Co-funded by the European Union

Novel solutions for pluvial flood mitigation combining NBS & smart technologies

MS11 Catalogue of case/challenge specific solutions applicable to mitigate flood risks in analysed sub-catchment areas

Activity report
9-20-2024

CONTENTS

LIFE LATESTADAPT -

CATALOGUE OF DESIGNS - TECHNICAL SOLUTIONS OF THE DEMO SITES

Nils Kändler
Jurijs Kondratenko

Co-funded by the European Union

Workshop 19-09-2024

LIFE LATESTadapt

2022 - 2027

DEVELOPING AND DEMOSTRATING PORTFOLIO OF NATURE BASED AND SMART SOLUTIONS FOR IMPROVING URBAN CLIMATE RESILIENCE IN LATVIA AND ESTONIA

LIFE sub-programme Climate Action
Call: LIFE-2021-SAP-CLIMA
Project Nr. 101074438

Co-funded by the European Union

Republic of Estonia Ministry of Climate

State Regional Development Agency Republic of Latvia

LIFE21-CCA-EE-LIFE LATESTadapt

VIIMSI VALLAVALITSUS

Ministry of Environmental Protection and Regional Development Republic of Latvia

BEF ESTONIA

BEF LATVIA

HAAPSALU 1279

RĪGA

VÕRU

cēsis

Rakvere linn

NARVA

VALMIERA

TAL TECH

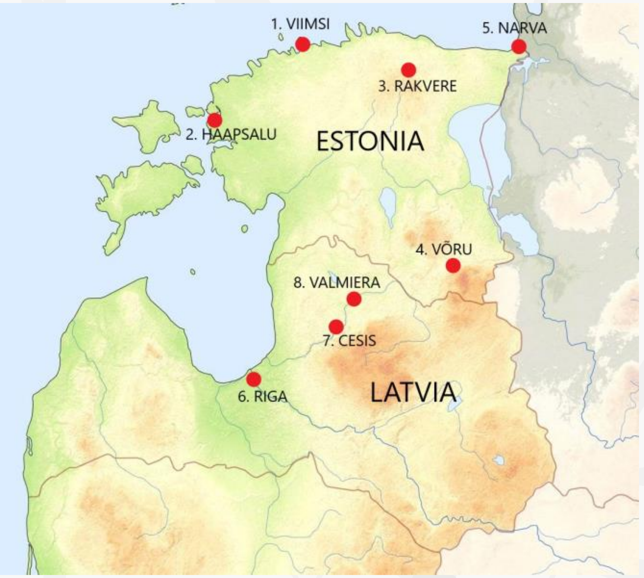
RIGA TECHNICAL UNIVERSITY

nordicbotanical

Institute for Environmental Solutions

BALTIJAS KRASTI

LIFE21 CCA EE – LIFE LATESTadapt



PROJECT LOCATION:
Estonia and Latvia

BUDGET INFO:

Total amount: 5 144 488,31

% EC Co-funding: 60%

DURATION: Start: 01/09/22 - End: 31/08/27

PROJECT'S IMPLEMENTORS:

Coordinating Beneficiary: Viimsi Municipality

Associated Beneficiaries: Võru, TalTech, BEF EE, NordicBotanical, Haapsalu, Rakvere, Narva, Riga, Valmiera, Cesis, MoEPRD, BEF LV, RTU, IES, BalticCoasts

TAL TECH

Tanel Mätlik, Project Manager

VIIMSI VALD

PROJECT’S HIGHLIGHTS

- **innovation for improving the climate resilience –** joint development and testing by municipalities, universities/research, NGOs and SMEs
- **strong cross-border approach –** implemented by 8 Latvian and 8 Estonian beneficiaries
- **wide coverage –** demo sites in 8 municipalities

TAL TECH

Tanel Mätlik, Project Manager

VIIMSI VALD

OBJECTIVES & SCOPE

Overall objective - to increase resilience of Estonian and Latvian urban areas to extreme weather events, by focusing on **4 specific objectives**:

- nature-based solutions – greening, water infiltration, collection and (re)use, storm water, nature inspired environment
- digital change – integrated decision support system to prevent/respond to floods
- quality of planning – new urban green infrastructure plans
- engaged communities and skilled enablers – workshops, training sessions and events, articles, leaflets, kids' education programmes, etc

TARTU AUGUST 2024

Uputas nii kaubanduskeskuste kui ka kortermajade keldrikorrustel ning Vallikraavi tänavalt uhtus vesi ära isegi tänavakivid. Tartu Veevärgi andmetel sadas juba esimese tunniga 50 kuni 60 millimeetrit vihma.

Vesi jõudis ka ülikooli kliinikumi Maarjamõisa haigla keldrisse ja A-korpusesse.

Sadamaraudtee läheb Riia tänava üleujutuste vältimiseks kopa alla (2)

Tartu veevärgi juht Toomas Kapp puhastas teisipäevase uputuse ajal Riia tänava raudteeviadukti all reste männikooremultšist. Lootust on, et uute jämedamate torude paigaldamise järel seal uputust ei tekigi. — Foto: Jürgen Puistaja

TALLINN SEPT 2024

ERR.ee UUDISED TV RAADIO LASTELE JUPITER

uudised EESTI ARVAMUS MAJANDUS VÄLISMAA KULTUUR SPORT MENU TEAD

Tugev vihmasadu tekitas Tallinna teedel ja tänavatel üleujutusi

EESTI
14.09.2024 21:55

Kuula artiklit 1 min

Foto on illustratiivne. Autor/allikas: Airika Harrik/ERR

Tugev vihmasadu tekitas laupäeva õhtul Tallinna teedel ja tänavatel üleujutusi, mistõttu on liiklus Tallinna tugevalt häiritud. Liiklus oli suletud ja ümber suunatud Järvevana teel ja Reidi teel, kuhu tekkisid üleujutuste tõttu suured ummikud.

Politsei palus võimalusel vältida autoga liiklemist, seda eriti kohtades, kus üleujutuste tõenäosus on suurem, näiteks erinevad tunnelid, madalamad teed ja tänavad.

Project application
real urban challenges

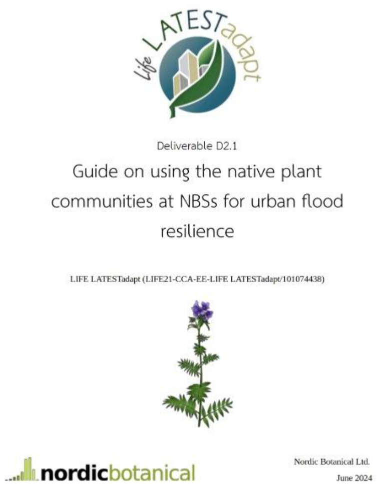
Detailed design for construction bidding

Monitoring programme D1.1

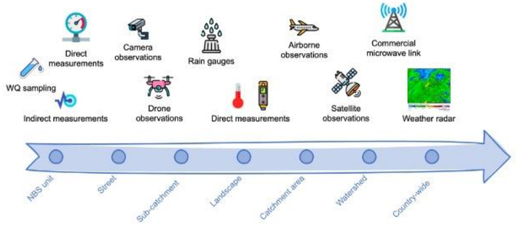
Ideas → **Sketches** → **Design** → **Constructon** → **Monitoring**

Technical description for design bidding

Guide on using the native plant communities at NBSs


Deliverable D2.1
Guide on using the native plant communities at NBSs for urban flood resilience
LIFE LATESTadapt (LIFE21-CCA-EE-LIFE LATESTadapt/101074438)
nordicbotanical
Nordic Botanical Ltd.
June 2024

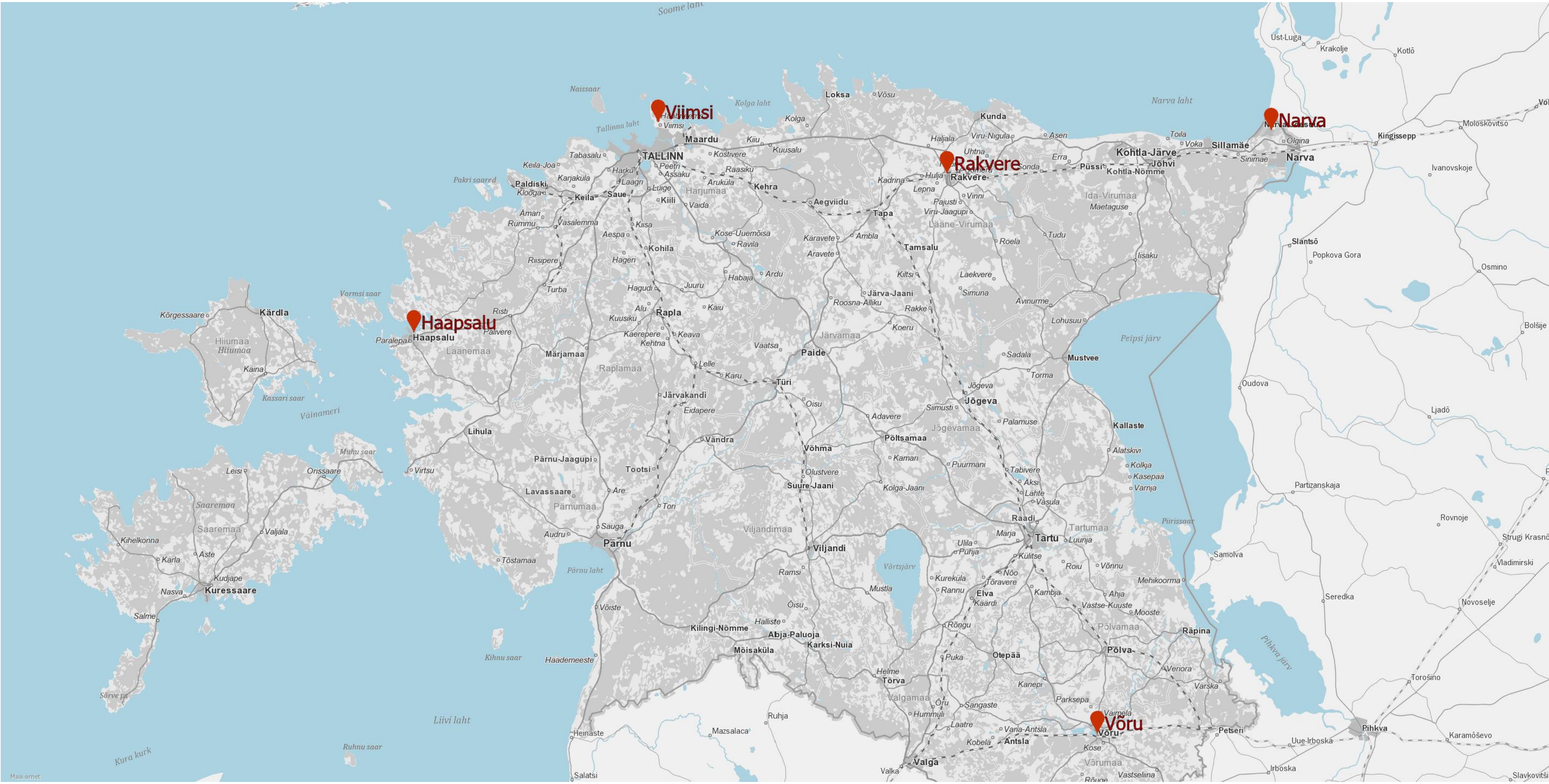
Identifying and testing novel sensing techniques to monitor NBS performance



Valmiera Hacathon - LifeHack
Tallinn Hacathon - Ecotech

TAL TECH

ESTONIAN PILOTS



VIIMSI

- Transforming the existing monofunctional, poorly landscaped and flood-prone area into a modern climate change adaptation area
- Stormwater exploitation/circular use functions
- Increase the resistance of the area to climate change and flooding threat posed by heavy rains
- increase awareness of general public and interested parties about exploitation of stor
  systems/nature-ba

This stormwater expl
system of its kind in
and used for municip

Viimsi veekriisile jätkusuutlikku lahendust ei paista

EESTI

Ehe Kaldmaa
15.06.2023 21:11

Foto: Priit Mük/ERR

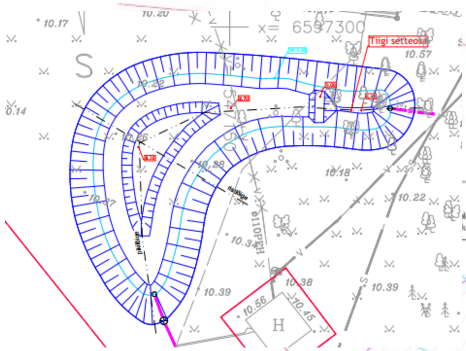

Haabneeme
Viimsi
Lubja
Pärnamäe
Soosepa raba
Miiduranna
Randvere tee
Aiandi tee
Rohuneeme tee
Kaluri tee
Meriranna tee
Ravi tee
Heki tee
Tammepõllu tee
Nuuli tee
Muuli tee
Soosepa tee
Kopimae
Kangsepa
Auskneem
Viimsi park

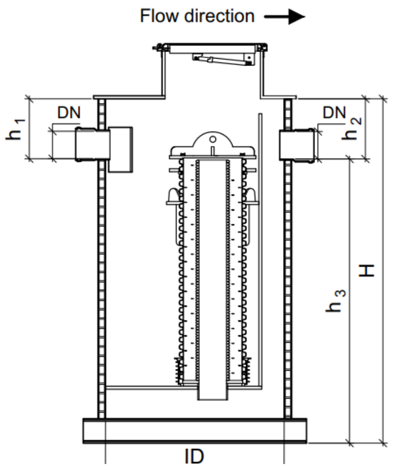

KALURI tee

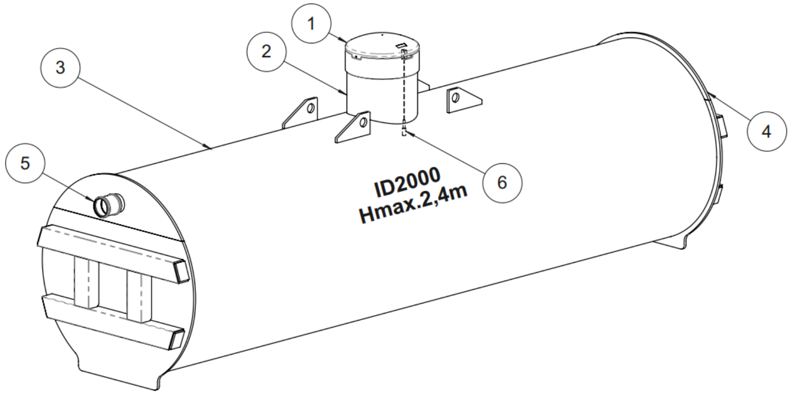

Rohetunnel

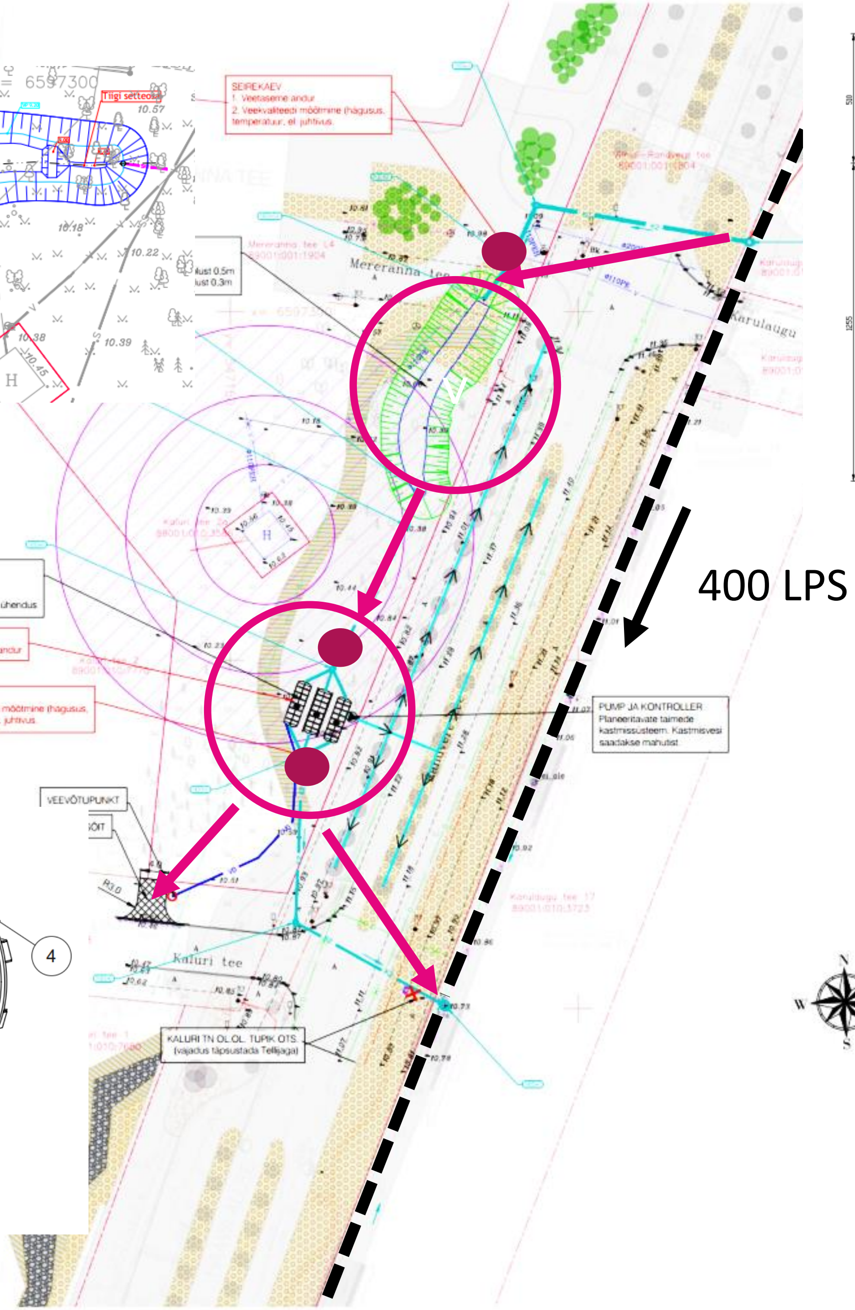
TAL
TECH

VIIMSI









Sensors:

- level sensors
- turbidity
- temperature
- el.conductivity
- sedimentation

Life LATESTAdapt

Viimsi, Harju maakond, Eesti

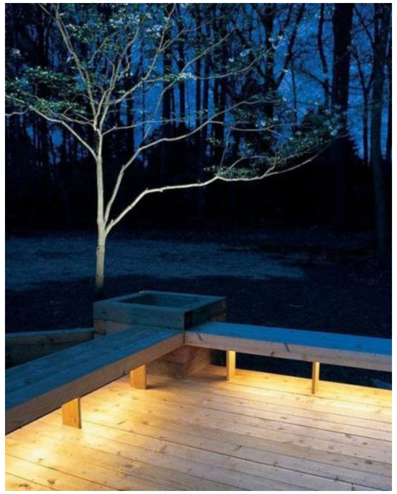
Eskiis lahendus | M 1:500

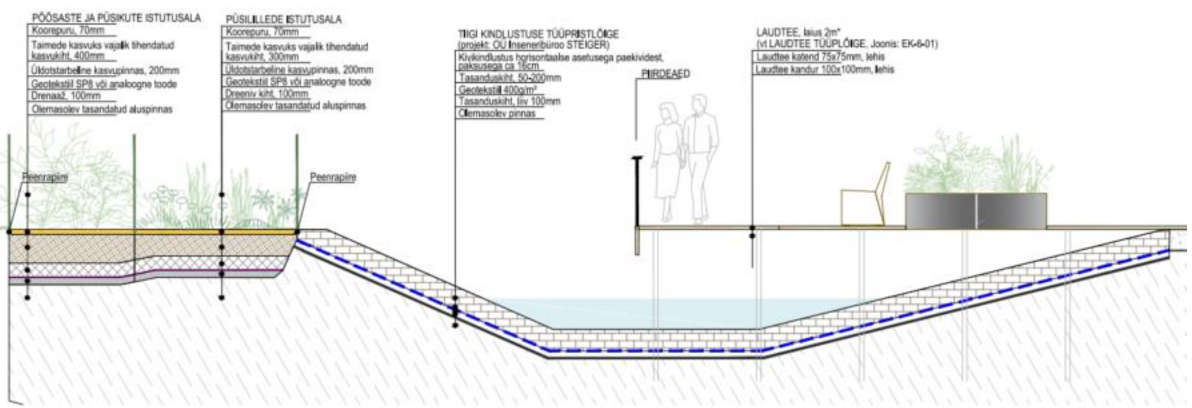
001

Märkused: Koordinaadid L-EST97 ja kõrgused EH2000 süsteemis.

