Use of Storm Water Management Model for on lot drainage

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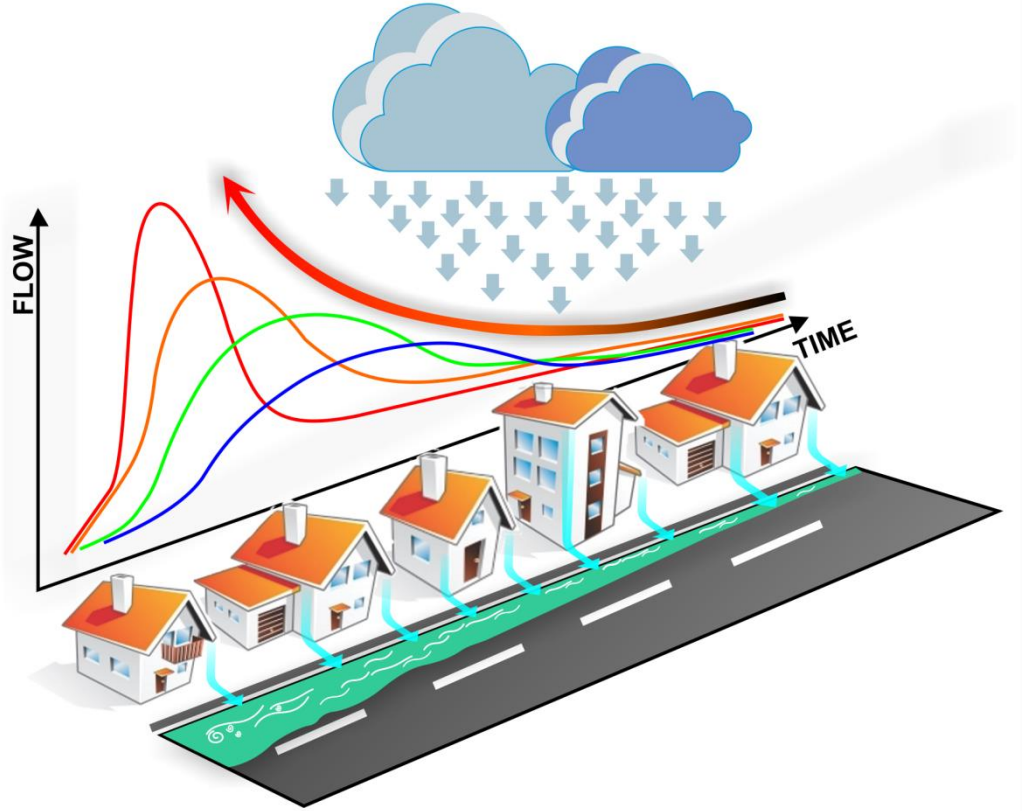
- The **increased runoff flow** is **one of the impacts** caused by the **construction of buildings** in urban areas

- **Post-occupation runoff hydrograph: increase** in the **volume disposed off** in a **short period** of time



Flash Flooding and Urban Flooding

Urban drainage

The best approach is to combine:

on lot drainage systems **+** **conventional** urban drainage systems **+**

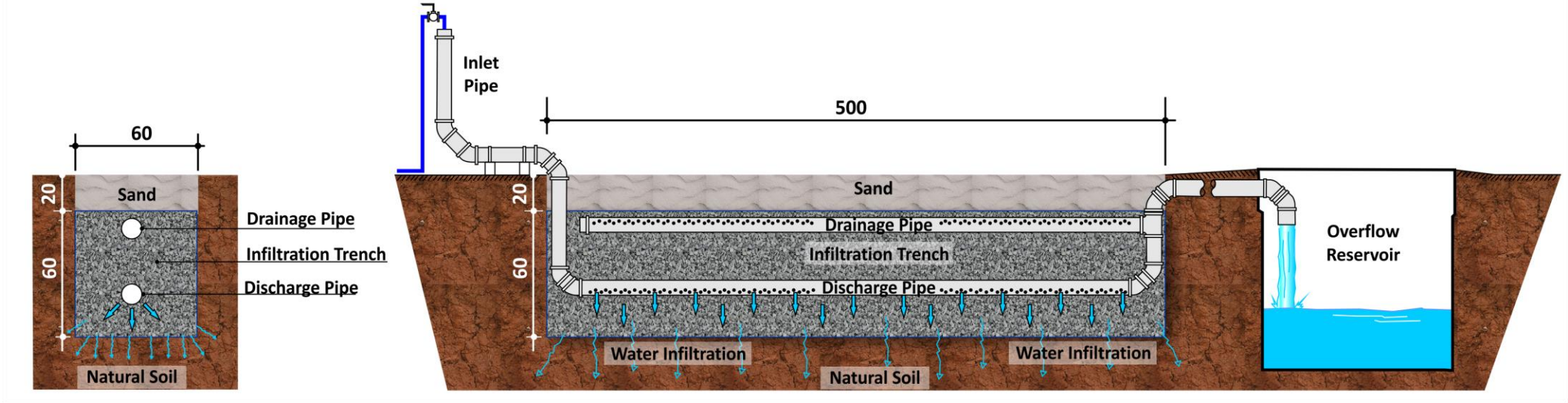
non-structural management instruments (regulation of land use and occupation, environmental education, etc), where **each part acts to solve the problem** related to the **increasing of runoff**

- the **S**torm **W**ater **M**anagement **M**odel – **SWMM** was **developed** by **US Environmental Protection Agency)** for *"**modeling** the **generation** and **transport** of **runoff flows**, and **estimate** the **production of pollutant loads** associated with this runoff"* ...

- ... **SWMM** has been used for **simulating** the performance of **on lot drainage systems.**

- The **objective** of this paper is to verify the **applicability** of the use of this **software** for the **performance simulation** of **infiltration trenches.** For this, **we compared the output hydrographs** of an **experimental infiltration trench** with the **output hydrographs** obtained with the **SWMM model.**

Experimental apparatus



Centrifugal pumps with adjustable flow
High precision water meters
Water level sensors

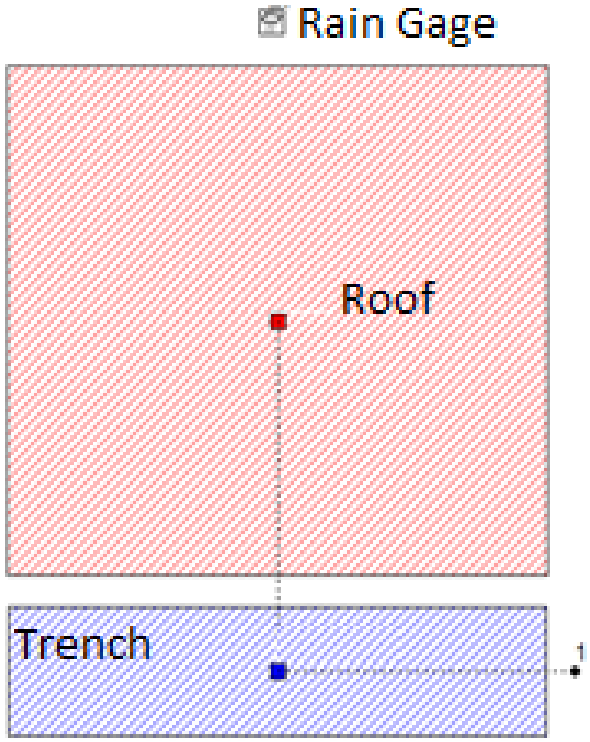
I. **2.75 m³/h** (45.90 L/min), **30 min**
(equivalent to a rainfall of **52 mm/h**)

