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# WEQUAL: A Research Project to Support Green Infrastructure

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Engineering a Better Solution

# 1. THE VISION





Have you ever wondered how a river project will perform in the long term from an ecological point of view?



Virgilio Channel (Guidizzolo, MN – Italy) http://www.frosisrl.it/opere/nuove-costruzioni/



Virgilio Channel (Valeggio sul Mincio, MN - Italy)



Arno River (Bibbiena, AR – Italy) © Maccaferri

Arno River (Bibbiena, AR – Italy) © Maccaferri



# 1. THE VISION



«Flood mitigation first»



«Flood mitigation... and sustainability»



✓ Regulations

- UE Water Framework Directive 2000/60/EC
- ✓ Socially responsible behavior
- Companies commitment



#### THE VISION: OUR COMMITMENT 1. 2012 1994 Gabions and Reno mattresses Gabions and Reno mattresses Third party study (Martino, Malcevschi, Lago, Locasiulli, Mazzetti di Pietralata, Scotti, Seghetti, Zavagno) Study commissioned to MR Energy Consulting (Roglieri) Supported by Italian Ministry of Environment

2017-2019



A research project supporting the design of sustainable stream stabilization solutions





MACCAFERRI

 $CO_2$ 

## 2. WEQUAL: GOAL AND ACTORS







in cooperation with: Maccaferri North America

GOAL

### Create a web platform

to support **designers and specialists** to assess (current) and predict (design) the **eco-morphological quality** of watercourses



unibz

### 3. WEQUAL: PROJECT STEPS

4. Implement WEQUI on the web app REQUALIFE

3. Calibrate WEQUI

2. Create a database of river stabilization solutions

1. Create the WEQUI method



Aquatic biologist Ornithologist Forester Botanist Agronomist Soil bioengineer Water-resources engineer Geomorphologist Drone experts GIS experts





# 4. CREATE THE WEQUI METHOD



Loft Bank Dight Bank

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		SCORE		
	INDICATORS	LEFT BANK	RIGHT BANK	
-545-	1 – LAND USE			
-545-	2 – LAT. CONTINUITY (CONNECTIVITY + MOBILITY)			
	3 – VERT. CONTINUITY (PERMEABILITY)			
-545-	4 – LONG. CONTINUITY (TRANSVERSE STRUCTURES)			~
-545-	5 – RIVERBED MORPHOLOGY			
	6 – RETENTION CAPABILITY			
	7 – WATER REGIME			
	8 – CHEMICAL WATER QUALITY			
	9 – MACROBENTHIC COMMUNITY			
	10 – FISH SUITABILITY			
SE-	11 – VEGETATION RIPARIAN ZONE/FLOODPLAIN			
Sto-	12 – RIPARIAN/FLOODPLAIN VEGETATION WIDTH			
-545-	13 - RIPARIAN/FLOODPLAIN VEGETATION CONTINUITY			
-55-	14 – CARBON SEQUESTRATION			
	15 – CARBON FOOTPRINT			
	TOTAL SCORE			

### WEQUI WEQUAL Eco-morphological QUality Index

### EXAMPLE

### Indicator 12 Width of the riparian/floodplain vegetation zone

	Left Durik	Night Dunk		
Width of the vegetative zone: > 30 m	۲	0	=	16
Width of the vegetative zone: 10-30 m	0	۲	=	8
Width of the vegetative zone: 6-10 m	0	0	=	4
Width of the vegetative zone: 3-6 m	0	0	=	2
Width of the vegetative zone: < 3 m	0	0	=	1

- Indicators based on measurable variables
- Objective evaluation













# 4. CREATE THE WEQUI METHOD







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Adige River - Lagundo (South Tyrol, Italy)







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### **Concrete wall**



**Drystone covering** 





Cemented stones weir



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#### **CURRENT STATE** × 10<sup>4</sup> Water: SAVI Bins Example: 13 – Continuity of the riparian/floodplain vegetative zone DTM Alt DTM Alt 815 DTM Alt Filt E 818 te an MLQ 816 3 815 814 1<sup>st</sup> derivative d(DTM alt)/ds [m/px] d(DTM Alt) d(DTM Alt Filt) 0.5 100 -0.4 -0.3 -0.2 -0.1 0 0.1 S<sub>coord</sub> [px]



#### Indicator 13 -Continuity of the riparian/floodplain vegetative zone

	Left Bank	Right Bank
Vegetative zone length: >80% of the investigated length	$\bigcirc$	۲
Vegetative zone length: 60-80% of the investigated length	$\bigcirc$	0
Vegetative zone length: 40-60% of the investigated length	۲	0
Vegetative zone length: 20-40% of the investigated length	$\bigcirc$	$\circ$
Vegetative zone length: >20% of the investigated length	$\bigcirc$	$\bigcirc$





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### **CURRENT STATE**

N.	Indicator	Left bank	River	Right bank
1	LAND USE	2		4
2	LATERAL CONTINUITY (CONNECTIVITY)	1		1
3	VERTICAL CONTINUITY (PERMEABILITY)	2	16	4
4	LONGITUDINAL CONTINUITY (TRANSVERSE STRUCTURES)		8	
5	RIVERBED MORPHOLOGY		8	
6	ORGANIC-MATTER RETENTION CAPABILITY		8	
7	WATER REGIME		4	
8	CHEMICAL WATER QUALITY		16	
9	MACROBENTHIC COMMUNITY		8	
10	FISH SUITABILITY		4	
11	RIPARIAN/FLOODPLAIN VEGETATION	16		16
12	RIPARIAN/FLOODPLAIN VEGETATION WIDTH	2		4
13	RIPARIAN/FLOODPLAIN VEGETATION CONTINUITY	4		16
14	CARBON SEQUESTRATION	2		8
15	CARBON FOOTPRINT	4	4	4
		111/272		133/272
		Poor		Moderate





