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EH demosite in Lyon periurban area

Pascal Breil, Ph. Namour, Michel Lafont, Isabelle Braud, Flora Branger,
Laurent Schmitt, O. Navratil, Marylise Cottet, Benoît Cournoyer, Anne-Marie
Aucour, et al.

► **To cite this version:**

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Submitted on 28 Sep 2022

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EH demosite in Lyon periurban area

IRSTEA-Lyon,

Pascal BREIL, *EcoHydrology*, Philippe Namour, *Biochemistry*, Michel Lafont*, *Hydro-Ecology*
Isabelle Braud, *Hydrology*, Flora Branger, *Hydrology*,.....

University – Lyon2 (now University of Strasbourg)

Laurent Schmitt, *Hydro-Geomorphology*, Oldrich Navratil, *Hydro-Geomorphology*
Marylise Cottet, *Social sciences*,.....

University – Lyon1

Benoit Cournoyer, *Microbiology*, Anne.M Aucour, *Geochemistry*....

INSA – Lyon & ENTPE

Bernard Chocat, *Urban hydrology*..... Jen Yves Perrodin, *Ecotoxicology*



Ecohydrology Workshop - 30-31/01/2019 – Univ. Birmingham, UK



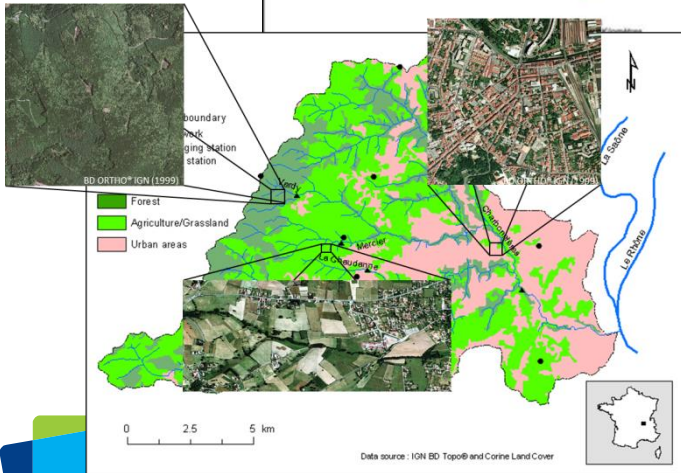
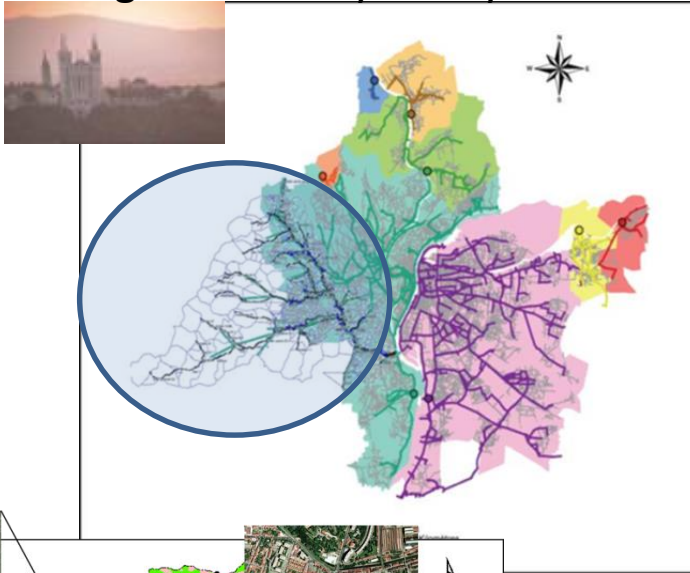
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Where?

Lugdunum....Lyon city



Why?

1- How does the peri-urbanization process impact the flow regime in quality & quantity of water?

2- How can we mitigate these (-) impacts?



The Yzeron watershed has been an experimental site for Irstea-Lyon since 1994



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(I) Watershed scale approach to understand the hydrological and ecological templates





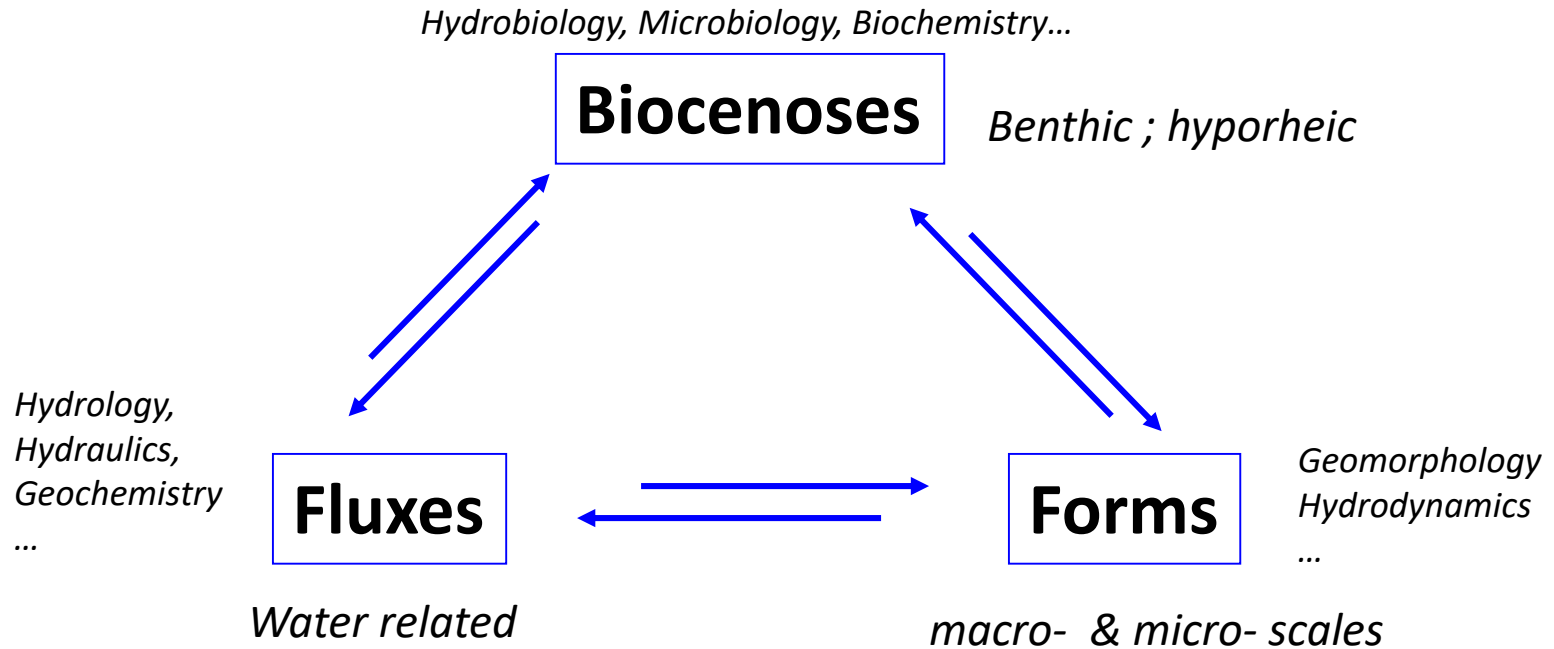
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EH dual regulation principle



