



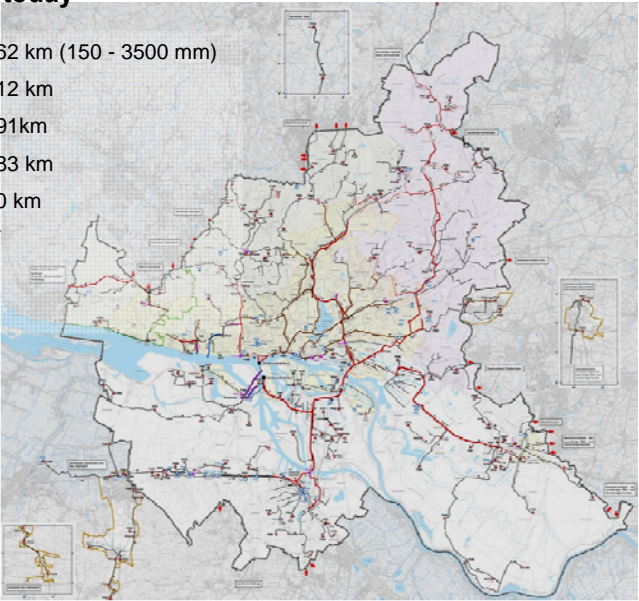
Dimensioning of sewer pipes

Dipl.-Ing. Klaus Krieger

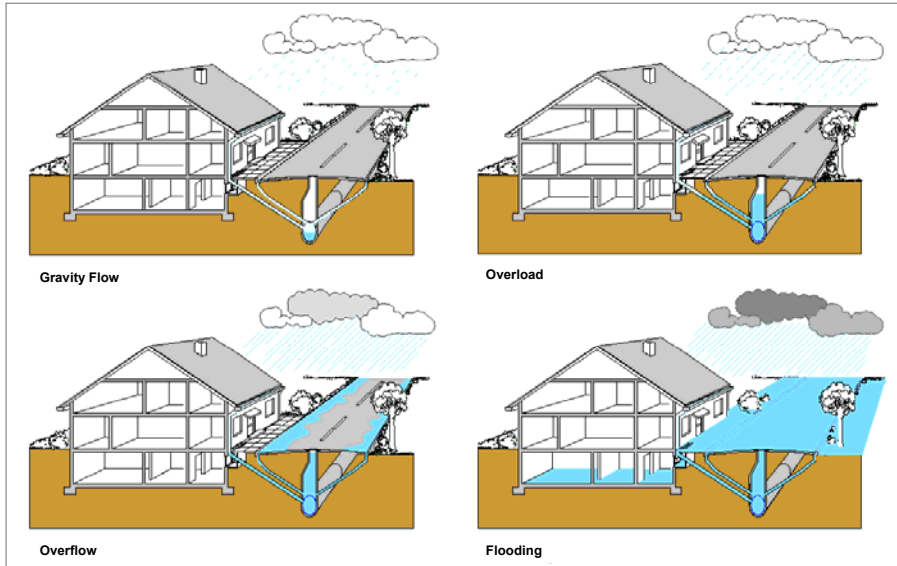


Hamburg's sewer network today

- Total length of sewers 5,562 km (150 - 3500 mm)
- Combined sewers 1,212 km
- Wastewater sewers 2,191 km
- Stormwater sewers 1,683 km
- Pressure sewers 470 km
- Number of pumping stations 227
- Number of retention basins 43
- Number of WWTPs 2