TECH

VIIMSI





TAL TECH

SCHÖTTLI KESKKONNATEHNIKA

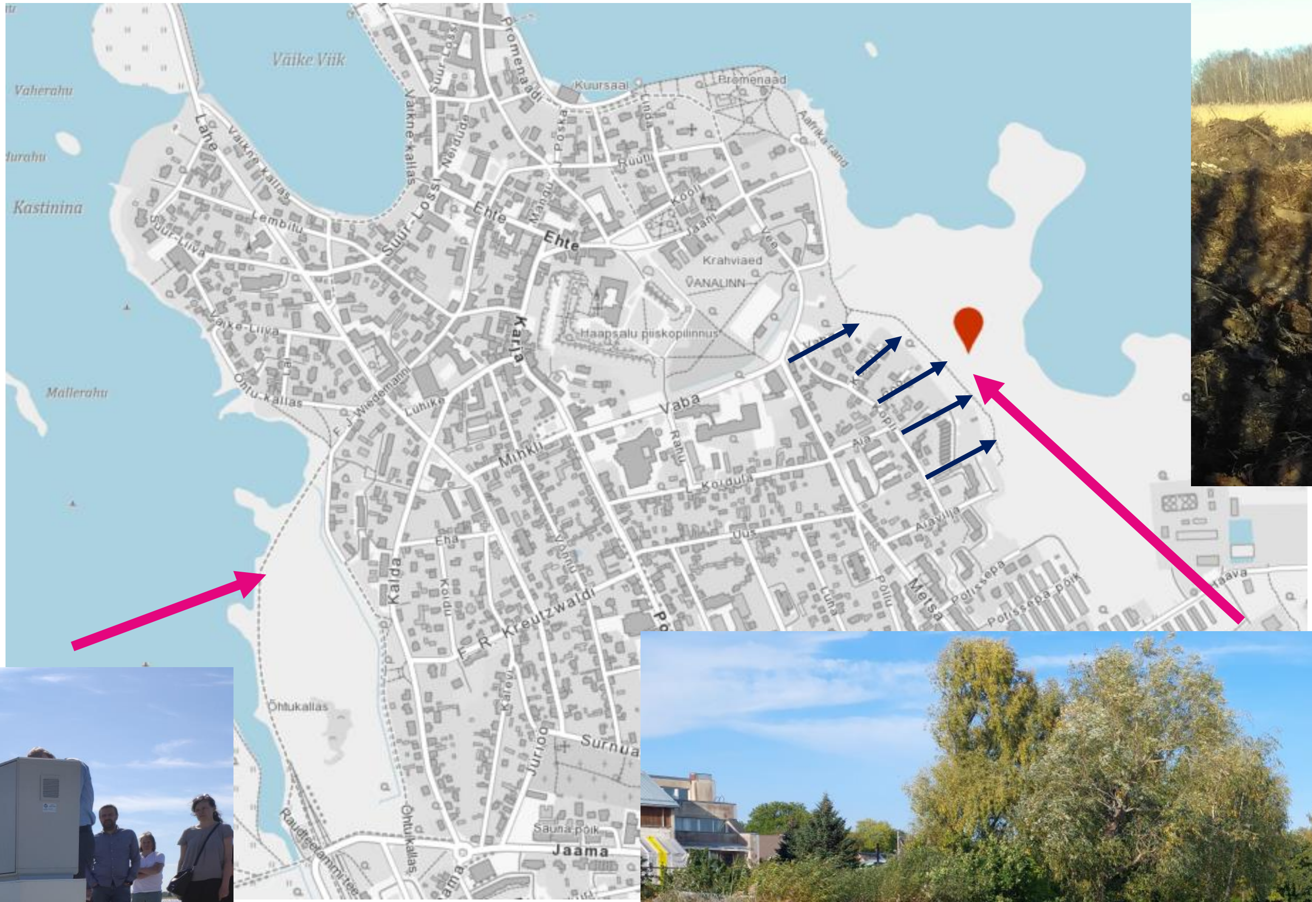
SFÄÄR PLANEERINGUD

HAAPSALU

- Improve the environmental condition of Haapsalu Tagalaht bay area
- Reduce the flood risk
- Decrease volume of poor-quality rainwater flowing into the Tagalaht bay
- Increase natural diversity

TAL TECH

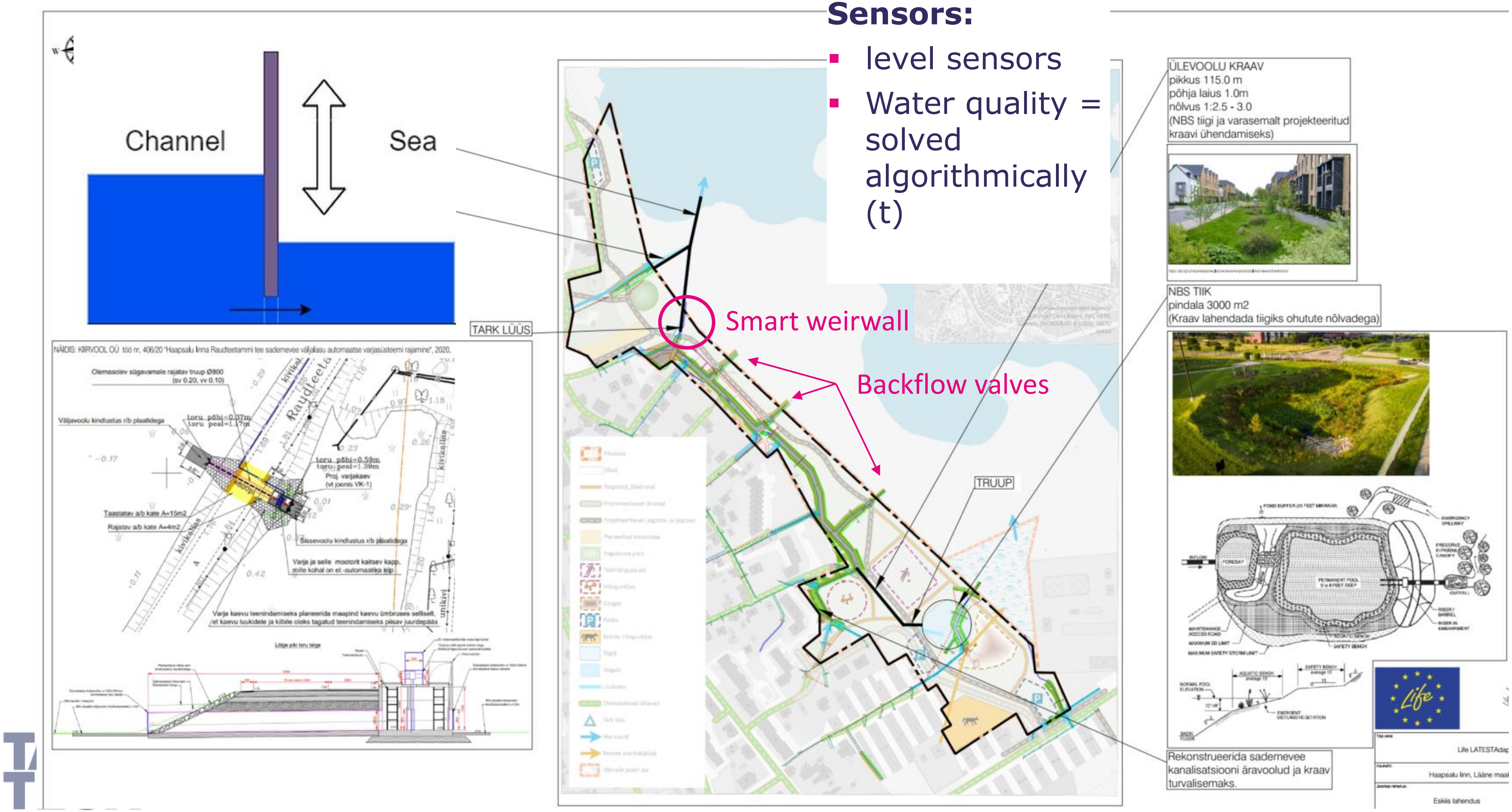
HAAPSALU



2021 NOAH

Sensors:

- level sensors
- Water quality = solved algorithmically (t)



RAKVERE

Ideas | Sketches

- Reduce the flood risk
- Decrease the nutrient load in local water body
- Improve the ecological status of natural stream
- Open existing stream enclosed in pipeline
- Testing wood-chip bioreactor: During the LIFE IP CleanEst project similar solution (in-stream woodchip bioreactor) was installed and it has proven to remove up to 80% of nitrates.

cleanest

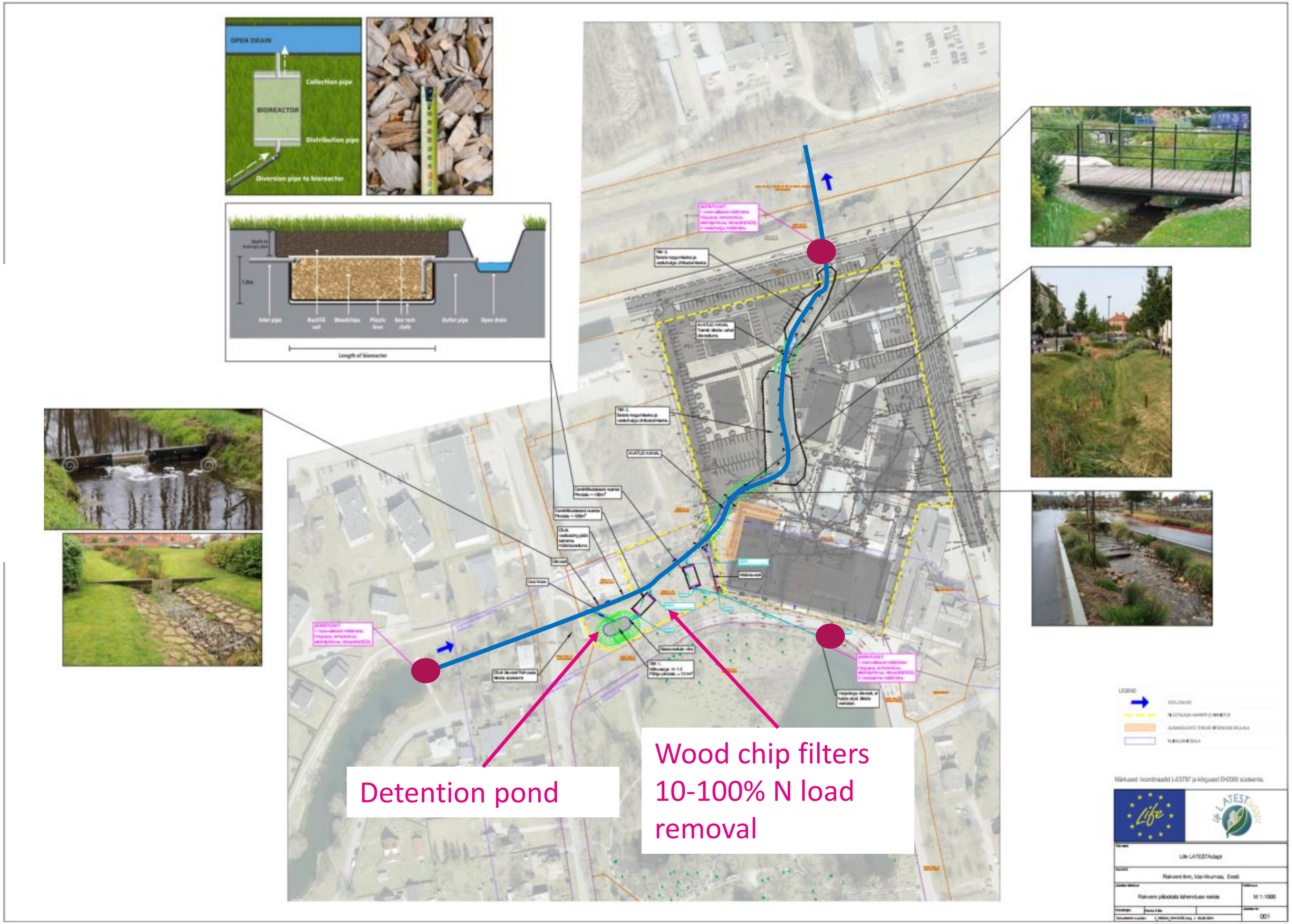
TAL TECH

RAKVERE

Tobia creek

Sensors:

- Turbidity
- Temperature
- El.cond
- NO3



Detention pond

Wood chip filters 10-100% N load removal

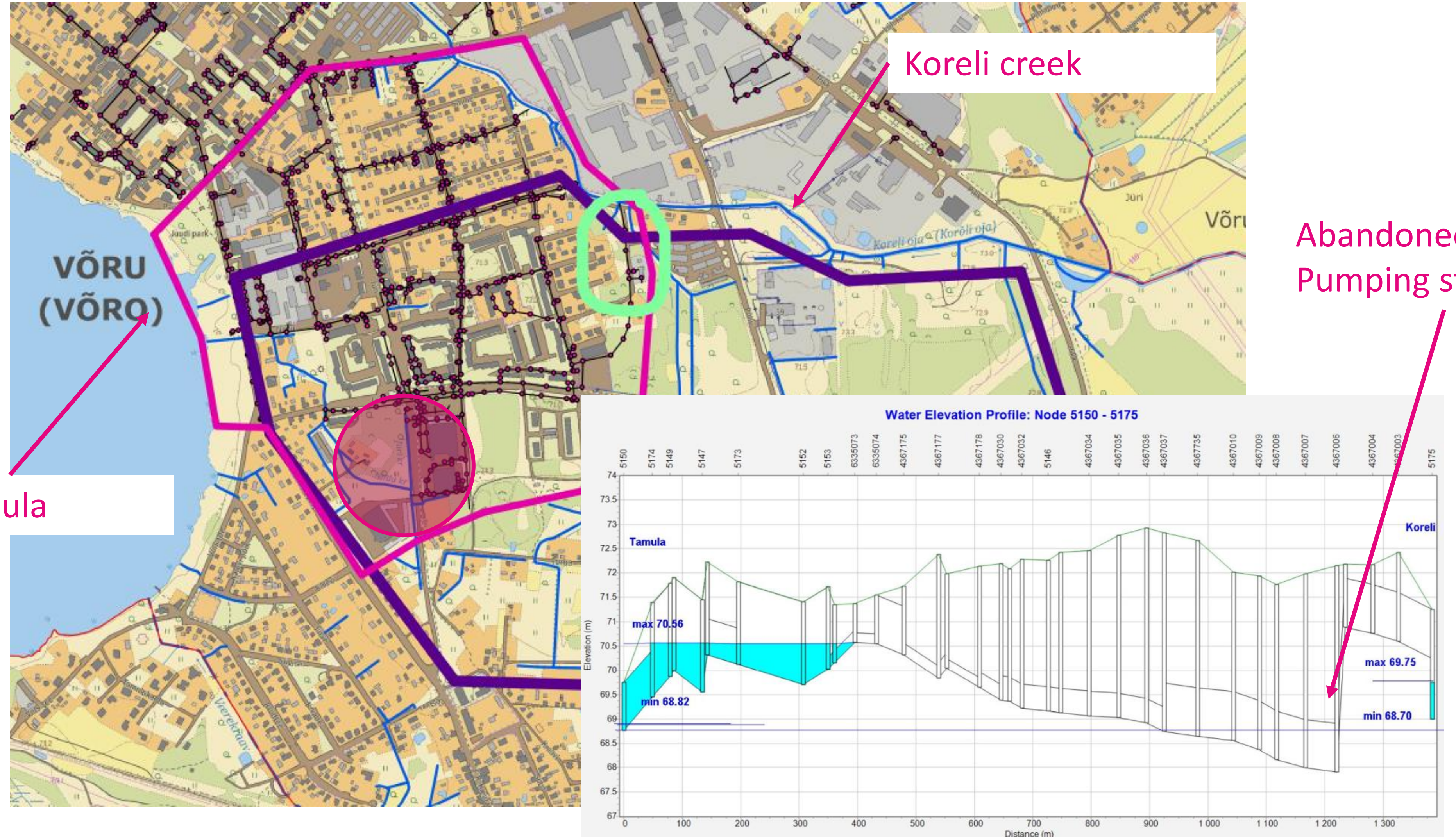
TAL TECH

VÕRU

- Demonstration site will be established to solve the drainage and stormwater system in the area in such a way that the stormwater would first be used in a technology park or other facilities in the area, and then drain the previously buffered drainage and stormwater into Lake Tamula.
- Redirect stormwater flow
- After modelling – impossible task
- New pilot site:
- Accumulate and retain flow from large parking area
- Improve water quality of the urban runoff

TAL TECH

VÕRU – SEARCHING PROJECT SITE



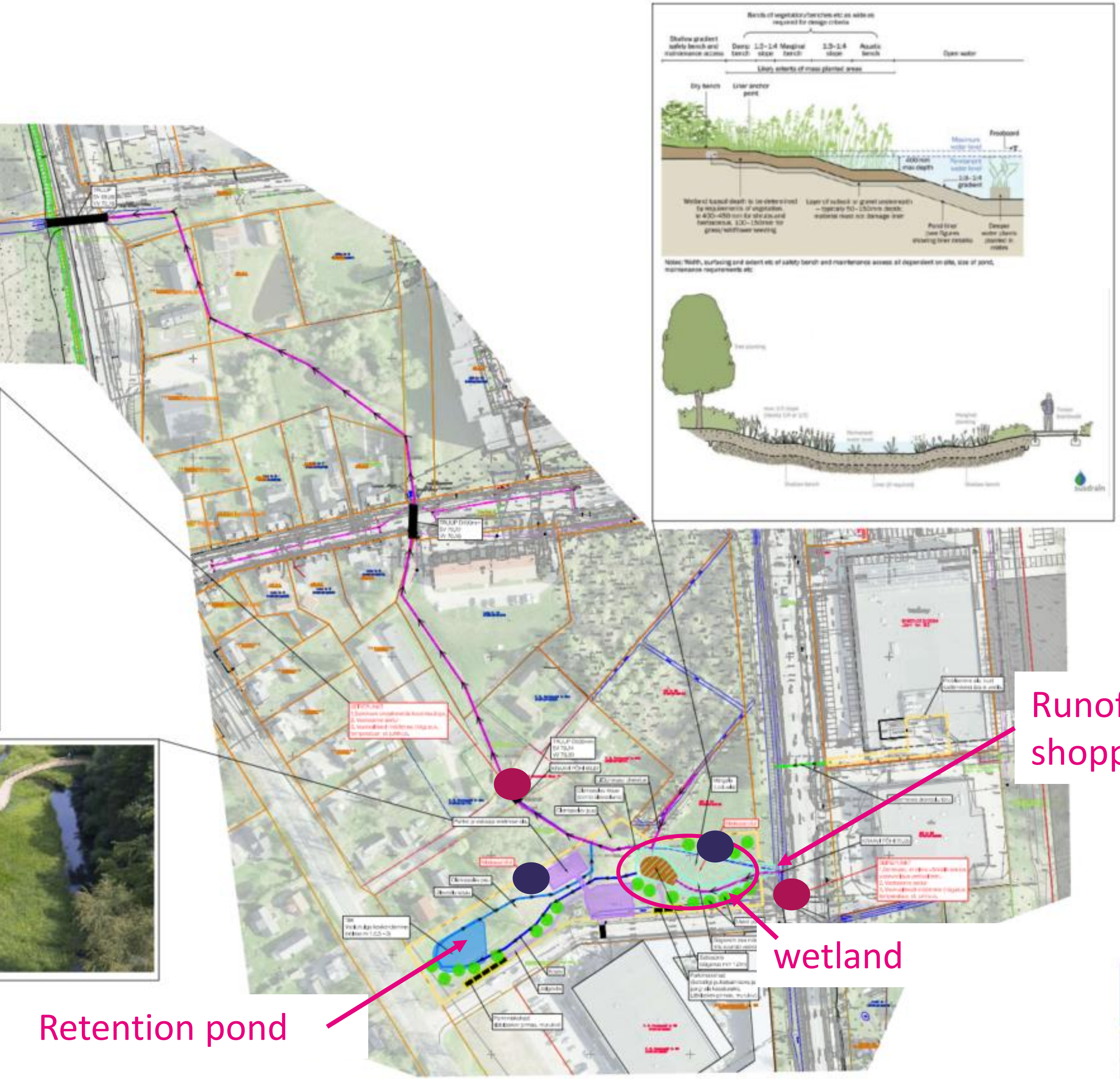
TAL
TECH


Prospective water quality
Prospective water quality
Prospective water quality
Luha
Jüri
Võru, Võru County
Google Street View
Jun 2024
See more dates
Coop Lotoga
smartpost
itella
VÕTI
VALMIS
Kohale tellimi
66
Luha
Luha
Võru Ma
Peetri Pizza
K-Rauta Võru
Kalevi
Google

