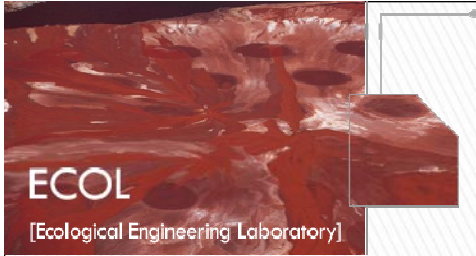


# HydroPix Monitoring

**A Vision-Based Tool for the  
Understanding of Hydraulic Structures**



# Presentation Structure

## Context

- Problem Statement

- Stormwater

- Combined Sewer Overflows

- Limitations of actual measurement systems

## System Requirements

### Hardware

### Algorithms

- Water Level

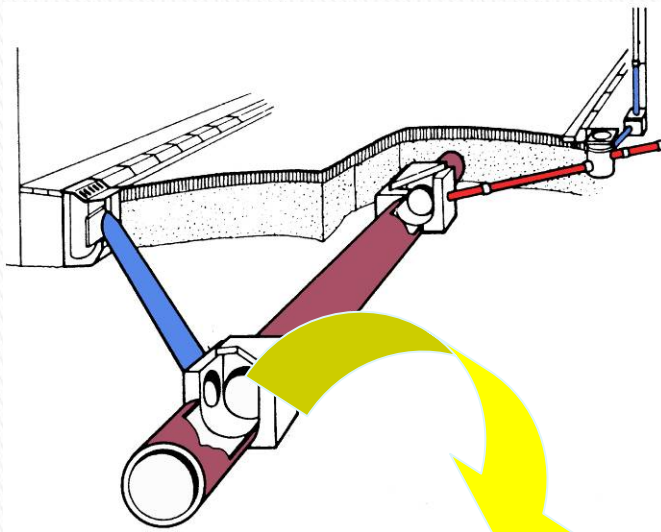
- Surface Water Speed

### Partners

# Wet-weather problematic in urban areas : an introduction



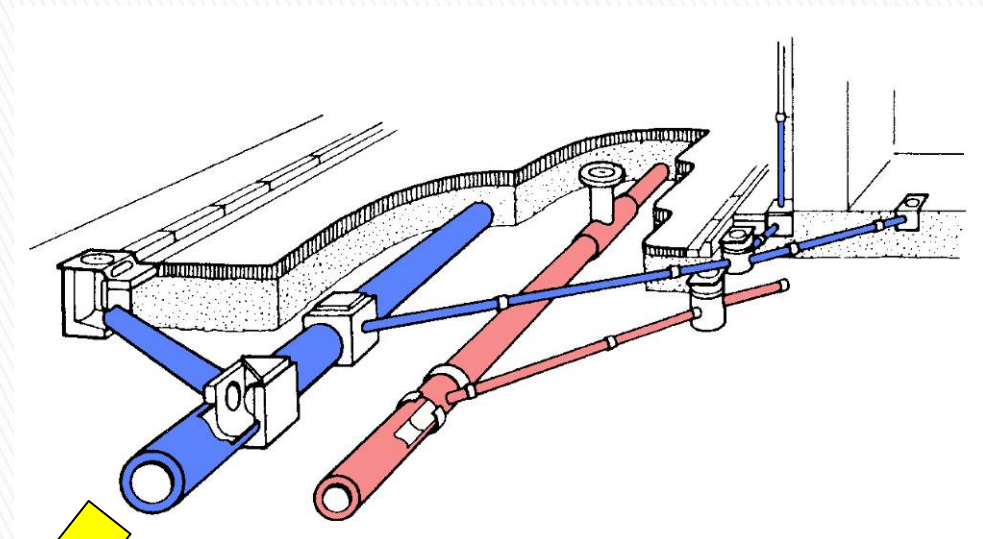
Combined sewer system



CSOs



Separated sewer system



Stormwater discharges

# Stormwater

ECOL

[Ecological Engineering Laboratory]

Main source of pollution for heavy metals, PAHs, in urban areas...



