

## Lesson gained from French R&D programs for pesticides dissipation by use of constructed wetlands

[J. TOURNEBIZE](#), B. VINCENT, C. CHAUMONT, E. PASSEPORT, C. GRAMAGLIA, C. MARGOUM, P. MOLLE, N. CARLUER, J.J. GRIL

Cemagref

Corresponding Author: [julien.tournebize@cemagref.fr](mailto:julien.tournebize@cemagref.fr)

### Context, Problematic, Stakes

- **French Social Demand** about water quality management from agricultural areas and particularly from subsurface drained areas
  1. To limit transfers of agricultural contaminants (pesticides)
  2. To reduce impacts of agricultural activities on water quality
  3. To provide solutions to respect the objectives of « Good Ecological Status » of European Water Framework Directive (2000)

**What kind of mitigations focusing on pesticide could be implemented at a catchment scale?**

## Context, Problematic, Stakes

- The simplest solution « ZERO PESTICIDE »



↪ not achievable for now (technic and economic reasons)

- French governmental solution: Reduction of 50% of total pesticide applied amount,

↪ only part of the issue, do not concern directly transfer



3

## Context, Problematic, Stakes

- Complementary solution:

↪ Concept of **buffer zone**: area dedicated to the treatment of agricultural water

- Research projects

↪ Cemagref group TRUSTEA:

**Rustic Treatment of Agricultural Water**

↪ European Environment Life Project:

**ARTWET (Artificial Wetland, see [www.artwet.fr](http://www.artwet.fr))**

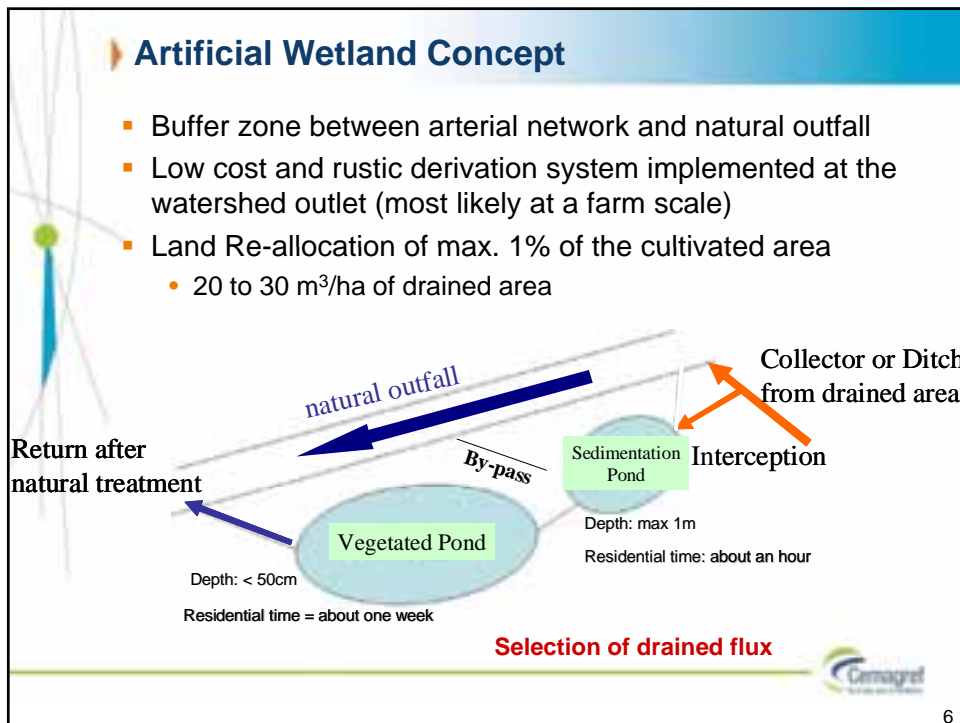
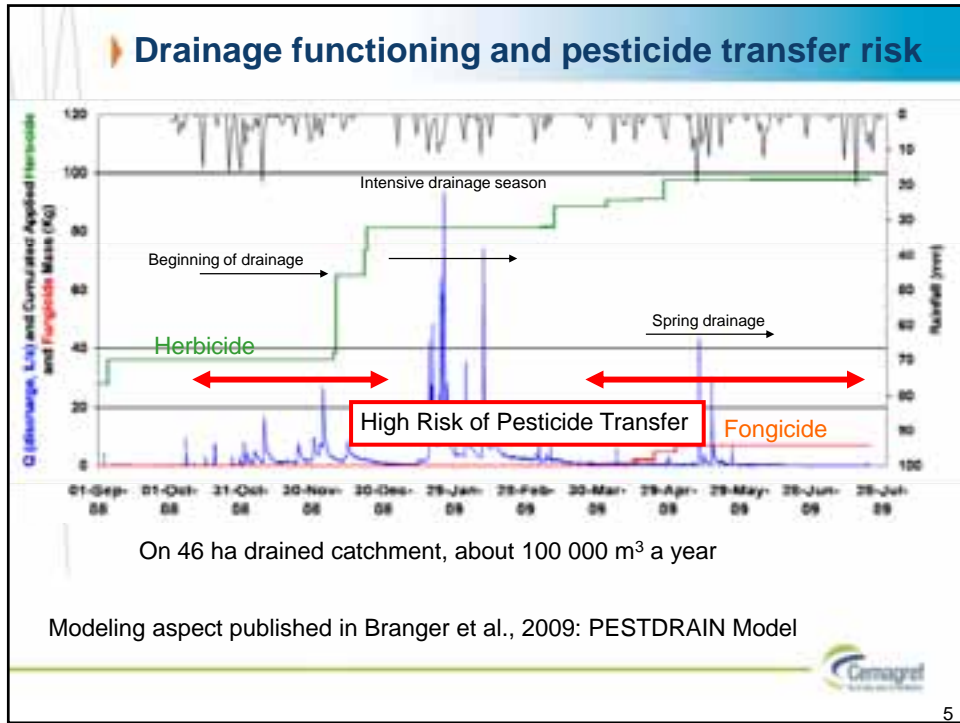
- Experimental Potentiality of Artificial Wetland

