Revitalizing New Belgrade through Valuing Rainwater

---Strategic Integration of Urban Rainwater System and Urban Public Space in New Belgrade

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Fascination

rain & public space in the city
Site Selection——New Belgrade as A Case Study

at the confluence of the Sava and Danube rivers.
Problem Statement
Prepares for flooding, using sand bags

Problem Statement
Problem Statement

Social Issue—Post-socialist city

Informal building

Highrise building

Grand boulevards

Housing for Exploding Population

Dormitory

Sleeping City

Same Configuration
underuse and undesirable public space

Basic facilities

— Grassland, lack of trees, hard paving

— No clear identity

— Monotonous function
Problems in New Belgrade

Rainwater Flooding

Public Space with Low Quality

Potential?

Integrate rainwater system within public space network
Research Question

How to create a sustainable urban landscape, and improving the livability of the city, utilizing rainwater as a tool, while integrating flood-resilient area with improvements of qualities of public spaces and cohesion of public space system of the south neighbourhood of New Belgrade?

1. How does the rainwater and public space system work now?
2. What is the toolbox of integrating rain in urban landscape?
3. How to design a green-blue network in regional scale while providing social, ecological, functional, spatial quality?
4. How does this green-blue network utilize in smaller scale?
INTRODUCTION
Fascination
Site Selection as a Case
Problem Statement
Research Question

THEORETICAL FRAMEWORK
Theory
Case Study
Rainwater Toolbox
New Approach

ANALYSIS & POTENTIAL
Context
Rainwater Analysis
Public space Analysis
Network Analysis
Integrating Potentials

STRATEGIC FRAMEWORK
Strategic Goal
Concept
Strategic Framework

DESIGN ELABORATION
Urban Hub Design
Local Hub Design

OUTLOOK & REFLECTION
Outlook
Reflection
Theory

Rainwater Public Space

1 landscape is a living system

2 green-blue infrastructure

3 urban accupuncture
Theory

Rainwater

The Dutch model has 3 steps of water principle: retention--storage--discharge

Source:
water storage design 't Regent, 't Regent...
Steffen Nijhuis (2009)

Source:
Case Study

Structure thinking of green and blue

Design group: Stoss
DETROIT, MI, USA
Blue Green Infrastructure plan - Detroit Future City Strategic Framework Plan

Based on natural condition

LIW Planning
Humlebaek, Denmark
Shaping nature in a new sustainable master plan

Active Spine with runoff management

Nevue Ngan Associates
Portland, OR
SW Montgomery Green Street
Proposal——Define a Design Framework for Integrating Rainwater into Urban Public Space

How to build a Green-Blue network?

1. Creating a Hydrologic Setting
2. Forming the Hierarchy of Open Space
3. Developing a Green Network
4. Identifying Different Waterscape Type
5. Activating Hubs
How to build a **Green-Blue** network?

Proposal——Define a Design Framework for Integrating Rainwater into Urban Public Space

1 Defining a Hydrologic Setting

Water is base of soil, flora and fauna.

In urban situation, relates to pipelines.
2 Forming the Hierarchy of Open Space

Diverse value
Usage situation (daily, weekend)

How to build a **Green-Blue network?**
Proposal—Define a Design Framework for Integrating Rainwater into Urban Public Space

Dundee Public Open Space strategy 2008-2011’ by Dundee City Concil
How to build a **Green-Blue** network?

Proposal—Define a Design Framework for Integrating Rainwater into Urban Public Space

3 Developing a Green Network

healthy, high-performing, coherent network.
big system
movement experience.

Compact City Model, “The key components of a mixed-use and integrated urban neighborhood”, according to Lord Rogers of Riverside – Illustration by Andrew Wright Associates
How to build a **Green-Blue network?**

Proposal—Define a Design Framework for Integrating Rainwater into Urban Public Space

4 Identifying Different Waterscape Type

Suitable for different condition and demands (public or collective)
Diversify city public space

System + Composition
How to build a **Green-Blue** network?

