

‘nature-based’ blue-green-grey infrastructure solutions

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Global Water Leader

MILLENNIUM PARK CHICAGO

The Nature
Conservancy



ARUP



outline

context

blue + green + grey methodology

global examples

case study 1 New York City

case study 2 Rainscape Wales

conclusions

CENTRAL PARK NEW YORK

context | start with grey

*Pumps, pipes, concrete still have
a role to play*

MANCHESTER, FROM KERSAL MOOR EDWARD
GOODALL (1795-1870), AFTER A PAINTING BY W. WYLDE.

SHIBUYA, TOKYO

“by 2050, 70% of
people will live in
cities”



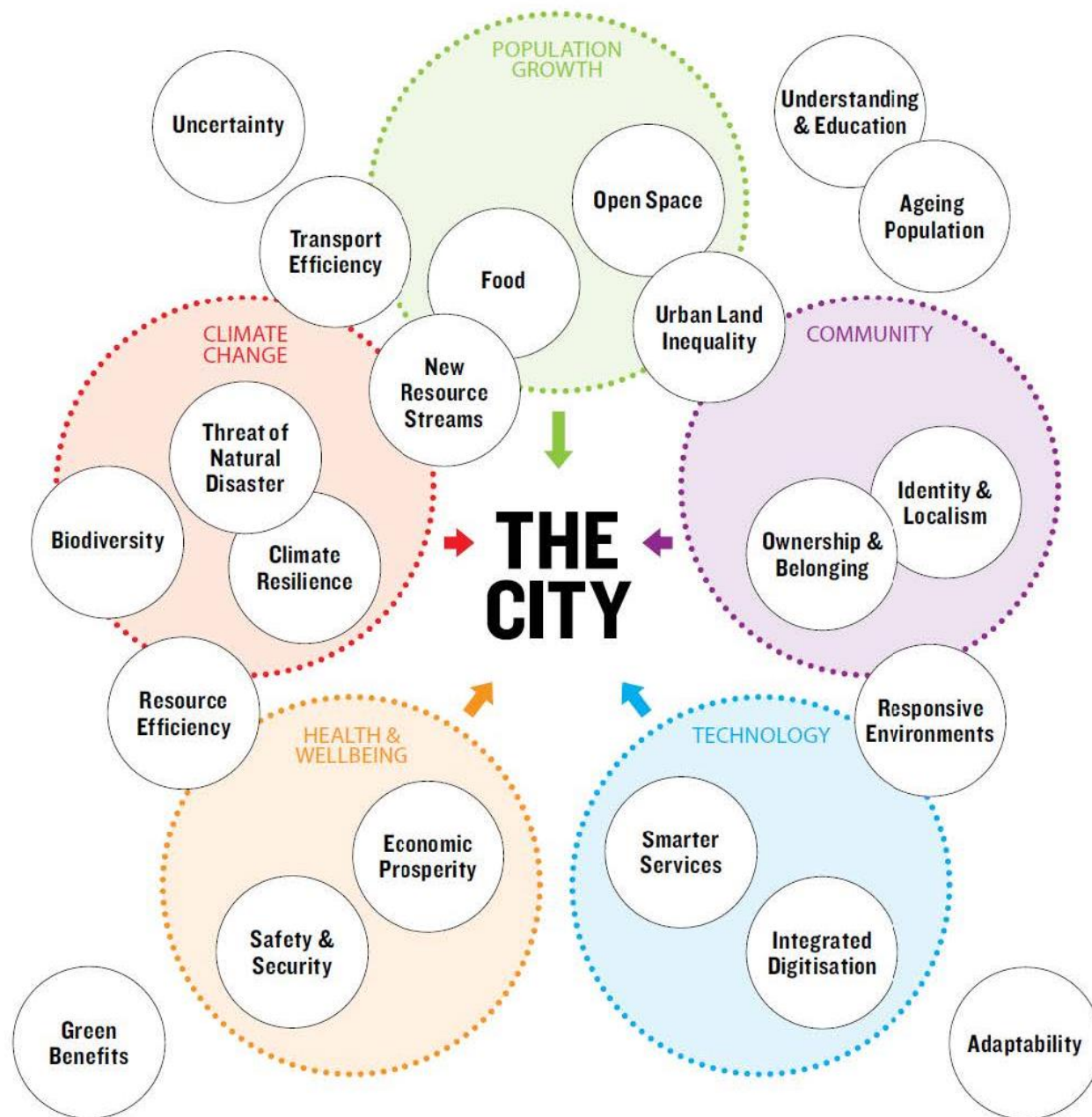
* UNITED NATIONS – WORLD URBANISATION PROSPECTS (2010)

BANGKOK 2011

© SHUTTERCOCK



“climate change is costing the world more than \$1.2 trillion annually”



CITY CHALLENGES



blue + green + grey
methodology

‘nature-based’

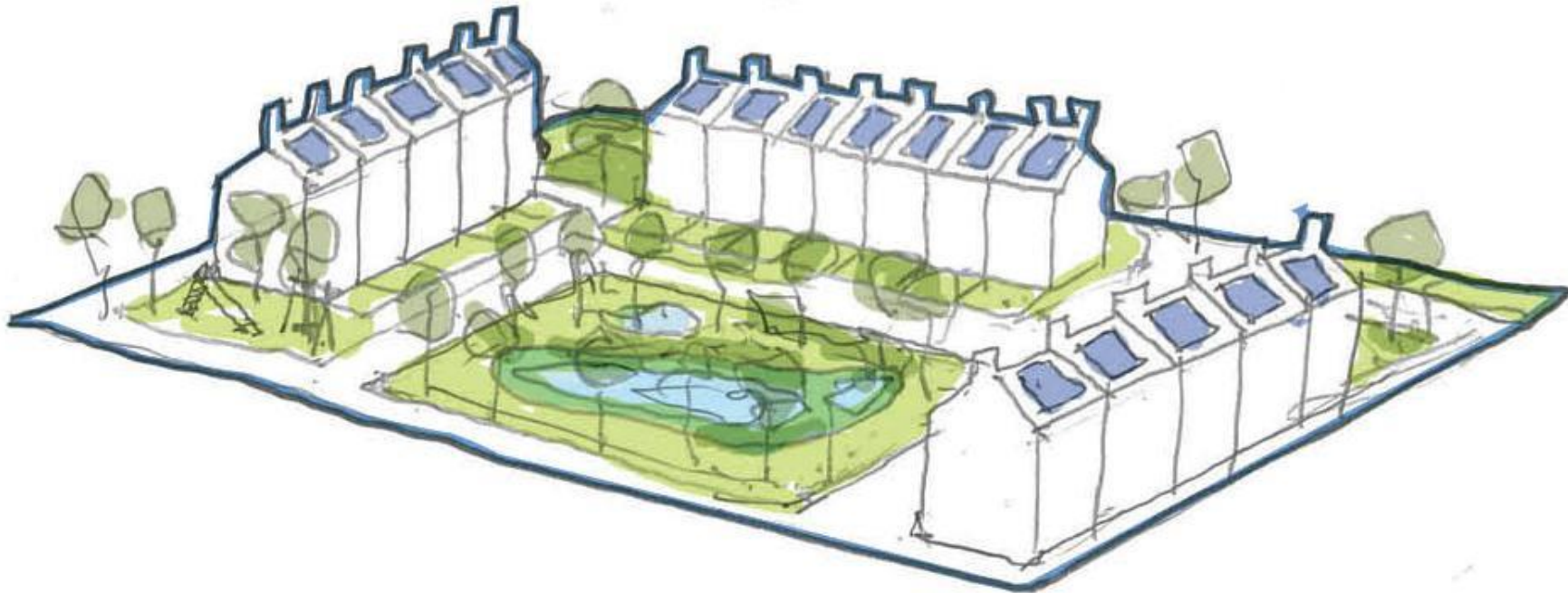
retrofit existing cities
masterplan new cities