▪ in lab and in pilote field

- Application on a real case

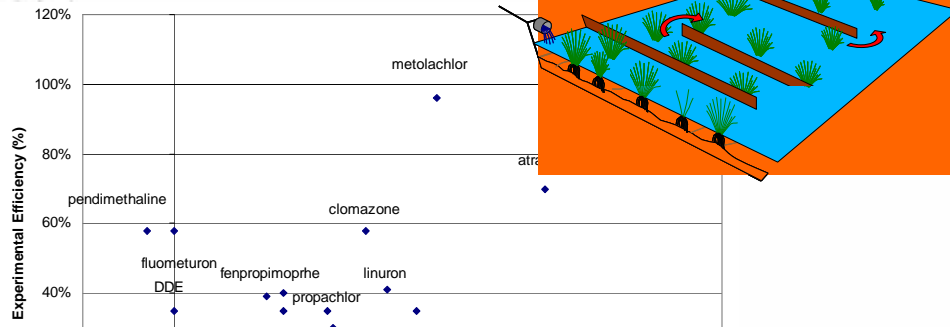


4

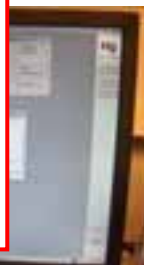
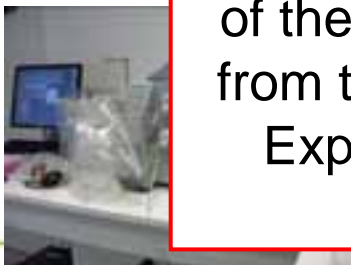
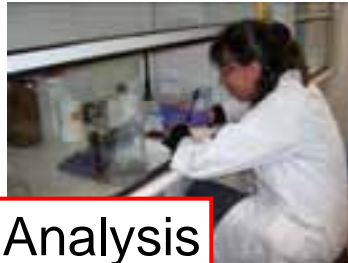


