

# ROOF WATER-FARM

## Blue-green infrastructure of water-sensitive cities



Dr. Grit Bürgow

TU Berlin, Department of Urban & Regional Planning (ISR)  
Chair of Urban Design & Urban Development



# ROOF WATER-FARM

\_\_1 WHAT IS IT ABOUT

\_\_2 URBAN VISION & INTERMEDIATE RESULTS

\_\_3 COMMUNICATION & NEXT STEPS



# 1 \_\_\_\_\_ WHAT IS IT ABOUT?



# AIMS – LEVELS – PRODUCTS

**ROOF WATER-FARM** is a design-concept and a flexible infrastructure for building-integrated water-reuse combined with food production. We develop and test the technology and envision the integration into the urban realm.

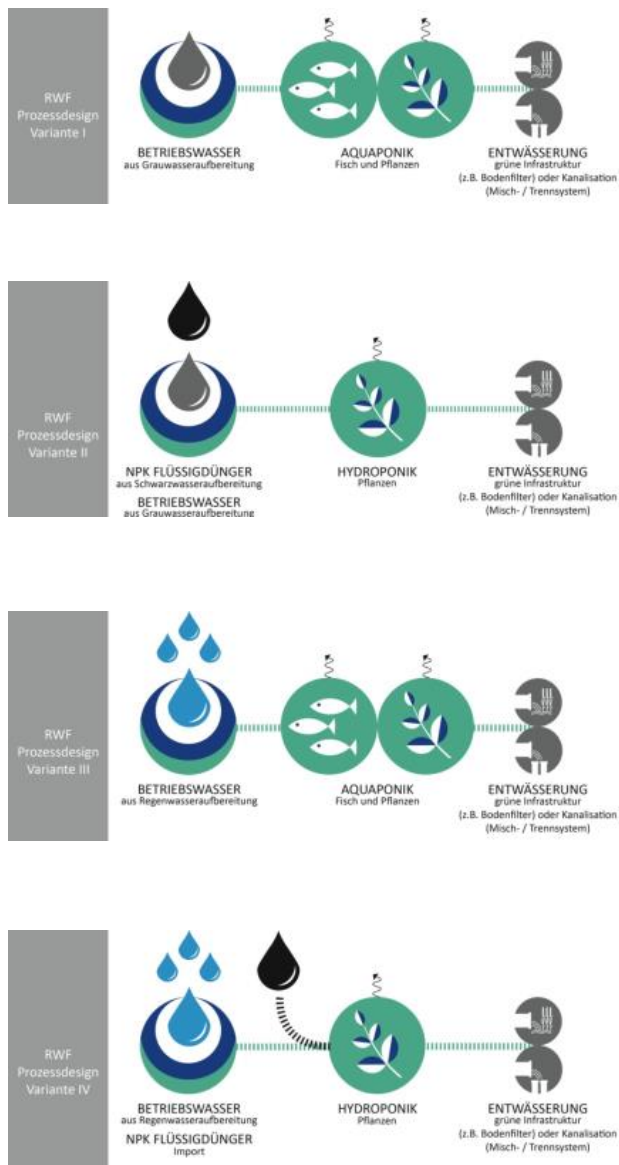
## TECHNOLOGY

\_\_pilot plant water and farming technology  
test site: Berlin-Kreuzberg/ Block 6 –  
IBA project 1987 „social-ecological housing“  
+ integrated water concept 2006/2007

## CITY + ACTORS

\_\_design & case studies at urban micro & macro scale,  
>> building-typologies & model districts in Berlin  
\_\_media for communication & training  
>> different target groups („makers and developers“)





© ROOF WATER-FARM, Grafik: F. Bentlin, TUB-ISR

# APPROACH

## “RWF as cross-sectoral infrastructure”

- REUSING 2 WATER SOURCES FROM THE BUILDING
  - \_\_process water from greywater (practical > RWF test-site)
  - \_\_process water from rainwater (theoretical > design studies)
- + REUSE OF NUTRIENTS AND MINERALS
  - \_\_via plant fertilizer production (NPK) from blackwater or fish water
- IRRIGATING & FERTILIZING 2 TYPES OF WATER-FARMS ON THE ROOF or BUILDING-RELATED
  - \_\_aquaponics (fish + plants) // local plant fertilizer = fish water
  - \_\_hydroponics (plant) // local plant fertilizer = NPK-fertilizer from blackwater