WETLAND & WILDFOWL CENTRE, LONDON

green thinking

- ☺ Work with nature-based thinking across the water cycle
- ☺ Use green + blue space – create, expand, adapt
- ☺ Capture, store, treat and release
- ☺ Cools, attenuates, provides amenity and recreation and improves landscape
- ☺ Design places using vegetation
- ☺ Natural/semi-natural: bush, tree, copse, wood, forest, meadow, wetland
- ☺ Man-made: green roof, planter, flowerbed, park, field, footpath, hedgerow

Eg encourage
Urban Forest

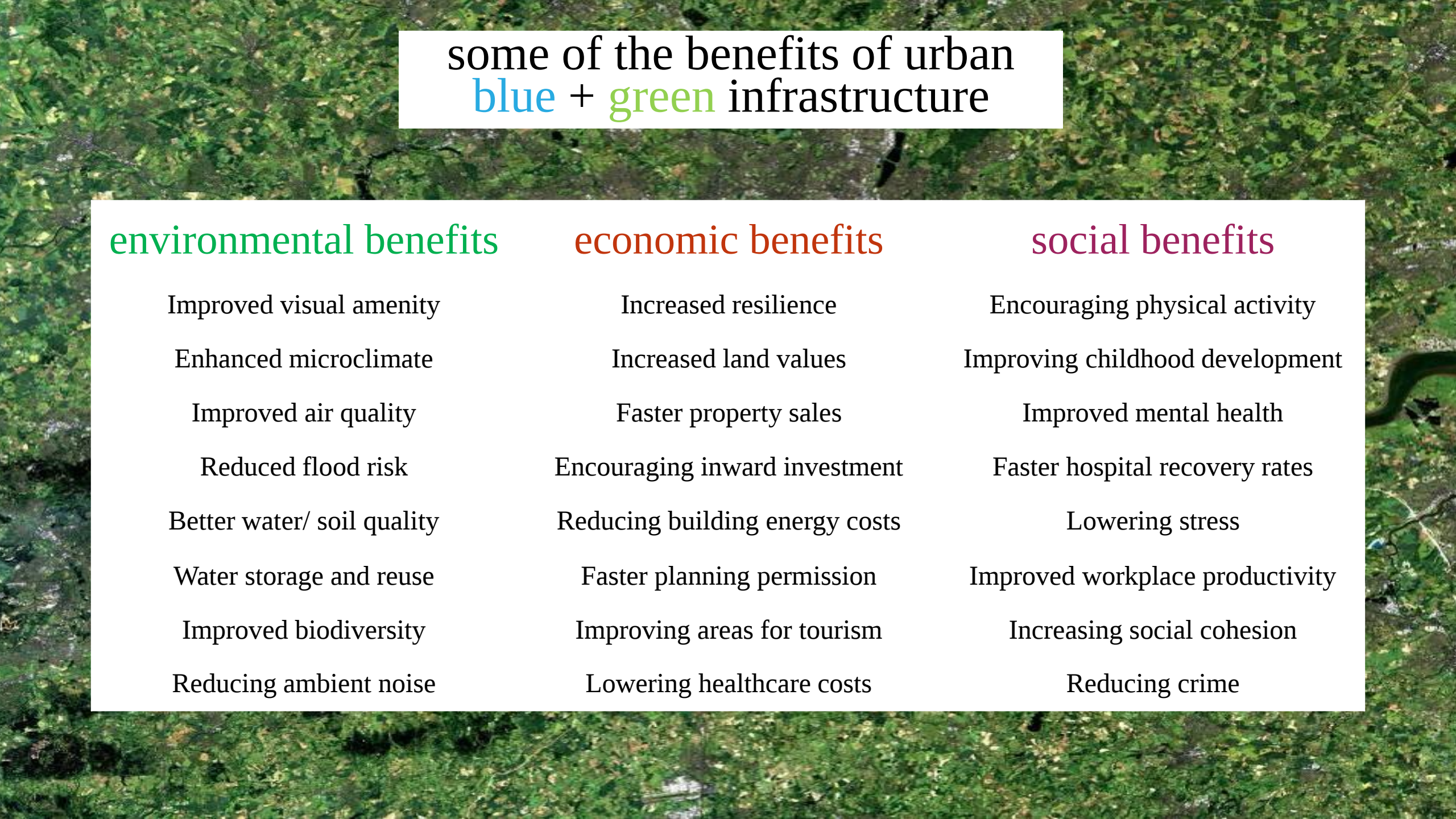


blue thinking

- ☺ Work with **nature-based thinking** across the **water cycle**
- ☺ Use **green** + **blue** space – create, expand, adapt
- ☺ Capture, store, treat and release.... and provide continuity across the **water cycle**
- ☺ Design places to use **water** practically and creatively
- ☺ Provides amenity and recreation benefits
- ☺ Natural/semi-natural: **puddles, pools, ponds, lakes, streams** and **rivers**
- ☺ Man-made: **Taps, toilets, reservoirs, canals, swales, fountains, ditches** and **drains**

Eg de-culvert Urban
Watercourses





some of the benefits of urban blue + green infrastructure

environmental benefits

- Improved visual amenity
- Enhanced microclimate
- Improved air quality
- Reduced flood risk
- Better water/ soil quality
- Water storage and reuse
- Improved biodiversity
- Reducing ambient noise

economic benefits

- Increased resilience
- Increased land values
- Faster property sales
- Encouraging inward investment
- Reducing building energy costs
- Faster planning permission
- Improving areas for tourism
- Lowering healthcare costs

social benefits

- Encouraging physical activity
- Improving childhood development
- Improved mental health
- Faster hospital recovery rates
- Lowering stress
- Improved workplace productivity
- Increasing social cohesion
- Reducing crime



*'PEOPLE IN GREENER
AREAS REPORTED
LOWER LEVELS OF
STRESS AND HIGHER
DEGREES OF LIFE
SATISFACTION'

“contact with nature lowers stress
levels and improves life satisfaction”

EXETER UNIVERSITY HEALTH RESEARCH – 5,000
HOUSEHOLDS OVER 17 YEARS



‘GREEN+ BLUE STREETS
CAN CUT POLLUTION BY
30%’

“urban blue + green streets cut
pollution & clean the environment”

PUGH T, MACKENZIE A, WYATT J, HEWITT C, 'EFFECTS OF GREEN
INFRASTRUCTURE FOR IMPROVEMENT OF AIR QUALITY IN URBAN
STREET CANYONS – ENVIRONMENT, SCIENCE + TECHNOLOGY (2012)





*RESIDENTS IN GREEN
ENVIRONMENTS WERE
3.3 TIMES MORE LIKELY
TO TAKE FREQUENT
PHYSICAL EXERCISE*

FORESTRY COMMISSION UK (2010) 'THE CASE FOR TREES IN
DEVELOPMENT AND THE URBAN ENVIRONMENT'

