River restoration as a basic concept for the city spatial planning & sustainable development (SWITCH, LODZ)

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UNESCO
United Nations Educational, Scientific and Cultural Organization

ERCE
European Regional Centre for Ecohydrology Under the auspices of UNESCO

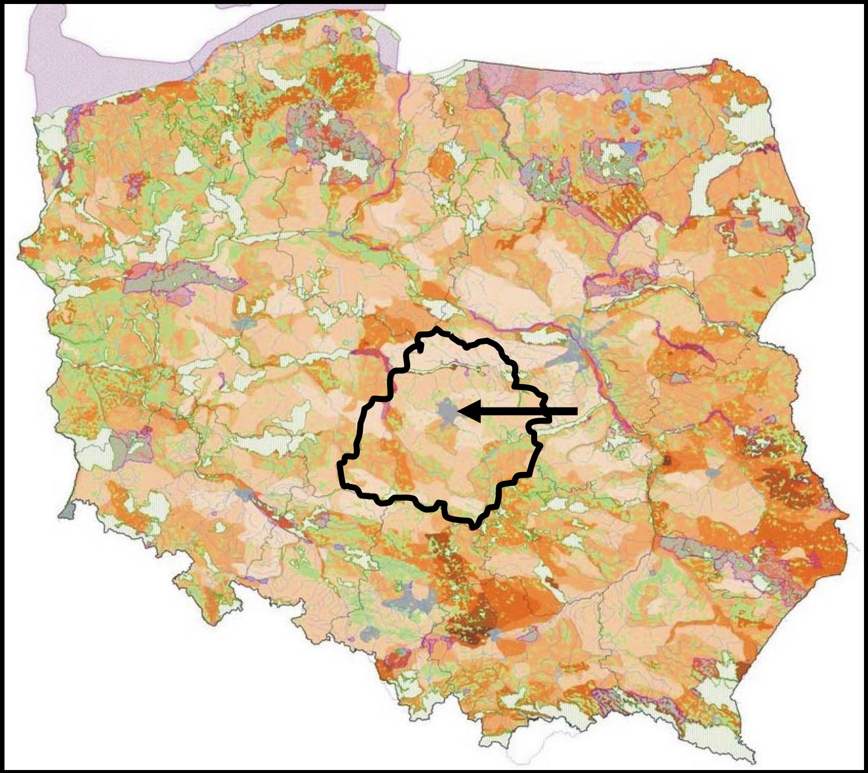
II International Seminar on Revitalization of Rivers, Belo Horizonte, Brasil, 10-12 May 2010

Overview

Where we are?

LOCATION
CONCEPTS
PARADIGM *SWITCH*
IMAGINING THE FUTURE
CURRENT CONSTRAINTS
COMBATING CONSTRAINTS
ONE STEP FURTHER

The City of Lodz



Structure of employment:

Agriculture	29,9%
Services	30,6%
Industry	39,5%

Industry:

textile, food processing, coal mining, ceramics

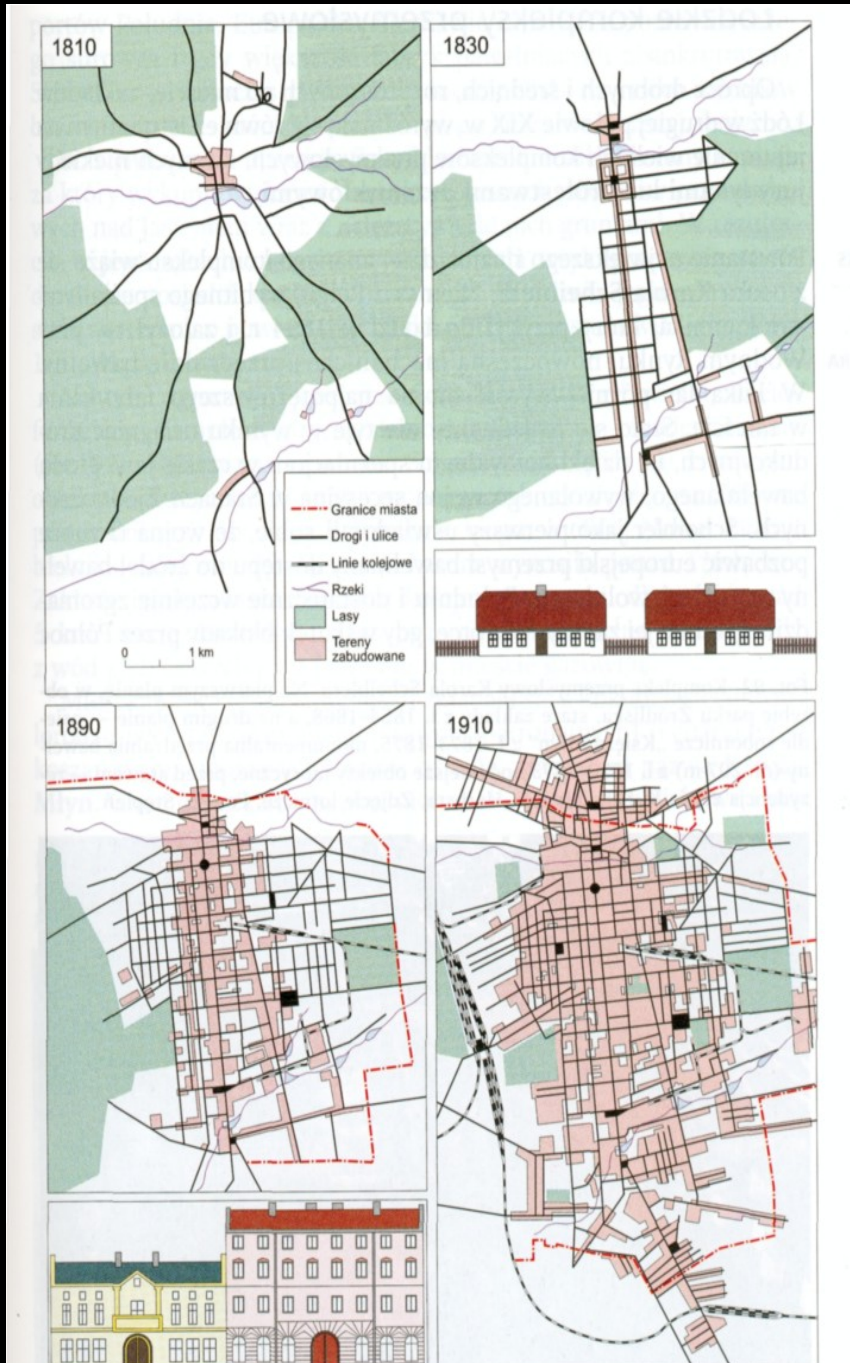
Profile:

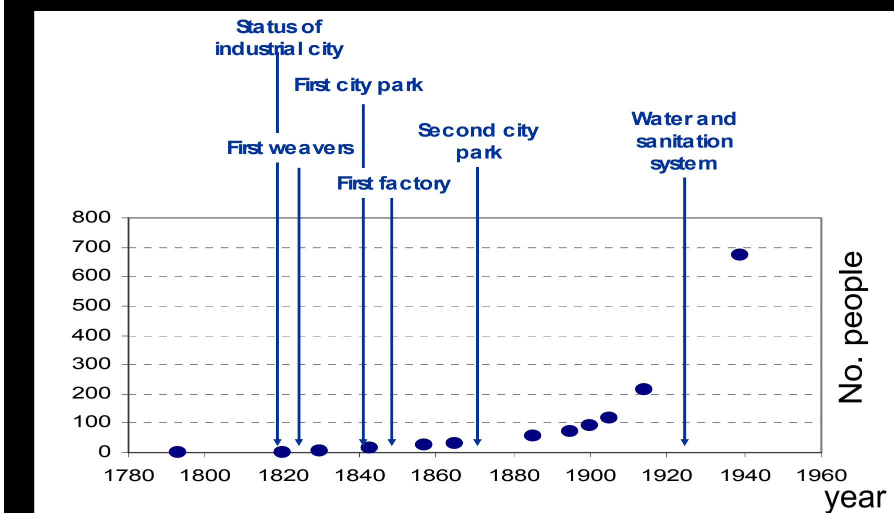
education, cinematography, logistics, technology

- an example of urban area that expensed very rapidly in the first quarter of the XIX Century, based on natural resources (water, forests) essential for establishing textile industry;
- 800 thousand inhabitants;
- has no big rivers but its area is divided into 18 small city catchment

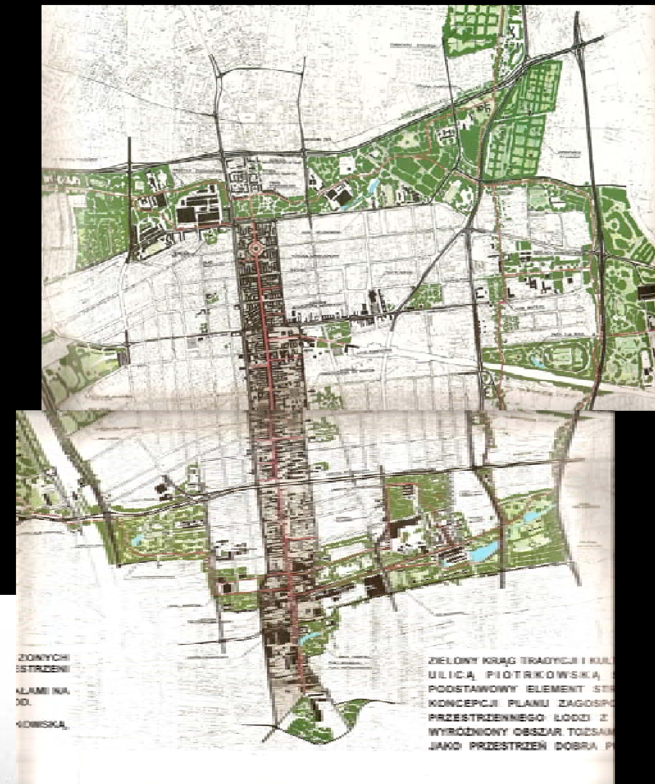
Location

The City

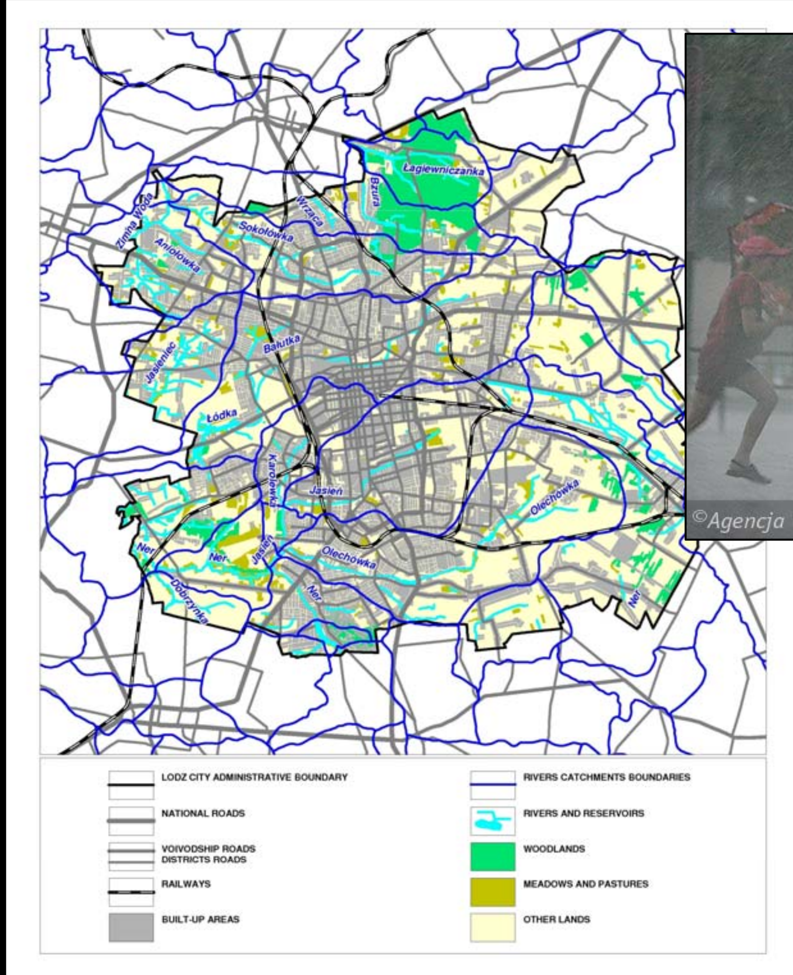

1810
1830
1890
1910
Granice miasta
Drogi i ulice
Linie kolejowe
Rzeki
Lasy
Tereny zabudowane
0
1 km


Status of industrial city
First weavers
First city park
First factory
Second city park
Water and sanitation system
800
700
600
500
400
300
200
100
0
1780
1800
1820
1840
1860
1880
1900
1920
1940
1960
year
No. people

The City


ZIELONY KRĄG TRADYCJI I
ULICĄ PIOTRKOWSKĄ
PODSTAWOWY ELEMENT
KONCEPCJI PLANU
PRZESTRZENNEGO ŁODZI Z
WYRÓŻNIONY OBSZAR
JAKO PRZESTRZEŃ DOBRA

The City


Łagiewniczanka
Bzura
Wrzaca
Sokołówka
Zimna Woda
Aniołówka
Bałutka
Jasieniec
Łódka
Karolewka
Jasień
Olechówka
Ner
Dobrzynka
LODZ CITY ADMINISTRATIVE BOUNDARY
NATIONAL ROADS
VOIVODSHIP ROADS
DISTRICTS ROADS
RAILWAYS
BUILT-UP AREAS
RIVERS CATCHMENTS BOUNDARIES
RIVERS AND RESERVOIRS
WOODLANDS
MEADOWS AND PASTURES
OTHER LANDS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KOLPORTER

The City

CHALLENGES

floods

water shortage

degradation of heritage

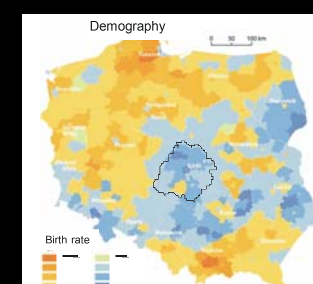
rapid land development

OPPORTUNITIES

culture / history

architecture

nature



decreasing population

The City

PROBLEMS:

- Lack of identity: no respect for nature, culture, heritage, history, low investment, depopulation, unemployment
- Structural barriers: no use of potential, marginalization of people
- Critical health situation: asthma, cancer, depression,
- Critical transport situation: traffic jams, air pollution

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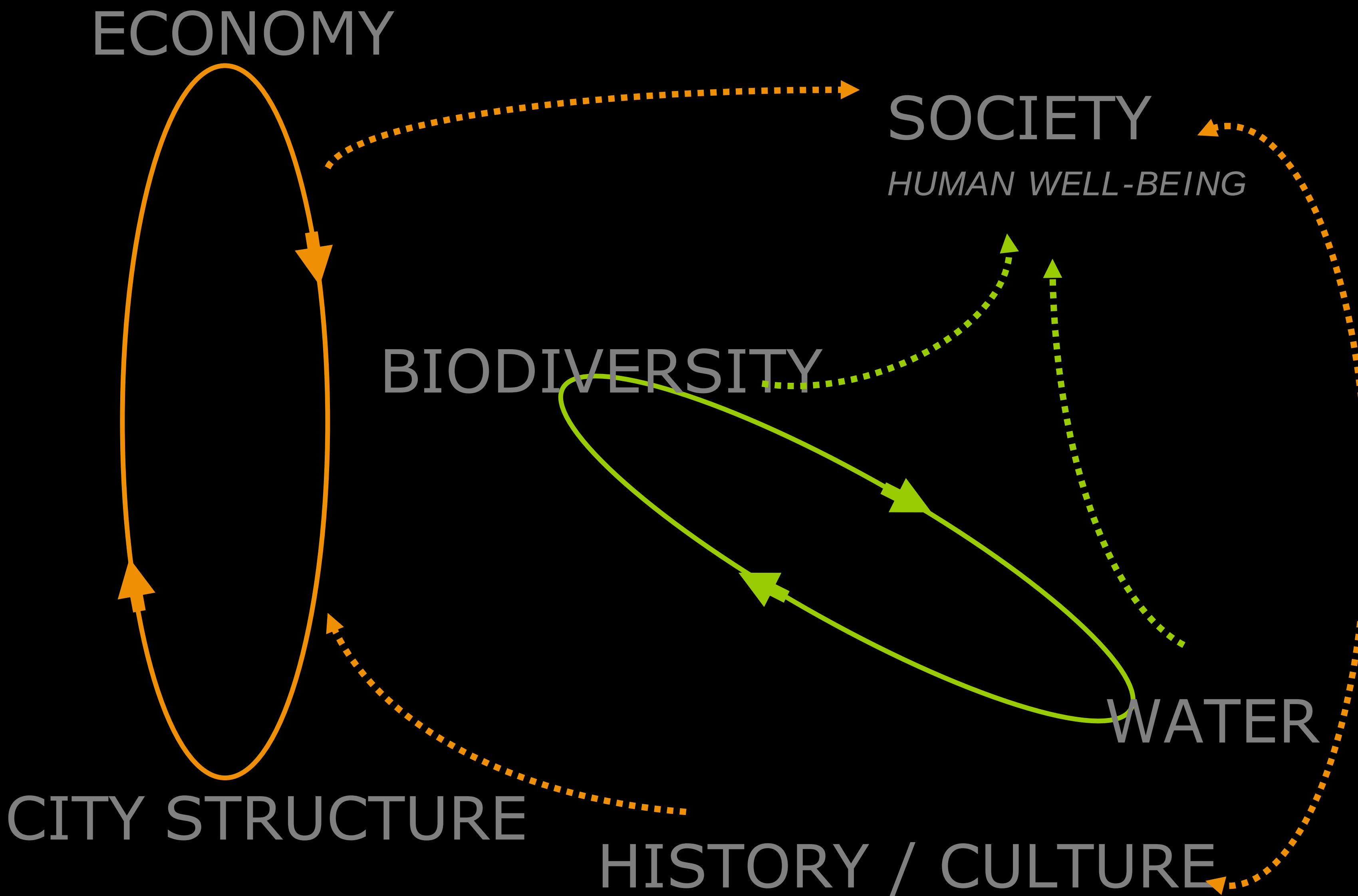
Paradigms



ECONOMY
SOCIETY
HUMAN WELL-BEING
BIODIVERSITY
WATER
CITY STRUCTURE
HISTORY / CULTURE

Paradigms

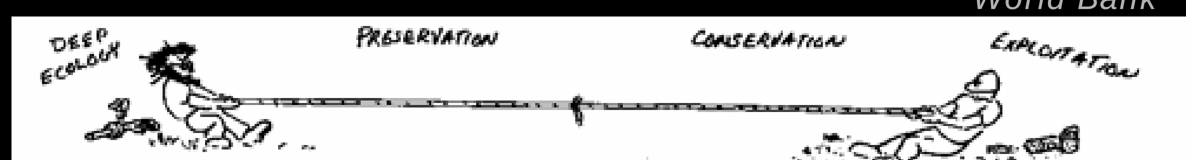
BIODIVERSITY

- ecosystem management
- preservation and conservation
- adaptive co-management (active management by a considerable number of local stewards, considering multiuse of the area)

Environmental Management

- Frontier Economics (nature as an infinite supply of physical resource)
- Deep Ecology (ethical, social, and spiritual aspect of the relationship between nature and human socioeconomic activity)
- Environmental Protection (*ameliorating* the effects of human activities)
- Resource Management (economy of nature)
- Eco-Development (the integrated coevolution of conscious civilization and nature)

World Bank



Paradigms

CITY – SOCIETY:
- human exemptionalism paradigm – technological and social progress allow to overcome environmental problems
- new ecological paradigm – city mimics ecosystem (*urban metabolism = flows instead of metabolic cycles)*
- compact city – development of cities' functions in way optimizing/limiting land use
- ecocity: introducing nature and eco-technologies to the city for improving the quality of inhabitants' life and lower the impact of urban areas on nature

WATER:
- hydraulic / engineering approach
- ecosystem approach (some socio-ecological dependencies)
- adaptive management (stress on practices and resource use, institutionalization)
- integrated water management

Paradigm SWITCH

Effects of increasing global change pressures:

- escalating costs and
- other risks inherent to conventional environment management
- increasing difficulties in efficiently managing scarcer and less reliable water resources and over-stressed green areas
- difficulties in satisfying water and BD uses/services and
- waste water disposal without creating environmental, social or economic damage

Paradigm SWITCH

„The Sustainable Water Management Improves Tomorrow's Cities' Health"

SWITCH is the name of an action research programme, implemented and co-funded by the European Union and a cross-disciplinary team of 33 partners from 15 countries around the world.