●● = 4 RWF-VARIANTS // BLUE-GREEN INFRASTRUCTURE

FACHGEBIET STÄDTEBAU UND SIEDLUNGSWESEN  
INSTITUT FÜR STADT- UND REGIONALPLANUNG | TU BERLIN



inter3  
INSTITUT FÜR RESSOURCENMANAGEMENT



Umlandentwicklungs GmbH

Fraunhofer  
UMSICHT

Senatsverwaltung  
für Stadtentwicklung  
und Umwelt



FACHGEBIET STÄDTEBAU UND SIEDLUNGSWESEN  
INSTITUT FÜR STADT- UND REGIONALPLANUNG | TU BERLIN



INIS – Verbundprojekt ROOF WATER-FARM



## CHALLENGE

“Rethinking the city from the single water pipe to the whole city”

\_\_playing all scales: FROM PROCESS-TECHNOLOGY with nano-, microgram dimensions (micro pollutants) via milligrams (usual water parameter) and L/m<sup>3</sup> (water quantities) TO THE URBAN SCALE incl. single buildings, neighbourhoods and the city

\_\_rethinking local value chains & actors' constellations, responsibilities, operation models

\_\_adapting institutional framework (regulations, standards, qualities...)

\_\_creating acceptance, attractivity & use of decentralized water and farming technologies as „new banalities“ (ReUse, ReDesign, prosuming, daily life & business)

