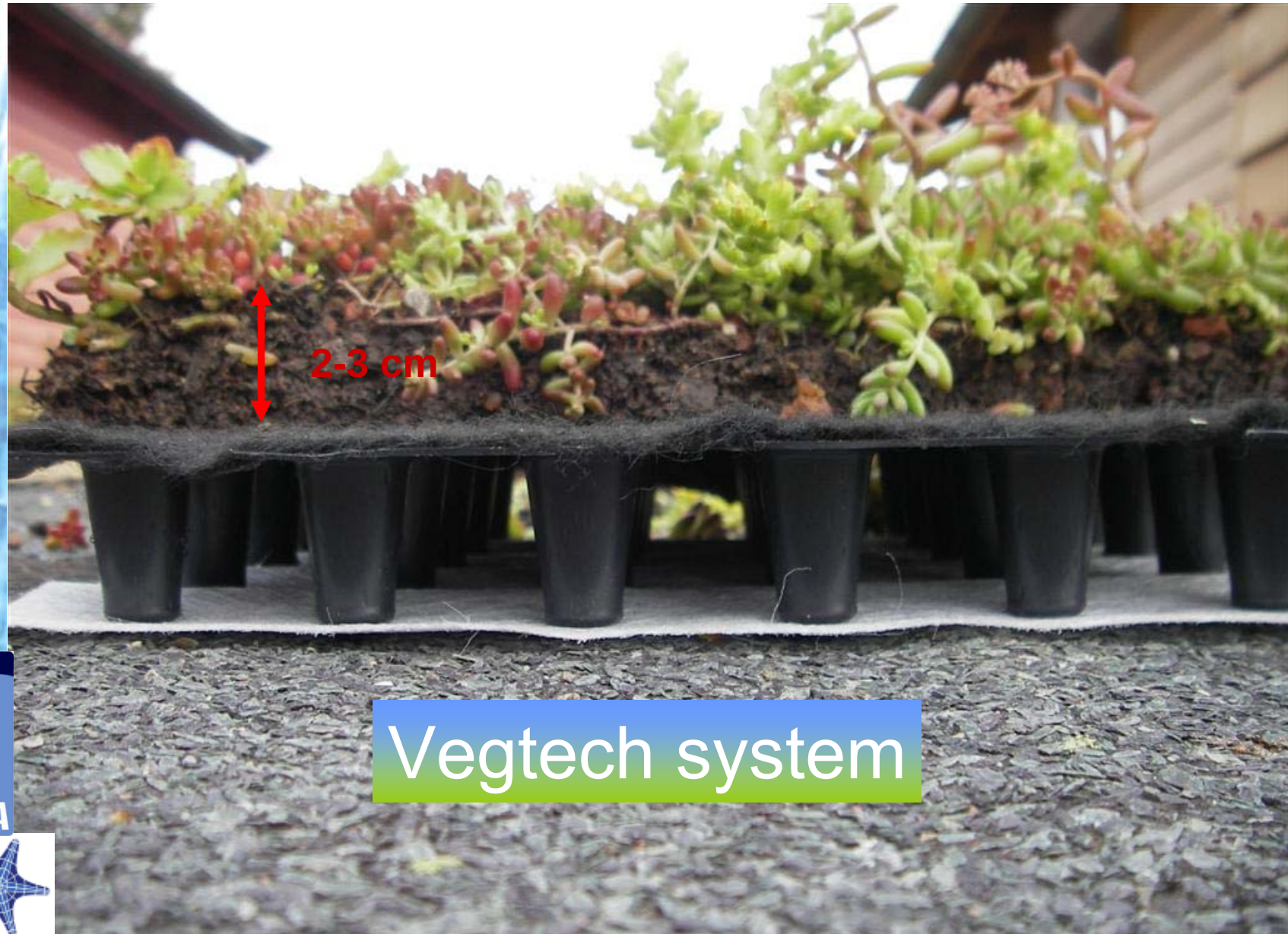
Established summer 2009

Green roof system



NVE

