

Storm water urban surface retention system – case study Gdańsk

Magdalena Gajewska
Gdańsk University of Technology

GDANSK, 28 April 2020 Webinar

Gdańsk in numbers

INHABITANTS – 470 904

AREA - 261.96 km²



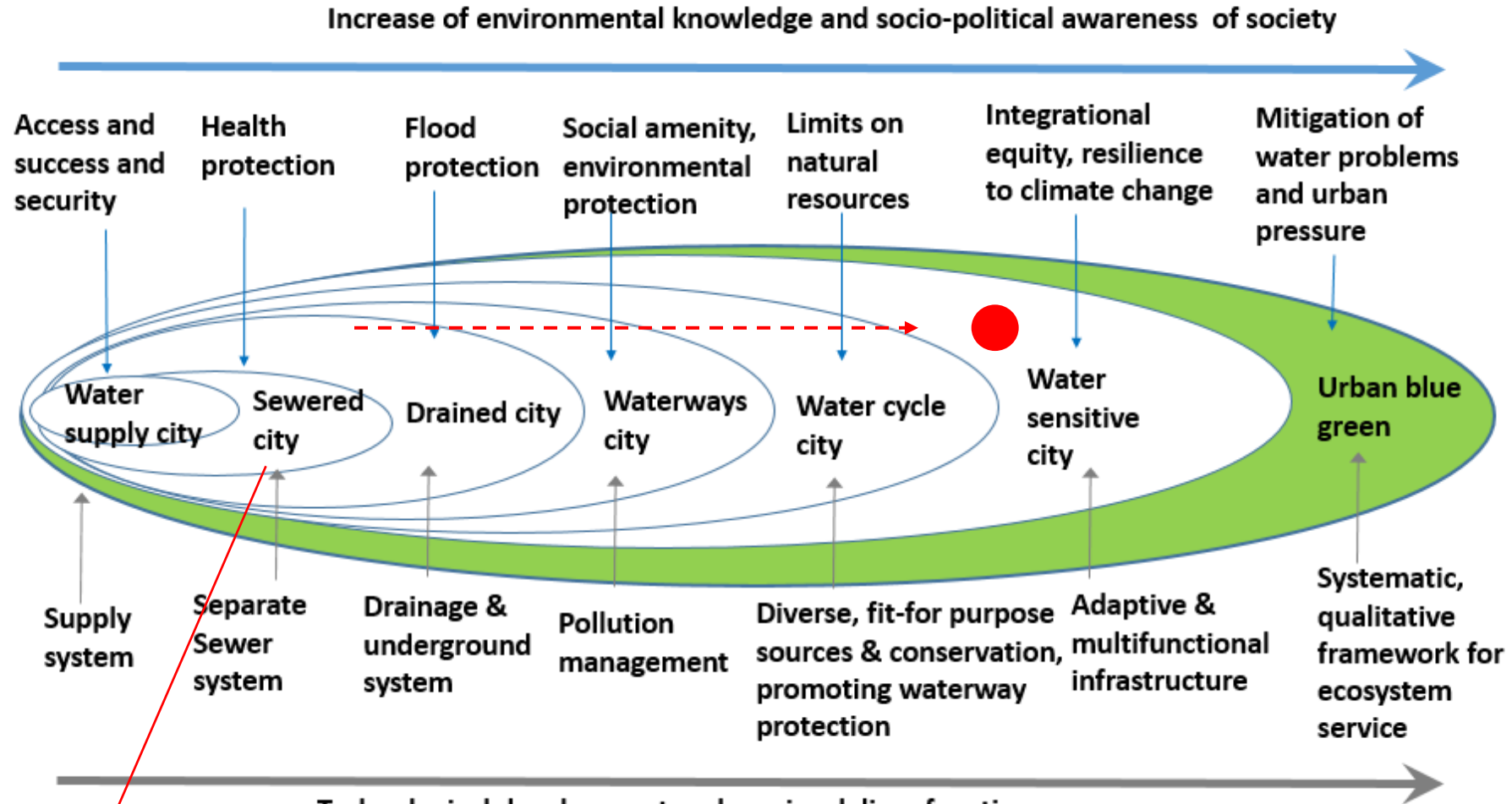
The meridian extent of the city is 19.1 kilometers and the latitudinal extent is 33.9 kilometers

The city's natural resources include a large green area 24%.

Green areas include forest areas (4589 ha), urban greenery (592 ha) and allotment gardens (957 ha)

There are 21 publicly accessible public parks in the city, covering a total area of over 180 ha.

The largest are Park Ronald Reagan (62 ha), Park im. John Paul II (25 ha), Oruński Park (19 ha), Steffens Park (13.6 ha), Oliwski Park (11.3 ha), Park on the Motława River (11 ha), Brzeźno Park (about 10 ha)



In Gdańsk since 1870 and separate sewer and storm water systems

Technological development and service deliver functions

Blue-Green Systems

© 2020 The Authors
112



Blue-Green Systems Vol 2 No 1
doi: 10.2166/bgs.2020.932

A review of nature-based solutions for urban water management in European circular cities: a critical assessment based on case studies and literature

Hasan Volkan Oral^a, Pedro Carvalho^b, Magdalena Gajewska^c, Nadia Ursino^d, Fabio Masi^e, Eric D. van Hullebusch^f, Jan K. Kazak^g, Alfonso Exposito^h, Giulia Cipollettaⁱ, Theis Raaschou Andersen^j, David Christian Finger^k, Lena Simperler^l, Martin Regelsberger^m, Vit Rousⁿ, Matej Radinja^o, Gianluigi Buttiglieri^{p,q}, Pawel Krzeminski^r, Anacleto Rizzo^e, Kaveh Dehghanian^s, Mariyana Nikolova^t and Martin Zimmermann^u

