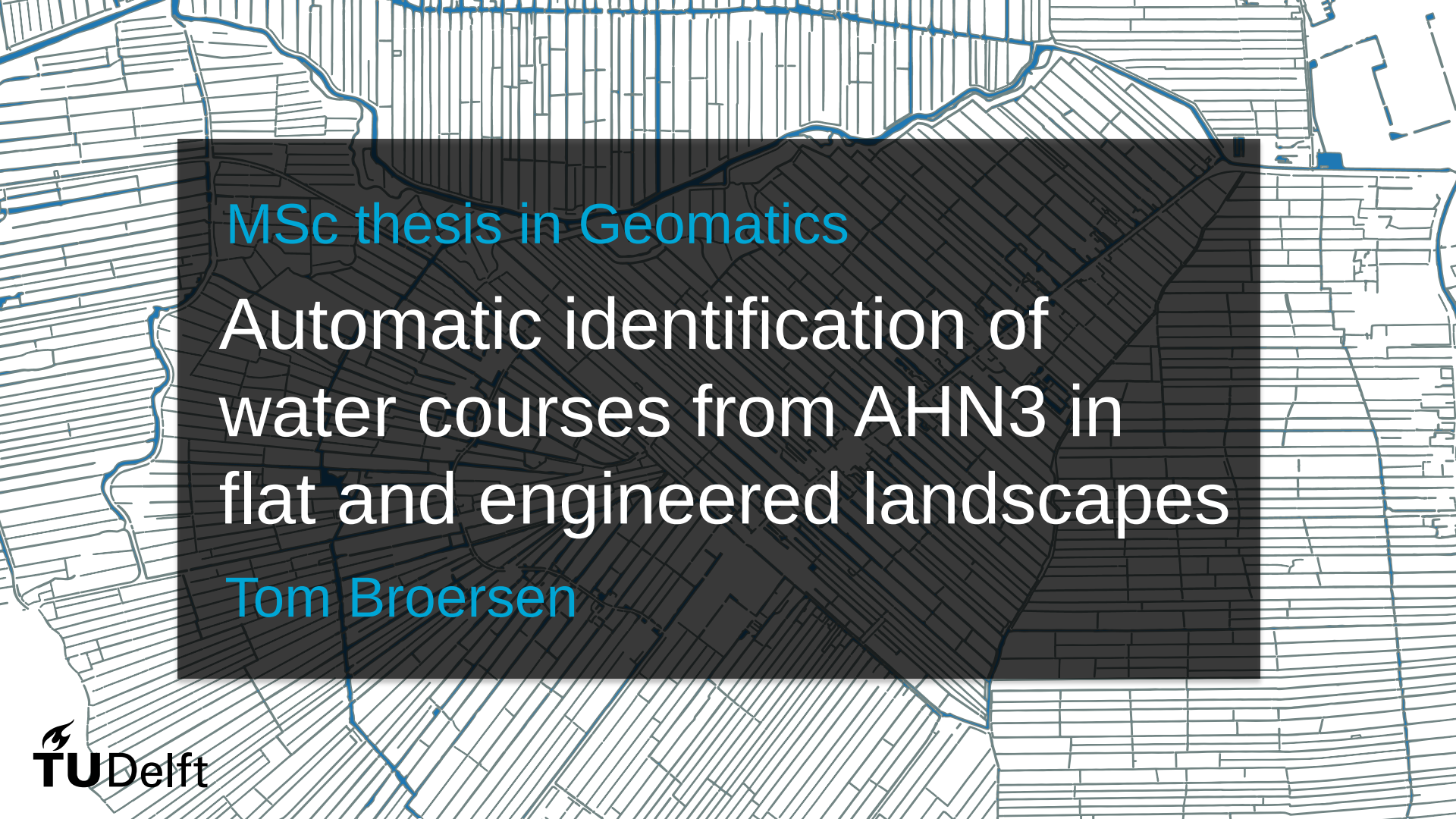
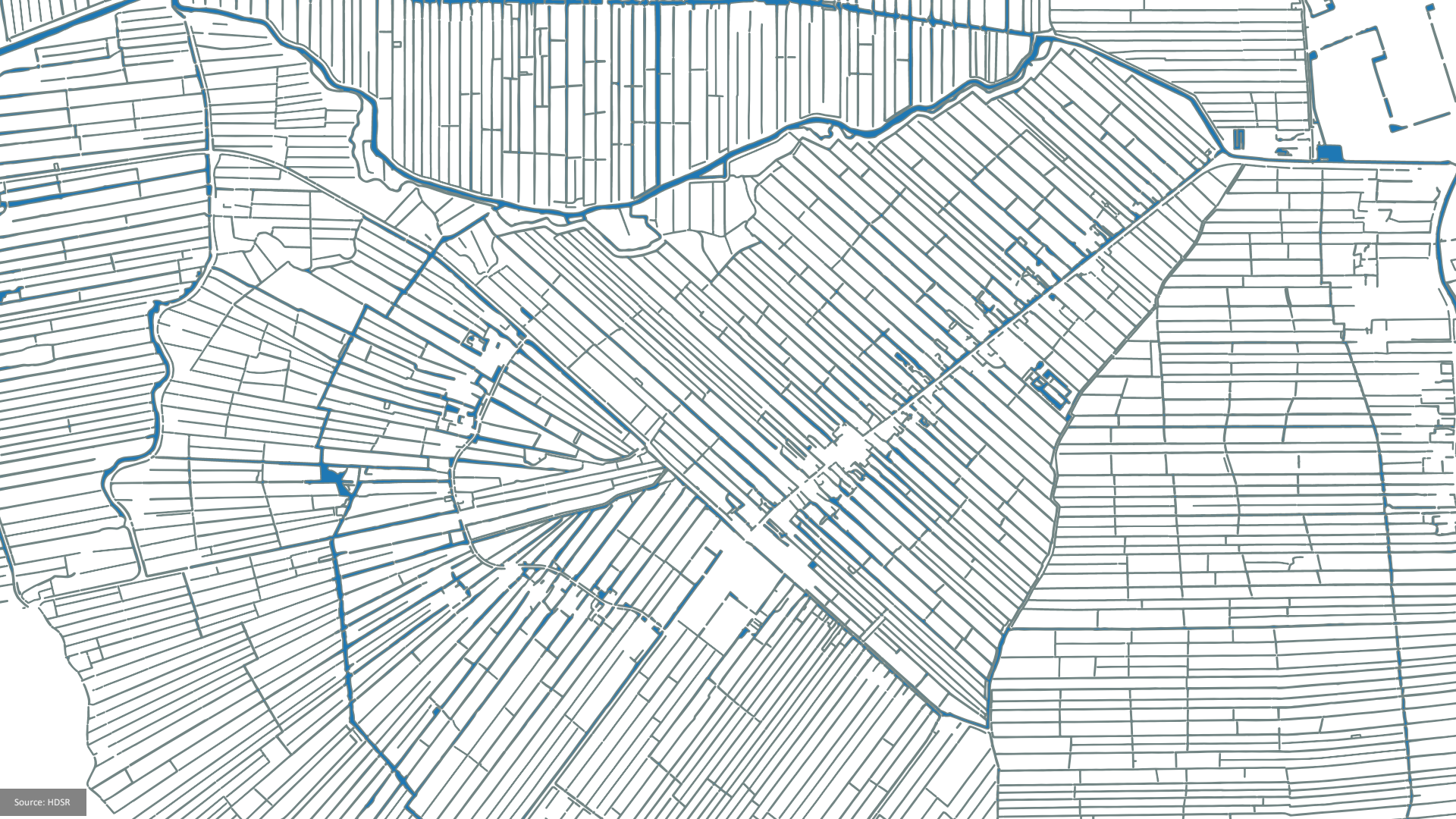