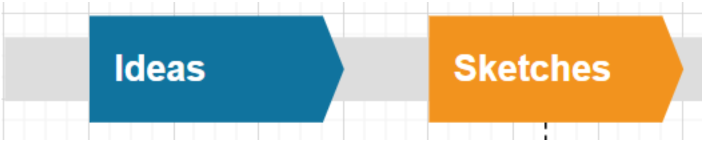
VÕRU

Sensors:

- Level
- Turbidity
- Temperature
- El.cond
- moisture



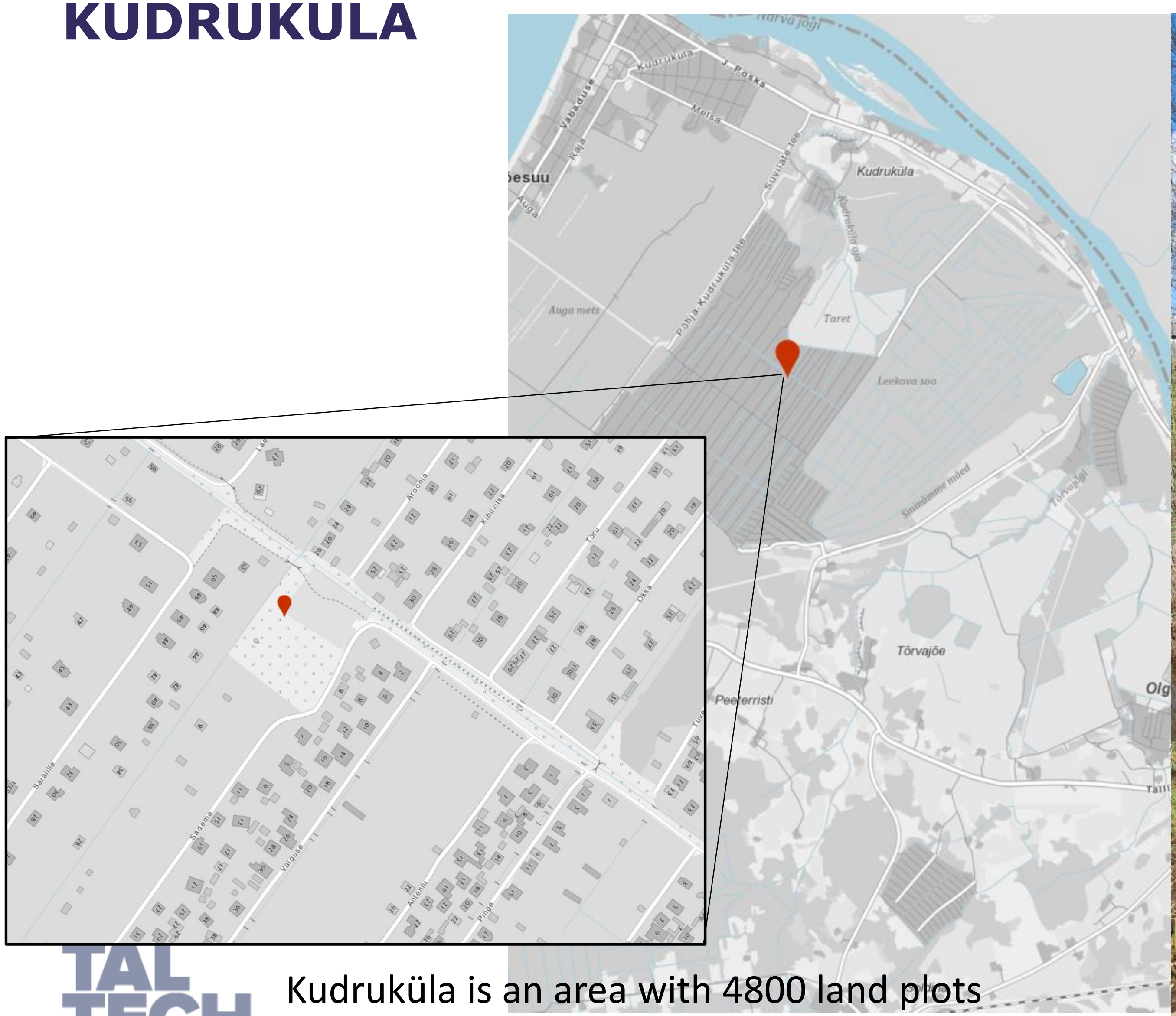
NARVA



- NBS will be developed for Kudruküla area located 12 km northwest from Narva town
- District of allotment gardens - an important part of the green economy in Narva
- Improve surface water quality
- Reuse of surface water for garden irrigation and firefighting water storage
- Presence of firefighting water is needed by legislation to get building permits

TAL TECH

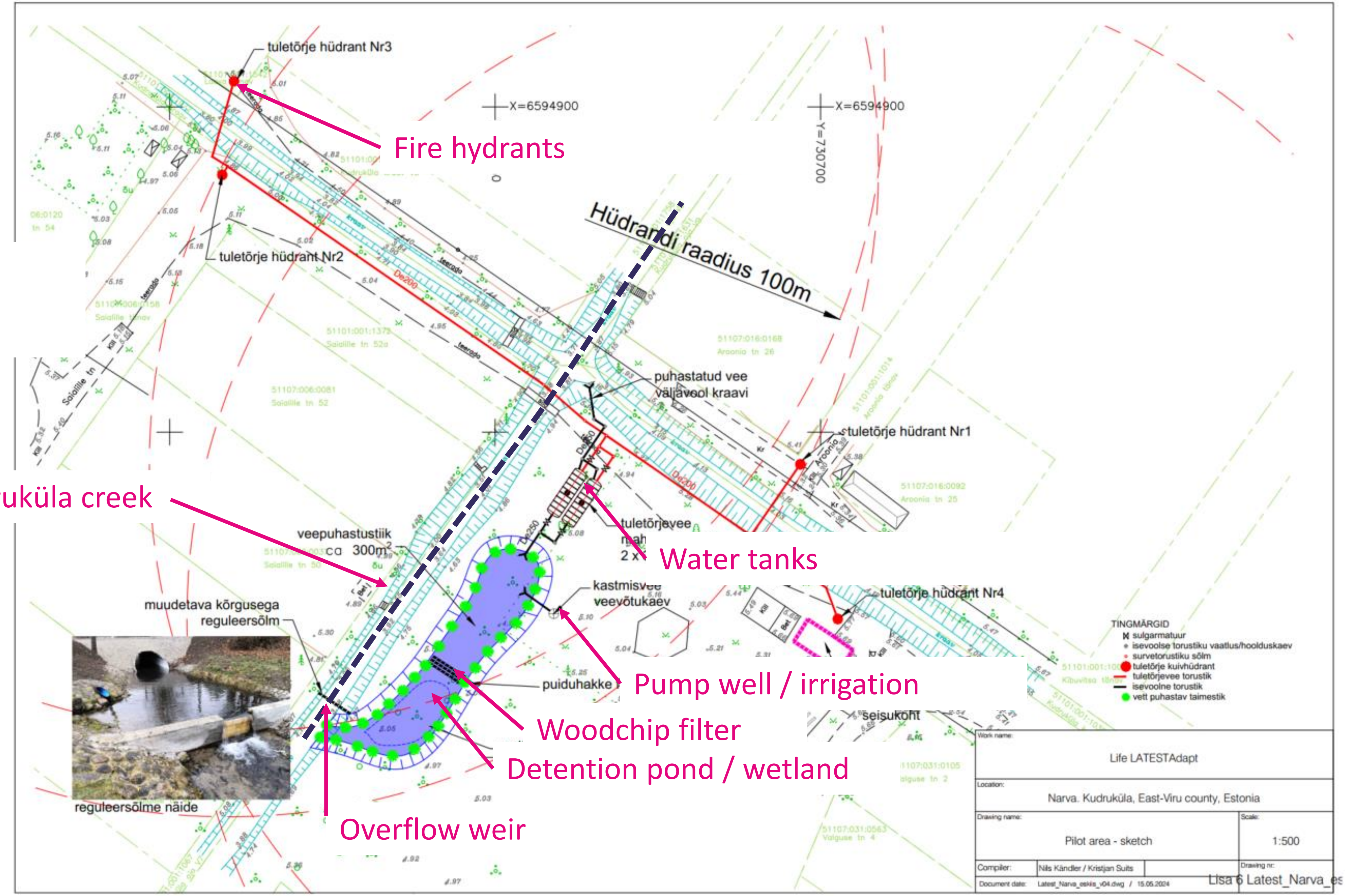
KUDRUKÜLA



Kudruküla is an area with 4800 land plots
Originally used only in summer / becoming year-around residential district

Sensors:

- Humans



REMOTE SENSING – REAL-TIME CAMERA

CHALLENGES

- Novel sensing
- Data collection, Integration and Analysis
- Predictive Modeling
- Sustainable Infrastructure
- Community Engagement and Education
- Partnership and Collaboration
- …
- And
- …
- **How to fit it all into the budget**

TAL TECH

AND NOW – LET’S GO TO LATVIA!

RĪGAS TEHNISKĀ UNIVERSITĀTE
ŪDENS PĒTNIECĪBA & BIOTEHNOLOĢIJAS

Catalogue of nature based solutions - Latvia

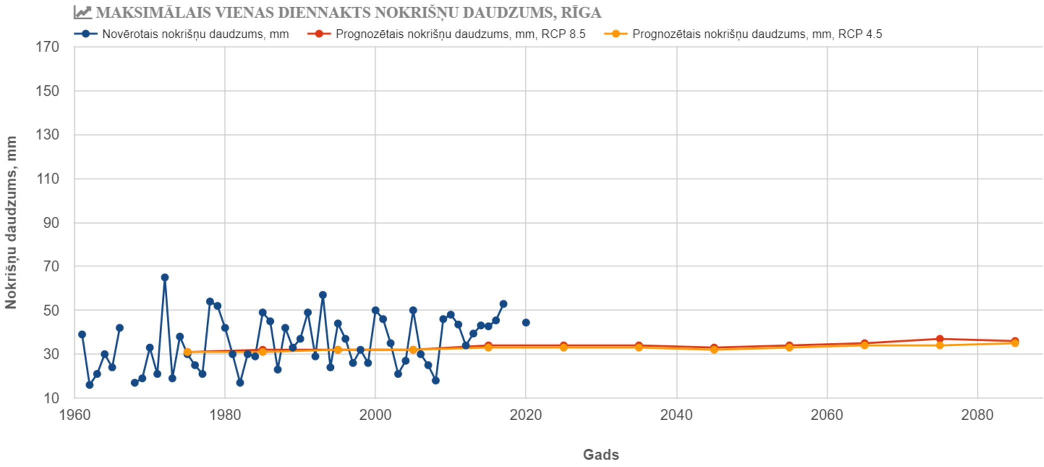
Jurijs Kondratenko, RTU WREBTI

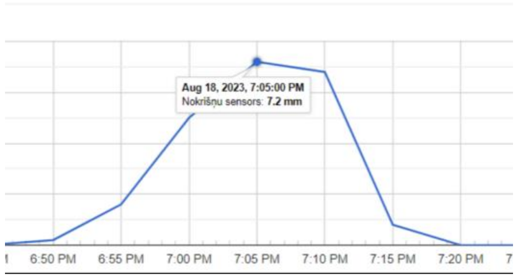
19.09.2024

Atkārtojamība (reizi gados)	Nokrišņu daudzuma pieaugums tuvā nākotne (2021.-2050.gads), %	Nokrišņu daudzuma pieaugums tālā nākotne (2071.-2100.gads), %
2	21%	27%
5	19%	33%
10	18%	35%
20	18%	37%
100	17%	39%
200	17%	40%

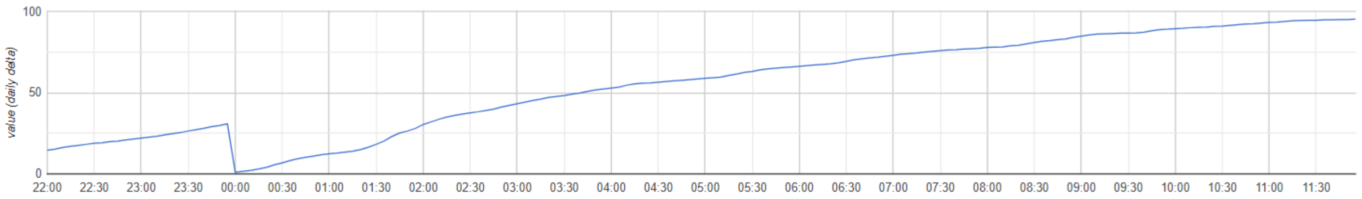
Intensity/volume of heavy/extreme rains increases