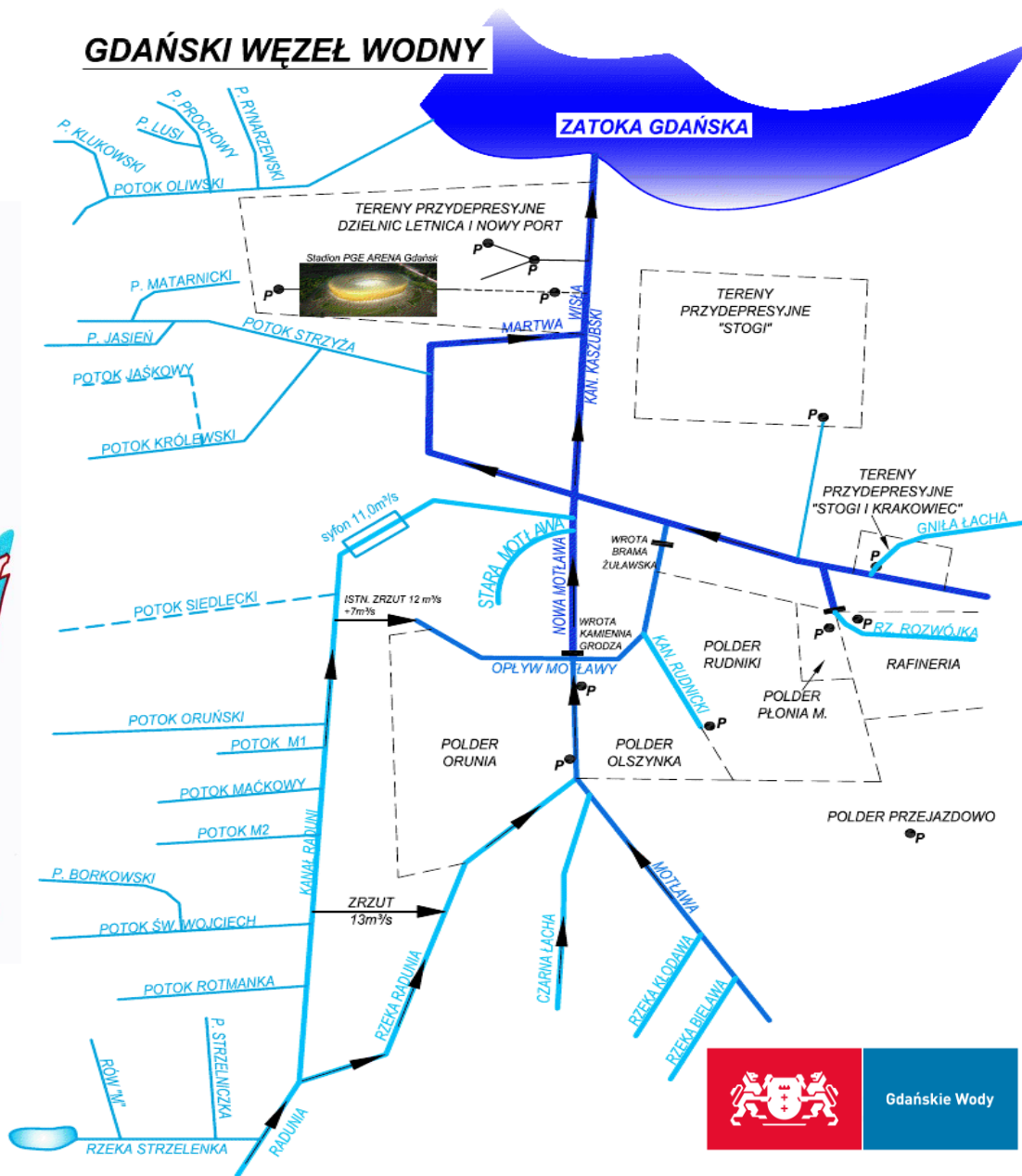
PLATFORM
BSR WATER

Composition of Gdansk drainage system

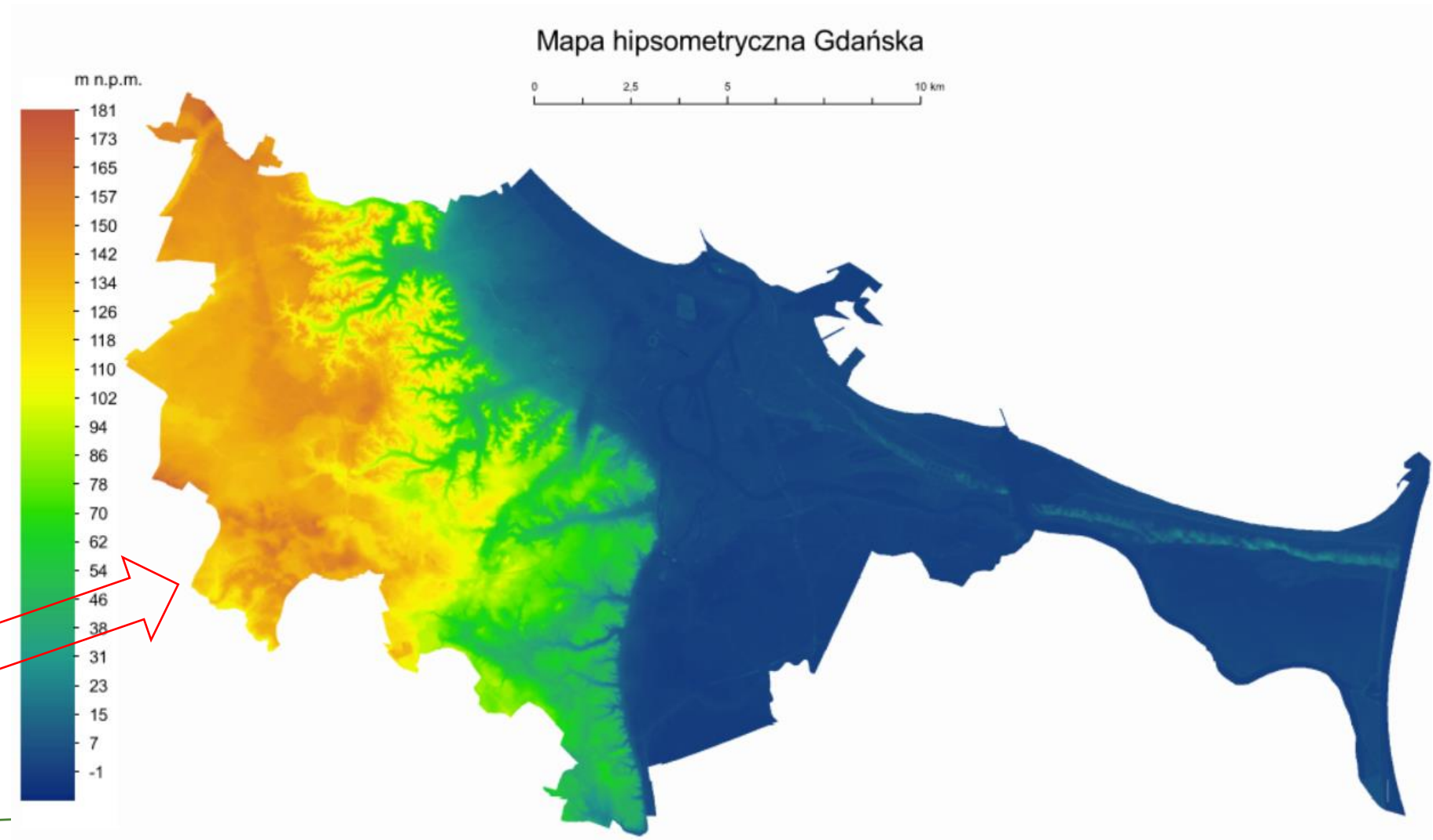
Streams	78 km
drainage channel – primary	63,8 km
Drainage channel- secondary	168 km
Retention reservoirs'	49 item/ 52
Structures on water units	1 099 item
Embankment	15,6 km
Pumping stations	24 item
Radunia's Channel	9,8 km

rainwater sewage system - collector	644 km
storm water drainage - drains	102 km
revision wells	22 076 item
street inlets	18 326 item
Sand trap	104 item
petroleum separators	151 item
drainage networks	9,8 km