MSc thesis in Geomatics

Automatic identification of water courses from AHN3 in flat and engineered landscapes

Tom Broersen

TU Delft

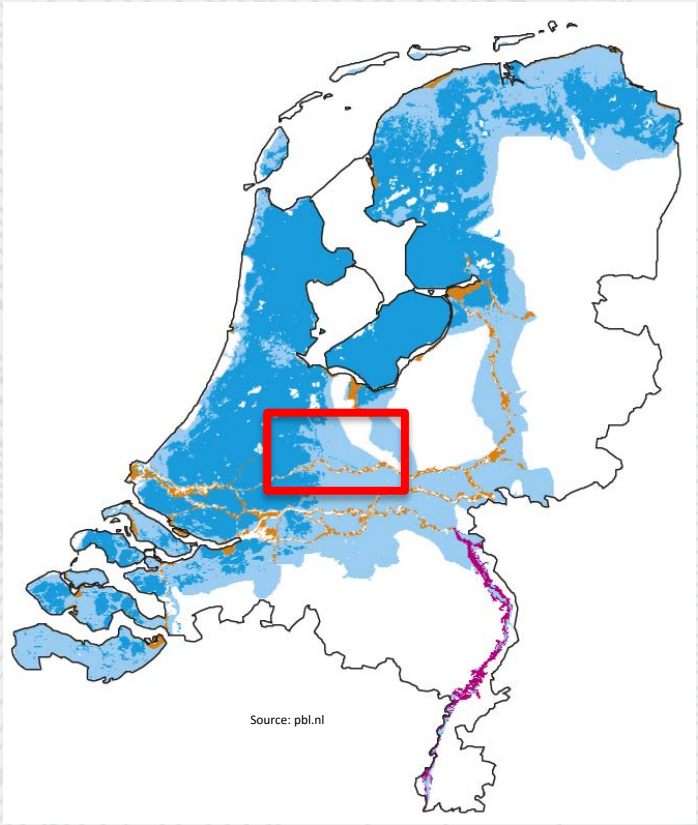


Source: HDSR

Introduction

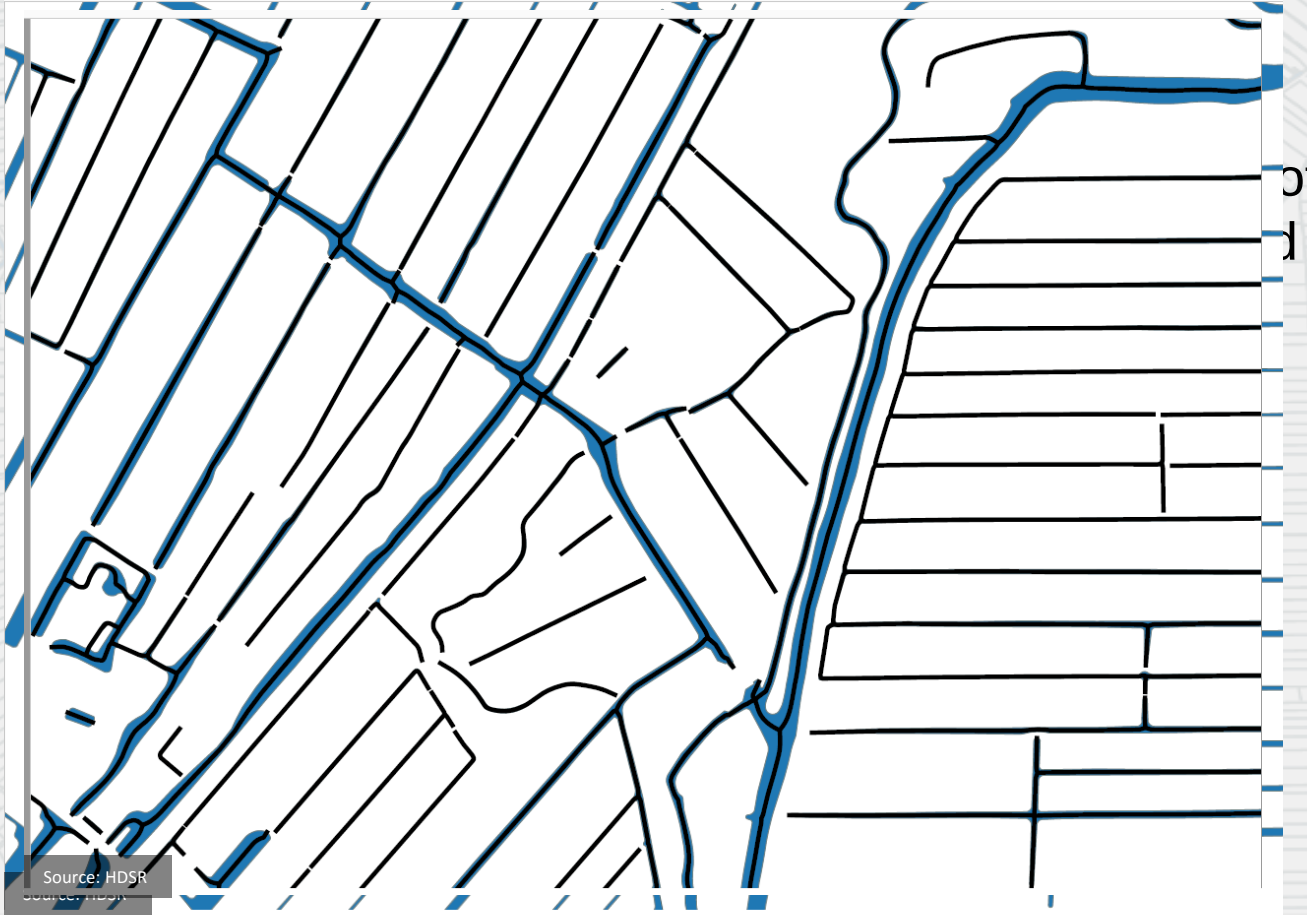
Motivation

- ‘Hoogheemraadschap De Stichtse Rijnlanden’ (HDSR) responsible for Utrecht
- HDSR requires a dataset with the network of water courses



Objectives

1. of water
   d Utrecht
2.
3.



