sEEnergies

On the Effective Width for District Heating Systems

7th International Conference on Smart Energy Systems - Copenhagen

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21th – 22th September 2021

This project has received funding from the European Union's Horizon 2020 Research and Innovation Action under Grant Agreement No 846463.

Overview

- Introduction
- Research questions
- Data
- Methodology
- Results
- Discussion

Introduction

- Model developed by Werner and Persson:

$$Specific\ Distribution\ Cost \propto \frac{Trench\ Length \cdot Average\ diameter}{Heat\ Demand}$$

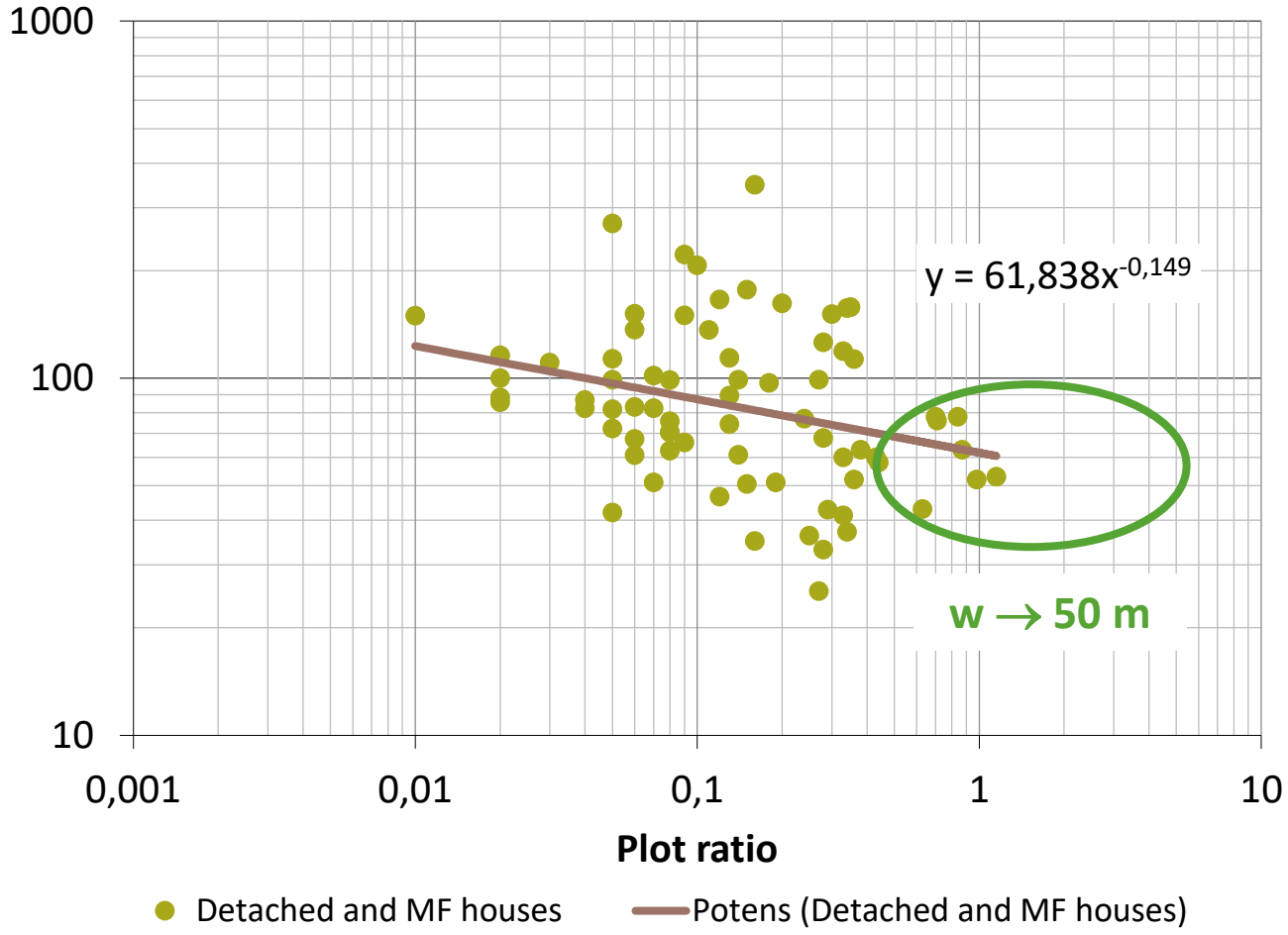
- How to measure the pipe length → Effective width concept, w

$$w = \frac{Land\ area}{Trench\ length} \rightarrow m^2_{ground} \Big/ m_{trench}$$

Introduction

In previous studies:

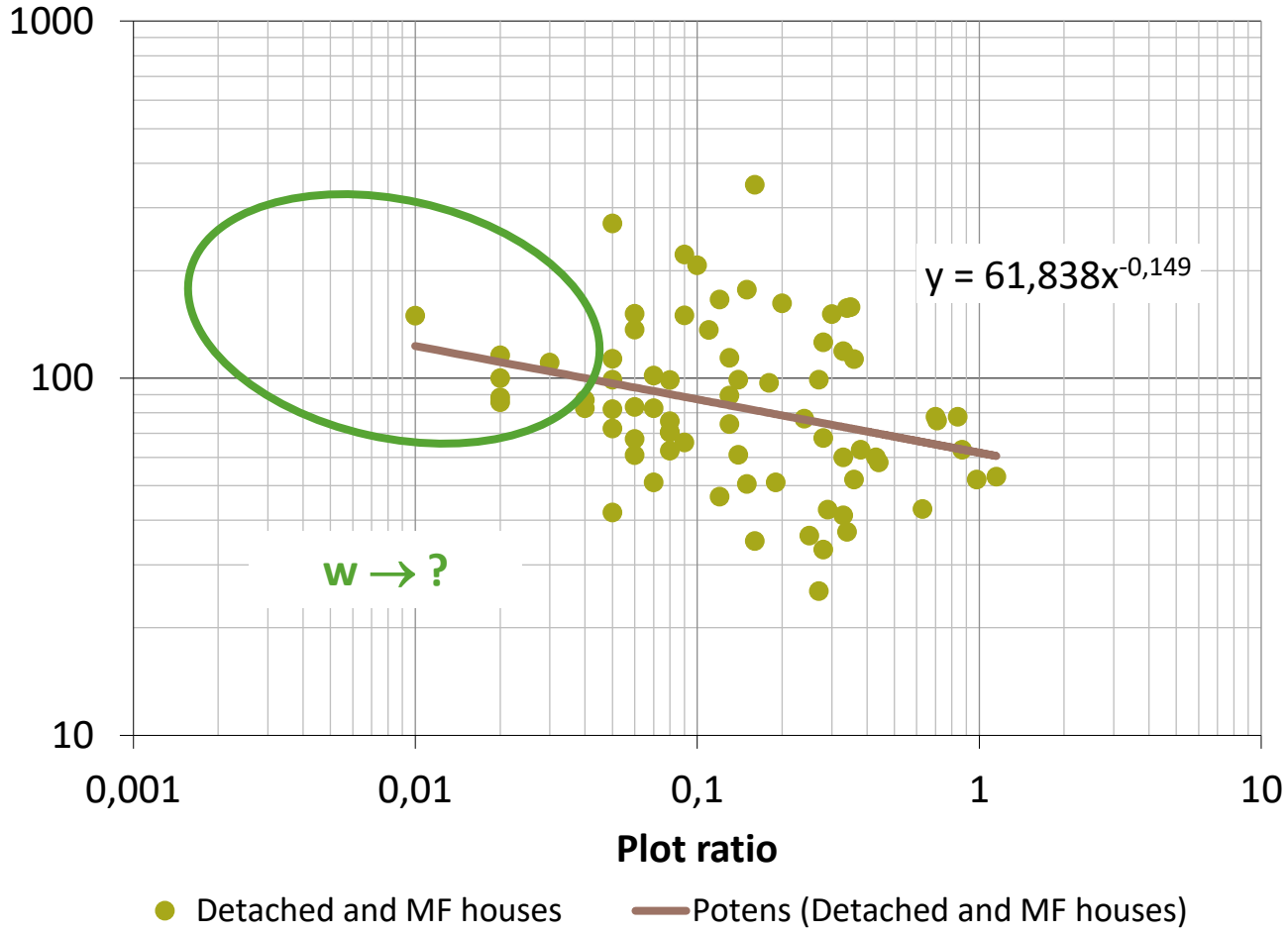
- Effective Width dependent on Plot Ratio
- In dense areas, w → 50 m
- Sparse areas are mostly unknown.
- Definition of land area has not been systematic.
- Only Distribution Pipes were studied



Effective Width according to Persson & Werner, 2011

Research questions

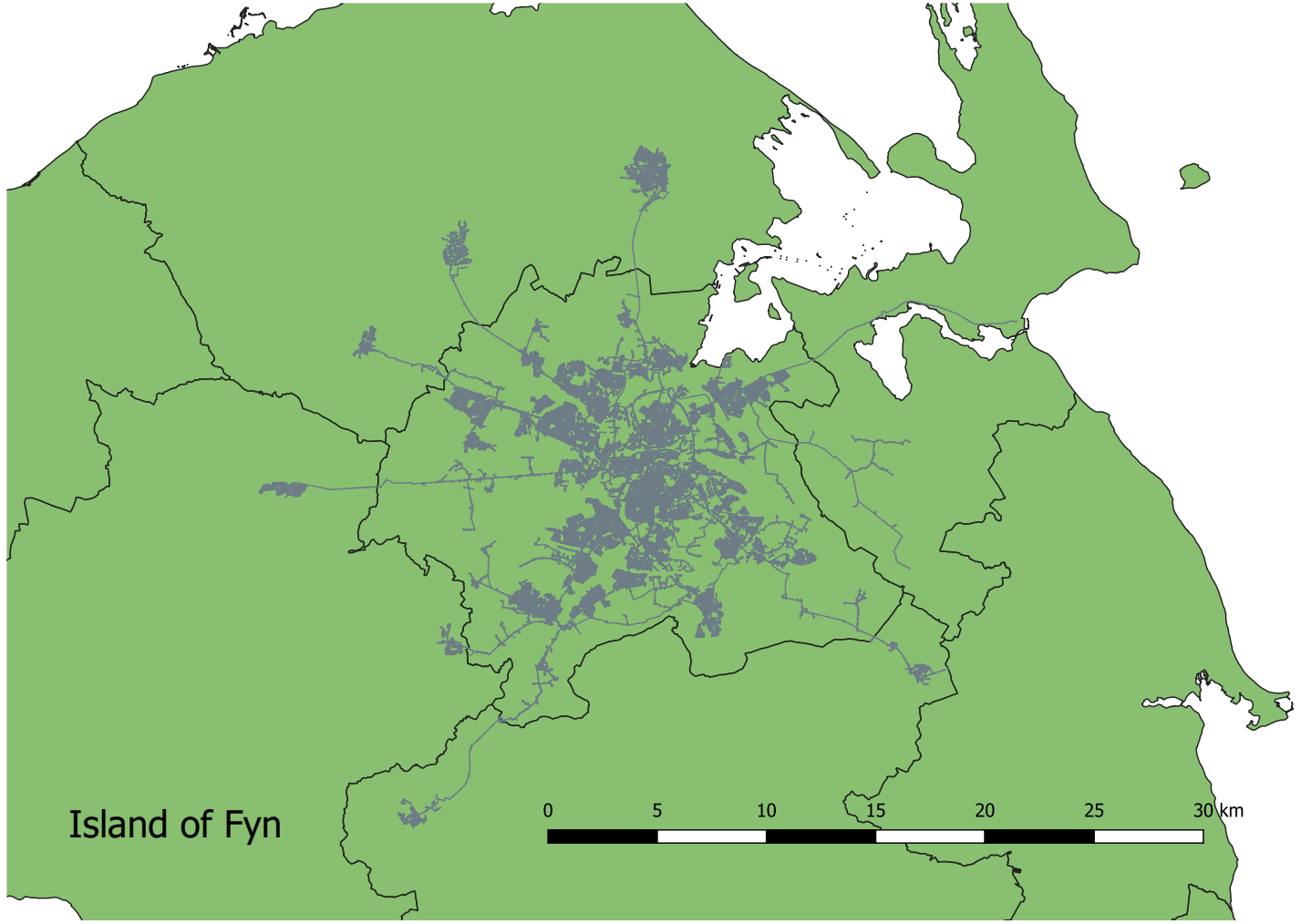
- What is the behaviour of effective width in sparse areas?
- What is the behaviour of effective width for both Distribution and Service pipes?
- Is the plot ratio the best independent variable?



