Sustainble Stormwater Management

Stockholm Royal Seaport

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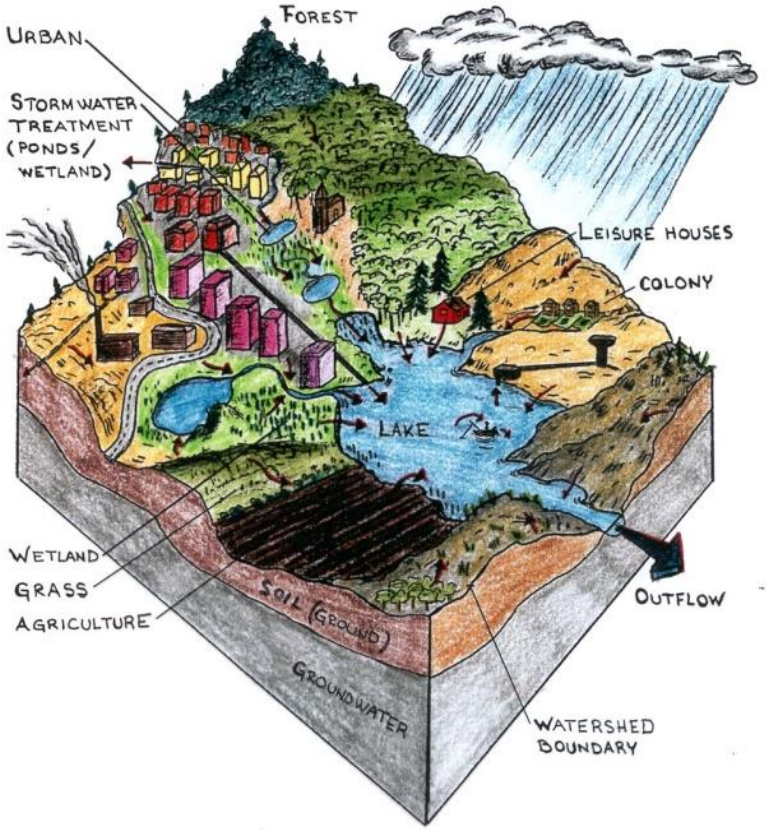
Urban Storm Water Management

Urban Storm Water Management

1. Storm Water Management Plans
   - cross-discipline
2. Flow and pollutant calculation
   - modelling and GIS
3. Receiving water capacity
   - water and mass balances
   - acceptable loads
4. *Low impact development*
   - *storm water facilities (BMPs)*
   - *detention and treatment*
5. Monitoring and Maintenance



Challenges to urban stormwater management

Quantity

- Too much water problems (flooding)
- No water problems (stressed vegetation)
- Climate trends
- Flooding and turbidity in receiving water

Quality / Pollution

- Protect or improve receiving waters
- Pollution transport and combined sewer overflow

Urban Storm Water Management

Strategies

1. On site infiltration (reduce volumes).
2. On site detention (reduce top flow).
3. Drain in preferably open systems
4. Secure secondary drainage paths, and use multi-functional areas
5. Treat the water that needs treatment

Low Impact development

Ecosystem services

- Enhance living experience
- Symbolic values
- Landscaping
- Increased bio-diversity
- Increased bio-resilience
- Drainage (detention and treatment)
- Resource-Efficiency
- Cost-Efficiency

