Development of stormwater-adapted green area planning tool for the City of Riga:

ZIPI

Jurijs Kondratenko, g93, 08.05.2018

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www.integratedstormwater.eu

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Background

Green Area Factor (GAF)

What is Green Area Factor?

A practical tool for urban planning

→ ensures sufficient green infrastructure when building new blocks in a dense urban environment

$$\textbf{GAF} = \frac{\text{total effective green area}}{\text{total lot area}}$$

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Helsinki Green Factor

adopted in 6 iWater cities

- **«Green Area Factor»** – developed in Helsinki in 2013 (as part of the Climate-proof City (ILKKA) – Tools for Planning project)
- **«Helsinki Green Factor»** – GAF, updated in the iWater project in 2016 – 2017
  - *stormwater elements are given a greater weight*
  - *improved overall usability*
- Other Green Factor methods utilized in the development of the Helsinki Green Factor: Berlin, Malmö, Stockholm, Seattle and Toronto
- Adopted in 6 iWater cities: Riga, Jelgava, Tartu, Turku, Gävle and Söderhamn

Ilmastonkestävän kaupungin **suunnitteluopas**

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Helsinki Green Factor –> ZIPI

What is ZIPI?

- Green infrastructure planning (and management) tool *(in Latvian: zaļās infrastruktūras plānošanas (un pārvaldības) instruments)* – **ZIPI**
- ZIPI coefficient – **ZIPIk**

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ZIPI objectives

- Preserve existing green territories, enhance their quality and quantity; promote development of new green territories in the City of Riga
- Provision of high-quality green infrastructures already in the urban planning process: controlling the ratio of the built-up territories and the free green territories
- Promote both the creation of high-quality green infrastructure and sustainable, decentralized stormwater management

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ZIPI
development process

ZIPI development process

- Acquisition of knowledge about existing green infrastructure planning approaches and tools
- In-depth analysis of the Helsinki Green Factor tool and its development process
- Comprehensive experts survey *(urban planners, building control specialists, real estate developers and maintainers, architects, environmental and ecosystem services specialists, etc.)*
- Adjustment of ZIPI element values, weightings of elements
- Approbation of ZIPI tool for further use in Riga City Municipality

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Green Area Factor workshop

In Riga, for local stormwater group, 06.12.2016

ZIPI coefficient

$$\mathbf{ZIPIk} = \frac{\text{effective green area, total}}{\text{area of the land plot, total}}$$

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ZIPI structure

36 elements | 5 groups of elements

- Preserved trees, vegetation and land – 4 elements
- Newly established urban greeneries – 9 elements
- Land surface coverings – 2 elements
- Stormwater management – 9 elements
- Bonus elements – 12 elements

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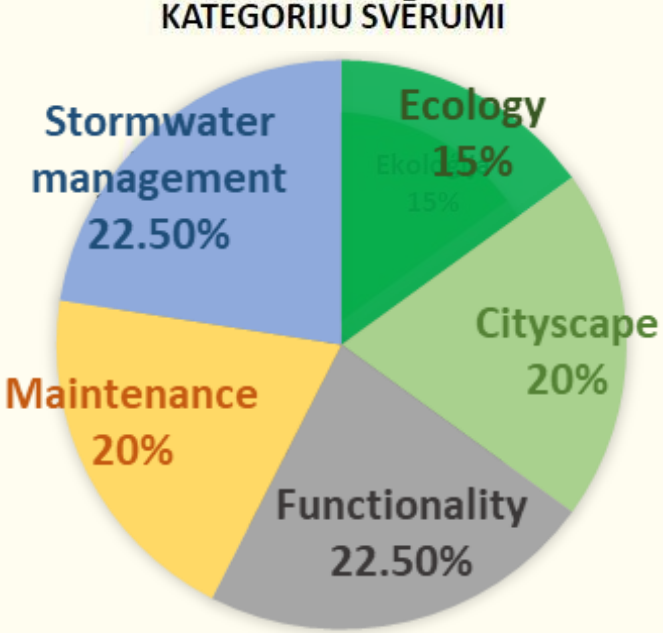
Weightings of categories:



Kategoriju svērumi				
Ekoloģija	Ainaviskums	Funkcionalitāte	Uzturēšana	Lietusūdens apsaimniekošana
0.75	1.00	1.13	1.00	1.13