18.08.2023: 28 mm in 0.5 hr = probability 1 in 50 years

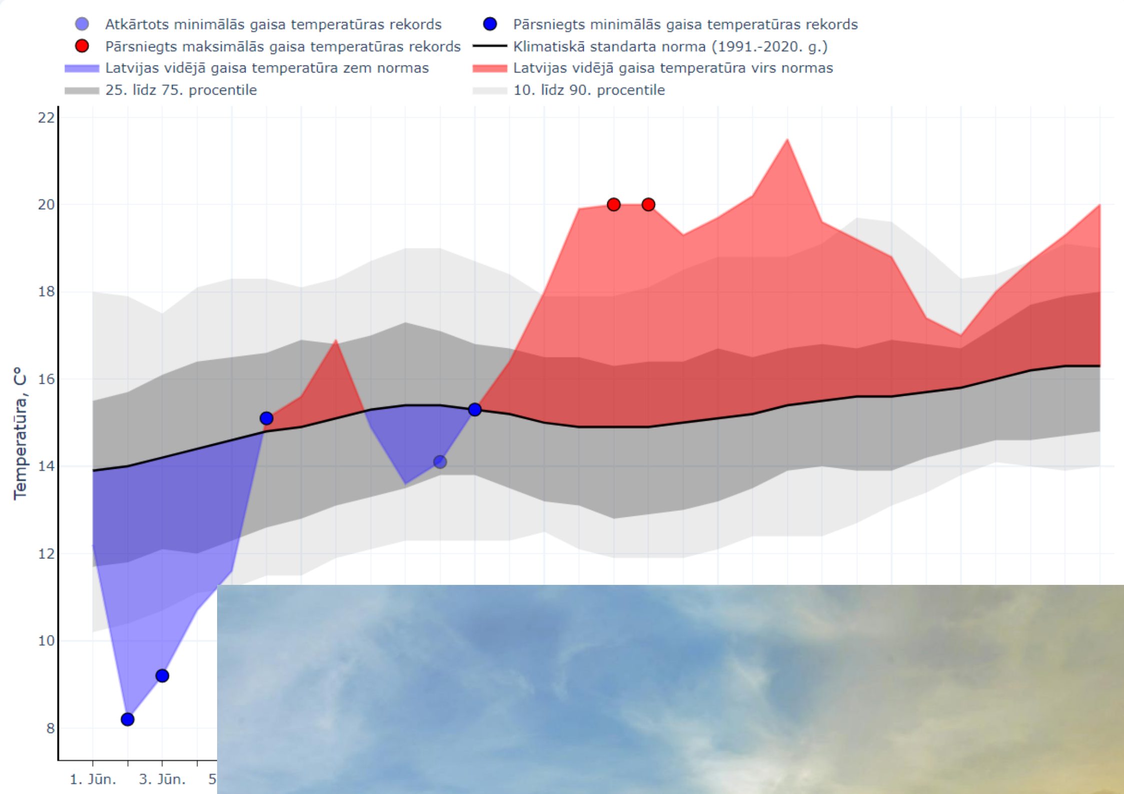


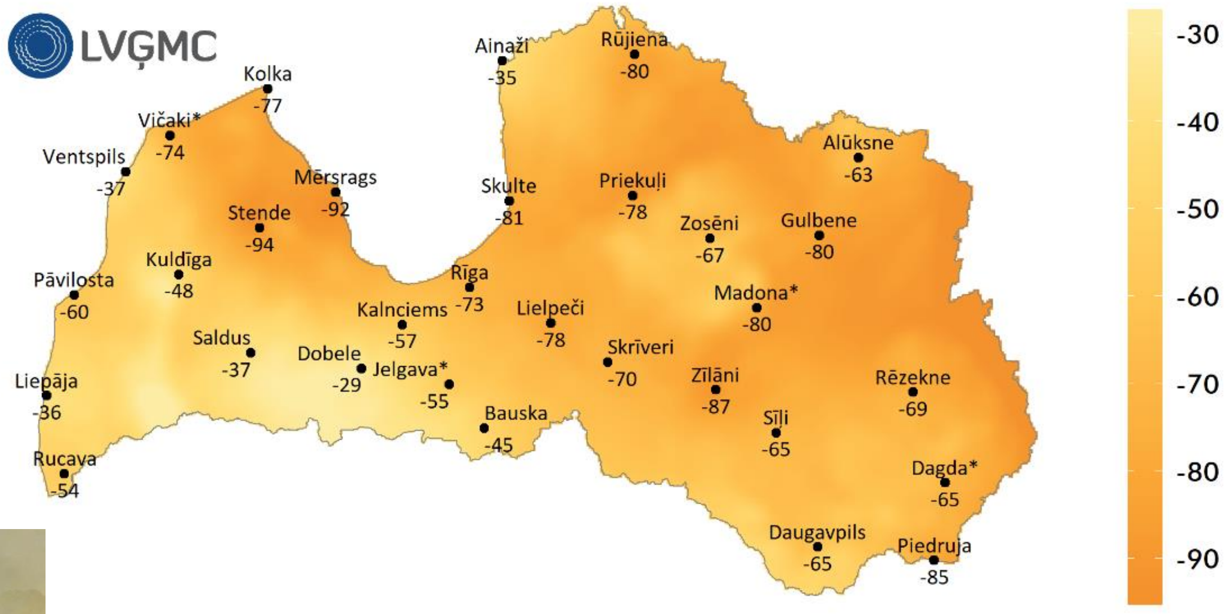


28-29.07.2024: 128 mm in 24 hrs = probability < 1 in 200 years



Not ony extreme precipitation but also heat



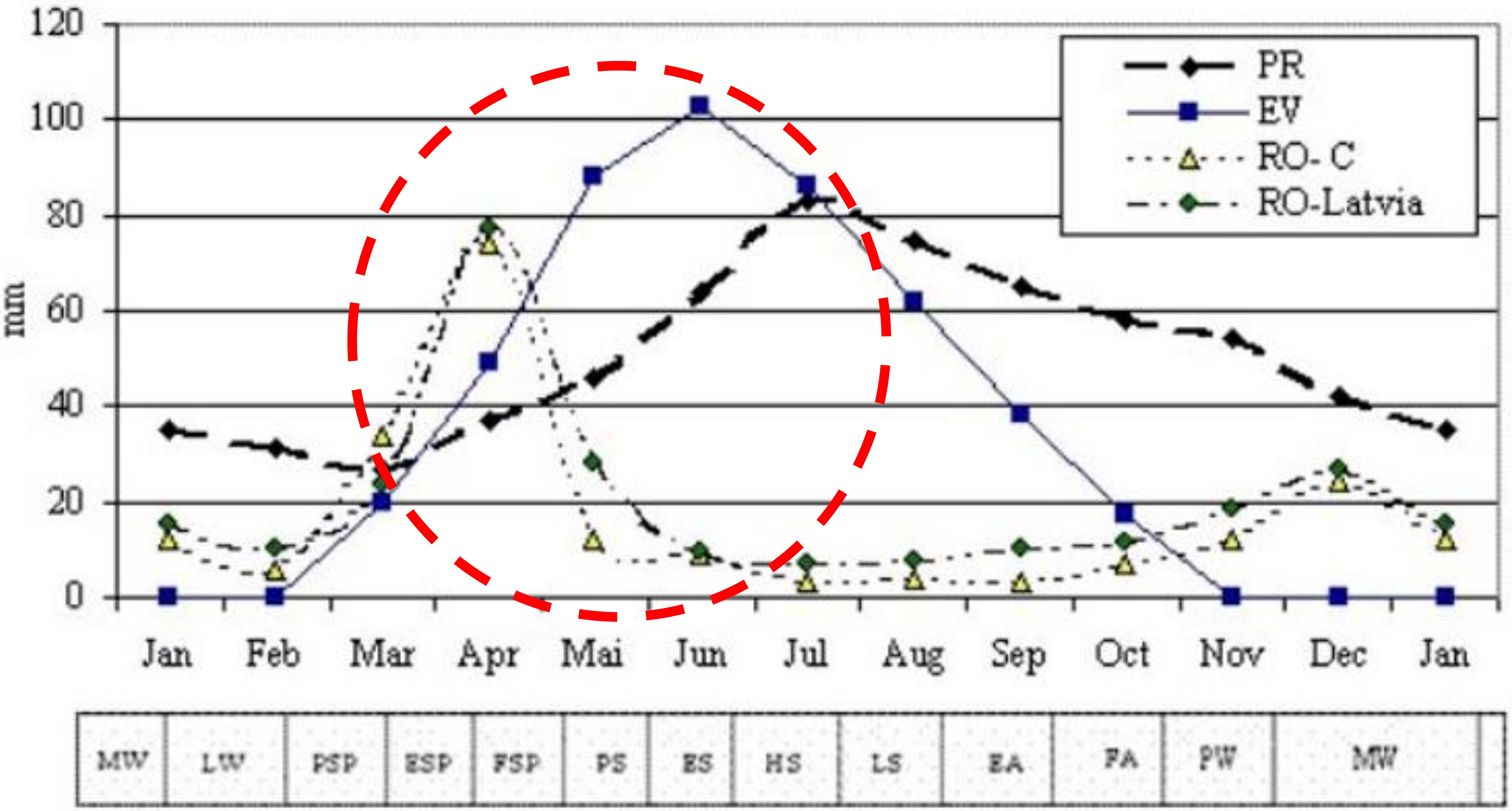


Nokrišņu daudzuma novirze no normas (1991.-2020.g.)
2023. gada jūnijā, %

* novirze no 1991.-2020. gada ilggadīgās vidējās vērtības

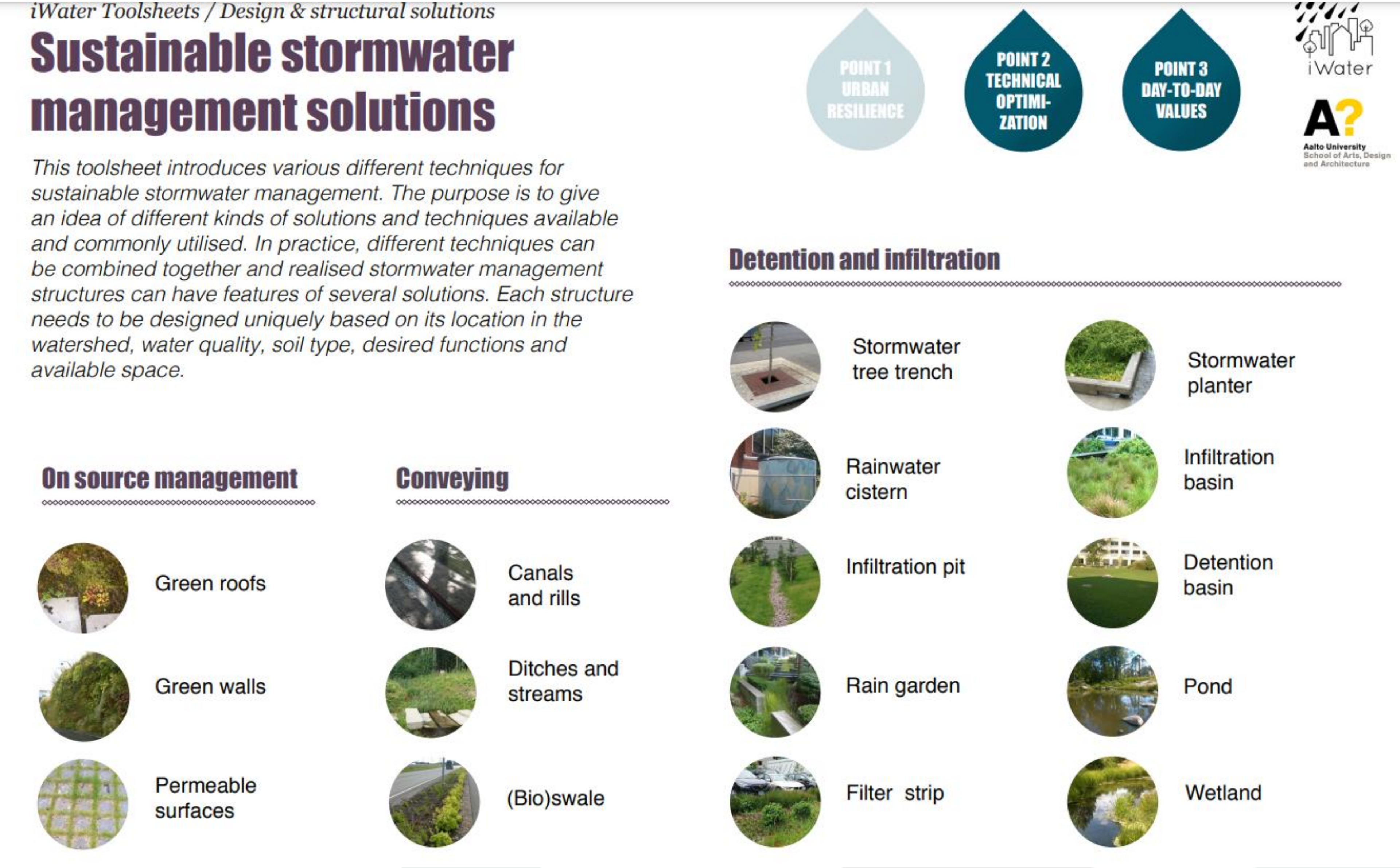
Annual water balance

From April to August evapotranspiration exceeds rainfall – potential to store and use rain water



Sustainable urban drainage

- Multifunctional solutions
  - Runoff management (quantity)
  - Water quaility
  - Public space improvements
- Combination of centralised and decentralised solutions
  - Rain sewers and drainage ditches
  - Large scale green infrastructure
  - Local green infrastructure
- Financial sustainability
  - Coverage of investment and maintenance costs



iWater Toolsheets / Design & structural solutions

Sustainable stormwater management solutions

POINT 1 URBAN RESILIENCE

POINT 2 TECHNICAL OPTIMI-ZATION

POINT 3 DAY-TO-DAY VALUES

iWater

Aalto University School of Arts, Design and Architecture

This toolsheet introduces various different techniques for sustainable stormwater management. The purpose is to give an idea of different kinds of solutions and techniques available and commonly utilised. In practice, different techniques can be combined together and realised stormwater management structures can have features of several solutions. Each structure needs to be designed uniquely based on its location in the watershed, water quality, soil type, desired functions and available space.

On source management

- Green roofs
- Green walls
- Permeable surfaces

Conveying

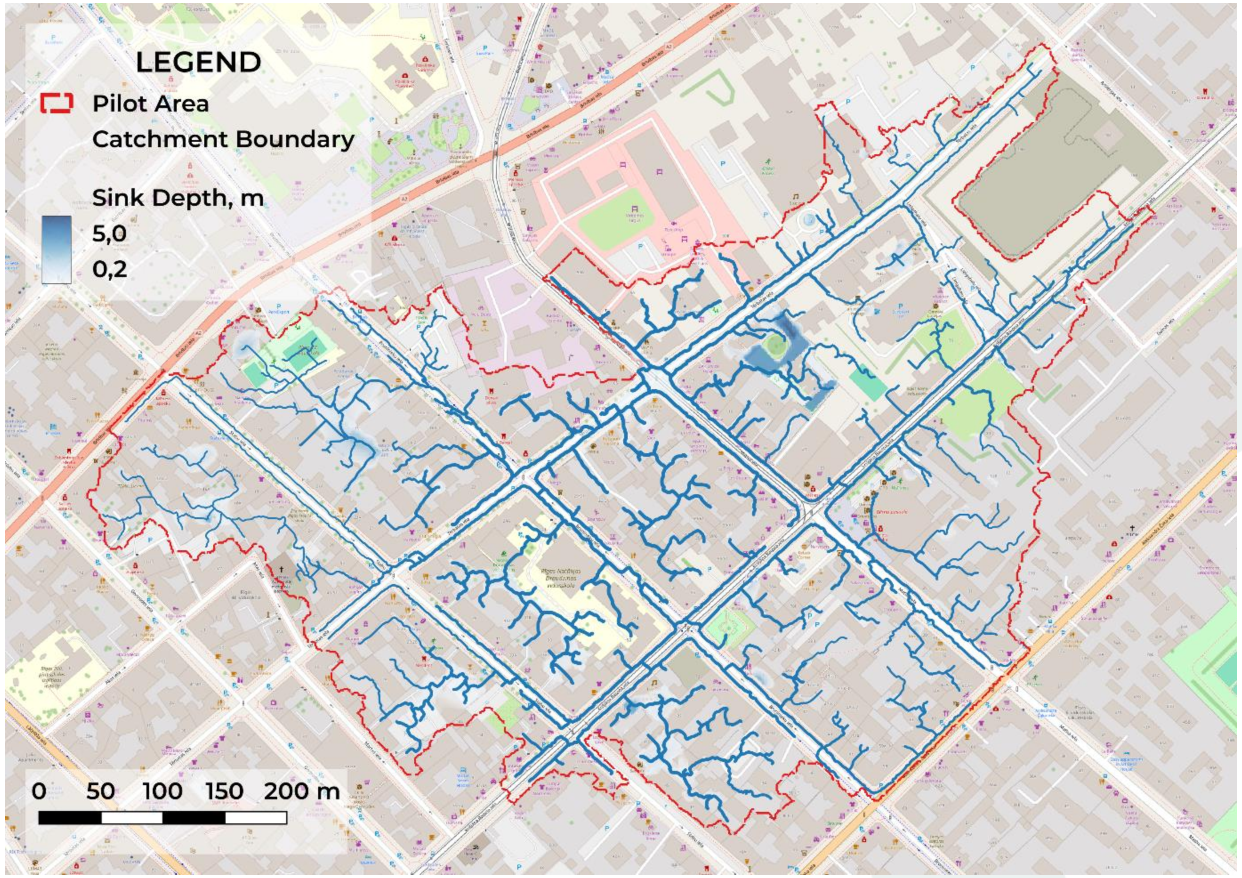
- Canals and rills
- Ditches and streams
- (Bio)swale

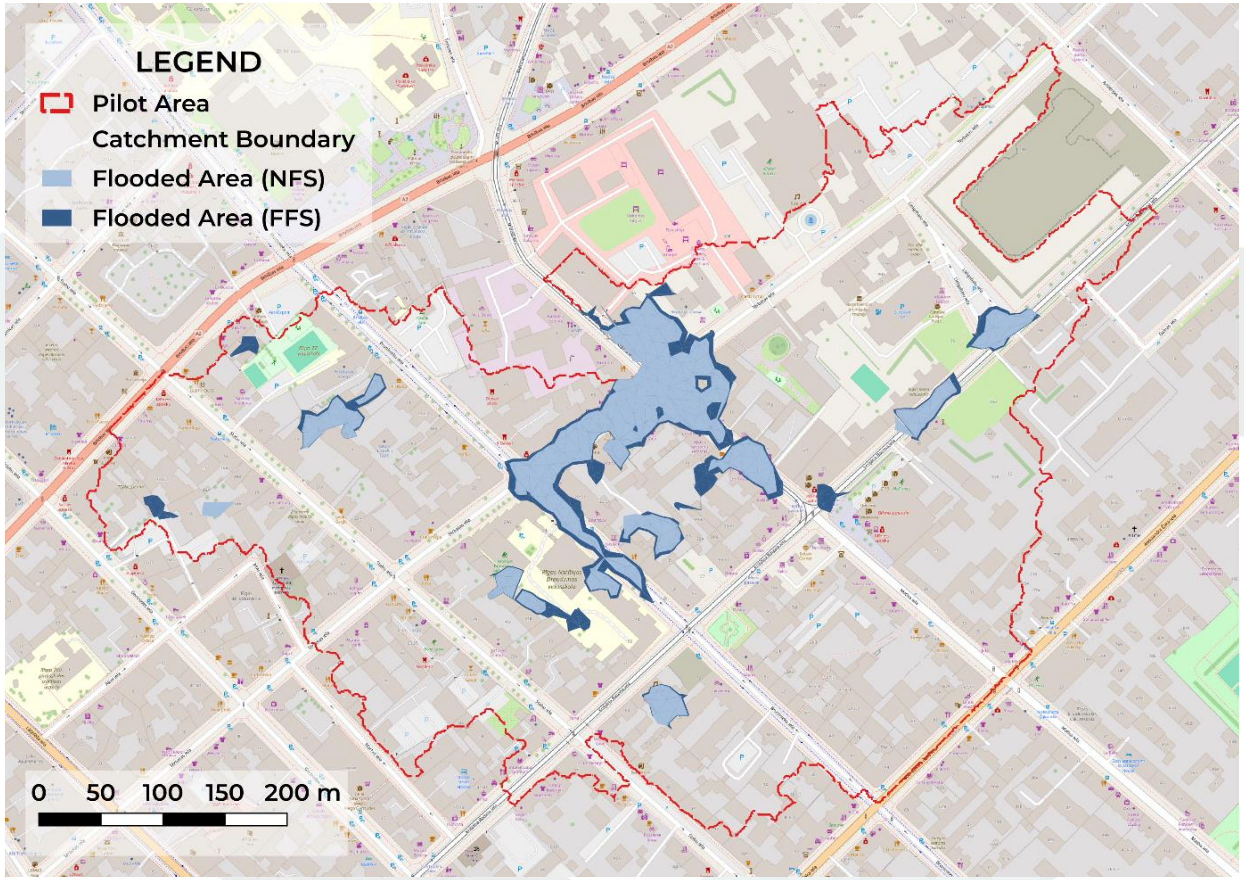
Detention and infiltration

- Stormwater tree trench
- Stormwater planter
- Rainwater cistern
- Infiltration basin
- Infiltration pit
- Detention basin
- Rain garden
- Pond
- Filter strip
- Wetland

https://www.integratedstormwater.eu/sites/www.integratedstormwater.eu/files/toolsheet_descriptions_of_swm_solutions.pdf