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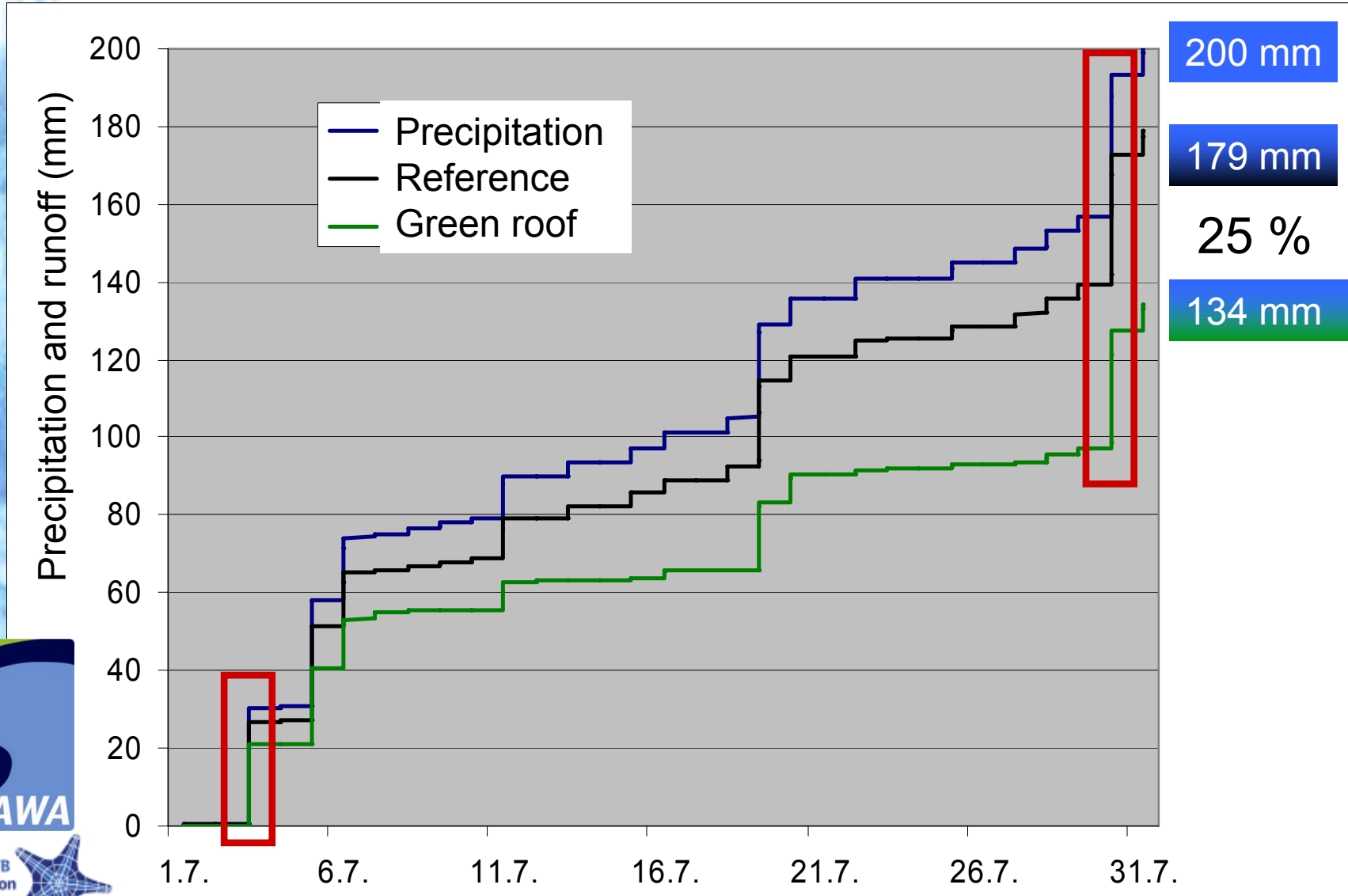
Sampling system