Source: HDSR

My hypothesis

I propose a new methodology based on two concepts:

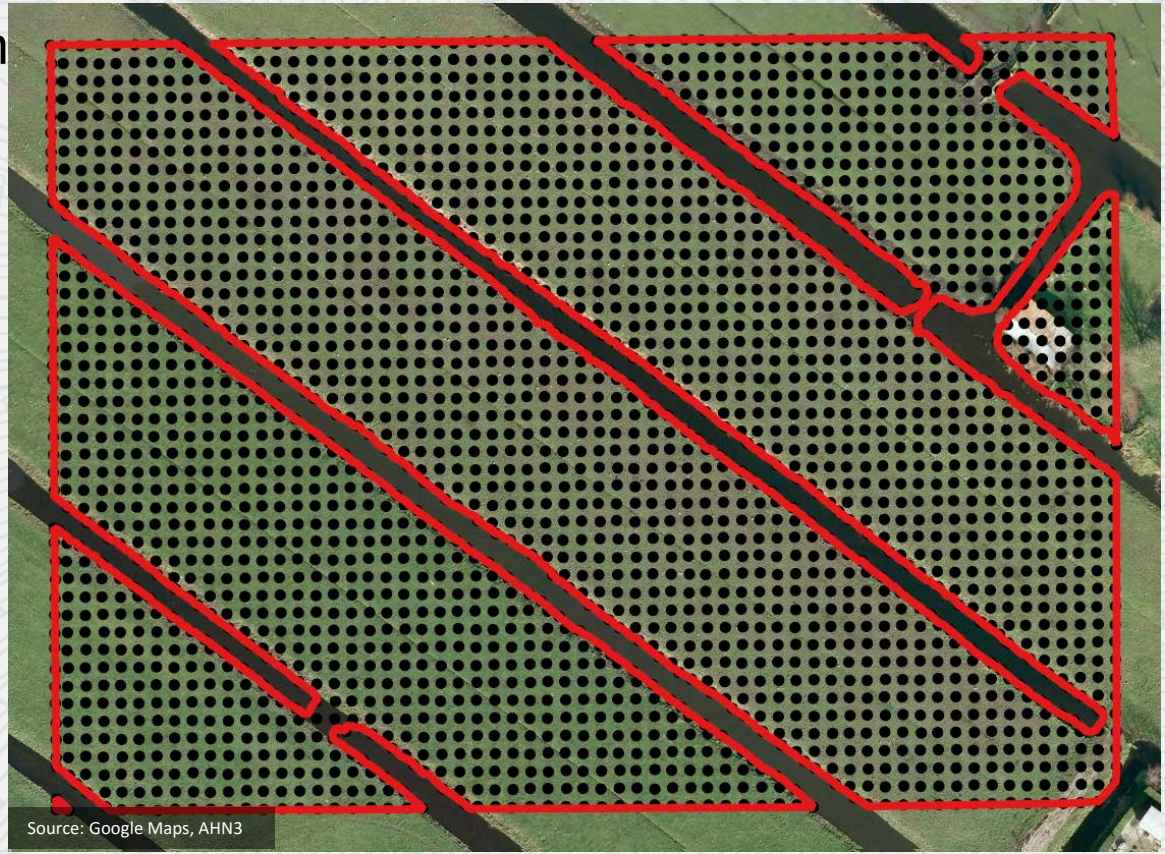
1. Concave hull > uses the precence of water
2. Medial Axis Transform (MAT) > uses concavity of the water courses

