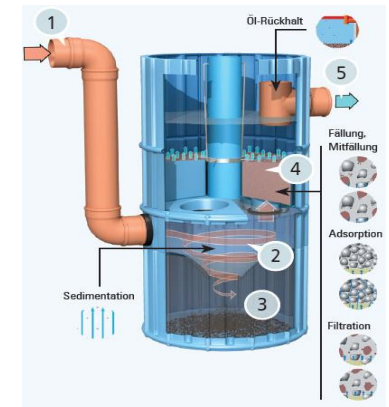


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# Storm Water Management – Pollution and Treatment

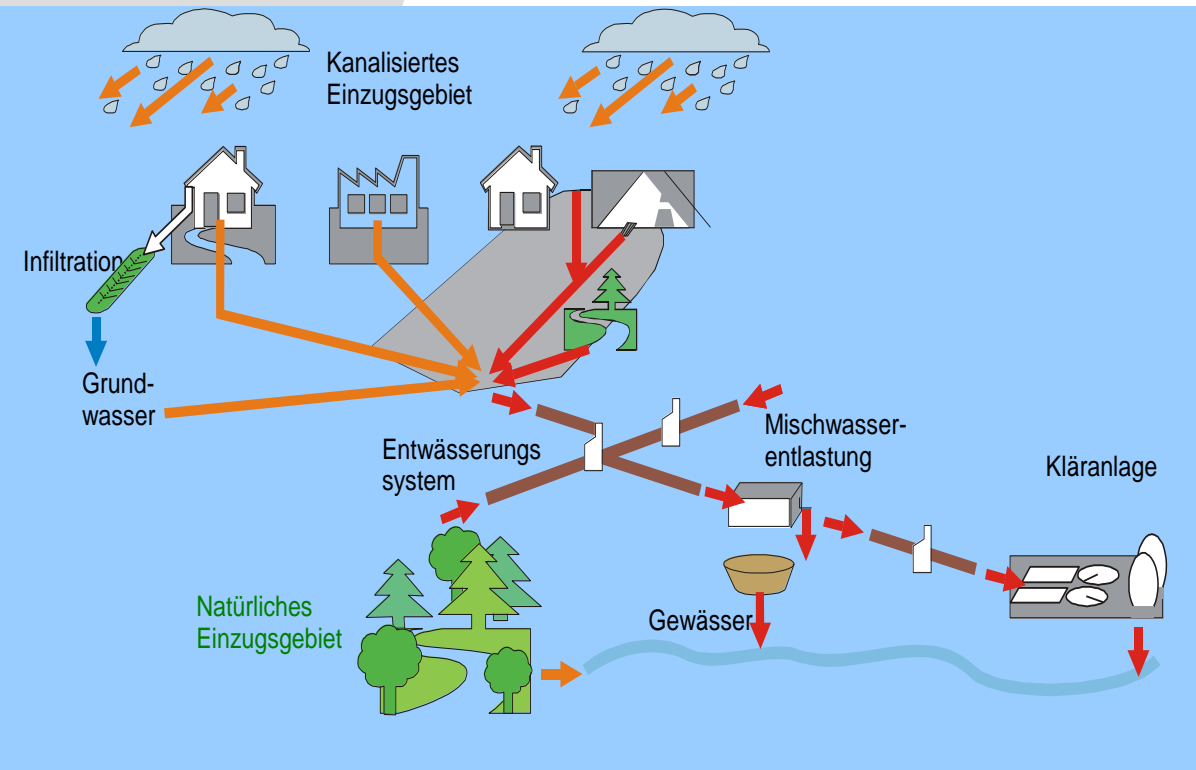


## Major Storm Water Concerns

- **Climate Change – Urban Flood Protection**
    - uncertainty – flood risk management
    - adaptation of urban drainage systems - flexibility
  
  - **Water Quality Control**
    - local water balance
    - pollution load of urban runoff
- issue: integrated urban drainage**