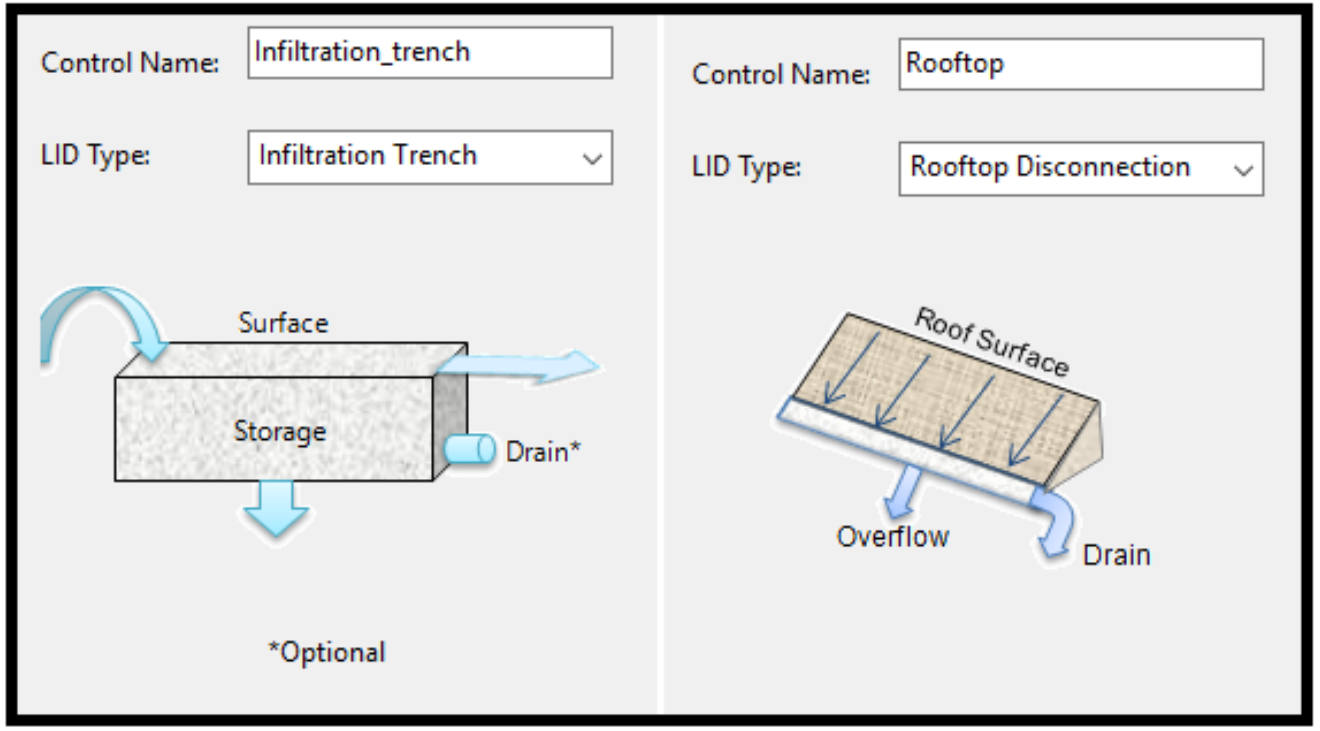
II. **10,10 m³/h** (169,60 L/min), **8 min**
(equivalent to a rainfall of **192 mm/h)**

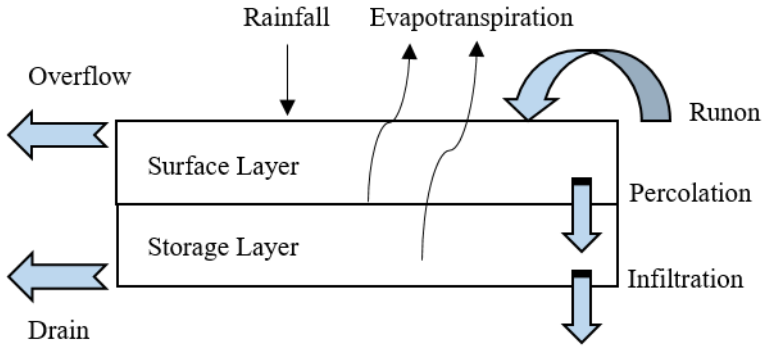
Both represents hydrological events of the city of Campinas, SP, Brazil.