GDANSK WATER NETWORK



Conditions of Gdańsk



GDANSK CONDITIONS



- 3 altitude zones: from depression to a plateau



- Big slope = large and fast outflows to the lower terrace of the city



- A dense network of erosion valleys of varying sizes



- Impact of the state of the sea on water receivers



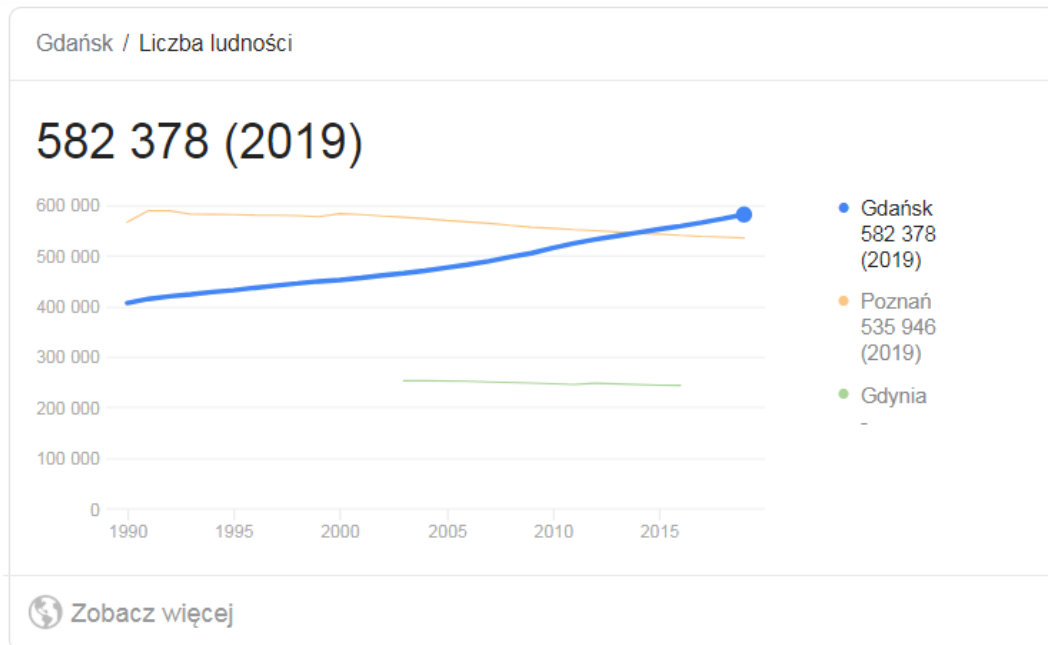
- Numerous mountain streams encountering barriers in the form of roads and railway



FLOOD HAZARDS IN GDAŃSK

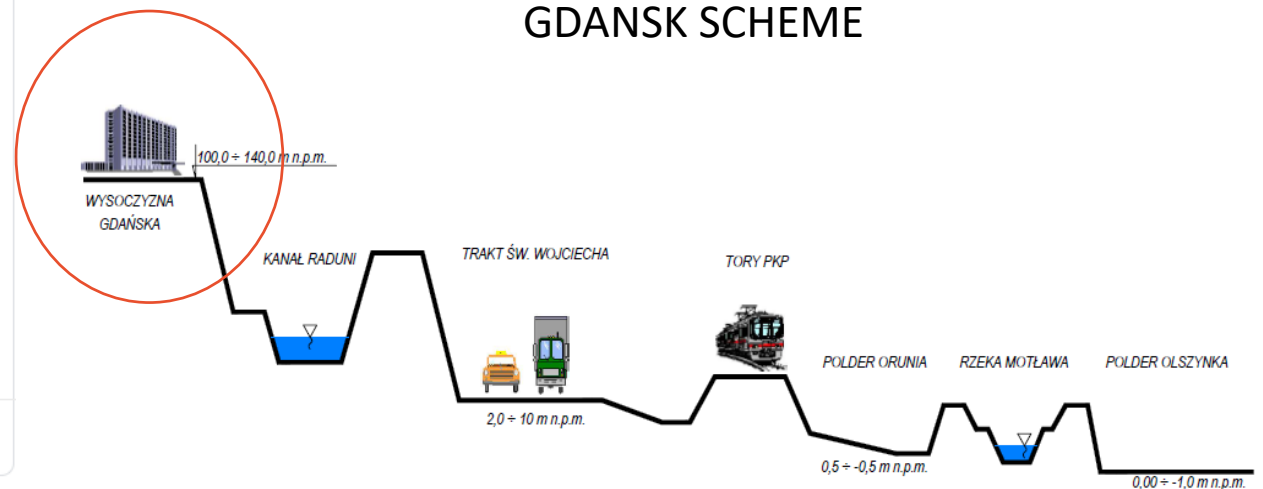


The increasing population forces the necessity of expansion on the upper terrace



Źródła: Europejski Urząd Statystyczny, Organizacja Narodów Zjednoczonych

Opinia



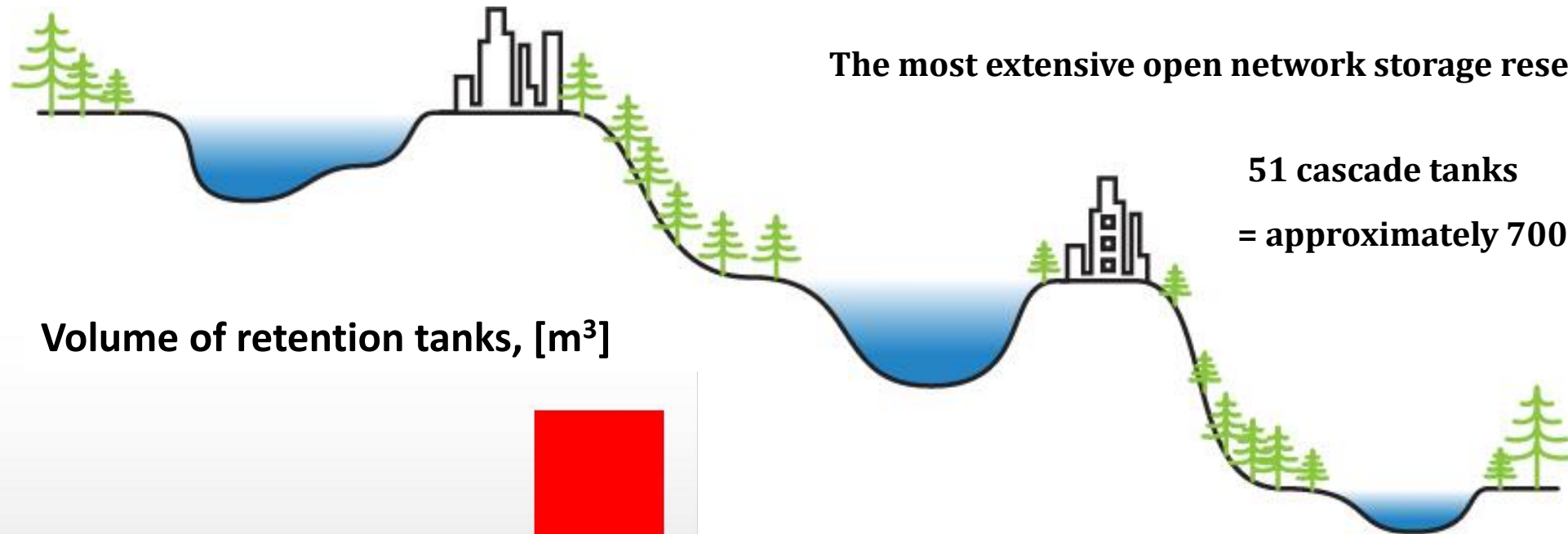
FLOODS



June 2001r.