July 2009 was 2 x wet as usual



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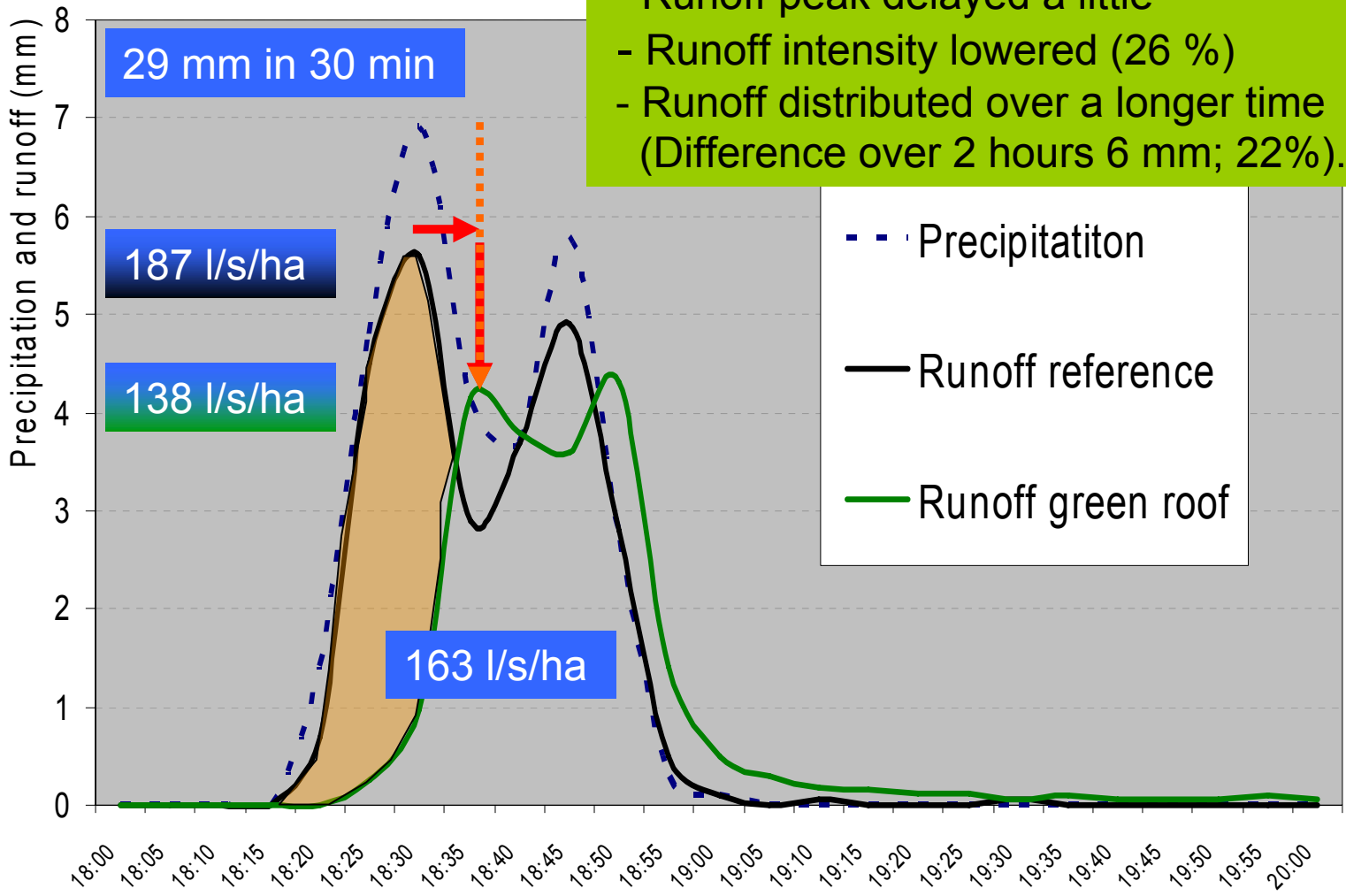
Extreme precipitation on a dry sedum roof

July 3rd 2009

- First rain absorbed (9 mm)
- Runoff peak delayed a little
- Runoff intensity lowered (26 %)
- Runoff distributed over a longer time (Difference over 2 hours 6 mm; 22%).