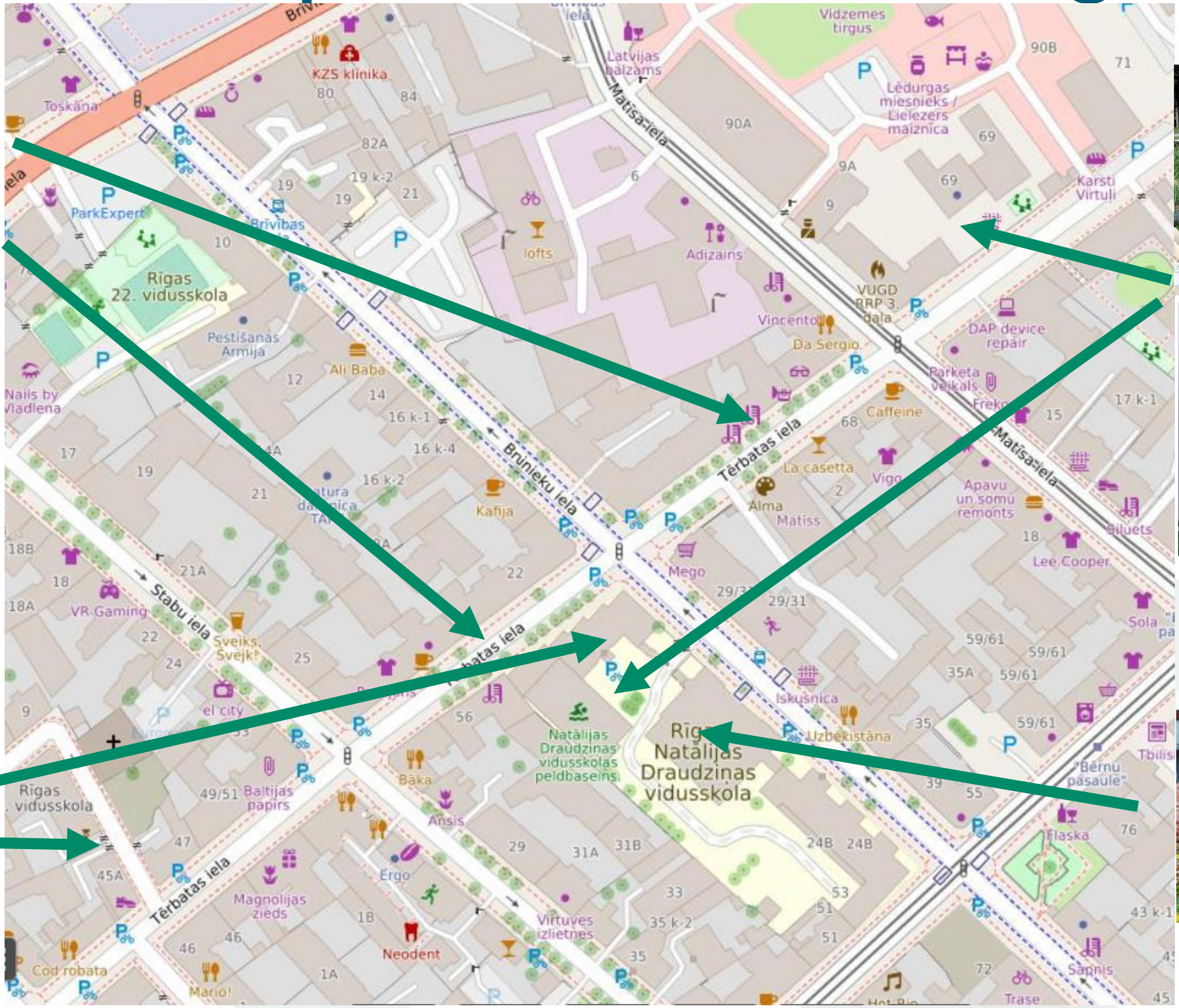
LIFE LatEst Adapt solutions in Riga





LIFE LatEst Adapt soutions in Riga

Rain garden in the street



Green wall

Rain garden/ bioswale in the courtyard

Rain water collection

Green roof

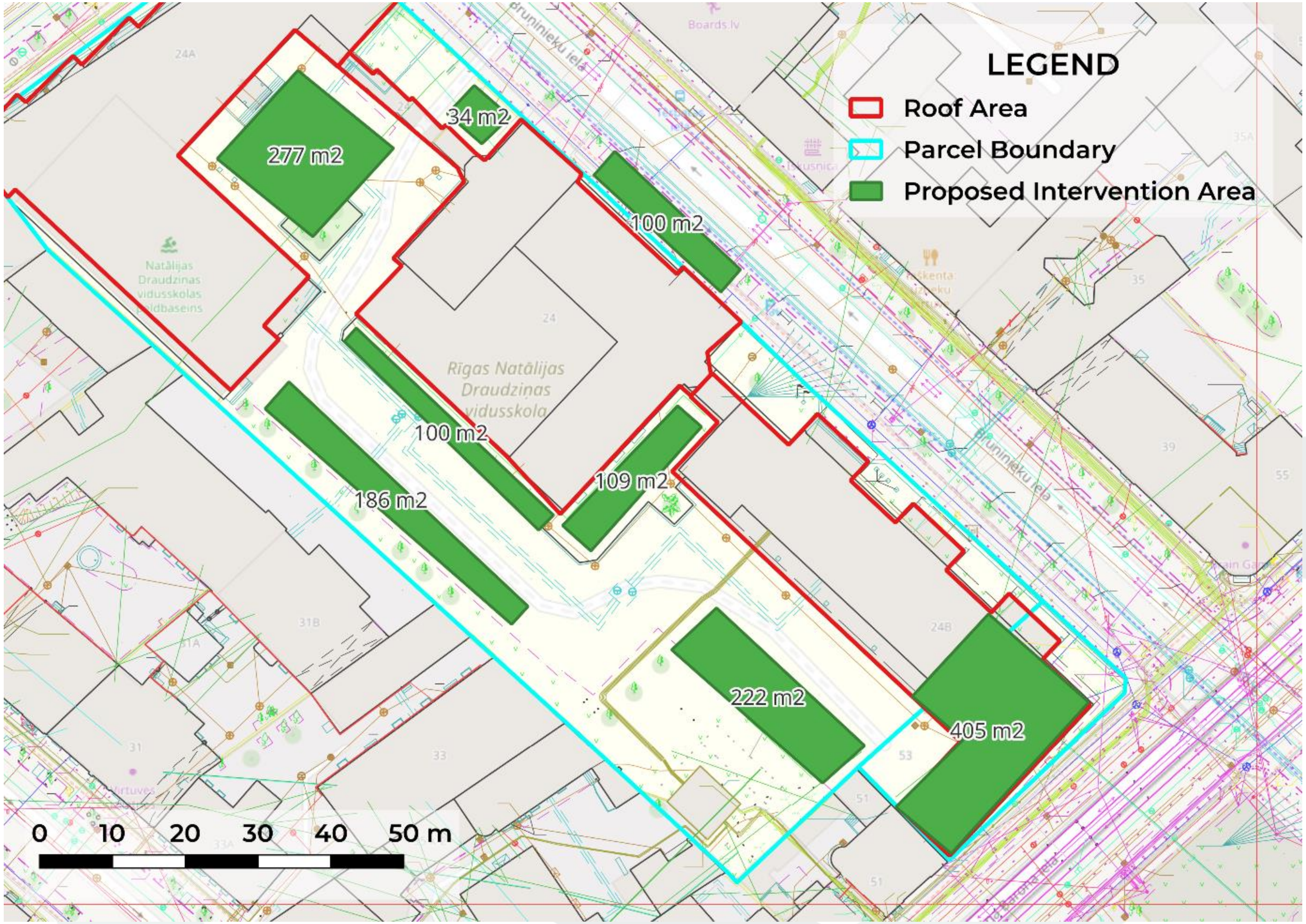
Conceptual soution for the school

Disconnection runoff of the rooftops and courtyard (2000-3000m2) from the combined sewer

Rain garden

Rain amphithetre

Green roof



School courtyard Conceptual solution

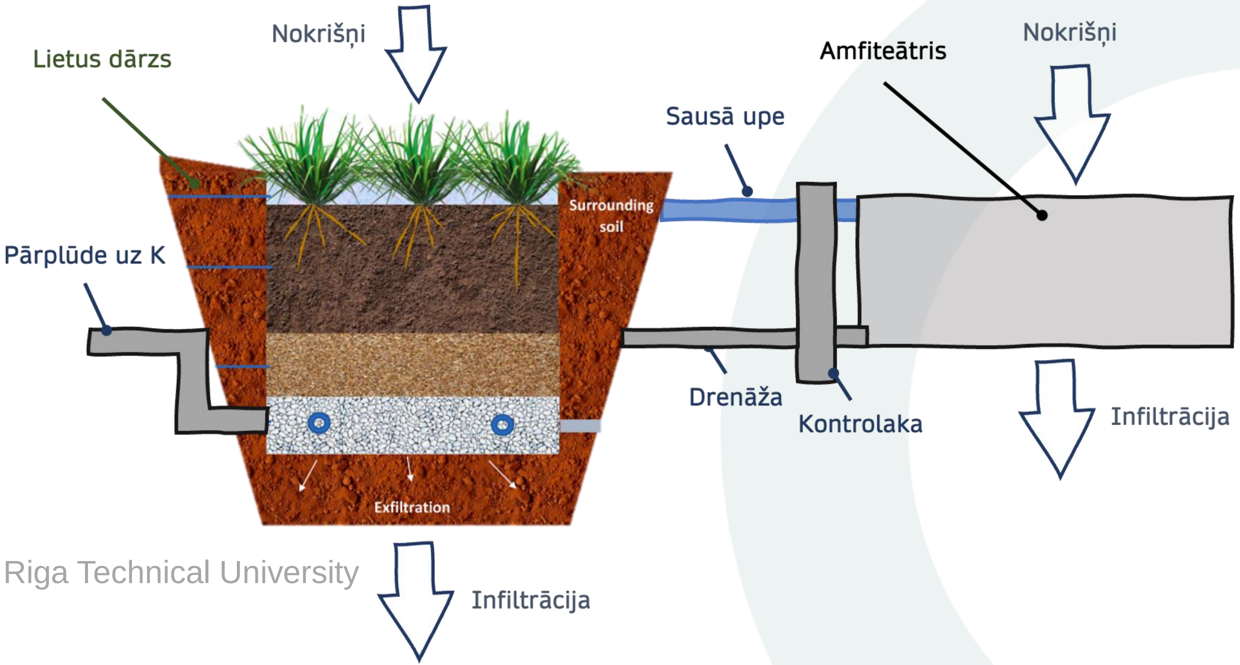
Stormwater runoff directed to NBSs, overflow to the combined sewer

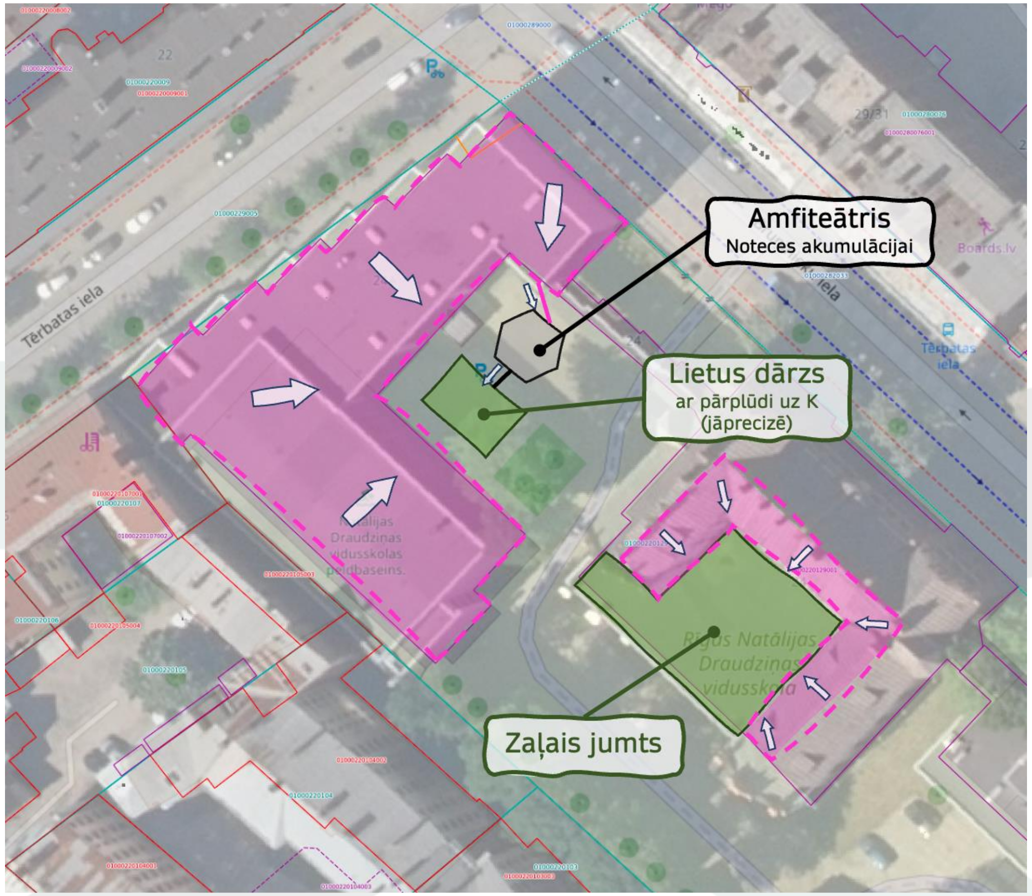
Catchment area up to 7000m2

Solutions area up to 2000m2

Total attenuation volume ~ 500 m3

(precipitation depth ~71 mm – up to 100 yr rainfall)

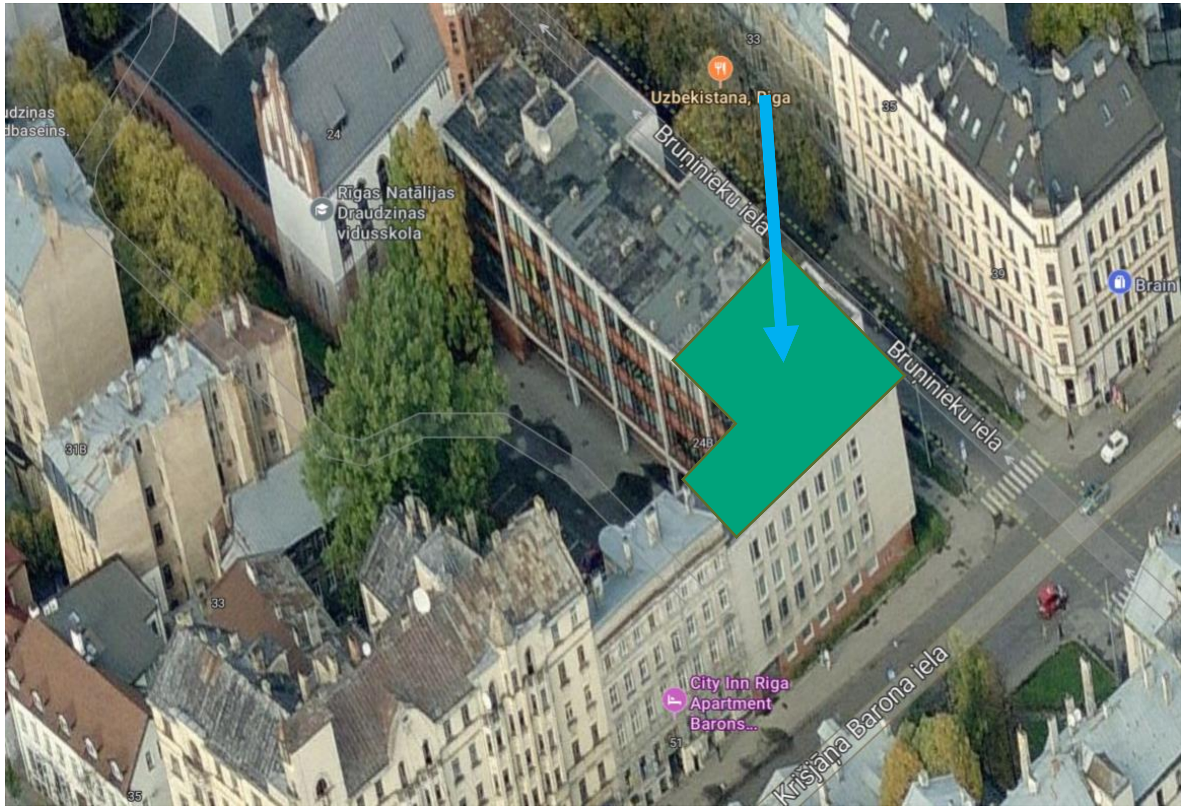




Green roof on the school roof

Approximately 400m2

(Extensive) roof



Extensive vs intensive roof

Extensive roof: thinner substrate layer, lower weight and cost, lower water retention and functionality

Intensive roof: : thicker substrate layer, higher weight and cost, higher water retention and functionality

Extensive vs intensive gree roofs

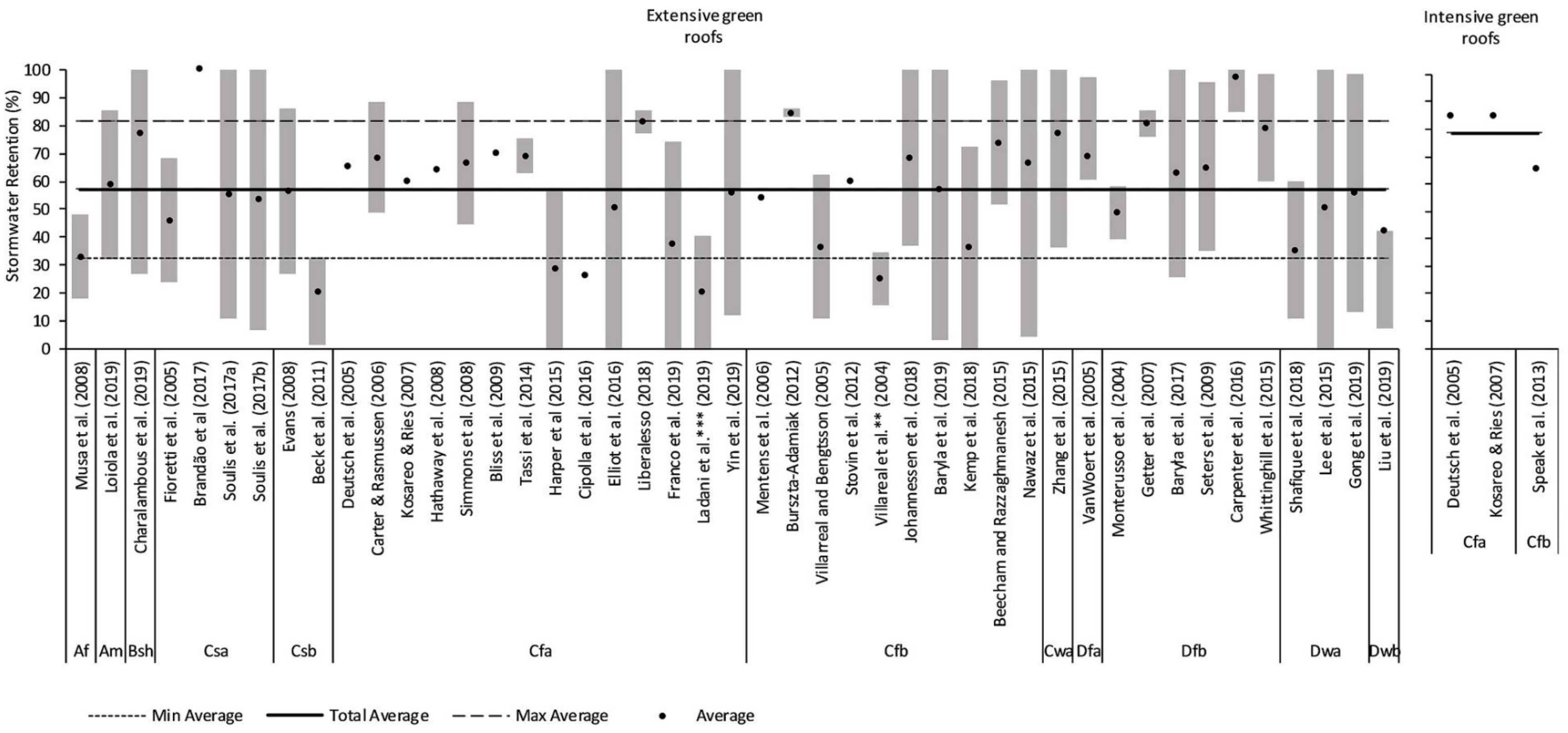
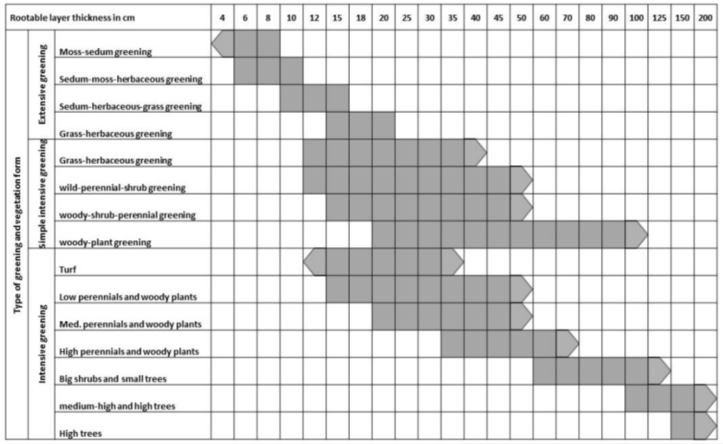


Fig. 7. Stormwater retention capacity of extensive green roofs [36,107,109,119–124,126–145] and intensive green roofs [72,119,146].