June 2016r.

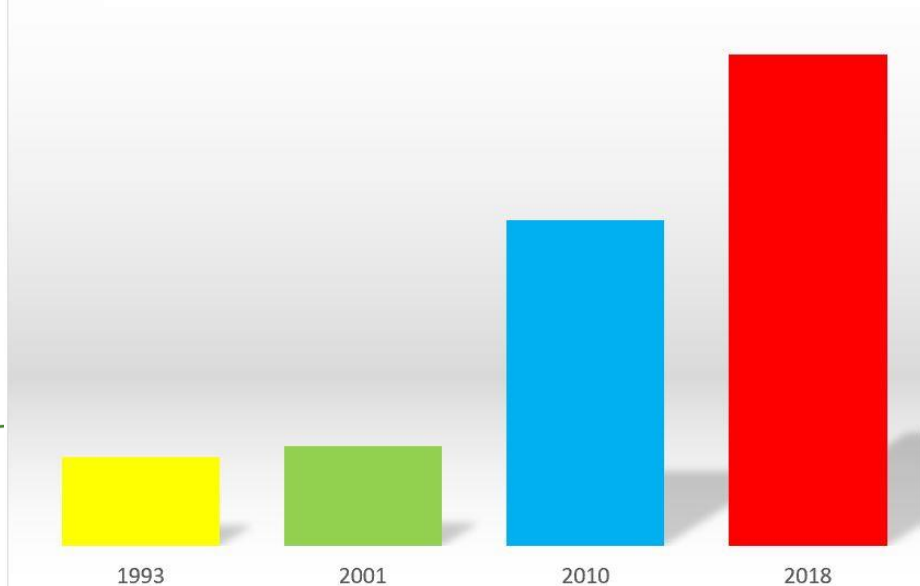
Retention reservoirs located on streams used to be basis of flood safety of Gdańsk



The most extensive open network storage reservoirs in Poland.

51 cascade tanks
= approximately 700,000 m³ of retention

Volume of retention tanks, [m³]