Example: Field survey (US): leaks of oil by vehicles is equivalent to about 27 Exxon Valdez tanker spills every year...



ECOL

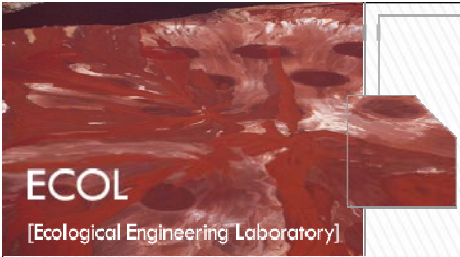
[Ecological Engineering Laboratory]

# Combined Sewer Overflows

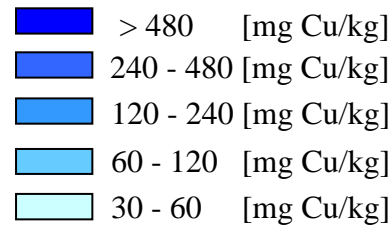
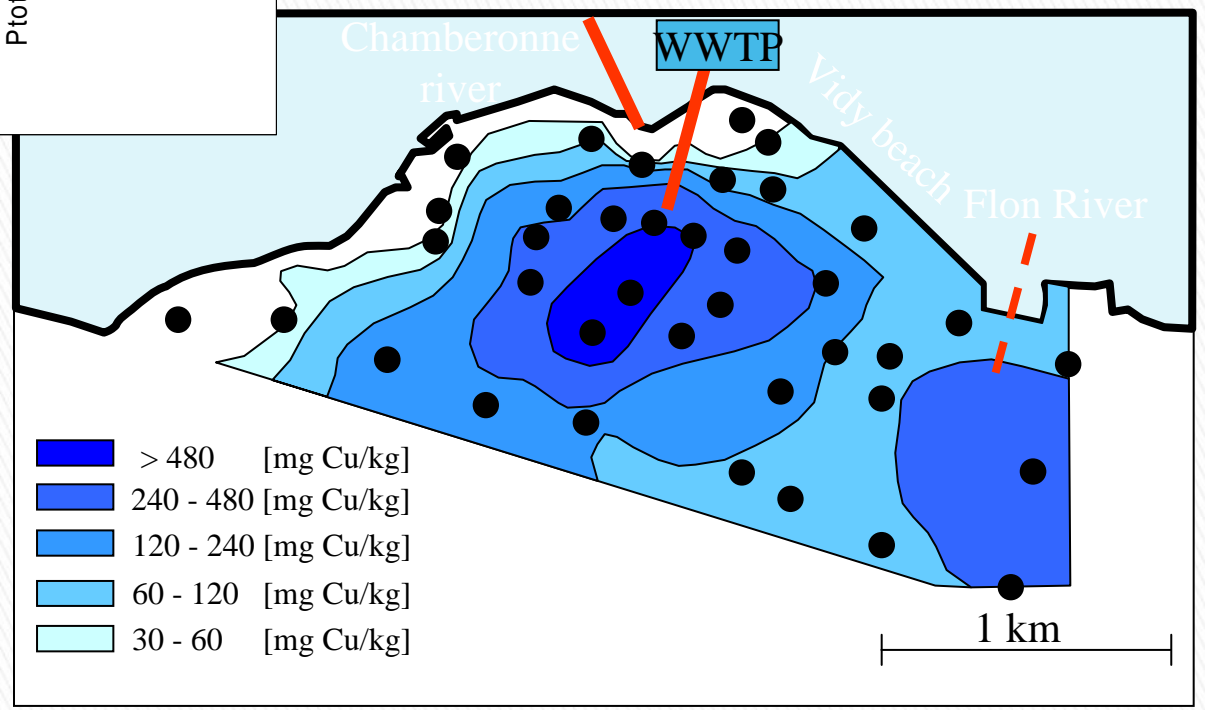
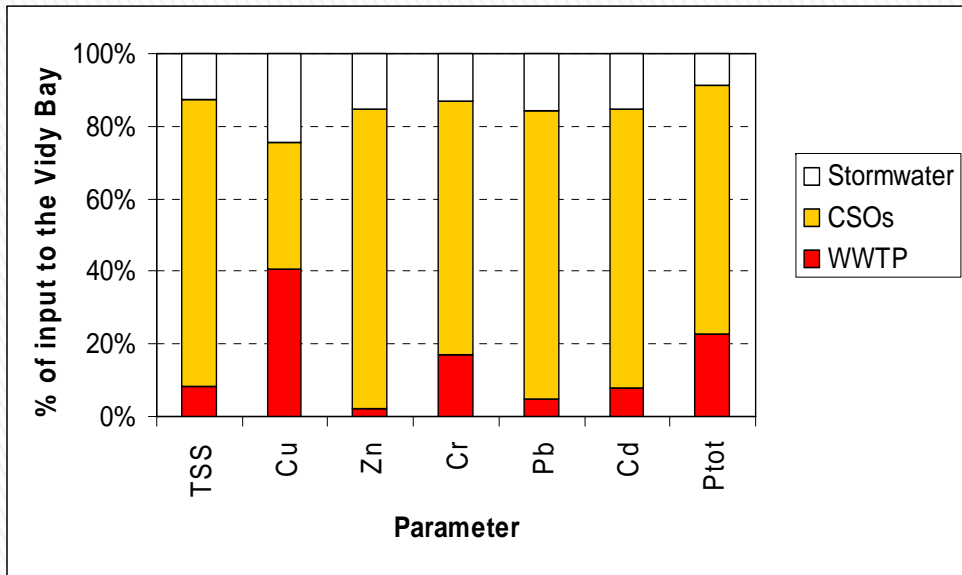
Important source of pollution: phosphorous, nitrogen, organic matter, pathogens and viruses, residues of pharmaceuticals...