Objective : Describe components and model their relationships

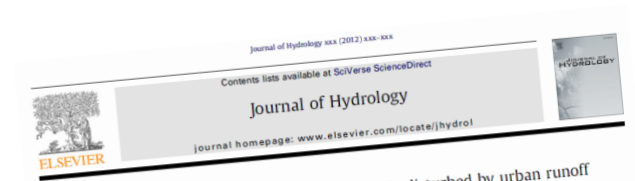
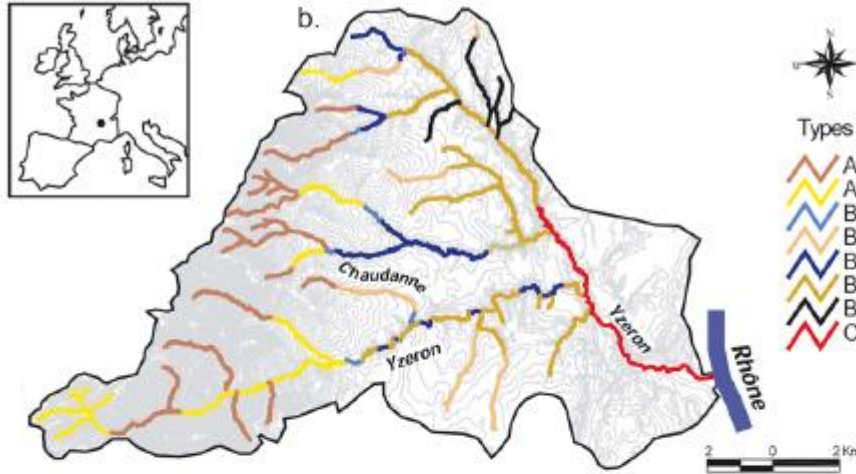




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Hydro-geomorphological typology



Hydrogeomorphic adjustments of stream channels disturbed by urban runoff (Yzeron River basin, France)
O. Navratil^{a*}, P. Breil^b, L. Schmitt^c, L. Grospretre^d, M.B. Albert^e



Evidence of the impact of urbanization on the hydrological regime of a medium-sized periurban catchment in France

I. Braud^{a*}, P. Breil^a, F. Thollet^a, M. Lagouy^a, F. Branger^a, C. Jacqueminet^b, S. Kermadi^b, K. Michel^b

HYDROLOGICAL PROCESSES
Hydrol. Process. 24, 2452–2464 (2010)
Published online 20 April 2010 in Wiley InterScience
(www.interscience.wiley.com) DOI: 10.1002/hyp.7664

Test of three methods to detect the overbank flow from water level time-series analysis

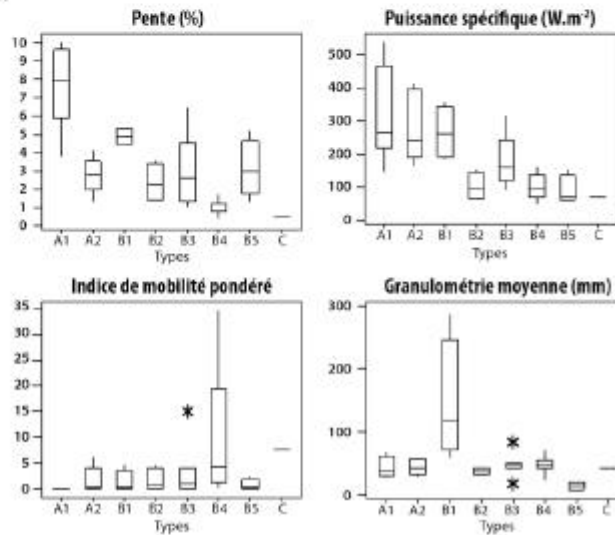
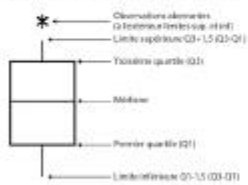
O. Navratil^{1*}, M. B. Albert² and P. Breil³



Using hydro-geomorphological typologies in functional ecology: Preliminary results in contrasted hydrosystems
Schmitt Laurent^{a*}, Lafont Michel^b, Trémolières Michèle^c, Jezequel Céline^{a,b}, Vivier Anne^b, Breil Pascal^b, Namour Philippe^b, Valin Karine^a, Valette Laurent^a

d.