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### **DESIGN ALTERNATIVES**

### **DESIGN SOLUTION A**



### **DESIGN SOLUTION B**

#### - DESIGN STATE -Drawing 10 ALTERNATIVE D: DESIGN STRUCTURES





**DESIGN ALTERNATIVES** 



Example: 14 – Carbon sequestration

### **DESIGN SOLUTION A**



✓ LEFT BANK: Bad Carbon sequestration
 ✓ RIGHT BANK: Scarce Carbon sequestration

### **DESIGN SOLUTION B**



✓ LEFT BANK: Good Carbon sequestration

✓ RIGHT BANK: Good Carbon sequestration





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### **DESIGN ALTERNATIVES**

### **DESIGN SOLUTION A**

N.	Indicator	Left bank	River	Right bank
1	LAND USE	2		4
2	LATERAL CONTINUITY (CONNECTIVITY)	1		1
3	VERTICAL CONTINUITY (PERMEABILITY)	1	16	8
4	LONGITUDINAL CONTINUITY (TRANSVERSE STRUCT.)		4	
5	RIVERBED MORPHOLOGY		2	
6	ORGANIC-MATTER RETENTION CAPABILITY		8	
7	WATER REGIME		4	
8	FISH SUITABILITY		2	
9	RIPARIAN/FLOODPLAIN VEGETATION	1		16
10	RIPARIAN/FLOODPLAIN VEGETATION WIDTH	-		2
11	RIPARIAN/FLOODPLAIN VEGETATION CONTINUITY	-		16
12	CARBON SEQUESTRATION	1		2
13	CARBON FOOTPRINT	1	4	8
		<b>47</b> /240		97/240
		Bad		Poor

### **DESIGN SOLUTION B**

N.	Indicator	Left bank	River	Right bank
1	LAND USE	2		4
2	LATERAL CONTINUITY (CONNECTIVITY)	8		8
3	VERTICAL CONTINUITY (PERMEABILITY)	16	16	16
4	LONGITUDINAL CONTINUITY (TRANSVERSE STRUCT.)		16	
5	RIVERBED MORPHOLOGY		8	
6	ORGANIC-MATTER RETENTION CAPABILITY		16	
7	WATER REGIME		4	
8	FISH SUITABILITY		8	
9	RIPARIAN/FLOODPLAIN VEGETATION	16		16
10	RIPARIAN/FLOODPLAIN VEGETATION WIDTH	2		4
11	RIPARIAN/FLOODPLAIN VEGETATION CONTINUITY	16		16
12	CARBON SEQUESTRATION	8		8
13	CARBON FOOTPRINT	8	16	8
		<b>160</b> /240		164/240
		Good		Good





## DATABASE AND CALIBRATION



WEQUAL project

WEQUAL Eco-morphological QUality Index Current-state assessment (asses 10059000) Overview of the study area						
DATE	19/08/2018	DATA COLLECTED BY		D. Sales and R. Gomes		
GPS COORDINATES	N: 44*37'09.30"		£2.80*	56'53.17"		
TYPE(5) OF HYDRAULIC STRUCTURE(5)	Gabion mat					
SITE EXTENT [ha]						
SITE DESCRIPTION (sustream bound, downtream bound, downtream bound) left tank, right tank)	Updream: Indian Tafa. Deawthream: In Water Joannel and/s into the Georgian Bay. In Water Joannel and the Among Joannel and Antonicas, At the time of the ski visit the water was very shallow. Left bank: In Cablin reventment. Right bank: I combine wati, 3 bir gobien wall, 6kd double bank wire combine.					

Create the database

prediction robustness

Calibrate WEQUI

Ensure software

Assessment of a wide range of river stabilization solutions (min. 15 years old)











### 6. DATABASE AND CALIBRATION











### 6. DATABASE AND CALIBRATION







# 7. REQUALIFE

- ✓ Free web platform
- ✓ Accessible through a simple login
- Available from October 2019



# 7. REQUALIFE

### NEW ASSESSMENTS

### Wizards available:

- Current state assessment
  - A. Self assessment
  - B. Guided assessment
  - C. Advanced assessment
- Design-solution assessment
  - A. Self assessment
  - B. Guided assessment



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#### REQUALIFE 7.

### MANAGE MY ASSESSMENTS FOR EACH LOCATION



VAT No: 00000000000





1879-2019

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#### REQUALIFE 7.

**EXAMPLE:** 

**STRUCTURES** 

DRAW

**DESIGN** 









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### SUMMARY

Collecting data is the starting

point!



Web platform REQUALIFE
Simple methodology WEQUI
Evaluation based on a score system

Ecological recovery

- ✓ Carbon sequestration
- ✓ Aquatic life suitability

Identify and quantify strength & weaknesses of a watercourse and address improvements to enhance ecosystems and support biodiversity





# Thank You!

Visit <u>https://wequalproject.eu/</u> for more information





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