The purpose of including these demonstration cities is to translate the results of the SWITCH research activities into tangible, socially-relevant demonstration activities.

The SWITCH project includes a number of demonstration activities, to be carried out in 10 identified SWITCH Demonstration Cities. These cities are: Accra, Alexandria, Beijing, Belo Horizonte, Birmingham, Chongqing, Hamburg, Lodz, Tel Aviv and Zaragossa. In addition, the Emscher Region of Germany is participating, and a Learning Alliance has been established in Lima, Peru.

Paradigm SWITCH

SWITCH towards:

- Adjustability to global change pressures.
- Considering interventions over the entire urban water cycle/chain, e.g. water use = wastewater production = water resource deterioration

= increased costs of drinking water production, greening of the city = support of natural processes = lower costs of securing water resources

- Reconsidering water use
- Stimulation of natural self-sustaining processes - maximise the delivery of ES through support of natural systems in urban water cycle management.

Paradigm SWITCH

‘urban ecological security’

Ensuring the protection of cities from the impacts and effects of climate change and resource constraints

Building self-sufficiency into the supply of water and energy, the mobility of people and goods, and the disposal of wastes

Demonstration

PROJECT 1

Sokolowka River

Restoration of a municipal river for stormwater management, increase of water retentiveness and improvement of quality of life

Catchment area	44,5 km2
River length	13,4 km
Gradient	0,55 %
River channel regulation	100 %
Annual rainfall	535 mm
Annual runoff	135 mm

Discharge [m³/s]:

average	**0,17**
Min.	**0,02**
Max.	**2,61**

Land use:

Agricultural	60,1 %
Forests and wetlands	7,3 %
Urban	32,7 %

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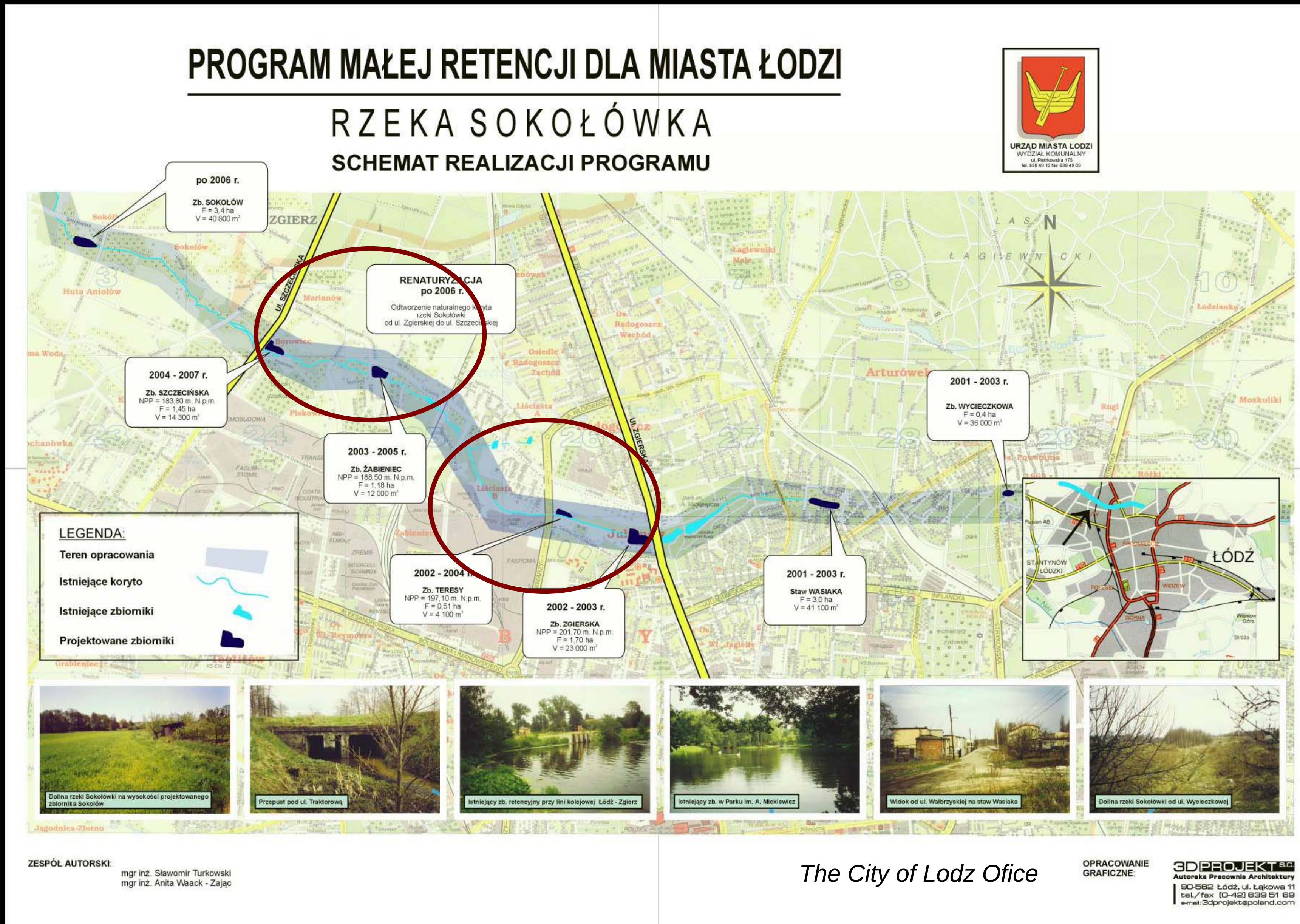
Demonstration



The City of Lodz Ofice

Network SWITCH

Demonstration

PROJECT 2

Ner River

Sewage system management for environment quality and positive socio-economic feedbacks

- limited capacity of sewage treatment system for stormwater purification;
- disposal of treated sewage (2,5 m3 s-1) into a river of natural flow < 0,3 m3 s-1,
- high contamination of the floodplain with heavy metals and organic compounds;
- sewage sludge utilization (200t/day).

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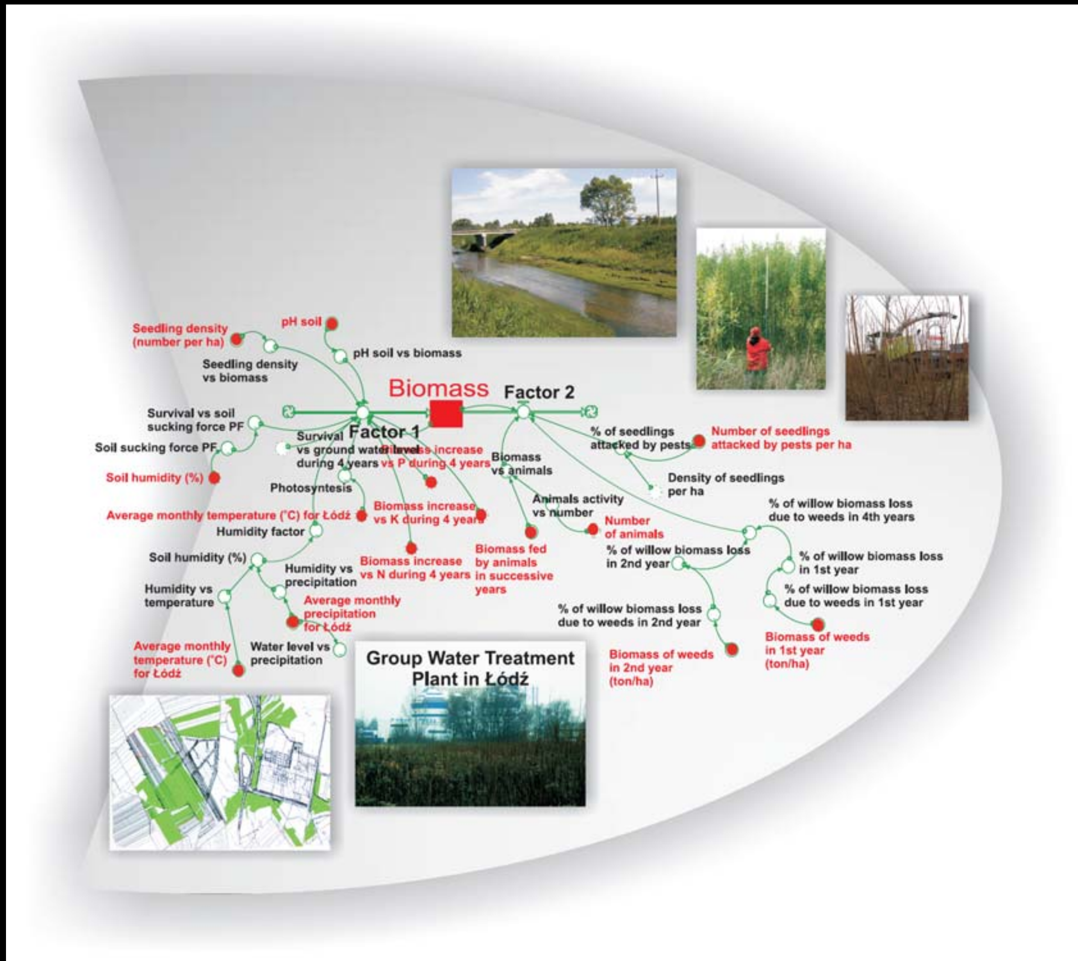
Demonstration



I: Salix viminalis clones;
II: Tordis (Salix schwerini x S. viminalis) x S. viminalis;
III: Salix viminalis gigantea;
IV: Salix viminalis (clone 192)

METHODS

Experimental Plantation (64 ha) in the protective zone

Comparative experiments on different species and varieties of willow

Learning alliance

DEFINING A STAKE & TOPIC OF COMMON INTEREST

STAKEHOLDER ANALYSIS

DEMONSTRATION OF FEASIBILITY

RIDA ANALYSIS
(RESOURCES, INFRASTRUCTURE, DEMAND / / ACCESS)

KNOW-HOW

FACILITATION OF KNOWLEDGE TRANSFER

Outside facilitators

Specialist interdisciplinary support

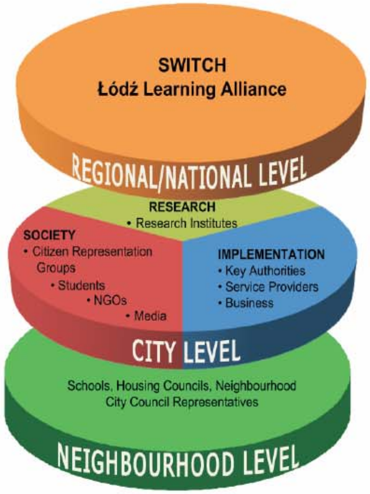
Project cycle management
programme proceeds through evolutionary stages managed as a process not a series of one-off events

A ***stakeholder platform***
a forum for stakeholder dialogue, conflict resolution & integrated planning

A ***learning alliance***
a group of individuals or organisations with a shared interest in innovation and the scaling-up of innovation, in a topic of mutual interest

Learning alliance

Partners and LA members involved



The Lodz Learning Alliance (LA) was launched in May 2006. The group of members is constantly growing and the LA has now a wide representation of stakeholders from the national, regional and local levels. The key partners on the City level are:

Authorities:

- City of Lodz Office
- Lodz Infrastructure Company (LSI)

Researchers:

- University of Lodz
- European Regional Centre for Ecohydrology u/a of UNESCO, PAS
- Lodz Technical University: Department of Environmental Engineering
- Nofer Institute of Occupational Medicine in Lodz

Service Providers:

- Waterworks and Sewage Systems Company (ZWiK)
- Waste Water Treatment Plant (GOS)

Project Mentor: Maciej Zalewski
Project Coordinator: Iwona Wagner
LA Facilitator: M. Dziegielewska-Geitz

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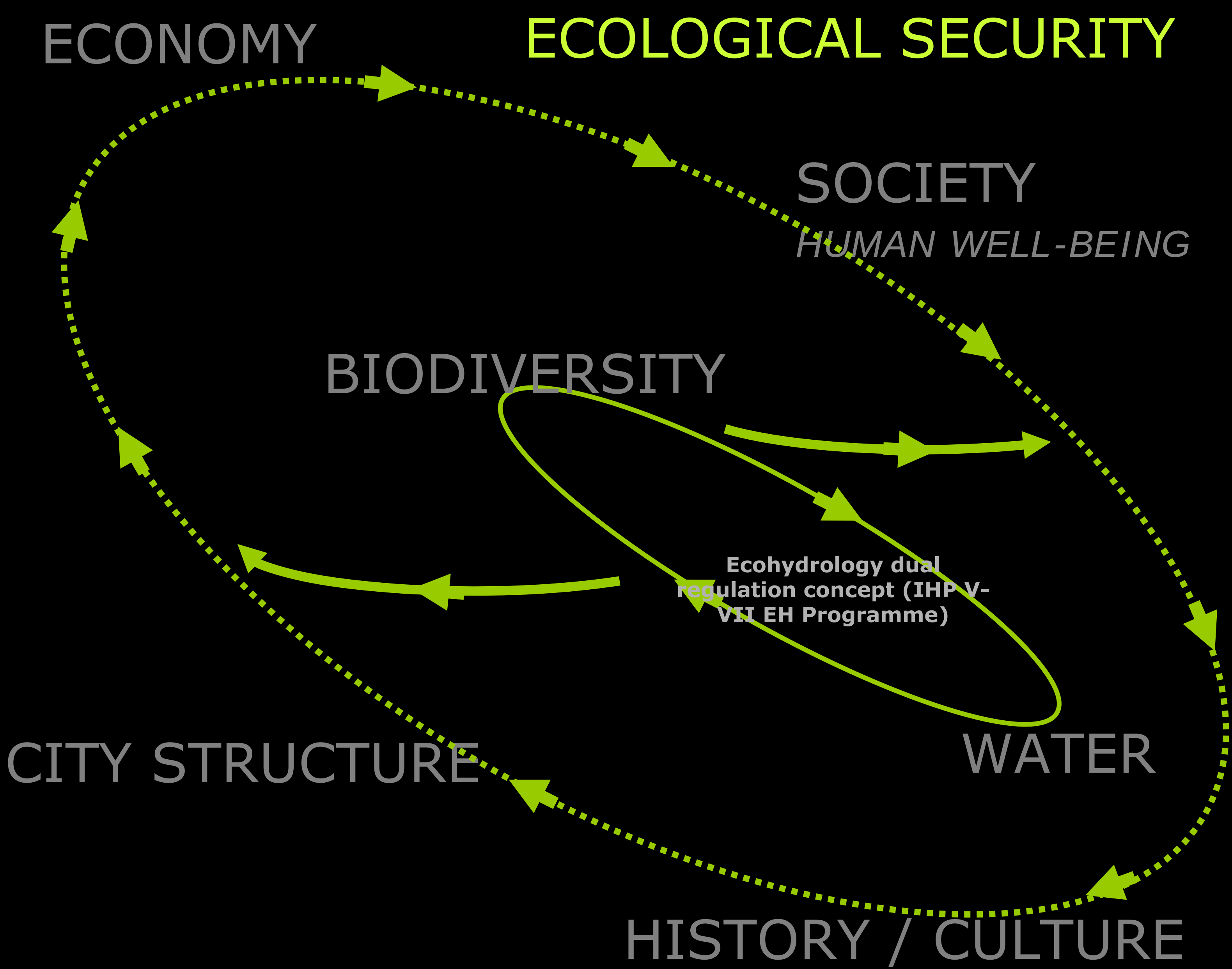
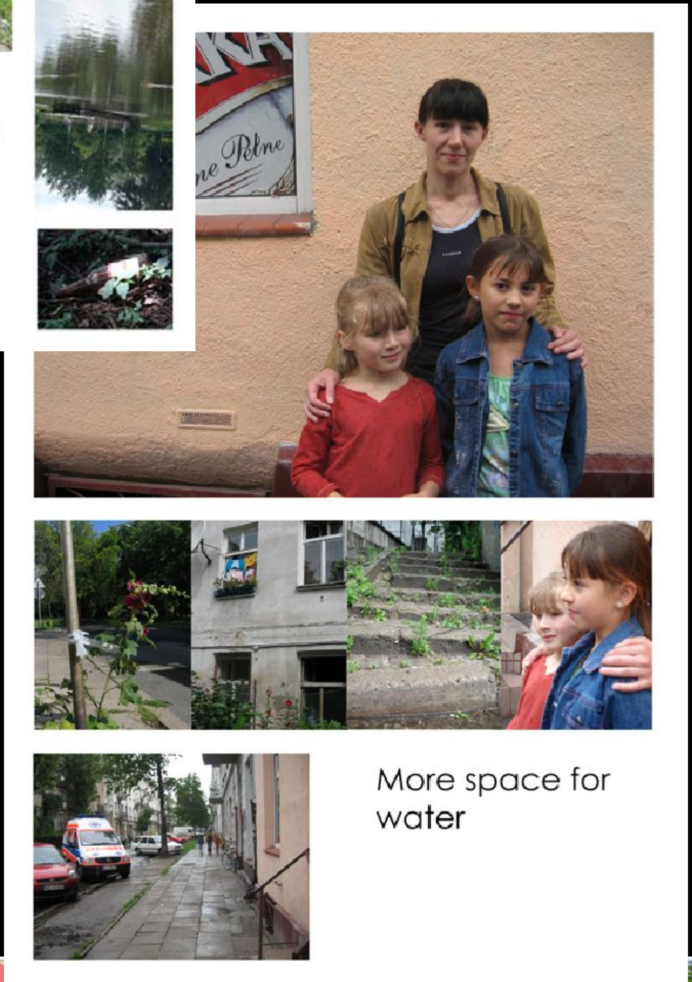
Paradigm SWITCH