- Due to the **short duration of the tests limited by the volume of the reservoir for the overflow water**, the **rainfall** used in the **model** is a **projection of the events tested in the field for a period of 60 minutes**:
  - This consideration **does not change the intensity of the design rainfall, only its duration**, and was adopted to **better represent the hydrograph**.
  - The **longer duration of the design rainfall** also **does not determine the reduction of the infiltration rate during the test**, since **the measurements** have already considered the **worst situation in terms of soil saturation**, with **percolation** occurring when the **soil** had already **reached its field capacity**.

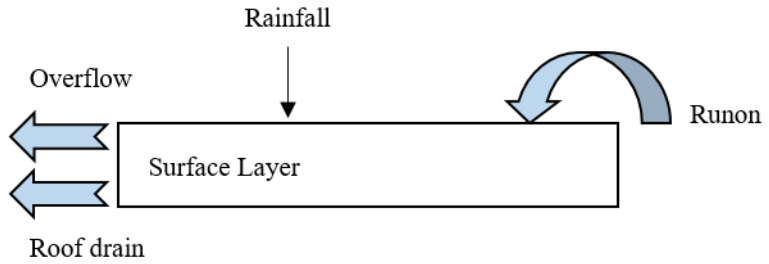
SWMM







Conceptual model of the
LID structure Infiltration Trench.

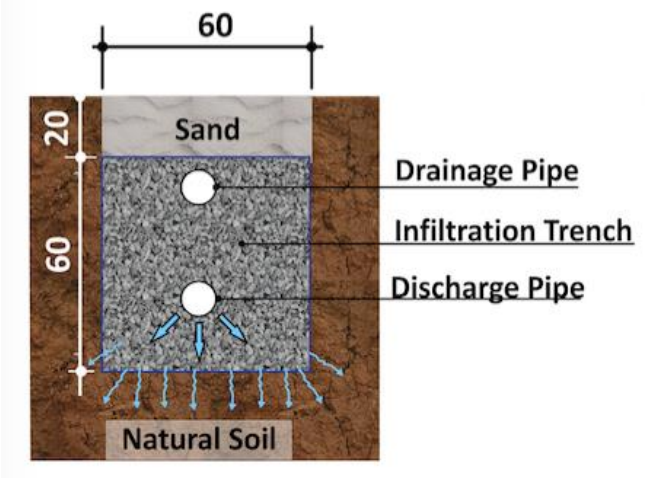


Conceptual model of the
LID structure Rooftop Disconnection

- For the simulation, **some artifices were necessary for the software to correctly interpret the input data** to produce results as close as possible to reality, for example:

  - the definition of the **precipitation time series** → the precipitation **values were inserted every 10 sec** for the program to interpret the **data as a continuous rainfall**, with **duration of 60 min**;

  - In the **experimental facility**, there is a **layer of sand** which **could not be considered in the SWMM** model. One option would be to use the **Bio-Retention structure**, which has **different characteristics** when compared with the infiltration trench.