Categories:

- Ecology
- Functionality
- Cityscape
- Maintenance
- Stormwater management

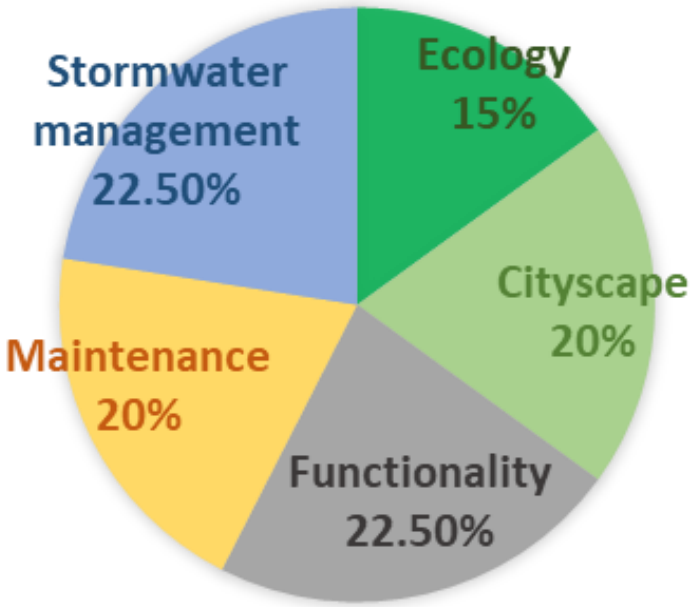
	Elementa vērtība pa kategorijām					Svērtā vērtība
	Ekoloģija	Ainaviskums	Funkcionalitāte	Uzturēšana	Lietusūdens apsaimniekošana	
Saglabāti lieli koki labā stāvoklī, augumā vismaz 3m (25 m² katram)	3.0	3.0	3.0	2.5	3.0	**2.9**

Aprēķins:
*3.0 *0.15 + 3.0*0.20 + 3.0*0.225 + 2.5*0.20 + 3.0*0.225 = 2.9*

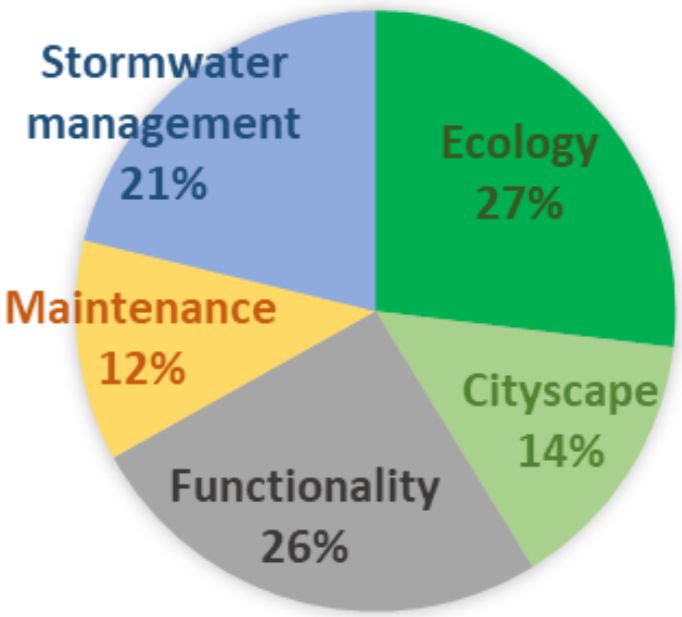
Weightings of categories

Differences between ZIPI and Helsinki Green Factor

Riga (ZIPI)



Helsinki Green Factor



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Weightings of elements in different categories and their weighted values: sample

				Categories					
				0.15	0.2	0.225	0.2	0.225	
Groups of elements	Element	Unit	m^2	Ecology	Functionality	Cityscape	Maintenance	Stormwater management	Average weighted value
Preserved trees, vegetation and soil	Preserved large trees (adult tree height > 10 m) in good conditions, height at least 3 m (25 m^2 each)	1 pc, 25m^2	25	3.0	3.0	3.0	2.5	3.0	2.90
	Preserved small trees (adult tree height < 10 m) in good conditions, height at least 3 m (15 m^2 each)	1 pc, 15m^2	15	2.5	2.5	3.0	2.5	3.0	2.73
	Preserved trees in good conditions (height 1.5 – 3 m) or large bushes (3 m^2 each)	1 pc, 3m^2	3	2.0	2.0	2.0	2.0	2.5	2.11
	Preserved natural meadow or natural vegetation	m^2	1	2.0	1.5	1.5	2.0	2.5	1.90