# 2\_\_\_\_\_URBAN VISION & INTERMEDIATE RESULTS

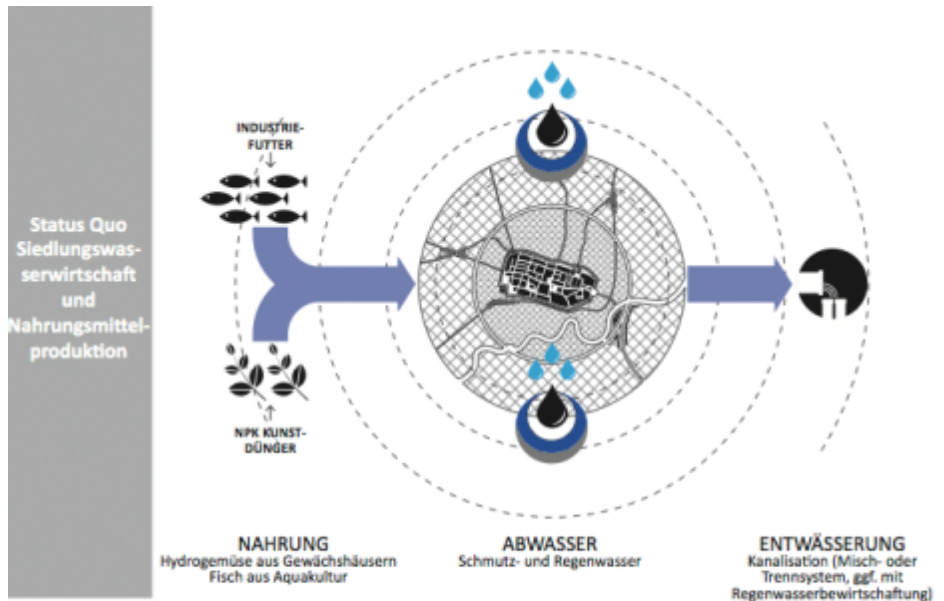


FACHGEBIET **STÄDTEBAU UND SIEDLUNGSWESEN**  
INSTITUT FÜR STADT- UND REGIONALPLANUNG | TU BERLIN

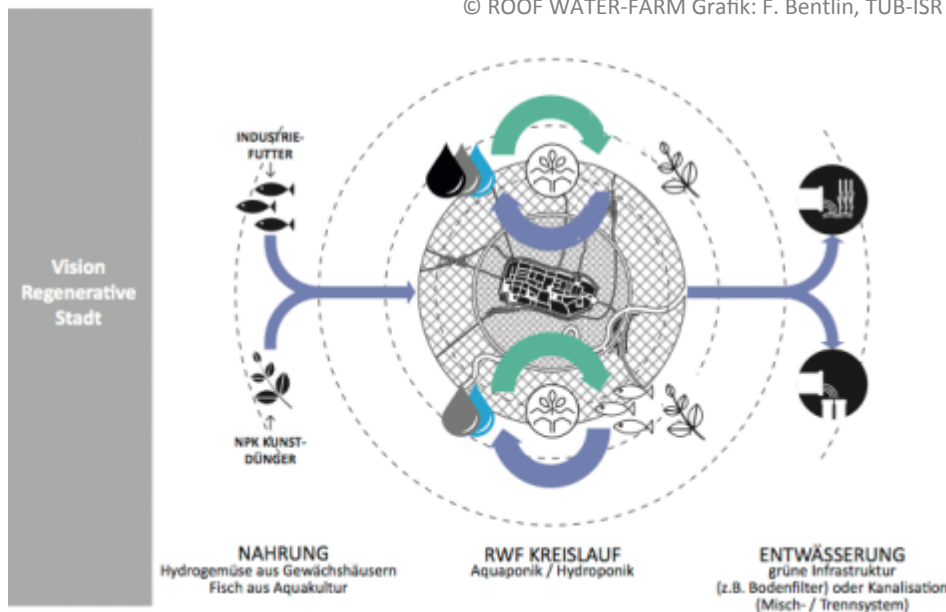


INIS – Verbundprojekt ROOF WATER-FARM





© ROOF WATER-FARM Grafik: F. Bentlin, TUB-ISR



## URBAN FRAMEWORK + VISION

### STATUS-QUO

„Linear City“

fossil-energy based & centralized  
urban water management and urban  
food supply

### VISION

„Loop City / Kreislaufstadt“

regenerative & decentralized water  
and food cycles

(e.g. World Future Council & HCU: 2010)





Fotos: © ROOF WATER-FARM

## INTERMEDIATE RESULTS\_\_technology

\_\_spring 2014 startup of greenhouse test module 1: aquaponics (fish – tench and catfish, strawberries, seasonal salads, ...)

\_\_since spring 2014: measurements – process water house/greywater treatment and test-greenhouse

### MEASUREMENTS KEY QUALITY PARAMETER

\_\_ *Which RWF-key parameter are obligatory for treatment of process water from greywater and blackwater? (cooperation Prof. Dott / BMBF-RISKWA project)*

- >> hygienic parameter
- >> heavy metals
- >> organic trace substances/micro pollutants
- >> anionic surfactants
- >> ecotoxicity



© ROOF WATER-FARM

## INTERMEDIATE RESULTS\_\_technology

### 1. RWF-season 2014:

#### MEASUREMENT RESULTS GREYWATER + PRODUCTS AQUAPONICS

How safe is the reuse of process/service water (from greywater) as irrigation source for fish and plants?

>> safe! (e.g. better than EU-Bathing Water Directive = below several potencies with power of 10)

How safe are the products from aquaponics (fish, plants)?