## Artificial Wetland Concept and Efficiency

### ● Efficiency: State of Art

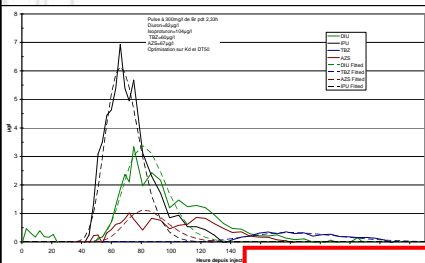


Test and assessment of potential treatment efficiency in controlled conditions



Chemical Analysis  
of the Samples  
from the Tracer  
Experiment

Test and assessment of potential treatment efficiency in controlled conditions

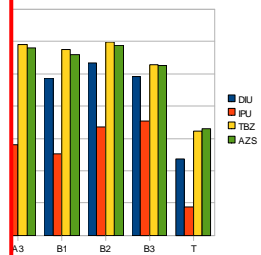


	Flux	% Max Conc
<b>Br</b>	<b>89%</b>	<b>8.4%</b>
<b>IPU</b>	<b>73%</b>	<b>6.7%</b>
<b>DIU</b>	<b>63%</b>	<b>4.1%</b>
<b>AZS</b>	<b>24%</b>	<b>1.5%</b>
<b>TBZ</b>	<b>10%</b>	<b>0.5%</b>



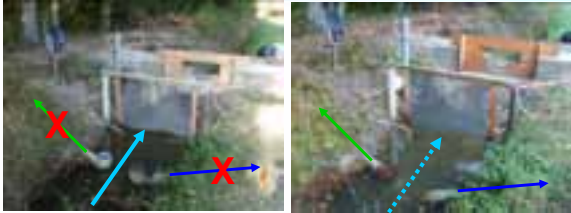


Modeling and  
Assessment  
+ Microcosm  
Complementary  
Experiment

adsorbées en % de la masse en entrée




**Project Artwet**

↑ *Disconnected*      ↑ *Connected*

Rotation : Barley, Rape, Winter Wheat  
 Farm area: 46 ha  
 Wetland Area: 0.3ha  
 Efficiency: between 20 and 90%


**Field Experiment:  
 Test of our  
 concept on at one  
 farm scale**



**Theoretical Conclusions**

- **Real potential but not the same efficiency for all pesticides (depend on chemical properties)**
- **Land request non negligible, for hydrological purposes (volume to be treated)**
- **Role of vegetation**
- **Main processes of dissipation:**
  - Adsorption by substrats (vegetation, straw, sediment, clay)
  - Degradation by bacterial activities, enhanced by Redox conditions, ... habitat

↪ **ecological services of wetland to water quality preservation**



12

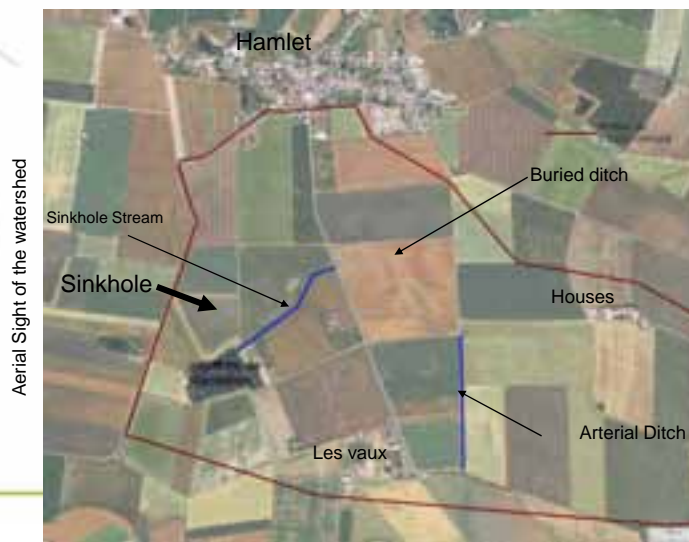
## Test on a real case



13

## Test on a real case: Description

- Protect groundwater from pesticide contamination in a totally drained watershed of 400ha



14

## Test in a real case: Description

- Sinkholes make a direct link between surface water and groundwater



Example of a sinkhole

## Test in a real case: Stakeholders

- Water Agency → Water Framework Directive
- Local authority → Drinkable water to citizens at a lowest treatment as possible
- Farmers → Food production
- And Scientists → Improve knowledge and provide solutions, tools ...