GOOD AND PROVEN SOLUTION IN THE CASE OF GDAŃSK



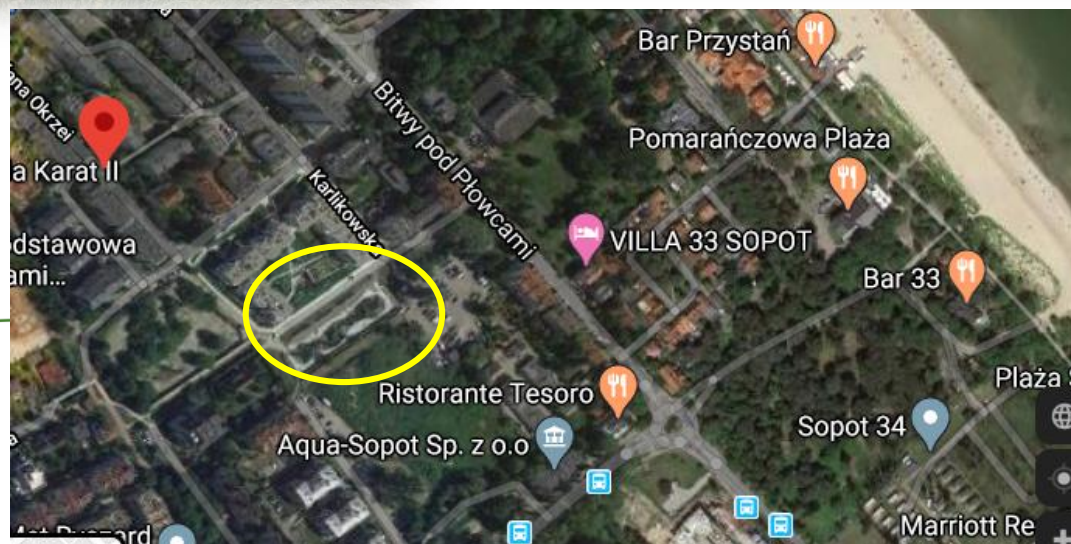
PLATFORM
BSR WATER



SMALL URBAN RETENTION - semi- wet reservoirs



SMALL URBAN RETENTION - dry reservoir , case study Sopot next to Gdańsk border



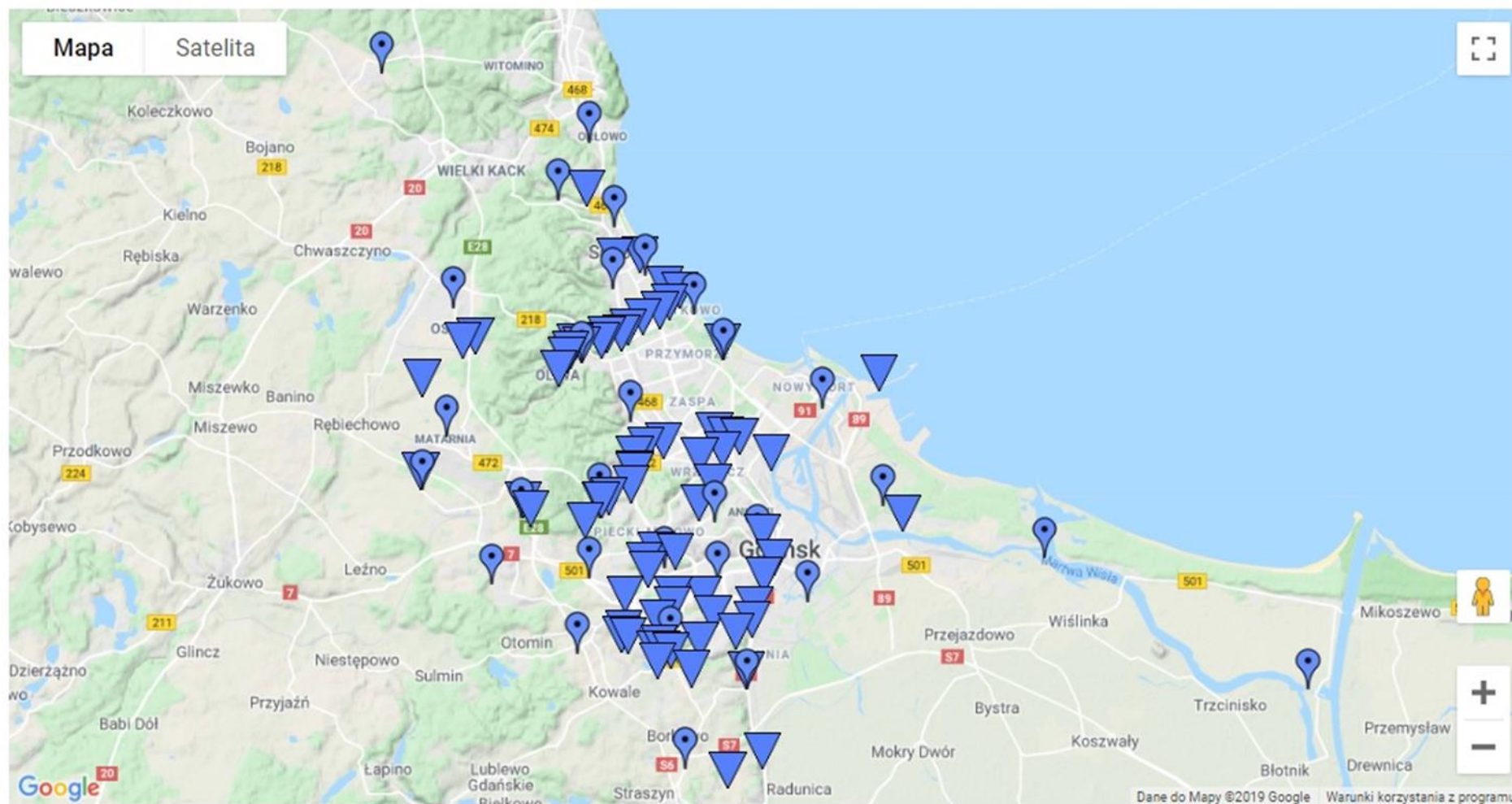
Stacje pomiarowe

Strona główna

Aktualności

Mapa - pomiary

Retencja miejska



**In June 2001
during 24h
up to 130
mm of
precipitation**

n



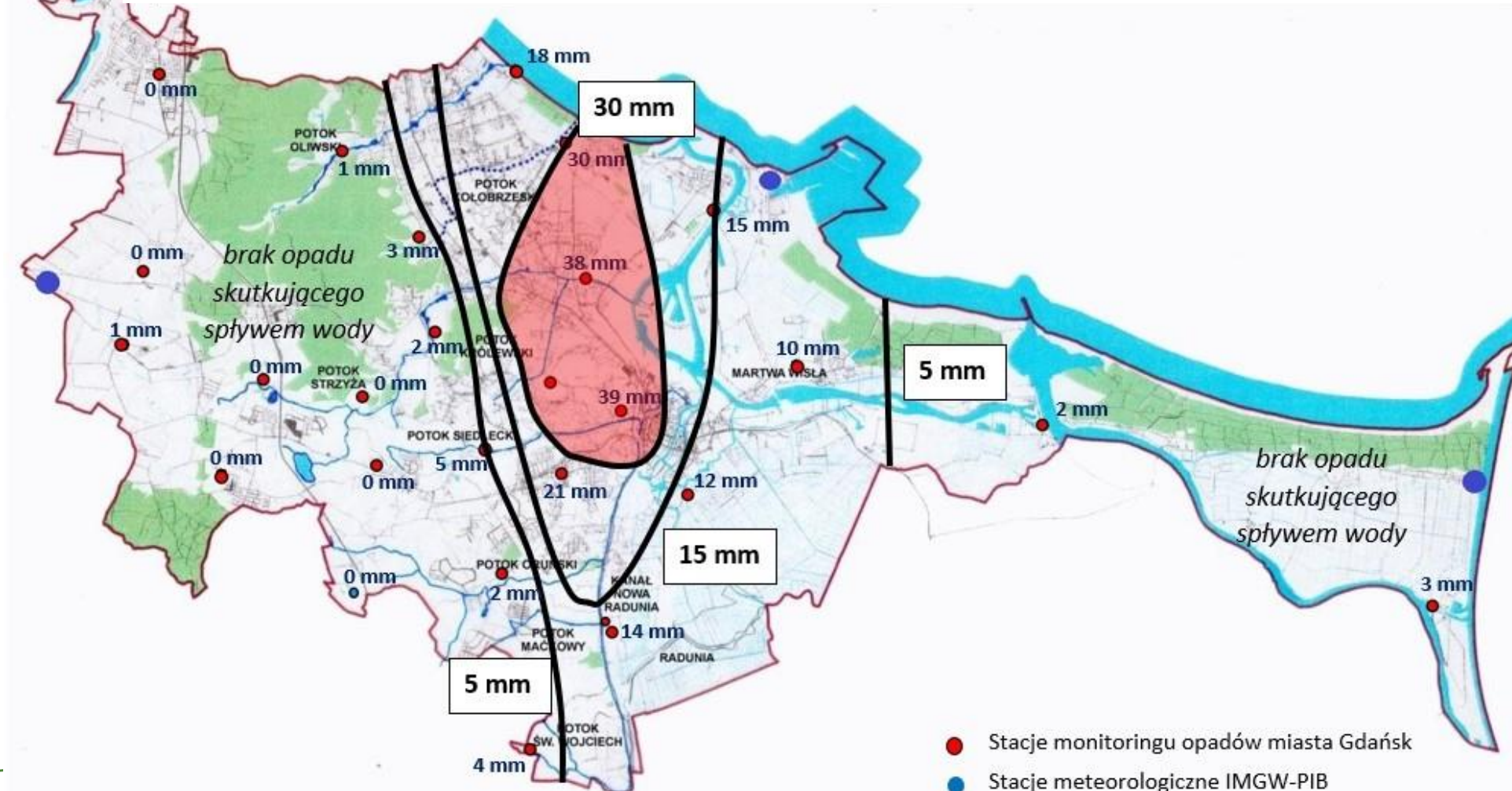
**14/15 of June
2016 during 14
h was 160 mm
of precipitation
which
corresponds to
a two-month**

rainfall

In XXI in Gdańsku:

- 4 events resulting from longer rainfall with sums exceeding daily 100 mm –over 100 years of rain**
- flash flood over 100-years np. 11 May 2018, 12 June 2018, 1 August 2018**