“a green + blue environment
stimulates better physical health”



'URBAN GREEN CAN
SLOW DOWN & REDUCE
STORM WATER RUNOFF
BY UP TO 8%'

“urban **wetland** and permeable
surfaces provide **flood** resilience”

HERRERA ENVIRONMENTAL CONSULTANTS (2008) 'THE EFFECTS' OF
TREES ON STORM WATER RUNOFF

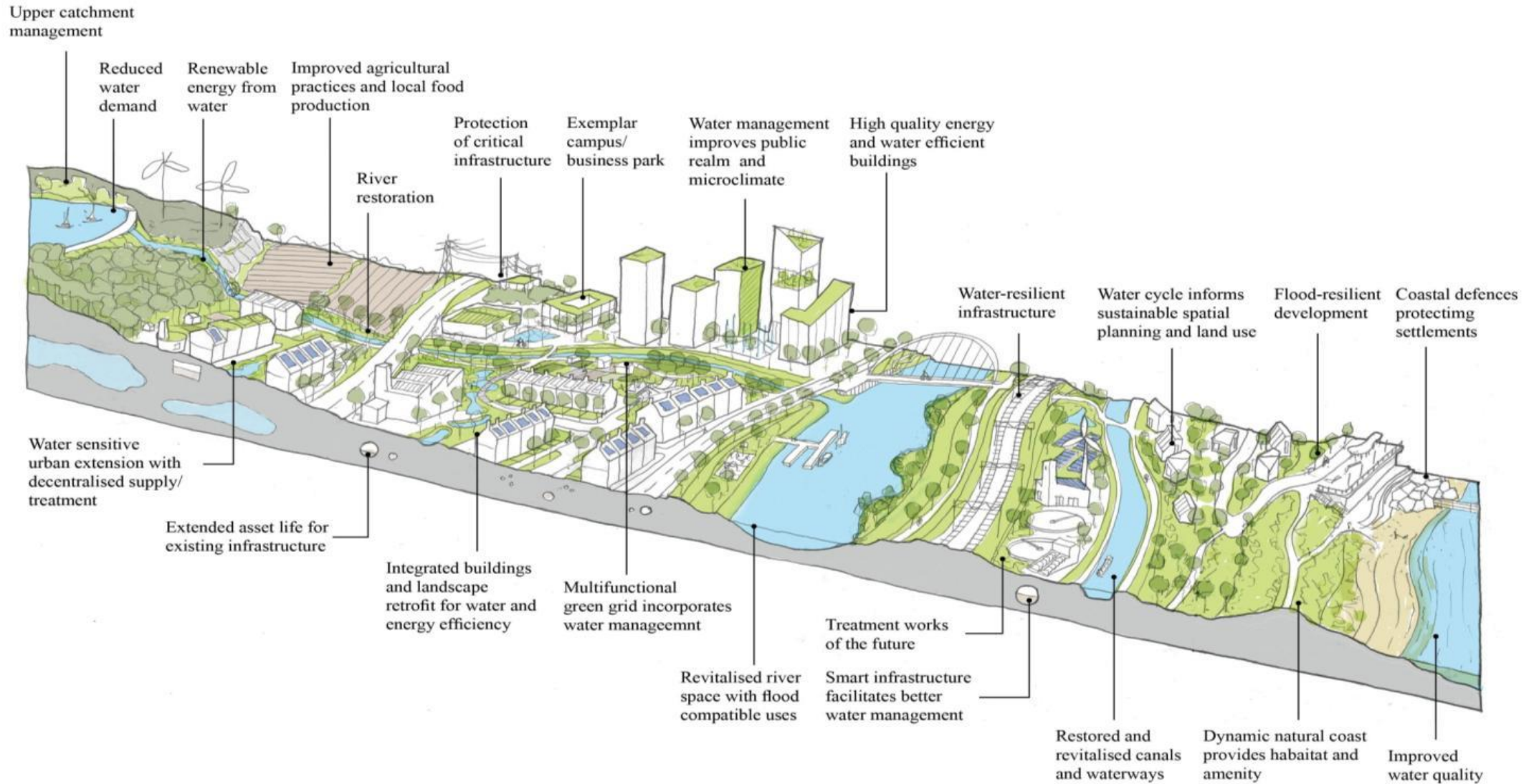


'SURFACE TEMPERATURE
REDUCED BY 13° C
UNDER A MATURE TREE
CANOPY'

“urban blue + green creates better
microclimates, cooling and shade”

THOMAS AM, PUGH A, MACKENZIE R, WHYATT JD, (2012)
'EFFECTIVENESS OF GREEN INFRASTRUCTURE'
(LANCASTER ENVIRONMENT CENTRE)