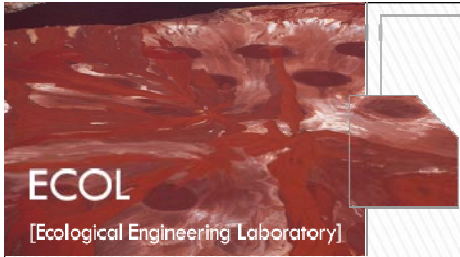
Video1 and Video 2



# Example of problem: Vidy Bay, Lausanne

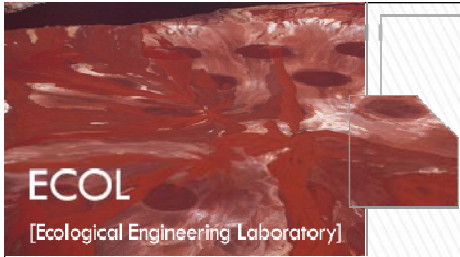


Probable effect concentration:  
150 [mg/kg]



# « Classical » measurements : important flow variations

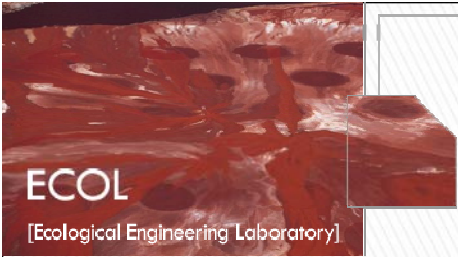




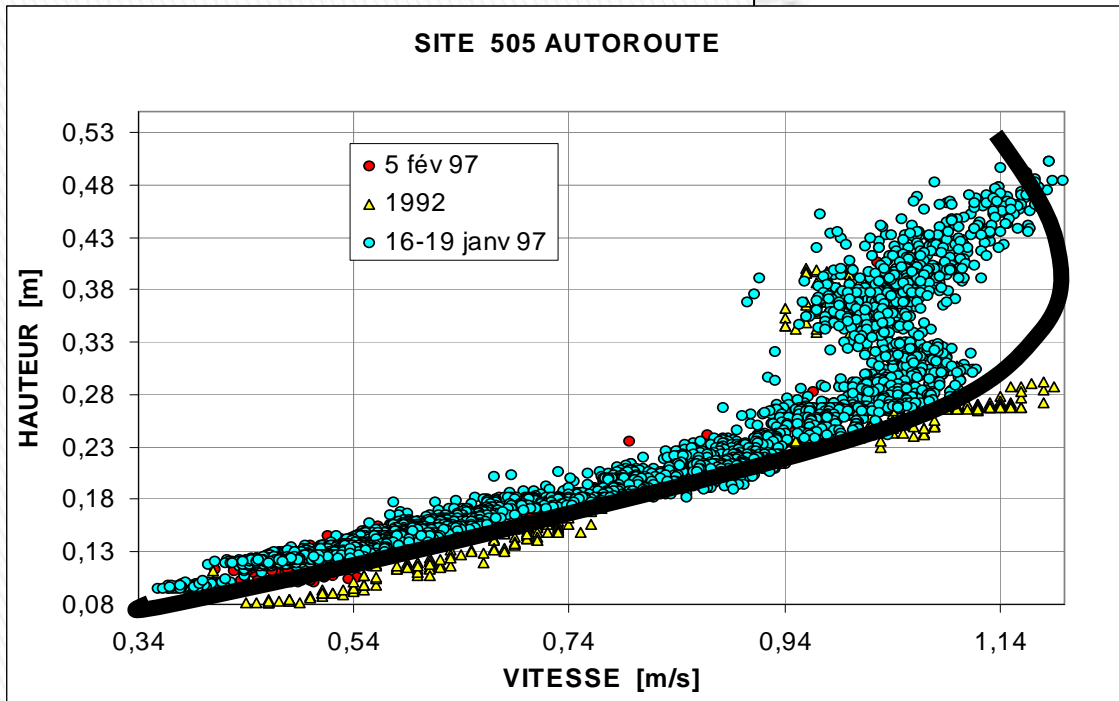
# Accessibility of measuring sites during rain events





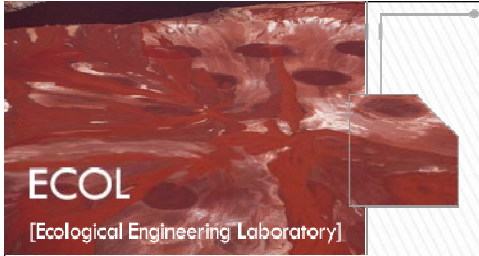


# Hydraulic behaviour ?



Urgent need of a new measurement system !

 Hydropix monitoring project



# System Requirements

- Waterproof
- Resistance to corrosion
- Lighting
- Event-based recording
- Intelligent filing
- Alarms
- Flow measurements
  - Water level
  - Surface water speed
- Remote viewing



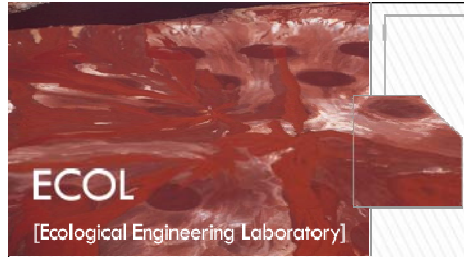
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# Hardware : Cameras