Definitions of Overload, Overflow and Flooding



Definitions of Overflow and Flooding



Overflow: water emerges from manhole



Flooding: overflow causes damage

Recommended criteria for dimensioning of storm water sewers

		Dimensioning <small>Drainage without overload based on design storm</small>	Proof of overload DWA A 118 <small>overload frequency based on long term series simulation</small>	Proof of flooding DIN EN 752 <small>flooding frequency based on long term series simulation</small>
		1	2	3
Criteria		max. frequency of design storm (once in n years)	max. frequency of overflows (once in n years)	max. frequency of flooding (once in n years)
Rural area		1 in 1	1 in 2 (1 in 1)	1 in 10
Living area		1 in 2	1 in 3 (1 in 2)	1 in 20
City center	With verification of flooding	1 in 2	1 in 5 (1 in 3)	1 in 30
Commercial area	Without verification of flooding	1 in 5		not to apply
Subsurface traffic		1 in 10	1 in 10 (1 in 5)	1 in 50

(Proof of existing sewers)

Classification of heavy rains

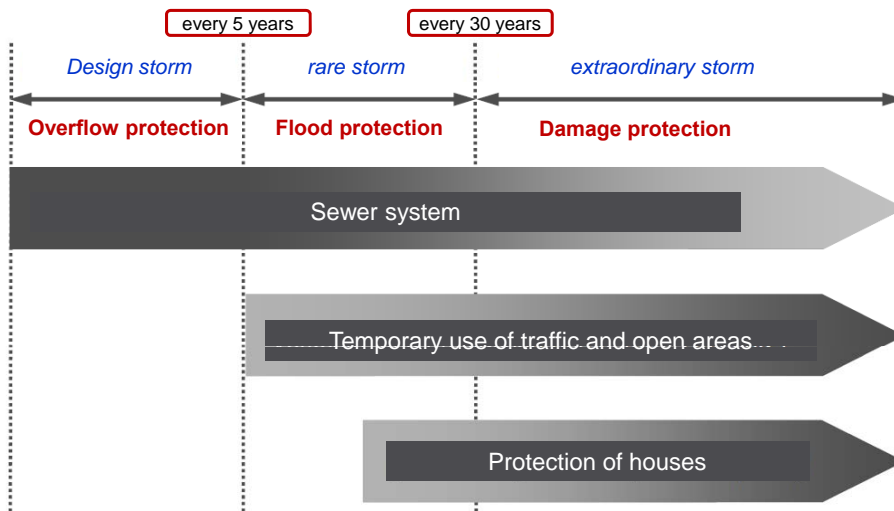
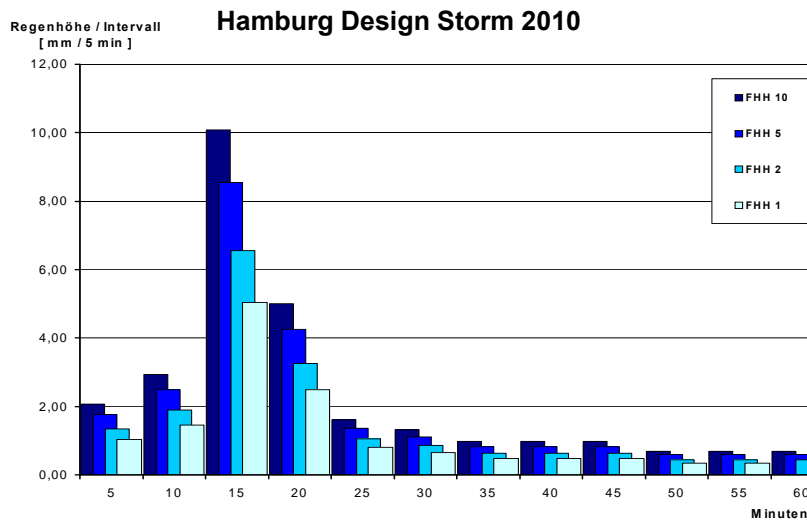
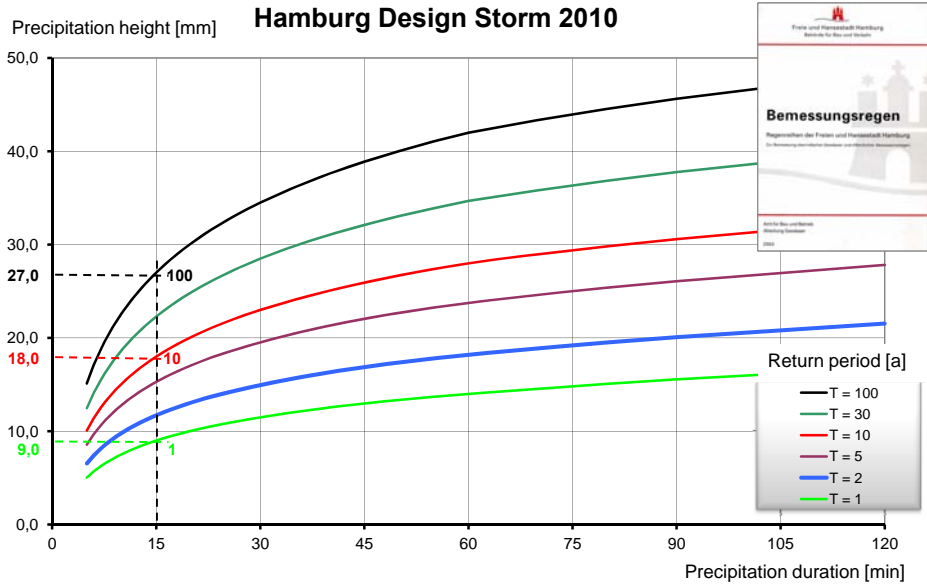
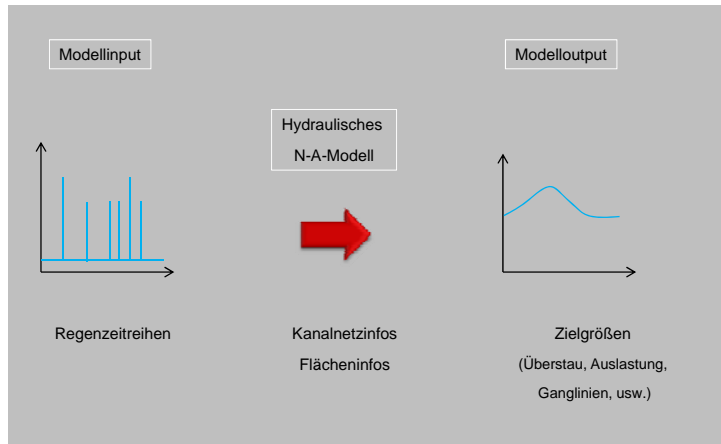


