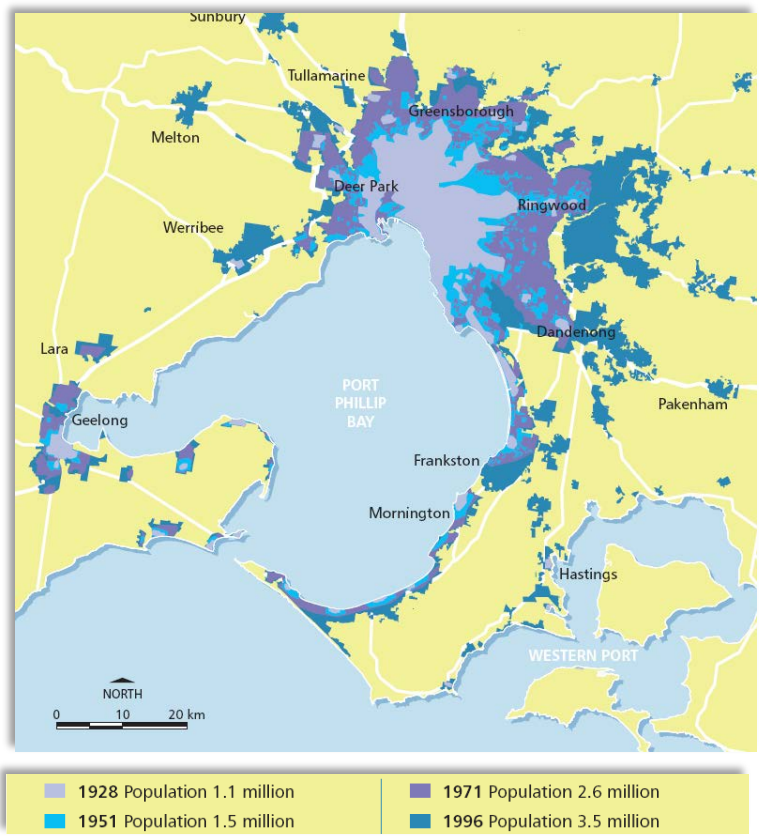


Evolution of Urban Drainage Networks in DAnCE4Water

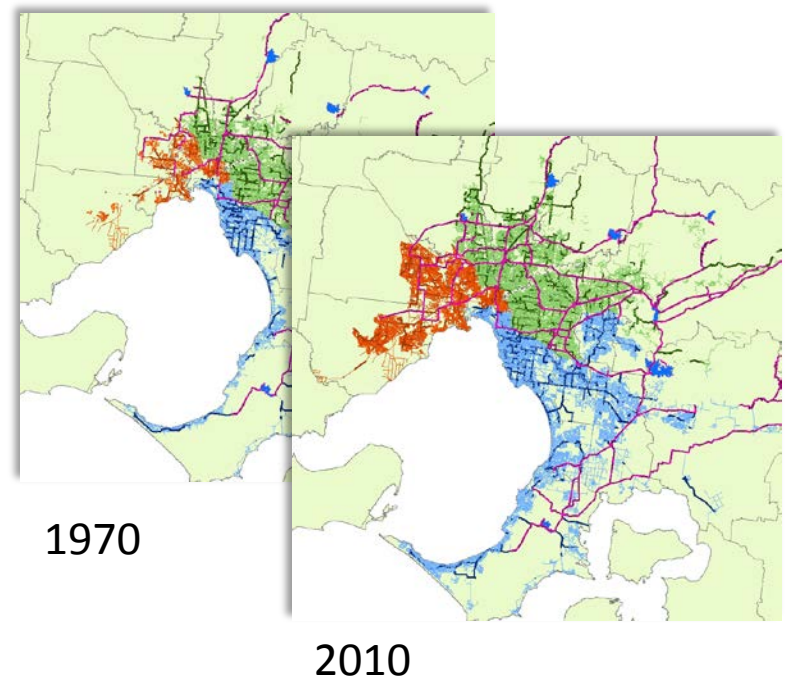
C. Urich , R. Sitzenfrei, M. Kleidorfer, P. M. Bach,
D. T. McCarthy, A. Deletic , W. Rauch