Rainfall Izohieta of May 11, 2018 with a duration of 30 min

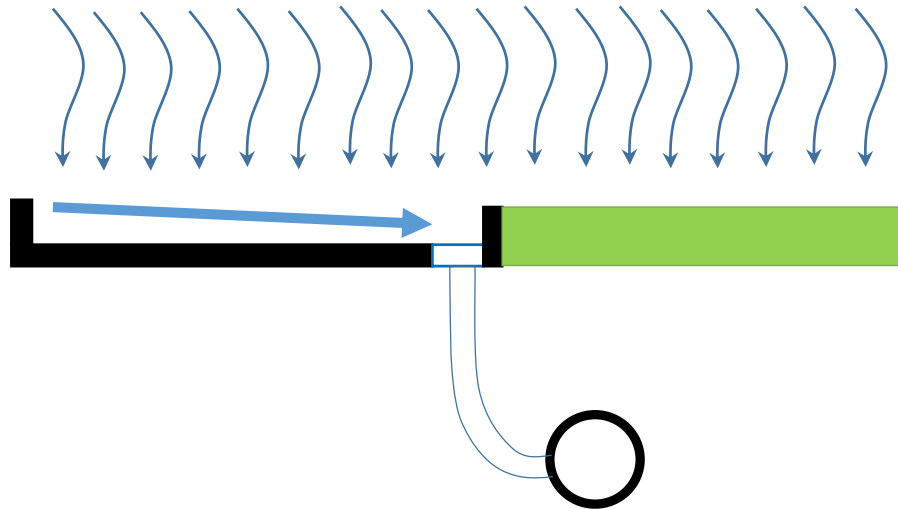


Change of approach since 2016

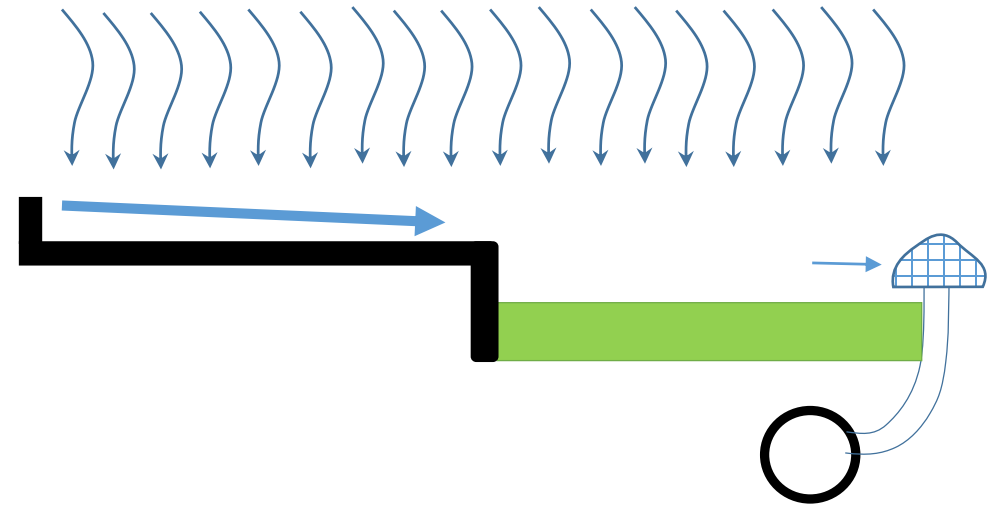


1. It is necessary to relieve the storm water drainage system
2. stop, delay the flow
3. use rainwater for green infrastructure watering
4. treat the rain water to keep the quality if necessary

PREVIOUS APPROACH – end of pipe devices



CURRENT APPROACH – before pipe devices



STORM WATER URBAN SURFACE RETENTION SYSTEM APPROACH BY GDAŃSKIE WODY

GREEN

INFRASTRUCTURE



URBAN
GREENERY

STREET
RETENTION

HOUSES
RETENTION



FIELD
RETENTION

RESERVOIR
RETENTION



STORM
WATER

LEADERSHIP BY EXAMPLE

20

KACZEŃCE St BASE of Gdańskie Wody - THE FIRST GDAŃSK'S RAIN GARDEN, 2017

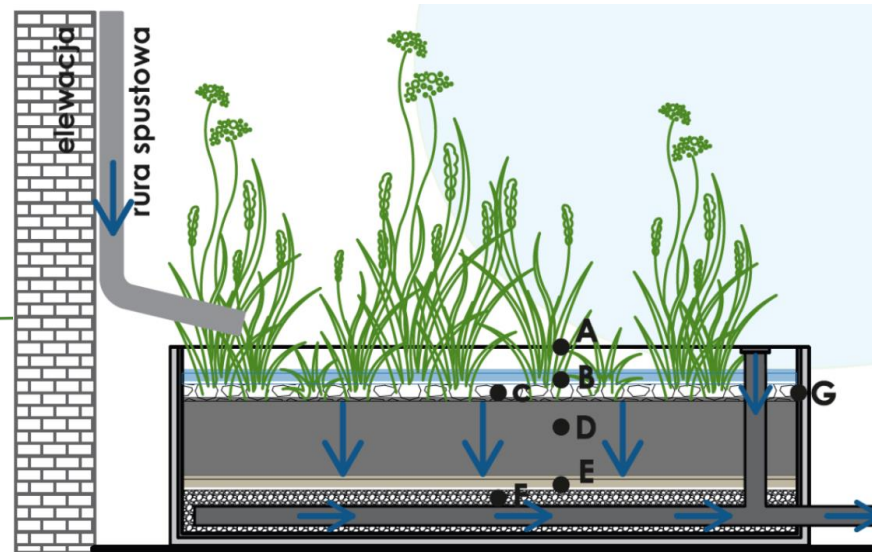
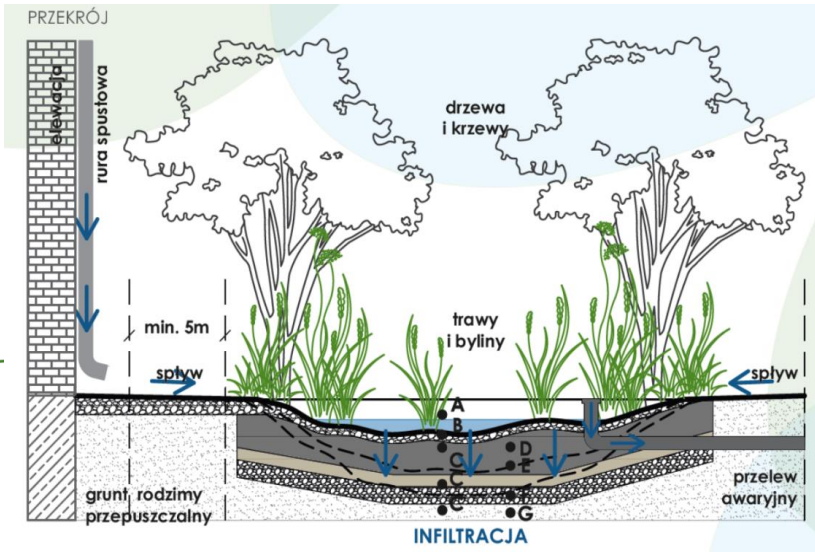
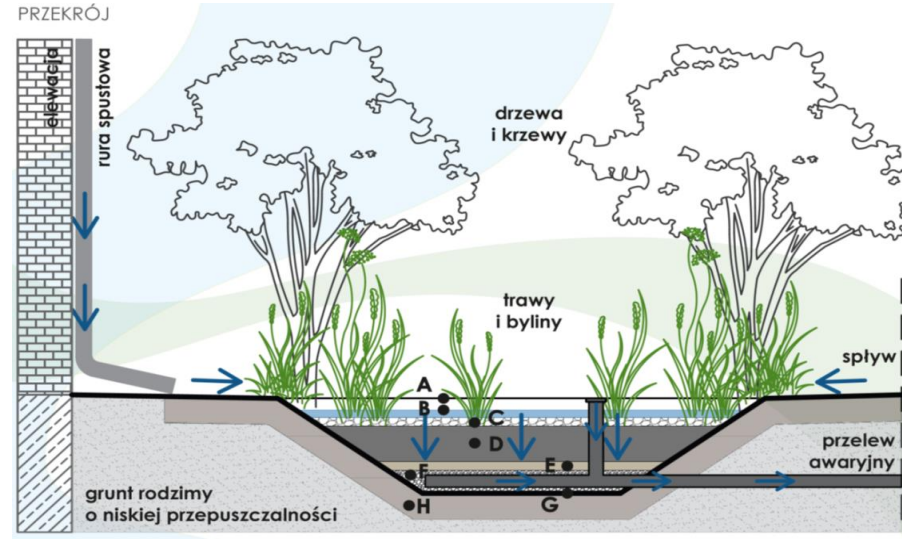