			Kategoriju sverumi				
			0.15	0.2	0.225	0.2	0.225
Elements	Vienība	m2	Ekoloģija	Funkcionalitāte	Ainaviskums	Uzturēšana	Lietusūdens apsaimniekošana
Zaļā siena, vertikāla virsma	m2	1	0.5	1.0	2.0	1.0	0.3
Daļēji caurlaidīgi segumi ar veģetāciju (betona eko-bruģis, stiprināts zāliens)	m2	1	0.5	1.0	1.0	0.5	2.0
Daļēji caurlaidīgi segumi bez veģetācijas (piemēram, betona bruģis, caurlaidīgs asfalts vai betons, grants, smilts, šķembas)	m2	1	0.3	1.0	1.0	2.5	2.0
Lietus dārzi (biofiltrācijas teritorija, bez diķa ar ūdeni) ar daudzveidīgiem augiem	m2	1	2.5	2.0	2.0	1.5	3.0
Intensīvi zaļie jumti, substrāta dziļums 20 – 100 cm	m2	1	1.5	1.5	2.0	1.0	2.5
Vidēji intensīvi zaļie jumti, substrāta dziļums 15-30 cm	m2	1	1.0	1.0	1.5	1.5	2.0
Extensīvi zaļie jumti, substrāta dziļums 6-8 cm	m2	1	1.0	1.0	1.0	2.0	1.5
Infiltrācijas ievalka vai baseins ar augiem vai šķembām, (bez pastavīga ūdens līmeņa, cauralidīgā augsne)	m2	1	2.5	1.5	1.5	1.5	3.0
Pazemes infiltrācijas aka / tvertne / grāvis	m2	1	1.5	1.0	0.0	1.5	1.5
Dīķis, mitrājs vai ūdens pļava ar dabisku veģetāciju (ir pastāvīga ūdens virsma vismaz daļu no gada, pārējā laikā zeme saglabājas mitra, neizžūst)	m2	1	3.0	2.0	2.0	2.0	3.0
Ūdens aizturēšanas vai uzkrāšanas baseins vai ievalka ar augiem vai šķembām, (bez pastavīga ūdens līmeņa, cauralidīgā augsne līdz risinājuma apakšai)	m2	1	2.0	1.5	1.5	1.5	2.5
Pazemes tvertne vai cisterna	m3	1	1.0	1.0	0.0	2.0	1.0
Lietusūdens izmantošana laistīšanai, plānojot lietusūdens savākšanas risinājumus	m2	1	0.3	0.2	0.0	0.2	0.3
Ūdens recirkulācijas / pastāvīgās tecēšanas paredzēšana lietusūdens apsaimniekošanas risinājumos	m2	1	0.3	0.2	0.5	0.2	0.3
Ēnu sniedzoši lieli koki (25 m² katram) ēkas dienvidu vai dienvidrietumu pusē (īpaši – lapu koki)	gab, 25m2	25	0.5	1.0	1.0	1.0	0.0
Ēnu sniedzoši nelieli koki (15 m² katram) ēkas dienvidu vai dienvidrietumu pusē (īpaši – lapu koki)	gab, 15m2	15	0.5	1.0	1.0	1.0	0.0
Augļu koki vai ogu krūmi (10 m² each)	gab, 10m2	10	1.0	1.0	1.0	0.5	0.0
Vietējo sugu / šķirņu augi, vismaz 5 šķirnes/100 m²	m2	1	1.0	0.5	1.0	1.0	0.0
Ziedošie koki vai krūmi (10 m2/katrs)	gab	1	0.5	0.5	1.0	1.0	0.0
Tauriņu pļavas vai smarzīgi, krāšņi ziedoši augi	m2	1	1.0	1.0	1.0	0.5	0.0
Saglabāti nogāzti koki, stumbeņi u.tml. struktūras, kas kalpo par dzīvotnēm (arī putnu būri) (5 m² katram)	gab	5	1.0	1.0	0.5	1.0	0.0