Table 3: Thicknesses of different greening and vegetation types [1)]



Roof pitch up to 5°		Roof pitch greater than 5°
for > 50 cm layer thickness	C_s = 0,1	——
for > 25 – 50 cm layer thickness	C_s = 0,2	——
for > 15 – 25 cm layer thickness	C_s = 0,3	——
for > 10 – 15 cm layer thickness	C_s = 0,4	C_s = 0,5
for > 6 – 10 cm layer thickness	C_s = 0,5	C_s = 0,6
for > 4 – 6 cm layer thickness	C_s = 0,6	C_s = 0,7
for > 2 – 4 cm layer thickness	C_s = 0,7	C_s = 0,8

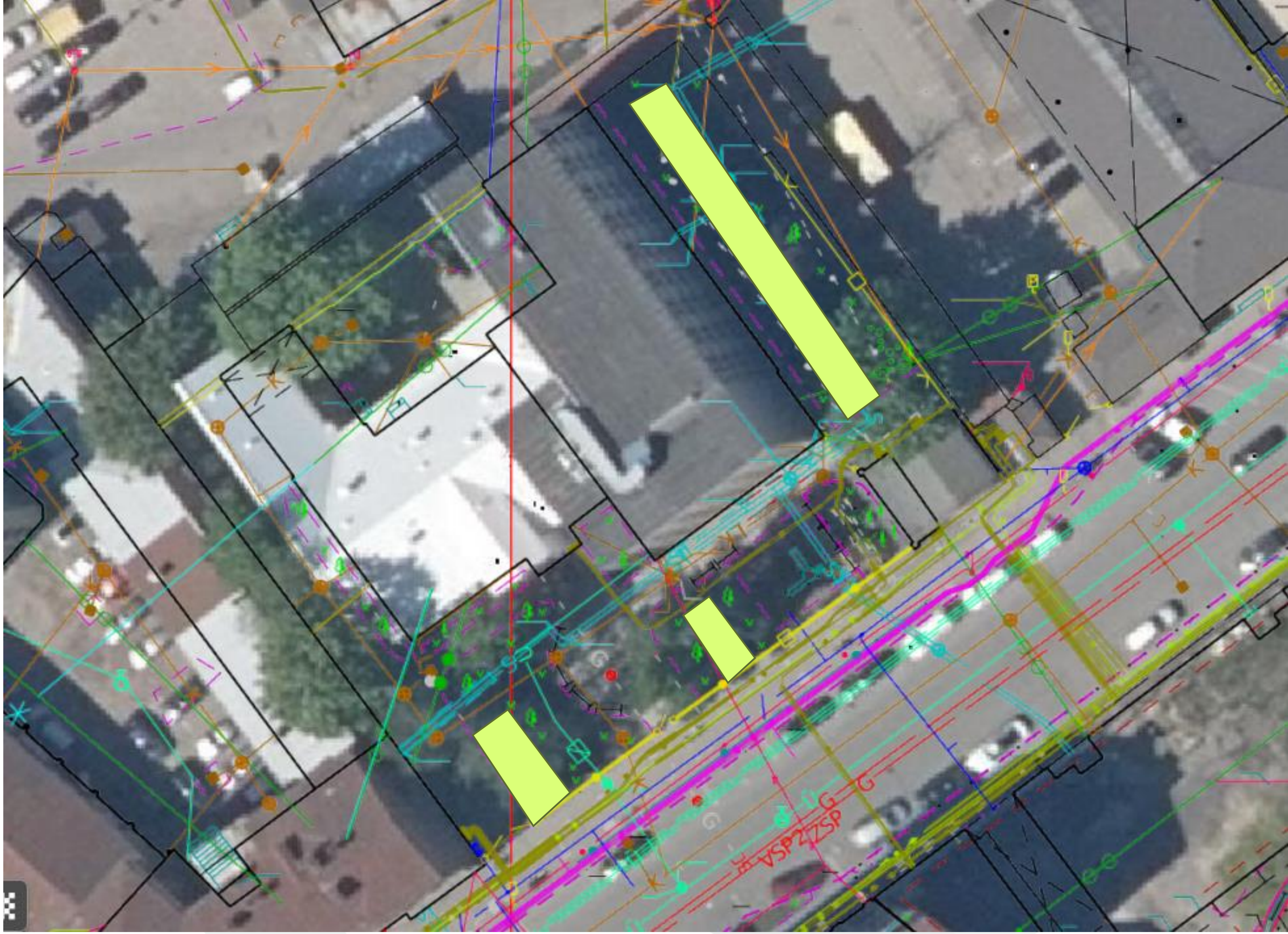
N0.	1	2	3	4
1	Type of greening	Structural thickness in cm	Annual average water retention in %	Annual runoff coefficient Ψ_a/ sealing factor
2	Extensive greening	2 – 4 > 4 – 6 > 6 – 10 > 10 – 15 > 15 – 20	40 45 50 55 60	0,60 0,55 0,50 0,45 0,40
3	Intensive greening	15 – 25 > 25 – 50 > 50	60 70 ≥ 90	0,40 0,30 ≤ 0,10

Orphan court solutions

Opportunity to collect water from rooftops

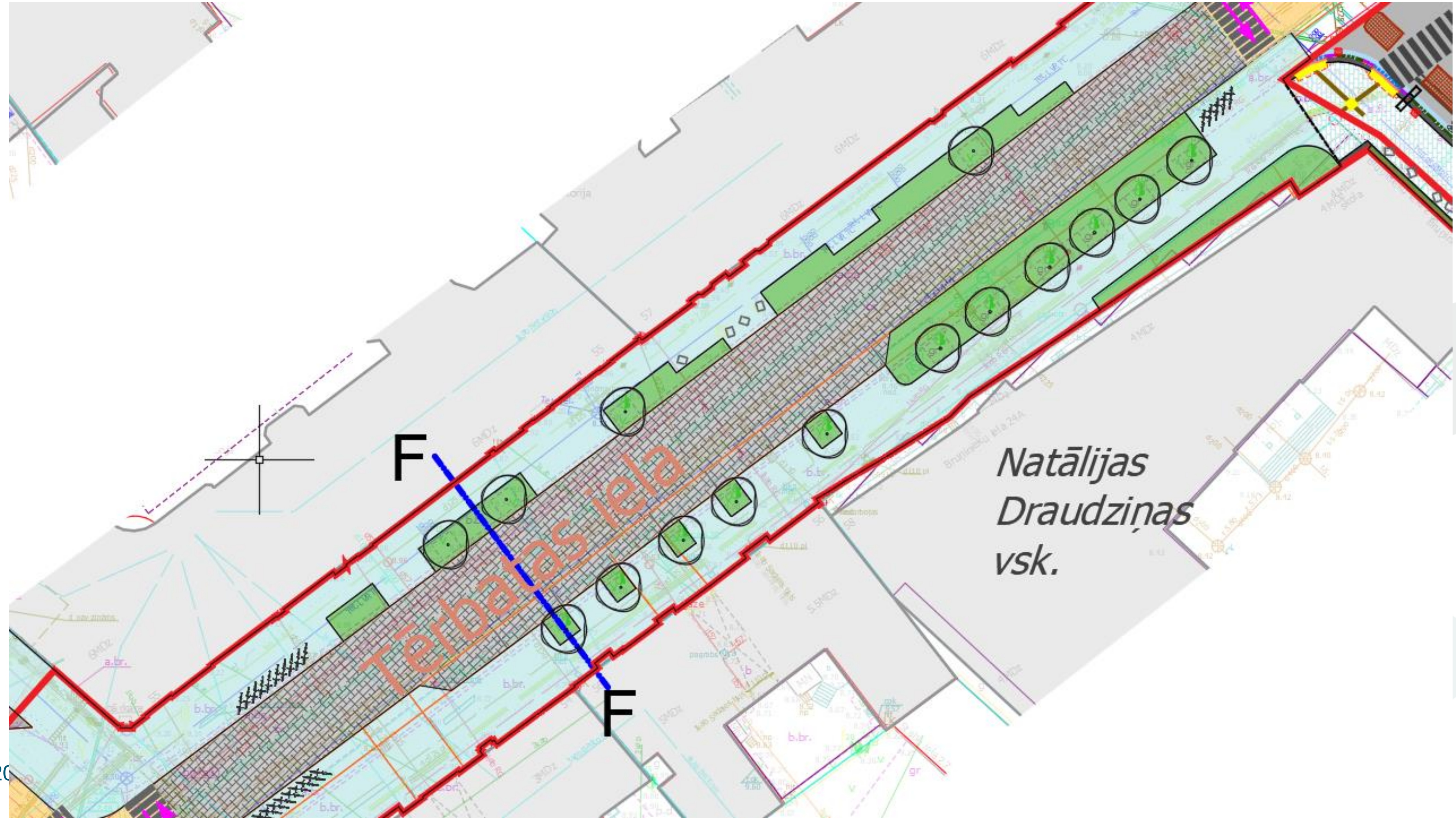
Utilities issues

Combination with trees possible?



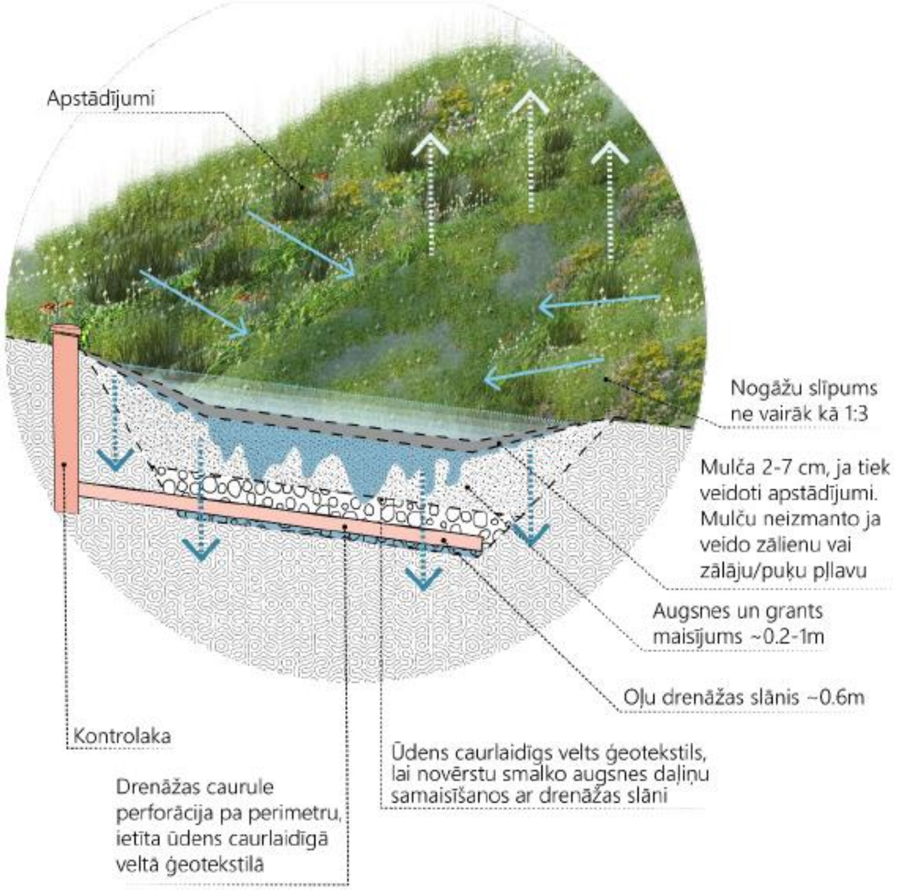
Rain gardens / bioswales

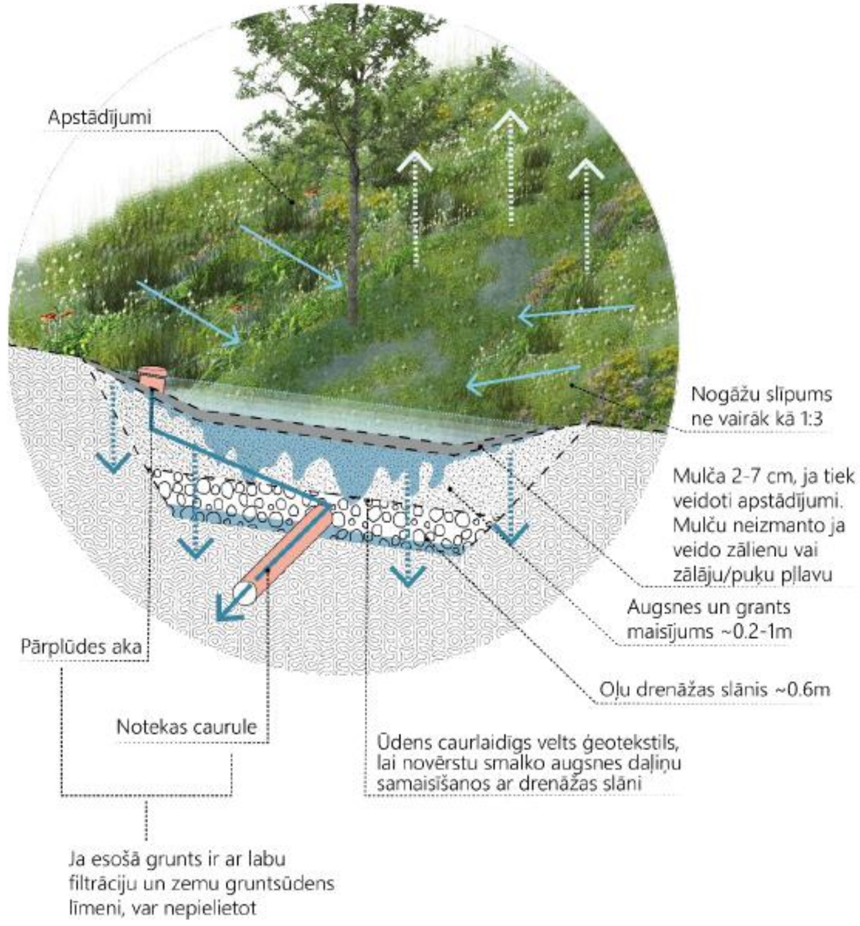
Rain gardens / bioswales in the street



Rain gardens / bioswales in the street

Rain gardens – with and without overflow





Rain garden with internal water storage (IWS)

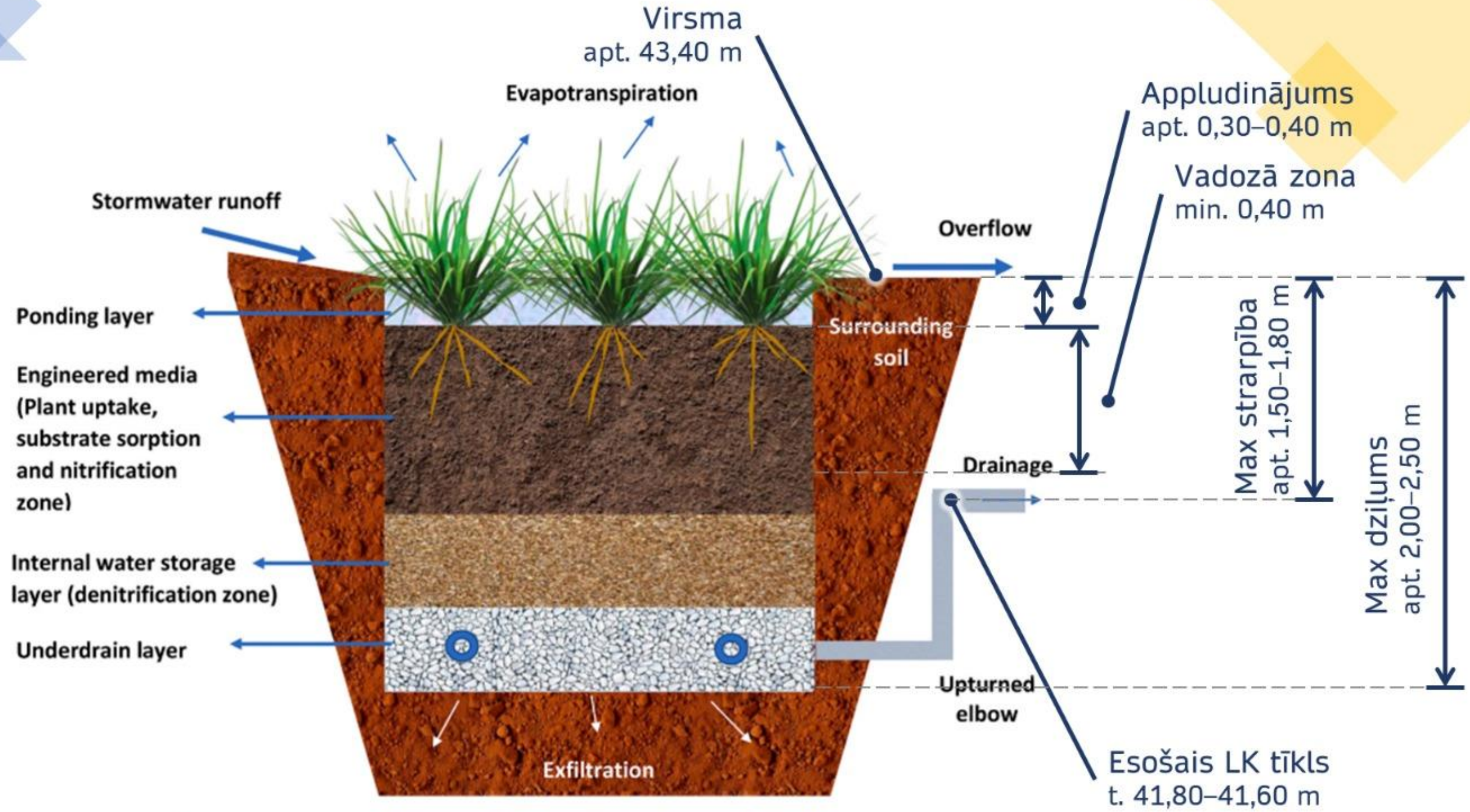
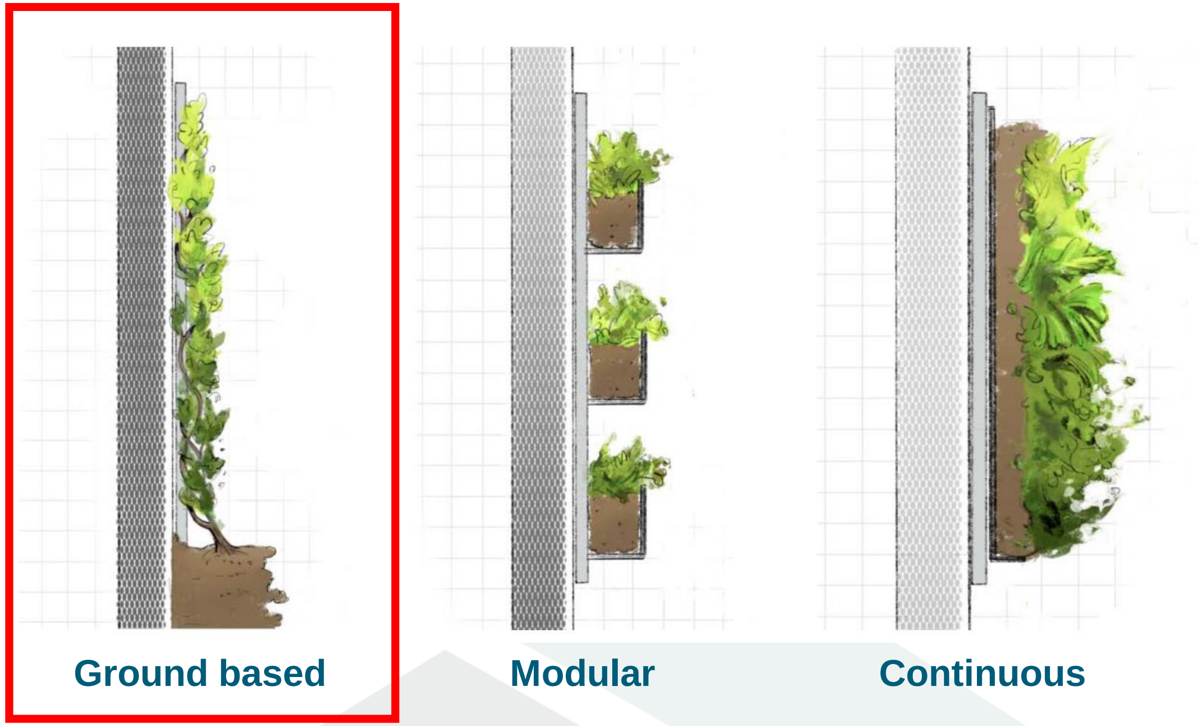


Fig. 1. Schematic representation of bioretention with internal water storage arrangement.