Proposal—Define a Design Framework for Integrating Rainwater into Urban Public Space

5 Activating Hubs

Adding recreational and other social values which evoke local initiatives
In relation to different actors

approach: top-down + bottom-up
actor: municipality + inhabitants
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Context
Rainwater Analysis
Public space Analysis
Network Analysis
Integrating Potentials

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OUTLOOK & REFLECTION
Outlook
Reflection
Context——Topography with Rainwater

Because of flat topography and the covering area of the lower part, New Belgrade has more potential to do the rainwater retention.
The soil of new Belgrade is wetter and is associated with marshes and streams. It is more permeable and more suitable for water-loving plants.
Context —— Landuse

- residential
- informal buildings
- industry
- urban functional block
- urban green
- agriculture
Context —— Social Aspect
Context —— Population

"Blokovi" Neighbourhood 89561 population

"The Sunny Community" ("Naselje Sunca")

- socio-economically mixed
- retired army
- intellectual
- artist
- children
- old people
- elite

"Bežanija" 44505

"Savski" 45056
Design Scales and Intervention Areas

**Regional Context**
- New Belgrade
- South neighbourhood of Belgrade

**5-step framework**

**Middle Scale**
- South neighbourhood of Belgrade

**Local Intervention**
ANALYSIS & POTENTIAL

Context
Rainwater Analysis
Public space Analysis
Network Analysis
Integrating Potentials

1 lower area
2 water storage place
3 permeability of open space
4 fluctuation level
Site Analysis——Rainwater

1. lower area
2. water storage place
3. permeability of open space
4. fluctuation level

large storage place, 5m height difference
roads are lower
Site Analysis—Rainwater

1 lower area
2 water storage place—surface
3 permeability of open space
4 fluctuation level
Site Analysis——Rainwater

1 lower area
2 water storage place
3 permeability of open space
4 fluctuation level
Site Analysis——Rainwater

1 lower area
2 water storage place
3 permeability of open space
4 fluctuation level

\[\begin{align*}
  +69.2 -149.1 +103.7 &= 23.8 \text{mm} \\
  \text{every year 690mm} \\
  149.1 \text{mm will be seasonal storage requirement}
\end{align*}\]

15cm fluctuation level

urban area: 15cm, 100% , need extra strorage place

peri-urban area: 30cm, 50%
Site Analysis—Public Space

Existing Park in City Scale

green space—lack of parks incontinuous of riverfront park because of industrial area

riverfront park
Site Analysis——Public Space
Ecological Benefit

trees & shrubs & orchards

trees & shrubs & orchards

biggest ecological benefit outside;
tree lines of main road is not continous
Site Analysis——Public Space

Public Catchment Area

- Park in city scale is not enough
- Neighbourhood could be selective

- 400m range park green
- 200m range neighbourhood green
Site Analysis——Public Space
Urban Flows/Attractions

- office and business
- commercial (retail, market, supermarket...)
- education
- hospital
- recreation and culture (attraction, monument, sports gym...)
Site Analysis——Public Space
Actors and Daily Routing
Site Analysis——Public Space
Special Features in-between Neighbourhood
Facilities——bunker, playground, sportsfield
Site Analysis——Public Space
Special Features in-between Neighbourhood

Private Gardens
Site Analysis—Network

Street Hierarchy

neighbourhood scale—secondary
bus, car no bicycle, pedestrian & parking

building scale:
car pedestrian, no bicycle,

city scale—main road
traffic spine and no activity space
bus, car, bicycle, pedestrian
main road lack of human scale and no trees
Site Analysis——Network

Public Transportation

- Train station
- Tram line
- Train line
- Bus stop

Images of bus stop and tram.
Site Analysis——Network
Bicycle and Pedestrian

- Bike lane
- Pedestrian lane
- Dike
<table>
<thead>
<tr>
<th>INTRODUCTION</th>
<th>THEORETICAL FRAMEWORK</th>
<th>ANALYSIS &amp; POTENTIAL</th>
<th>STRATEGIC FRAMEWORK</th>
<th>DESIGN ELABORATION</th>
<th>OUTLOOK &amp; REFLECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fascination</td>
<td>Theory</td>
<td>Context</td>
<td>Strategic Goal</td>
<td>Urban Hub Design</td>
<td>Outlook</td>
</tr>
<tr>
<td>Site Selection as a Case</td>
<td>Case Study</td>
<td>Rainwater Analysis</td>
<td>Concept</td>
<td>Local Hub Design</td>
<td>Reflection</td>
</tr>
<tr>
<td>Problem Statement</td>
<td>Rainwater Toolbox</td>
<td>Public space Analysis</td>
<td>Strategic Framework</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research Question</td>
<td>New Approach</td>
<td>Network Analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Integrating Potentials</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Integrating Potentials

Rainwater

Public Space

Network
Strategic Goals

1. reduce the flooding & water absorption (rainwater)

2. improve public space qualities, considering the diverse values (public space)