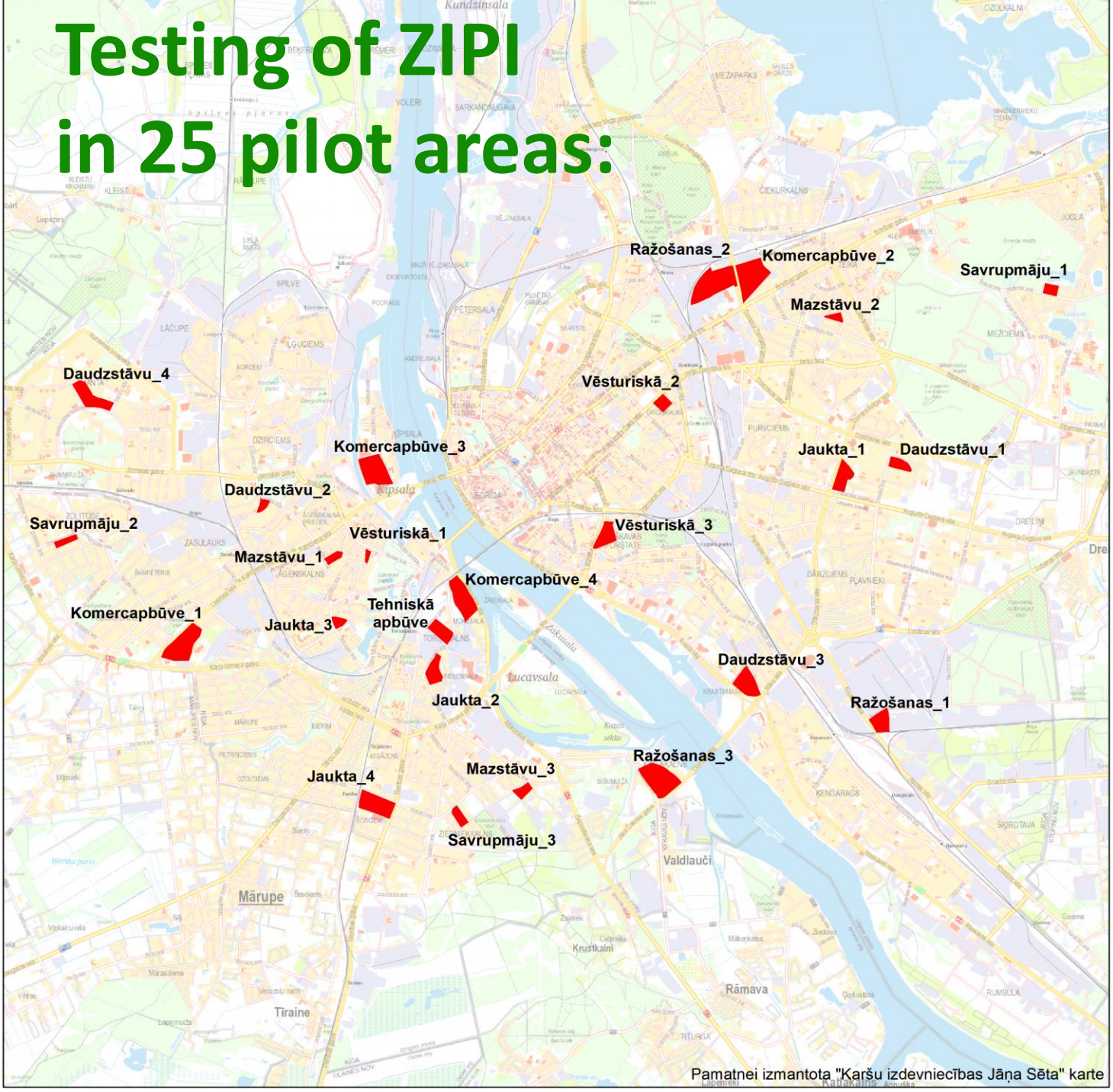
Changes in weighted values of elements

Categories:

- Ecology
- Functionality
- Cityscape
- Maintenance
- Stormwater management

ZIPI
testing

Testing of ZIPI in 25 pilot areas:



3 – individual (family) housing areas

3 - low-rise residential building areas

4 – high-rise residential building areas

4 – mixed city centre building areas

4 - commercial building areas

3 - historical building areas

3 - industrial building areas

1 – industrial, technical and infrastructure building areas

ZIPI testing

- For all pilot areas – analysis of the current situation and calculation of the ZIPI coefficient
- For all pilot areas – definition of ZIPI coefficient in 7 different scenarios, incl. meeting the minimum free (effective) green area requirements
- In representative territories - green infrastructure modelling and calculation of the ZIPI coefficient (Scenario 8)

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ZIPI testing scenarios I

1. Entire area – green lawn, large-size trees (maximum ZIPI coefficient)
2. A half of the area – green lawn, medium-size trees, all asphalt surfaces replaced by partially permeable surfaces, half of the roofs are green (extensive)
3. A half of impervious surfaces – semi-permeable pavements, sustainable SWM solutions for the 20 mm rainfall scenario
4. A half of impervious surfaces – semi-permeable pavements, sustainable SWM solutions for the 50 mm rainfall scenario

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ZIPI approbation scenarios II

5. A half of impervious surfaces – semi-permeable pavements, sustainable SWM solutions for the 100 mm rainfall scenario
6. Permitted minimum* of free green area (and proportional up/downscaling of existing GI elements), the rest of green area replaced by semi-permeable pavements
7. Permitted minimum* of free green area (and proportional up/downscaling of existing GI elements), the rest of green area replaced by non-permeable asphalt pavements

* set by building regulations of Riga masterplan

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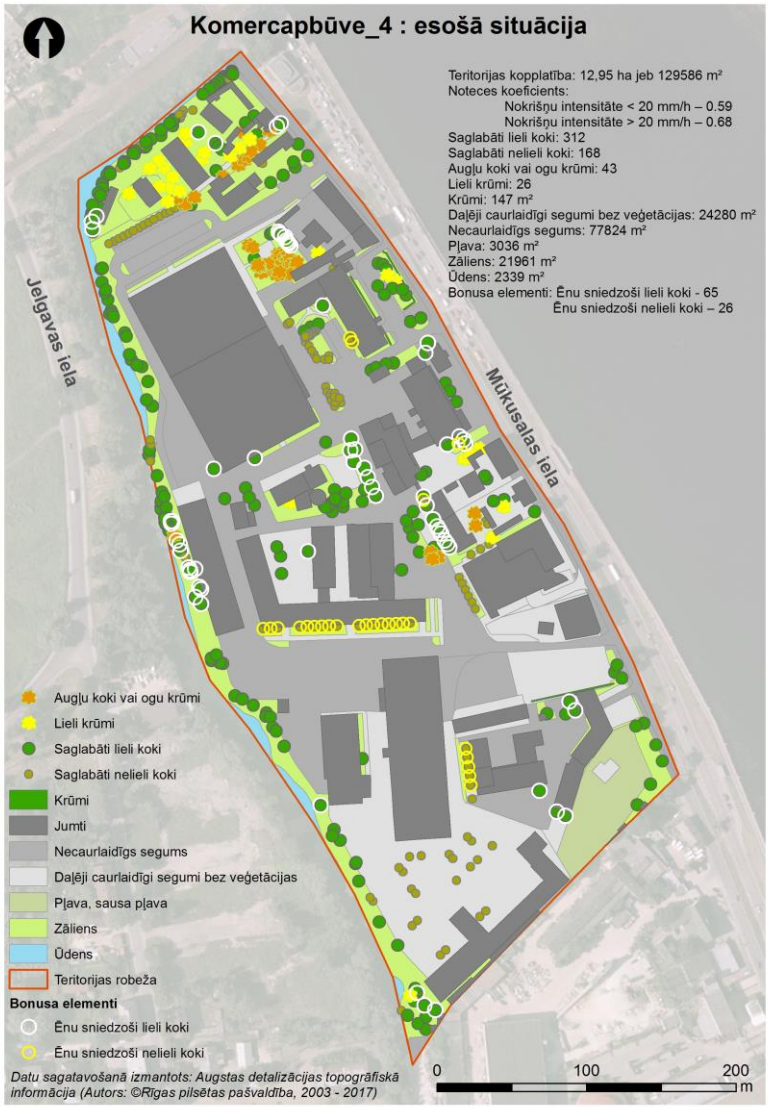
ZIPI testing results