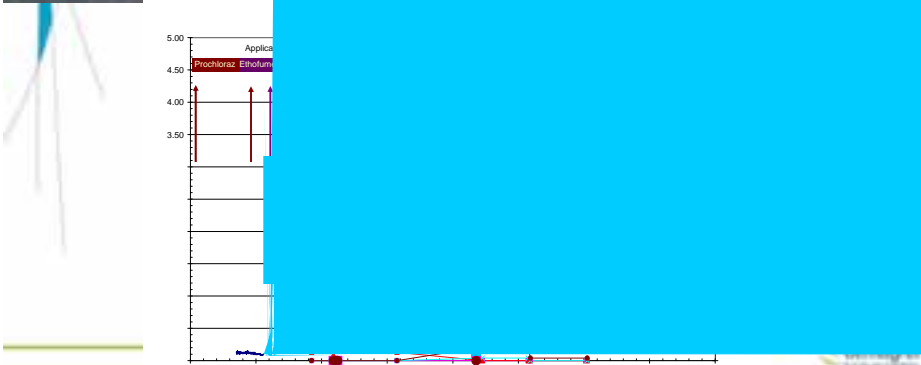
**Test in a**

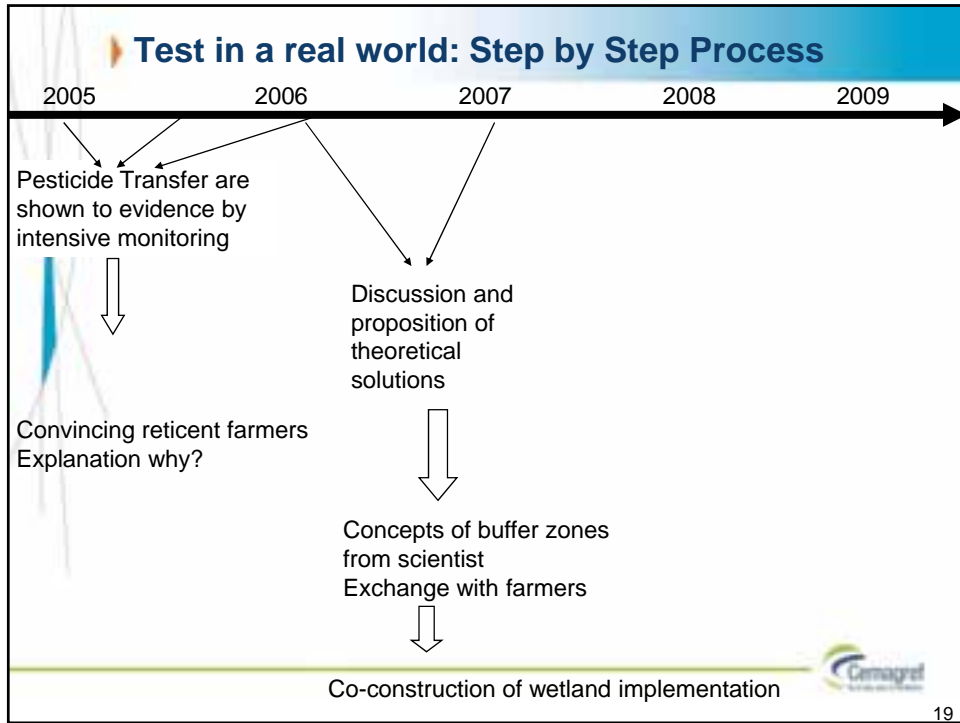
2005                      200

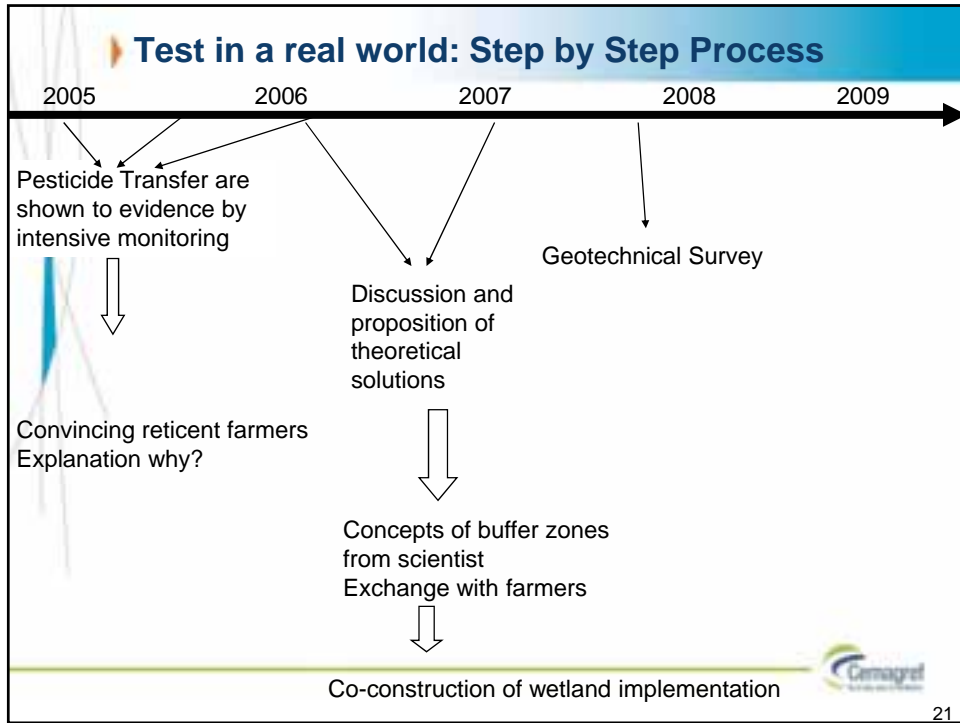
Pesticide Transfer are shown to evidence by intensive monitoring