Urban development

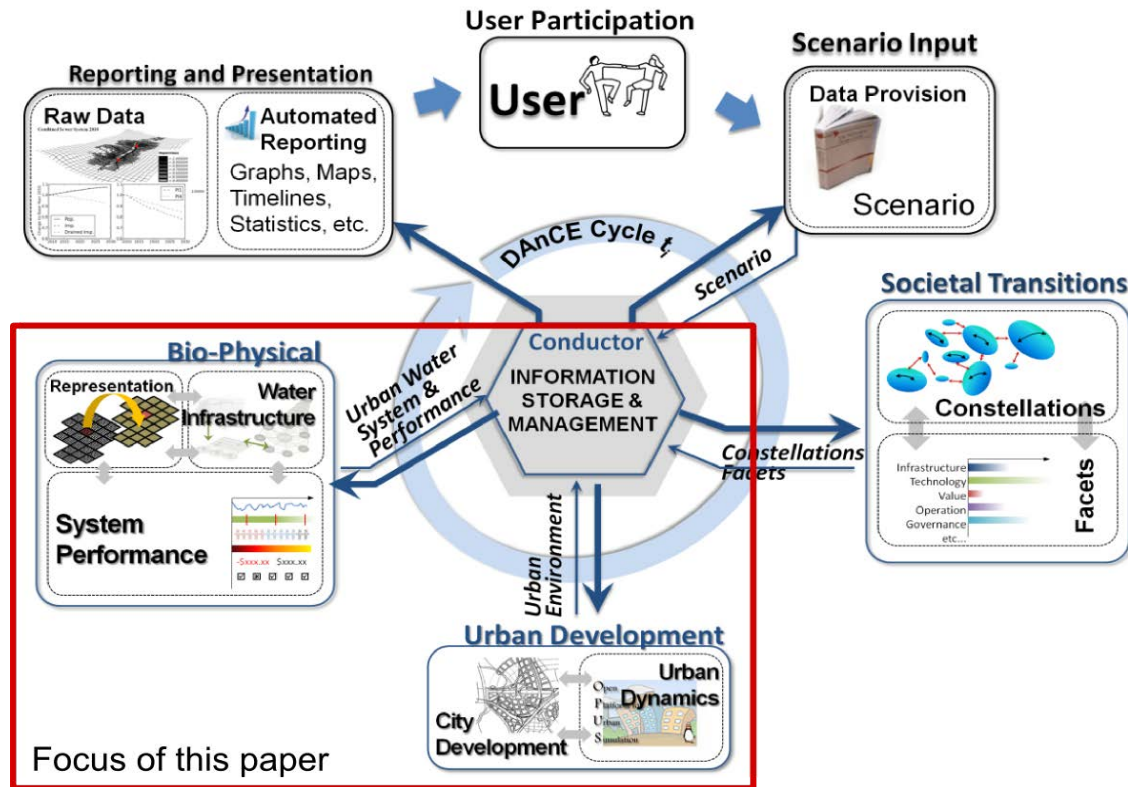


infrastructure development



1970

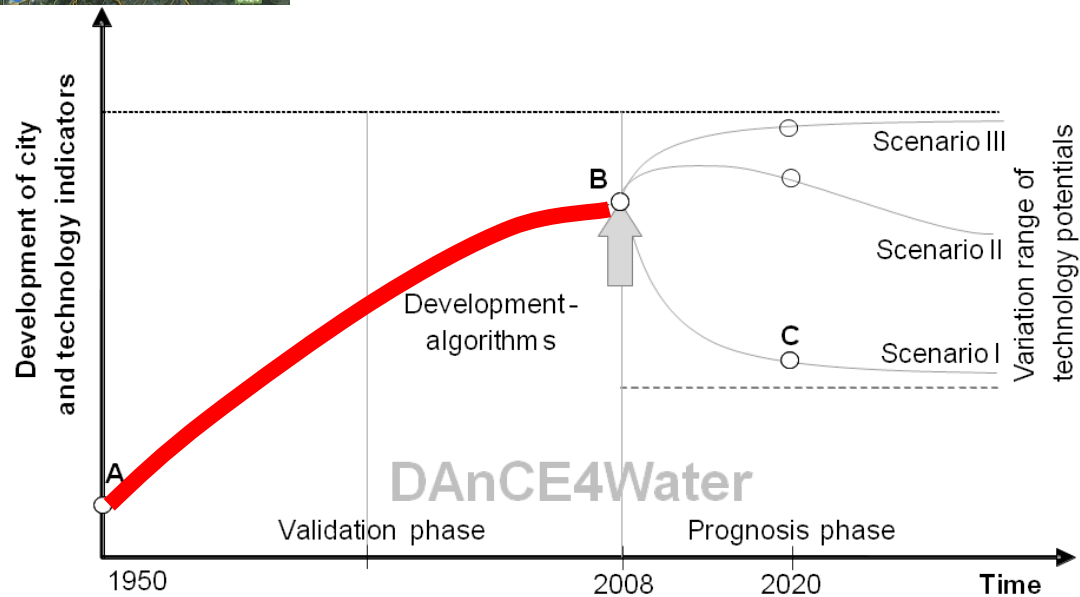
2010



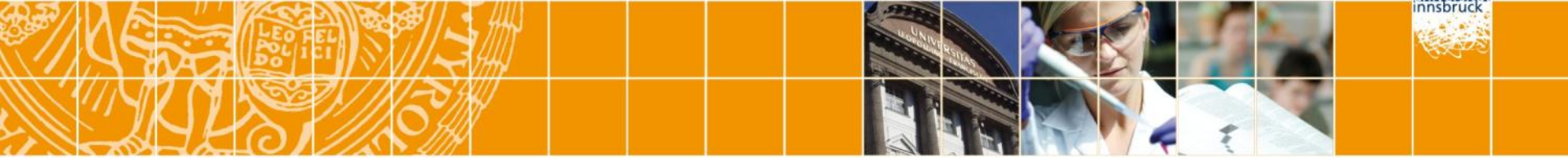
DAnCE4Water

Dynamic Adaptation for enabling City Evolution for Water

Development of Scotchman's Creek



○ A Initial state ○ B Start state ○ C Prognosis state



Evolution of Urban Drainage Networks in DAnCE4Water

C. Urich , R. Sitzenfrei, M. Kleidorfer, P. M. Bach,
D. T. McCarthy, A. Deletic , W. Rauch



Content

1. Dynamics
2. Ants and Agents
3. DAnCE4Water



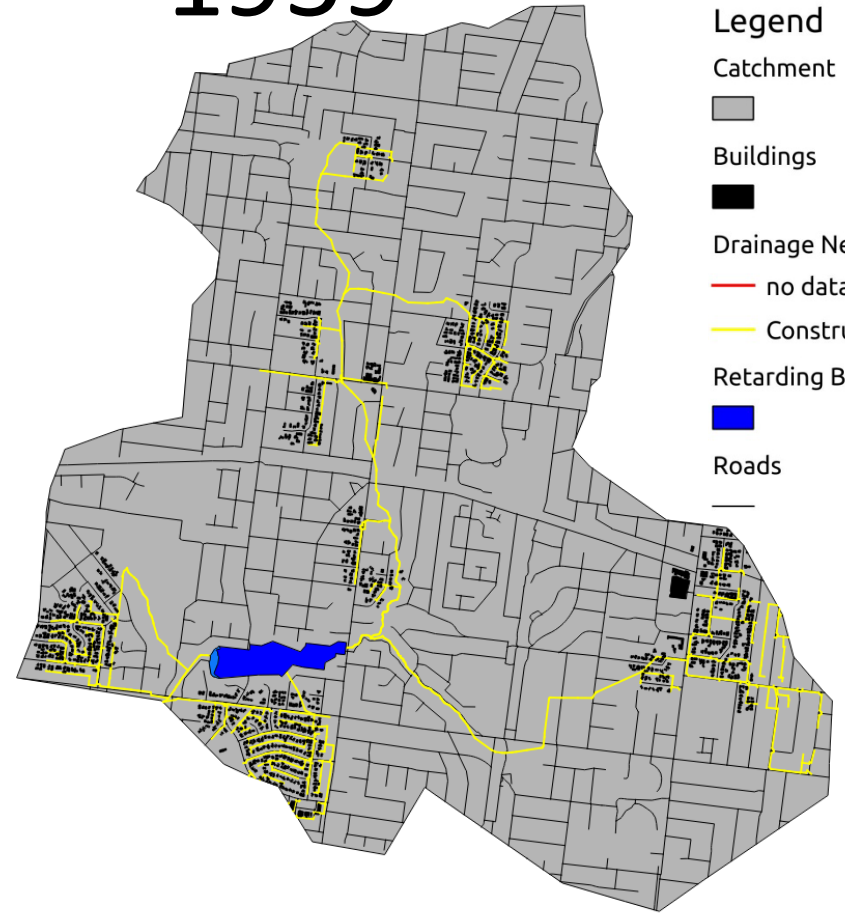
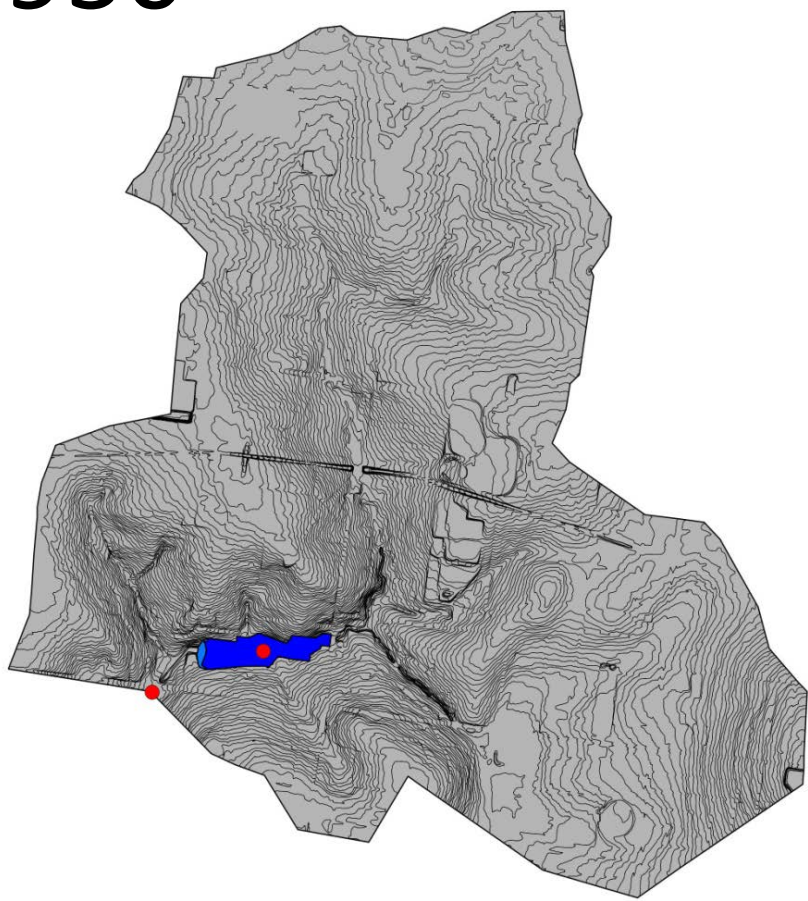
Content

1. Dynamics
2. Ants and Agents
3. DAnCE4Water



1950

1959

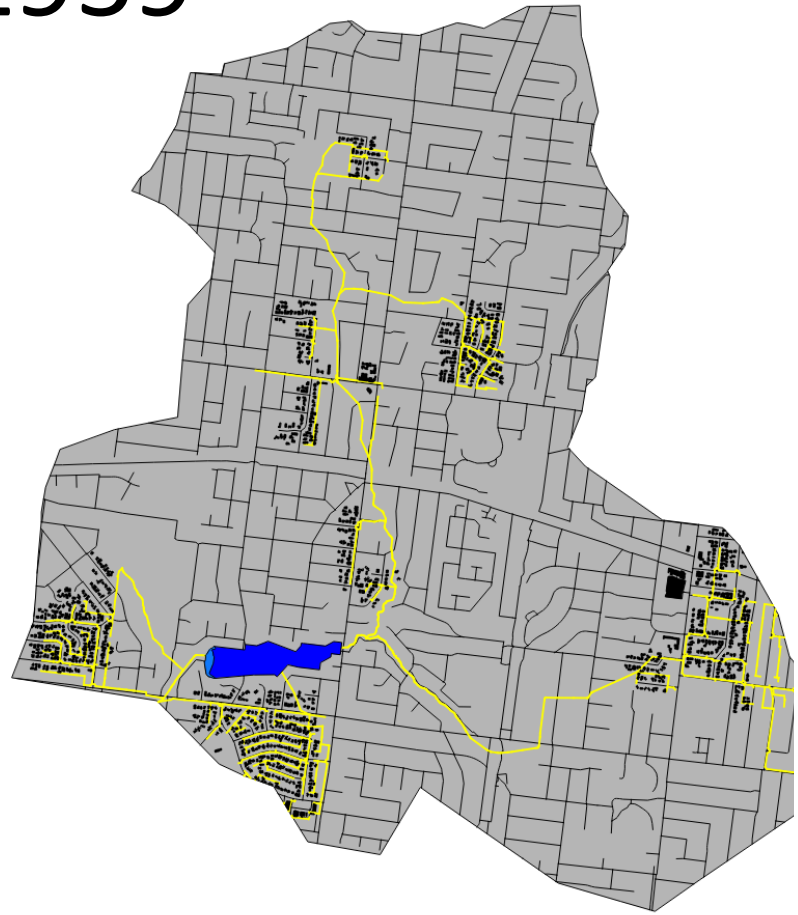


- Legend**
- Catchment
 - Buildings
 - Drainage Network
 - no data
 - Construction Date
 - Retarding Basin
 - Roads