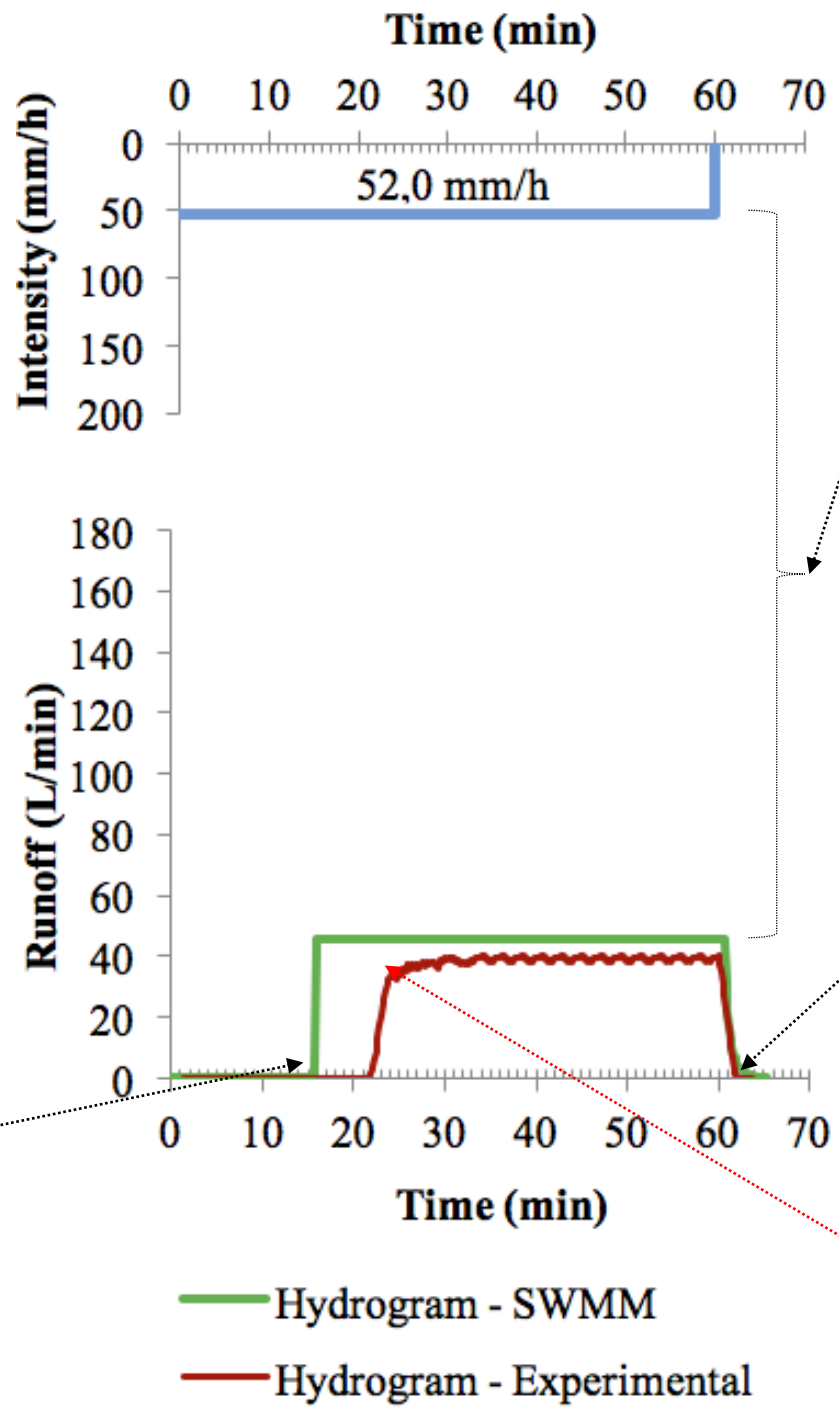


RESULTS
Scenario I

- **beginning of the runoff flow**:
  - 940 sec
  - 1310 sec

- **SWMM** considers that the **infiltration** occurs only by the **trench bottom layer**, actually, infiltration occurs by the **bottom and side** of it.

- the **anticipation** of **runoff time** (trench overflowing) in the model **may have been resulted from this.**



runoff flow decay begins after the **end of the precipitation, more slowly** in the **model**.

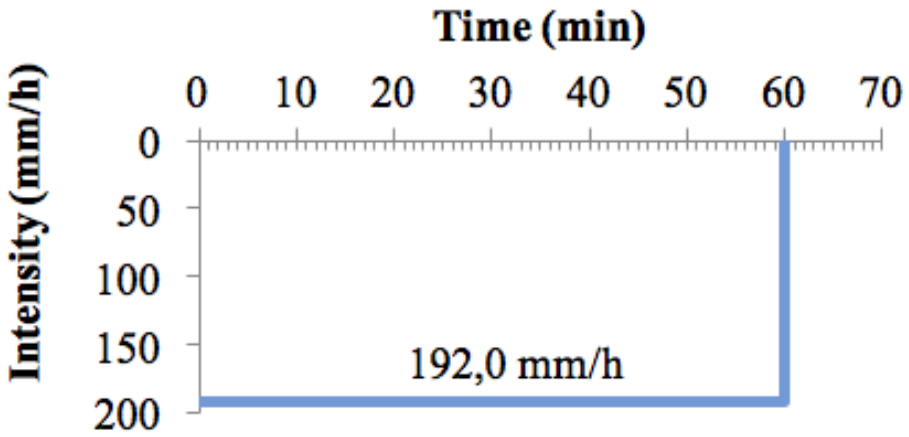
This difference may also have been caused by the consideration of the **infiltration only** by the trench **bottom layer**