3. search for a better cohesion at urban scale, integrating the diverse public spaces into a network (network)

4. make a resilient framework with steady city structure for development and flexible function for local concerns

Concept

Blue

Green

Mobility

= Public Space System
Methodology & Principles

1. Defining a Hydrologic Setting
2. Forming the Hierarchy of Public Space
3. Developing a Green Network
4. Identifying Different Waterscape Type
5. Activating Hubs
Methodology & Principles

1 Defining a Hydrologic Setting
1 Use Green Area to Capture Rainwater on-site

- Main street and potential center
- Other green space to contain water

1 Defining a Hydrologic Setting

- Surface pond area
- Infiltration area
1 Defining a Hydrologic Setting

2 Channelled Water to Form Axes

1 main street——open channel
2 secondary street ——bioswale
3 two inner axes

h = 1 m-1.5m

h = 20-40cm
3 Store Water and Reuse

North axis: use underground storage
South axis: use existing bunker

In-between neighbourhood space: use the water tower to visualize water storage
3 Store Water and Reuse

In-between Neighbourhood Space
4 Stormwater Circulation

Defining a Hydrologic Setting

- secondary street
- main street

- lower part

- main street
  - h=50cm

- secondary street
  - h=35cm

- water flow
- underdrain
- extra storage
4 Stormwater Circulation

Outside Storage Space

- wetland
- forebay, recreational lake
- slit and steps
- fluctuation 30cm
- underdrain
Methodology & Principles

1. Defining a Hydrologic Setting

2. Forming the Hierarchy of Public Space
1 Urban Hub——Metropolitan Level
2 District Hub——Neighbourhood Level

2 Forming the Hierarchy of Public Space

north axis

south axis
3 Local Hub——Building Level

2 Forming the Hierarchy of Public Space

- existing functional in-between space
- empty space
2 District Hub—Neighbourhood Level

North Axis Collage

underdrain underdrain storage underdrain
South Axis Collage
Methodology & Principles

1 Defining a Hydrologic Setting

2 Forming the Hierarchy of Public Space

3 Developing a Green Network
1 Continuous, Friendly Green Avenue
2 Animate Main Road without Interrupting with Vehicle Traffic
3 Developing a Green Network

Accessible, Convenient Network

Public Transportation

- new bus stop
- bus stop
- tram lane
- bus land
- car lane
3 Accessible, Convenient Network

Bicycle and Pedestrian

- Bicycle lane
- Pedestrian lane

entrance of west area
3 Accessible, Convenient Network

- Pedestrian platform
- Bicycle lane
- New bus stop
- Elevator for bicycle and pedestrian
- Bicycle and pedestrian road
- Slope
- Rainwater retention terrace and steps
3 Developing a Green Network

1. Bicycle bypass underground tunnel
2. Pedestrian above
3. Bicycle and pedestrian wooden road
4. Car road
5. Pedestrian above
6. Widened bicycle and pedestrian 0.5m higher
3 Developing a Green Network

4 Gateway & Balcony
4 Gateway & Balcony

1 Balcony: See outside through a plaza with shade

2 Gateway(south): colored paving and open plaza entrance with water feature

3 Gateway(north): continuous colored bicycle paving and tree line
5 New Housing Typology

3 Developing a Green Network
5 New Housing Typology

Type 1:
- located on the slight terrace, with their own garden and outside view

Type 2:
- located in the plain area, with their own courtyard

Type 1 section
Main Street with Open Channel

Source: Passeig de Picasso, Barcelona
Neighbourhood Axis with Water Feature

- 5m
- 8–18 m
- 5m
- 18–28 m

- 4m
- 3m
- 2m
- 7–17 m
- 2m
- 5m
- 5m

- bike lane
- pedestrian
- water
- flower

- 18–28 m
Methodology & Principles

1. Defining a Hydrologic Setting

2. Forming the Hierarchy of Public Space

3. Developing a Green Network

4. Identifying Different Waterscape Types
1 Urban District hub
With Designate Park Function
Water for Recreation

Diversify the public space

4 Identifying Different Waterscape Type

- wetland
- water playground
- water mirror /shallow water
- retention pond
- retention basin(artificial)
- stream corridor
- water square
2 Local Hub
With Collective Use
Water for Reuse and Storage

- bunker storage
- water tower storage
Methodology & Principles

1. Defining a Hydrologic Setting

2. Forming the Hierarchy of Public Space

3. Developing a Green Network

4. Identifying Different Waterscape Type

5. Activating Hubs
Integrate Different Actors

1 top-down framework:
- urban, district hub
- & the priority location of local hub