RAIN GARDEN IN 5 STEPS



Gdańskie Wody

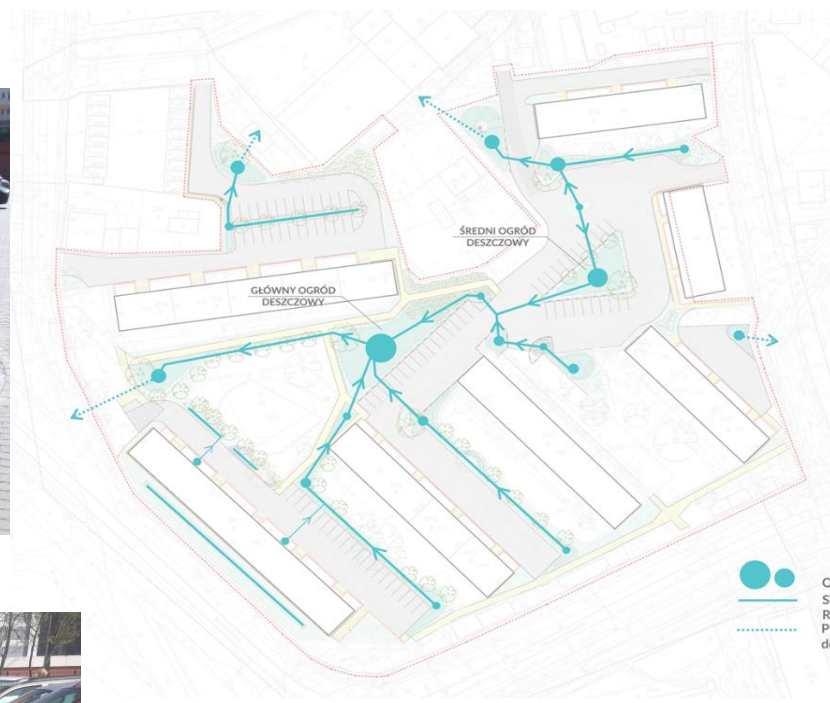


PLATFORM
BSR WATER

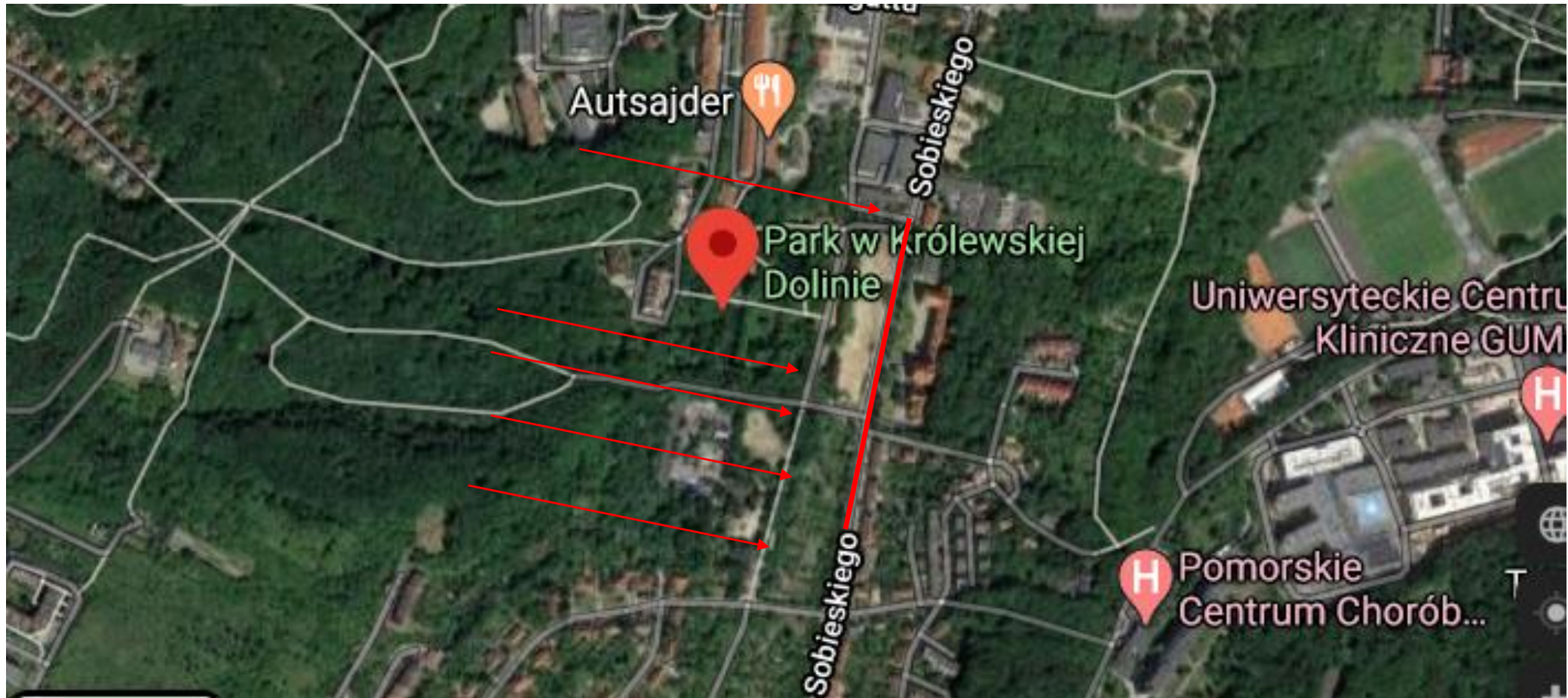
PROMOTION OF RAIN GARDENS DURING THE DOMINICAN FAIR 2019