Valeurs indiquées par les boîtes à moustaches :





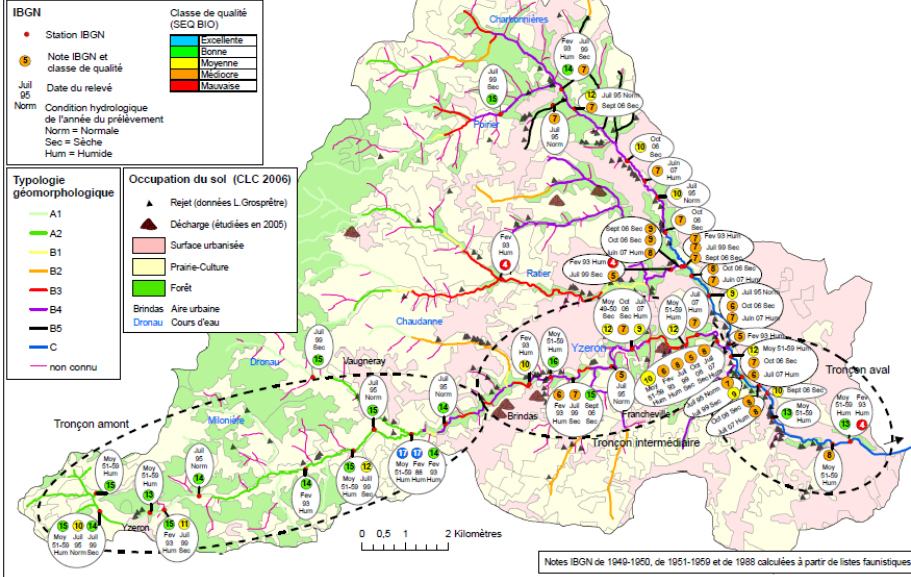
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Biocenoses status..& functions



Synthèse des relevés IBGN réalisés sur le bassin versant de l'Yzeron entre 1950 et 2006



Water Science & Technology Vol 56 No 9 pp 13-20 © IWA Publishing 2007

Bioassessment of wet-weather pollution impacts on fine sediments in urban waters by benthic indices and the sediment quality triad

M. Lafont*, L. Grapentine**, Q. Rochfort**, J. Marsalek**, G. Tixier*** and P. Breil*

© Springer 2006

Hydrobiologia (2006) 564:183-193
P.F.M. Verdonchot, H. Wang, A. Pinder & R. Nijhoer (eds), Aquatic Oligochaete Biology IX
DOI 10.1007/s10750-005-1718-8

Surface and hyporheic oligochaete assemblages in a French suburban stream

Michel Lafont^{1,*}, Anne Vivier², Sylvie Nogueira¹, Philippe Namour³ & Pascal Breil⁴

Journal of Water Resource and Protection, 2012, 4, 984-992
doi:10.4236/jwrp.2012.41114 Published Online November 2012 (<http://www.SciRP.org/journal/jwrp>)

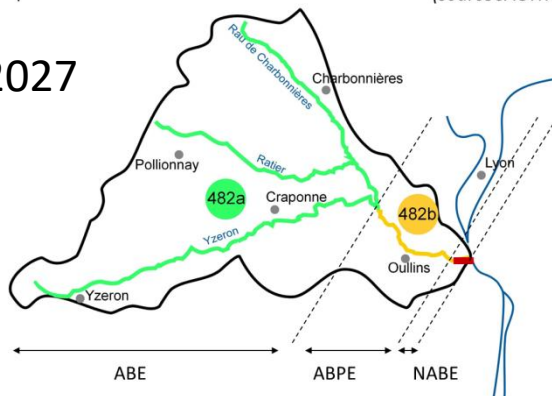


Multi-Level Approach of the Ecotoxicological Impact of a Combined Sewer Overflow on a Peri-Urban Stream

Céline Becouze-Lareure^{1,2*}, Christine Bazin², Philippe Namour^{3,4}, Pascal Breil⁵, Yves Perrodin¹

WFD..2027

(source SAGYRC)



An approach to pathogens flux simulation in a combined sewer system

Une approche de la simulation des pathogènes dans un réseau unitaire

¹Breil P.; ²Petit S.; Boukerb A.; ^{3,4}Namour Ph.; ⁵McCarthy D.; ²Cournoyer B.



NOVATECH 2013

Human-Driven Microbiological Contamination of Benthic and Hyporheic Sediments of an Intermittent Peri-Urban River Assessed from MST and 16S rRNA Genetic Structure Analyses

Romain Marri¹, Sébastien Ribun¹, Jean-Baptiste Aubin², Céline Collinon¹, Stéphanie Petit¹, Laurence Marjollet¹, Michèle Gourmelon¹, Laurent Schmitt¹, Pascal Breil¹, Marylise Cottet¹ and Benoit Cournoyer^{1*}





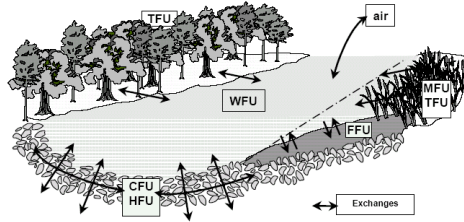
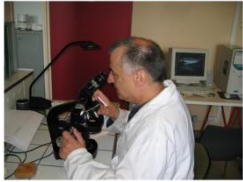
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Biocenoses /forms & /fluxes



Functional Units



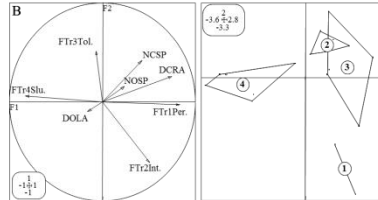
	Functional Unit
WFU	Water FU
MFU	Macrophyte FU
TFU	Terrestrial FU
FFU	Fine sediment FU
CFU	Coarse sediment FU
HFU	Hyporheic FU