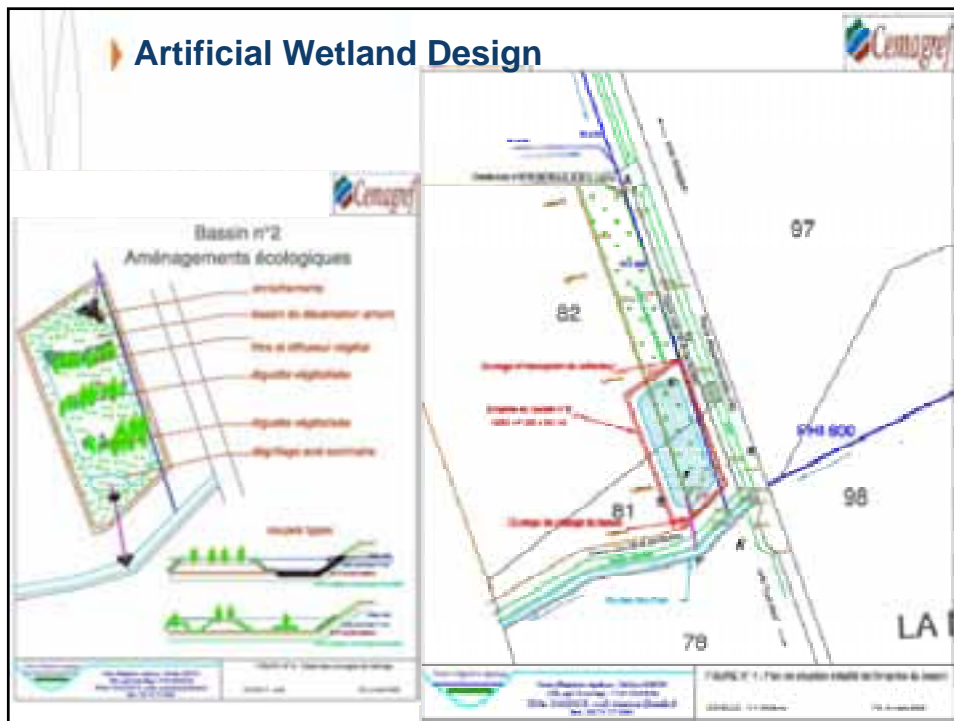
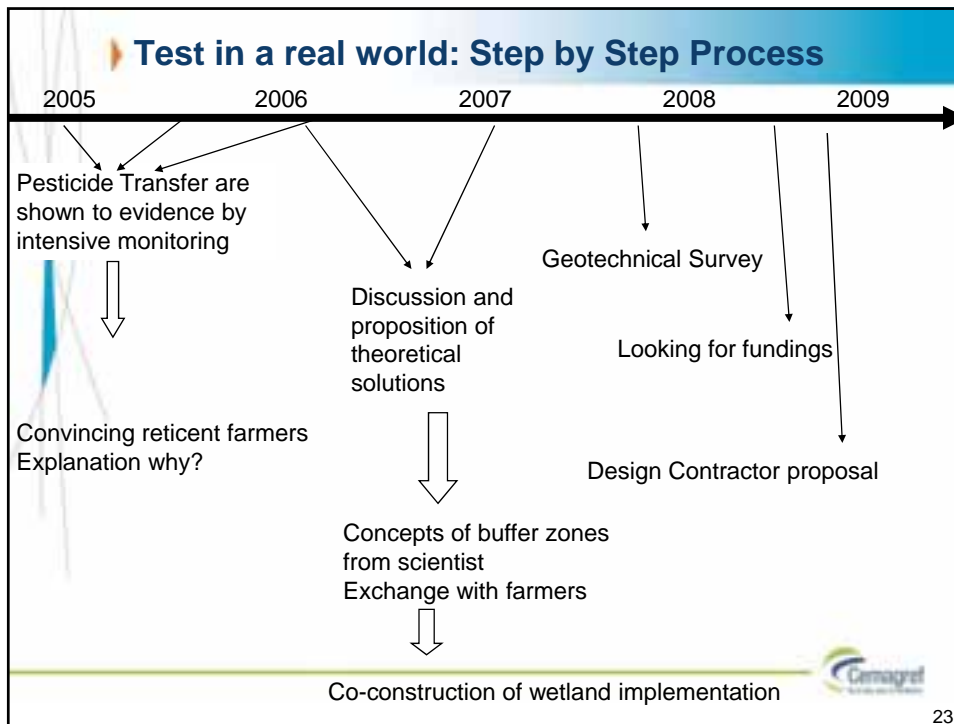
↓