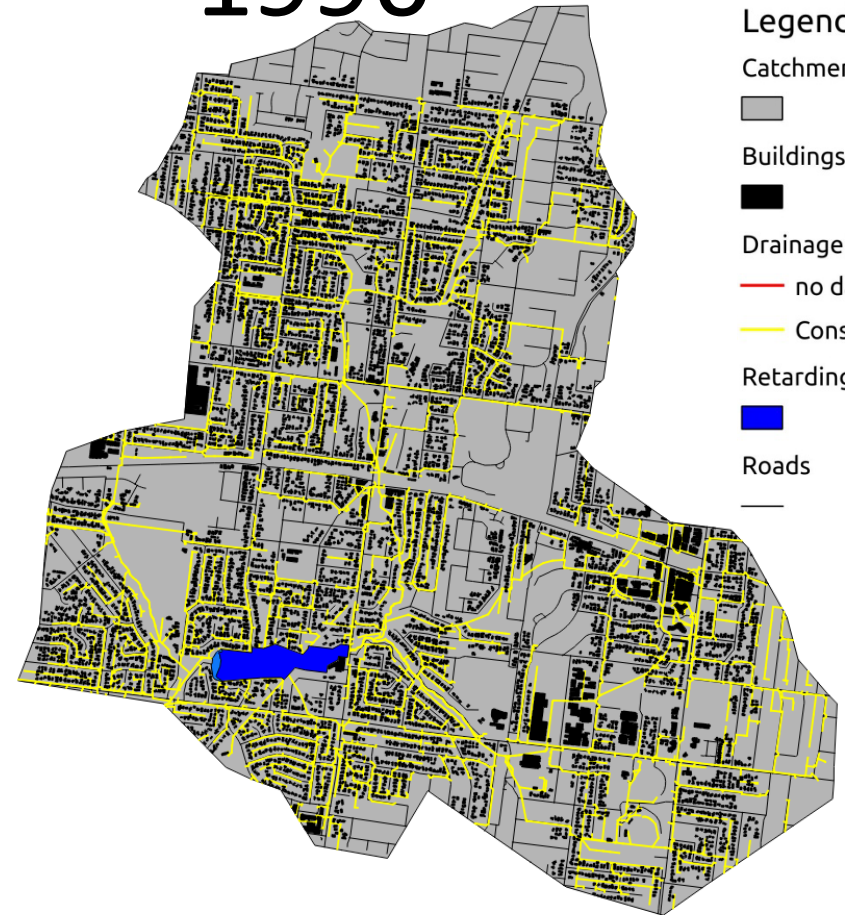




1959



1990



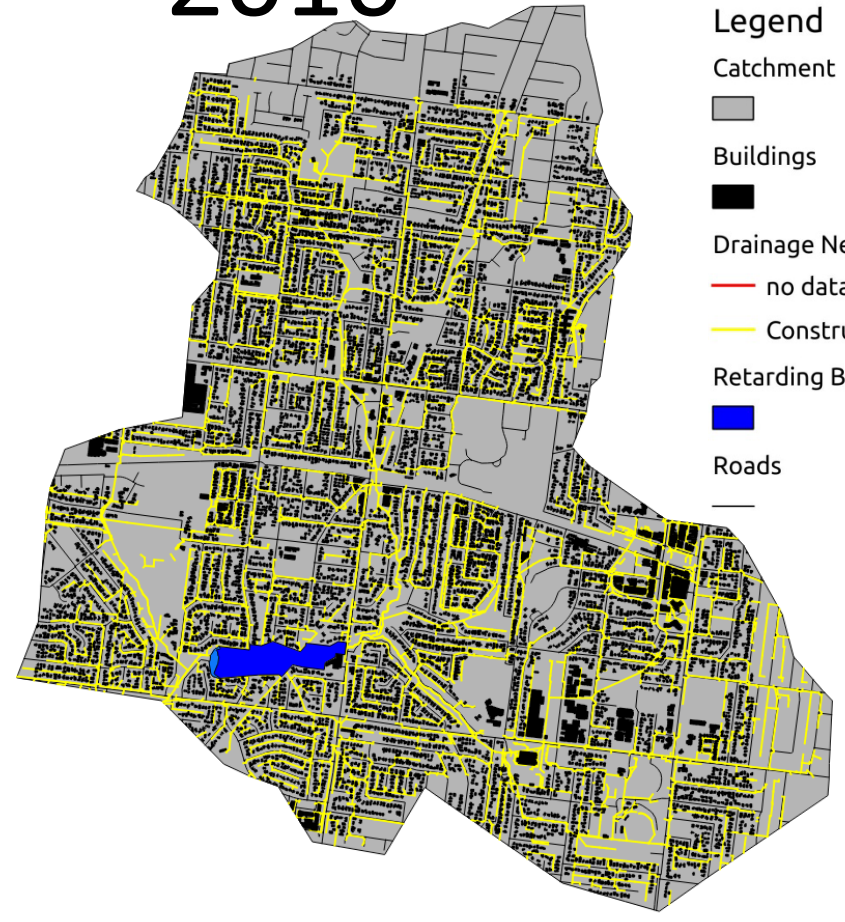
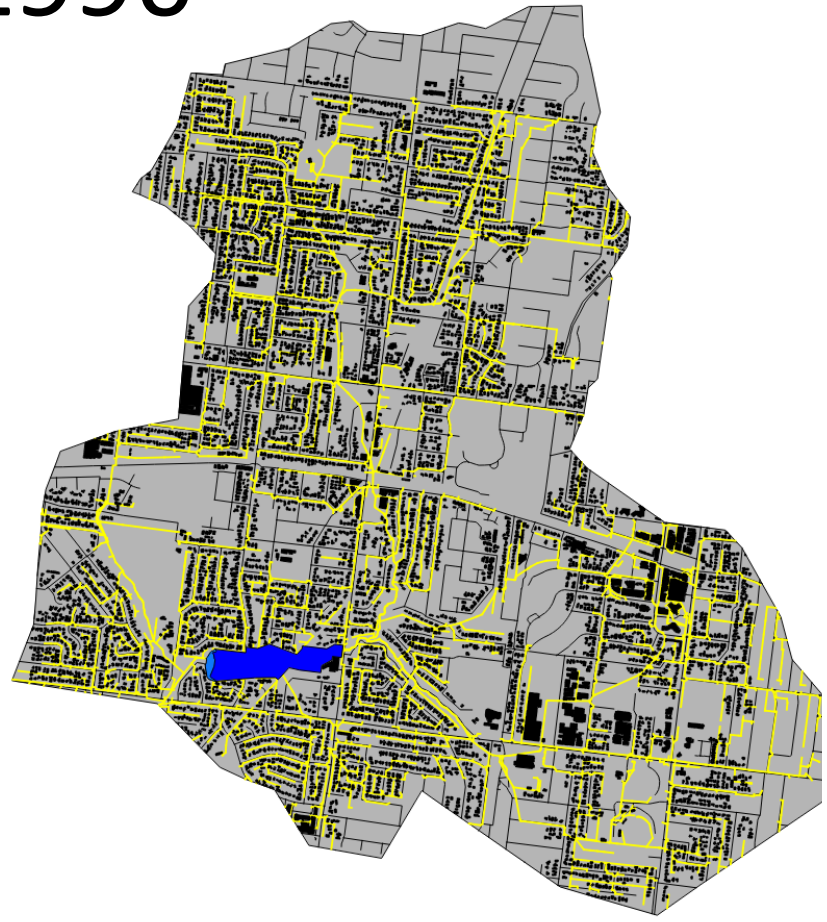
- Legend
- Catchment
 - Buildings
 - Drainage Network
 - no data
 - Construction Date
 - Retarding Basin
 - Roads





1990

2010

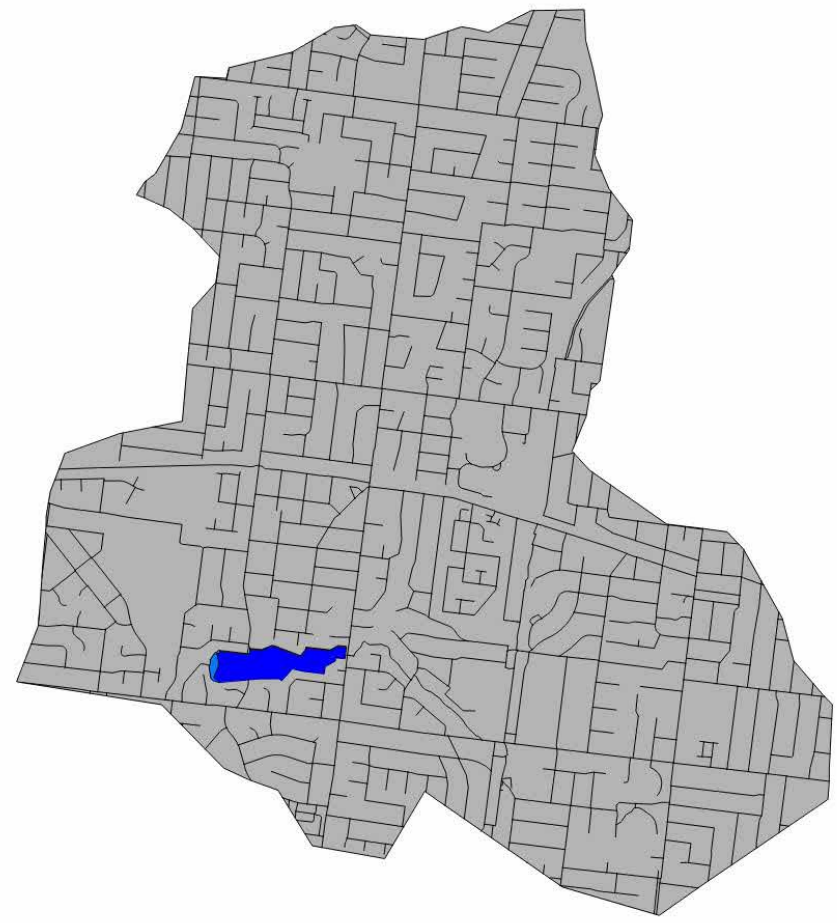


- Legend
- Catchment
 - Buildings
 - Drainage Network
 - no data
 - Construction Data
 - Retarding Basin
 - Roads