>> analysis of pollutants harmless

#### MEASUREMENT RESULTS BLACKWATER AT LAB SCALE

>> Variant 1: mechanical-chemical: hygienization via membrane filtration proven

>> Variant 2: mechanical-biological: tests started



© ROOF WATER FARM

## INTERMEDIATE RESULTS\_\_technology

### COSTS-BENEFITS?

#### Cost estimation for greywater:

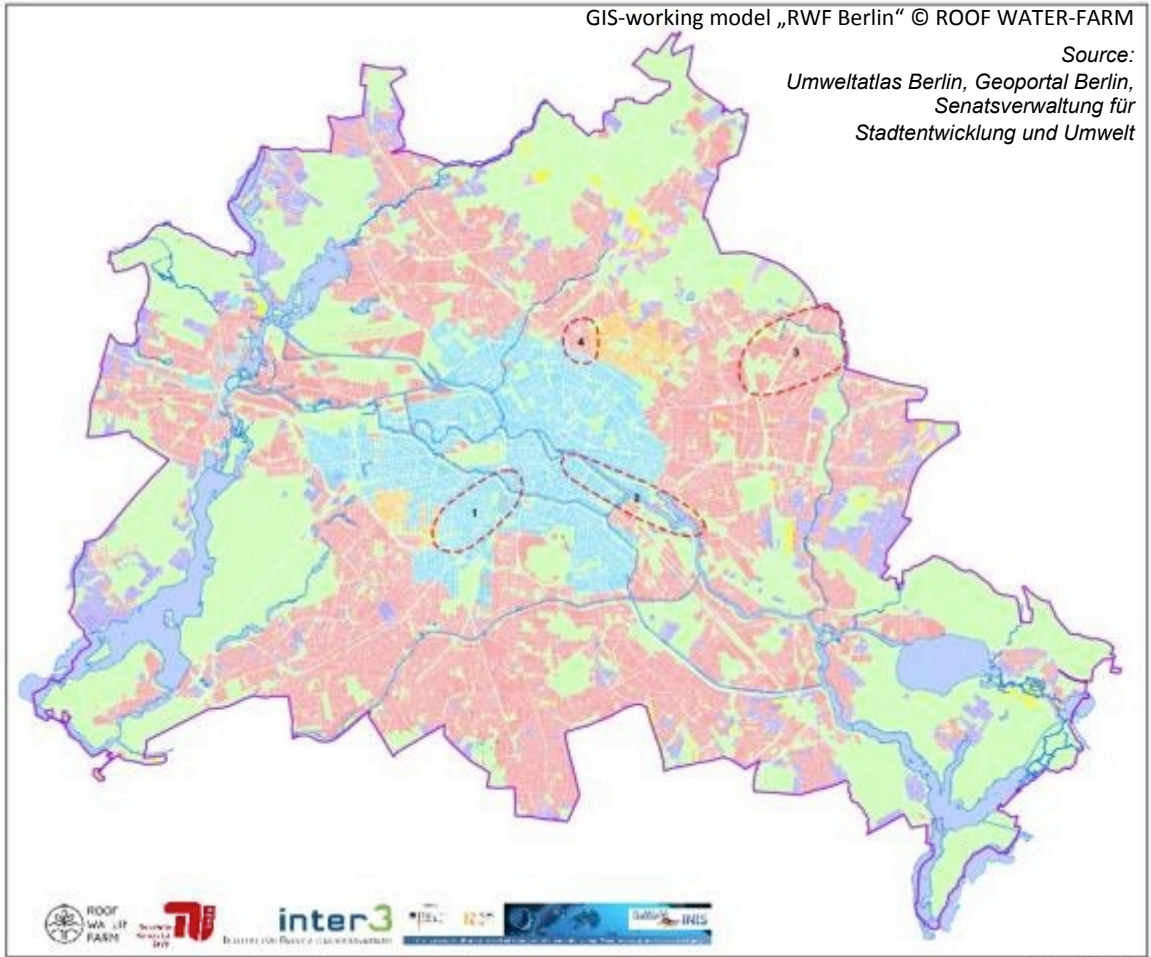
- >> 2. pipe system: ca. 500 €/apartment
- >> systems engineering: ca. 500 €/P
- >> process water price: < 3 €/m<sup>3</sup>

### LIFE CYCLE ASSESSMENT RWF-SYSTEM

- finalization Water-Footprint, Carbon-Footprint, primary energy expenditure (life cycle) for greywater treatment
- definition and collection of data of RWF-reference greenhouse in process...

BUILDING TYPOLOGIES ACCORDING TO USAGE	TYPE 1 RESIDENTIAL BUILDING		TYPE 2 SPECIAL RESIDENTIAL BUILDING		TYPE 3 EDUCATIONAL BUILDING	
USAGE VARIATIONS	1A RESIDENTIAL low price	1B RESIDENTIAL high price	2A STUDENT HOSTEL	2B SENIORS' RESIDENCE	3A SCHOOL / UNIVERSITY	3B CENTER FOR CHILDREN
planning option	existing + conversion	new building	existing + conversion	new	existing + conversion	existing
RWF variant	[Icons: 2 leaves, 2 water drops]		[Icons: 1 leaf, 1 water drop]		[Icons: 2 leaves, 2 water drops]	
BUILDING TYPOLOGIES ACCORDING TO USAGE	TYPE 4 COMMERCIAL BUILDING		TYPE 5 HOTEL BUILDING		TYPE 6 SOCIAL/CULTURAL AND INDUSTRIAL TRANSFORMATION BUILDING	
USAGE VARIATIONS	4A OFFICE ADMINISTRATION	4B TRADE SUPERMARKT	5A HOTEL/HOSTEL low price	5B HOTEL/HOSTEL high price	6A COMMUNITY CENTER	6B TRANSFORMATION BUILDING INDUSTRY
planning option	existing	existing	conversion + new	conversion + new	existing	existing
RWF variant	[Icons: 2 leaves, 2 water drops]		[Icons: 1 leaf, 1 water drop]		[Icons: 2 leaves, 2 water drops]	

# INTERMEDIATE RESULTS\_\_city of Berlin



GIS working model RWF-Berlin:

- \_\_ model areas (inner city, border area – large housing estate; transformation area)
- \_\_ theoretical flat-roof potential
- \_\_ wastewater flows according to building typologies/ uses
- \_\_ type of canalisation
- \_\_ preliminary nutrient flows of the RWF-variants