blue + green thinking helping to create liveable cities



blue + green + grey thinking “nature-based” methodology

Project Identification

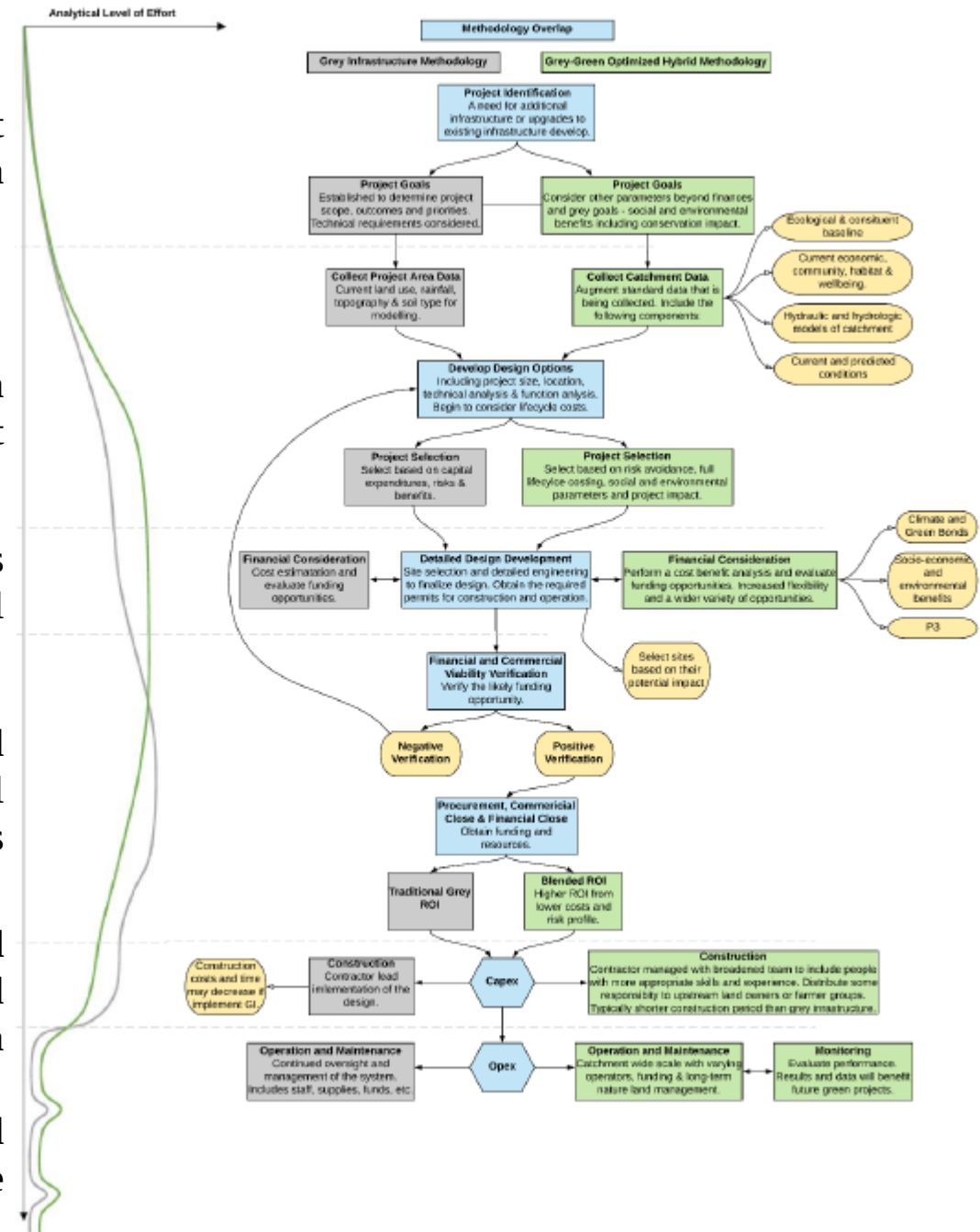
Design Development

Options Appraisal

Financial and Commercial Analysis