5 minute intervals

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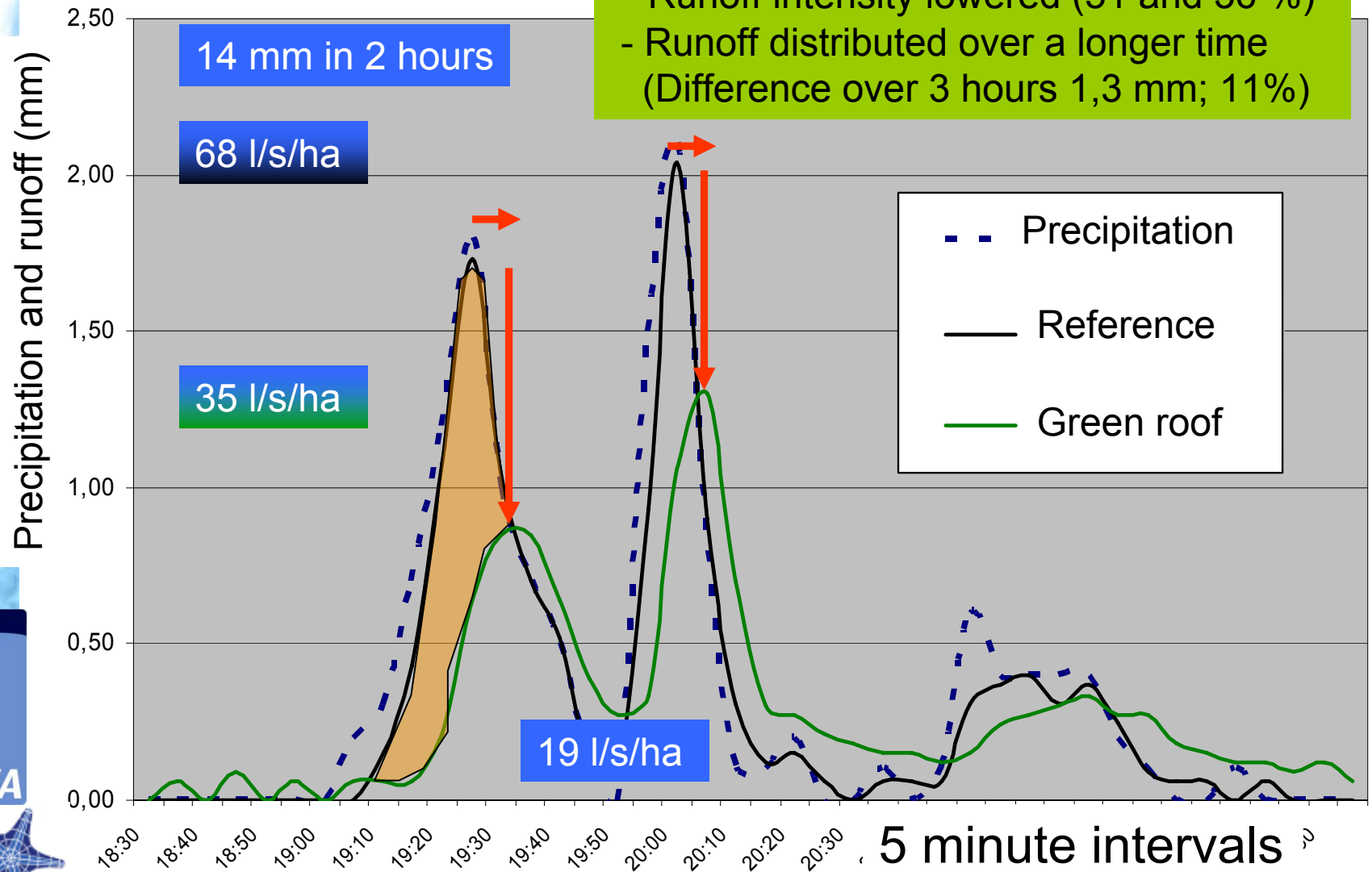
Runoff from a wet green roof

30th July 09

- First rain absorbed (2,5 mm)
- Runoff peak delayed a little
- Runoff intensity lowered (51 and 36 %)
- Runoff distributed over a longer time (Difference over 3 hours 1,3 mm; 11%)



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Green Roofs Copenhagen, Denmark
New houses with roof angle
less then 30 degrees
will have a green roof
Dorthe Røhmø
City of Copenhagen

Green Roofs drivers: Climate adaptation and greener city

Dorthe Røhmø
City of Copenhagen


All new flat roofs must be green
in new local plans
Digit 8 by BIG
Dorthe Røhmø
City of Copenhagen

http://www.greenroof.se/default.asp?pid=1

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Scandinavian Green Roof

GREEN ROOF

Augustenborgs Botanical Roof Garden

Augustenborg's Botanical Roof Garden

Scandinavian Green Roof Association

- **Start**
  - Brochures in 7 languages
  - Sponsors & members
- **About green roofs**
- **Augustenborgs Botanical Roof Garden**
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Living green roofs

Ecological solutions for the modern city

Guided tours of the Augustenborg Botanical Roof Garden

A royal visit!