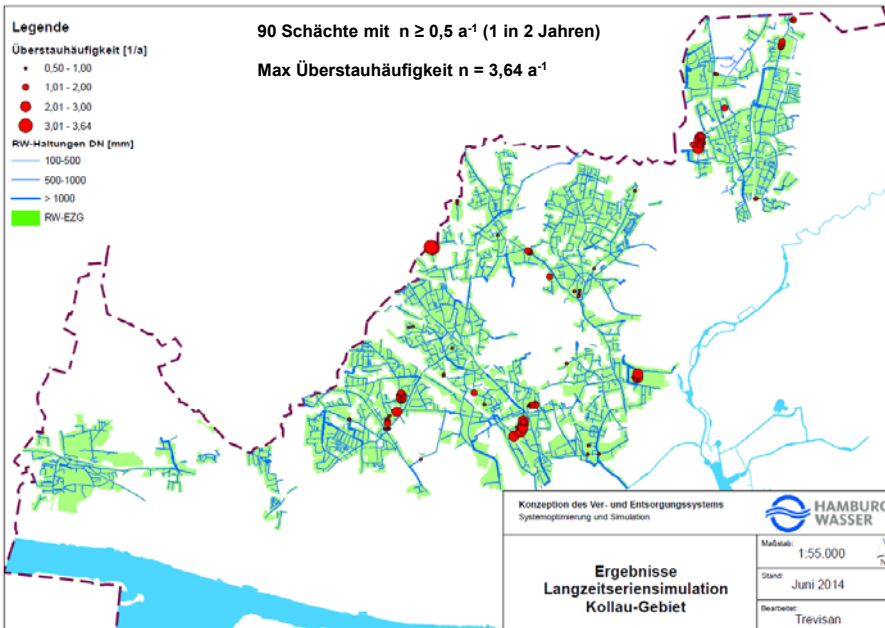
Abbildung 1: Elemente des Überflutungsschutzes kommunaler Entwässerungssysteme in unterschiedlichen Belastungsbereichen (nach [DWA, 2008])