My hypothesis is that a combination of these methods will work best

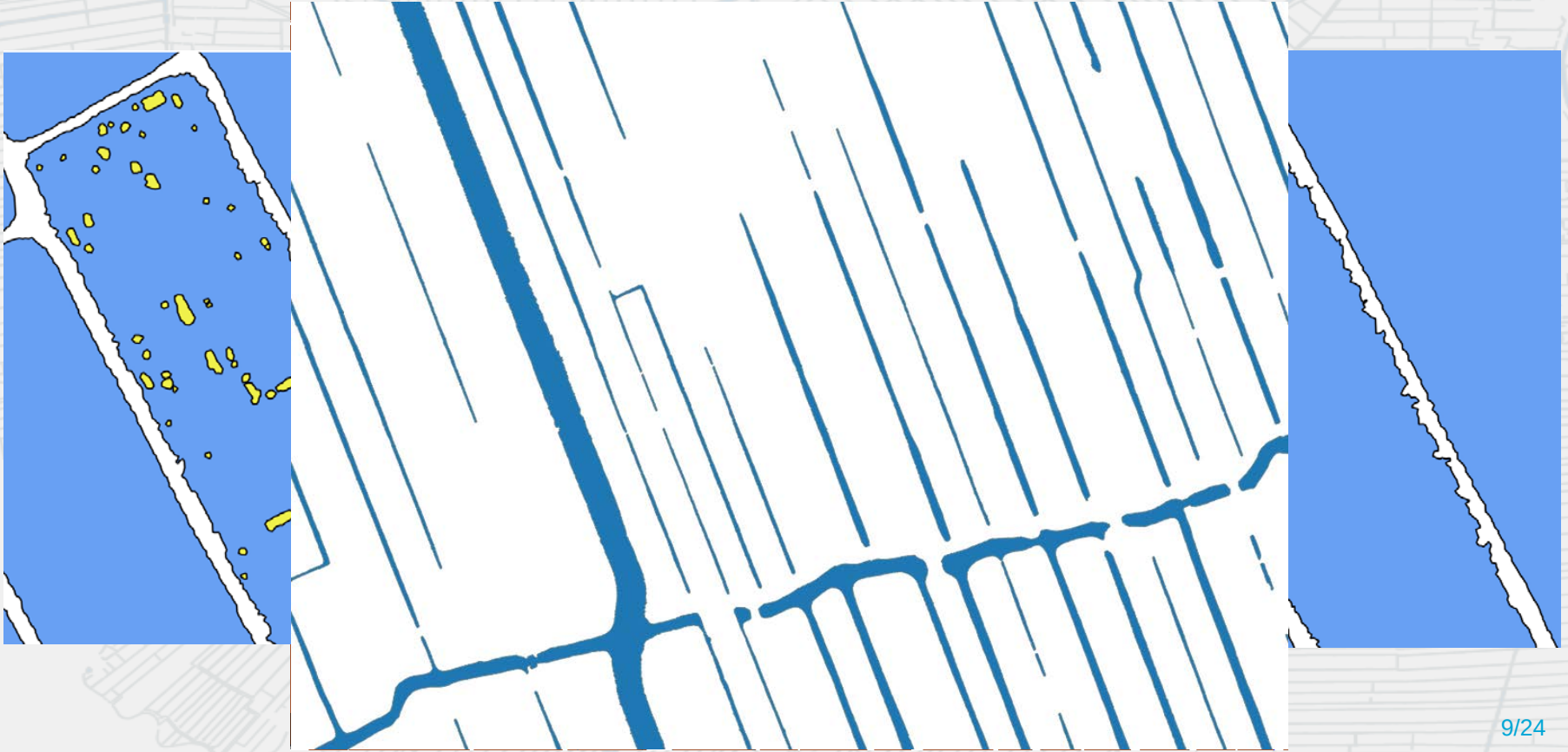
Methodology

Concave hull

- Based on

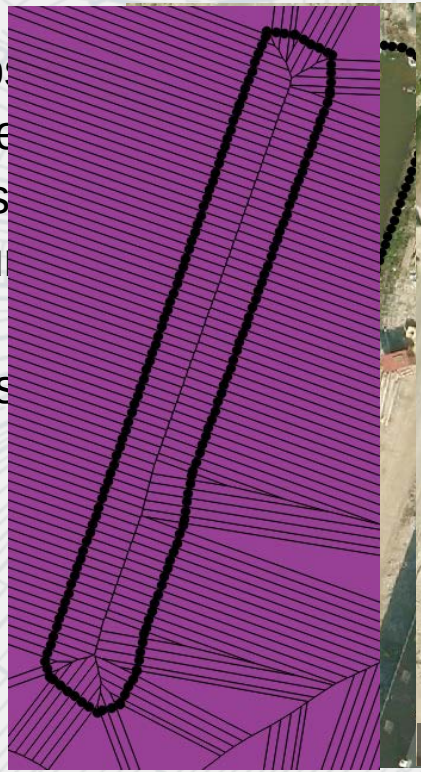