Functional traits

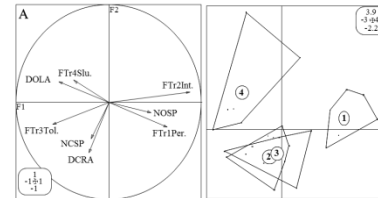
Biological FTrs	Oligochaete species characterizing each FTr
FTr1 "Permeability"	<i>Trichodrilus strandi</i> , <i>Stygodrilus heringianus</i> , <i>S. parvus</i> , <i>Rhyacodrilus ardierae</i> , <i>R. coccineus</i> , <i>R. falciiformis</i> , <i>R. subterraneus</i> , <i>Haber speciosus</i> , <i>Pristina aequisetata</i> , <i>Pristinella jenkinsae</i> , <i>P. osborni</i> , <i>Cernosvitoviella atrata</i> , <i>Achaeta vesiculata</i> , <i>Marionina argentea</i> , <i>Haplotaxis gordioides</i>
FTr2 "Intolerance"	<i>R. ardierae</i> , <i>R. falciiformis</i> , <i>R. subterraneus</i> , <i>C. atrata</i> , <i>A. vesiculata</i> , <i>M. argentea</i> , <i>Vejdovskyella comata</i> , <i>Eiseniella tetraedra</i>
FTr3 "Tolerance"	<i>Nais elinguis</i> , <i>P. jenkinsae</i> , <i>Dero digitata</i> , <i>Marionina riparia</i>
FTr4 "Sludge effect"	immatures of Tubificidae with and without hair setae, <i>Tubifex ignotus</i> , <i>T. tubifex</i> , <i>Limnodrilus hoffmeisteri</i> , <i>Bothrioneurum</i> sp., <i>Lumbricillus</i> spp.



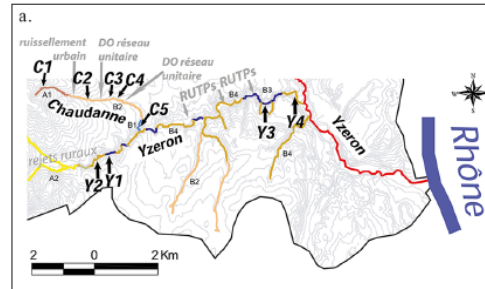
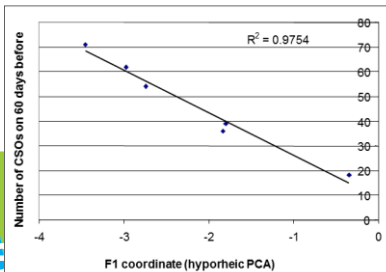
ACP on hyporheic sediments



ACP on benthic sediments



Hydrology –number of CSOs



Géomorpho-type B3	Rejets ruraux		Rejets urbains	
	Y1	Y3	Y2	Y4
Code du site	33.3	57.7	33.1	50.0
Suf. bassin versant (km²)	4.4	17.2	4.3	18.3
% surf. urbanisées				
Eau de surf.				
Oligochètes				
EP	6.1	7.3	4.8	63.3
FTr1 (%)	91	93	52	50
FTr2 (%)	60	66	67	96
FTr3 (%)	24	21	23	0
FTr4 (%)	0	0	1	2
Géomorpho-type B4				
Code du site	33.1	50.0		
Suf. bassin versant (km²)	4.3	18.3		
% surf. urbanisées				
Eau de surf.				
Oligochètes				
EP	4	7.7	2.9	4.5
FTr1 (%)	70	90	57	64
FTr2 (%)	46	70	44	57
FTr3 (%)	28	19	23	11
FTr4 (%)	0	1	11	15



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Forms & Fluxes

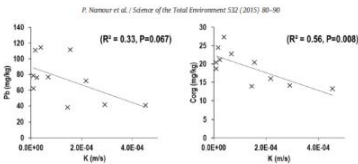
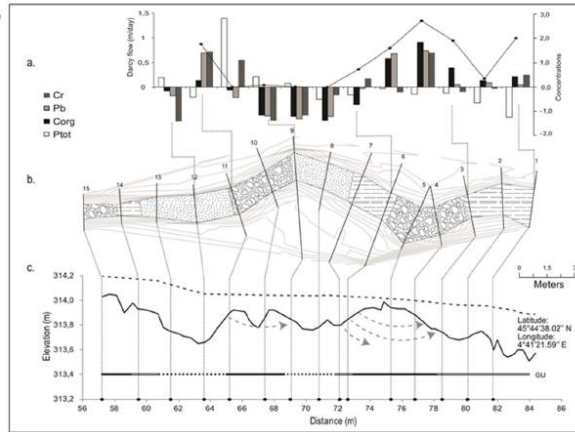
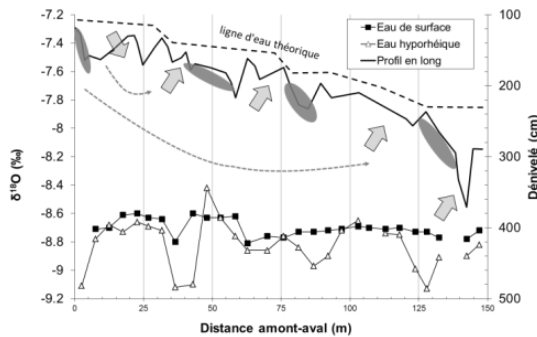


Fig. 8. Relationship between concentration of Cu_{2+} and Pb with K values at the upstream reach with probability for R^2 to equal zero.



Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Stream pollution concentration in riffle geomorphic units (Yzeron basin, France)

Philippe Namour^{a,b,*}, Laurent Schmitt^c, David Eschbach^c, Bertrand Moulin^d, Guillaume Fantino^d, Claire Bordes^a, Pascal Breil^e

2632

© IWA Publishing 2013 Water Science & Technology | 68-12 | 2013

Nitrogen patterns in subsurface waters of the Yzeron stream: effect of combined sewer overflows and subsurface-surface water mixing

A. M. Aucour, T. Bariac, P. Breil, P. Namour, L. Schmitt, R. Gnouma and P. Zuddas

La zone hyporhéique, une composante à ne pas négliger dans l'état des lieux et la restauration des cours d'eau

Ingénieries n° 54 - p. 3 à 18
juin 2008

Thibault Datry^a, Marie-José Dole-Olivier^a, Pierre Marmonier^b, Cécile Claret^c, Jean-François Perrin^d, Michel Lafont^a et Pascal Breil^d

Ann. Limnol. - Int. J. Lim. 48 (2012) 253-266
© EDP Sciences, 2012
DOI: 10.1051/limn/2012009

Available online at:
www.limnology-journal.org

The role of organisms in hyporheic processes: gaps in current knowledge, needs for future research and applications