Crown Princess Victoria and Prince Daniel visited the Augustenborg roof gardens on march 10.

Read more>

Did you know you can book a guided tour, or use the venue at the Botanical Roof Garden for conferences?

Read more>

Malmö stad

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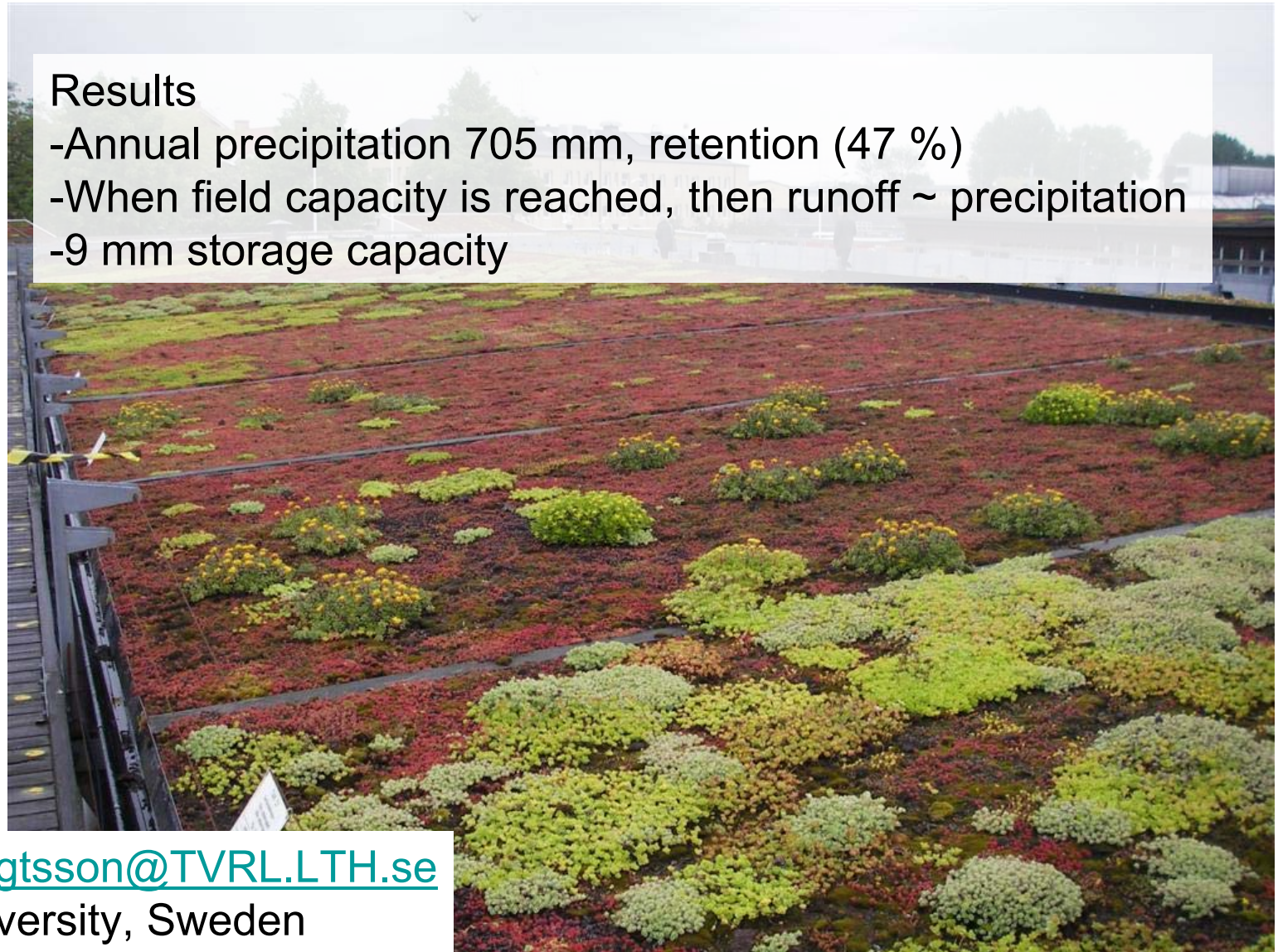
Sweden - Malmö