1950-2009





Content

1. Dynamics
- 2. Ants and Agents**
3. DAnCE4Water

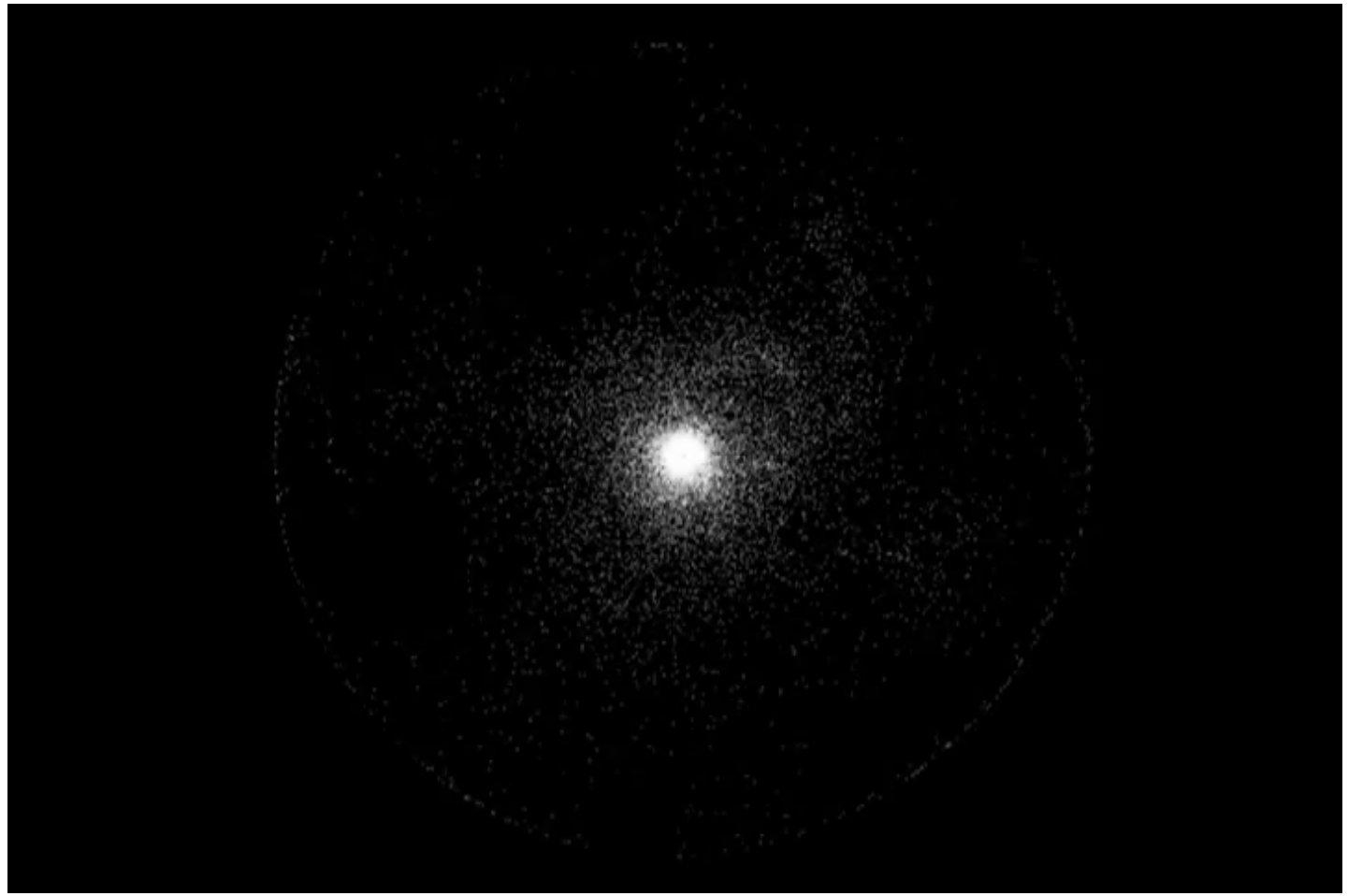


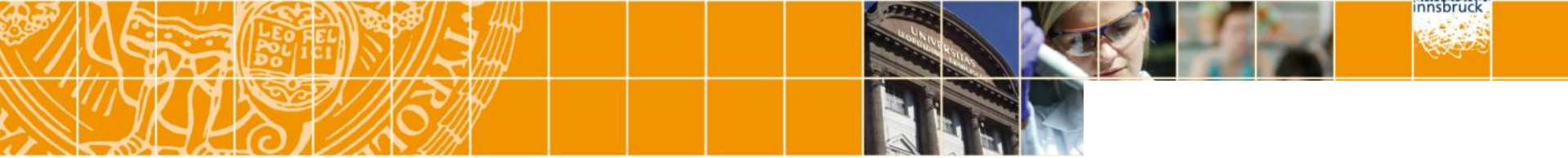
Ant Trail Formation





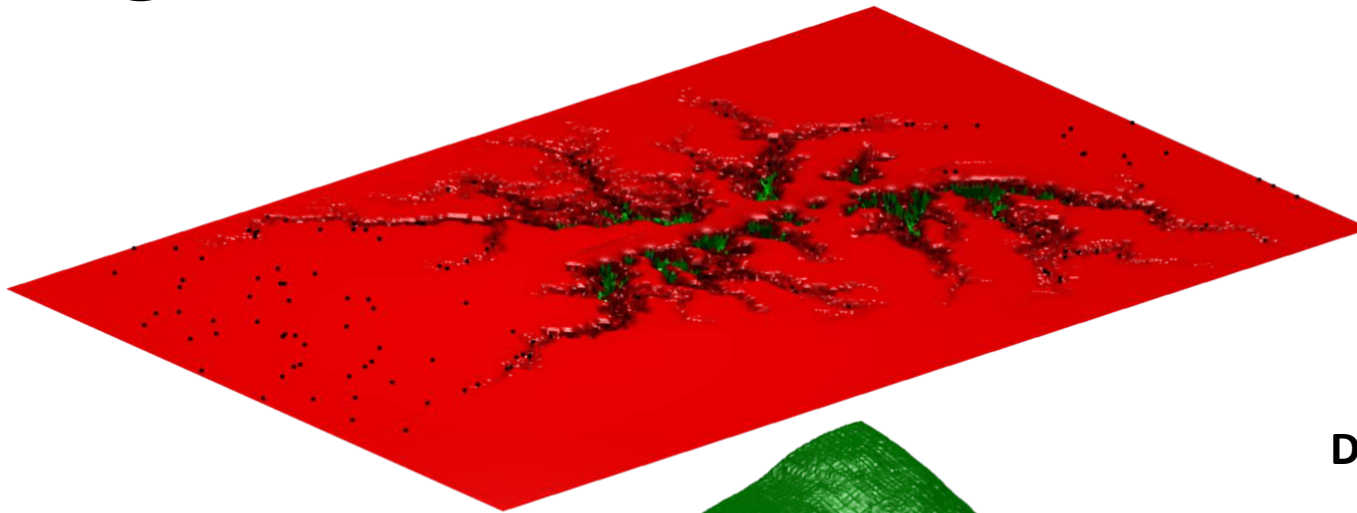
Ant Trail Formation



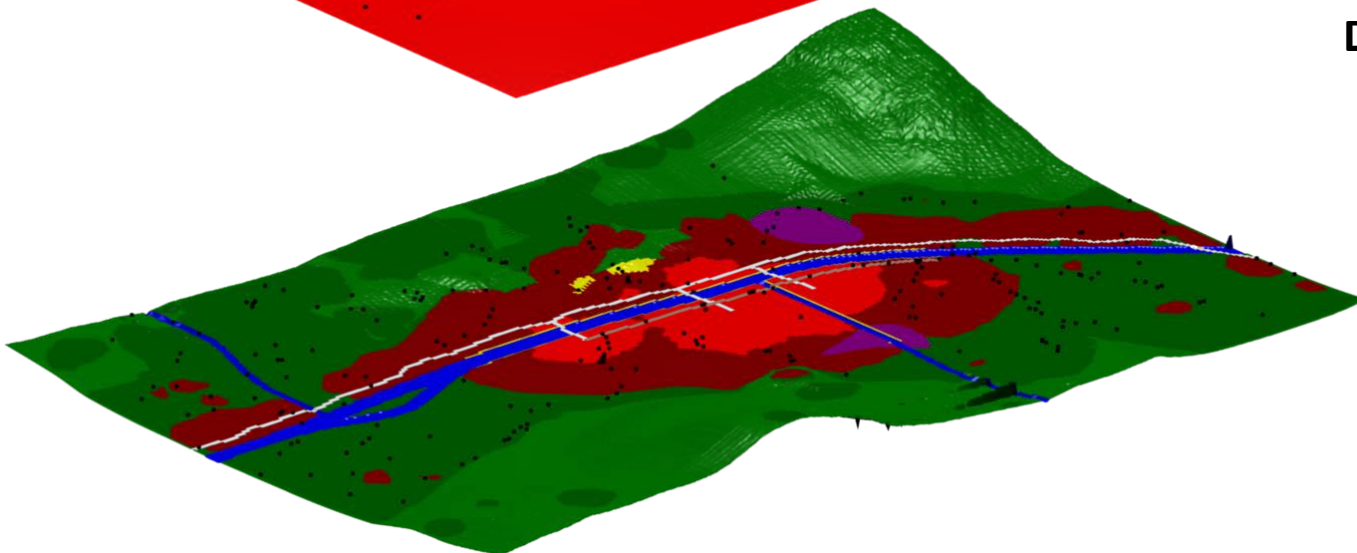


Agent Based Modell

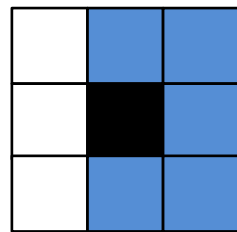