FACHGEBIET **STÄDTEBAU UND SIEDLUNGSWESEN**  
INSTITUT FÜR STADT- UND REGIONALPLANUNG | TU BERLIN



GEFÖRDERT VOM  
Bundesministerium  
für Bildung  
und Forschung



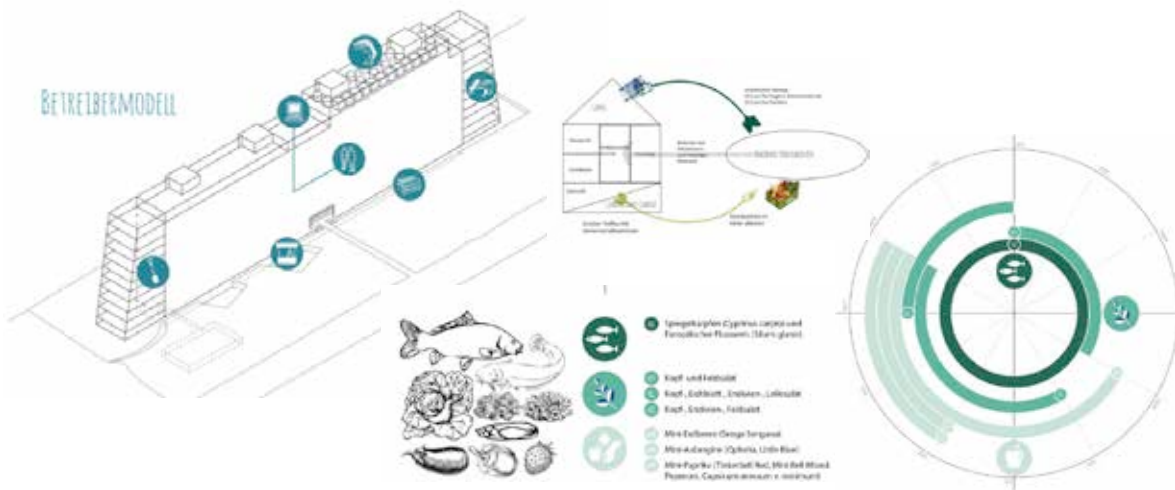
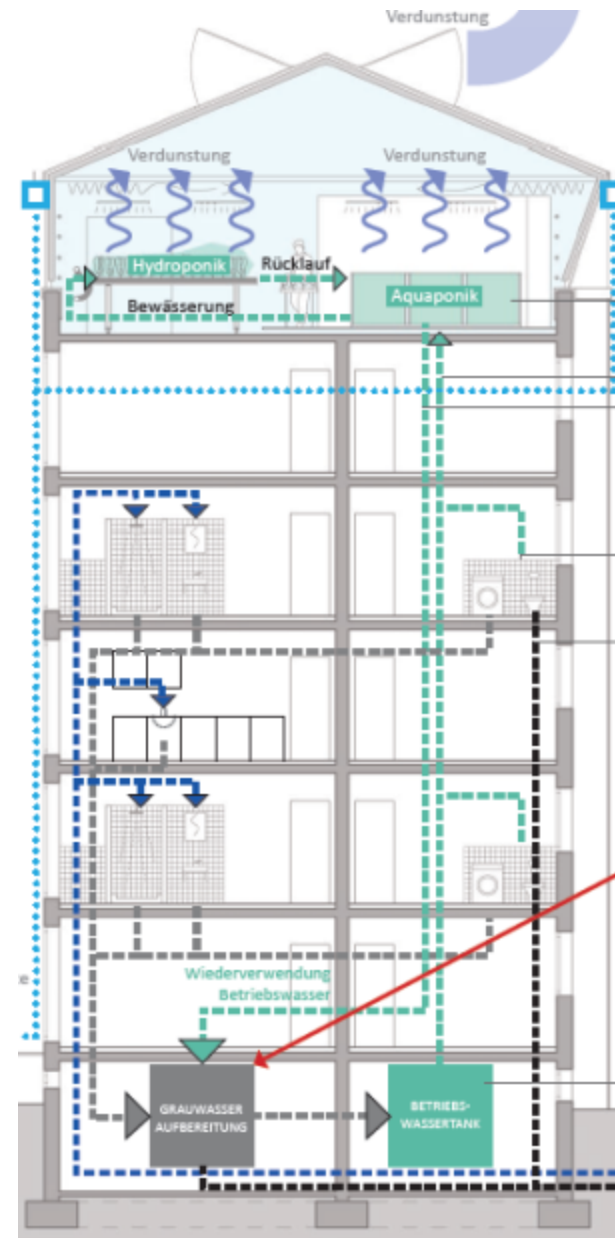
INIS – Verbundprojekt ROOF WATER-FARM