Augustenborgs Botanical Roof Garden

Plenty of sedum,
but also other types of green roofs

Runoff experiments on 3 cm sedum

Results
-Annual precipitation 705 mm, retention (47 %)
-When field capacity is reached, then runoff ~ precipitation
-9 mm storage capacity



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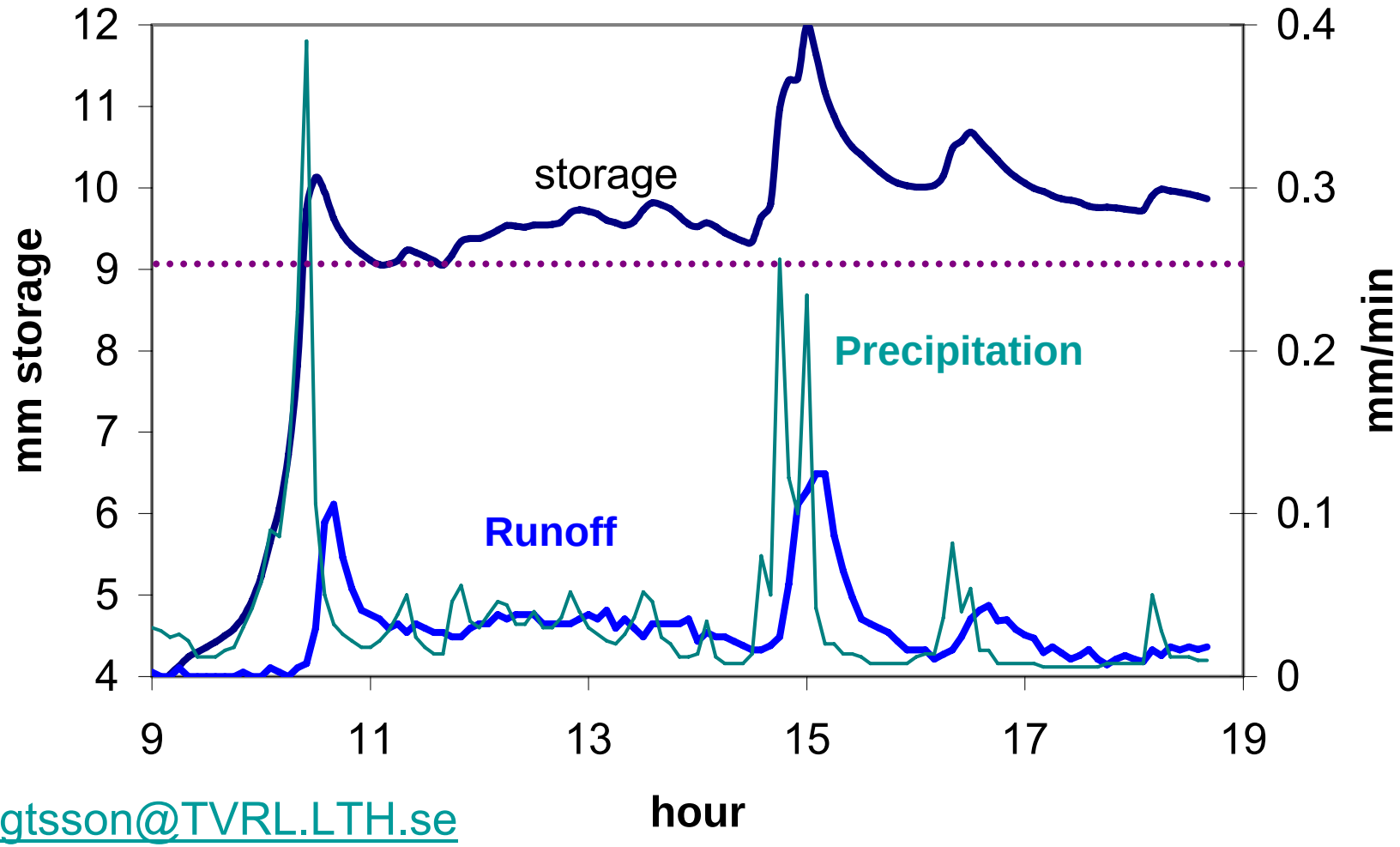
Water storage increases with the precipitation intensity



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Priority one: Green roofs need to look beautiful!