ECOLOGICAL SECURITY



SWITCH Process Documentation
Training 1-5th July 2007, Lodz

People



Media

Over 80 posts

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SWITCH

Identification of stormwater as key issue of UWM in Lodz

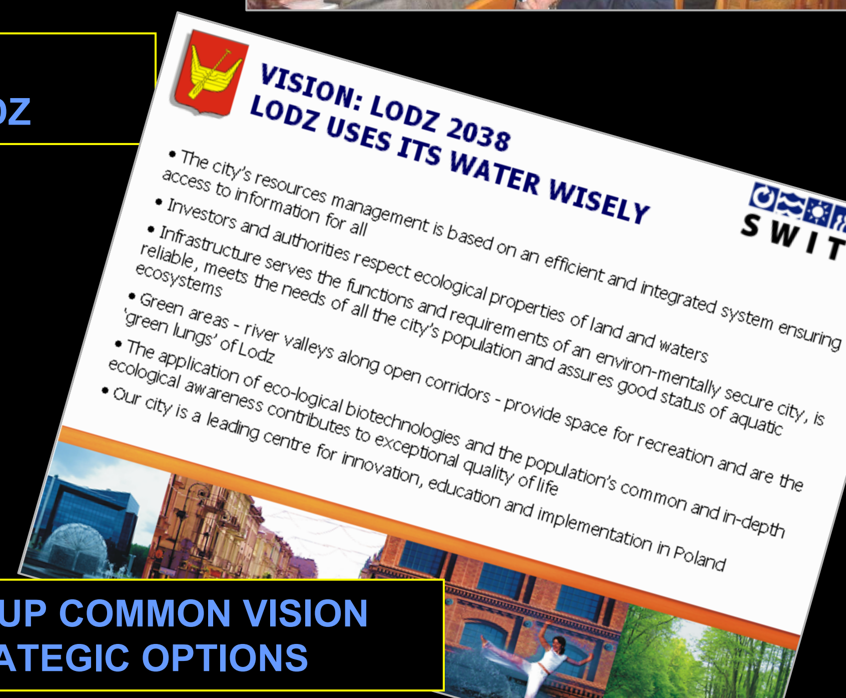
January 2007 - Stormwater management and the GIS tools for decision support systems tools in urban water management
(49 participants)

- LA expressed interest in active collaboration in developing the DSS for Lodz;
- identified further stakeholders to be invited to the SWITCH-Lodz LA;
- identified data and data sources;
- issued a request to the Mayor of the City of Lodz to support the initiative;

IDENTIFICATION OF STORMWATER MANAGEMENT AS KEY ISSUE IN LODZ

Visionning Workshop, January 2008 (60 participants)

The meeting was officially opened by:
-The First Deputy Mayor of Lodz – Mr Wlodzimierz Tomaszewski
-Minister Antoni Tokarczuk, the Director of the Economic Chamber Polish Waterworks



VISION: LODZ 2038
LODZ USES ITS WATER WISELY

- The city's resources management is based on an efficient and integrated system ensuring access to information for all
- Investors and authorities respect ecological properties of land and waters
- Infrastructure serves the functions and requirements of an environ-mentally secure city, is reliable, meets the needs of all the city's population and assures good status of aquatic ecosystems
- Green areas - river valleys along open corridors - provide space for recreation and are the 'green lungs' of Lodz
- The application of eco-logical biotechnologies and the population's common and in-depth ecological awareness contributes to exceptional quality of life
- Our city is a leading centre for innovation, education and implementation in Poland

SETTING UP COMMON VISION AND STRATEGIC OPTIONS

Paradigm SWITCH

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January 2008, Vision for Lodz 2038

Vision 2038

Vision elements	Strategy components	Scenarios I	II	III	IV
The city's water resources management is based on an efficient and integrated planning system…….	-Alignment of plans across different sectors (within context of an overall spatial development plan) -Institutional collaboration strengthened -IUWM planning processes and management systems adopted -Emphasis on managing demand (and thereby improving efficiency)	x	√	X	√
……ensuring access to information for all.	-Policy of free and open access to information adopted -Common information is set and a team to manage, update and quality control is established with a secure line of funding -Information made available in a form that can be understood by non-specialists	x	√	?	√
Investors and authorities respect ecological properties of land and waters	-Environment impact assessments included in the IUWM planning process -Investment plans evaluated and approved against environmental criteria -Best management practices are encouraged as an integral part of planning and implementation processes	x	√	?	√
Infrastructure serves the functions and requirements of an environmentally secure city……	-Existing infrastructure upgraded to meet current and future demands -Sustainable use of available water resources by protecting sources (quantity and quality), developing alternative sources, managing demand etc -Adoption of polluter pays principles -Challenges linked to peak oil, climate change, etc considered in IUWM strategy -Alignment of with urban plans that reduce urban sprawl (and therefore demand for urban transport other than walking and biking), increase potential of urban gardening etc.	x	√	?	√
…..is reliable …..	-O&M systems that are well resourced -Peoples' awareness built to reduce pollution, vandalism etc -Infrastructure that can perform even during extreme events (floods)	?	√	√	√
…..meets the needs of all the city's population…..	-Planning takes account of social inclusion issues of the poor, the old, the infirmed etc -Targeting of services or subsidies -Adequate representation within fora and mechanisms to hear complaints and failures -Monitoring of impacts of projects and programmes on marginalized -IUWM strategy aligned where appropriate to unemployment (groundwork) initiatives	x	√	X	√
…… and assures good status of aquatic eco-systems.	-Mainstreaming ecological principles into decision-making -Managing ecological flows and groundwater levels (maximizing infiltration) -Managing quality and enforcing regulations -Separating stormwater and sewage flows (ensure treatment)	x	√	X	√
Green areas - river valleys	-Protection within land use plans, including identification of what recreation is				

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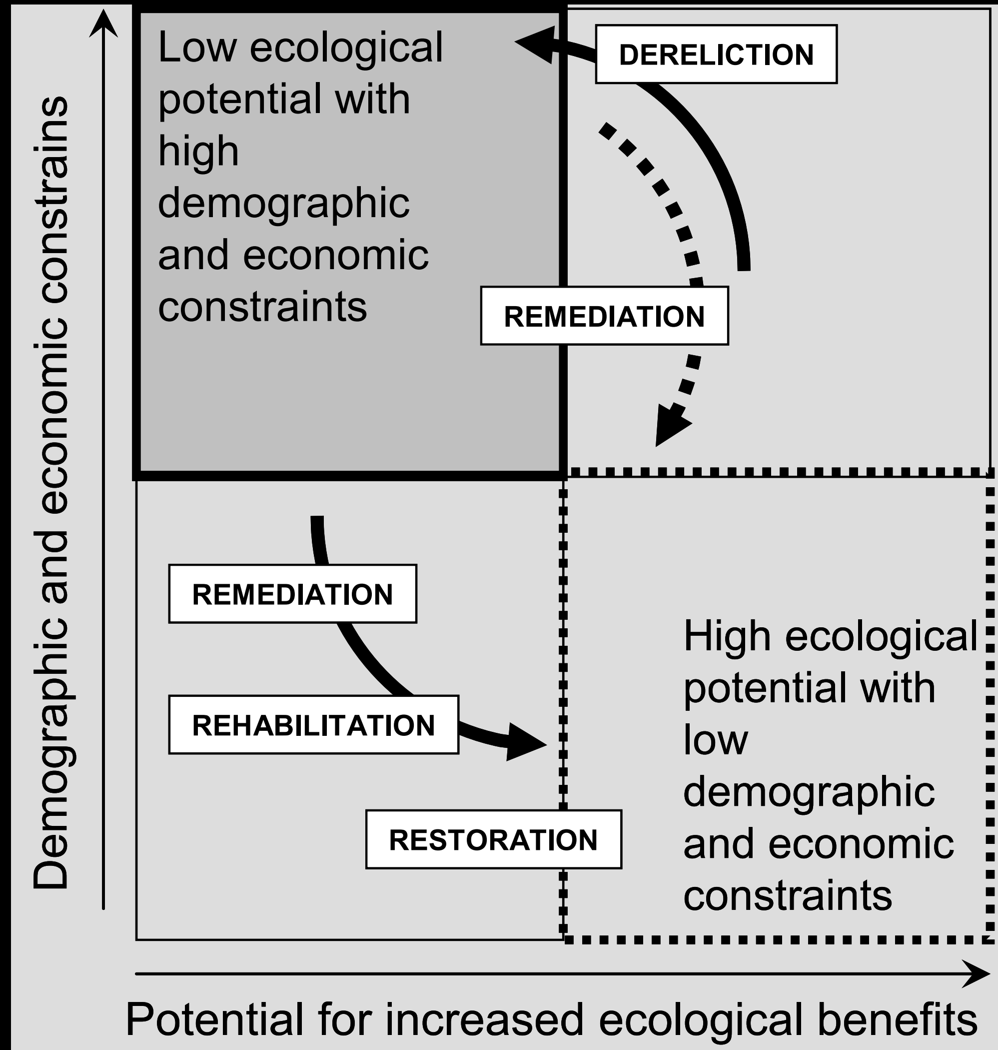
Enhancement

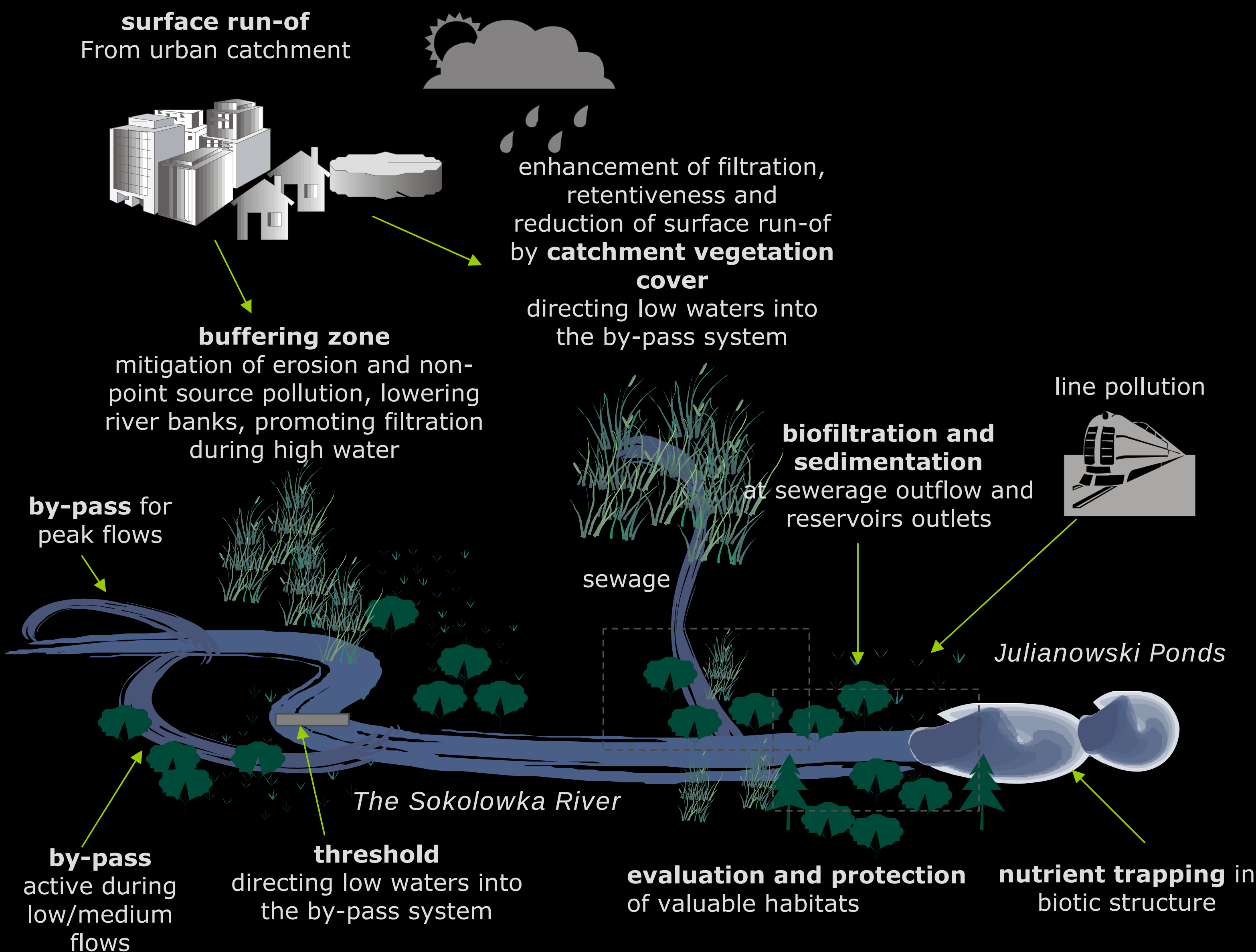
?

Enhancement



(modified after Hulse and Gregory, 2004).

Concept



surface run-of
From urban catchment
enhancement of filtration, retentiveness and reduction of surface run-of by **catchment vegetation cover**
directing low waters into the by-pass system
buffering zone
mitigation of erosion and non-point source pollution, lowering river banks, promoting filtration during high water
line pollution
biofiltration and sedimentation
at sewerage outflow and reservoirs outlets
by-pass for peak flows
sewage
Julianowski Ponds
The Sokolowka River
by-pass
active during low/medium flows
threshold
directing low waters into the by-pass system
evaluation and protection of valuable habitats
nutrient trapping in biotic structure