Precipitation-Drain-Model



Bildquelle: Lothar Fuchs, ITWH

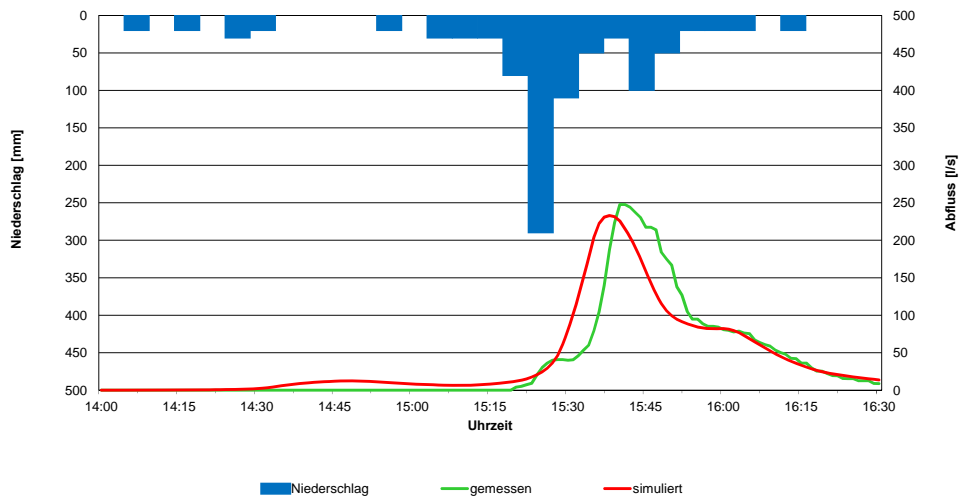


Flow Measurements



Dimensionierung von Abwasserkanälen vor dem Hintergrund des Klimawandels

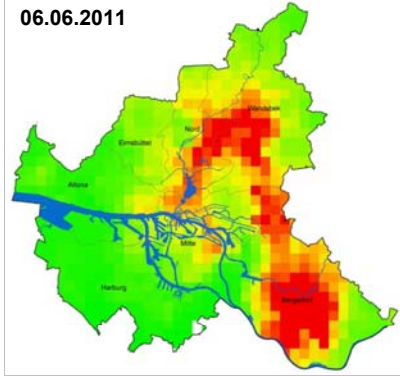
Model Validation and Calibration



Dimensionierung von Abwasserkanälen vor dem Hintergrund des Klimawandels

Non-uniform distribution of heavy storm events

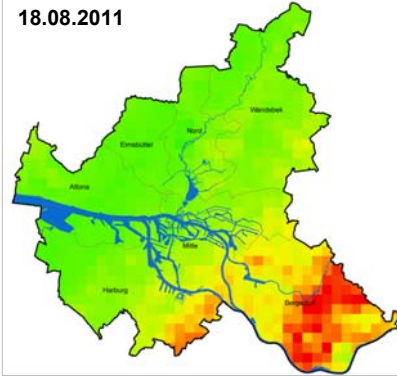
06.06.2011



Max. storm intensity

- N = 48,6 mm
- D = 75 min
- $T_N = 560$ a (> 100 a)

18.08.2011



Max. storm intensity

- N = 30,1 mm
- D = 40 min
- $T_N = 25$ a