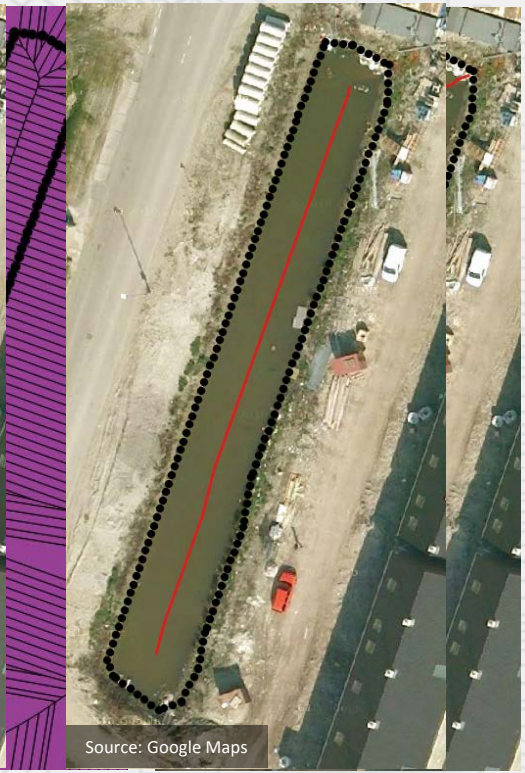
Concave hull



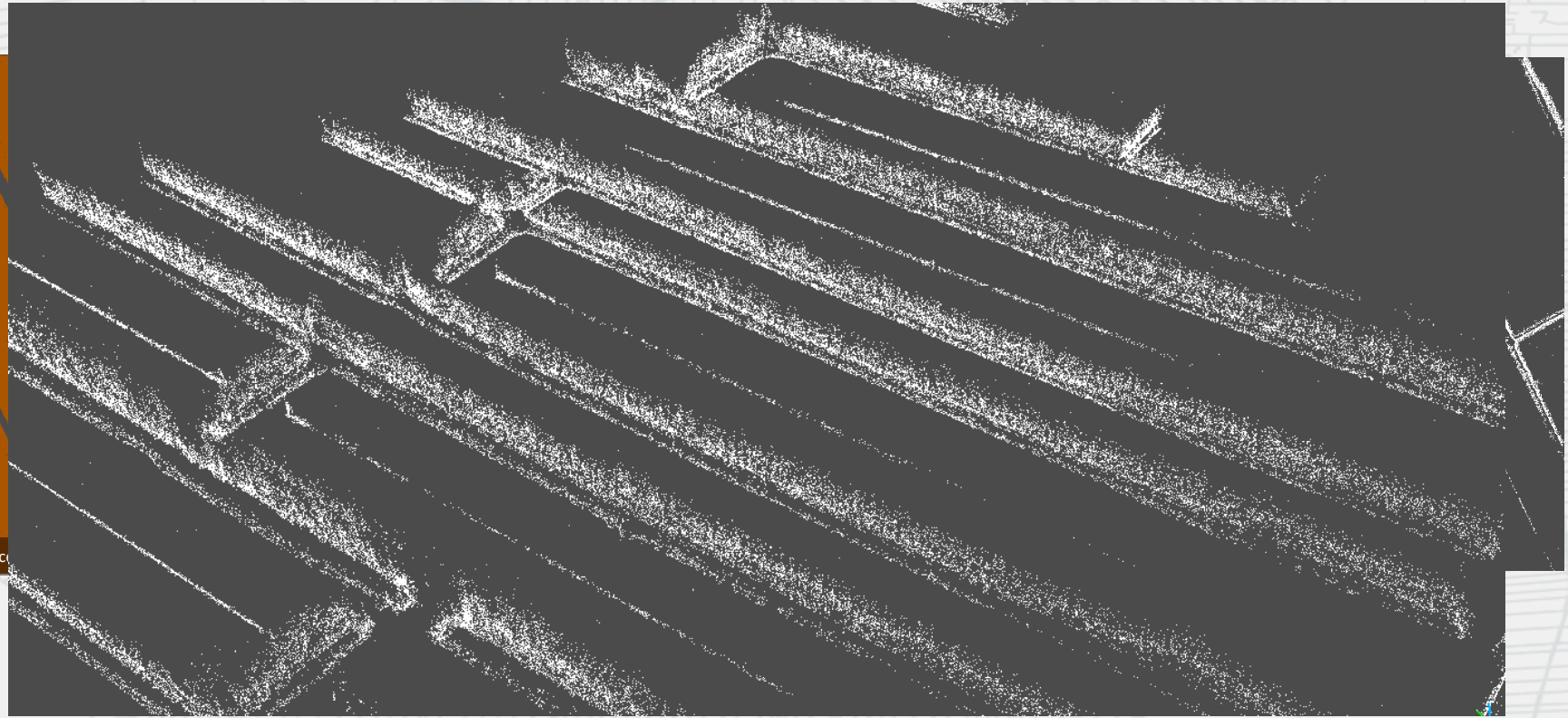
Concave hull

So
1.
2.
3.
4.
5.





MAT

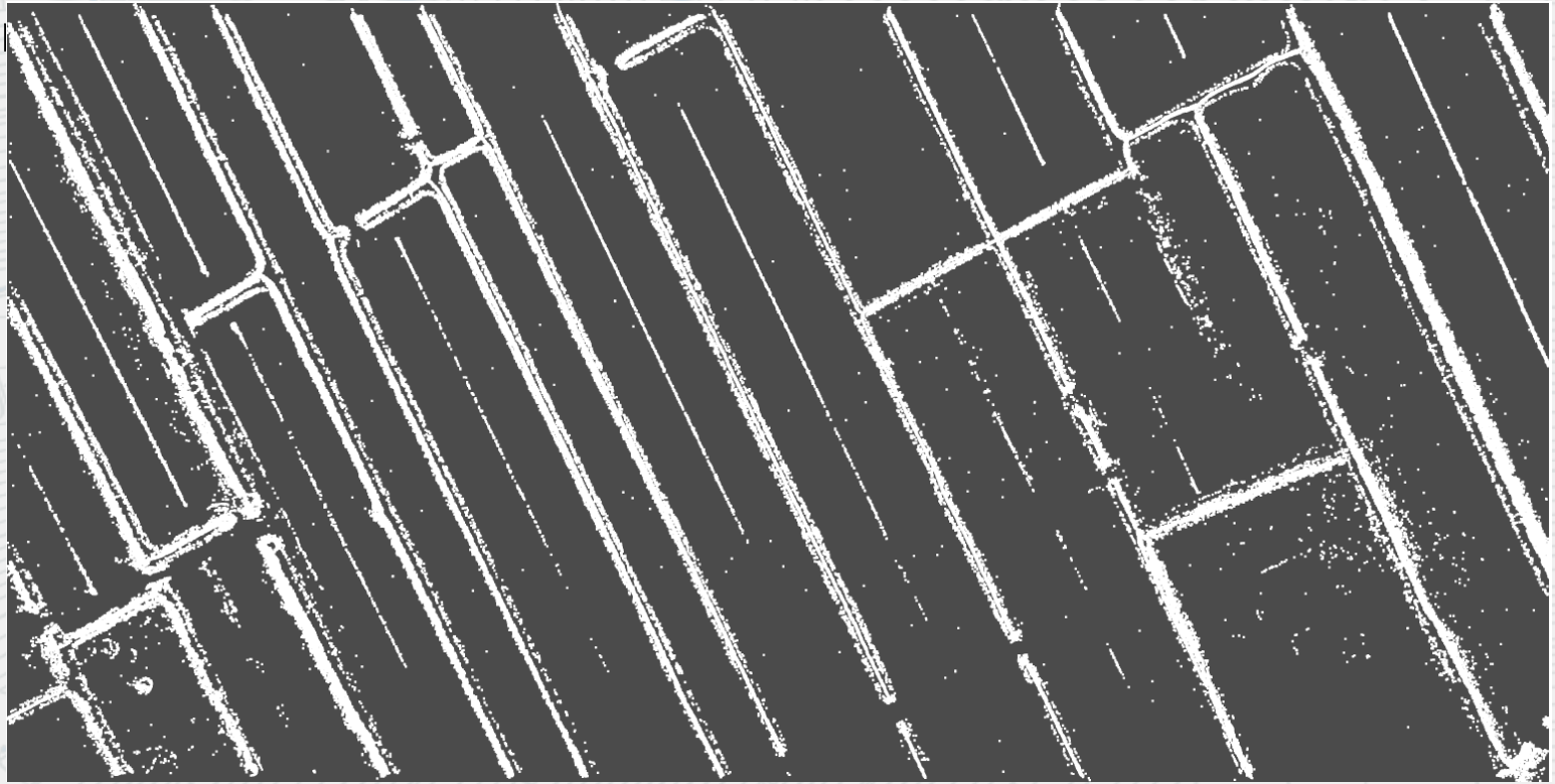


MAT

So

1.

2.