Monitoring

THREATENED WITH UNCONTROLLED DEVELOPMENT

POTENTIAL SINK OF SLUDGE

LIFE SUPPORT SYSTEMS

not-urbanized requiring careful spatial planning due to env. value

requiring investments in technical infrastructure

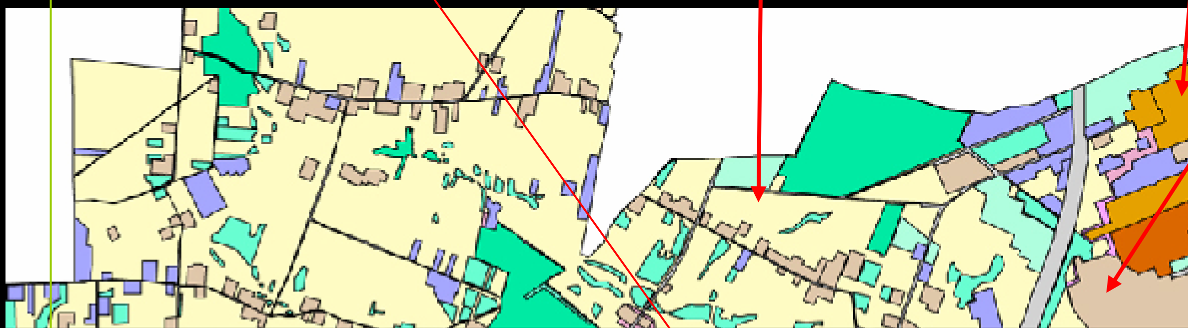
agricultural areas

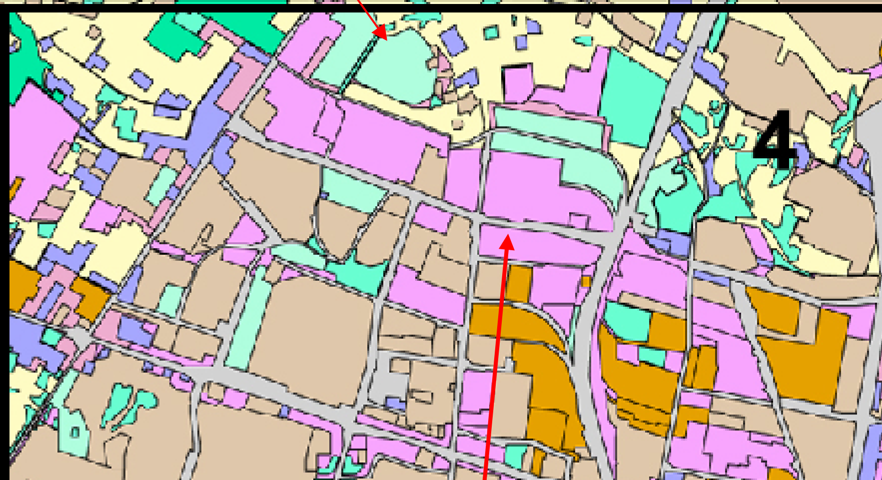
well developed urban areas

CERTAIN SINK OF POLLUTANTS

imposing threat to the nature

city green areas of good environmental status





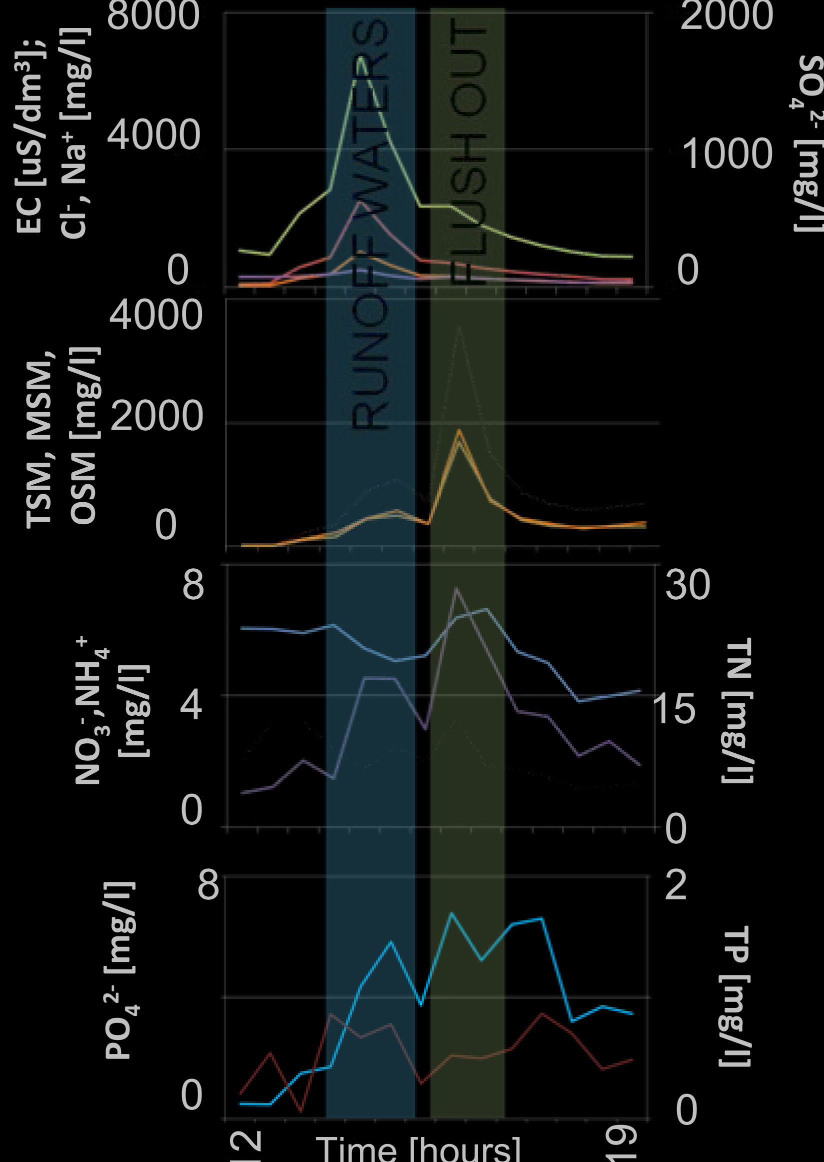
degraded areas requiring investments

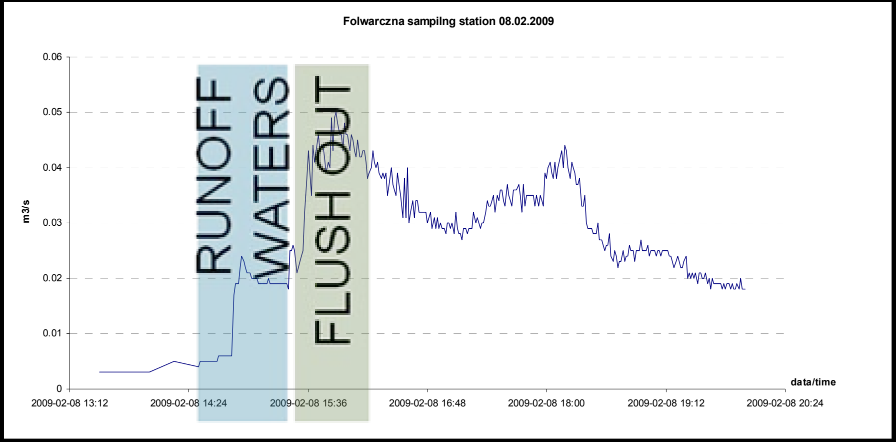
requiring rehabilitation

SOCIAL EXCLUSION PROBLEM, CONTINUOUS DEGRADATION

Monitoring

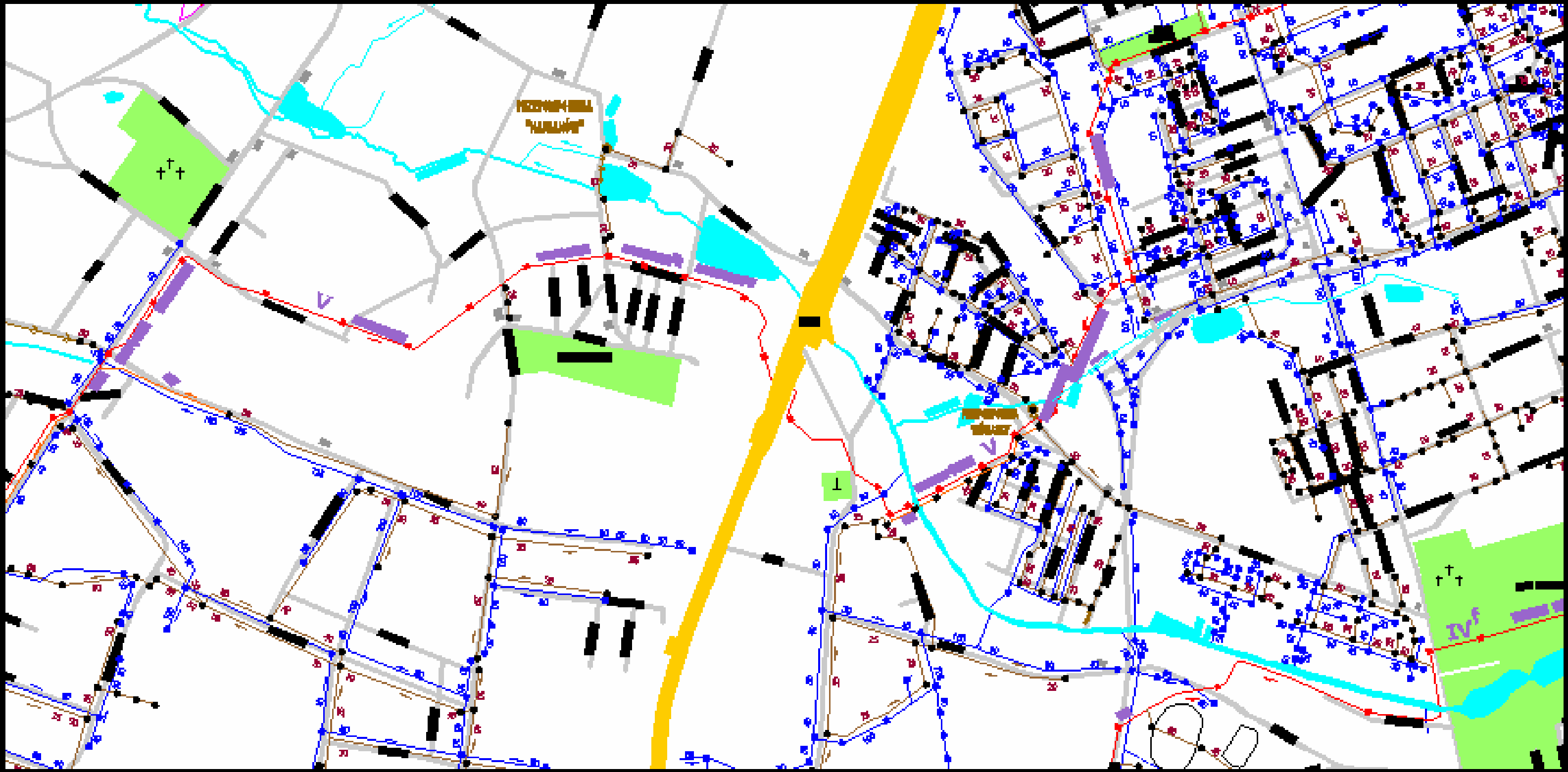
Hydrochemical monitoring of floods





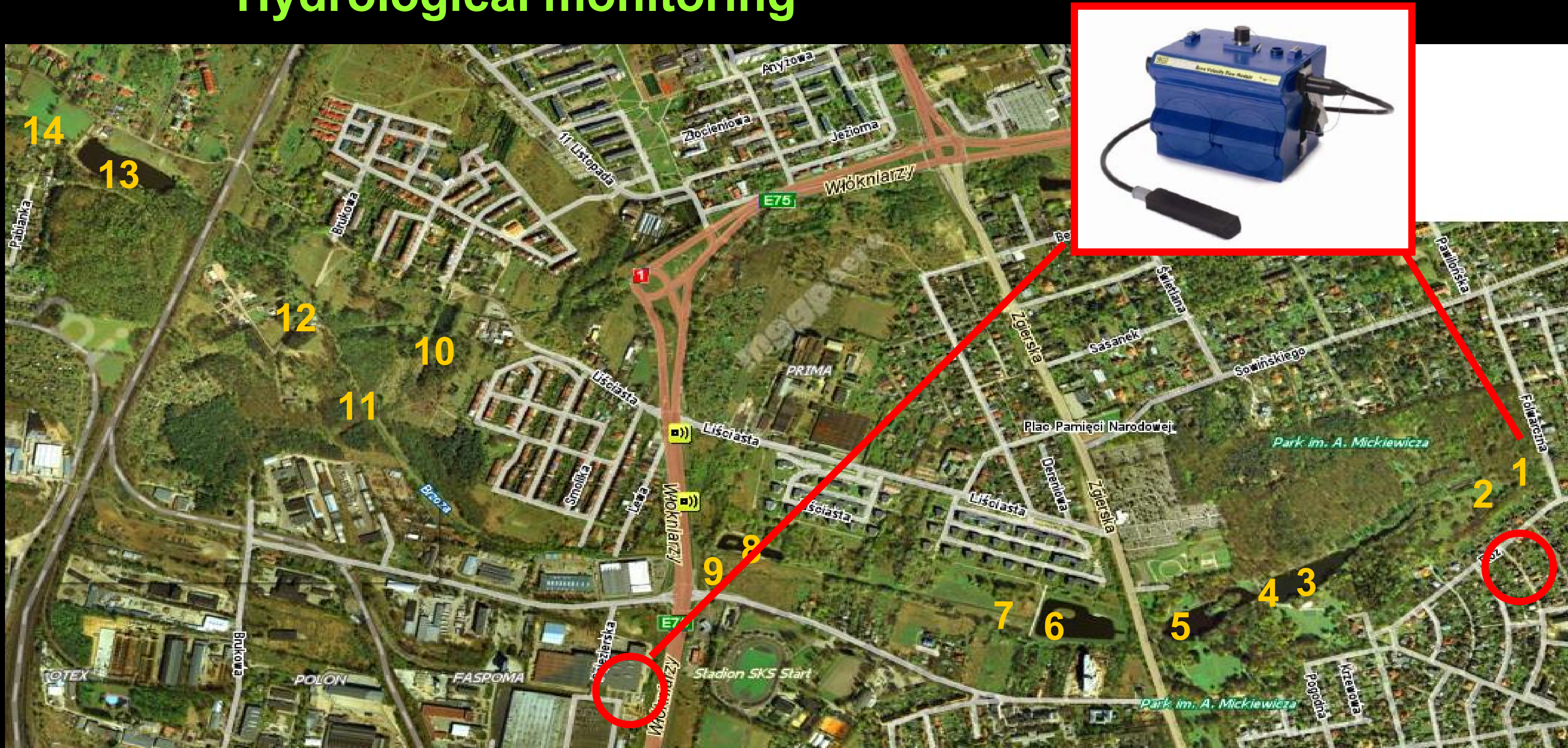
February 2009;
Precipitation 6.1 mm

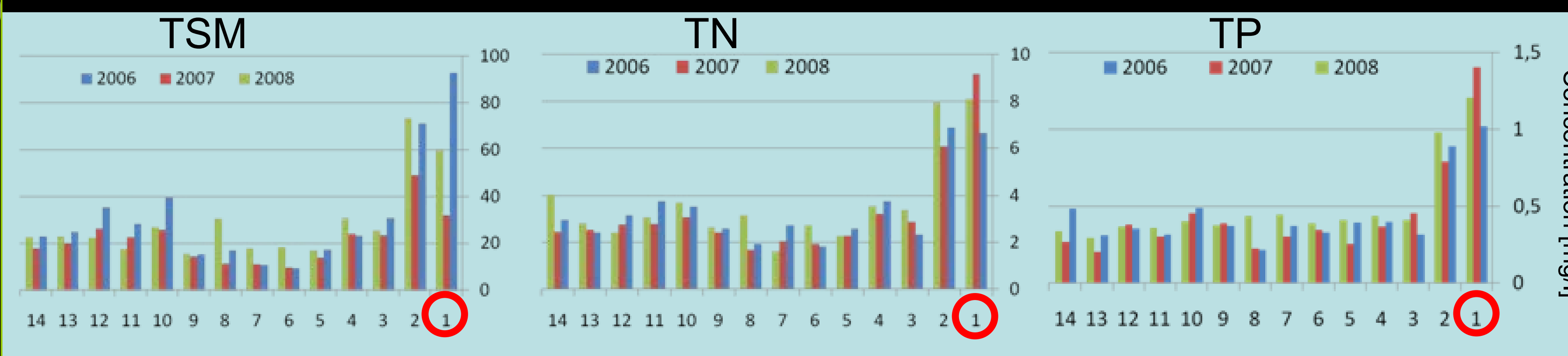
Stormwater system



Monitoring

Hydrological monitoring





Monitoring

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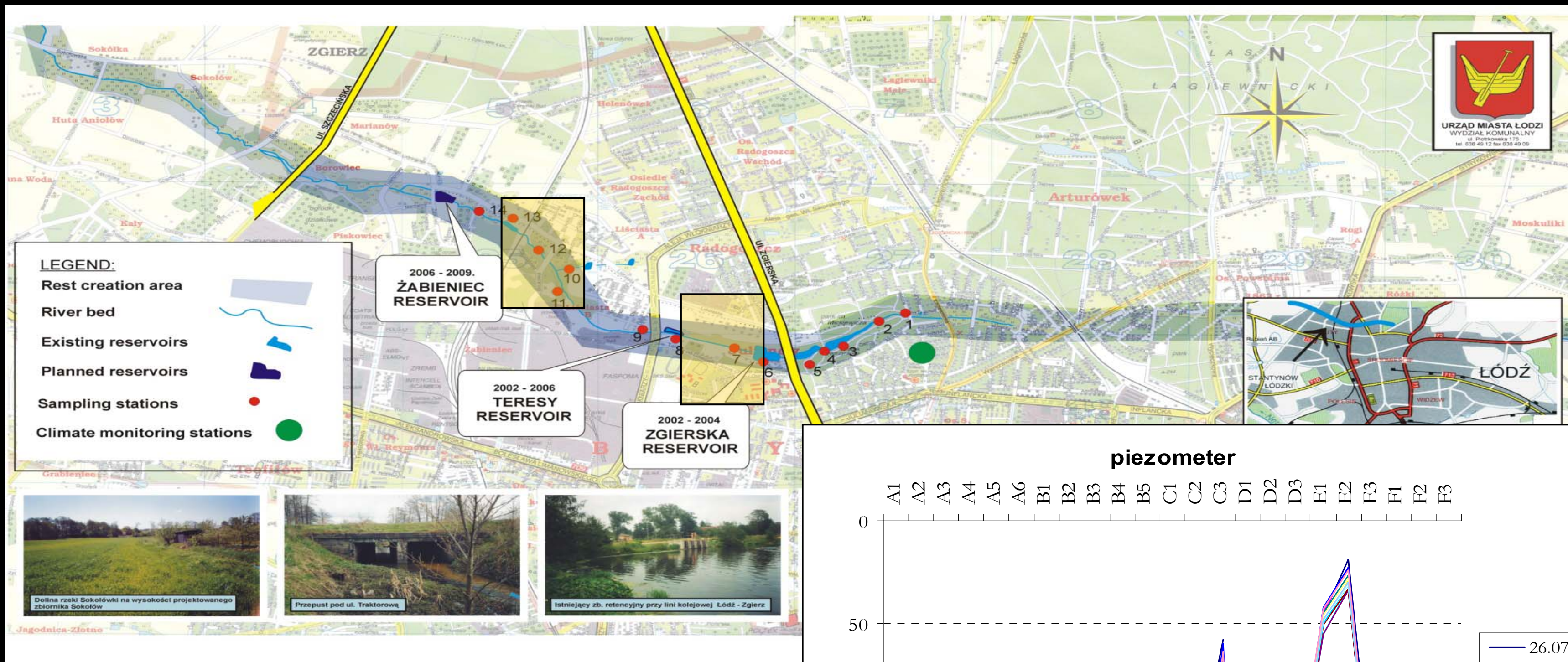
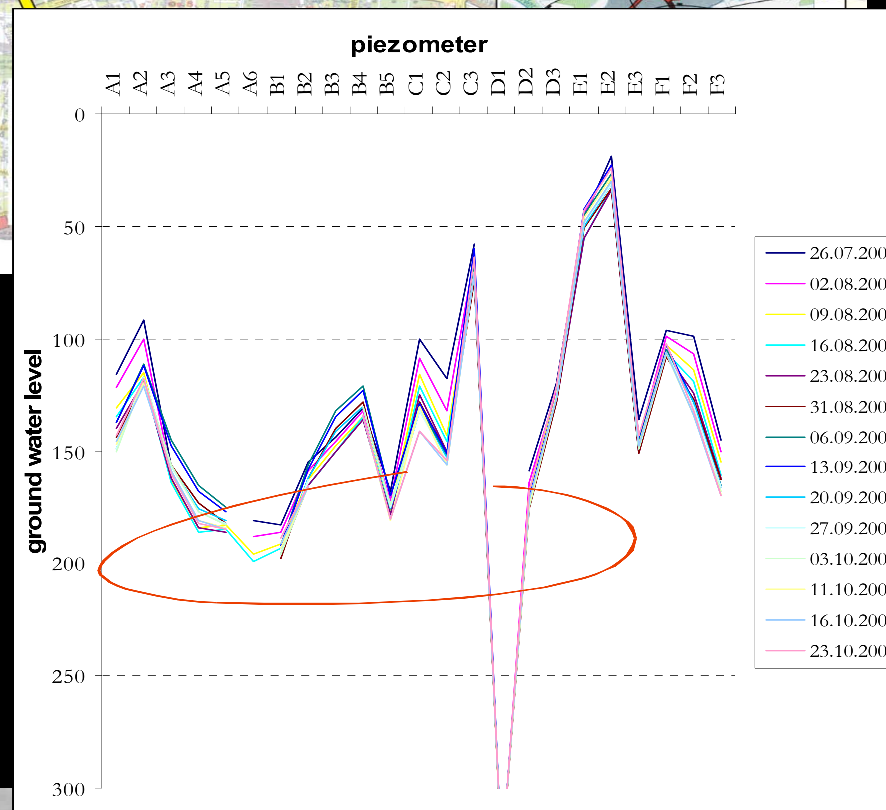
Monitoring

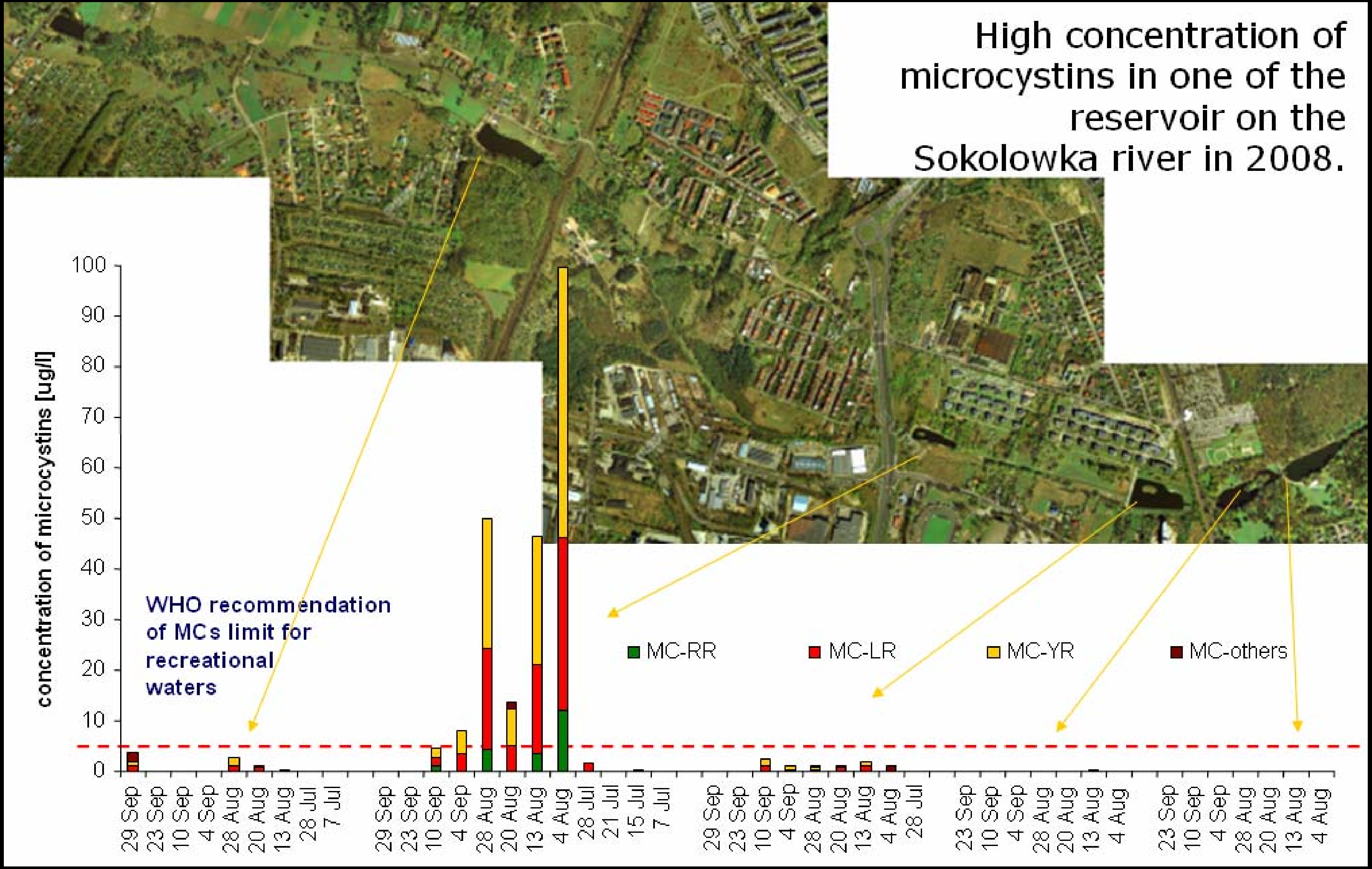




Monitoring of groundwater

Monitoring

High concentration of microcystins in one of the reservoir on the Sokolowka river in 2008.



