Smart City- Sewer System Monitoring for Better Characterization and Management

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1. Smart Sewage Concept
2. Large scale-Demonstrator
3. Smart monitoring
4. Data Analysis & anomaly detection
5. Numerical modelling
6. Conclusion
Smart sewage Concept

- GIS construction
- Smart monitoring
- Numerical modeling

Security Optimization

Storage Analysis Control
Large-scale demonstrator of smart city

Small City
Campus of Lille 1 University / VILLENEUVE D’ASCQ, LILLE
  • 110 hectares
  • 25000 users
  • 140 buildings
  • 100 km urban networks

Variety
  • Usage
  • Quality
Construction of GIS system

- Patrimoine
- Maintenance
GIS Data Base

140 Buildings

- Administration
- Activities
- Teaching and research

66% built before 1975
Sewage Network

✓ 4 Km primary network
✓ 12 Km Secondary network

Diameter = 100 to 250 mm
Sewage Network
Sewage Network-Maintenance
Sewage Network - Maintenance

- **video Inspection**
  - Type of failures
  - Degree de gravity
  - Localize vulnerable areas
  - Evaluation on long term
Monitoring system

- Site instrumentation
Instrumentation of studied site

- Surface 30 Hec
- Real time monitoring
  - Hydraulic Parameter
  - Quality Parameter
Instrumentation of studied site

Transmetteur Pack Battery

Sonde Flowmeter
Data analyses

- Normal Function
- Anomaly detection
Wastewater flow pattern

Average flow
2.7 m³/h
(Weekend)

Maximum Flow
7.5 m³/h
(Weekend)
Wastewater flow pattern

Average Flow
2.7 m³/h (Weekend)

6.3 m³/h (Jour ouvrable)

Maximum Flow
7.5 m³/h (Weekend)

20 m³/h (Working day)
Semaine du 3 au 10 Septembre 2015
Semaine du 24 Septembre au 1 Octobre 2015

Débit moyen
5,78 m$^3$/h
6,98 m$^3$/h
Detection of abnormal events

Graph showing flow rate from 3 Sep. to 10 Sep. 2015 and 10 Sep. to 17 Sep. 2015.

Flow m³/h
Detection of abnormal events

13 September

Flow m³/h

Time

3 Sep. to 10 Sep. 2015
10 Sep. to 17 Sep. 2015
Detection of abnormal events

Flow of 13 Sep. 2015
Rain of 13 Sep. 2015

96 mm/h
Detection of abnormal events

Flow m3/h

Time

Rain mm/h

Flow of 5 and 6 Oct. 2015
Rain of 5 and 6 Oct. 2015

3 Sep. to 10 Sep. 2015
1 Oct. to 8 Oct. 2015

7.8 mm/h
Wastewater flow modelling

Code EPA-SWMM
Dry periode

$Q = 3 \text{ l/s}$

09/22/2015 12:30:00

Flow (m$^3$/s)
Period with a significant rainfall event

(13 September, $\ln(\text{Max}) = 96 \text{ mm/h}$)

$Q = 15 \text{ l/s}$
Period with a significant rainfall event
Period with a significant rainfall event
Difficulties

Access
Conclusion

• Numerical Data base
• Real time monitoring system
• Hydraulic model
• Feedback experience
Thank you!