P. Marmonier^{1,*}, G. Archambaud², N. Belaidi³, N. Bougon⁴, P. Breil⁵, E. Chauvet^{6,7}, C. Claret⁸, J. Cornut^{6,7}, T. Datry⁴, M.-J. Dole-Olivier¹, B. Dumont², N. Flipo⁹, A. Foulquier^{1,4}, M. Gérino^{6,7}, A. Guilpart¹⁰, F. Julien^{6,7}, C. Maazouzi¹, D. Martin¹, F. Mermillod-Blondin¹, B. Montuelle^{4,11}, Ph. Namour^{4,12}, S. Navel¹, D. Ombredane¹⁰, T. Pelte¹³, C. Piscart¹, M. Pusch¹⁴, S. Stroffek¹³, A. Robertson¹⁵, J.-M. Sanchez-Pérez^{6,7}, S. Sauvage^{6,7}, A. Taleb³, M. Wantzen¹⁶ and Ph. Vervier^{6,7,17}





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After a decade of research in the Yzeron watershed, we reached the following conclusions :

- The self-purification capacity of a river system is unequally distributed;
- In our lotic system, the main bioreactor is the hyporheic zone;
- The main drivers are (I) the river geomorphology and (II) the connection to a ground water table;



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(II) Problem solving approach



Contents lists available at ScienceDirect

Ecohydrology & Hydrobiology

journal homepage: www.elsevier.com/locate/ecohyd

Editorial

Synthesis and conclusions to the International Symposium on Ecohydrology, Biotechnology and Engineering: Towards Harmony between the Biogeosphere and Society on the basis of Long-Term Ecosystem Research



Brian Moss^{a,*}, Giovanni Bidoglio^b, Robert Pietrowsky^{c,d}, Pascal Breil^e, Patrick Bourgeron^f, Johannes Cullmann^g, Giuseppe Arduino^h, Iwona Jasserⁱ, Artur Magnuszewski^j, Daniel Orenstein^k, Graham Piper^l, Sławomir Ratajski^m, Jun Xia^{n,o}, Kinga Krauze^p, Iwona Wagner^{q,r}, Maciej Zalewski^{p,q}



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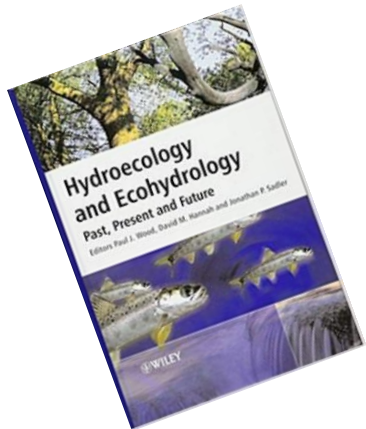
Ecohydrology & Hydrobiology

journal homepage: www.elsevier.com/locate/ecohyd

Original research article

The role of ecohydrology in creating more resilient cities

Iwona Wagner^{a,b,*}, Pascal Breil^c



Ecohydrology & Hydrobiology xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Ecohydrology & Hydrobiology

journal homepage: www.elsevier.com/locate/ecohyd

Editorial

Measuring, modelling and managing the natural processes related to water flows. Social values of the related ecosystem services



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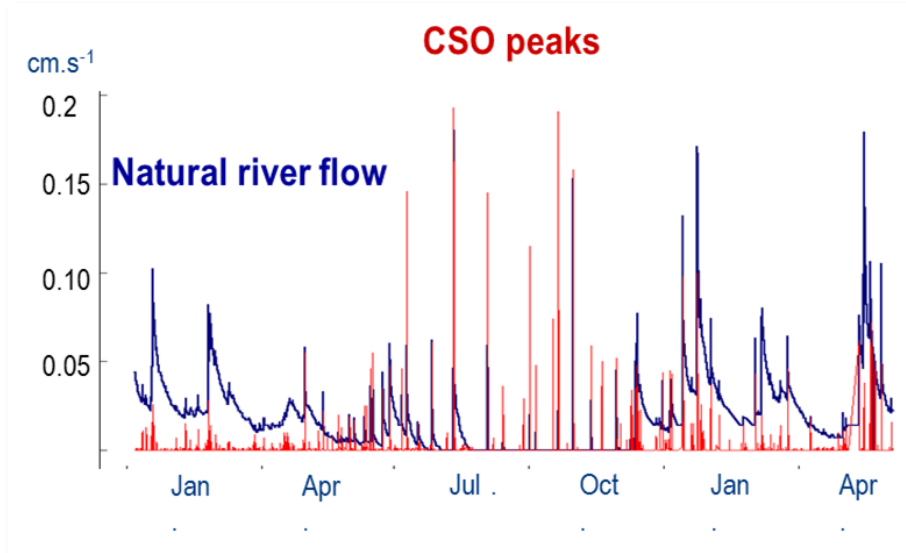
Low dilution capacity rivers , head waters, seasonal, intermittent..



Erosion



Deposits





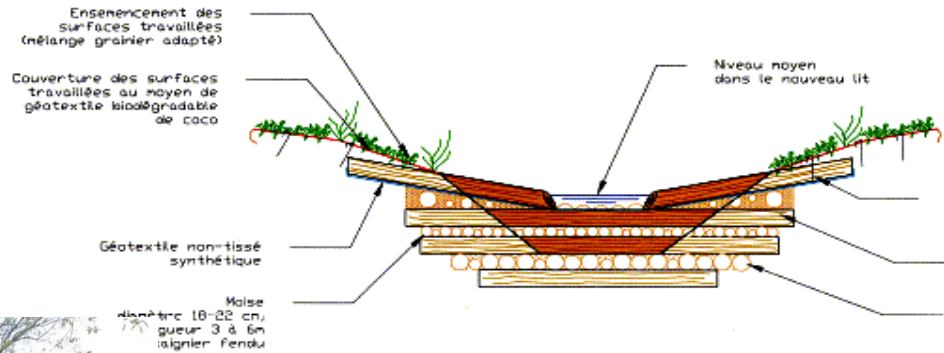
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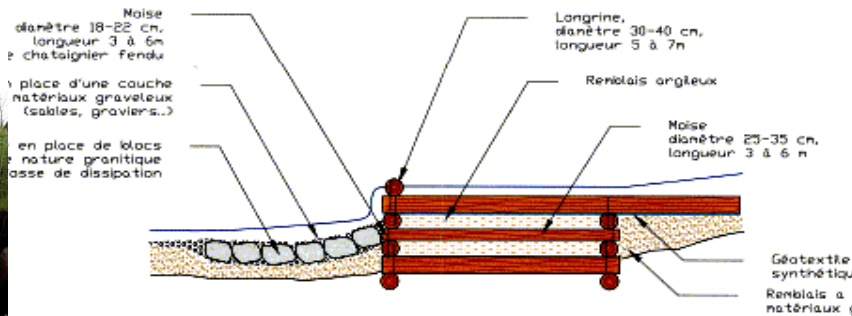
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Increase the self purification capacityartificial riffle