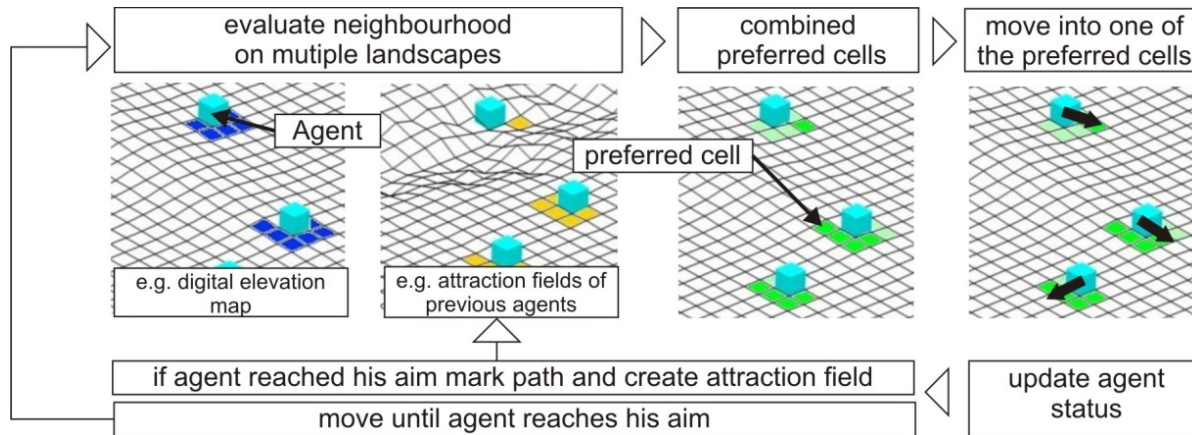
Communication Landscape



Digital Elevation Map

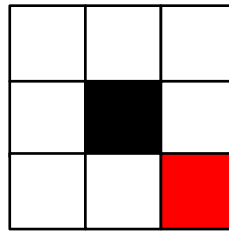


Agent Based Modell



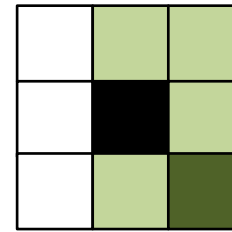
Elevation Map

+



Attraction Field

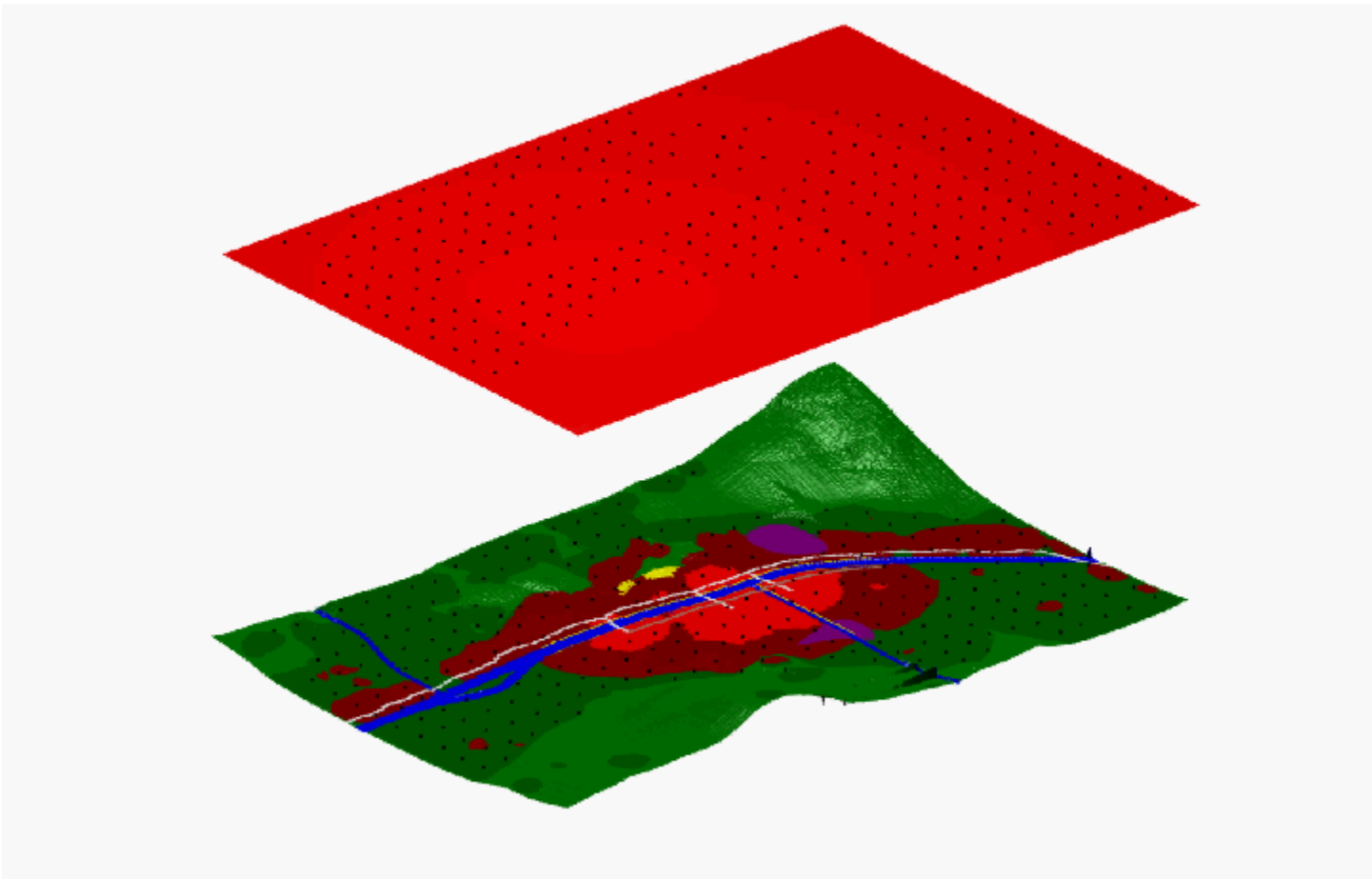
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Preferred Cells