# Scope of “Integrated Urban Drainage”

## Urban (Waste-)Water System



### Sub-systems:

- drainage system
- wastewater treatment
- receiving surface water
- groundwater

## *subjects of concern*

secure sanitation

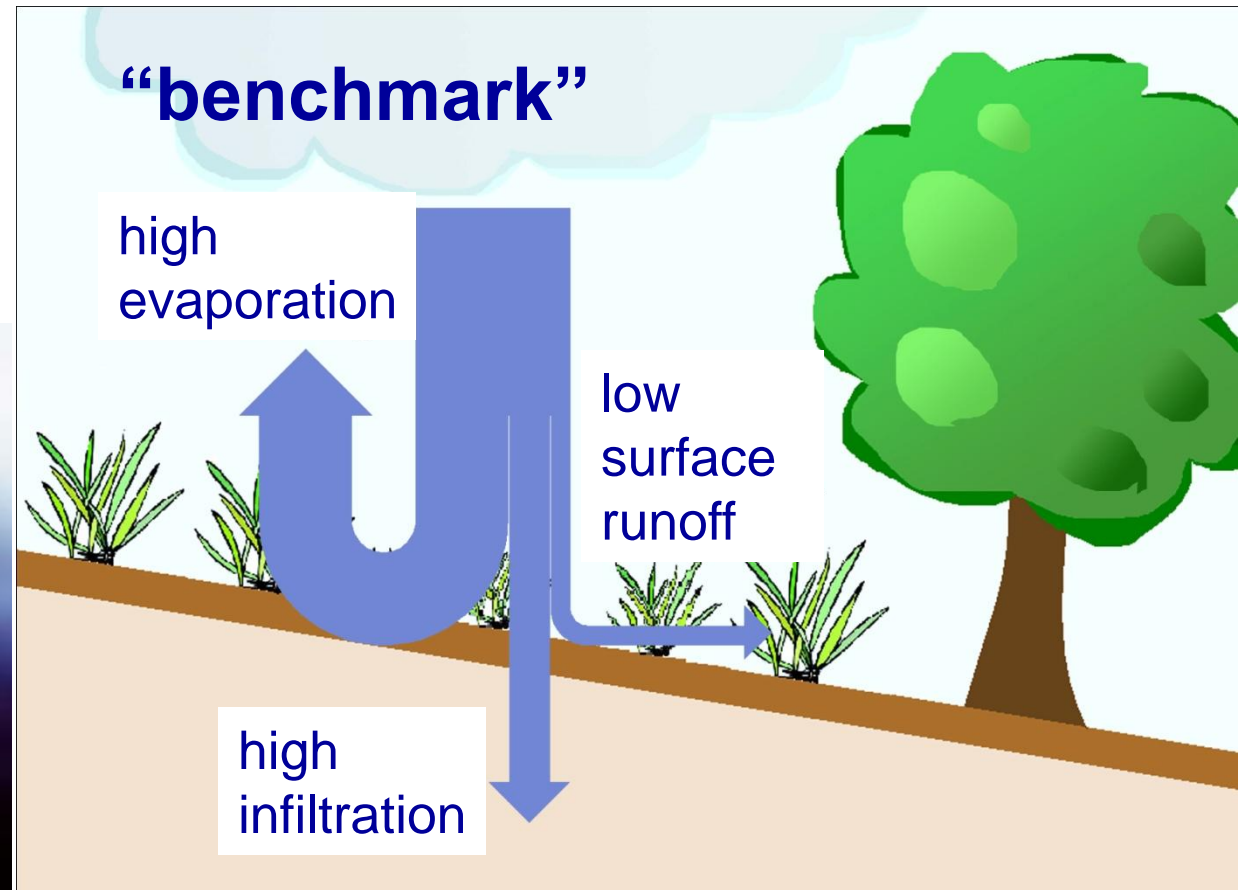
secure use of water

water quality control

other concerns

# Principle of future urban development ...

**Minimizing adverse effects  
of urban drainage  
on local water balance!**



# Urban Flood Protection

## Perception

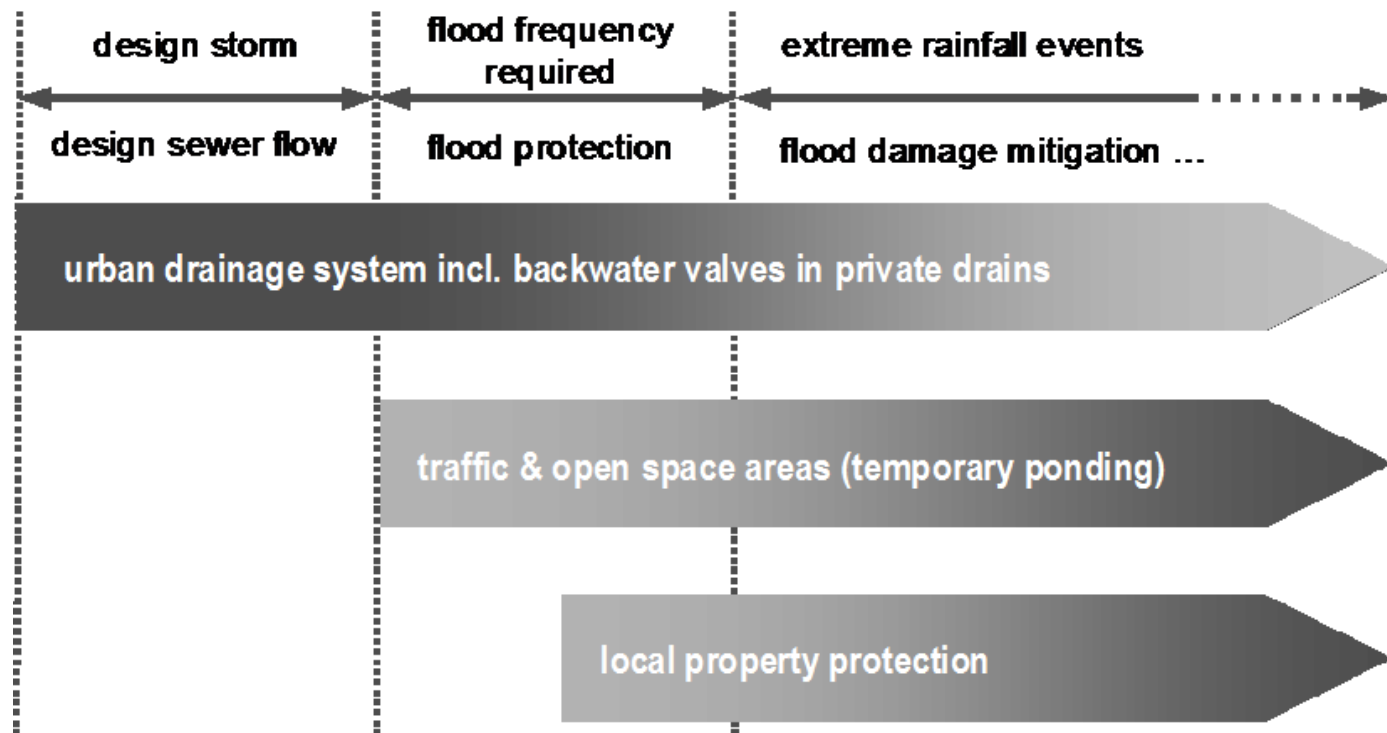
- high uncertainty about possible effects of climate change on extreme rainfall and urban flooding
- general increase of design frequency not conducive (no “climate factor”)