Effective Width according to Persson & Werner, 2010

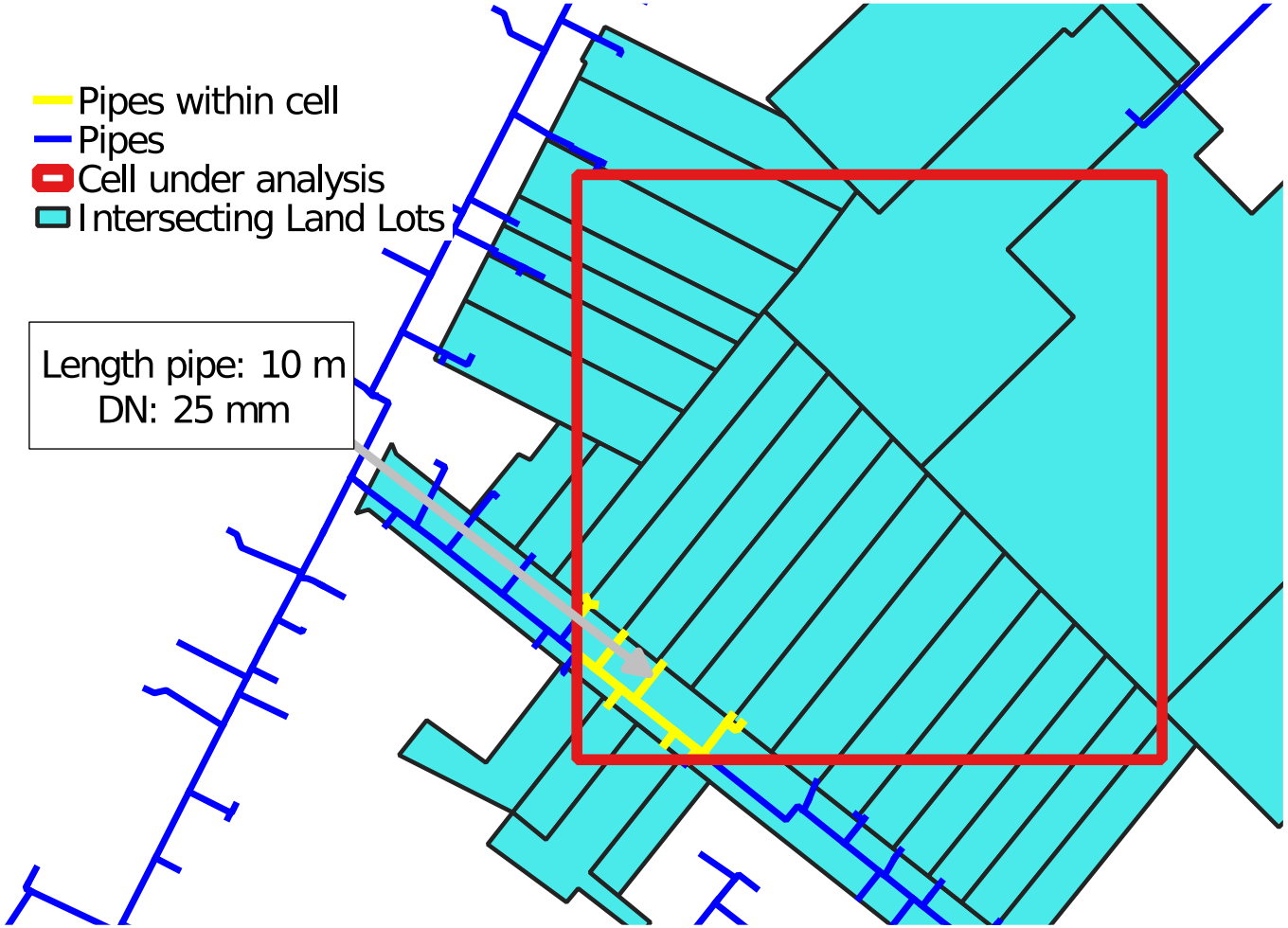
Data

- District Heating Network of Fjernvarme Fyn (Denmark)
- 2 264 km of trench length.
- District Heating Network of Aarhus (Denmark)
- More than 2 100 km of trench length.
- Danish Cadastre (BBR) for floor areas.