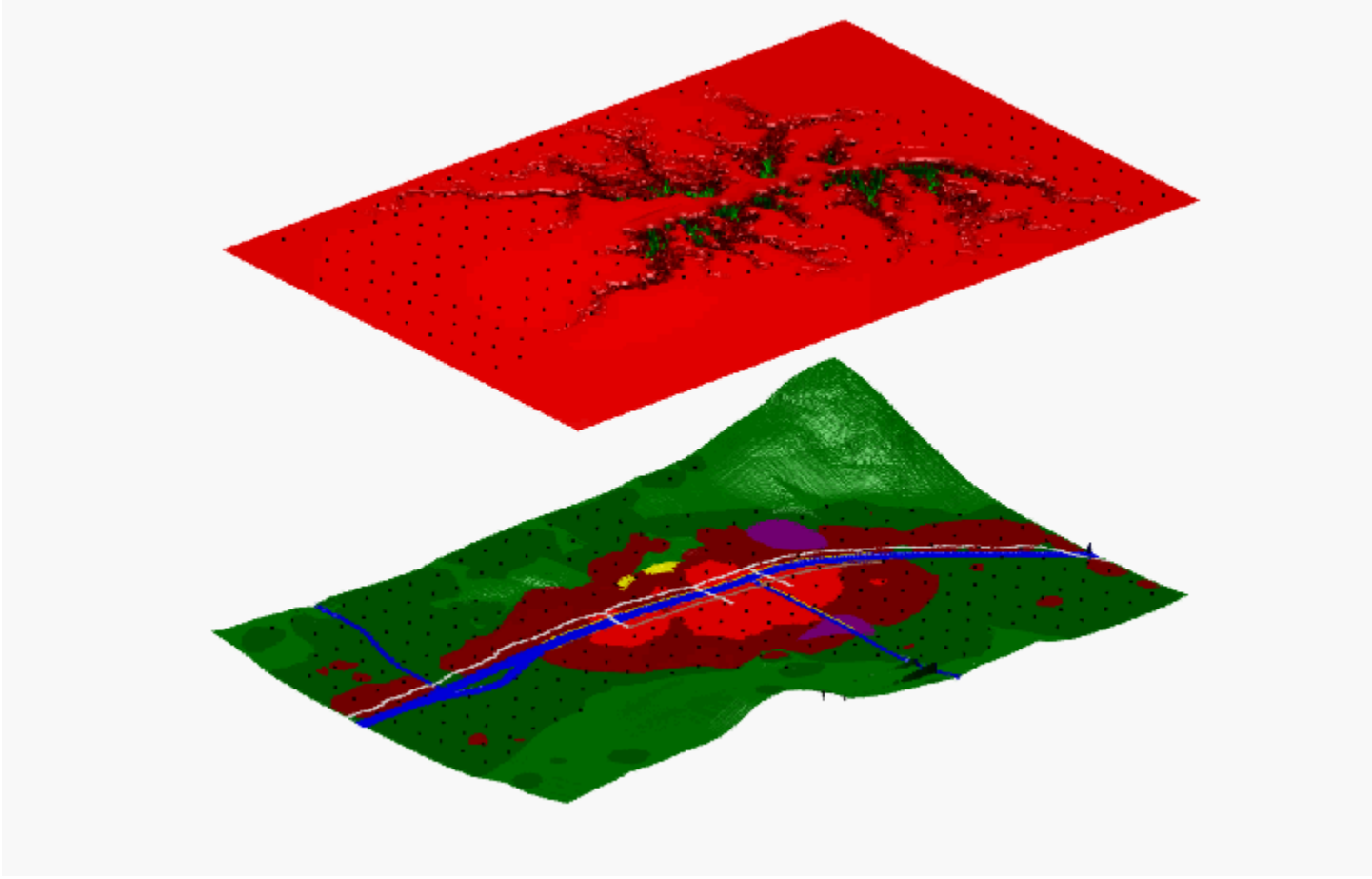


Agent Based Modell



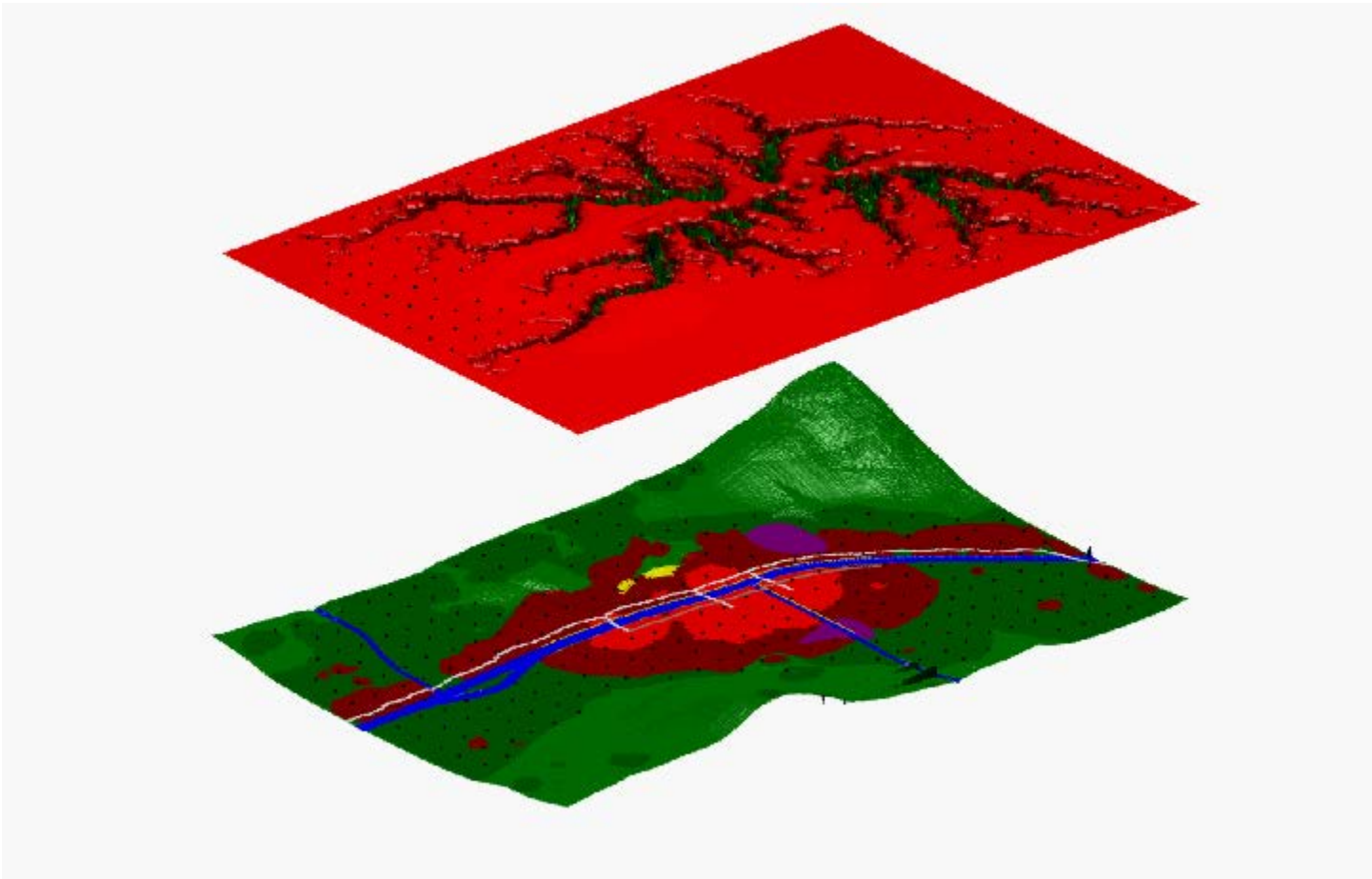


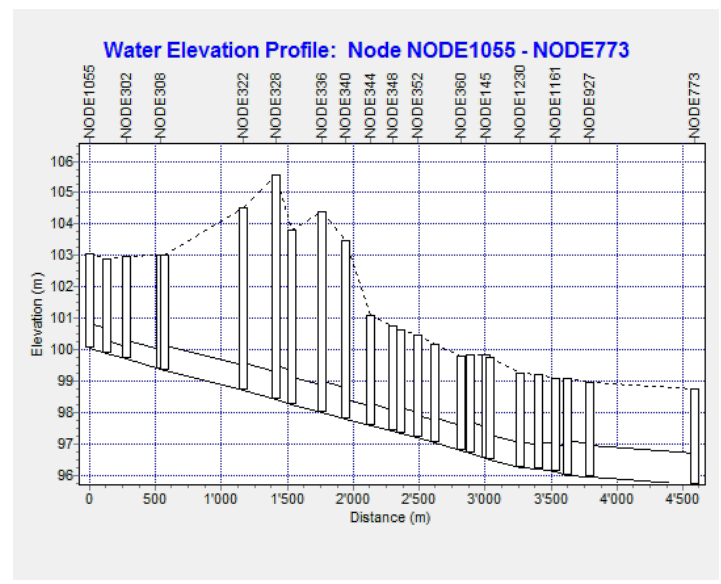
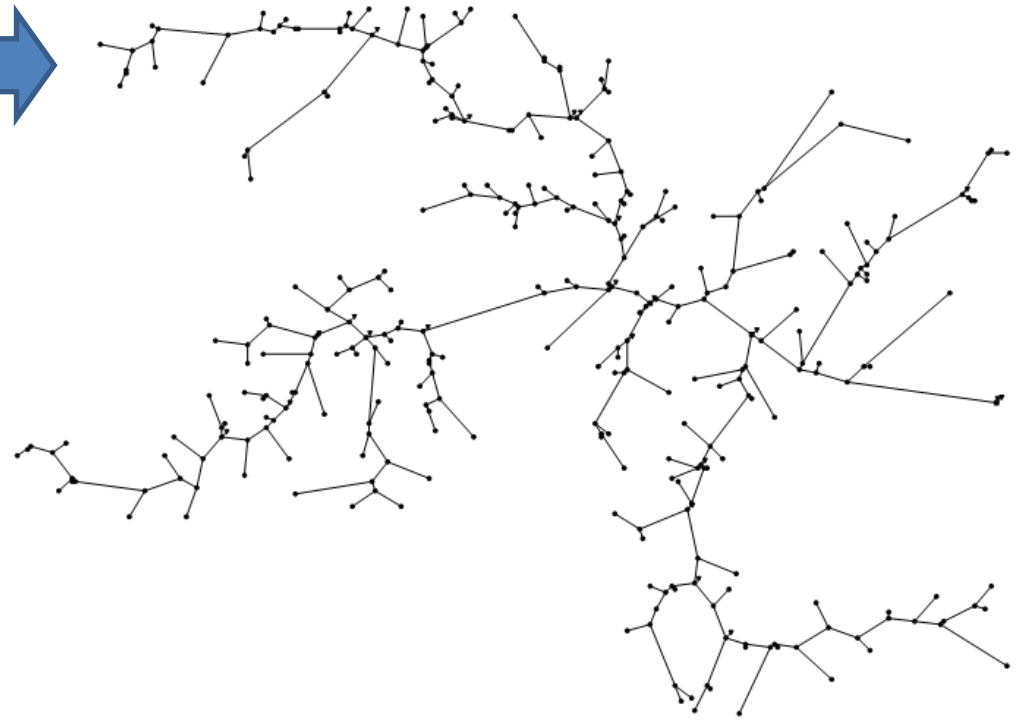
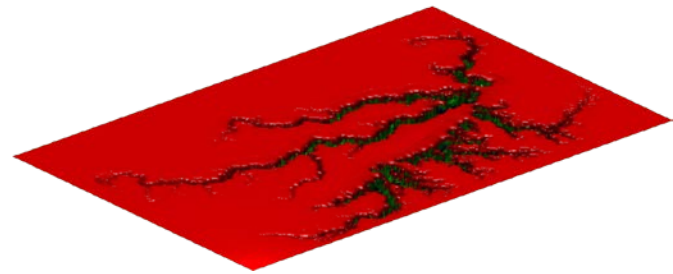
Agent Based Modell