Detailed Design and Construction

Operations and Maintenance

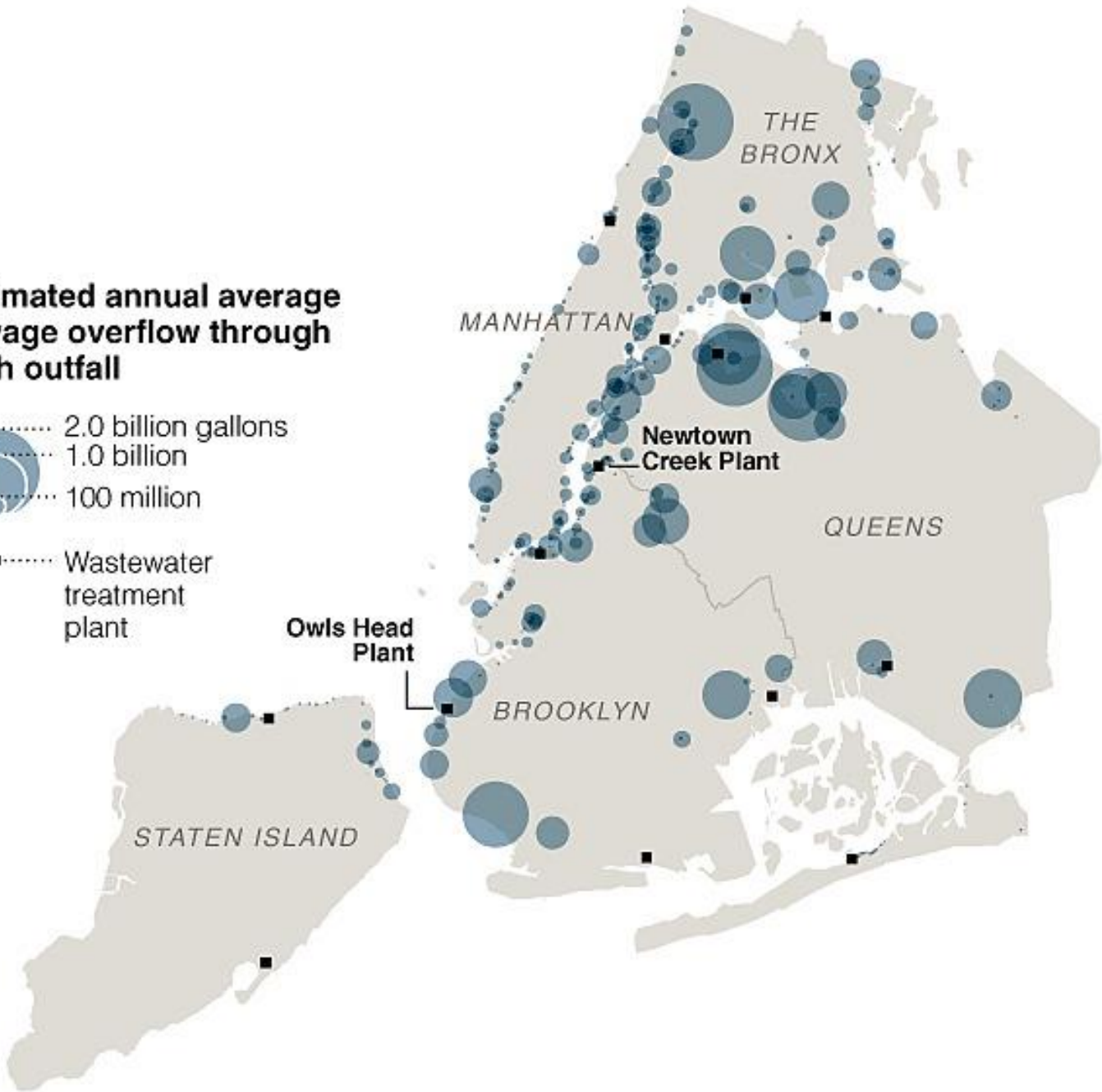


New York City | addressing water quality in New York City

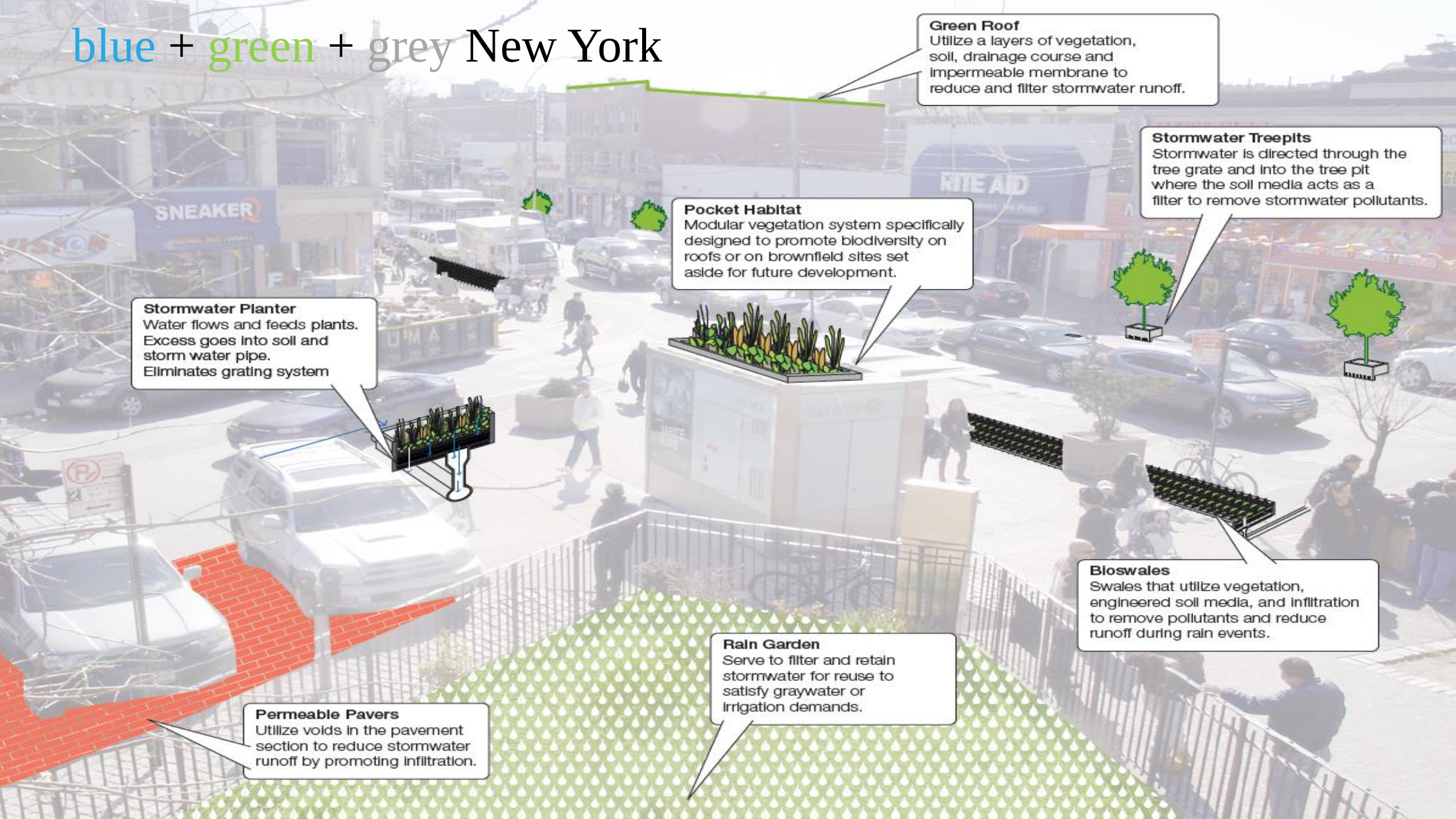
Estimated annual average sewage overflow through each outfall