Low Impact development

Secondary drainage paths,
Multi functional areas

Hammarby Sjöstad

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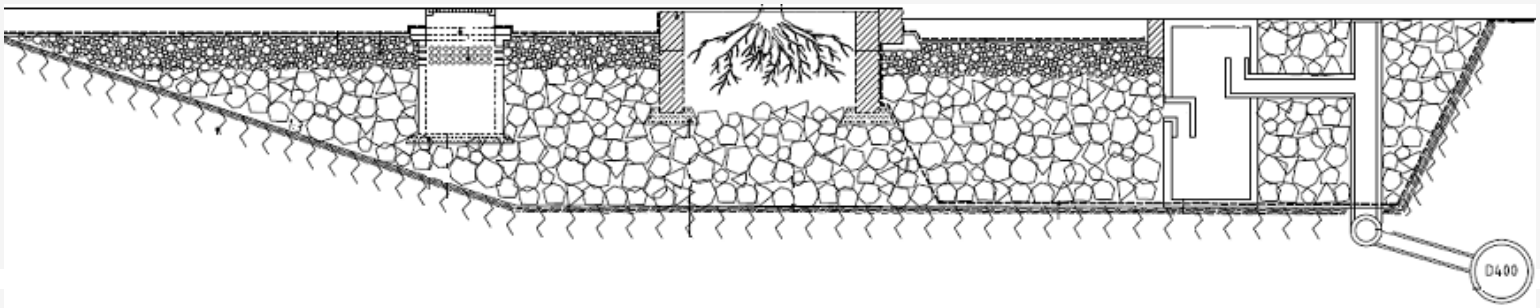


Hammarby Sjöstad

Lessons learnt (2004)

- Involve stormwater management early in the planning process
- Have an early dialogue and cooperation between landscape architects, civil engineers and spatial planers
- The importance of information signs to increase the awareness and knowledge about the different facilities.
- Design for easy maintenance

Stockholm Royal Seaport

Stockholm Royal Seaport

”The Royal Seaport innovation will become a sustainable urban area and an international model for sustainable urban development”

Working process

Environmental work with a holistic approach, evaluation and implementation

"Education" of constructors, dialogue and exchan of experiences

Continuous monitoring, review of the sustainabili goals

Strategy

Guidelines

Land Allocation Agreement

Design criteria (brief)

No increase in pollution load on the receiving water

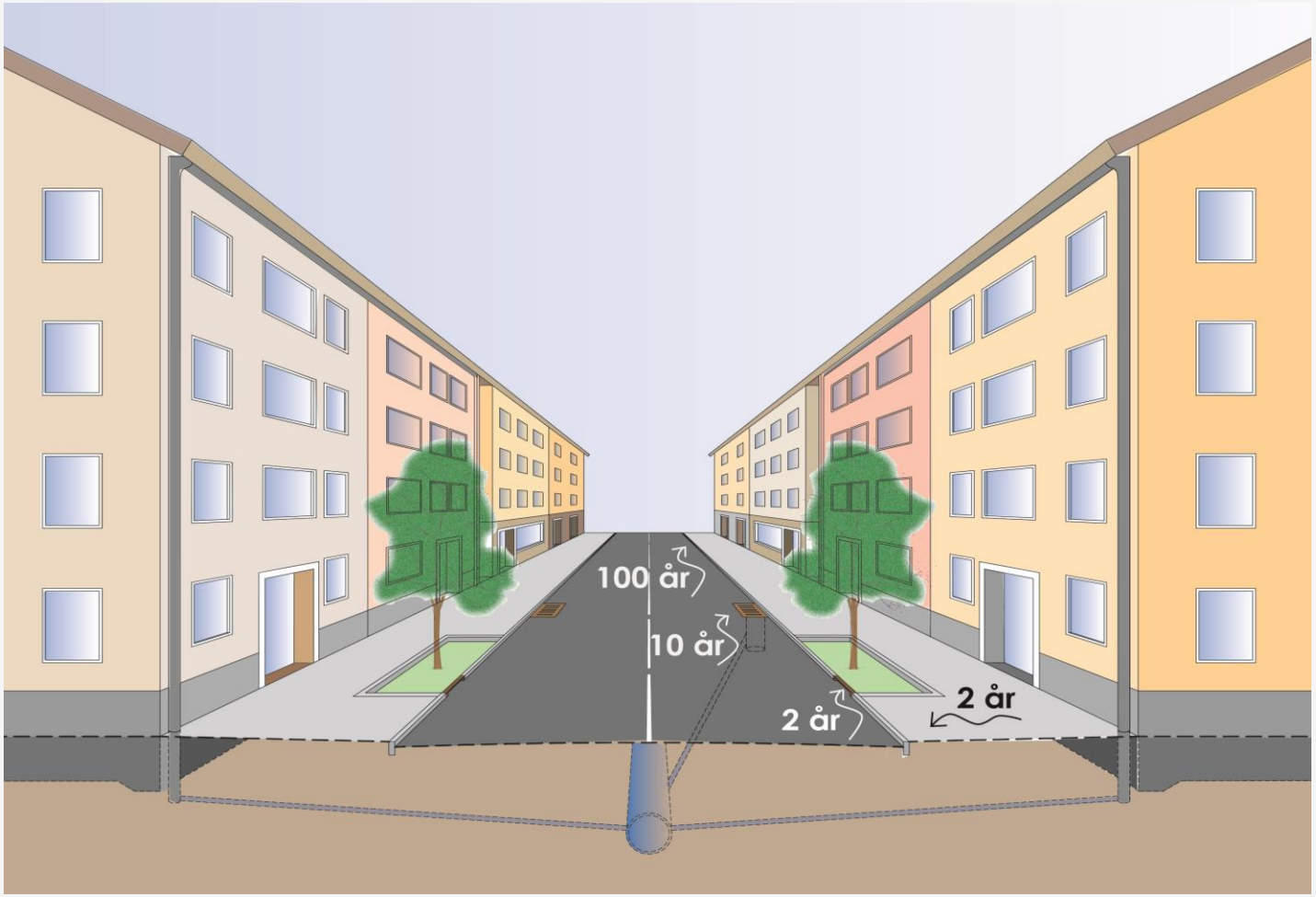
Design LIDs to drain a 2 year rain event