IP68 waterproof cameras  
Integrated IR illuminator  
Encoder





# Hardware testing: deployment @ Denantou CSO





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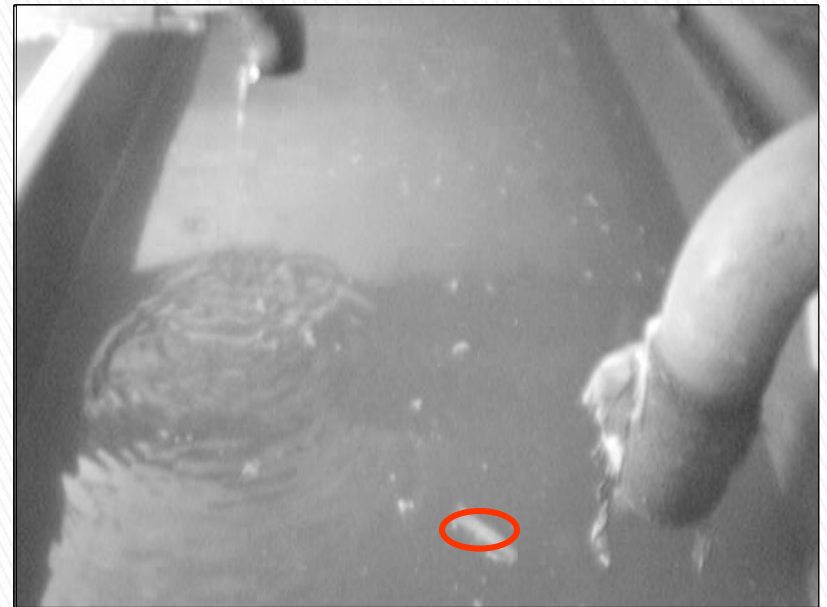
# Image Analysis Algorithms

Goals : use cameras for measurements

Estimation of flow

Water level

Surface water speed



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# Water Level Measurement

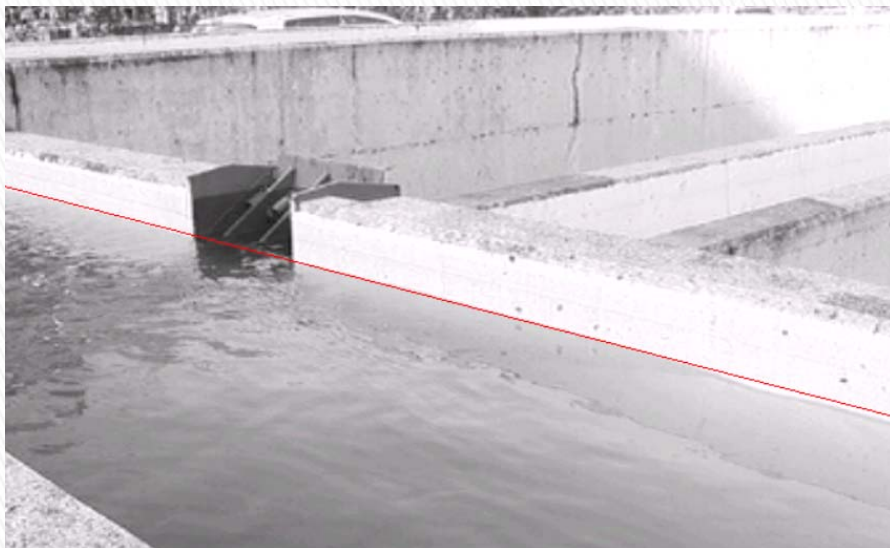
## Results

Robust line detection

Tested on real images

Around 40 configurations

Examples of results...



# Project partners

ECOL

[Ecological Engineering Laboratory]

CTI/KTI Project : 2.5 years

EtriNex

Videosurveillance

Communications

EPFL/ECOL : hydrology

EAWAG : hydrology

EPFL/BIG : image processing

City of Lausanne

Purchased a preliminary system



ECOL

[Ecological Engineering Laboratory]

# Project Advancement

Hardware : testing phase

Image acquisition : OK

Water level measurement

Done : robust line detection

To do : spatial calibration, *in situ* testing

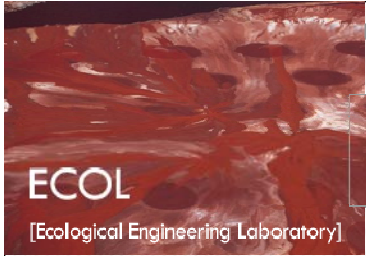
Surface water speed : to do

Database management : to do

Main program and GUI : to do







**Thank you for your attention**

**Questions ?**