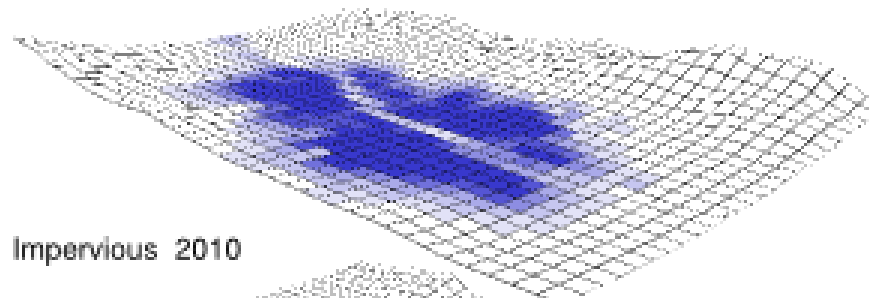


Agent Based Modell

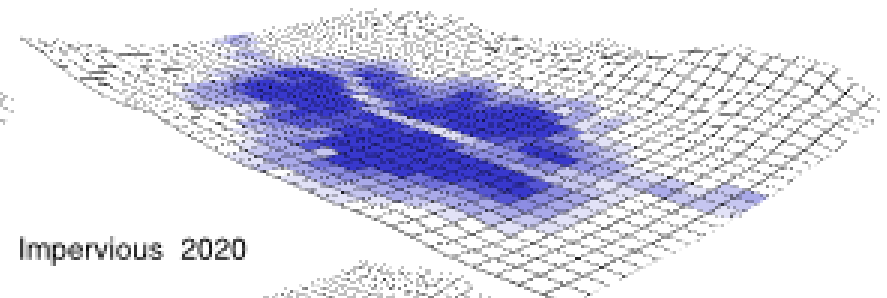




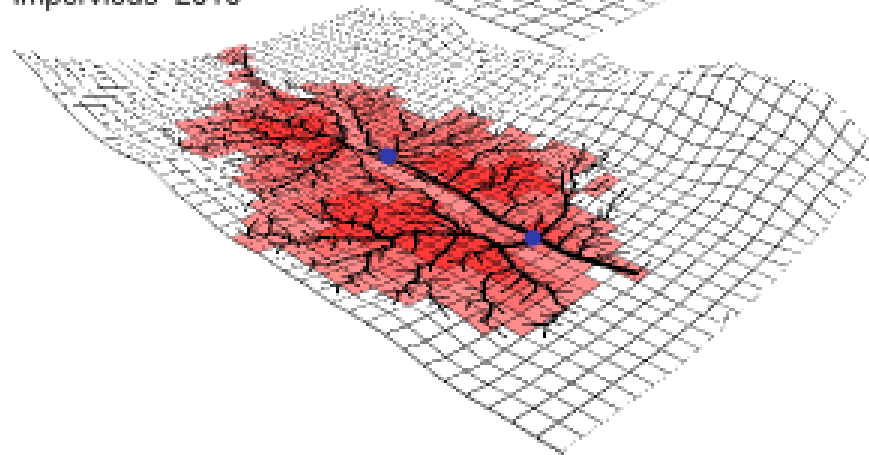
Population 2010



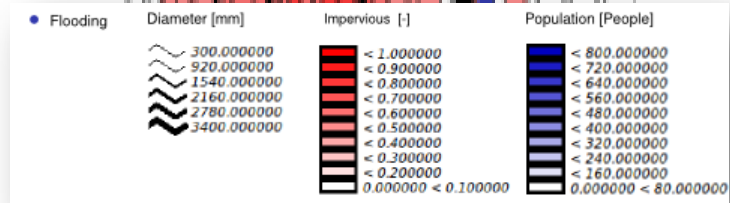
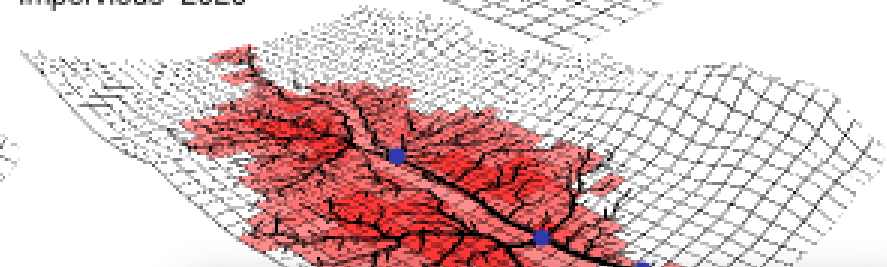
Population 2020



Impervious 2010



Impervious 2020

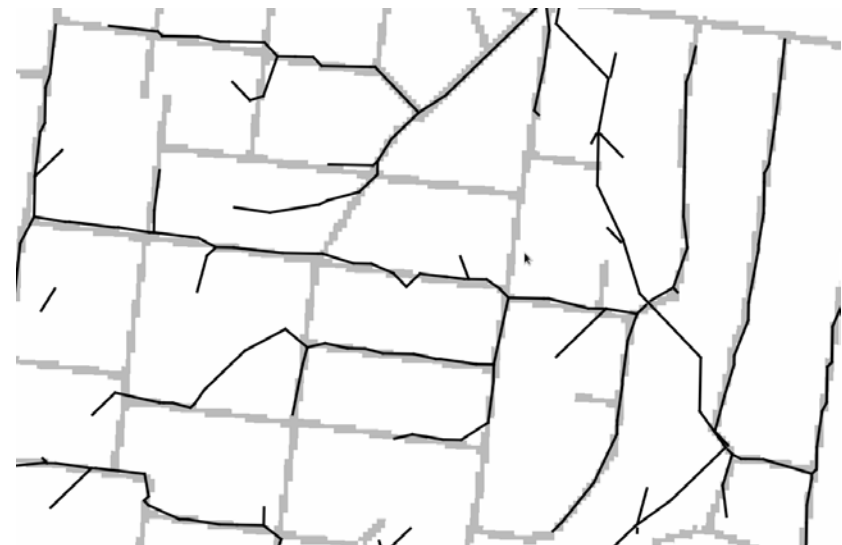
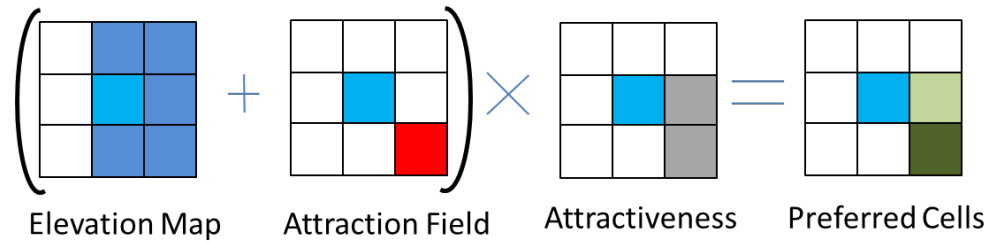


Urich, C., Bach, P., Hellbach, C., Sitzenfrei, R., Kleidorfer, M., McCarthy, D. T., Deletic, A., et al. (2011). Dynamics of cities and water infrastructure in the DAnCE4Water model. Proceedings of the 12th International Conference on Urban Drainage, Porto Alegre/Brazil, 10-15 September 2011. Porto Alegre/Brazil.