Coupe type d'un seuil en bois

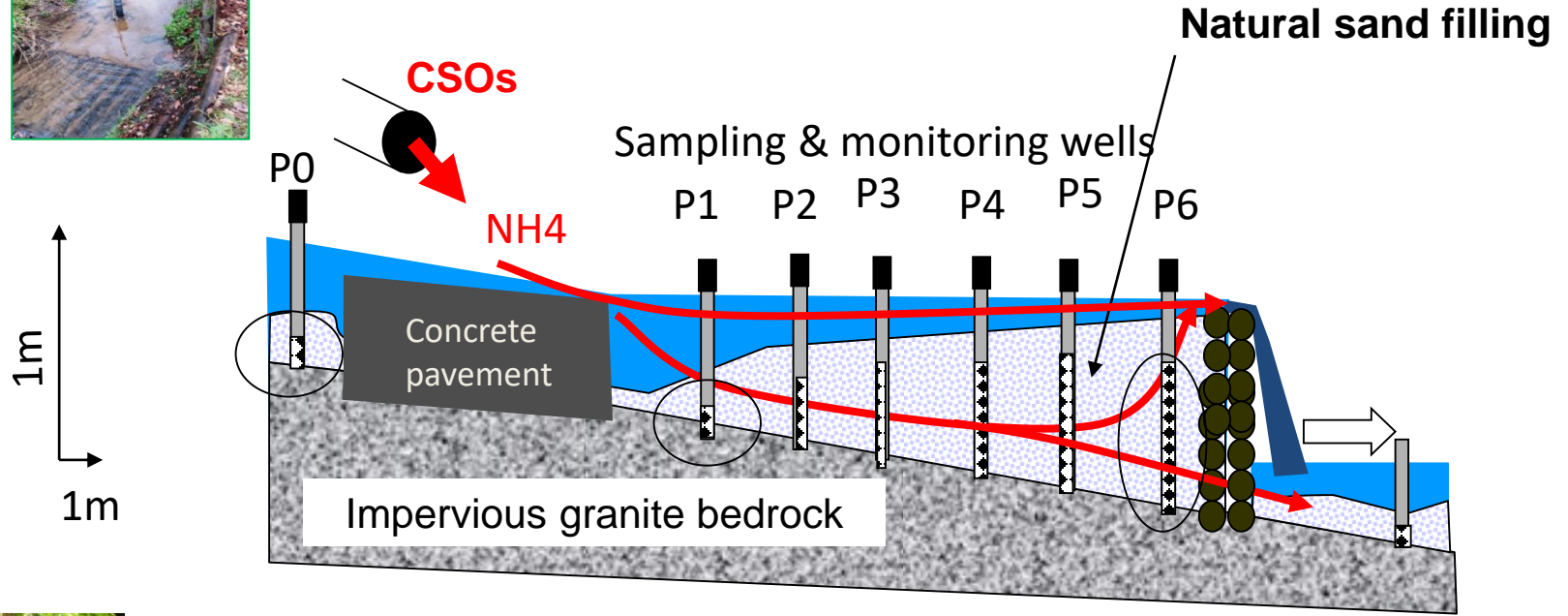


Moise diamètre 25-35 cm, longueur 6 à 9 m





Monitoring design



10 minutes time step
Multi-parameters loggers:

- Electrical conductivity
- Temperature
- pH & redox potential
- Dissolved oxygen
- Water pressure

Weekly sampling
for water quality analysis of

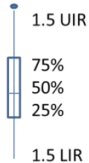
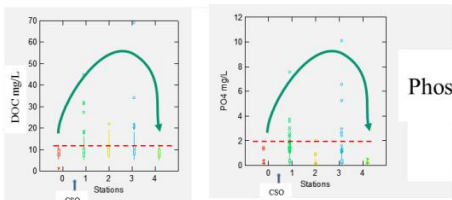
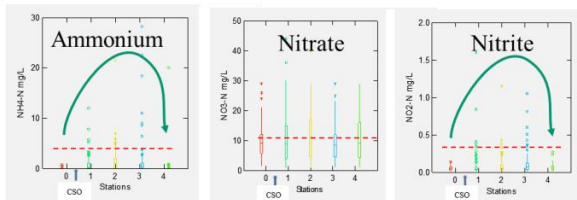
- NH₄ > CSOs source
- NO₃ > NH₄ nitrification or fertilizer origin
- NO₂ > NO₃ denitrification
- DOC > Dissolved Organic Carbon (CSOs & nat.)
- PO₄ > Phosphate (CSO, agriculture)



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Proof of concept... biodegradation process / uptake..