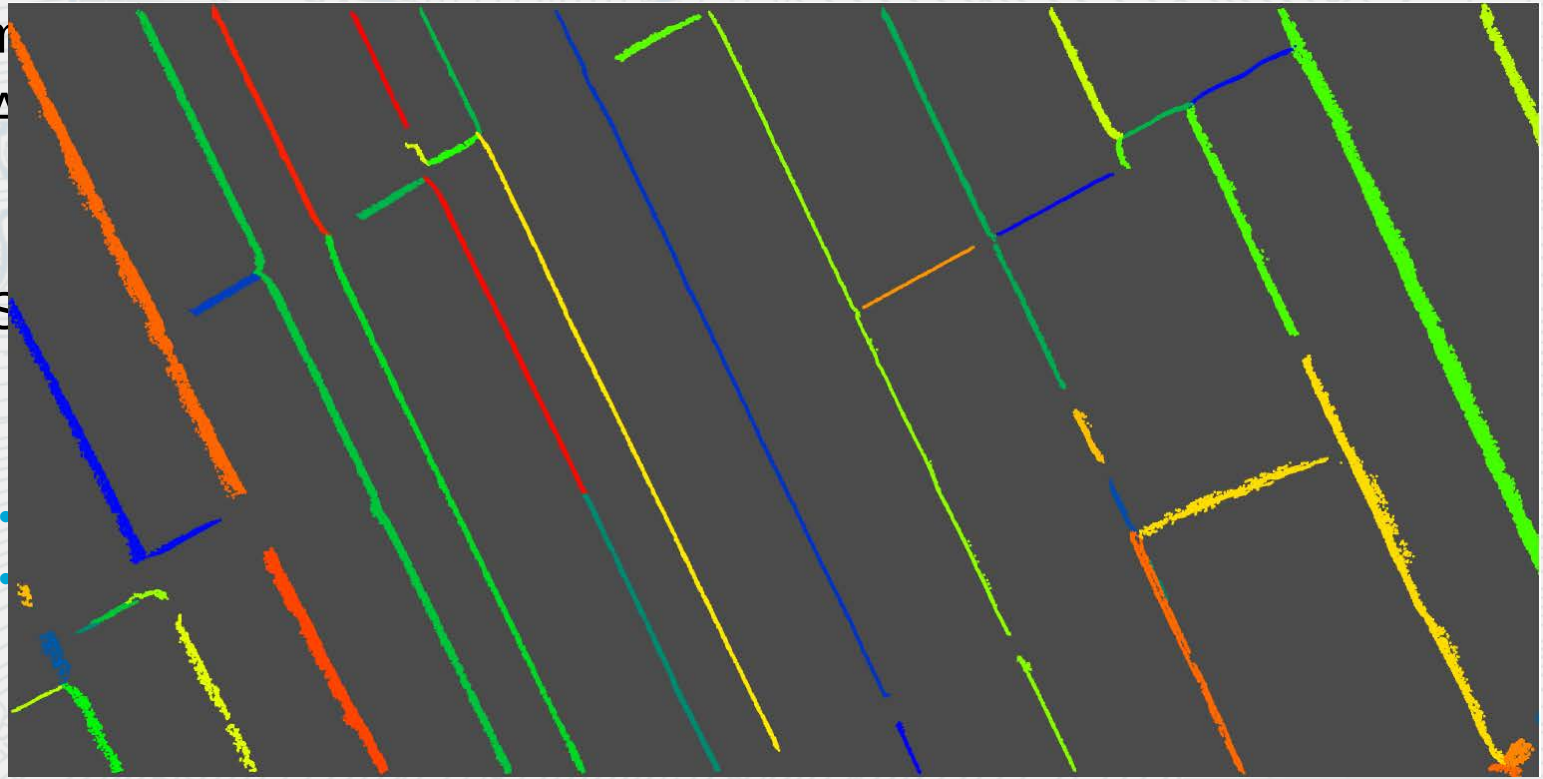
MAT

Som

1. A

2. S

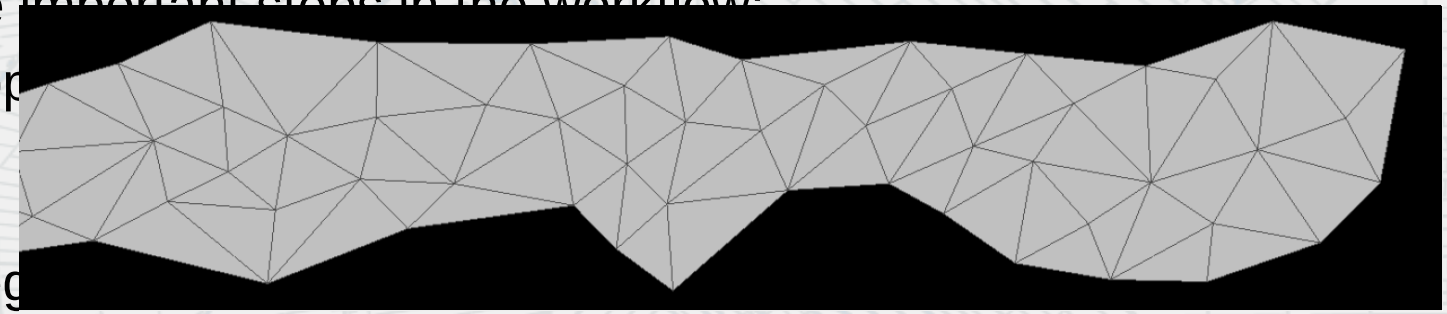
3.