# INTERMEDIATE RESULTS \_\_city // building + operation model

## First findings:

- \_\_1. prototype building study „RESIDENTIAL“ shows technical transferability of the RWF-concept due to the modularity & variability of the technology
- \_\_Selection and characterisation of RWF-building-typologies and optional operation models as transferable prototypes



RWF-building types and operation models © ROOF WATER-FARM, Graphics: Architekturbüro Freiwald & TUB-ISR & TEAM Q216

# INTERMEDIATE RESULTS\_\_city // neighborhood

## First findings:

\_\_\_ Neighborhood as important interface between technology and urban realm → Test-/Learning field

\_\_\_ Actors' interviews & „What if?-Approach“ >> RWF-networks, actors constellations +++

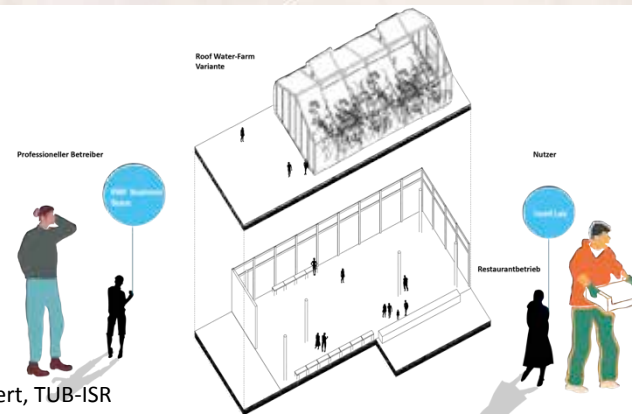
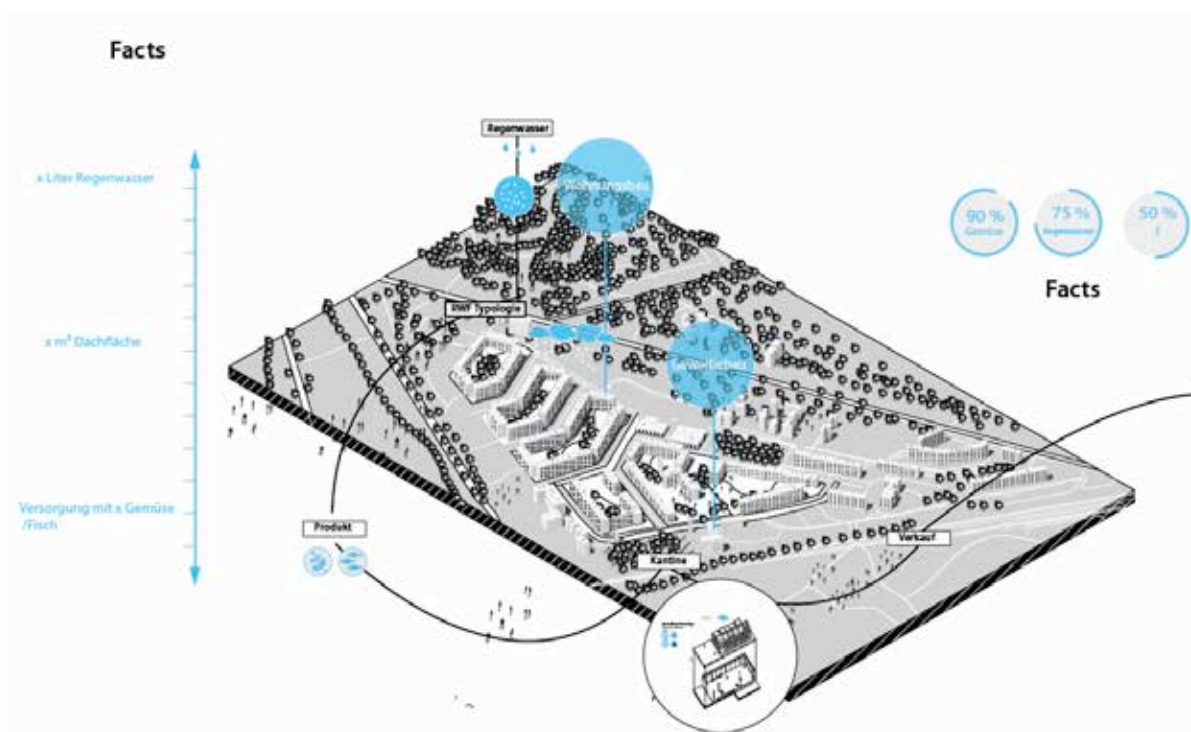