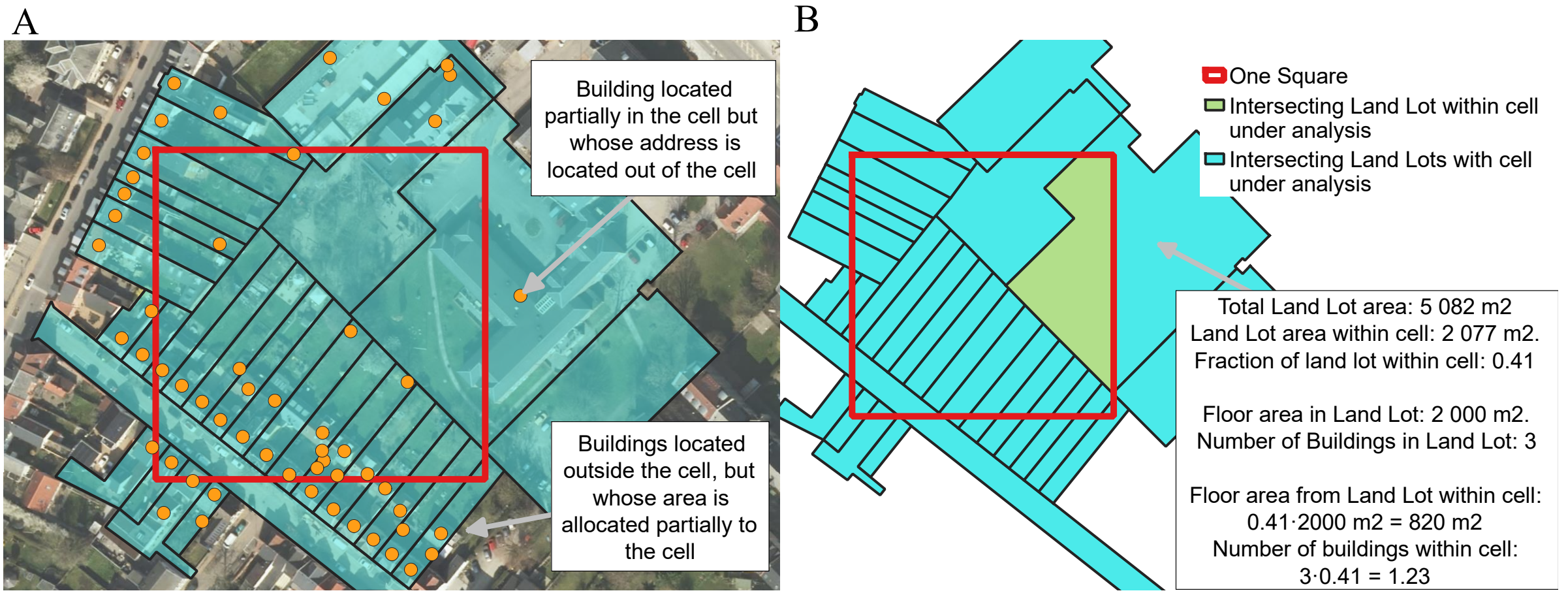
Methodology

1. 1-ha-cell grid.
2. Pipe length (Distribution and Service).
3. Effective Width
4. Floor area and Number of Buildings