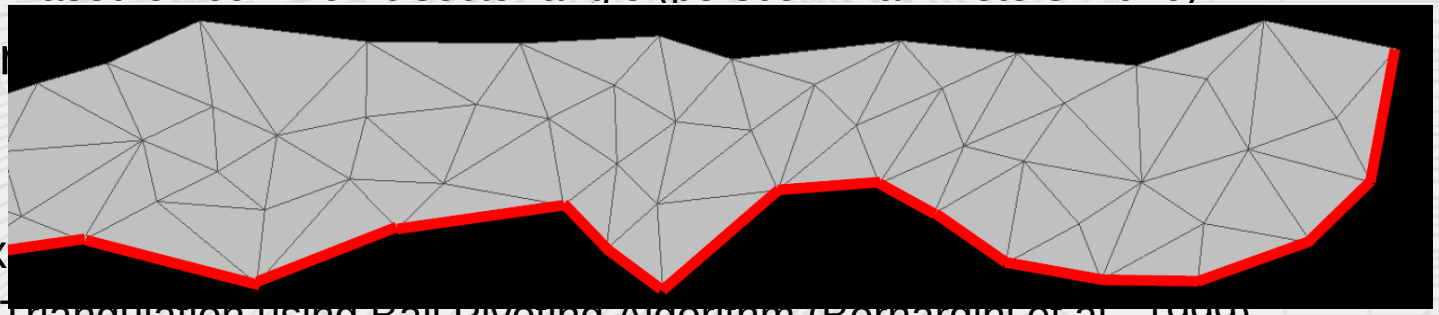


MAT

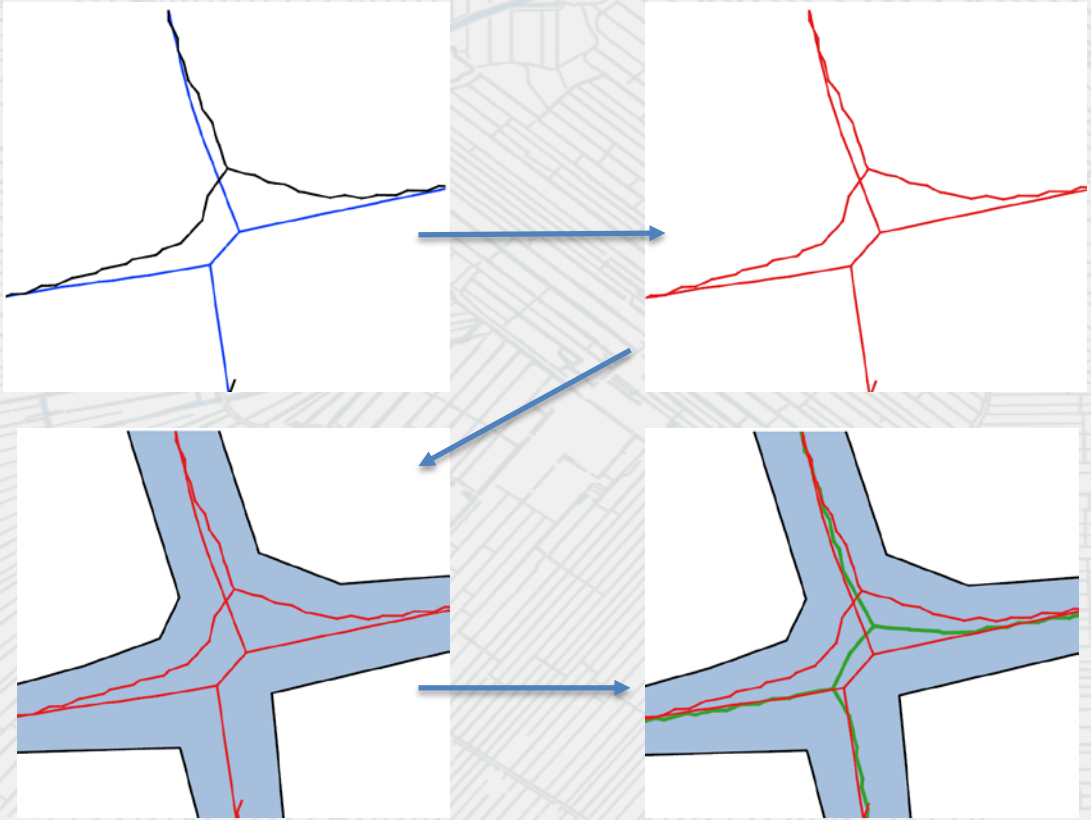
Some important steps in the workflow:

1. App
   -
   -
2. Seg
   - Based on common bisector angle (perscom Ravi Peters. 2016)
3. Ar
   -
   -
4. Ex
   - Triangulation using Ball Pivoting Algorithm (Bernardini et al., 1999)
   - Extract bottom edges of triangulation





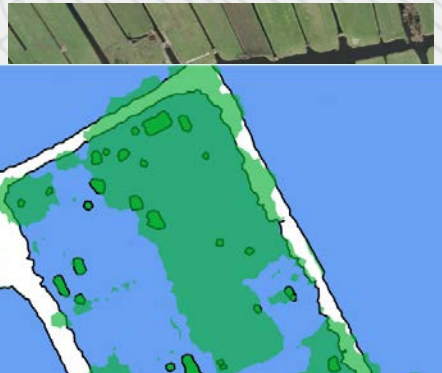
Combined Concave hull - MAT



Results & analysis

Results & Analysis – Concave hull

Clay:



Peat:

ntified: 95%

or: 2%

itional accuracy:

m

ntified: **91%**

or: **17%**

itional

uracy: 0.7m

Results & Analysis – Concave hull

Results & Analysis – MAT

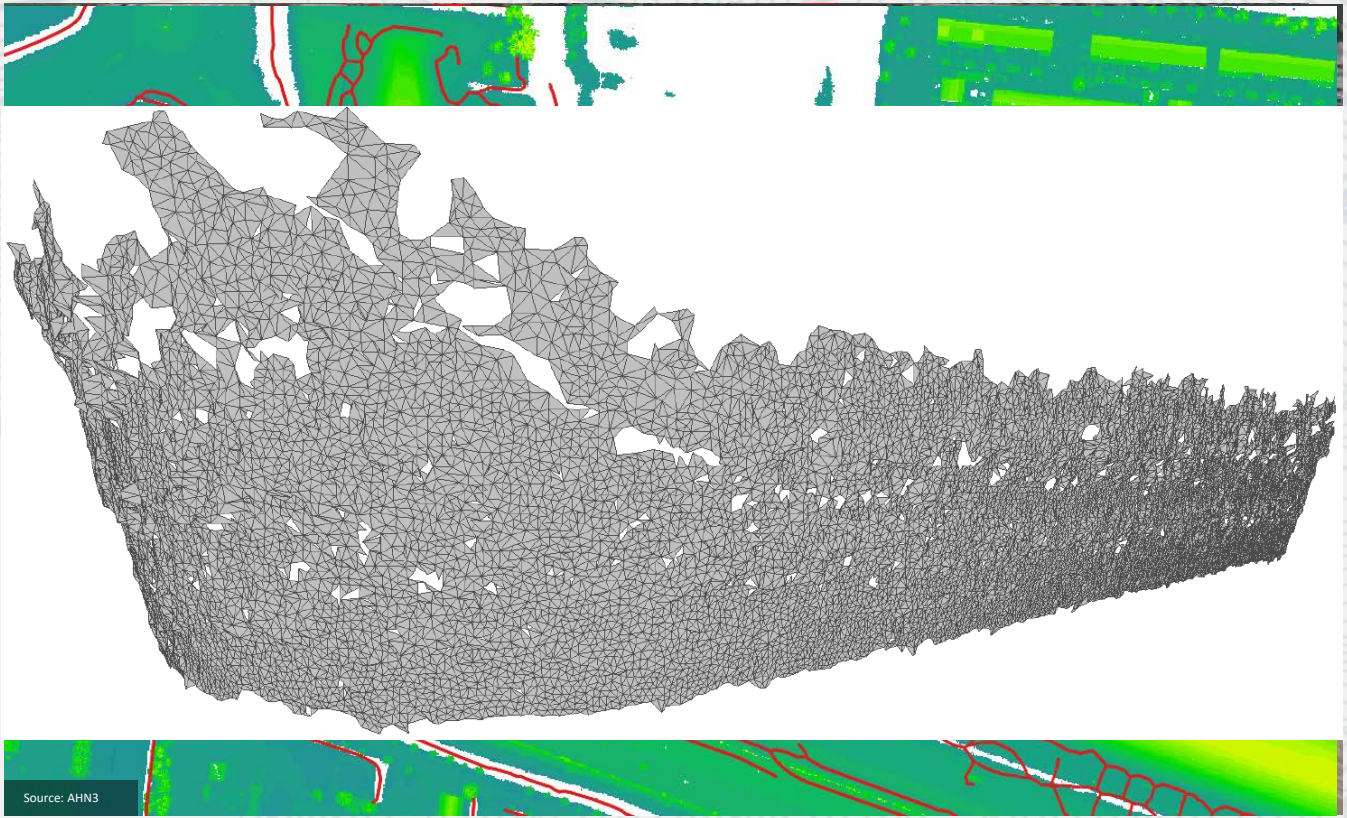
Clay:
- Identified: 96%
- Error: 8%
- Positional accuracy: 0.6m