## Future needs

- higher adaptiveness of drainage concepts
- local flood risk analysis
- surface features (street, open space, ...) part of drainage concept (retention, infiltration, discharge)
- communicating remaining ‘flood risk and uncertainty’

# Urban Flood Protection...

## ... a joint Community Effort



# *(Storm) Water Quality Control*

## Urban Runoff Pollution

- combined sewer overflow
- polluted storm water runoff

## Receiving Water Quality problems

- Hydraulic stress (small watercourses, creeks ...)
- **Pollution load: suspended solids, organics / oxygen demand, (nutrients)**
- Toxic / hazardous pollutants: trace organics, heavy metals
- Hygienic impairment (bathing waters)



# Storm Water Management

## **Source-controlled storm water management**

(LID: low impact development, BMP: best management practices;  
WSUD: water sensitive (sustainable) urban drainage)

### **“Minimize adverse effects on local water balance!”**

- maintain vegetation and infiltration capacity
- avoid / reduce pollution of drainage areas
- apply pervious pavements (minor polluted areas)
- on-site storm water retention, rainwater harvesting
- on-site infiltration facilities: bio-swales, basins, ...
- (on-site) treatment of polluted runoff

## Legal Requirements

### European Standard EN 752:

General requirement: “Protect surface receiving waters”

### e.g. German Water Act (2009 - §§ 56 - 57))

- **Stormwater runoff (collected & conveyed) = wastewater**
- *Preference to separate sewer systems*
- **Discharge permission requires** limitation of volume and harmfulness of wastewater according to best available technology (BAT)

however:

- **no BAT standards for storm water runoff provided**

# Combined Sewer Overflow (CSO)

## e.g. Germany:

60 % of population served by combined sewer systems

### → Reduce CSO occurrence”

- apply source-based SWM
- “avoid” combined sewer systems (German Water Act)
- increase wet-weather capacity of WWTP
- provide detention volume (overflow basins)
- install CSO treatment

# German Storm Water Policy

- 3 categories (I – III) of potential runoff pollution
- evaluation of drainage areas according to
  - land use (residential, city center, commercial/industrial)
  - area type (roof, street, parking, green zone)
- treatment required in category II and III – e.g. Cat. II:
  - reference: infiltration through vegetated soil
  - preference: near-source treatment in standardized devices
  - Category III: biological treatment → WWTP
- develop technical standards for centralized treatment facilities (sedimentation tanks, constructed wetlands)
- **no on-site monitoring during storm events!**

# German Storm Water Policy

## **Emission-based requirements in combination with receiving water quality criteria**

### ➤ **limitation of pollutant discharge**

- total suspended solids as ‘guiding parameter’

### ➤ **source control devices**

- industrial standards “welcome”
- Procedure for pre-qualifying to secure long-term operation and efficiency (to be established)

### ➤ **end-of-pipe treatment facilities**

- technical design standards (to be established)

### ➤ **water quality criteria**

- new surface receiving water regulation released

## Conclusion

- **Integrated sewer system management**
  - clear preference for source-controlled SWM
- **Urban Flood Protection / climate change**
  - uncertainty requires adaptiveness and flexibility
  - planning tool: flood risk analysis
- **Water Quality Control**
  - local water balance as guiding evaluation criterion
  - combined approach: limiting discharge and observe receiving water quality criteria
  - preference to source control of pollution

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# Storm Water Management – Pollution and Treatment