Method for determining the pipe length in a given cell

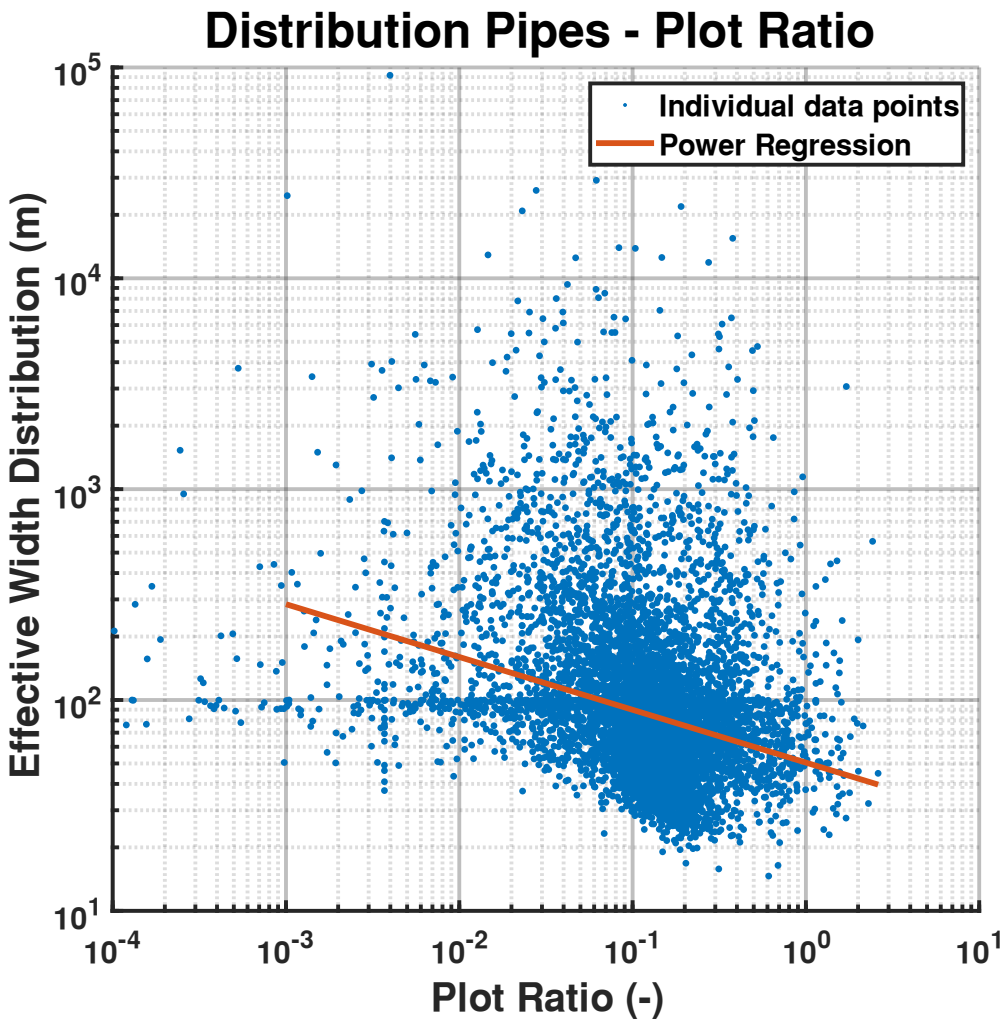
Methodology



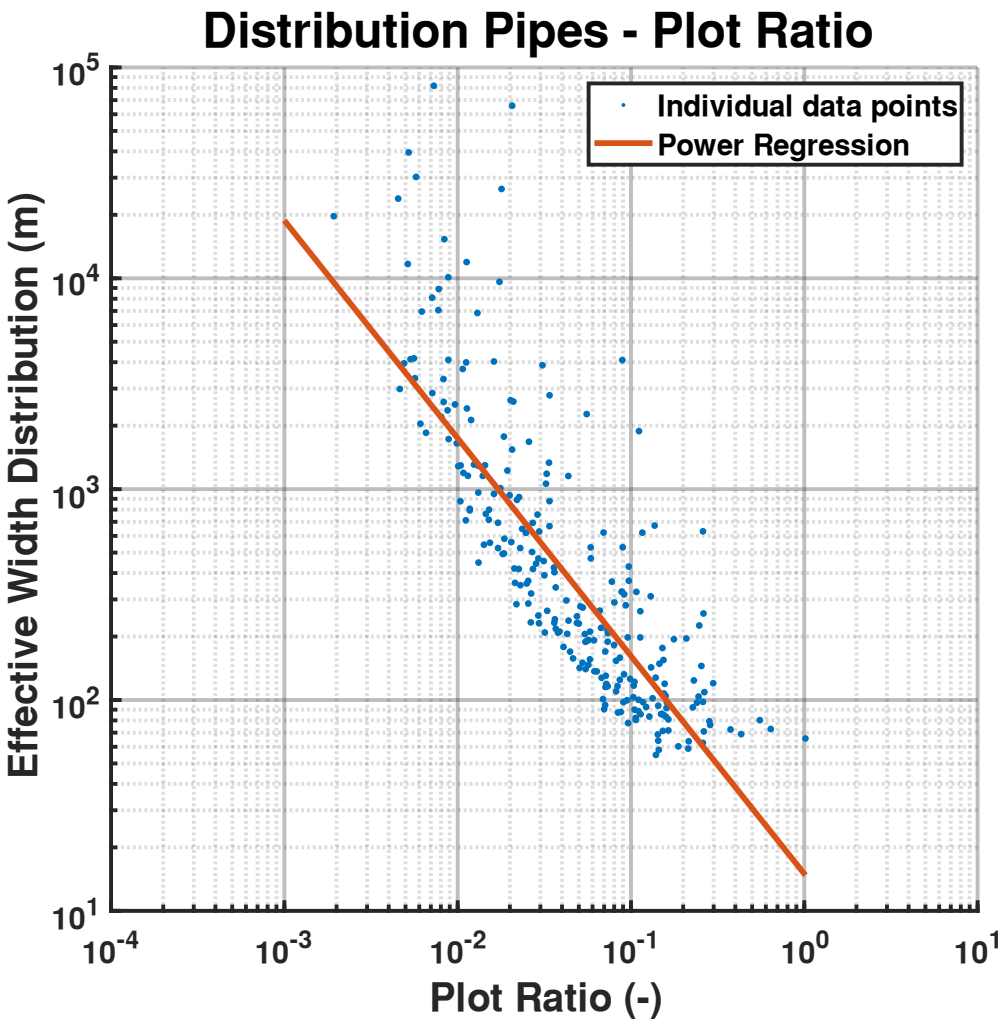
Method for determining the Number of Buildings and Floor area in the cell

Results

Which cell size is the best?