Design drainage system (pipes) to drain a 10 year rain event

Design secondary flow path to drain a 100-years rain event without damage to buildings

Require a city-block design to achieve a runoff coefficient of 0.25 (0,4)

Design criteria (brief)

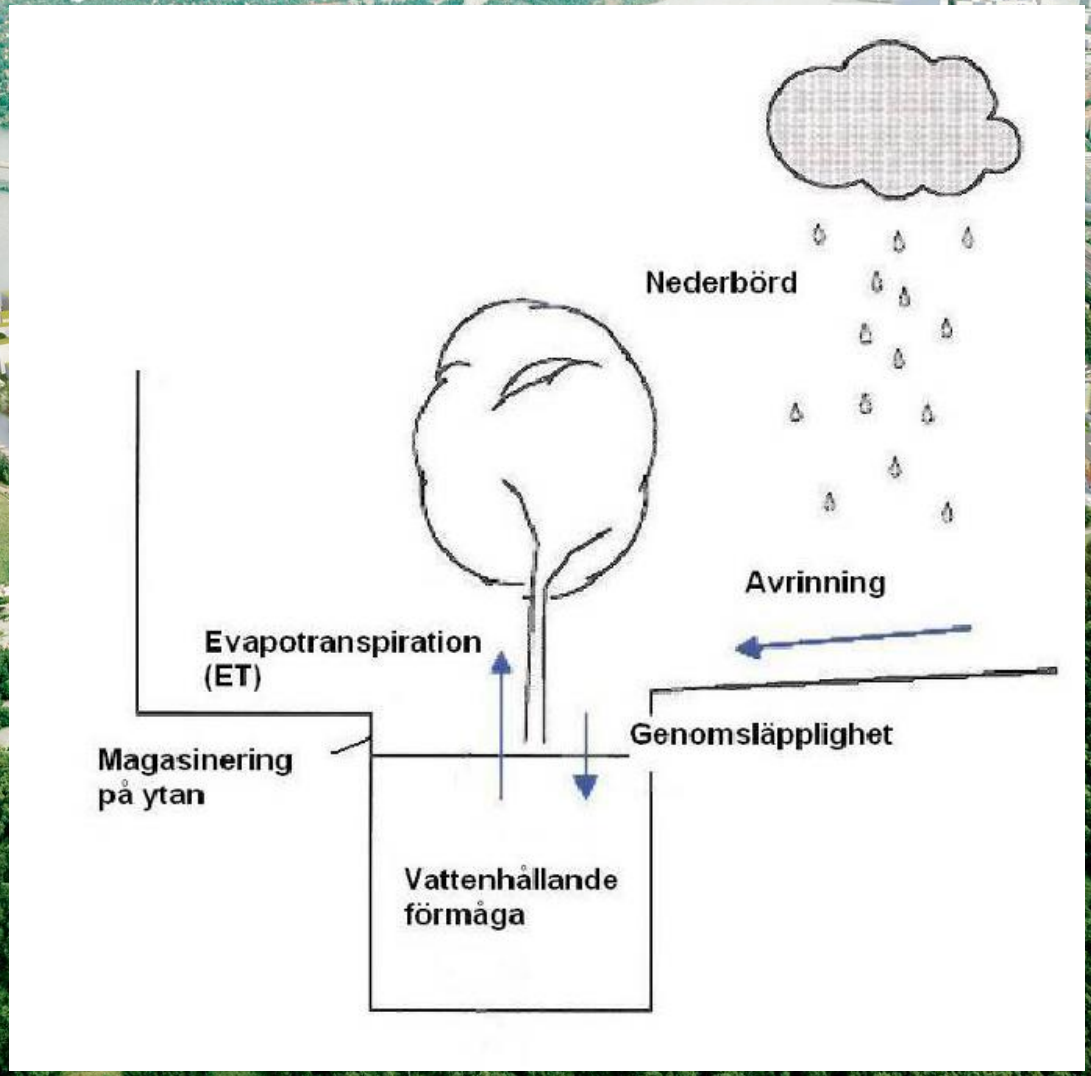


Pollution modelleing

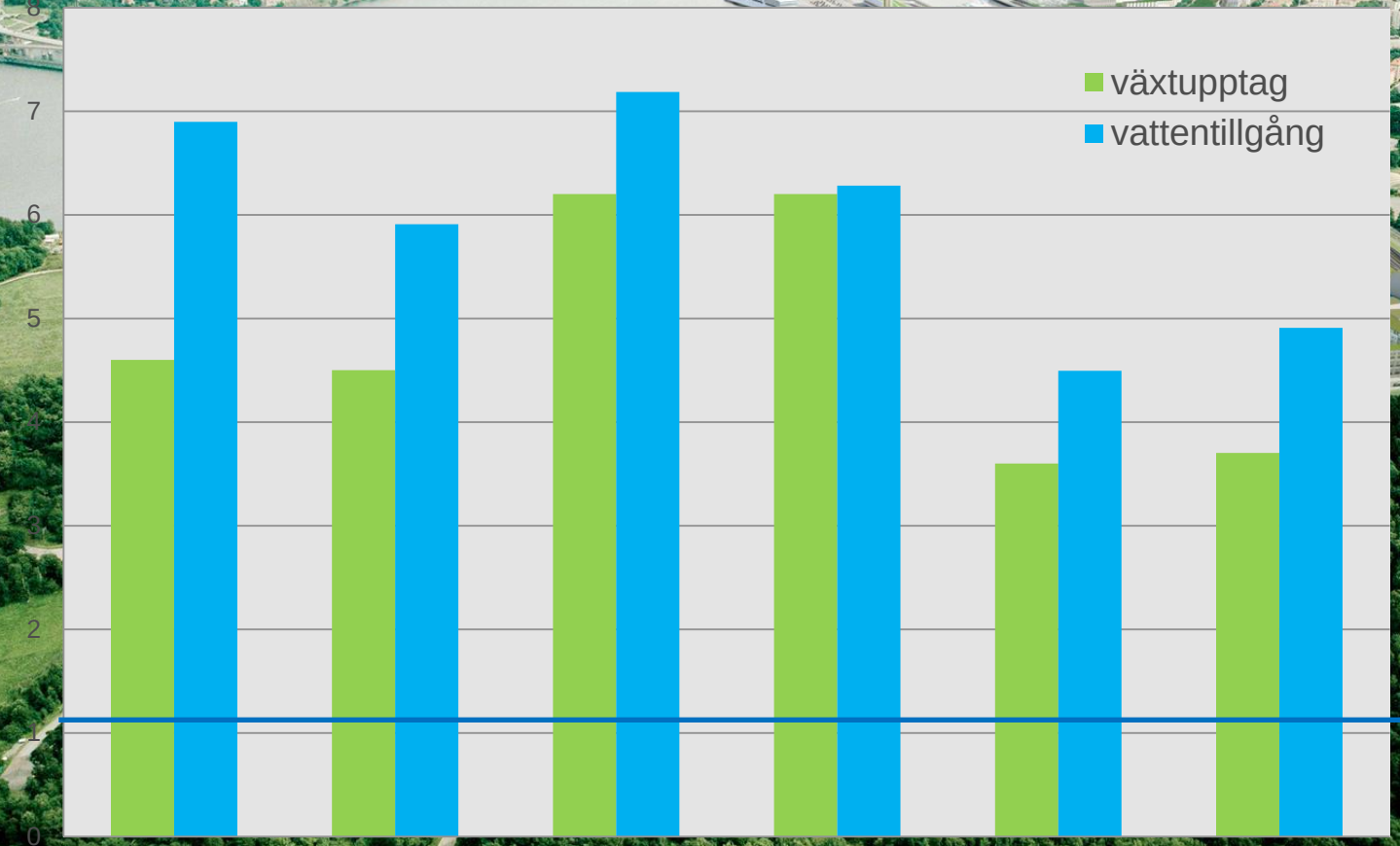
Annual mean concentration (StormTac 2015)