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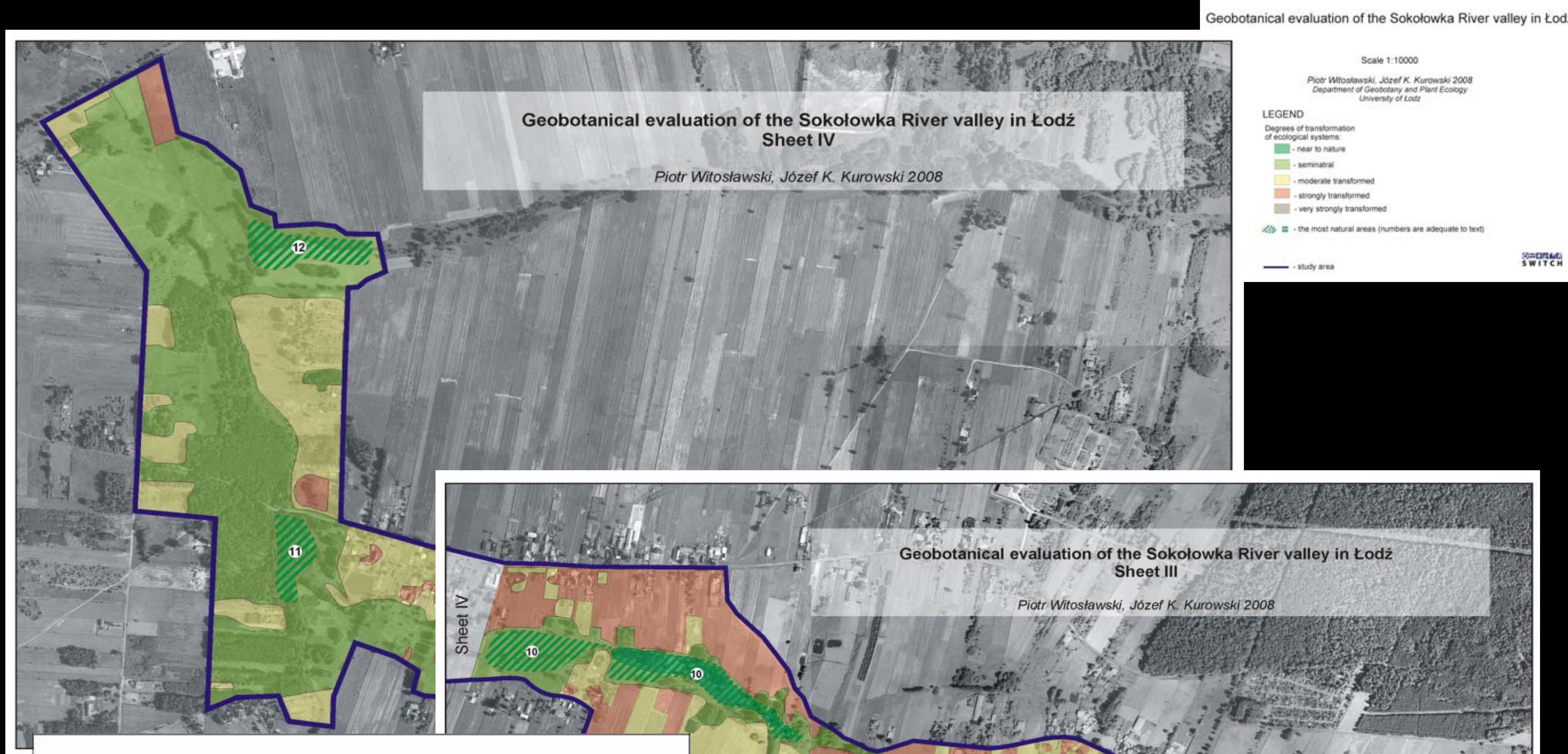
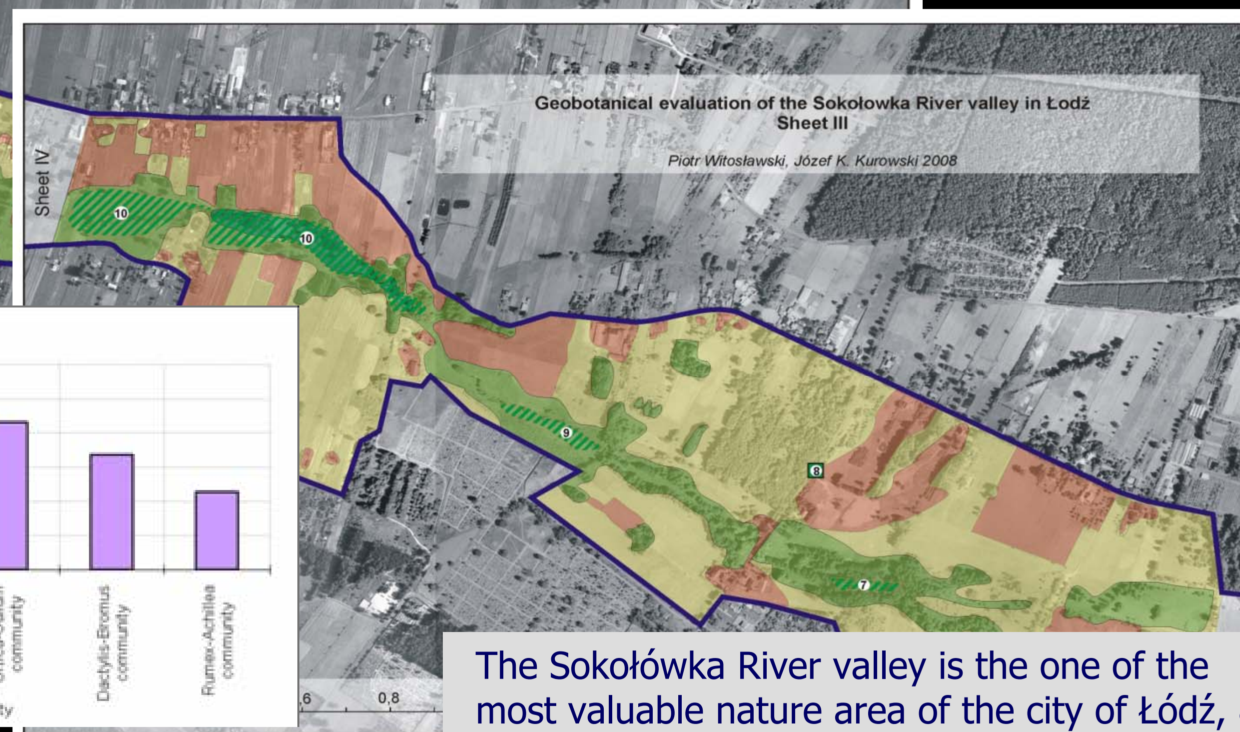
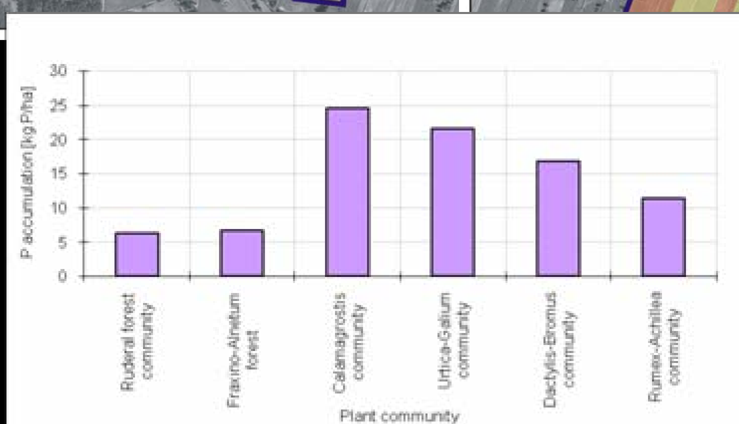
Enhancement





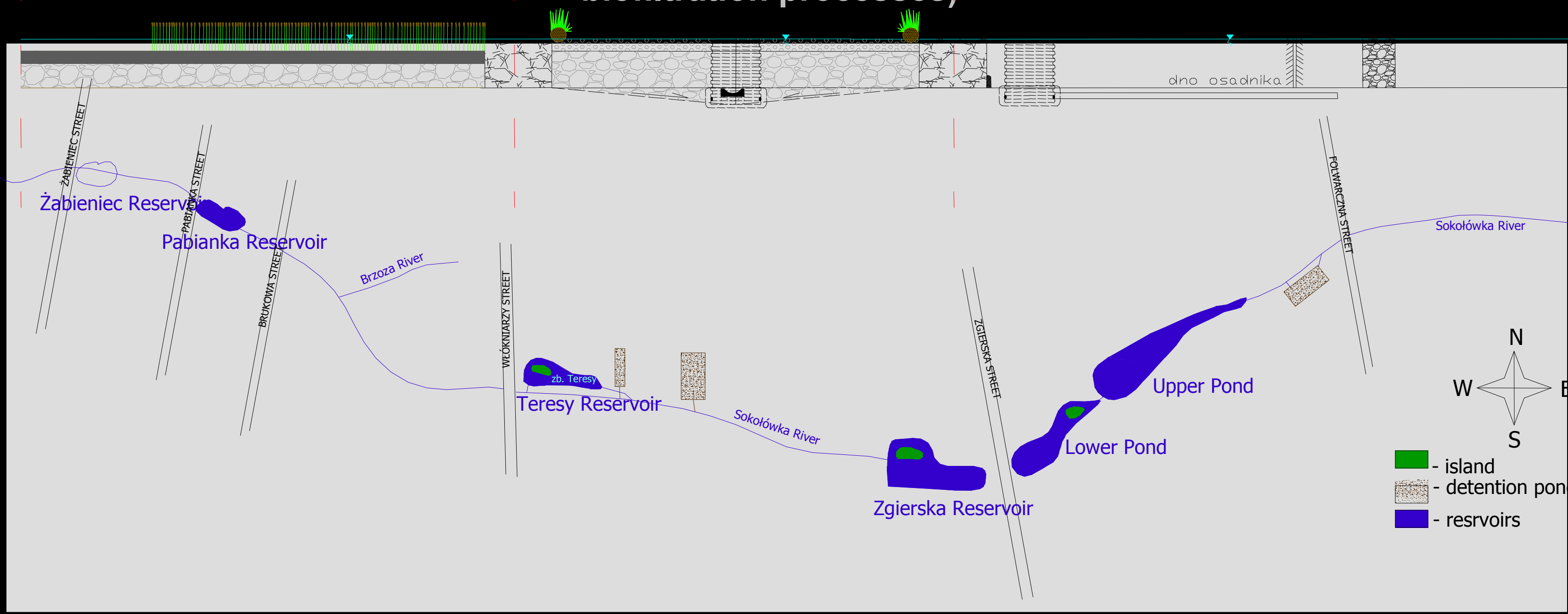


Phosphorus accumulation for predominant communities calculated per unit area [ha]

The Sokołówka River valley is the one of the most valuable nature area of the city of Łódź, & preserves patches of hydrophilous forest & rushes which are rare components of urban vegetation in Lodz & rare & legally protected plant species;

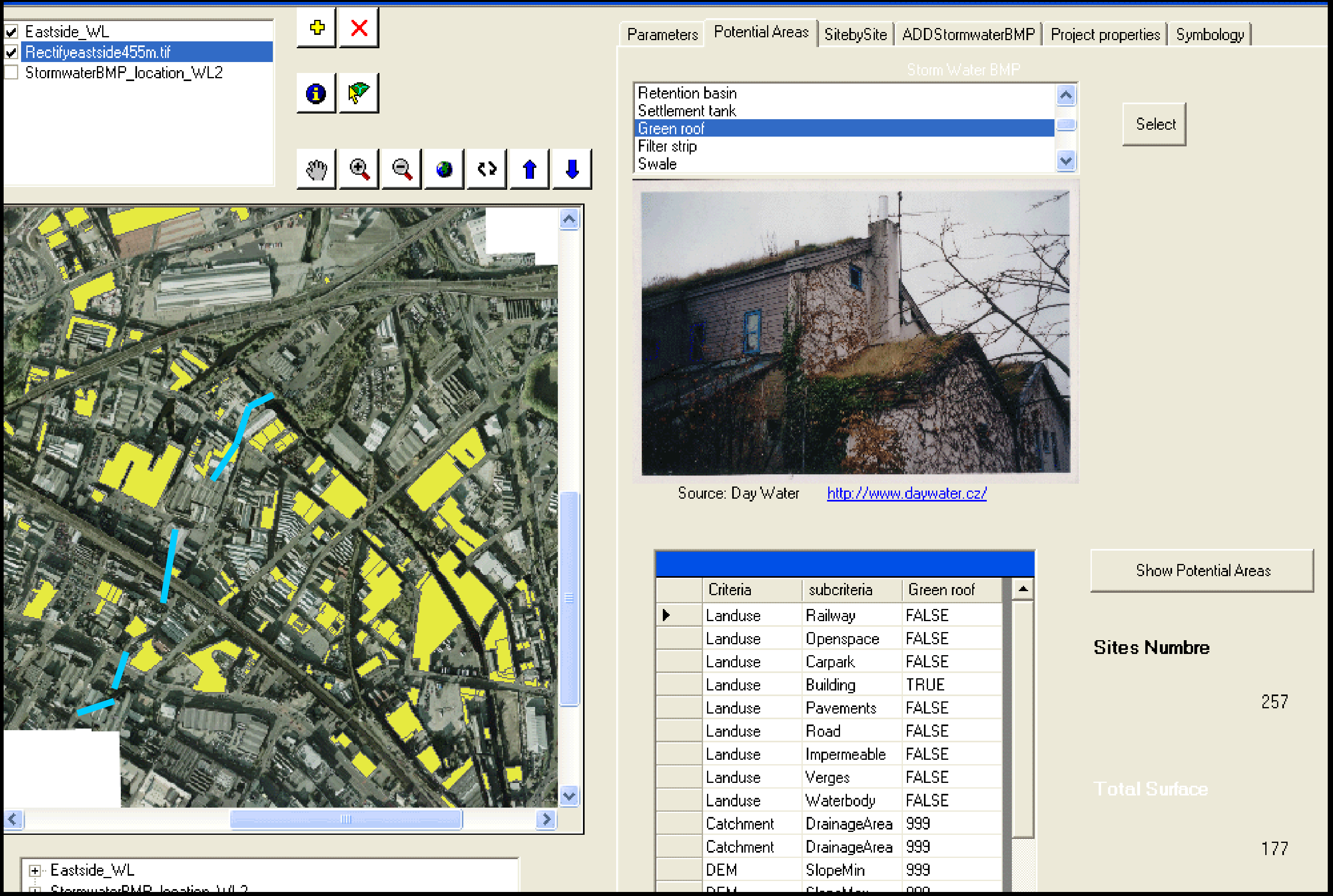
2002 - Constructed for protection of reservoirs cascade (sedimentation process only)

2009 Feibility study of the pond modernization (sedimentation, biogeochemical and biofiltration processes)



Enhancement

Interactive Map Functionality 1: Potential Areas Tool



Enhancement

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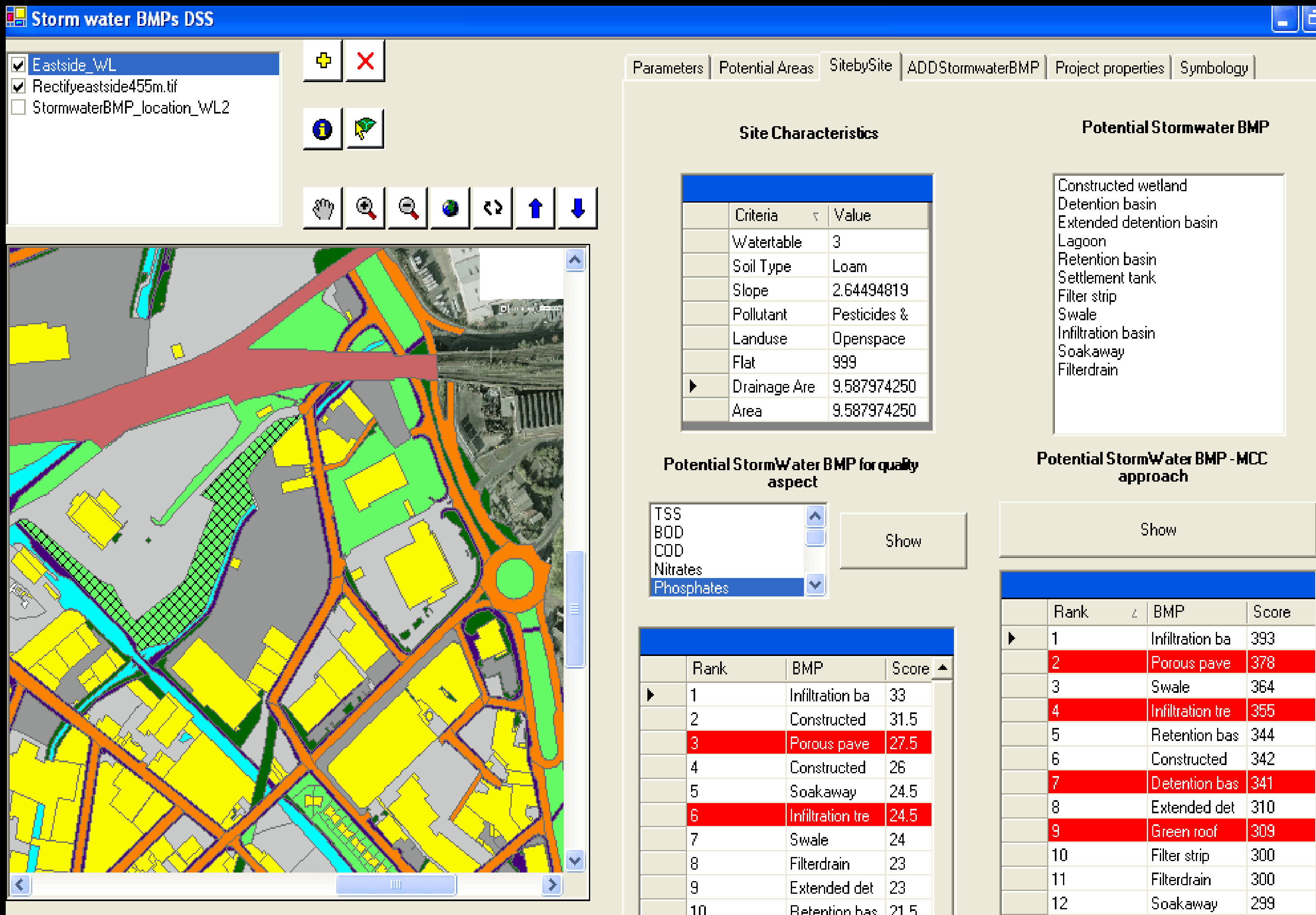
Interactive Map Functionality 2: Site-by-site Assessment Tool