17. July 2011

The Interreg IVB North Sea Region Programme

Frost damage?

25.08.10

8.06.11

11.07.11

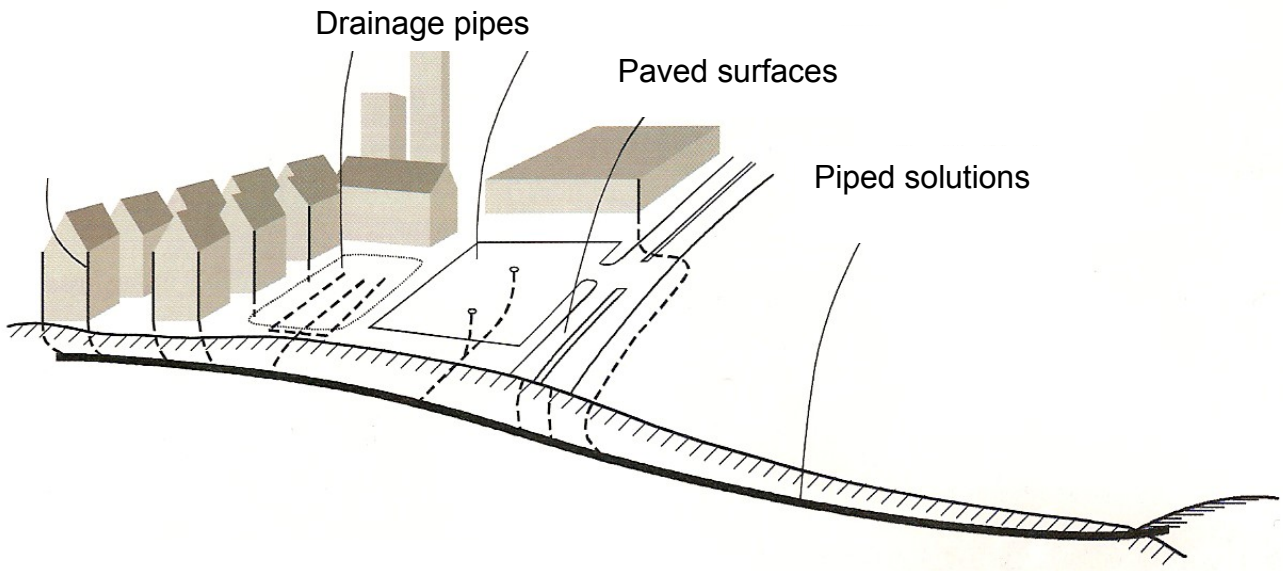

Vanning etter behov

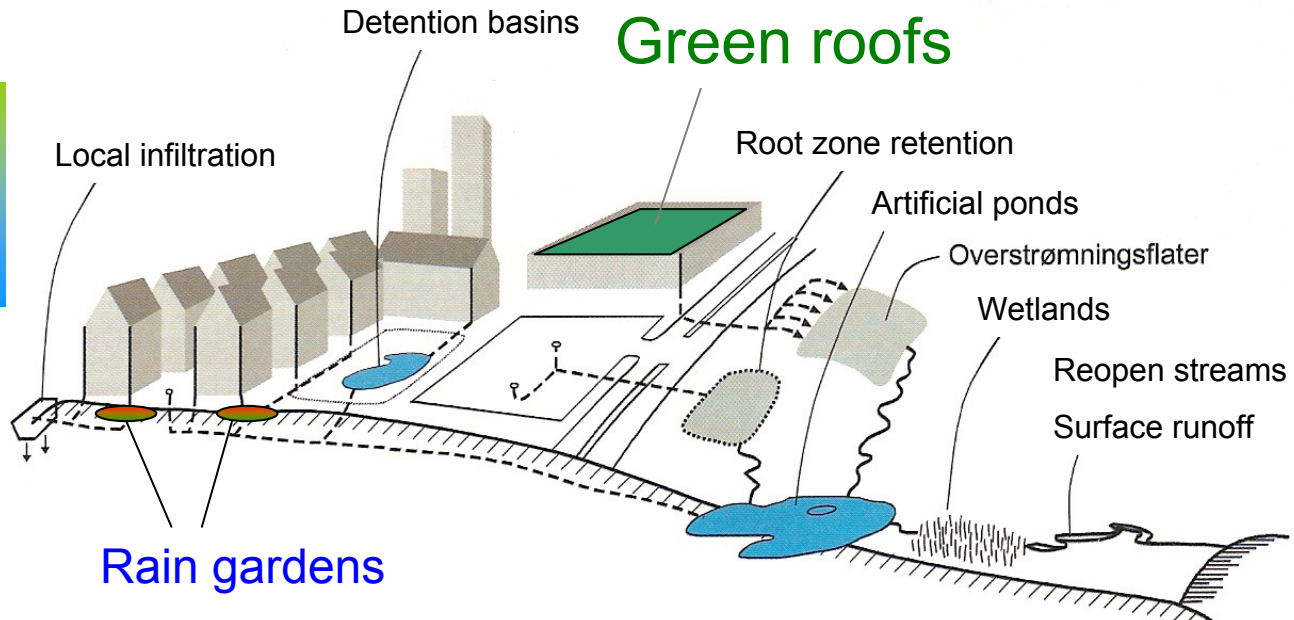
Sustainable Urban Drainage Systems

SUDS

Gray solutions

Green solutions





Testing av regnbeds kapasitet

Hvis regnbed er 7 % av takareal
og 50 års nedbør i Oslo.
Testet 30 min og 10 min regn

Regnbed på leire i Oslo

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Exflood

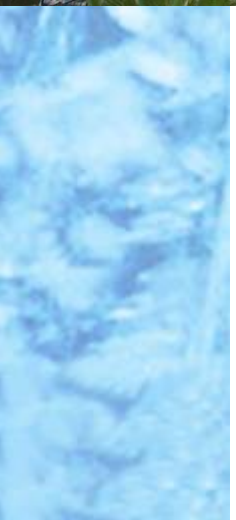
H2O OSLO