	P ug/l	N mg/l	Pb ug/l	Cu ug/l	Zn ug/l	Cd ug/l	Cr ug/l	Ni ug/l	Hg ug/l	SS mg/l	Olja mg/l	BaP ug/l
Land use												
Residential area	152	1.3	7	15	62	0.3	3	5	0.01	34	0.3	**0.04**
Terraced house area	**202**	1.4	9	**20**	70	***0.5***	5	6	0.02	36	**0.5**	**0.04**
Multifamily area	***259***	1.6	**12**	**26**	**87**	***0.6***	10	8	0.02	**60**	**0.6**	**0.04**
City environment	***259***	1.8	**18**	**20**	**130**	***0.9***	5	8	**0.05**	**92**	***1.4***	**0.09**
Commercial	***421***	**2.1**	***37***	**35**	***230***	***1.3***	**10**	13	**0.05**	***370***	***1.6***	***0.13***
Industry	***272***	1.8	***26***	***41***	***246***	***1.3***	**12**	**15**	**0.06**	**90**	***2.2***	***0.13***
Parking	95	1.1	***28***	**38**	**133**	**0.4**	**14**	4	**0.05**	***132***	**0.8**	**0.06**
Roads (1 000 AADT)	137	**2.4**	4	**22**	46	0.3	7	4	**0.08**	**63**	**0.7**	0.01
Roads (10 000 AADT)	**169**	**2.4**	**11**	**36**	***158***	0.3	**11**	8	**0.08**	**82**	**0.8**	0.02
Roads (20 000 AADT)	**205**	**2.4**	***20***	***52***	***281***	**0.4**	**15**	11	**0.08**	***104***	**0.8**	0.03
Park	84	1.1	4	10	18	0.2	2	2	0.01	33	0.1	-
Forrest	31	0.7	2	5	11	0.1	0	1	0.00	10	0.1	-
Guidline values	**P**	**N**	**Pb**	**Cu**	**Zn**	**Cd**	**Cr**	**Ni**	**Hg**	**SS**	**Olja**	**BaP**
Recienving water	160	2.0	8	18	75	0.4	10	15	0.03	40	0.4	0.03
Sub-catchemnt	**175**	**2.5**	**10**	**30**	**90**	**0.5**	**15**	**30**	**0.07**	**60**	**0.7**	**0.07**
Connecting point	***250***	***3.5***	***15***	***40***	***150***	***0.5***	***25***	***30***	***0.10***	***100***	***1.0***	***0.10***