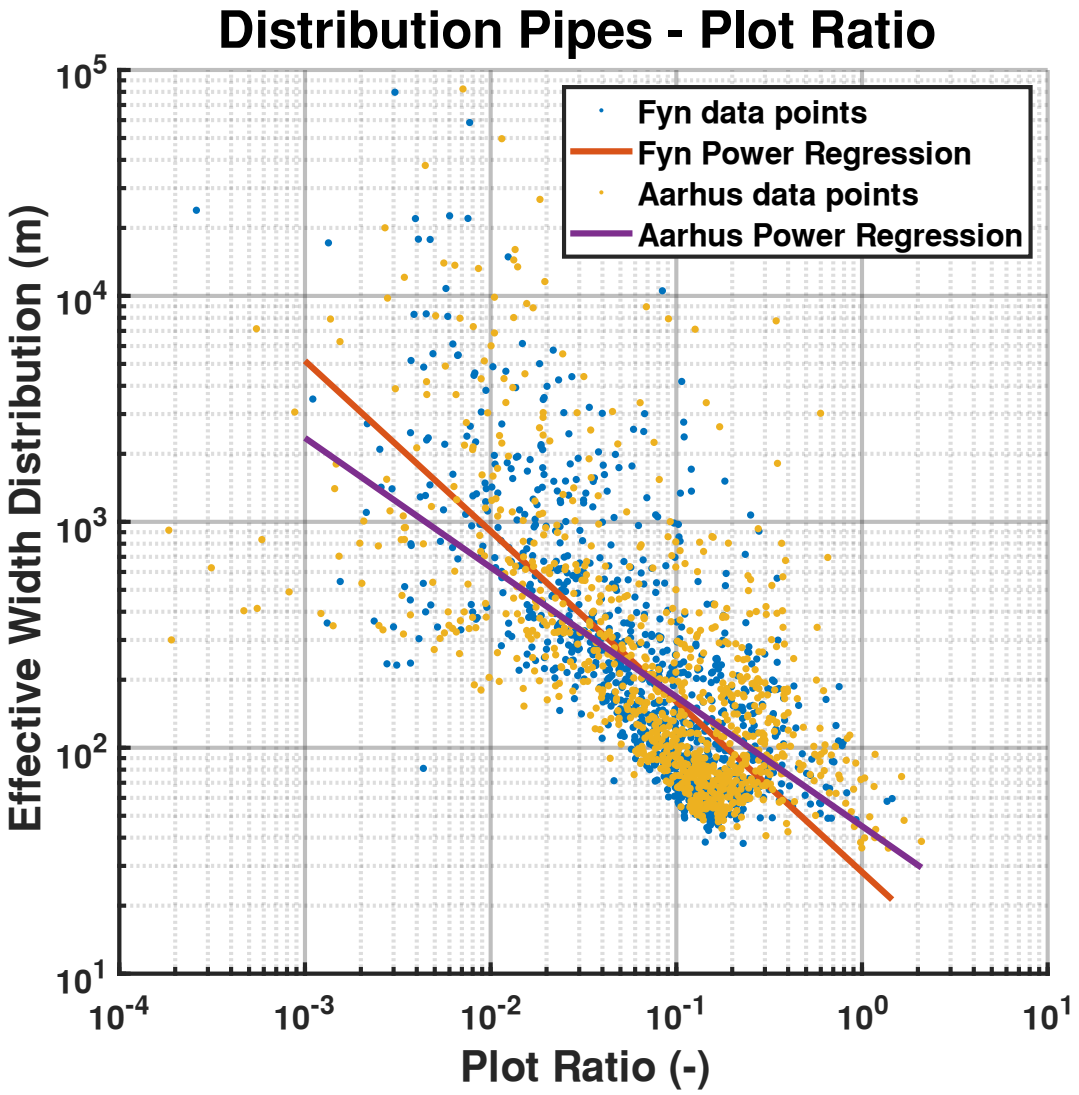
Cell Size of 1 ha

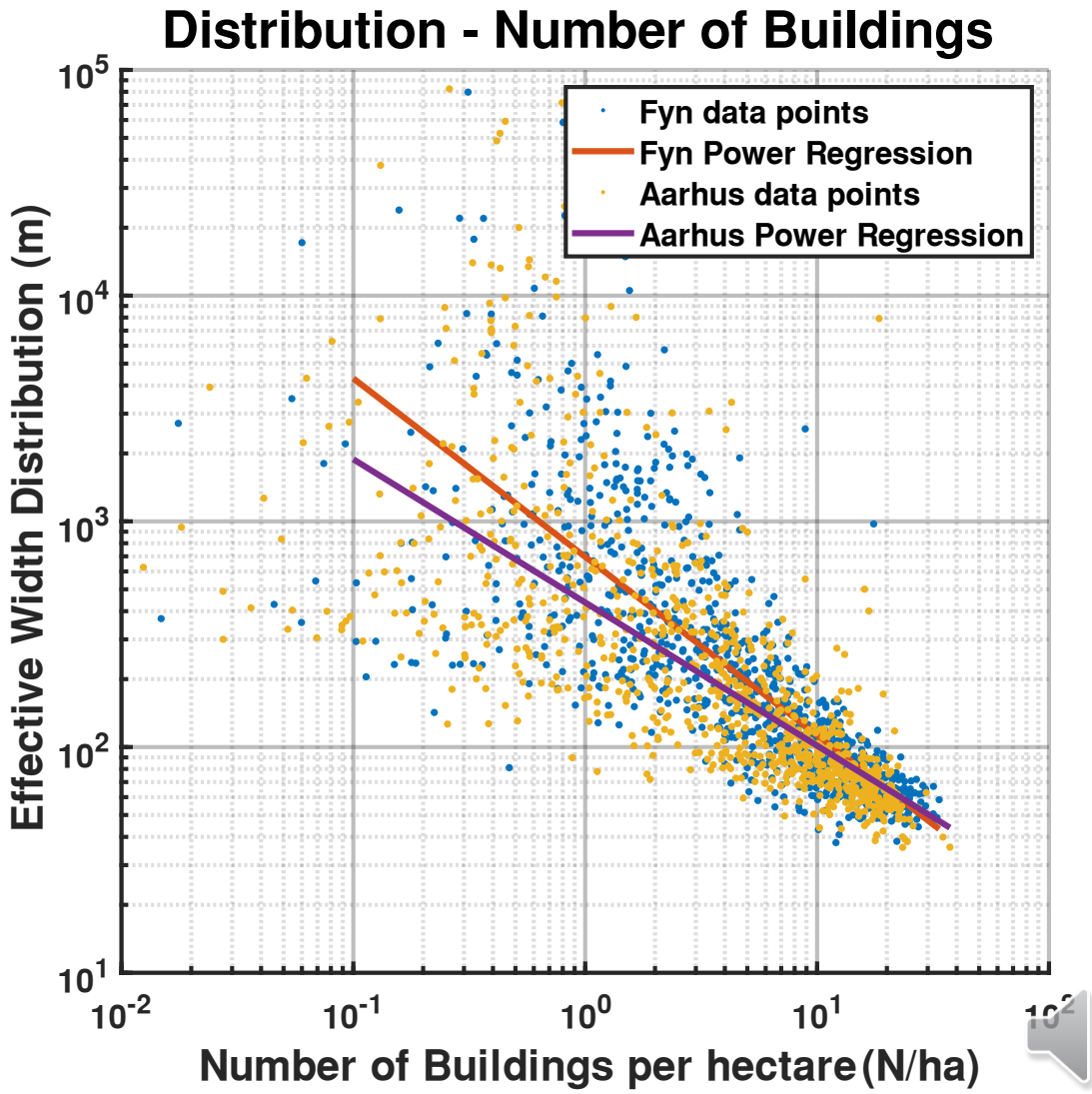