Figure: RWF model area „border area“/neighbourhood Marzahn-Hellersdorf © ROOF WATER-FARM, Graphics: Tim Nebert, TUB-ISR



# 3 \_\_\_\_\_ COMMUNICATION PARTICIPATIVE LEARNING OUTLOOK



# COMMUNICATION WEB: [roofwaterfarm.com](http://roofwaterfarm.com)



© ROOF WATER-FARM, Fotos Marc Brinkmeier



\_\_broad target group,  
campaign design

\_\_process documentation,  
information

\_\_networking

\_\_to evolve as online tool  
for users & makers,  
(creative citizens &  
developers...)



# PARTICIPATIVE FORMATS: LEARNING BY DOING



© ROOF WATER-FARM, Fotos Marc Brinkmeier



Okt 17 I DID IT MY WAY ... AQUAPONICS DIY-WORKSHOP

Öffentlich · Gastgeber: Roof Water Farm

Zusage Einladen Bearbeiten

\_\_experts (planning, design, architecture)  
\_\_makers („creative citizens and developers“)  
\_\_children, students, „future users“

# OUTLOOK

## \_\_INTERACTING RESOURCE CYCLES AND INFRASTRUCTURE SYSTEMS

# further linkages between water resource cycles + food production + ???? (e.g. energy)

# discovering spatial impact of multifunctional infrastructures - can be seen, felt, lived....

# playing with scales and perceptions (at the surface, beneath..)

# need of tools and formats of participation & education enabling to foster acceptance



Participatory Blue-Green Infrastructure Seminar  
c/o ROOF WATER-FARM Projekt, TUB-ISR, WS 2013/14  
TEAM C+ // Fabian Becker, Jürgen Höfler, Tim Nebert

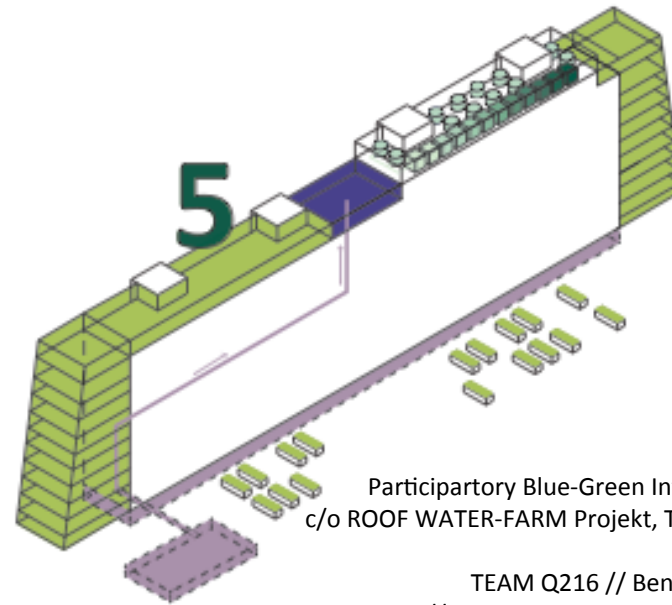
# OUTLOOK

## \_\_COURAGE OF LEARNING-BY-DOING & LEARNING-FROM-MISTAKES

# new operation models and urban communication formats are to be tested

>> challenge of the living urban context

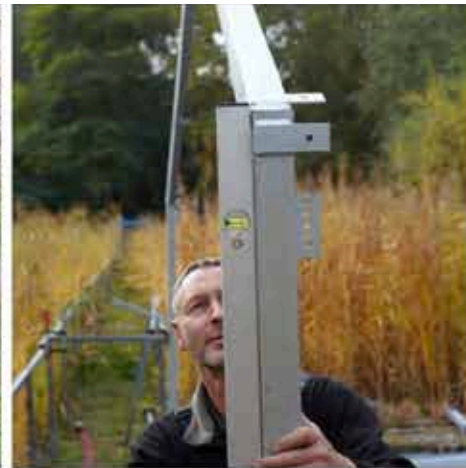
>> need of real-life labs/ „Reallabore“ for the future city/ “Zukunftsstadt“ as part of research + education



Participatory Blue-Green Infrastructure Seminar  
c/o ROOF WATER-FARM Projekt, TUB-ISR, WS 2013/14