Nitrogen amount (mg/L)

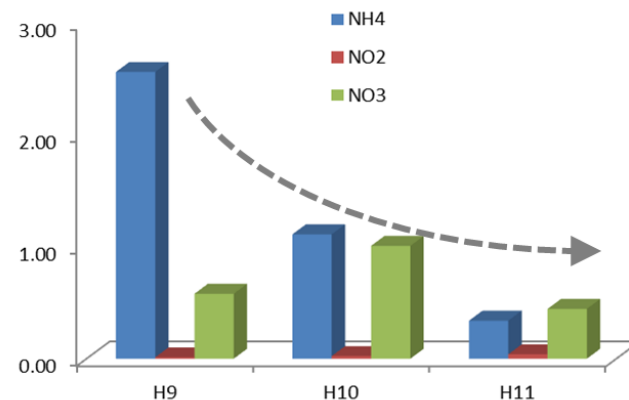
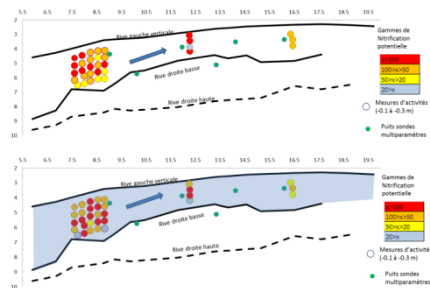
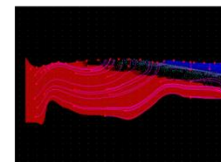
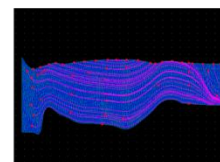


Figure 2 : System in operation on the field,



« low flow condition...trapping phase»

« high flow condition...regeneration phase»



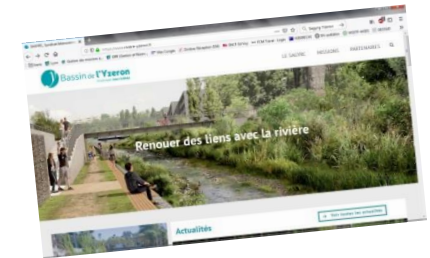
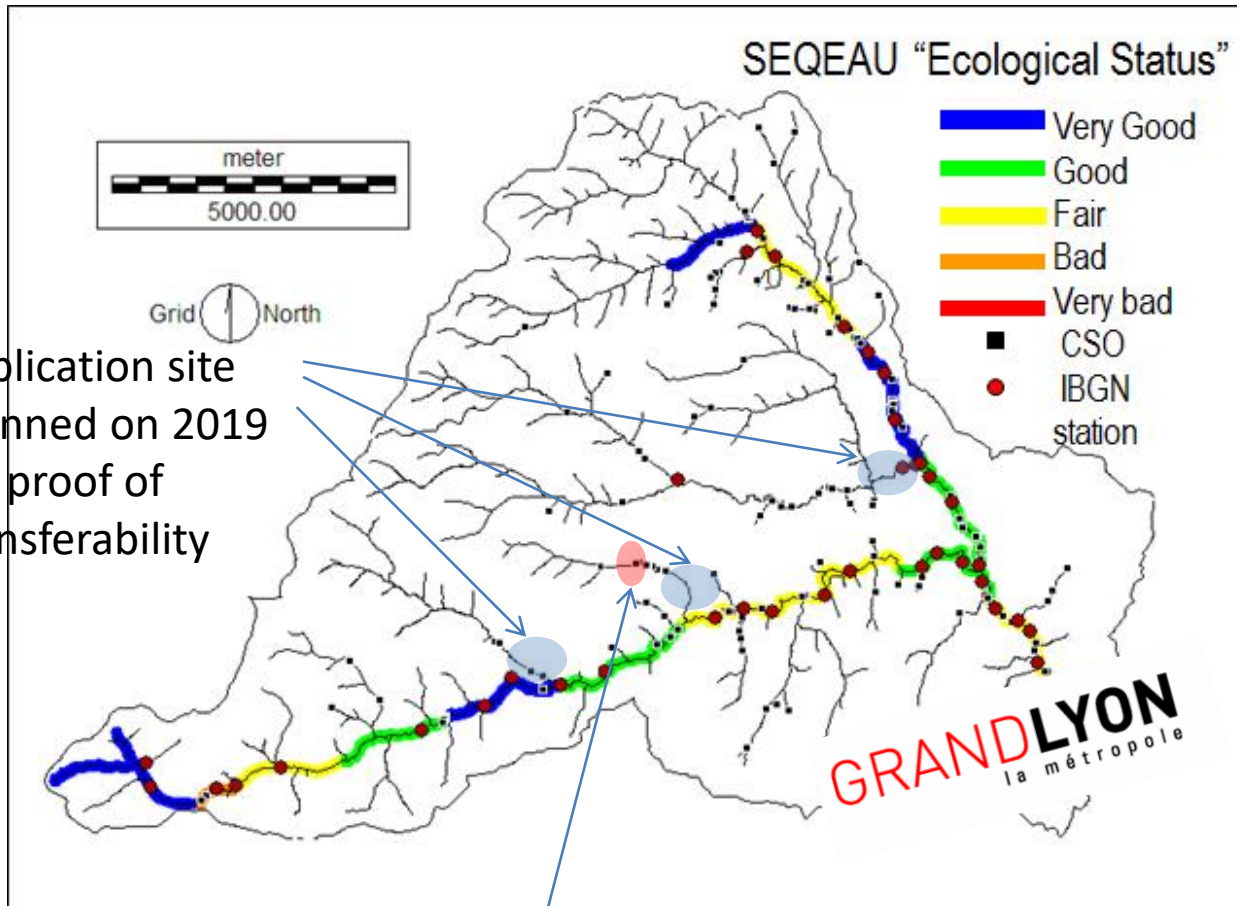


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Implementation strategy with the support of the river basin managers



Missions since 2000:
Flood, Drought, river resource management
WFD objectives / good ecological status...



Missions since 1974:
Sewer and waste water system planning and management.