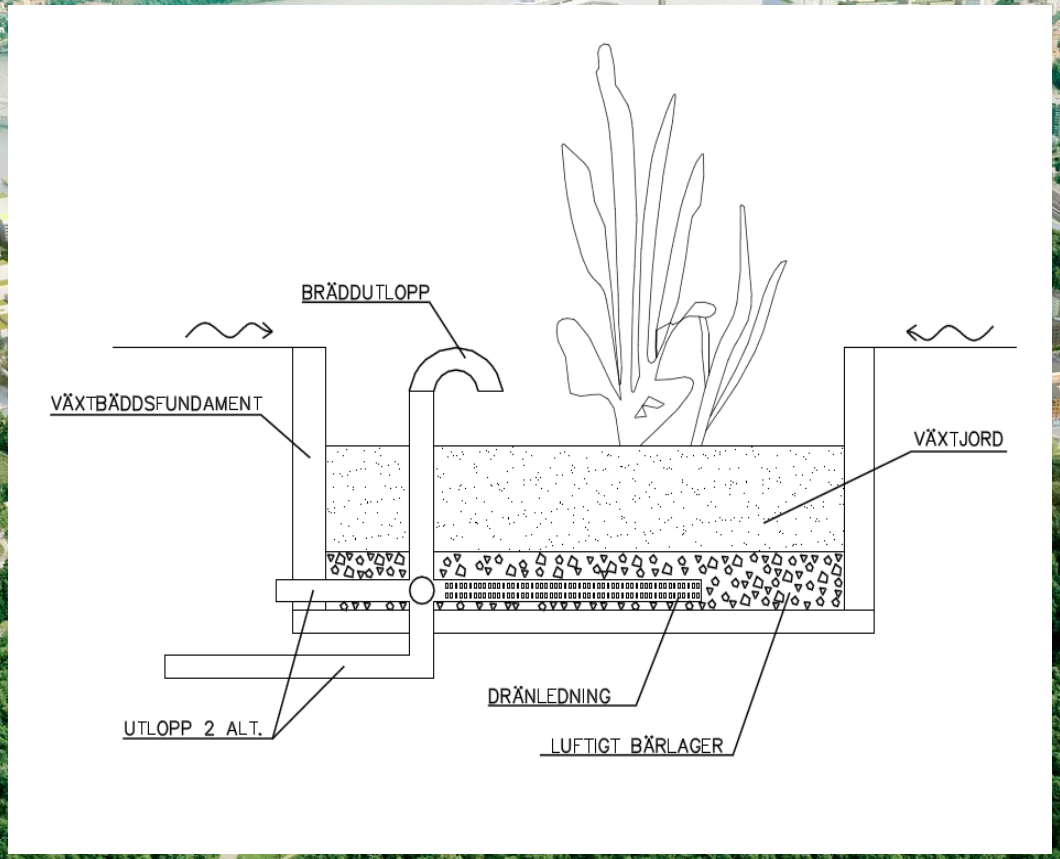
LID water balance modelling



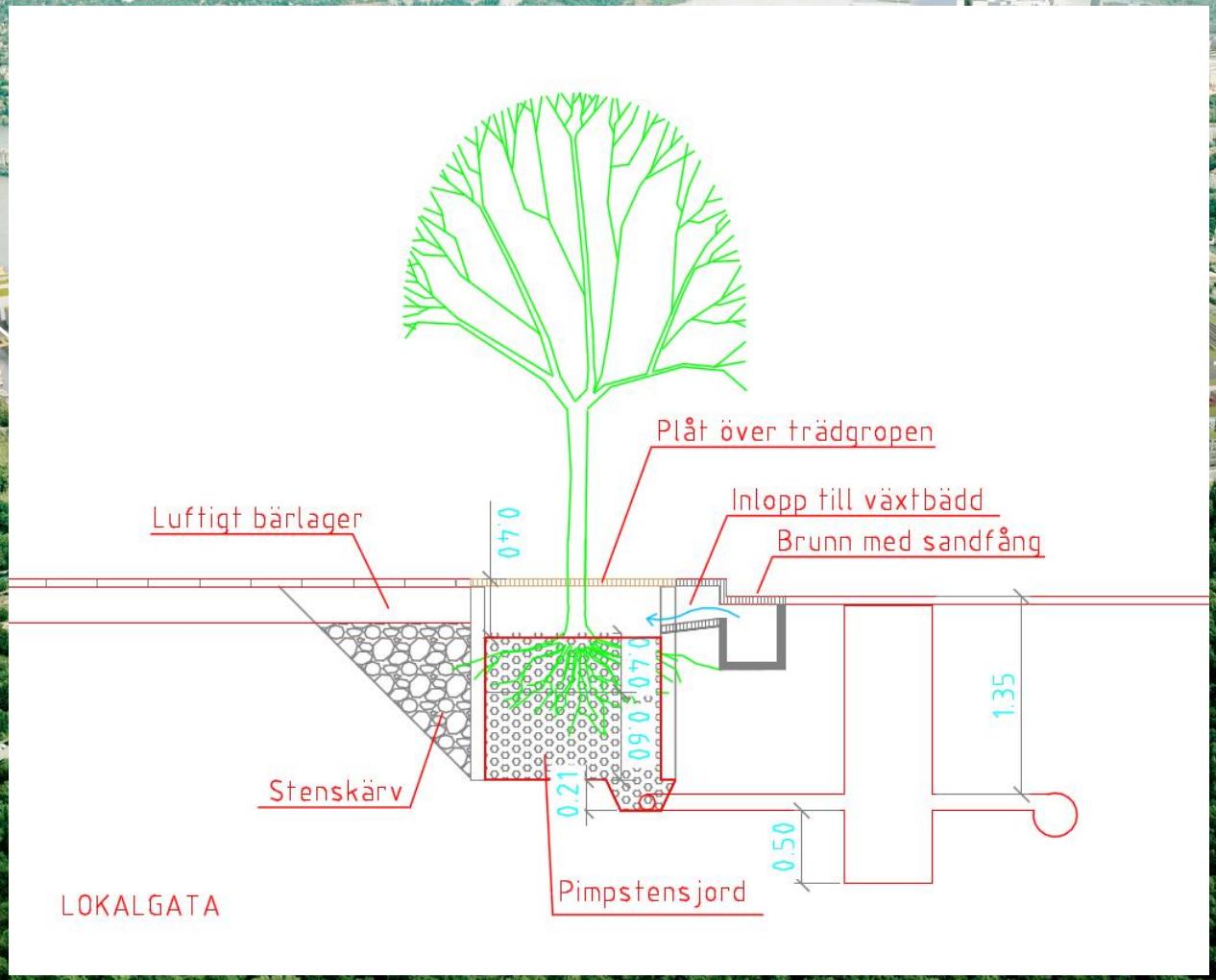
Water Balance



LID – design


BRÄDDUTLOPP
VÄXTBÄDDSFUNDAMENT
VÄXTJORD
DRÄNLEDNING
UTLOPP 2 ALT.
LUFTIGT BÄRLAGER

LID – design



Plåt över trädgropen
Inlopp till växtbädd
Brunn med sandfång
Luftigt bärlager
0.40
0.40
0.60
0.21
1.35
0.50
Stenskärv
Pimpstensjord
LOKALGATA

Public spaces (earliy drawing)

Public spaces (june 2015)

Low impact development

Obstacles

- Moved investments costs (organizational)
- Maintenance uncertainties
- It might be difficult to design
- Cross-discipline
- To good to true?

Storm Water Management

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Storm Water and Surface Water, Stockholm

Questions (after presentation)

- What consideration has been given to climate adaptation?
  The design storm has been increased by 20%. (This might change to a climate factor of 25% for design storm with a duration below 60 minutes, and 20% on storms up until 24 hours.)
- Do this LID-system have a higher investment cost?
  The investment cost is higher compared to a conventional drainage pipe system. The comparison is imperfect, with a LID-drainage system you obtain resilience in the system and a lot of ecosystem services.
- How are the pollution treated?
  The pollution in the storm water is mainly treated by infiltration in soil/biofilter. The dissolved (harmful) fractions are attached to soil particles; a lot of work are expended on avoiding pollution sources.