TEAM Q216 // Ben Lebeck, Sandra May  
TEAM C+ // Fabian Becker, Jürgen Höfler, Tim Nebert





© ROOF WATER-FARM, Fotos Marc Brinkmeier





ARD Home Nachrichten Sport Börsen Ratgeber Wissen Kultur Kinder ARD Intern

tagesschau.de

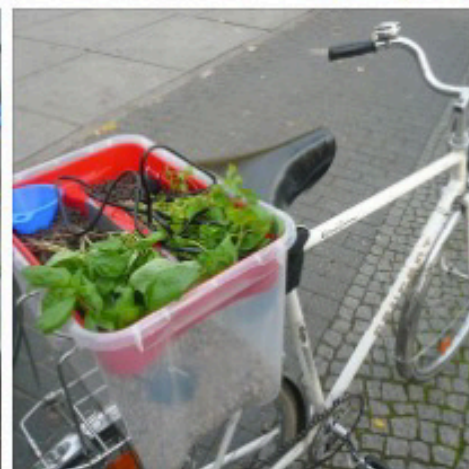
Startseite Videos & Audio Inland Ausland Wirtschaft Wahlarchiv Wetter

Startseite > Special > "Roof Water Farming": Obst und Fisch von Kreuzbergs Dächern

"Roof Water Farming" in Berlin  
**Obst und Fisch von Kreuzbergs Dächern**  
 Stand: 19.02.2015 11:01 Uhr

Facebook Twitter YouTube Email Print

"Zukunftstadt" ist das Motto des Wissenschaftsjahrs 2015. In Berlin wird schon geforscht: Obst, Gemüse und Fische sollen von den Dächern der Stadt kommen, das nötige Wasser aus dem Abwasser. Doch "Roof Water Farming" ist nur ein Baustein für die Stadt der Zukunft.  
 Von Marie-Kristin Böse, SWR, ARD Hauptstadtstudio



Die Bundesregierung

Bundeskanslerin Bundesregierung Themen

**NACHHALTIGE WASSERNUTZUNG**

**Badewasser bei die Fische – und Erdbeeren frisch vom Dach**

Frische Fische, Salat und Erdbeeren direkt vom Dachgarten, Landwirtschaft mitten in der Stadt. Bewässert mit dem Wasser aus Seduzanne und Geschirrspüler. Das wäre nicht nur praktisch, sondern würde auch Wasser, Transportwege und damit Energie sparen.

THANK YOU °°<)))>< °

roofwaterfarm.com

facebook.com/roofwaterfarm



© ROOF WATER-FARM Photos: M. Brinkmeier

FRESH WATER, FRESH FISH ....

“UP FROM THE ROOF...

....DOWN TO THE RIVER“!

Feel free to contact:

Dr. Grit Bürgow

[g.buergow@isr.tu-berlin.de](mailto:g.buergow@isr.tu-berlin.de)

t. +49 (0)30 314 28 093

## MORE TO READ...

<http://www.roofwaterfarm.com/category/publikationen/>

\_\_Bürgow, G.; Million, A.; Steglich, A. (2014): ROOF WATER-FARM. Frisches Wasser und frischer Fisch vom Dach bis zum Fluss. In: Stadt + Grün 7/2014

\_\_Nolde, E. (2014): Das ROOF WATER-FARM Projekt, Energie und Stoffkreisläufe dezentral mittels Abwasserrecycling schließen. In: fbr-wasserspiegel 3/14, 16-17.

\_\_Million, A.; Bürgow, G.; Steglich, A.; Raber, W. (2014): ROOF WATER-FARM. Participatory and Multifunctional Infrastructures for Urban Neighborhoods. In: Roggema, R. and Keffe, G., Proceedings – 6th AESOP Food Planning Conference Leuwarden, the Netherlands, 5-7 November: 659-678

\_\_Bürgow, G. (2014): Urban Aquaculture - Water-sensitive transformation of cityscapes via blue-green infrastructures. Dissertation Technische Universität Berlin. Schriftenreihe der Reiner-Lemoine-Stiftung, Shaker Verlag, Herzogenrath, ISBN 978-3-8440-3262-8

\_\_Memorandum „Klimagerechte Stadt – Ihre Stimme für eine nachhaltige Stadt- und Infrastrukturplanung“ - Online Petition <http://www.memorandum-klimagerechte-stadt.de/das-memorandum>  
In: Planerin - Mitgliederfachzeitschrift für Stadt-, Regional- und Landesplanung (SRL), Heft 6/2014, S. 45-47