Enhancement

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SWITCH

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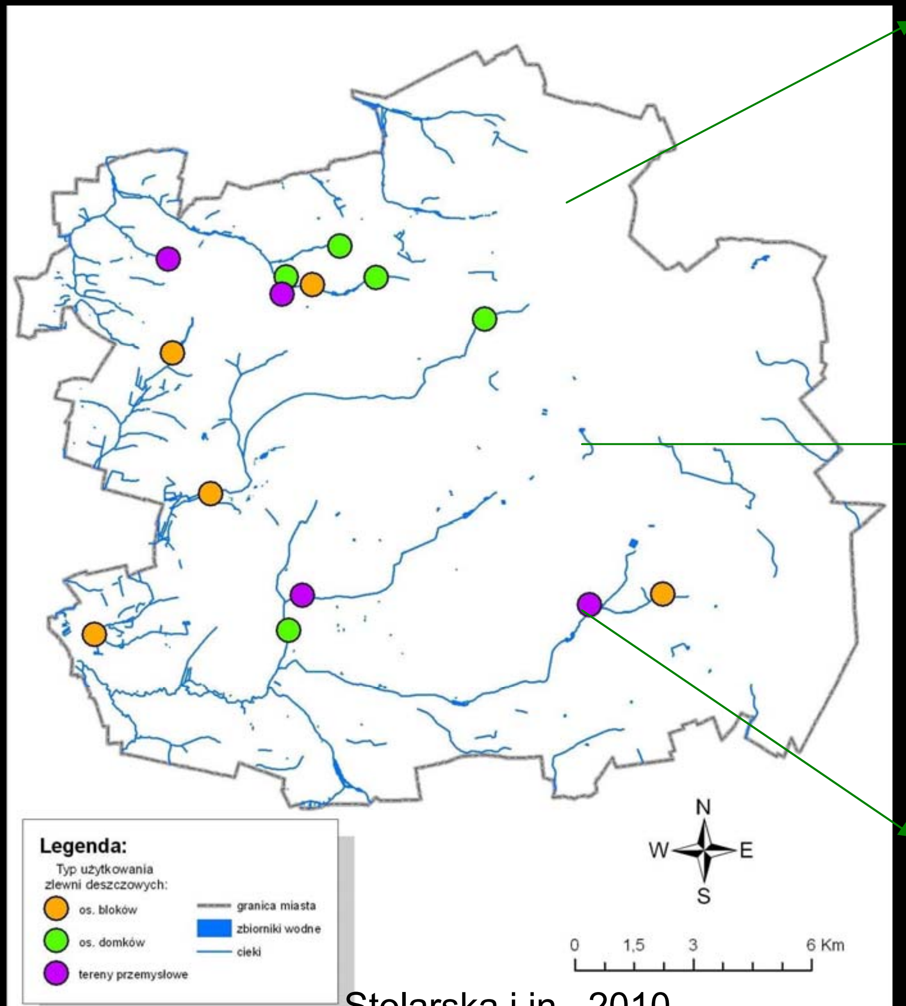
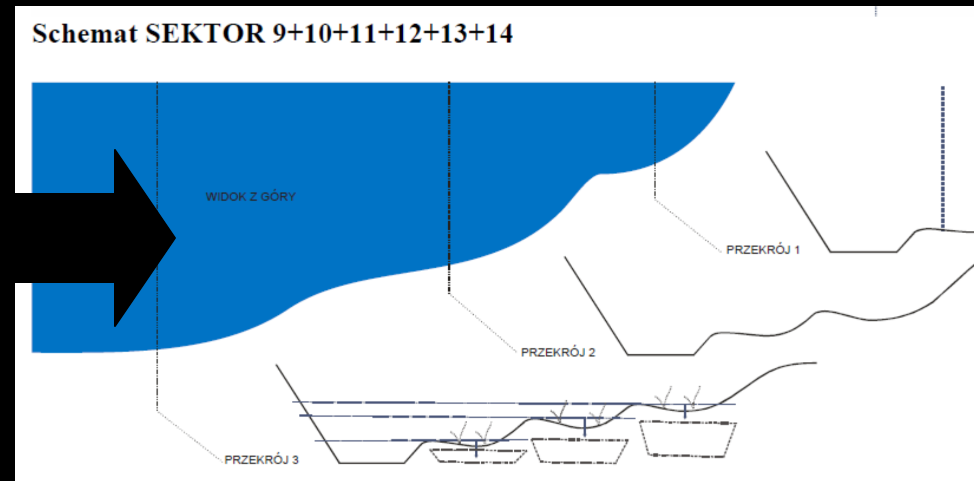
Enhancement

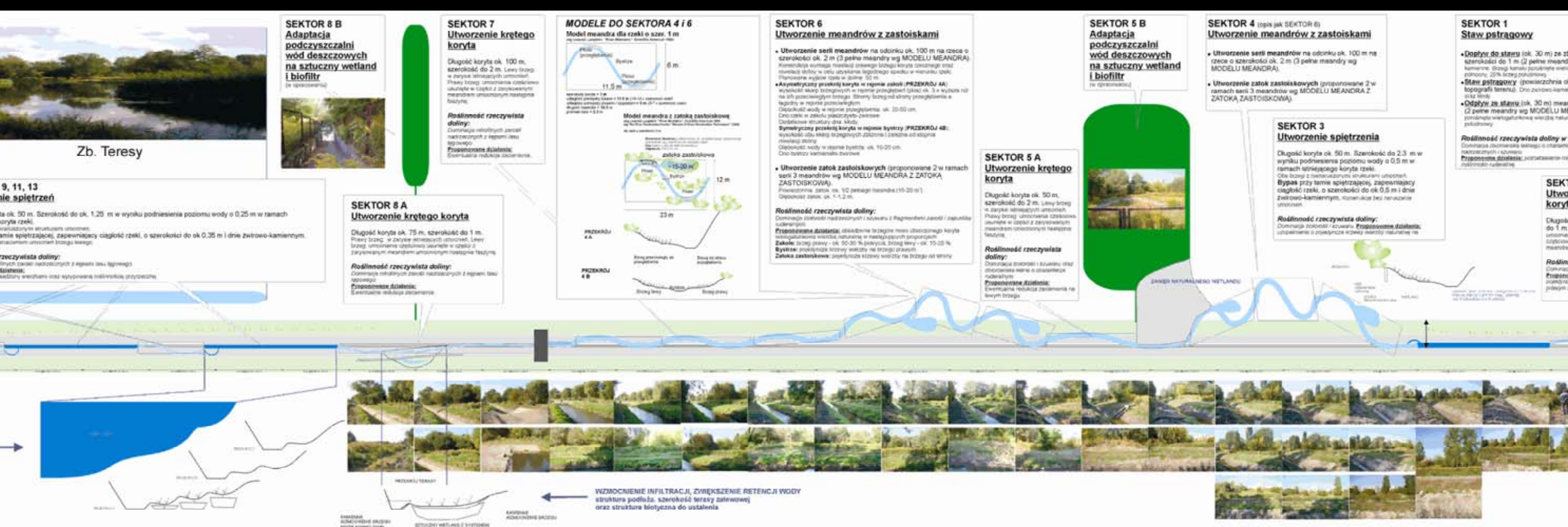
Recommendations for areas where BMPs could be first implemented considering cost-efficiency efficiency

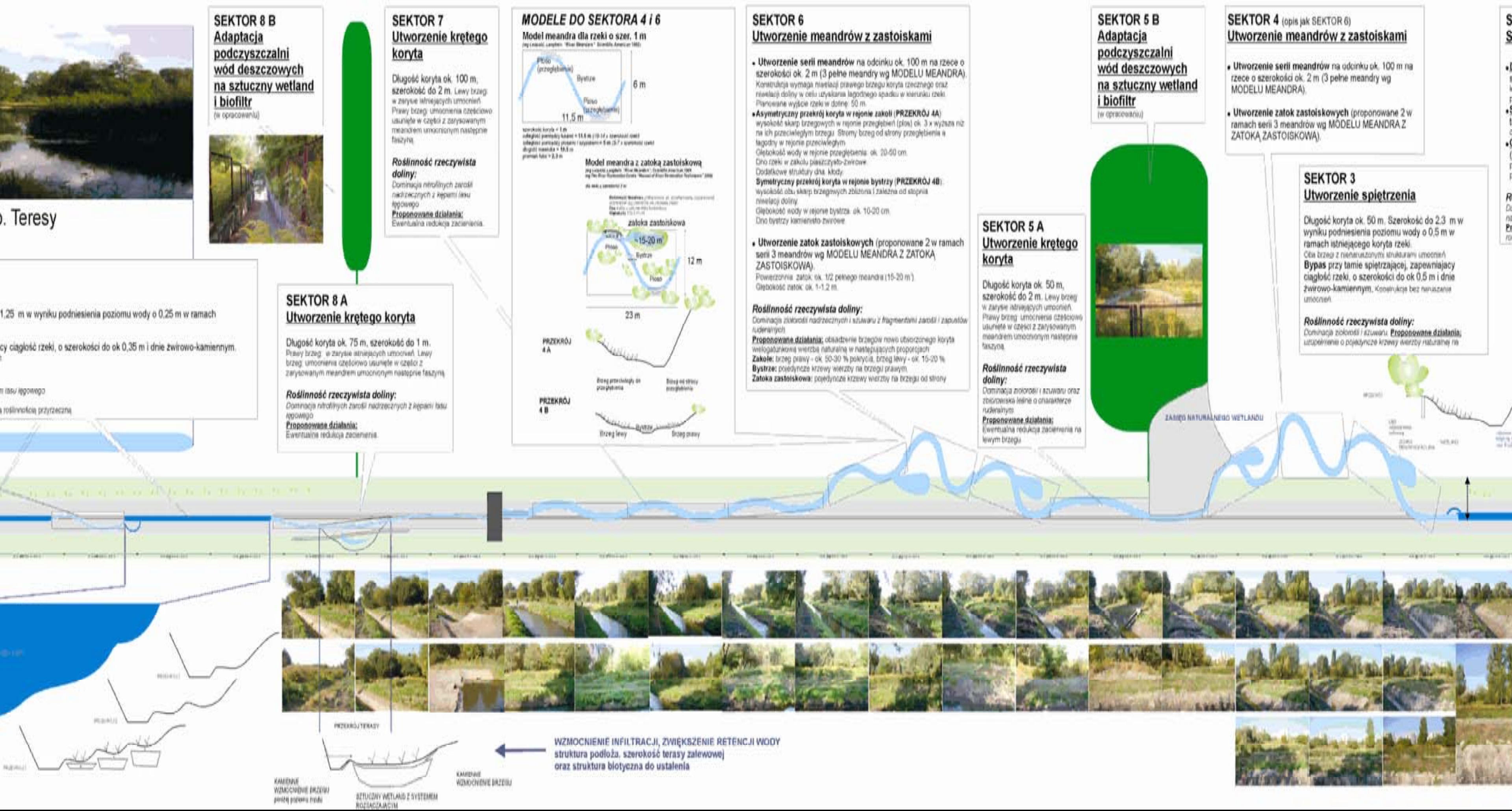


Stolarska i in., 2010

Demonstration Project 1: Restoration of a municipal river for stormwater management, increase of water retentiveness and quality of life (project finalised, implementation: 2010)







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River restoration acc. to EH Concept for WFD

Intermediate Riparian Complexity Concept

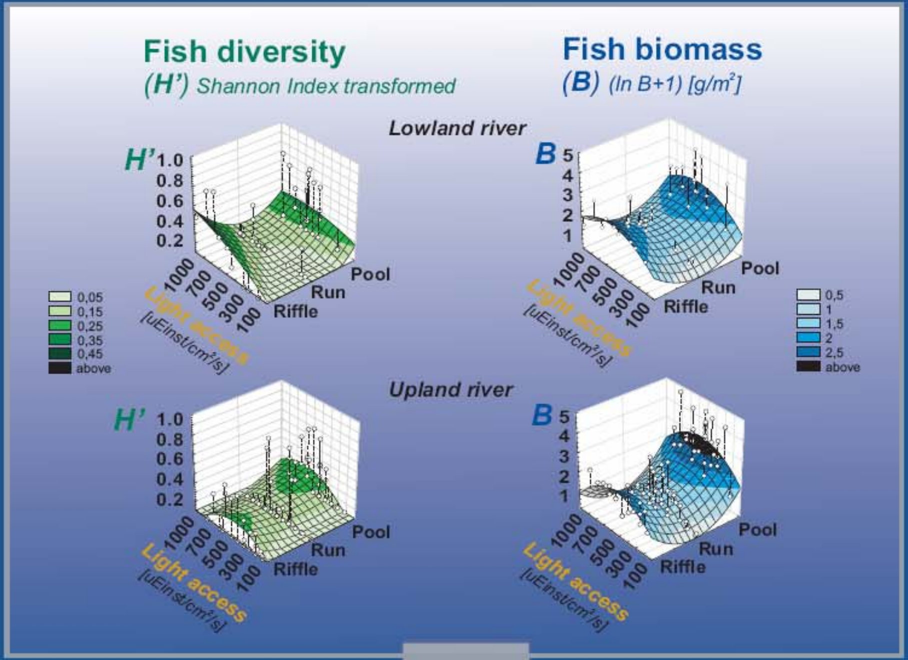
(Zalewski et al. 1994)

The relationships beteween riparian complexity, thus light access to habitat, and habitat type on fish diversity (**H'**) and fish biomass (**B**) quantitatively demonstrate that the maximum values might be achieved in habitats *(especially pools and riffles)* with intermediate light access to the river channel (~ 500 $uEinst/cm^2/s$) *(Lapinska 1997, Zalewski et al. 1998).*

Lapinska M. 1997. Space as a limiting factors for fish communities in lowland and upland rivers. PhD thesis, University of Lodz.

Zalewski M., Puchalski W., Frankiewicz P., Bis B. 1994. Riparian ecotones and fish communities in rivers - intermediate complexity hypothesis. In Cowx I.G. [Ed] Rehabilitation of Freshwater Fisheries, Fishing News Books, Oxford, pp.152-159.

Zalewski M., Bis B., Lapinska M., Frankiewicz P., Puchalski W. 1998. The importance of the riparian ecotoneand river hydraulics for sustainable basin-scale restoration scenarios. Aquatic Conservation: Marine and Freshwater Ecosystems 8:287-307.

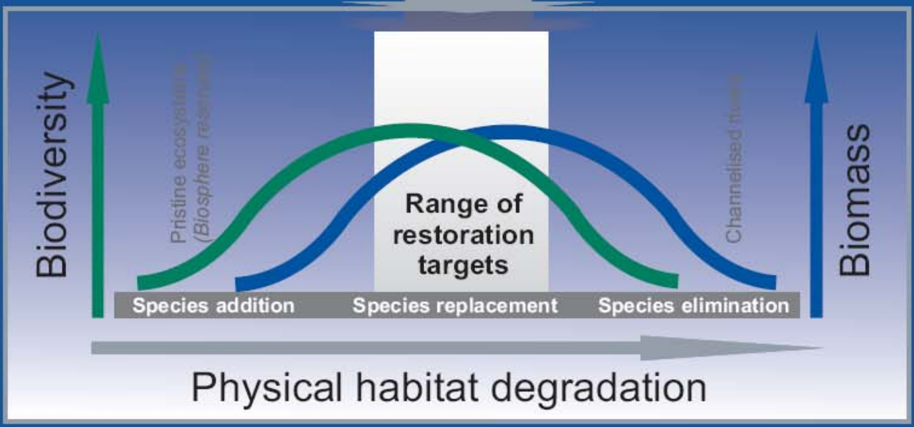


Intermediate River Restoration Concept

(Zalewski, Welcomme 2001)

The optimal river restoration goal should be the restoring of river ecosystem functionality and reversing symptoms of degradation. Thus, to achieve sufficiently good river status might be enough if restoration target lies in the range between maximum diversity and maximum productivity of fish communities.

Zalewski M., Welcomme R. 2001. Restoration of sustainability of physically degraded fish habitats - The Model of Intermediate Restoration. Ecohydrology&Hydrobiology 1/3:279-282.

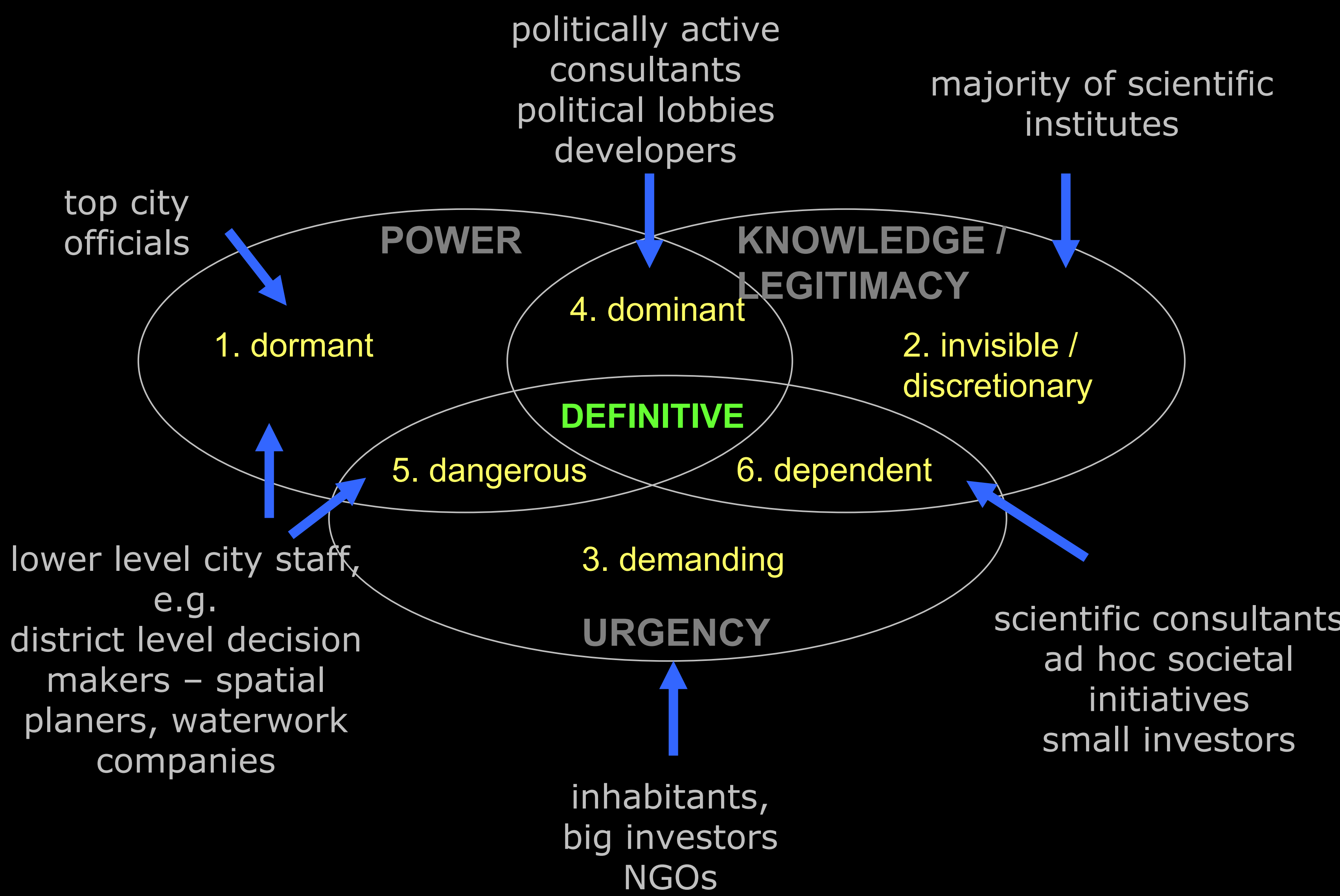


Enhancement

?