Wastewater treatment plant



blue + green + grey New York



Green Roof
Utilize a layers of vegetation, soil, drainage course and impermeable membrane to reduce and filter stormwater runoff.

Stormwater Treepits
Stormwater is directed through the tree grate and into the tree pit where the soil media acts as a filter to remove stormwater pollutants.

Pocket Habitat
Modular vegetation system specifically designed to promote biodiversity on roofs or on brownfield sites set aside for future development.

Stormwater Planter
Water flows and feeds plants. Excess goes into soil and storm water pipe. Eliminates grating system

Bioswales
Swales that utilize vegetation, engineered soil media, and infiltration to remove pollutants and reduce runoff during rain events.

Rain Garden
Serve to filter and retain stormwater for reuse to satisfy graywater or irrigation demands.

Permeable Pavers
Utilize voids in the pavement section to reduce stormwater runoff by promoting infiltration.



blue + green neighbourhood in
Hunter's Point South, New York



3

rows of Bioswales
on 51st Ave

92

enhanced tree pits

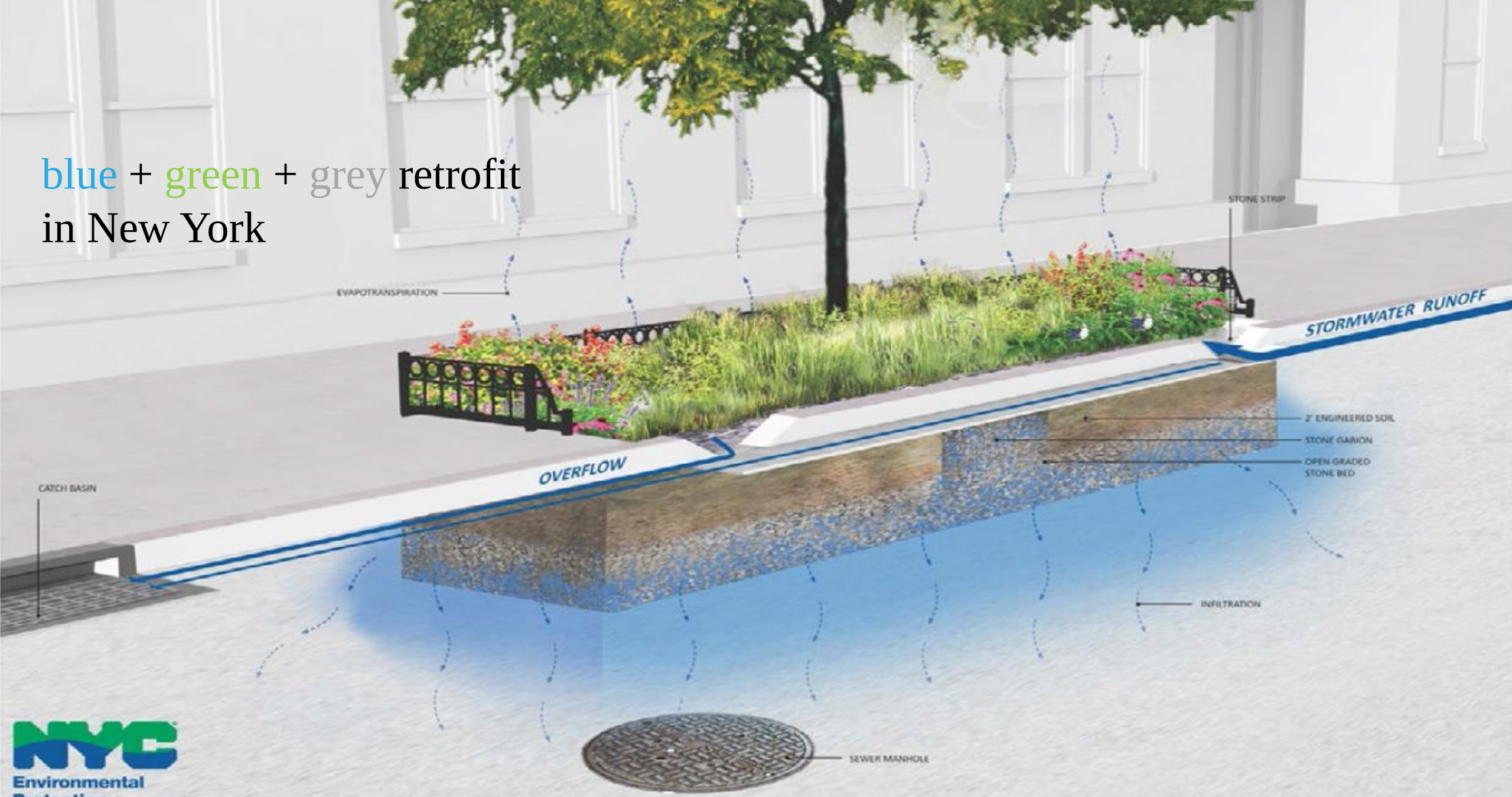
33%

of sidewalks are
porous pavement

3,400

linear feet new roads,
water and sewer

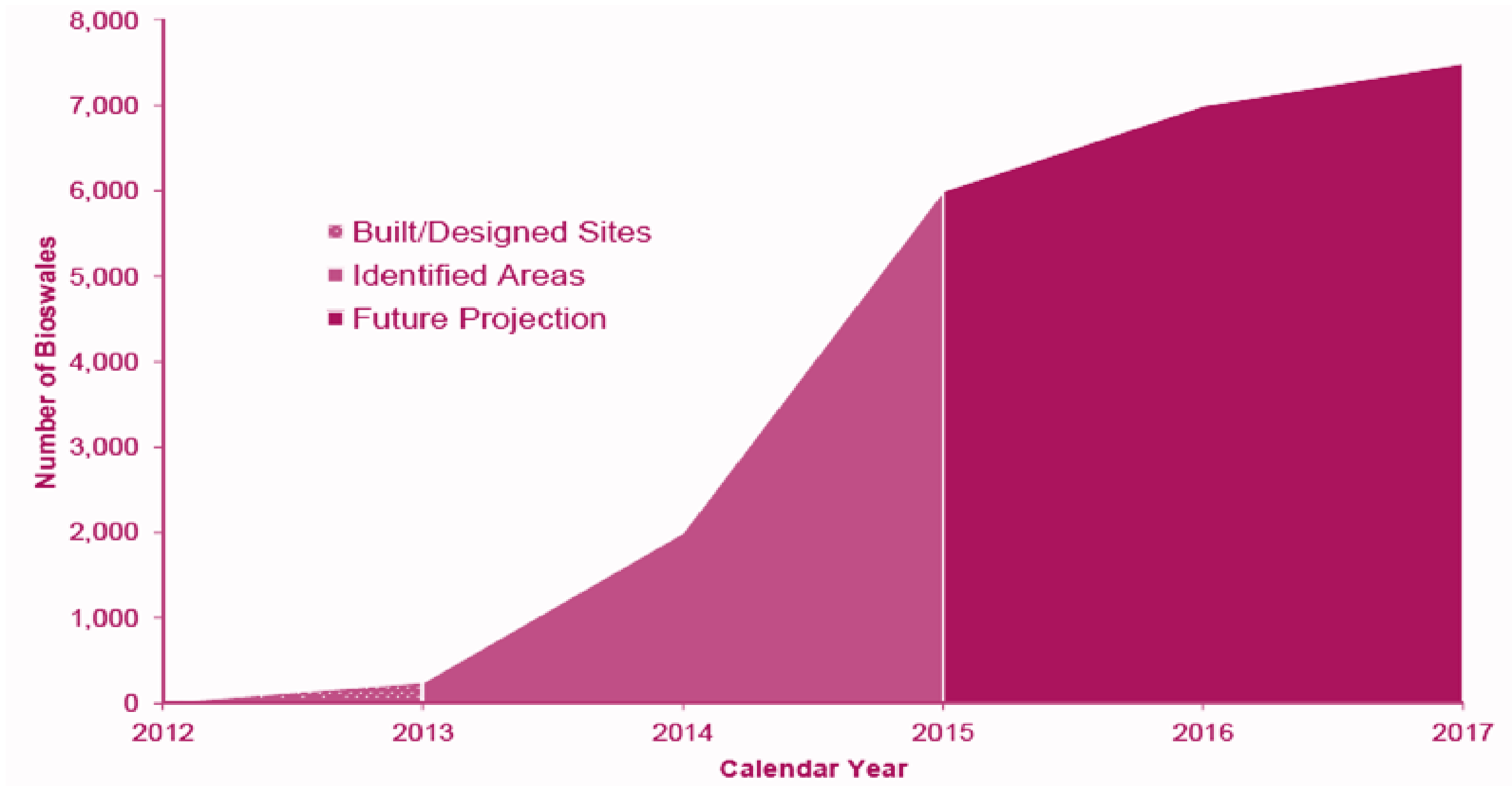
blue + green + grey retrofit
in New York