Demosite – proof of concept running since 2006



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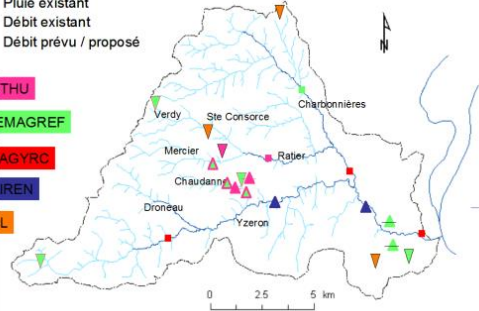
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The Lyon' EH demosite and research networks



- ▽ Pluie existant
- △ Débit existant
- Débit prévu / proposé

- OTHU
- CEMAGREF
- SAGYRC
- DIREN
- GL



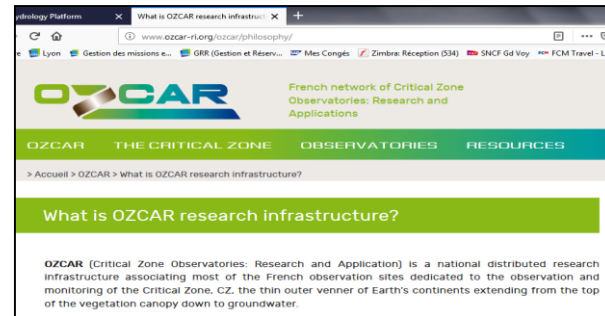
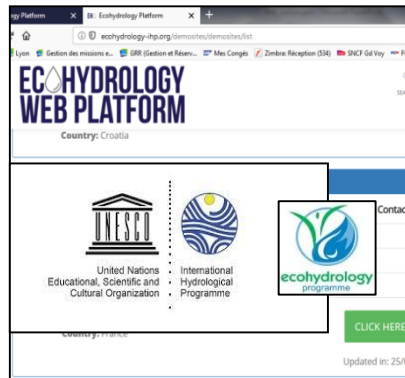
A research teams Federation
9 Universities and Engineering Schools
12 Research Laboratories, 90 PhD in 2015
Operational partners: Urban Community of Lyon, Water Agency, Ministries of Equipment, Ecology and Research, Agence de l'EAU

A long term and multidisciplinary approach
Climatology, Hydrology, Hydraulics, Soil science, Chemistry, Biology, science, Economy

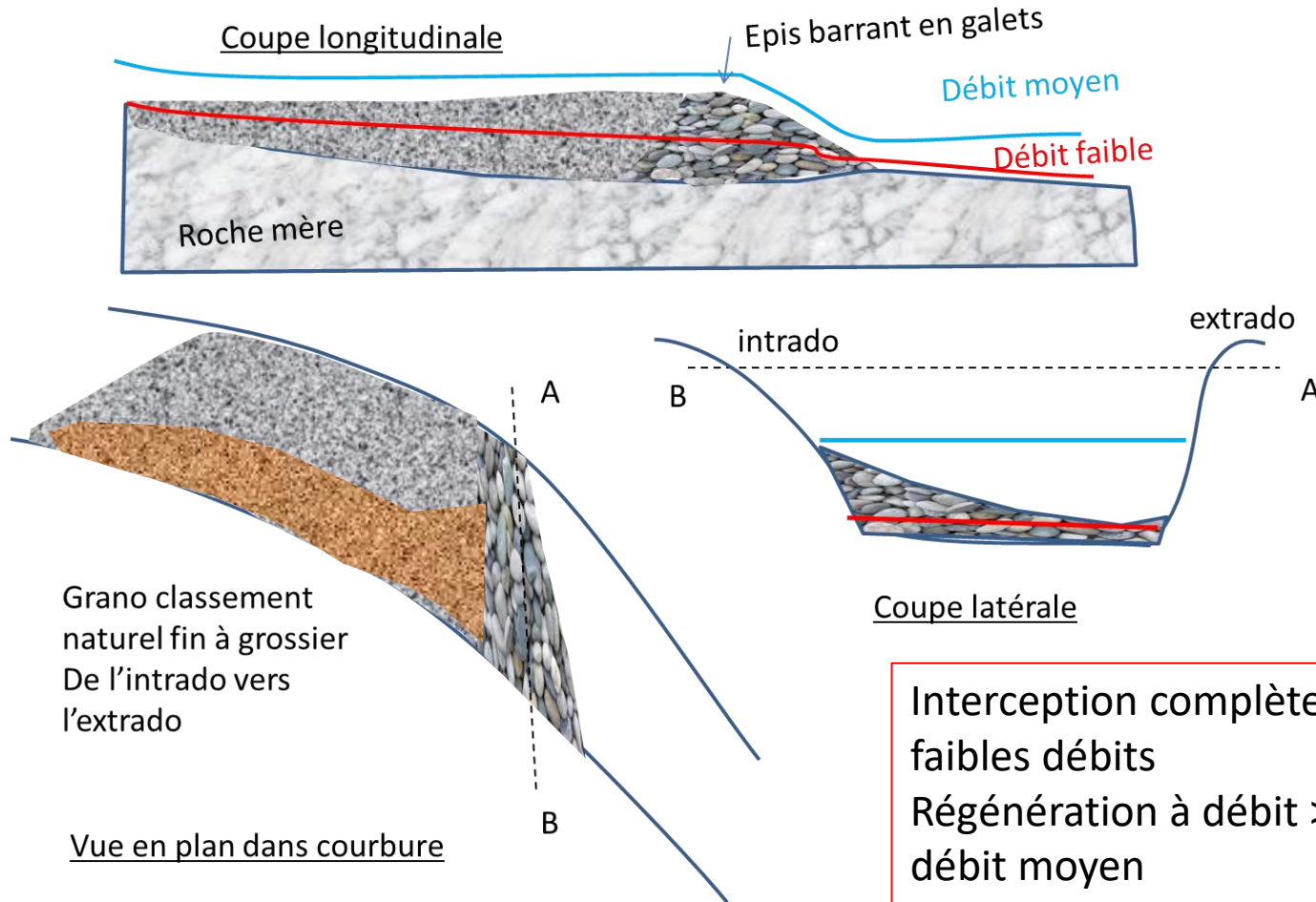
Research actions linked to end-users needs
- Hydraulic and pollutants loads in urban catchments during dry and wet weather
- Impact of discharges on soils, waterbodies & aquifers
- Development of strategies for sustainable urban water management
- Interaction between urban and rural areas

An original instrument of observation
based on long term monitoring systems with on-line monitoring for the global assessment of rainfall impact
5 experimental catchments in Lyon agglomeration, representative of Combined and separate sewers systems, CSOs, retention and infiltration
- Impacts on small perurban watercourses and aquifers

A strong effort devoted to results dissemination



Porous ramp principle



(Breil, 2018)