UNDERSTANDING DECISION EMERGING SYSTEM
(THROUGH STAKEHOLDER / ACTORS MAPPING)

UNDERLYING FORCES



adopted from „Power, Legitimacy, Urgency Model" (Mitchell, Angle, Wood, 1997)

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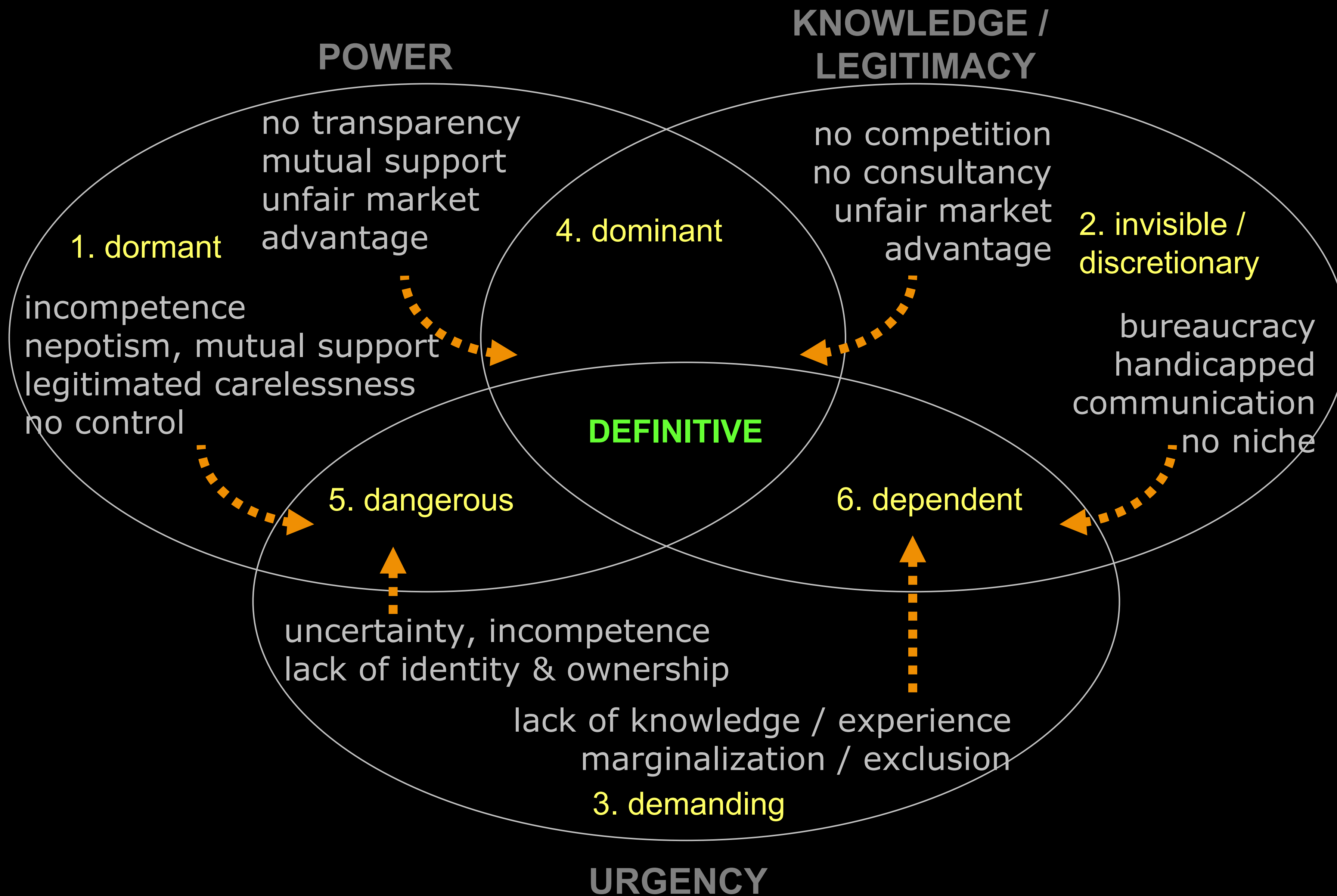
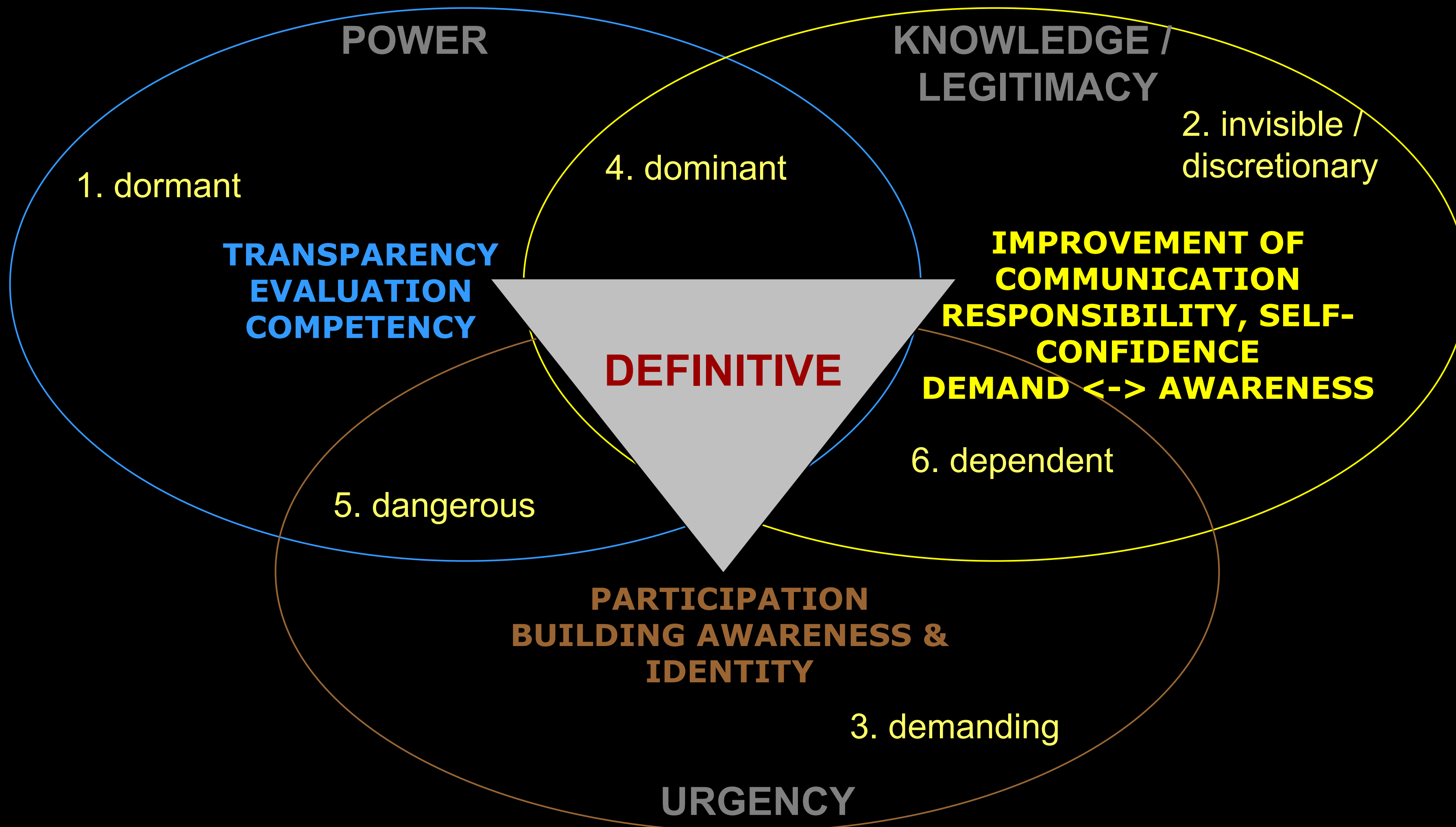
UNDERLYING FORCES



LEARNING ALLIANCE APPROACH



EMPOWERMENT

UNDERLYING FORCES

Drivers of water and environmental quality in Lodz

- Ecological awareness of citizens
- Law execution
- Economic potential of the city
- Adequacy and integrity of national and international regulations
- Land development
- Access to new technologies
- Welfare and life style
- Clear structure and competences of administration & governance
- International regulations
- Transport development & people mobility
- Community participation in decision making
- Political situation/environment
- Demography

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UNDERLYING FORCES

- **Ecological awareness of citizens**
- **Law execution**
- **Economic potential of the city**
- Adequacy and integrity of national and international regulations
- **Land development**
- Access to new technologies
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- Clear structure and competences of administration & governance
- International regulations
- Transport development & people mobility
- Community participation in decision making
- Political situation/environment
- Demography

Low ecological awareness

	low	low/medium	high/medium	high
Damage potential				
Probability				
Spatial scale				
Connectendness				
Irreversibility				
Acceleration				
Persistence				
Time delay				
Invisibility				
Info unavability				
Mobilization/attraction				

New ideas

Enhancement

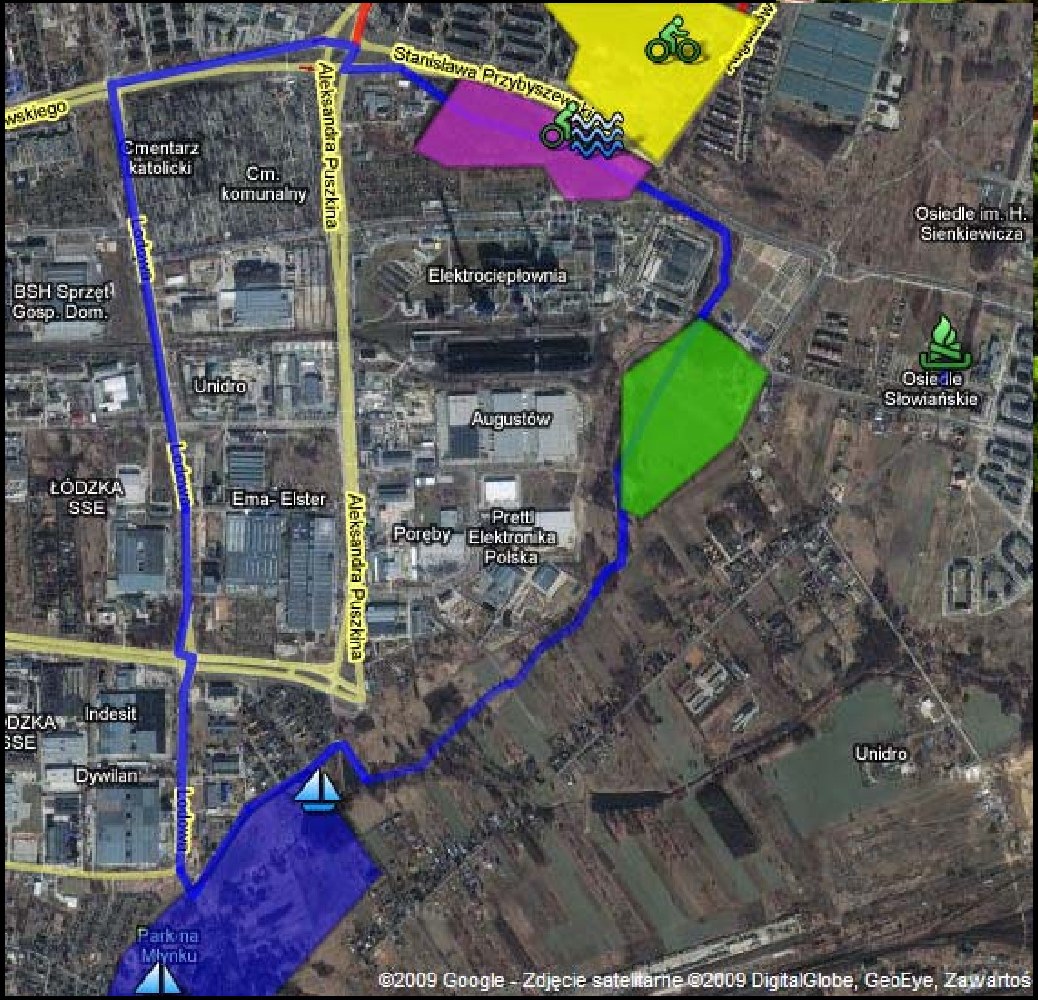
?

BEST PRACTICES IN GREENING - Green backyards

Stormwater management should include greening of city backyards for increasing infiltration, improvement of microclimate, better look

New ideas

GREEN TRANSPORT



New ideas

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MODERN INFRASTRUCTURE

New ideas

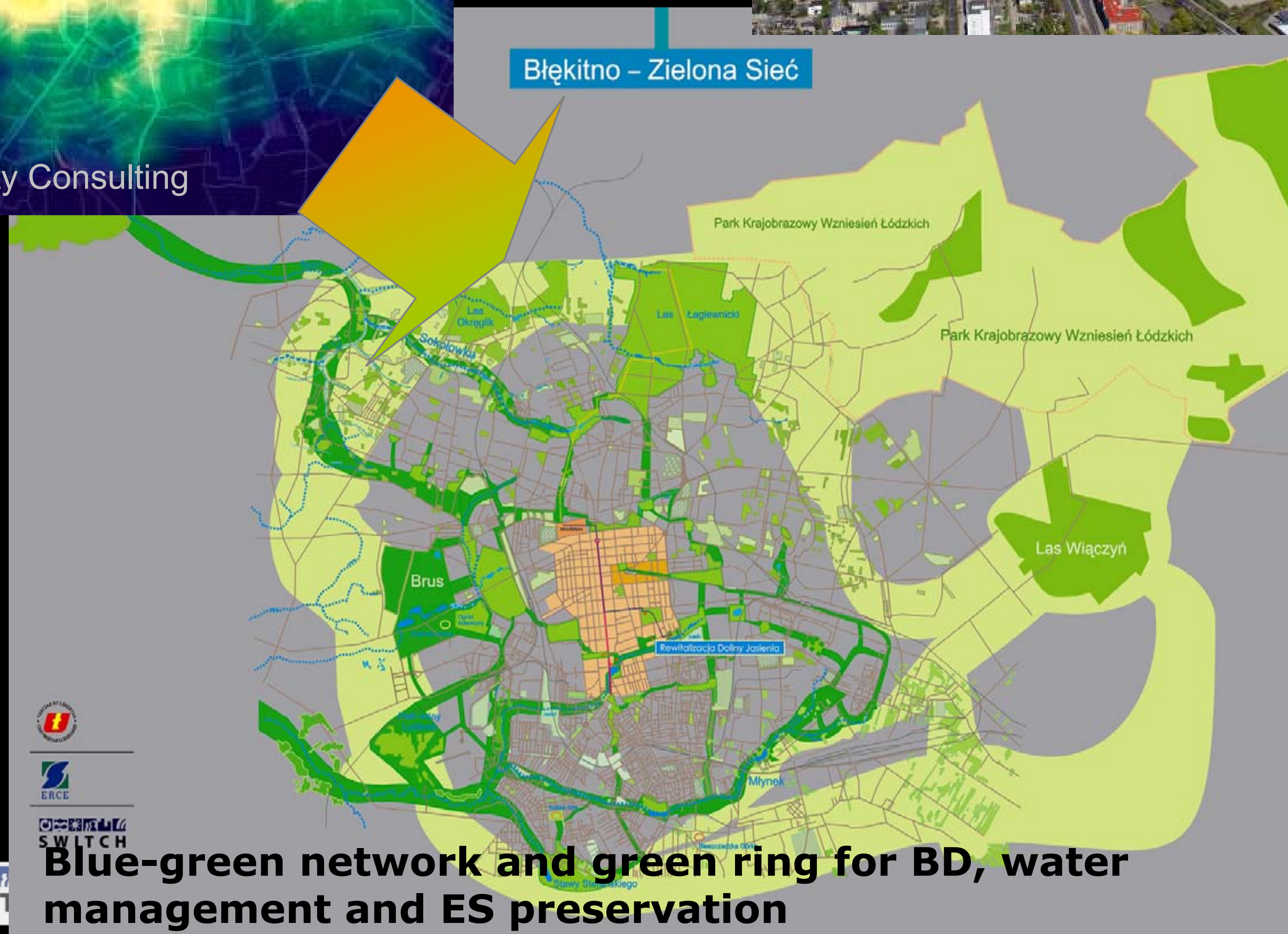
Źródło: Tree Development Group

CREATIVE CITY

Pasaż Scheiblera - Grohmana
Scheibler - Grohman Gallery Mall

New ideas

City of the future



Blue-green network and green ring for BD, water management and ES preservation

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SWITCH

BEST MANAGEMENT PRACTICES TO EVALUATE GAINS FROM ECOSYSTEM SERVICES IN CITIES

City of the future

highway runoff wetland

Site description and discharge	System purpose and components	System specification	Site data
A34 bypass. 13.5 km dual two lane trunk road; Discharges: 20–120 l/s for 1:50 and 1:25 design	Flood storage and balancing; 9 x wet detention basins with SF and SSF constructed wetlands. Front-end oil/silt bypass interceptors, grass filters and reedbeds *Phragmites/ Typha.*	Maximum design storage volumes = 121–676 m³ Retention times = 30–120 hours	% metal removals recorded: BOD –63–64; Cu –58–83; Cd –89–83; Zn –56–76. Wet weather % removals recorded: SS 40–75; Cd 90–99; Cu – 88–97; Pb 98; Zn 59–66. Metal sediment levels (µg/g); Zn, 20–28; Cd, 3–7; Pb 17–18; Cu, 4–12. Metal levels in plant tissue also recorded