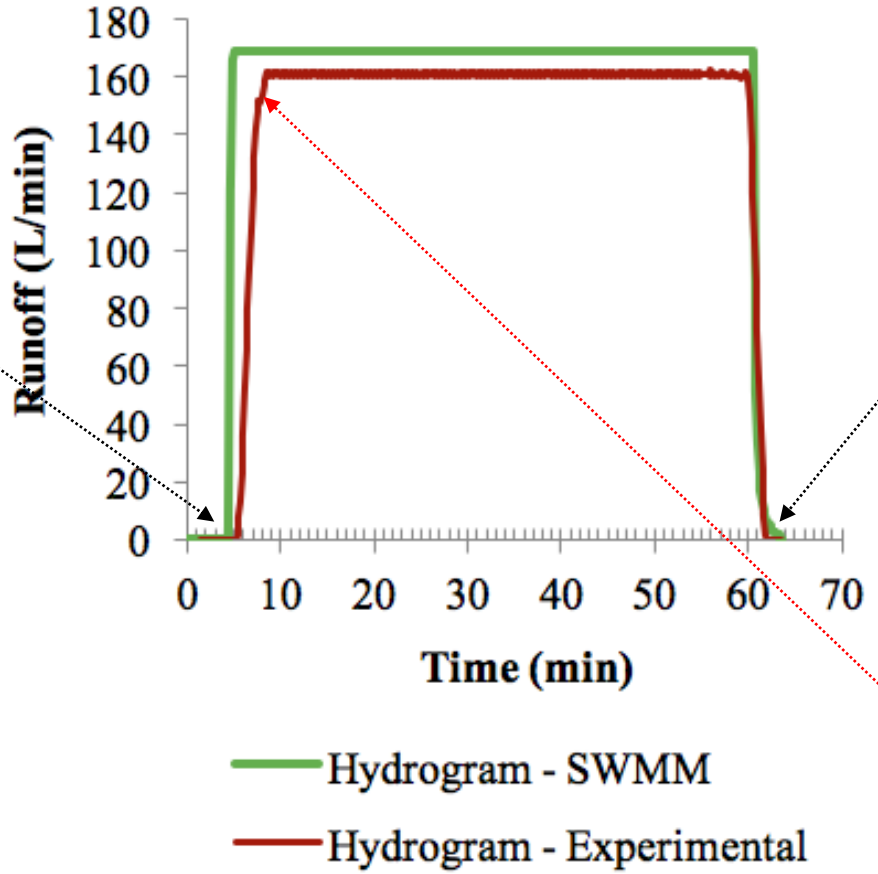
- **peak flow**:
  - 45.60 L/min
  - 38.64 L/min

damping of the flow after the stabilization of the peak flow was **very close**

perturbations in the **liquid line** or **expulsion of air** from the soil during **trench filling or emptiness**

RESULTS
Scenario II





- **beginning of the runoff flow**:
  - 280 sec
  - 320 sec

- **peak flow**:
  - 169.20 L/min
  - 161.10 L/min

damping of the flow after the stabilization of the peak flow was **very close**

perturbations in the **liquid line** or **expulsion of air** from the soil during **trench filling or emptiness**

Conclusions

- The complete **understanding of the modeling processes** must be **precondition on the use of Storm Water Management Model - SWMM effectively**, **avoiding** the generation of **models** that **do not represent reality**. For that, it is important that **input parameters be well defined and refined;**
- **Some artifices** were **necessary** for the software **to correctly interpret the input data** to produce results as close as possible to reality;
- The **SWMM model** showed **good fitness** when compared to the **results observed experimentally, however, adjustments are necessary** for **more accurate representation of the real situation**, especially for the **lowest flow tested**.

Thank You

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