Green walls / facades

Vertical greening Green walls / facades



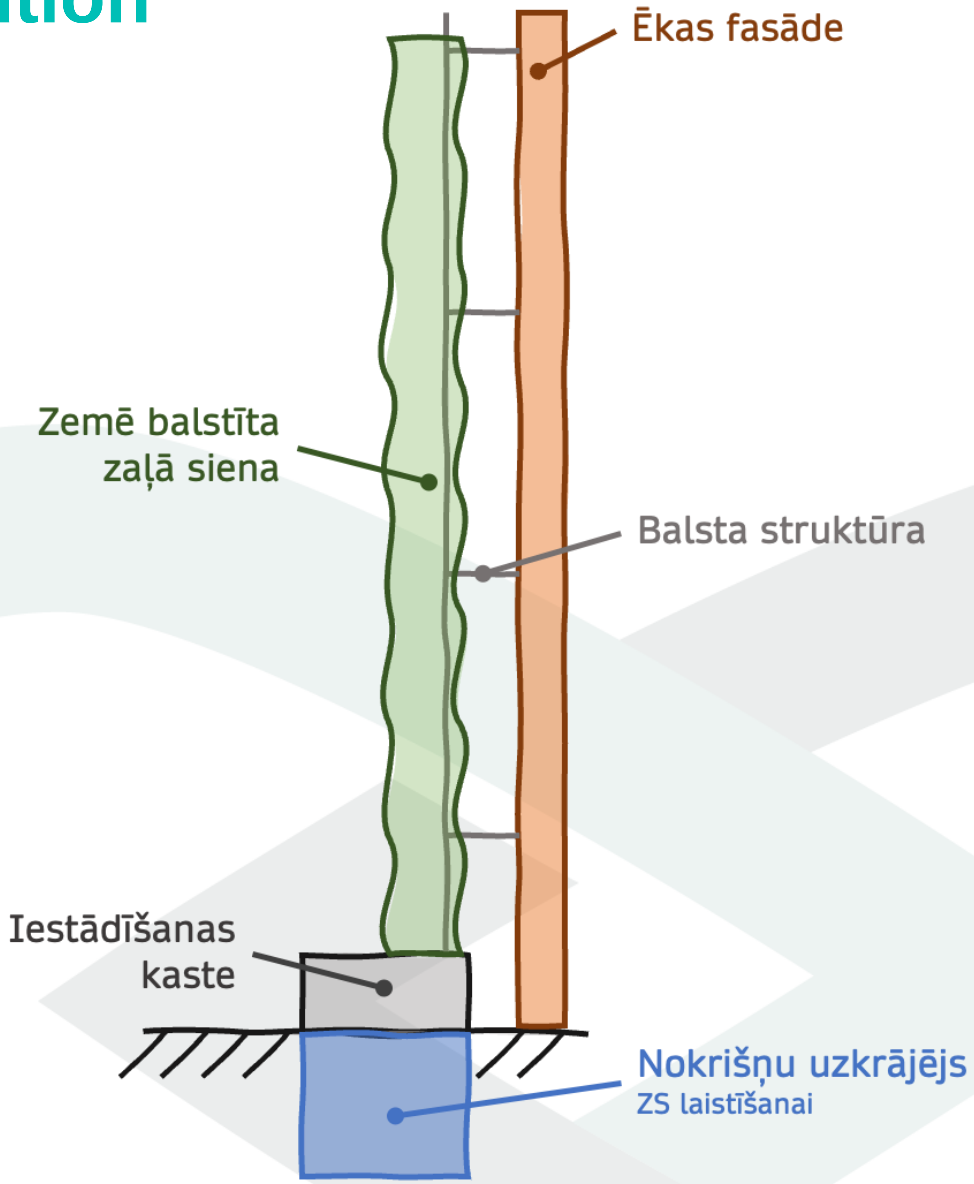
Green wall Conceptual solution

Plants need:

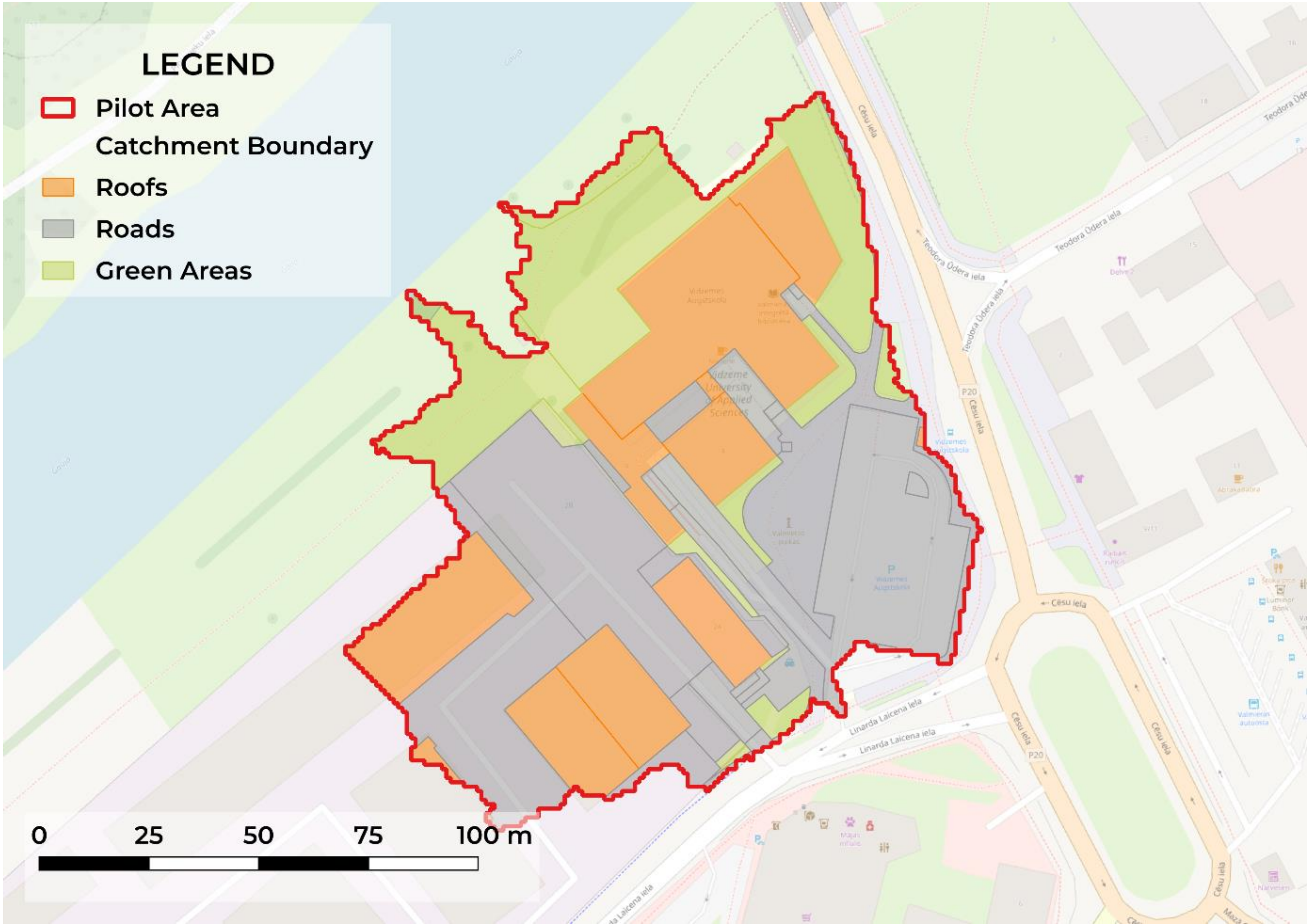
3-5 l/m²d

Needs to be detailed given plant type and facade orientation

If facade area is 100 m2, storage needed ~3m3 (7 day water demand)

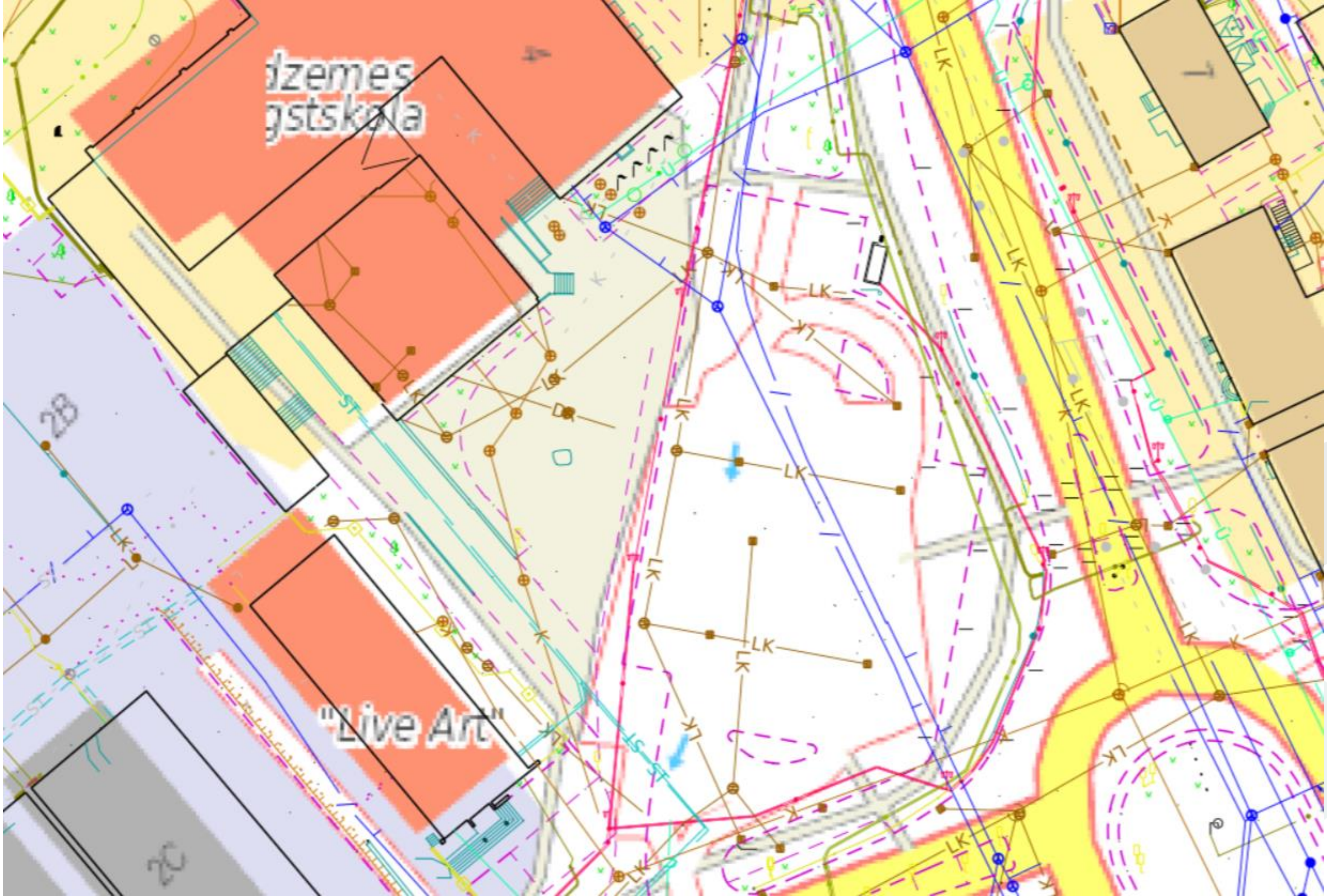


Valmiera pilot site



Catchment


LEGEND
Pilot Area
Catchment Boundary
Elevation, m ASL
40,00
30,00
0
25
50
75
100 m


dzemes
gstskola
"Live Art"
2B
2C
LK
ST

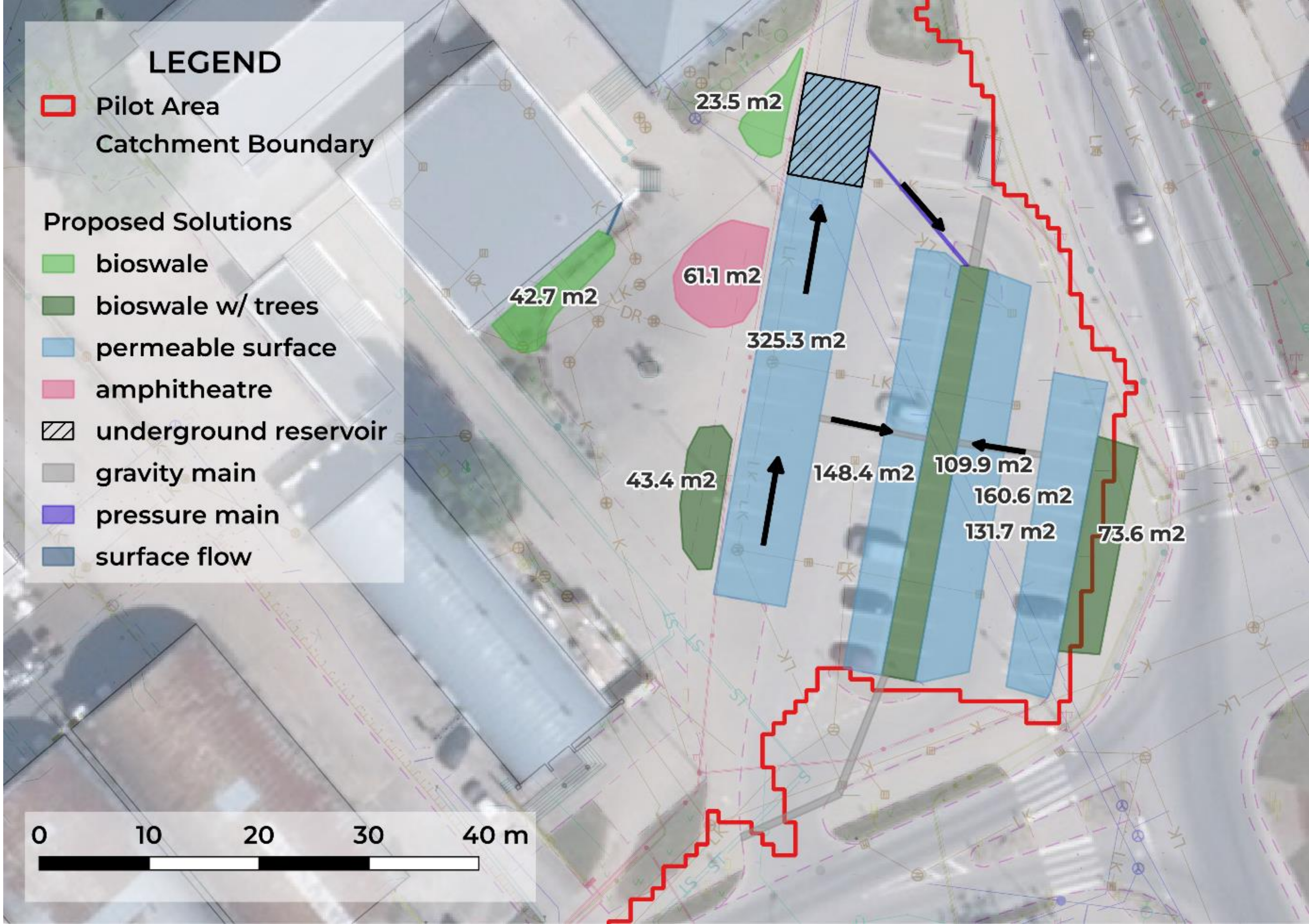
Issues

Heat stress in summer

Rain water runoff ‘lost’

Flooding not a problem

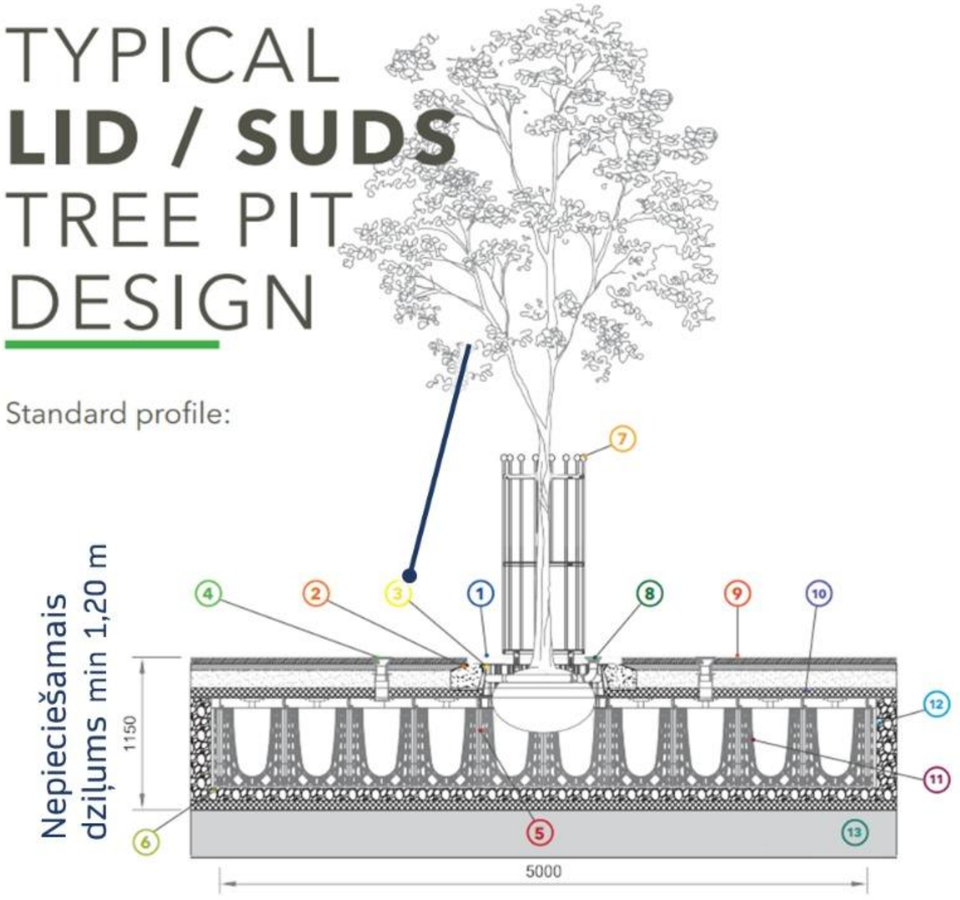
Conceptual solution



Bioswales in the parking lot

- Collect and fiter the runoff
- Overflow / drain to the existing storm sewer
- Variety of solutions to test
  - With overflow to the storm sewer or soakaway
  - With and without internal water storage
  - With and without trees
- Collection in the reservoir and recirculation

Bioswales with trees



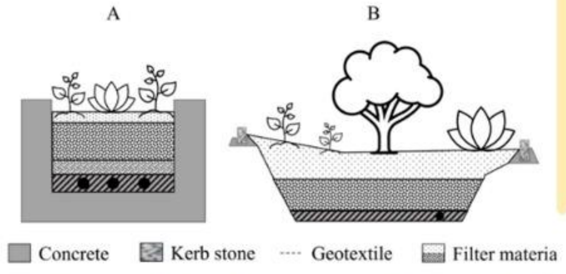


Fig. 1. Schematic illustrations of the design of bioretention types A, B, C, and D. For deta
see Table 1.

Table 1
Specifications for the bioretention systems that address various design parameters, construction compone

	—	B		C		D	
		B6	B7	C8	C9	D10	D11
Footprint	m^2	300	368	99	99	52	115
Catchment area	m^2	1500	1500	2000	2000	1400	3100
Excavation	m^3	450	550	100	100	105	225
Construction material							
Concrete	m^3	7	9	6	6	3	4
Reinforcing steel	kg	68	92	66	66	27	45
Paving stone	kg	7150	9900	6820	6820	2750	4950
Geotextile	m^2	0	0	0	0	76	135
PVC pipe 110	m	45	55	60	60	0	0
PEH pipe 110	m	0	0	0	0	18	31
Filter material mixture							
Sand	m^3	9	11	84	84	2	2
Gravel	m^3	51	63	11	11	13	19
Pumice	m^3	15	0	0	0	2	6
Biochar	m^3	0	0	0	11	0	0
Soil	m^3	241	331	17	6	16	52
Compost	m^3	15	0	0	0	2	6
Other design features		331 m3					
Overflow		✓	–	✓	✓	✓	✓
Saturated zone		–	–	–	–	–	–
Pre-treatment		–	–	✓	✓	–	–
Water storage capacity		high	high	med	med	low	low
Vegetation		a, b, c, d, e	a, b, c, d, e	b, d	b, d	a, b, d	a, b, d

a) shrubs b) perennial c) bulbs d) grasses e) trees.