blue + green + grey
retrofit in New York

blue + green + grey retrofit New York

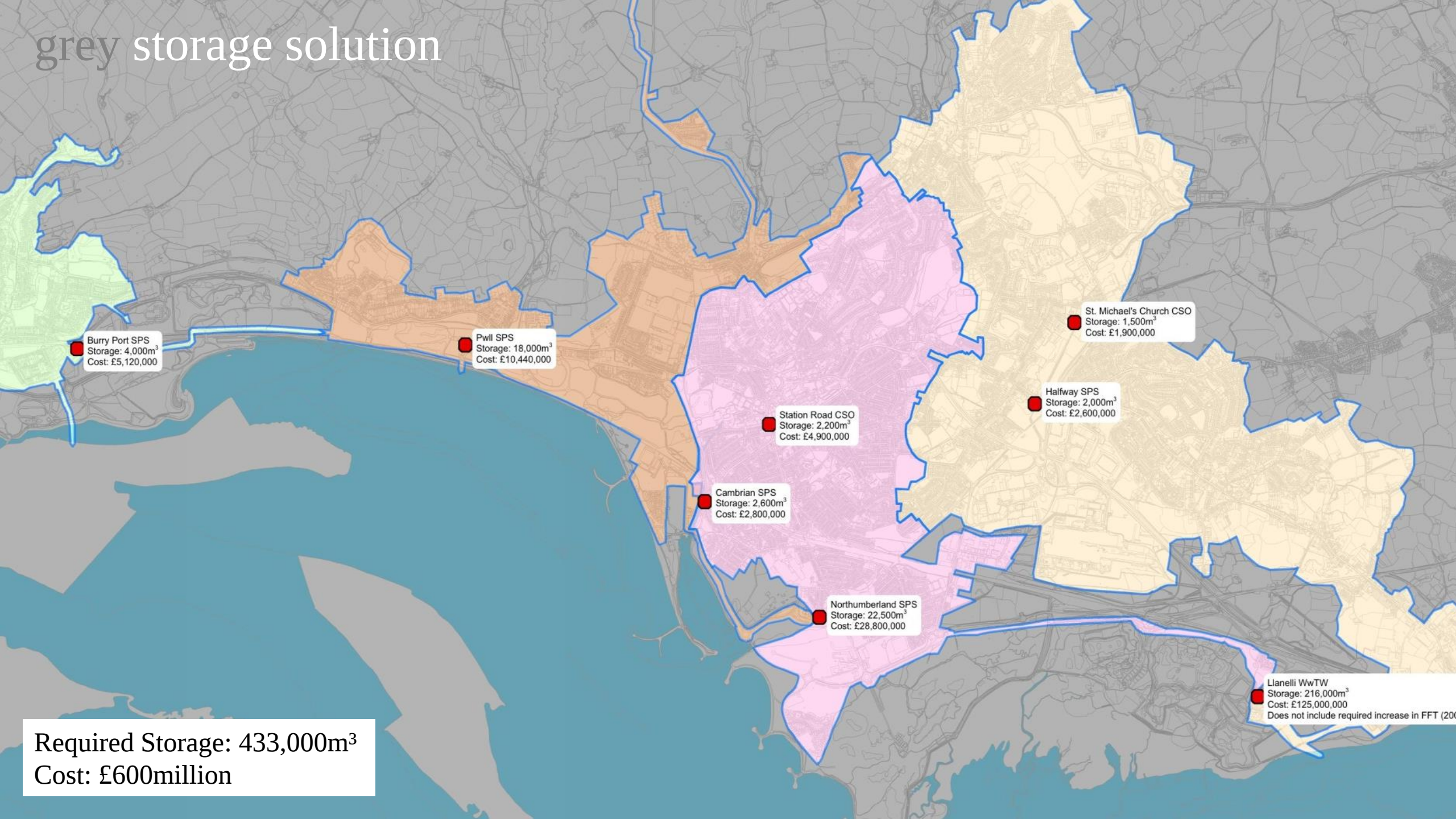


RainScape Wales | protecting shellfish waters from sewage pollution in Wales

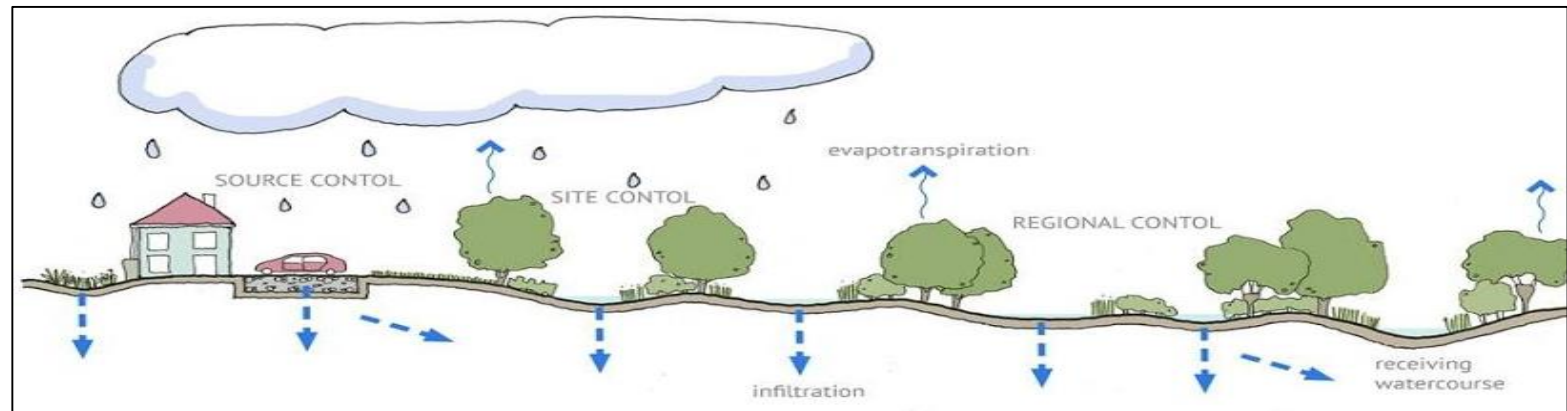
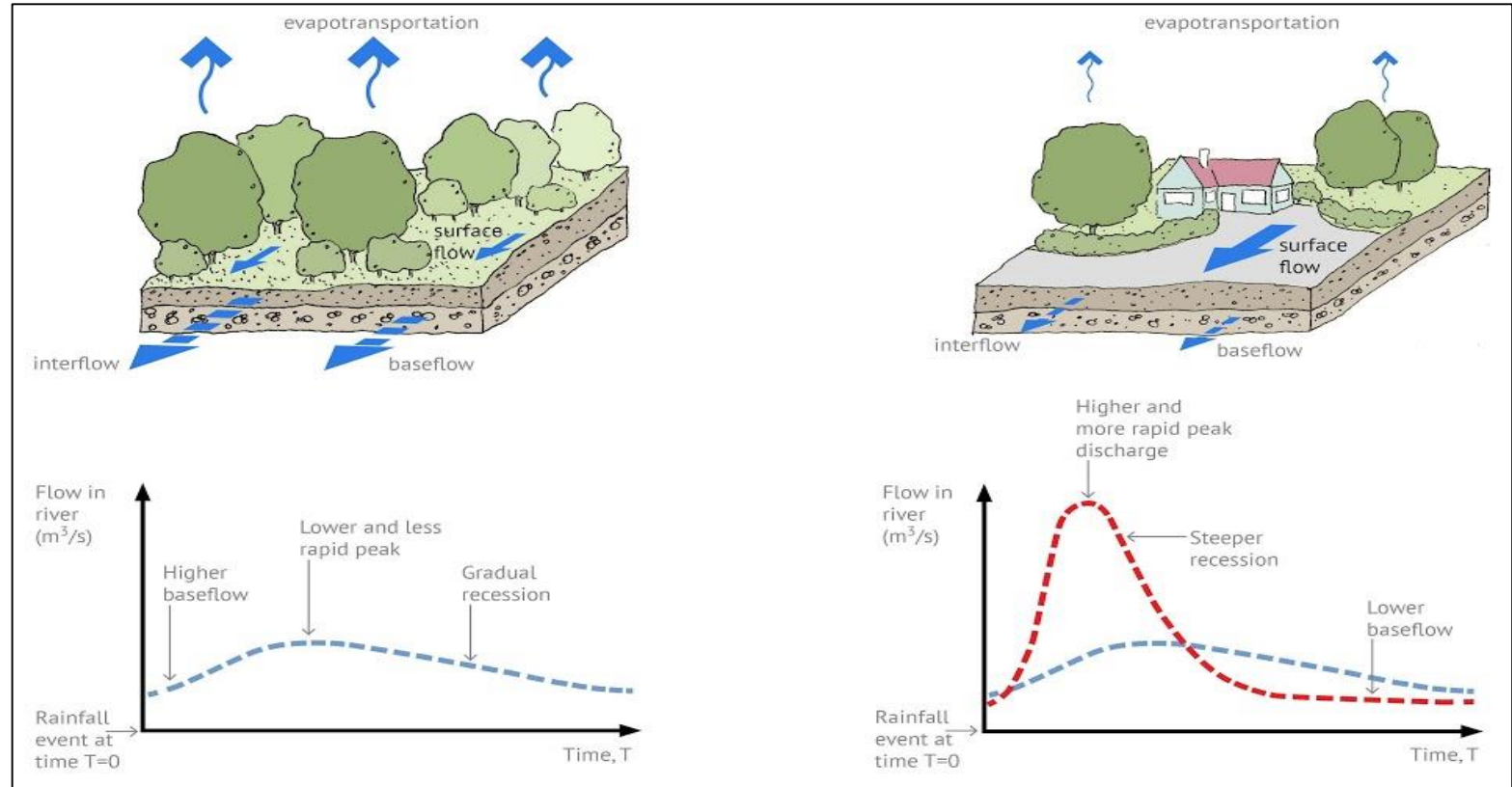