Cell Size of 100 ha

Results

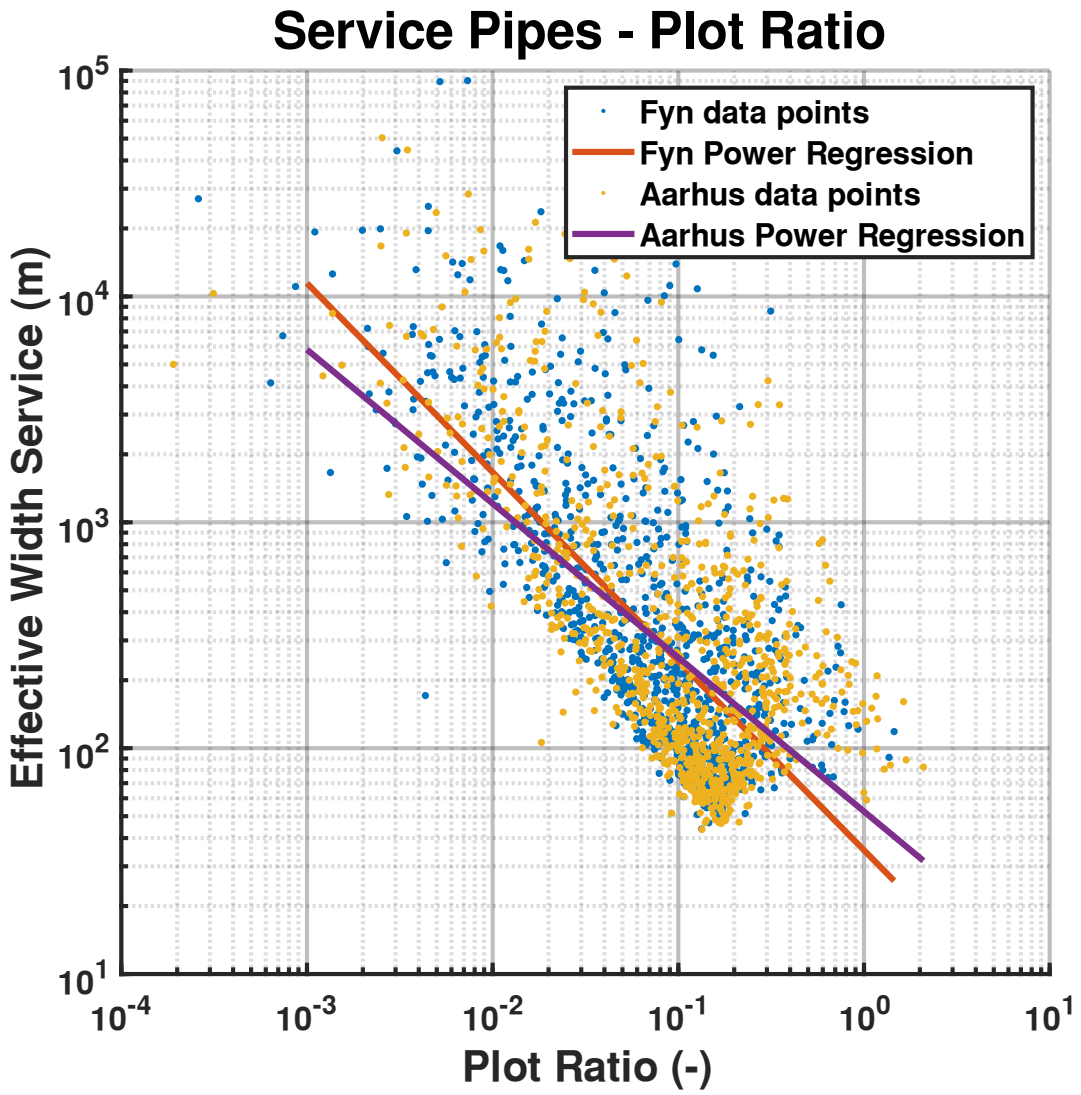
Effective Width for a cell size of 16 ha.