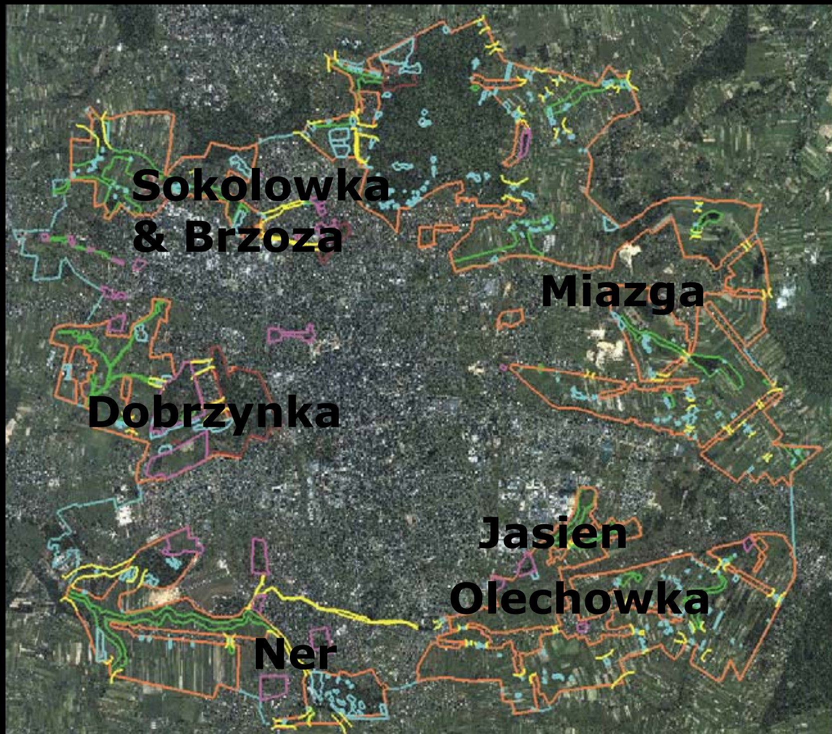
A General Comparison of BMP Costs

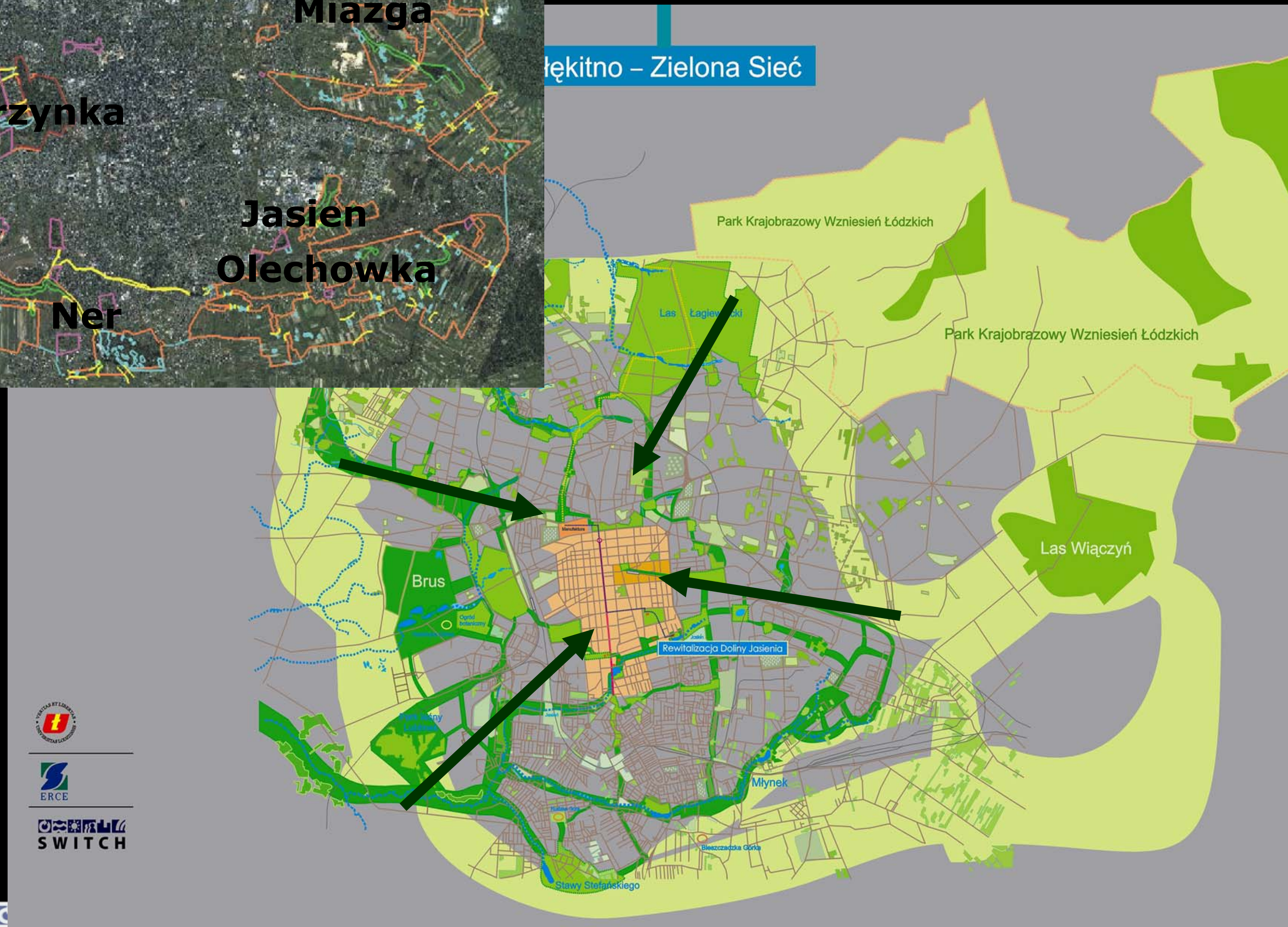
Treatment Device	Capital Cost (£'000s)	Maintenance Cost (£/per yr)	Comments
Gully/Kerb/Carrier Pipe System	150 - 220	1000	No fin drainage allowed for in costs
Filter/French Drains	160 - 180	1% to 10% of construction costs	Requires replacement after 10-12 years
Sediment/Litter traps and screens Vortex type (at peak flow treatment)	£4000 - £20,000/50ha catchment ~$40,000 per m^3/s	6% - 10% of construction costs -	
Grass Swale	15 – 40 (£2 - £4/m^2)	350 (Initially up to £3-£4/m^2 decreasing over first few years to £0.65 – £1/m^2)	With no off-site disposal of cuttings
Grass Filter Strip	£1.5 - £3/m^2	Up to £500/ha	
Oil Interceptors (with Grit chamber)	8 - 30	300 400	

(Revitt, 2008)

City of the future

Blue-green network and green ring





City of the future

Blue-green network and green ring

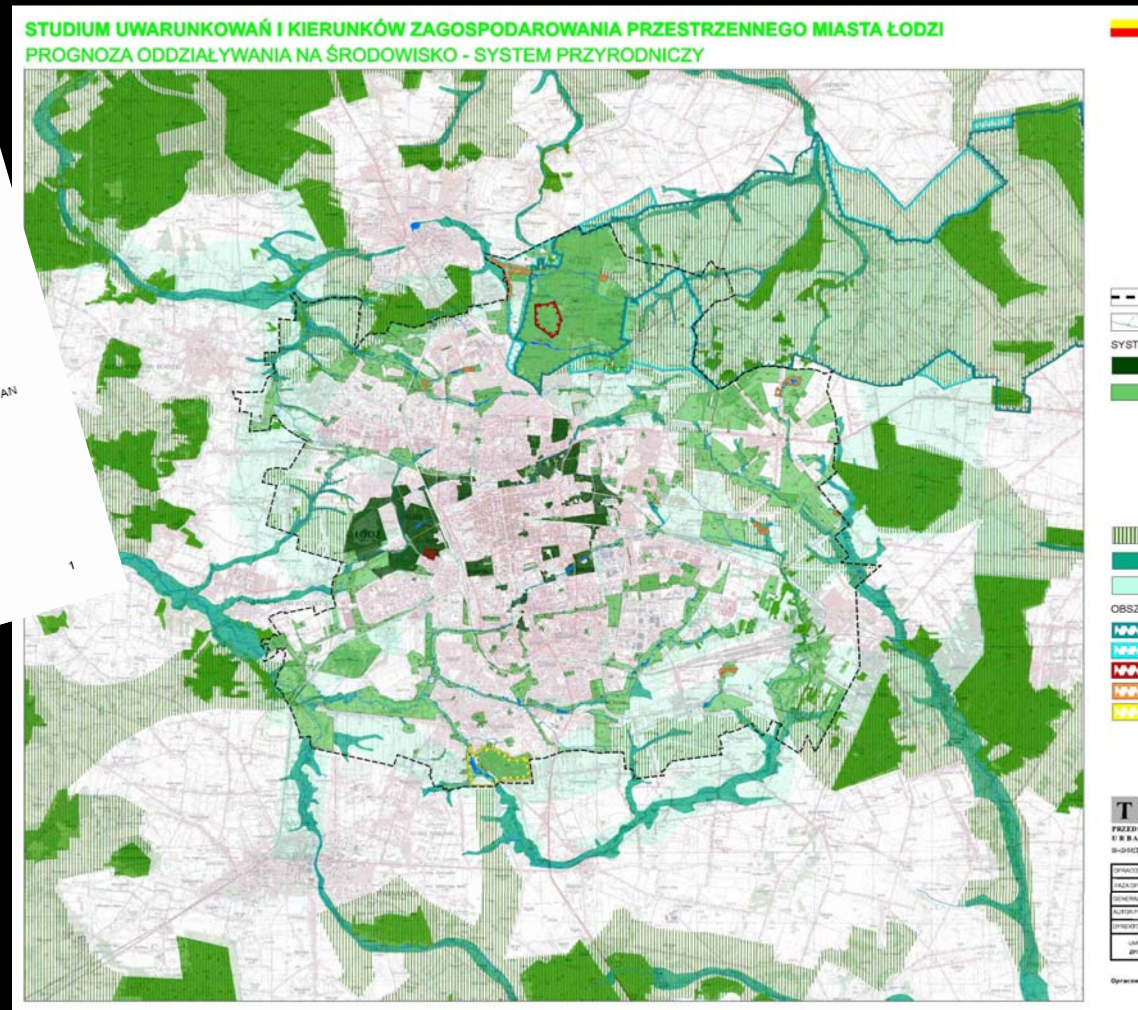
Analiza zasięgu terenów dolin na obszarze miasta Łodzi i zasad ich zagospodarowania

dla potrzeb studium uwarunkowań i kierunków zagospodarowania przestrzennego miasta Łodzi

Opracowanie wykonane przez Międzynarodowe Centrum Ekologii PAN na zlecenie Miejskiej Pracowni urbanistycznej w Łodzi

Łódź, 31 sierpień 2007

1



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EHREK

NFOŚiGW

Ecohydrologic rehabilitation
of recreational reservoirs "Arturówek" (Łódź) as a model approach to rehabilitation of urban reservoirs

Ekohydrologiczna rekultywacja
zbiorników rekreacyjnych "Arturówek" (Łódź) jako modelowe podejście do rekultywacji zbiorników miejskich

URZĄD MIASTA ŁODZI

PoLTER Network

EHREK

Ecohydrologic rehabilitation of recreational reservoirs “Arturówek” (Łódź) as a model approach to rehabilitation of urban reservoirs

Project: LIFE08 ENV/PL/000517

01/01/2010 - 31/12/2014

Total project budget: 1 244 319 €

Total eligible project budget: 1 011 069 €

EC financial contribution: 489 157 €

NFOŚiGW financial contribution: 451 612 €

FOLLOW UP

SUPPORTING:

NFOŚiGW

COORDINATOR:

VERITAS ET LIBERTAS · UNIVERSITAS LODZIENSIS

Uniwersytet Łódzki
Katedra Ekologii
Stosowanej

PARTNERS:

Urząd Miasta Łodzi

Łódzka Spółka
Infrastrukturalna

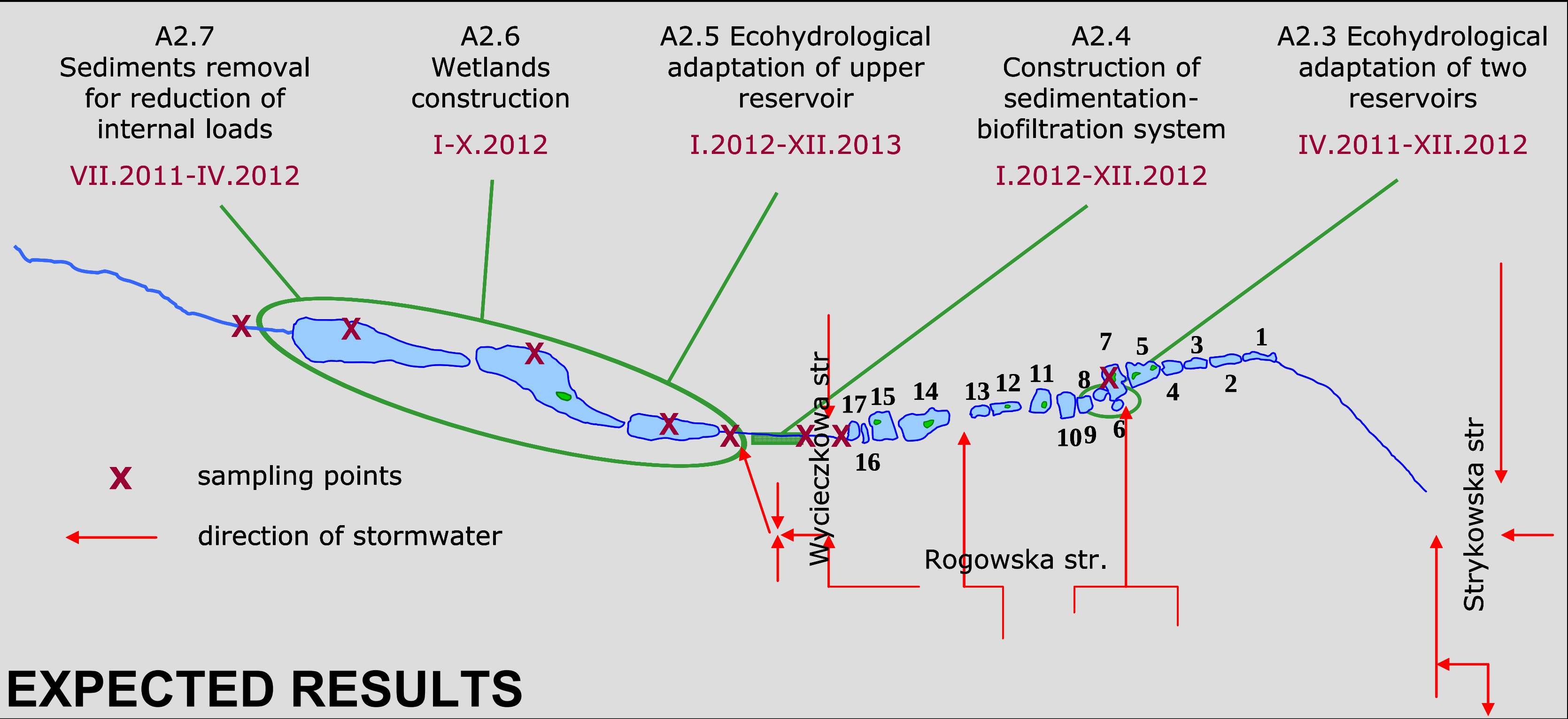
PoLTER Network

SWITCH

UNESCO

ERCE

FOLLOW UP



EXPECTED RESULTS

1) Improved quality of the water environment and recreational potential at cascade of reservoirs in municipal forest „Arturówek";

2) Implementation of ecohydrological methods to sustainable water management in urban areas;

3) Dissemination of ecohydrological methods among the decision makers and society;

4) Elaboration of the scientific and applied background for the rehabilitation of key water systems in Łódź City as a instrument for implementation of Water Framework Directive EC

Conclusions

Before tackling ecological, demographic, and urban problem perspectives, it is indispensable to understand the ways, in which various urban realities are interconnected and mediated by relations of domination, awareness, exploitation, urgency and legitimacy.

There is a place for an approach that focuses on political-economic history of the city, the rise and fall of its social institutions, its character and impact of underlying social and economic linkages.

The New Urban Paradigm: Critical Perspectives on the City
Joe R. Feagin

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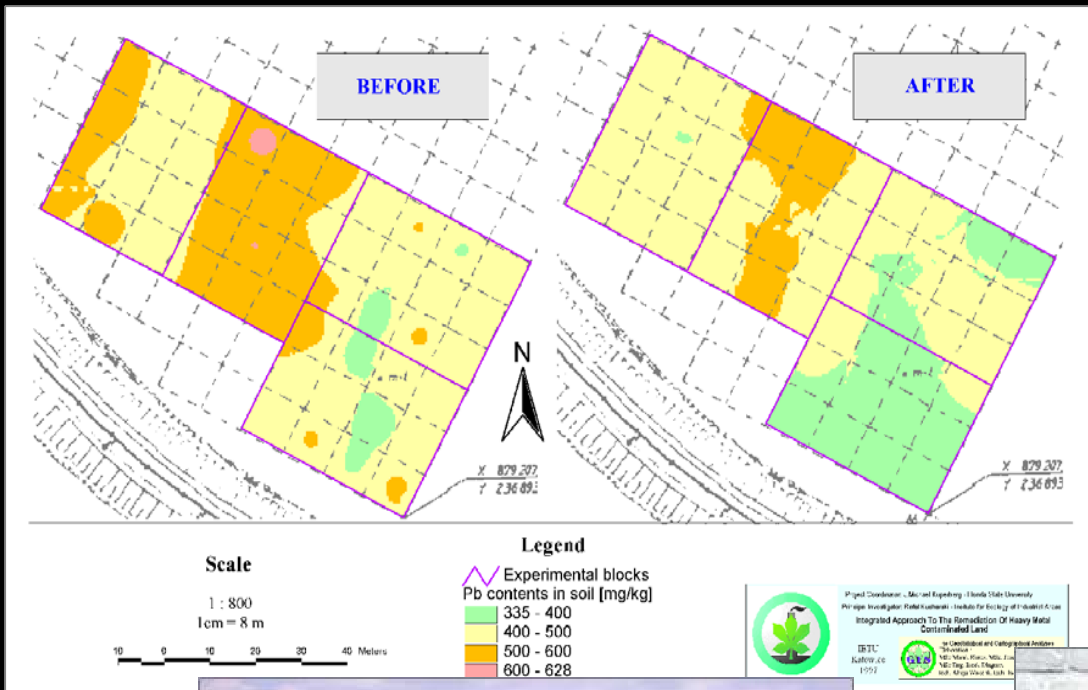
SOIL PHYTOREMEDIATION



Demonstration Project 1: Restoration of a municipal river for stormwater management, increase of water retentiveness and quality of life

Demonstration