*“DCWW firm to be sentenced for estuary
sewage pollution”*
Evening Post

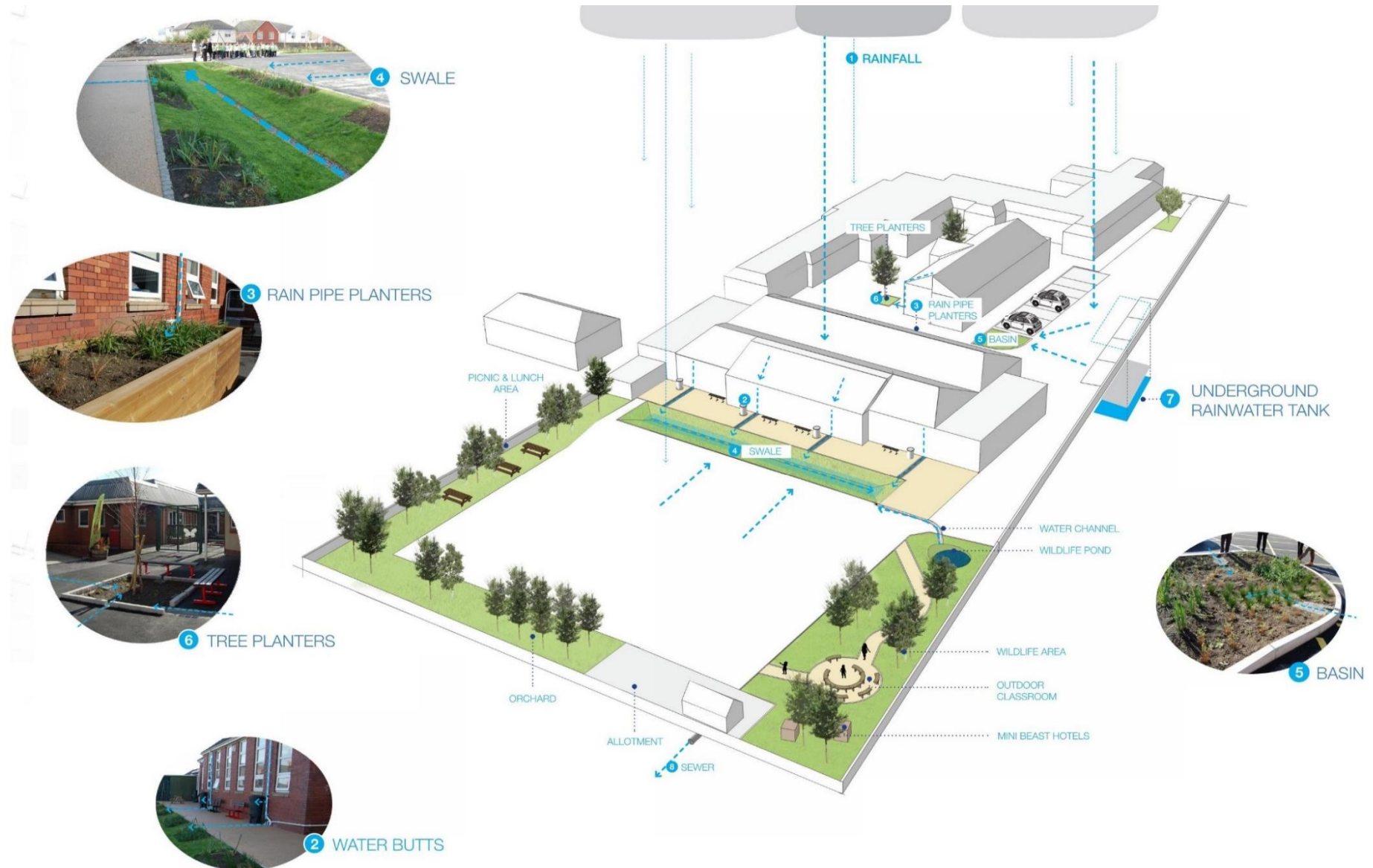
grey storage solution



blue + green solutions



blue + green retrofit solutions in schools





Before

blue + green + grey retrofit swale in schools



blue + green + grey
retrofit downpipe planters

Before



After

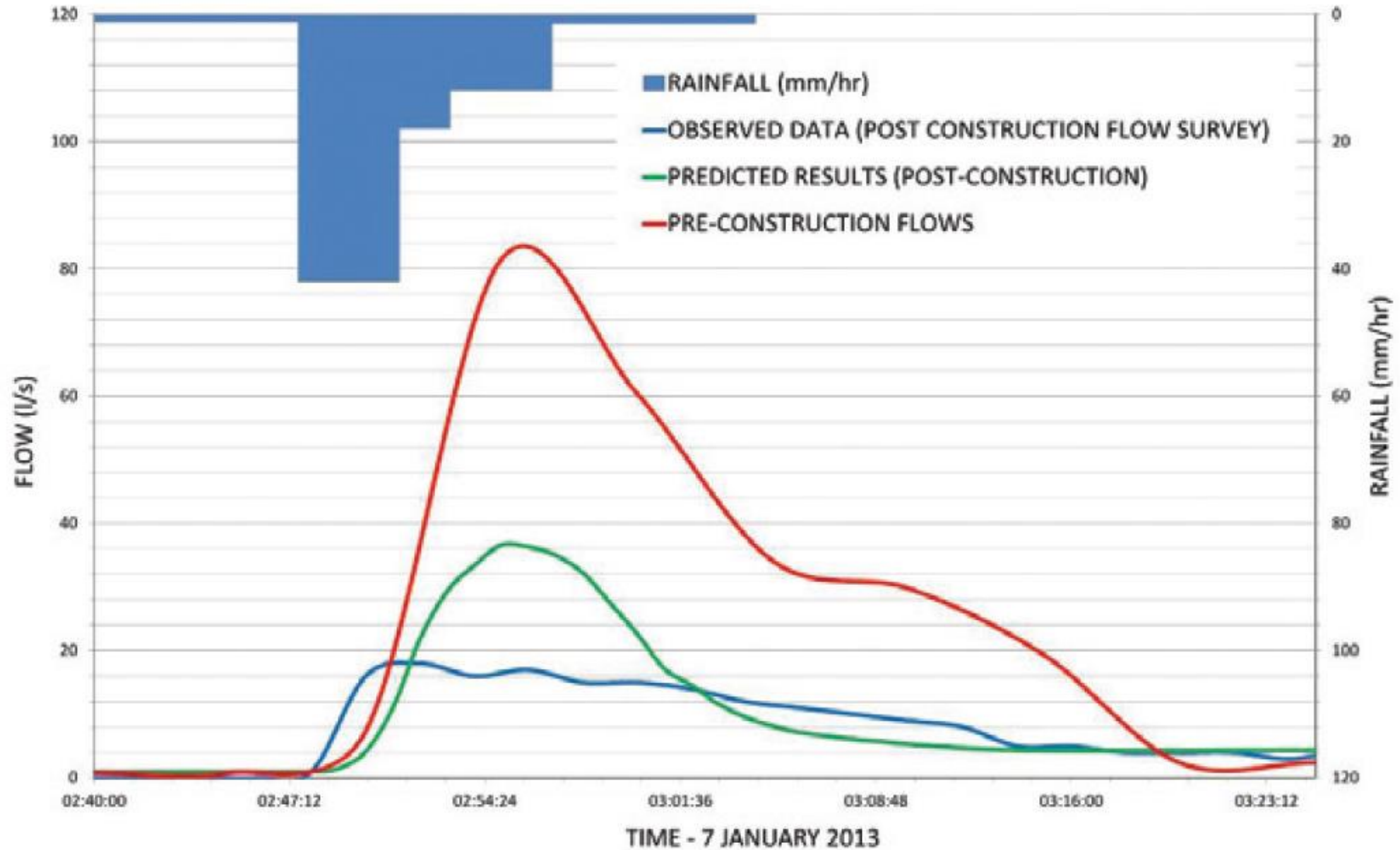


blue + green + grey stormwater attenuation basins



blue + green + grey stormwater attenuation planter

blue + green + grey solution performance



Conclusions

TNC Goal to develop an informed dialogue with funders on co-optimised blue-green-grey solutions

- Catchment scale modelling essential
- Evaluate blue, green and grey options including ‘nature-based’ thinking
- Learn from pilot studies – monitor and evaluate
- Use economic, social and environmental cost benefit assessment
- Incorporate capital, operational and maintenance costs and issues
- Develop a bench-marking tool

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