System of rain gardens on 1.6 ha in st.Stryjewski, Wrzosa and Skiba- most likely the bigger in Europe

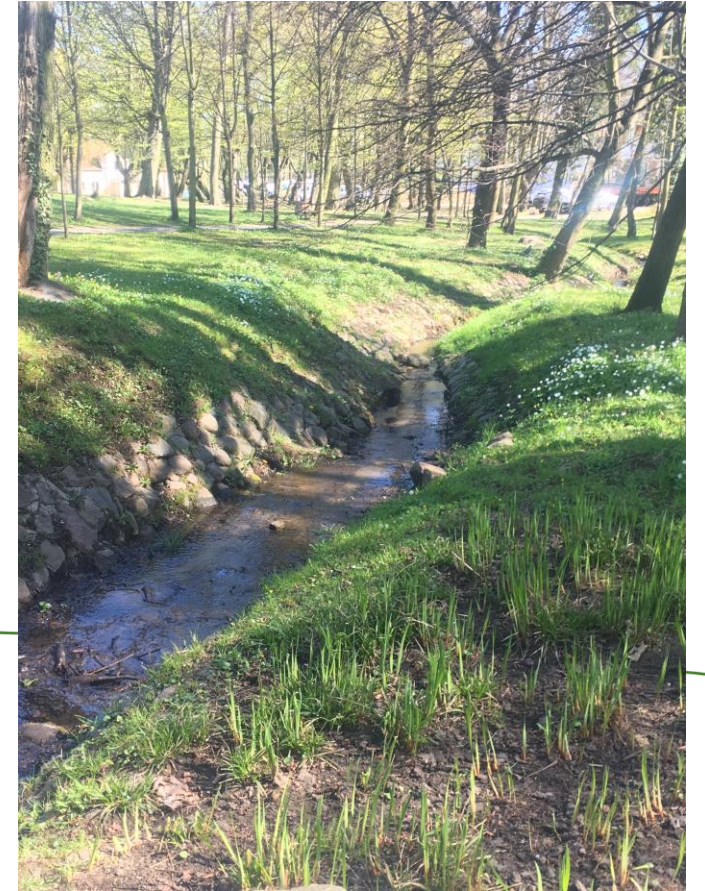


Case study Park in King Valley, King's Stream



CASCADE PONDS ON KING'S STREAM

26



PROTECTION OF SŁOWACKI ST.

27

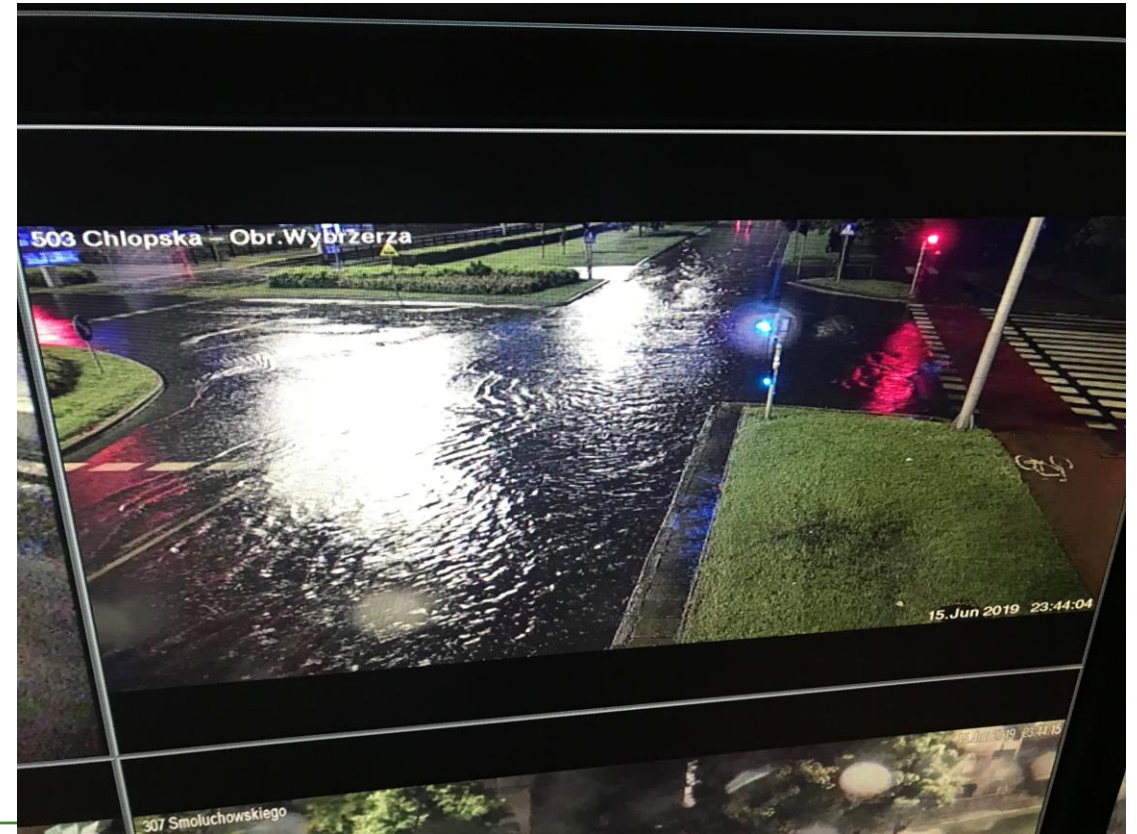


STORM WATER URBAN SURFACE RETENTION SYSTEM DEVELOPMENT IN GDAŃSK, 2019



STREET AND ROAD DESIGN IS STILL A PROBLEM

Gdańsk, street Peasant / Rot. Wybrzeże, 15/06/2019 at 23.44 III degree heavy rain, Gdańsk Brzeźno Station 21.7 mm in 30 mi



CONCLUSIONS

Retention reservoirs located on streams have been proven solution as a basis of flood safety of Gdańsk but not enough due to development of the city and climate change thus :

1.The approach to storm water management in the road and streets must be changed – green infrastructure should use to retain and delay the effective outflow of storm water

2.The maximum use of green infrastructure like rain gardens, green roof, grassy troughs for rainwater retention.

3. Rainwater should be treated as a valuable resource and used for irrigation of green areas

QUOTATION

Efficient storm water urban surface retention system (SWUSRS) must provide retention in many dimensions, in which all retention levels are equally important and complementary to one another.

Such multi-level retention should provide as many ecosystem services as possible and create sustainable environment for human activities.

Magdalena GAJEWSKA,

Coordinator of the EcoTech Center

Gdansk University of Technology

Faculty of Civil And Environmental Engineering

Department Water and Waste-Water Technology

Phone: +48 508 084

e-mail:mgaj@pg.edu.pl

Chair of IWA Scientific Group

„ Treatment wetlands for water pollution control”

2016-2020



EUROPEAN UNION

EUROPEAN
REGIONAL
DEVELOPMENT
FUND