Foreløpige resultater

Max inn: 184 l/min
(307 l/s ha)

Max ut: 29 l/min
(48 l/s ha)

Dempet vf-topp med: 84 %

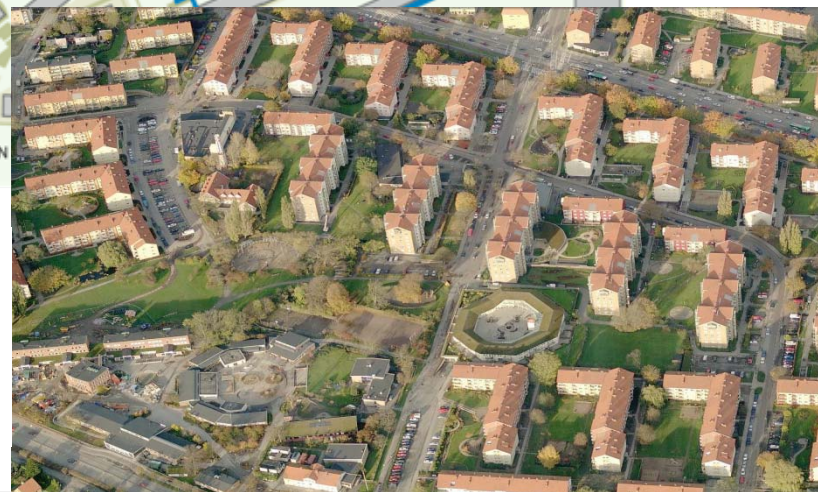


Master UMB 2012
Kjetil Kihlgren og
Vegar Saksæther

Ex flood

Stormwater BMPs in Malmö

Houses from the 50s
-Defekt stormwater system
-Social problems



Ekostaden Augustenborg

Kanaler og dammer

ISS Landscaping


Results:
- No stormwater related water damage
- Biodiversity increased 50 %
- Turnover sales decreased from 50 % to 20 %
- Number of voters from 54 % in 1998 to 79 % in 2002