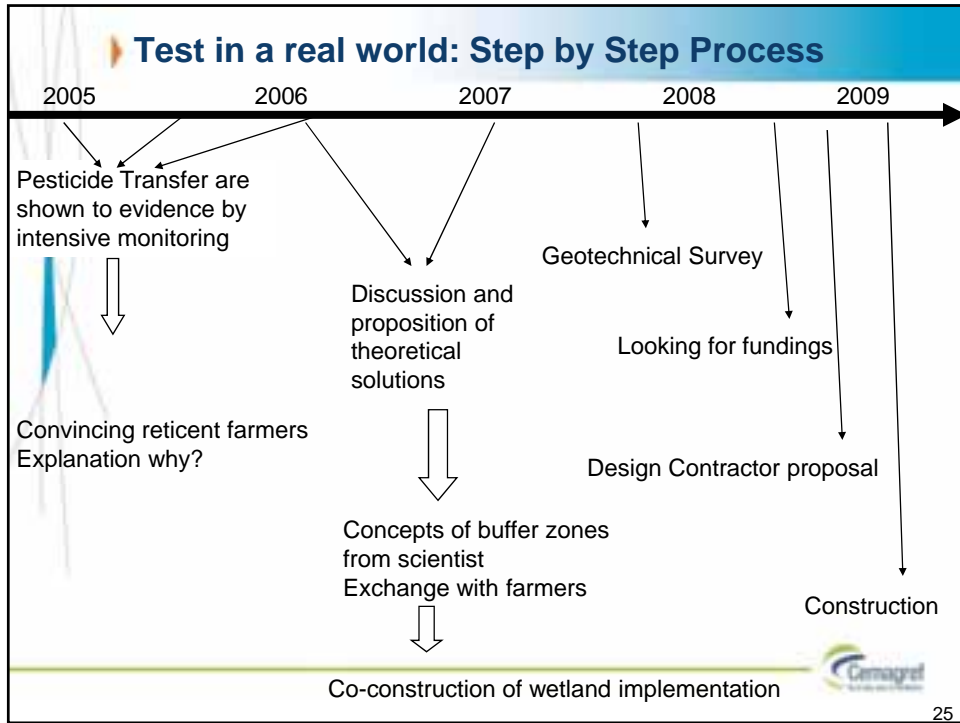
Convincing reticent farmers  
Explanation why?



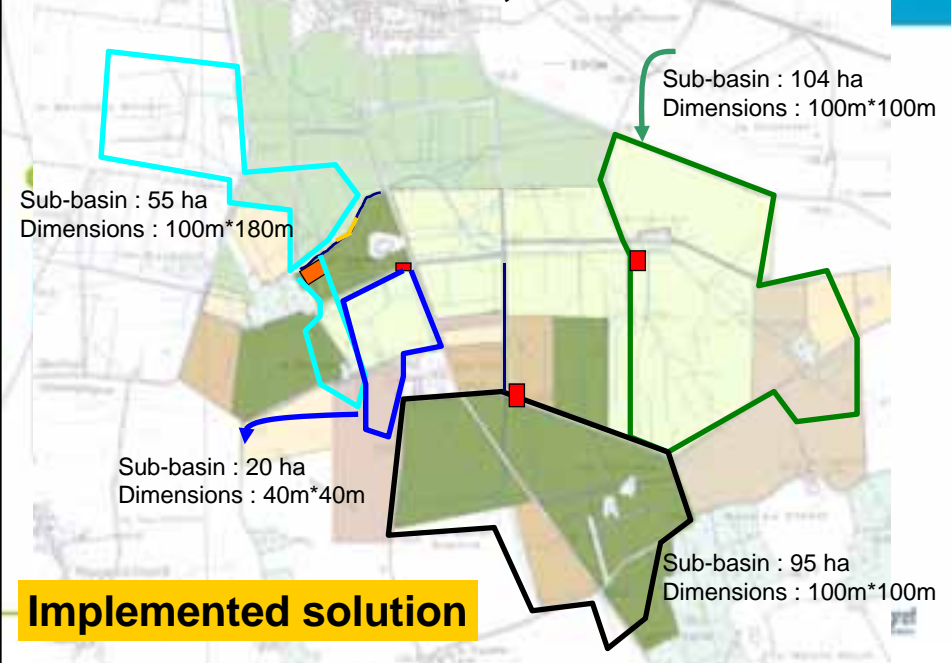








## Co-constructed solutions, after concertation



### Conclusions

- Ecological Services from Artificial Wetland could be useful for pesticide mitigation but with limits (chemical properties, hydrology)
- Artificial wetlands are not a pollution license. They have to be considered as a complementary tool at catchment scale for integrated management
- Science in the lab to face to real world need to adapt theoretical solution to socio-economical context and to involve farmers directly in a co-construction process

### Perspectives

- Assessment of the solution for water quality purposes
- Assessment of other services (biodiversity, ...)