2 bottom-up needs:
- collective use
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Context
Rainwater Analysis
Public space Analysis
Network Analysis
Integrating Potentials
STRATEGIC FRAMEWORK
Strategic Goal
Concept
Strategic Framework
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Local Hub Design
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Concept

Blue

Green

Mobility

= Public Space System
Strategic Framework

Urban Hub Design

180ha

Flood & Ecological
Topography

Current Situation

ditch
informal buildings

dike
building
informal sprawl
road
stream
government plan area
Urban Hub Design——Blue
Water Level——Summer Time—— 67.4m
Urban Hub Design——Blue
Water Level——Winter Time——67.7m

weir

67.7m
Urban Hub Design——Blue
Water Level——Flood Situation—— 68m

weir

68m
Urban Hub Design——Green

Plant Community

- Flowery grass
- Reed
- Grass
- Shrub
- Wet forest
- Forest

Diagram showing the distribution of plant communities.
Urban Hub Design——Green

Ecological Succession & Maintenance

**Flowers**
1st year Establishment: remove top soil to speed up wet condition

5th year later Growth / Maintenance: mowing 2 year

10th year later Growth / Maintenance: mowing 2 year

20th year Growth / Mature: mowing 2 year

**Grass**
seeding

mowing 1 or 2 year

mowing 1 or 2 year

mowing 1 or 2 year

**Reeds**
nature starting

mowing 3 or 5 year

mowing 3 or 5 year

mowing 3 or 5 year

**Shrubs**
nature starting

nature growing 5 years

limited grazing for patches

limited grazing for patches

**Trees**
nature starting

shrubs

young trees

mature as forest
Urban Hub Design——Mobility

Routing

- parking
- plaza
- overpass / sky bridge
- inner boardwalk
- outer boardwalk
- road
- entrance

View Point

- platform
- observation tower
- in the open water
- in the reeds
- in the flower
- in the forest
Urban Hub Design——Mobility

Ditches

boardwalk in the reeds

two sides of cattail (Typha albida)

soil added

boardwalk next the reed

one side of cattail (Typha albida)

soil added
Urban Hub Design——Green & Mobility
Plant Community & Routing Sequence

Canopy
- white willow (Salix alba)
- field elm (Ulmus minor)
- common alder (Alnus glutinosa)
- pedunculate oak (Quercus robur)
- common osh (Fraxinus excelsior)

Understory
- crack willow (Salix fragilis)
- almond willow (Salix triandra)
- purple willow (Salix purpurea)
- common hawthorn (Crataegus monogyna)
- guelder-rose (Viburnum opulus)

Groundcover & Water Plants
- yellow water lily (Nuphar lutea)
- common reed (Phragmites australis)
- narrowleaf cattail (Typha angustifolia)
- common chicory (Cichorium intybus)
- couch grass (Agropyrum repens)
- Canada thistle (Cirsium arvense)
- narrowleaf cattail (Typha angustifolia)

Fauna
- Fish
- Waders
- Amphibions
- Insects
- Songbirds
- Mammals

Periodic flooding 68m
Winter time 67.7m
Summer time 67.4m

Open Water
- Marsh
- Wet Shrub & Meadow
- Wet Forest
- Upland Forest
Urban Hub Design——view from wetland to city
Urban Hub Design——two-level routing
Transportation Analysis

green axis —— district hub
secondary road
neighbourhood vehicle road
neighbourhood pedestrian road
entrance to the building

Paving and Spacial Character Analysis

hard surface
grass
bunker
small basketball field
playground
Basic, Simple Facilities

Abandoned Bunker

Large Empty Green Space
Local Hub Design——Blue

rain channel→planter→open gutter→bunker
Local Hub Design——Green

tree & low hedge
Local Hub Design——Mobility

- Local Routing
- Parking
- Permeable pavement

Garage

Passer-by Routing
Local Hub Design——Flexibility
Local Hub Design——System
Flexibility——Scenario 1 & 2 & 3
Flexibility——Scenario 1

Urban Agriculture Garden
Flexibility—Scenario 2

Pop-up Open Air Cinema
Flexibility——Scenario 3

Public Art and Festival
Strategic Framework
Outlook

Elaboration of Urban Hub
Bird View
Layout of Publication

P4  P5
Reflection

Conclusion

Future Development

What I learn?

What We learn?
Thank you