Existing and planned (optimal) situation



Results: ZIPI coefficients in different scenarios

Types of urban teritories	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
Individual (family) housing areas	1.24	2.54	2.00	1.29	1.30	1.33	0.11	0.87
standard deviation	0.08	0.29	0.06	0.09	0.09	0.09	0.03	0.09
Low-rise residential building areas	1.03	2.04	1.77	1.13	1.14	1.17	0.62	0.91
standard deviation	0.22	0.68	0.23	0.15	0.15	0.15	0.10	0.14
High-rise residential building areas	0.92	1.74	1.69	1.08	1.09	1.13	0.60	0.80
standard deviation	0.13	0.07	0.05	0.11	0.11	0.11	0.12	0.10
Commercial building areas	0.73	1.17	1.43	0.89	0.91	0.95	0.51	0.63
standard deviation	0.23	0.43	0.20	0.20	0.20	0.20	0.16	0.18
Mixed city centre building areas	0.75	1.18	1.46	0.93	0.95	0.99	0.65	0.73
standard deviation	0.11	0.38	0.14	0.11	0.11	0.11	0.11	0.11
Historical building areas	0.82	1.24	1.47	0.94	0.96	1.00	0.67	0.78
standard deviation	0.29	0.54	0.25	0.23	0.22	0.22	0.05	0.16
Industrial, technical and infrastructure building areas	0.46	0.90	1.30	0.69	0.71	0.75	0.25	0.40
standard deviation	0.08	0.17	0.10	0.15	0.15	0.15	0.08	0.05

Proposals for ZIPI integration

in Riga planning framework

1. Using the weighted values of ZIPI elements in setting the requirements for the (minimum) free green area
2. Setting the minimum values of ZIPI coefficient for respective types of building
3. Setting the target values of ZIPI coefficient for respective types of building

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Proposals for ZIPI integration

in Riga planning framework

Types of building	Minimum ZIPI coefficient	Target ZIPI coefficient
Individual (family) housing	1	1.2
Low-rise residential building	0.9	1.1
High-rise residential building	0.8	1
Commercial and mixed city centre building	0.7	0.9
Historical building	0.8	1
Industrial, technical and infrastructure building	0.4	0.6

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Conclusions & recommendations

Conclusions I

Testing of ZIPI for further use in Riga City Municipality

- ZIPI effectively addresses the issues related to quality of urban green areas
- Riga is already sufficiently green city – high ZIPI coefficients
- The objectives are twofold – to not make worse the current situation and to manage urban stormwaters
  - ZIPI coefficients – at least at the current level
  - Green infrastructures for 20 mm rainfall (LBN* 79.5 l / s / ha = 9.5 mm in 20 minutes)

* Latvian Building Standard

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Conclusions II

Testing of ZIPI for further use in Riga City Municipality

- It is not at all difficult to achieve the recommended ZIPI coefficients even with the minimum free green areas (if semi-permeable surfaces are planned)
- The required amount of green area in specific development types in Riga is sufficient enough to accommodate a sustainable (green) stormwater management infrastructure – even for heavy rainfall events
- ZIPI does not set the objectives for the stormwater retention amount but facilitates the planning and laying out once the target is set (by city-side or sub-catchment stormwater management plans)

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Recommendations I

Testing of ZIPI for further use in Riga City Municipality

- Desired (ideal) long-term result – integration of ZIPI into the construction projects:
  - Required resources
  - Control mechanisms
  - Minimum and target levels
- Intermediate use of ZIPI – adjusted free green area calculation
- Continuation of ZIPI testing and support to ZIPI users in their daily work (processes of detailed and local planning)

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Recommendations II

Testing of ZIPI for further use in Riga City Municipality

- Specifying ZIPI minimum and target values for certain construction sites, types of buildings, their connection with the goals of the green infrastructure *(stormwater management, reduction of heat island, air purification, reduction of noise level)*
- Linking ZIPI minimum and target values to real estate tax values!

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Thank you!

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