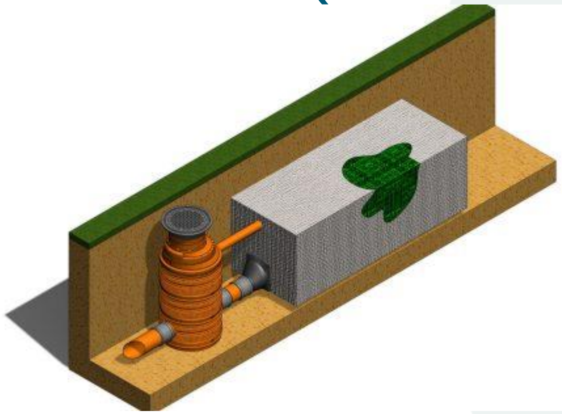
331 m3/ 300 m2 = 1,10 m

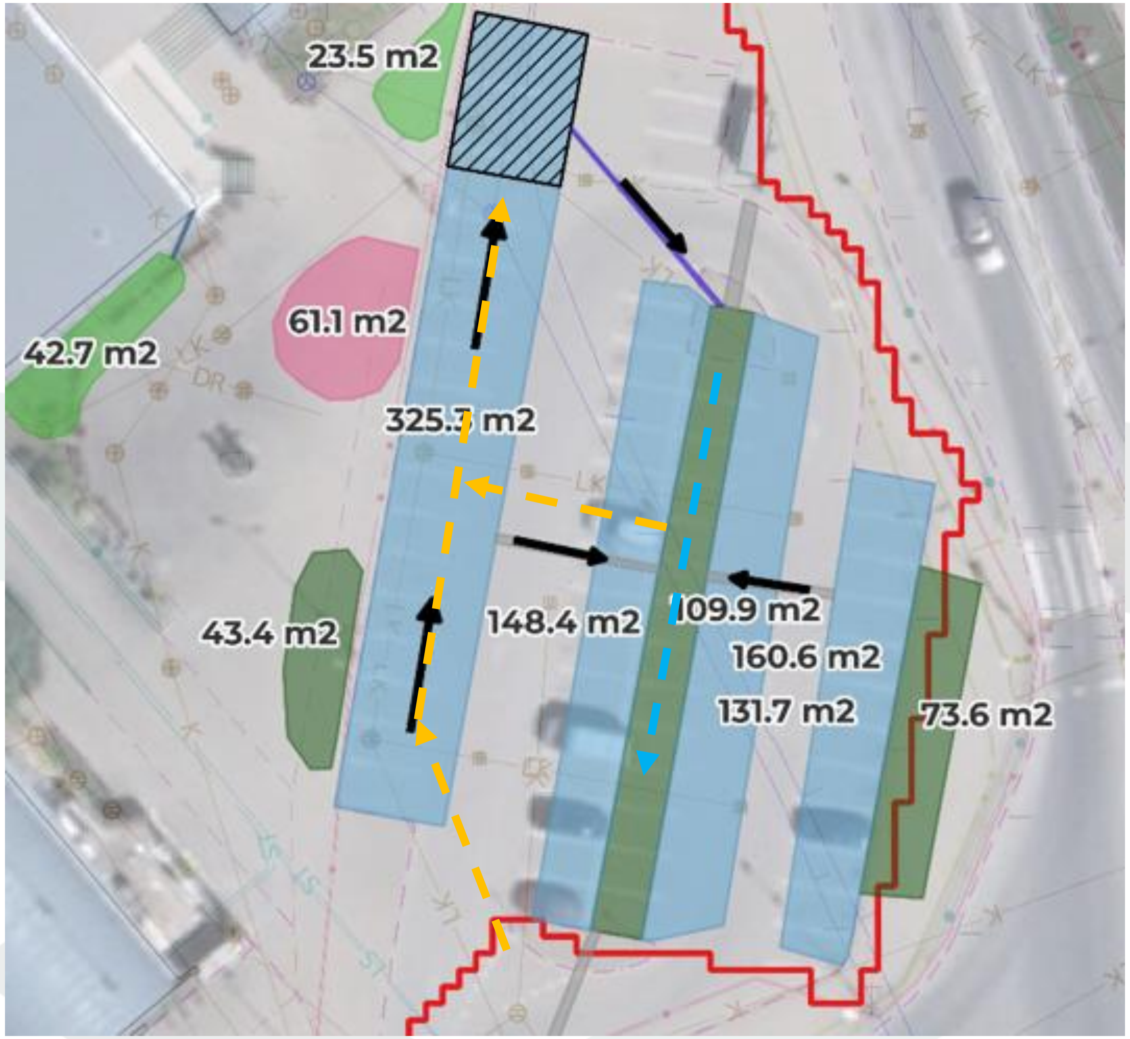
Storage reservoir and water recirculation

Drainage / overflow connected to the existing storm sewers

Water pumping to the central bioswale

Depth sensor and potential for smart real time control (smart outlet)





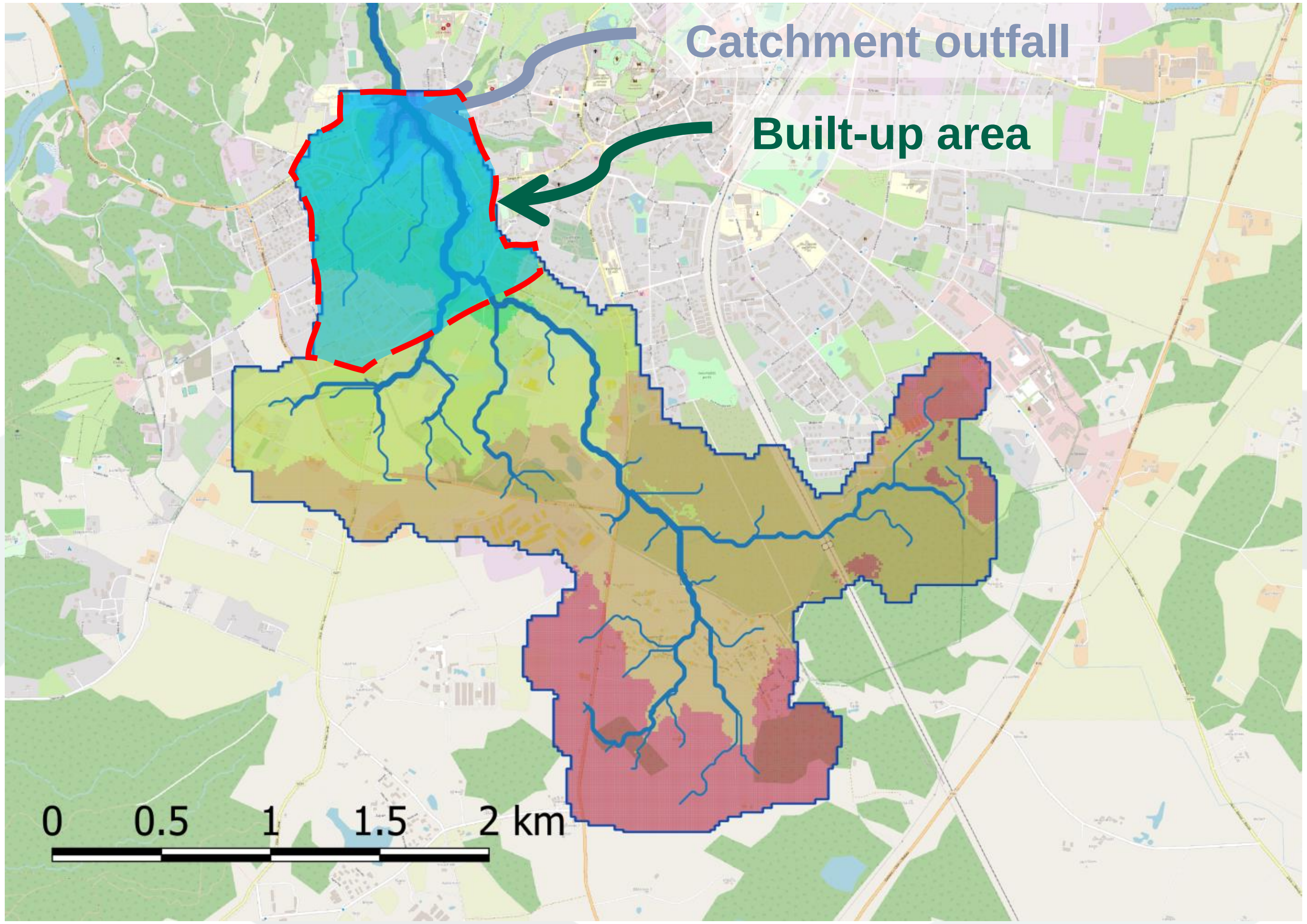
‘Dry river’




Life LATEST Adapt pilot site in Cēsis

Description:

- Total catchment area 521 ha w/ built-up area 63 ha
- Mostly green areas w/ built-up environment near catchment outfall
- Drainage network near catchment outfall



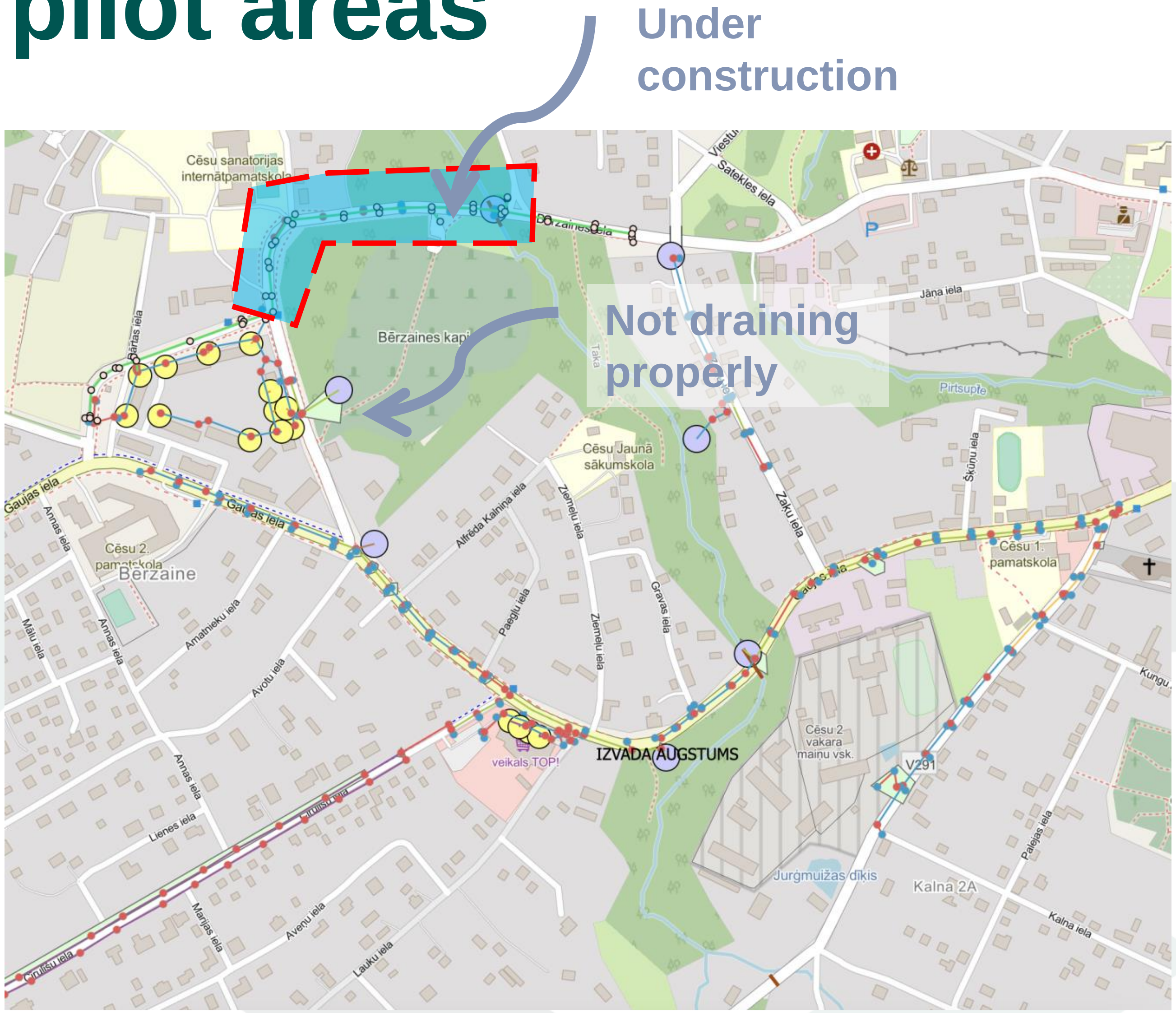
modelled area w/ Flo-2D

Life LATEST Adapt pilot areas

Cēsis

Problems:

- Not all parts of the real system are working properly
- Ongoing construction near system outfall – drainage pipes being rerouted
- Missing as-built data gathered during on-site inspections
- Erosion near storm sewer discharges
- Untreated storm water entering the small river entering the Natura2000 site
- Higher risks in extreme events and with climate cnange

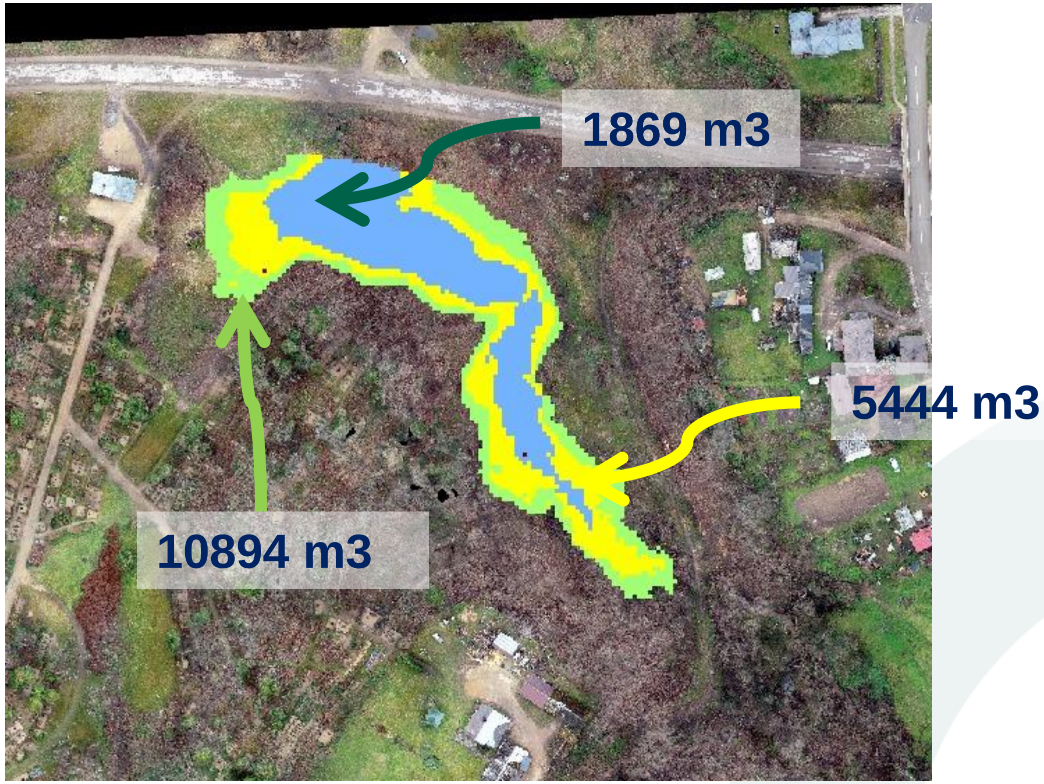


Pollution issues

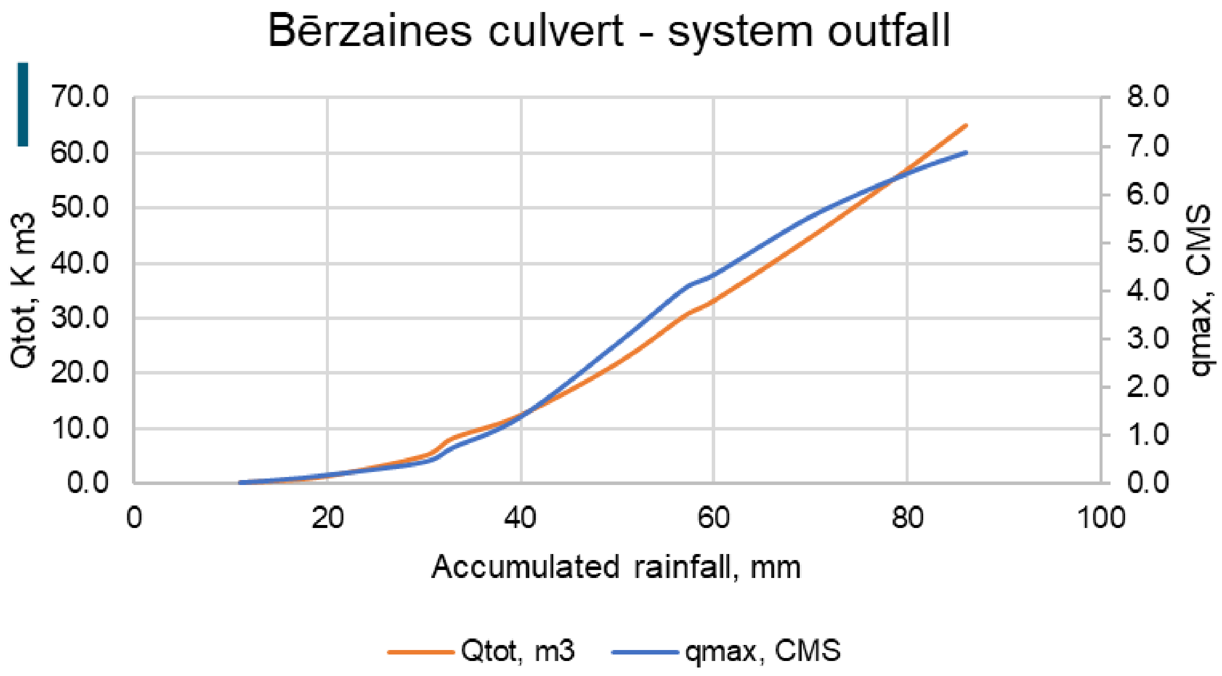
Great natural value, unused recreation potential

Eroded outfalls

Cēsis – flow modelling and potential storage



flooded area estimation

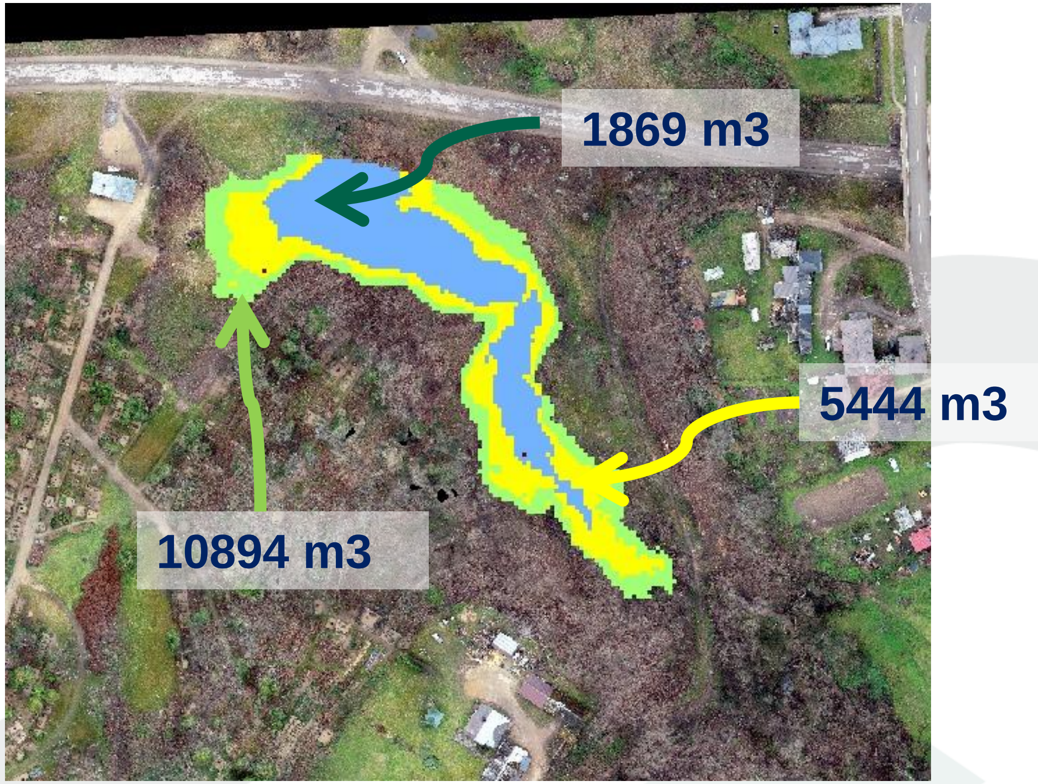


Life LATEST Adapt pilot areas

Cēsis

Solutions:

- Flow regime to be refined during design after flow sensor installation
- Design outline and plants to be detailed
- Flow reduction and storage with terraced swale/wetland, storage up to 2000m3
- Aesthetically attractive place suitable for recreation






Smart solutions

Real-time sensors:

- Water quantity: rainfall, flow rate
- Water quality: temperature, EC, turbidity
- Recreation: number of visitors

Later possibility to manage storage

Sewer outfall near the school

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ŪDENS PĒTNIECĪBA & BIOTEHNOLOĢIJAS

Thank you!

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