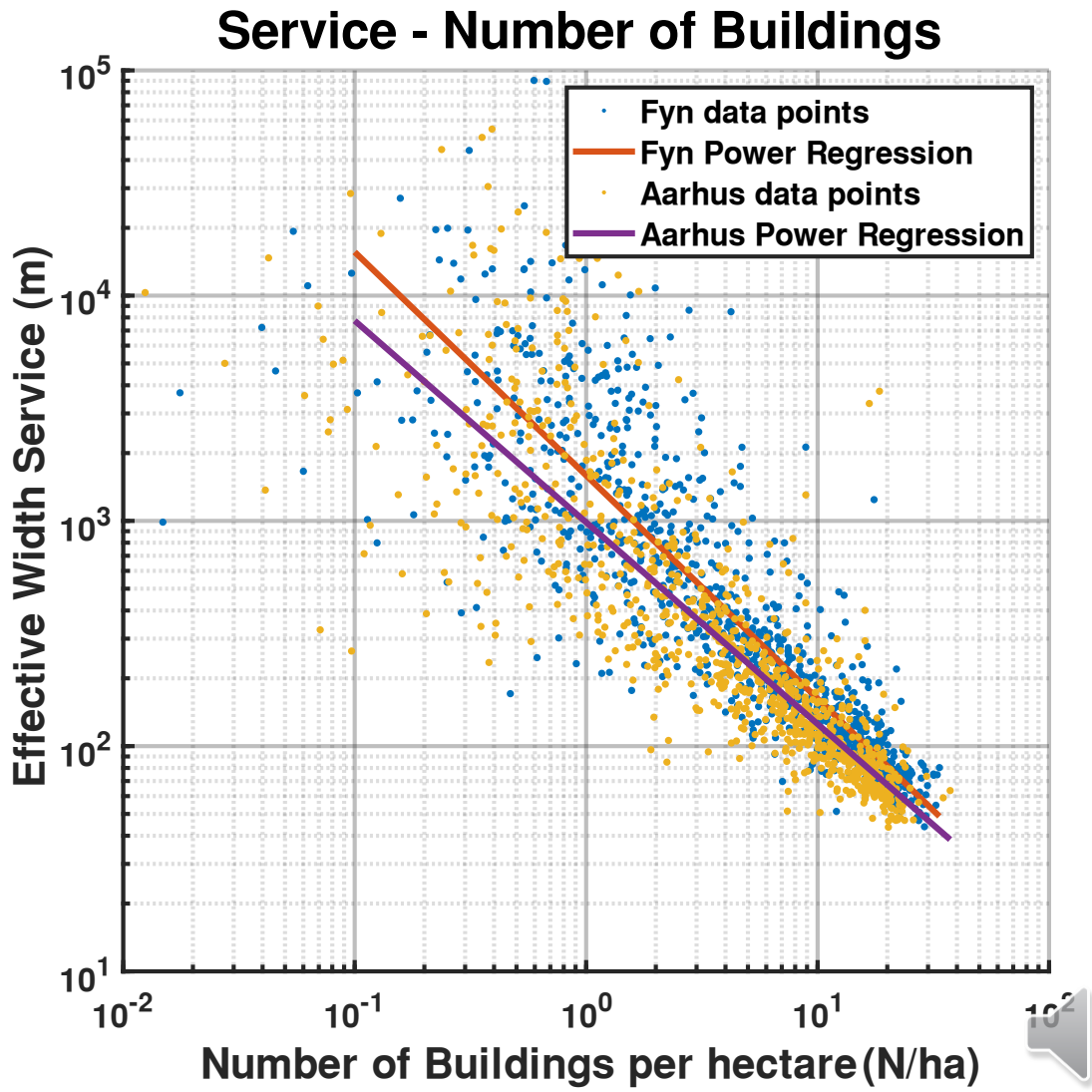




Results

Effective Width for a cell size of 16 ha.





Key takeaways and Discussion

Key results:

- Confirmation of previous model for Distribution pipes.
- New model for **Service** pipes.
- High possibility of lower bound for effective width in high density areas.
- Number of buildings is a better estimator than plot ratio.
- Very small cells lead to poor regressions.

Key takeaways and Discussion

Some problems still remain:

- High variability of effective width for the same value of the independent variable → The estimation of costs will not be very accurate.
- Residuals are highly skewed when using the plot ratio.
- Implicit Assumption: 100% penetration in areas with pipes
- Survival bias?


THANK
YOU
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MULTUMESC
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