Peat:
- Identified: 85%
- Error: 8%
- Positional accuracy:
- 0.8m

Sand:
- Identified: **74%**
- Error: **17%**
- Positional accuracy: 0.8m

Urban:
- Identified: 85%
- Error: **46%**
- Positional accuracy: 1m

Results & Analysis – MAT



- Water courses missed due to **insufficient concavity**
- High error due to local **concavities/convexities**

Results & Analysis – Combined

Clay:
- Identified: **98%**
- Error: 8%
- Positional accuracy: 0.6m

Peat:
- Identified: **97%**
- Error: 8%
- Positional accuracy:
- 0.7m

Sand:
- Identified: 76%
- Error: 17%
- Positional accuracy: 0.9m

Urban:
- Identified: **95%**
- Error**:** 47%
- Positional accuracy: 1m

Conclusion (1/2)

Concave hull:

+ Strong performance in water abundant landscapes
+ Robust to errors
- Sensitive to vegetation coverage and water surface width

MAT:

+/- Sensitive to surface curvature
+ Insensitive to voids in the data
- Prone to error

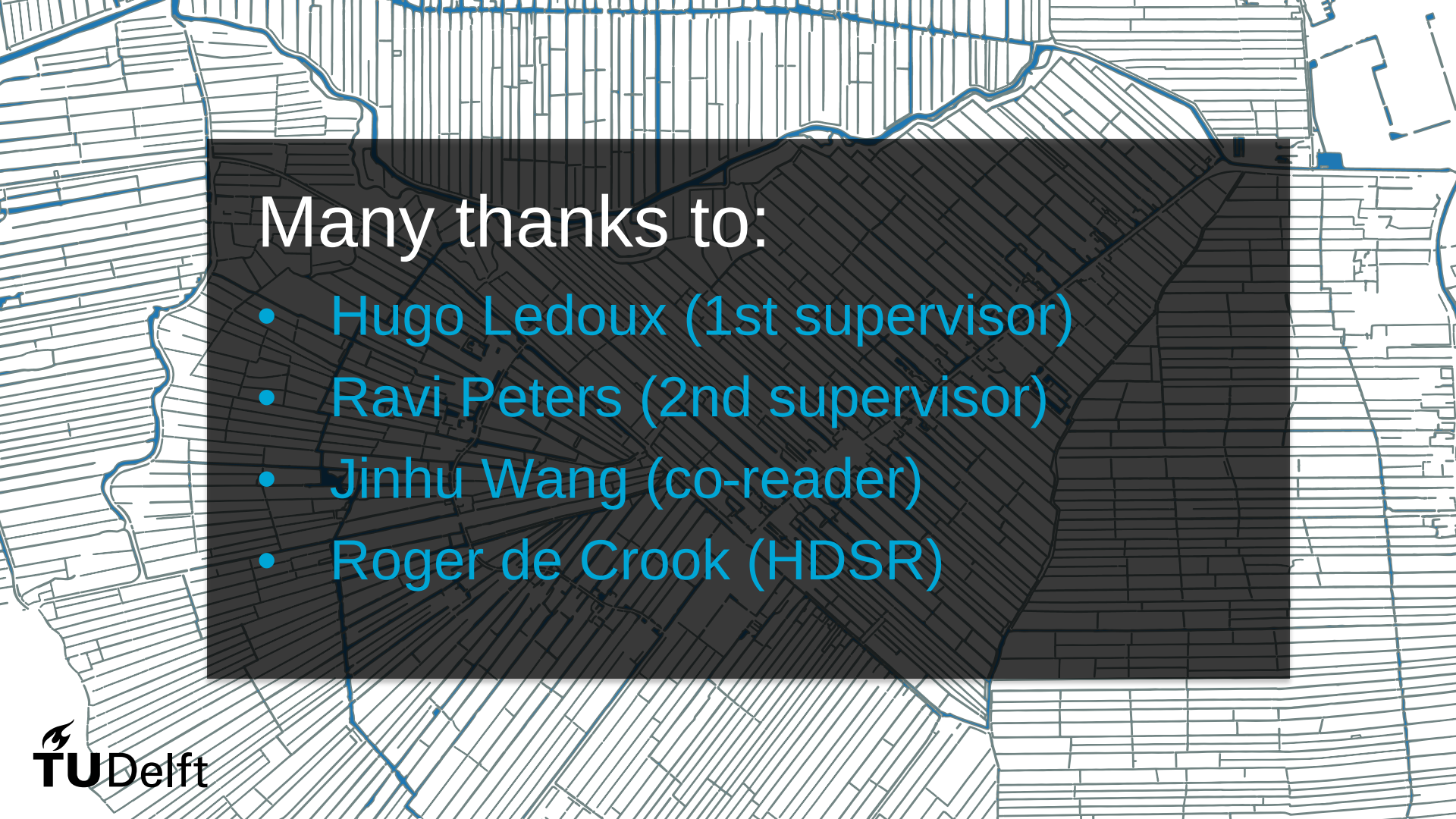
Conclusion (2/2)

- Clear potential of the combined methodology
- The strengths of Concave hull and MAT are combined, and weaknesses partially mitigated
  - >95% of all water course identified for clay, peat, and urban areas
- But: quality of datasets is of major influence
  - AHN3 classification
  - HDSR reference datasets
- Scientific contribution:
  - Automatic identification from AHN3 is clearly possible
  - This study presents the only raw-LiDAR based solution for flat and engineered landscapes

Future work…

- Obviously, improve the current methodologies

- Several interesting possibilities:
  1. Use the MAT to identify 3D geometries
  2. Manual collection of reference data
  3. Aesthetic enhancement
  4. Application to different environments and point cloud densities



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