Agent Based Modell: Streets



Attractiveness 0.0002
 1.0

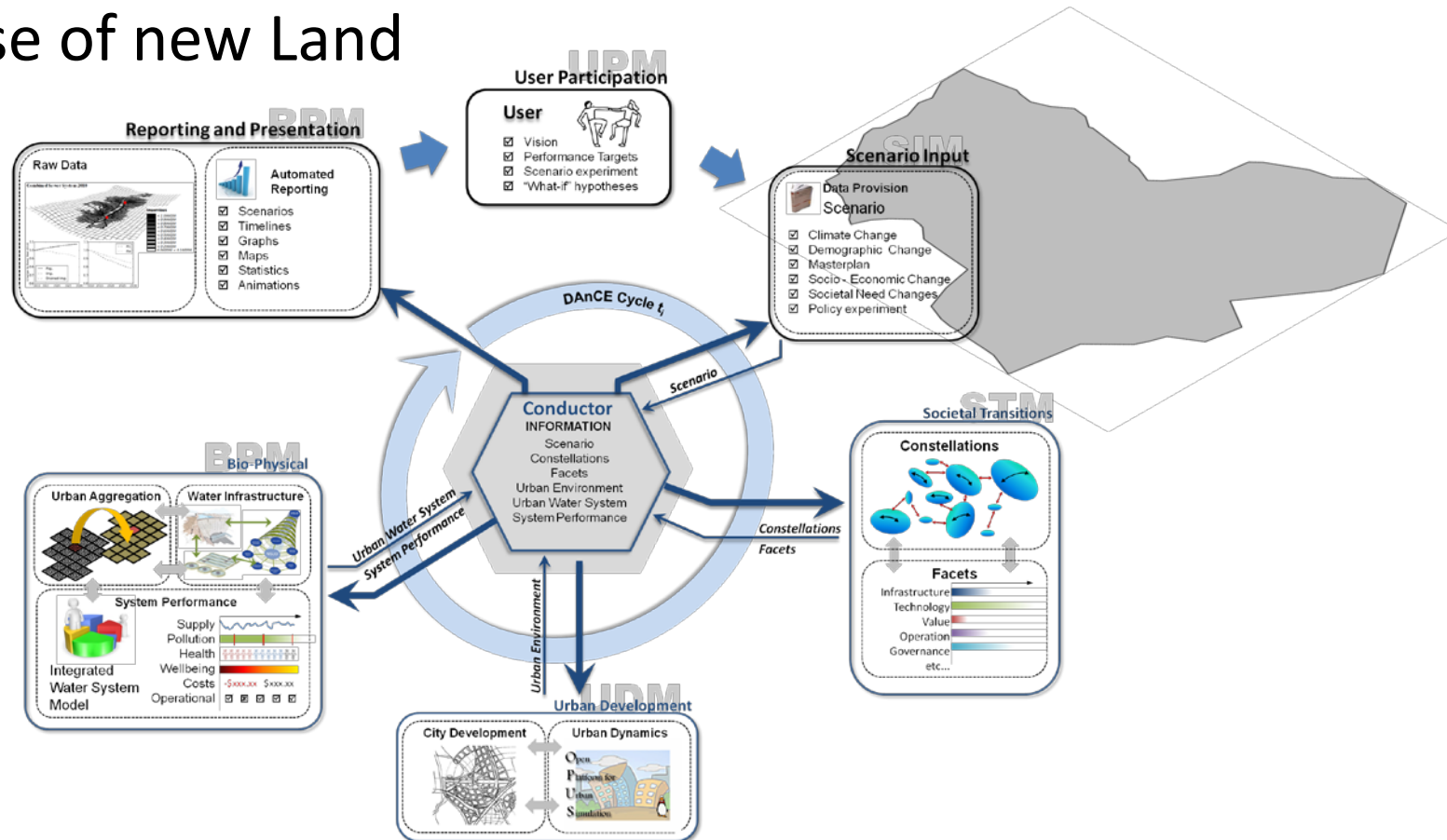




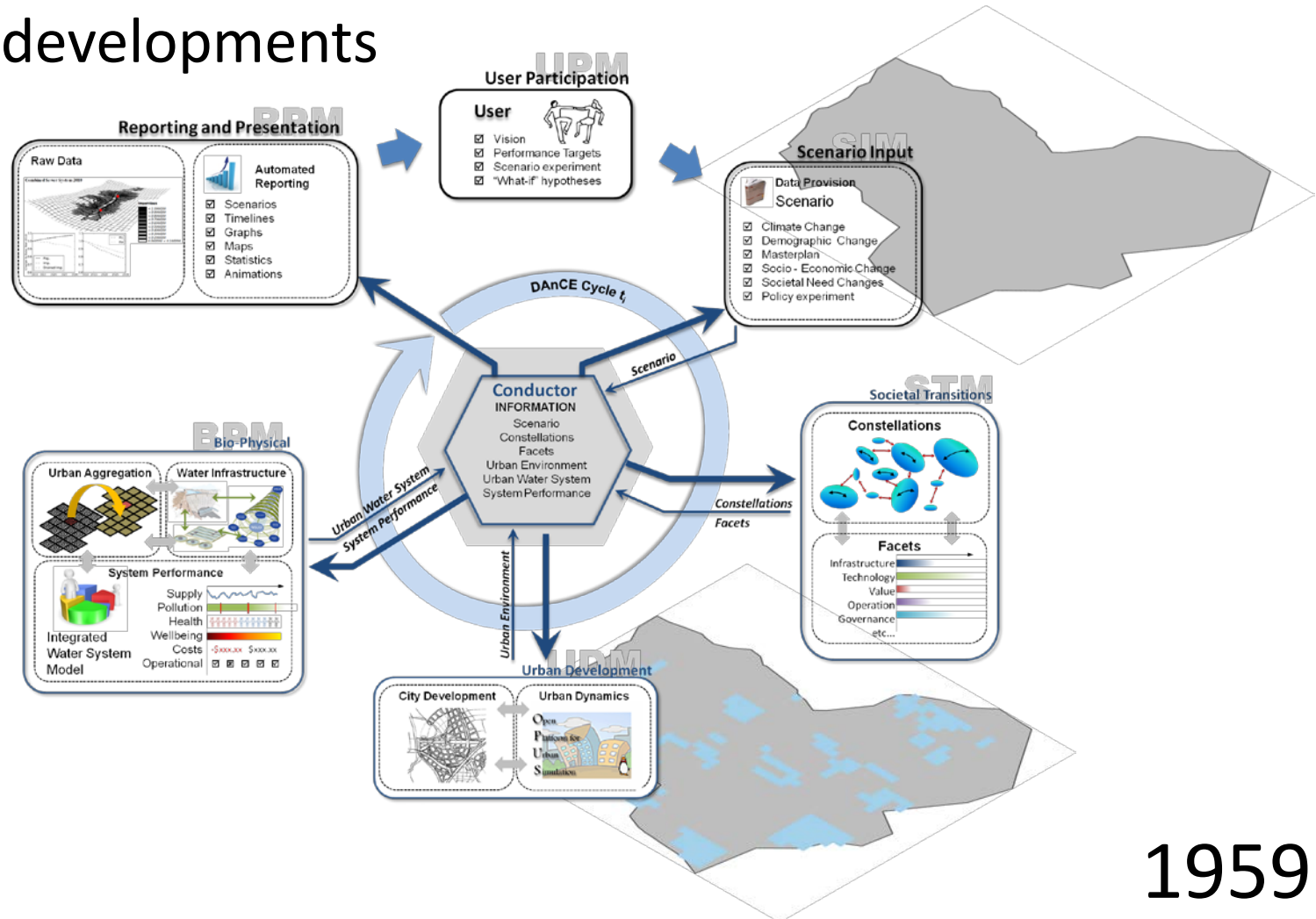
Content

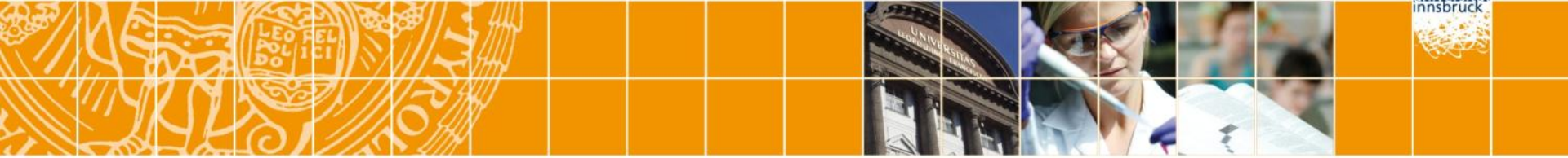
1. Dynamics
2. Ants and Agents
3. **DAnCE4Water**

SIM: Release of new Land

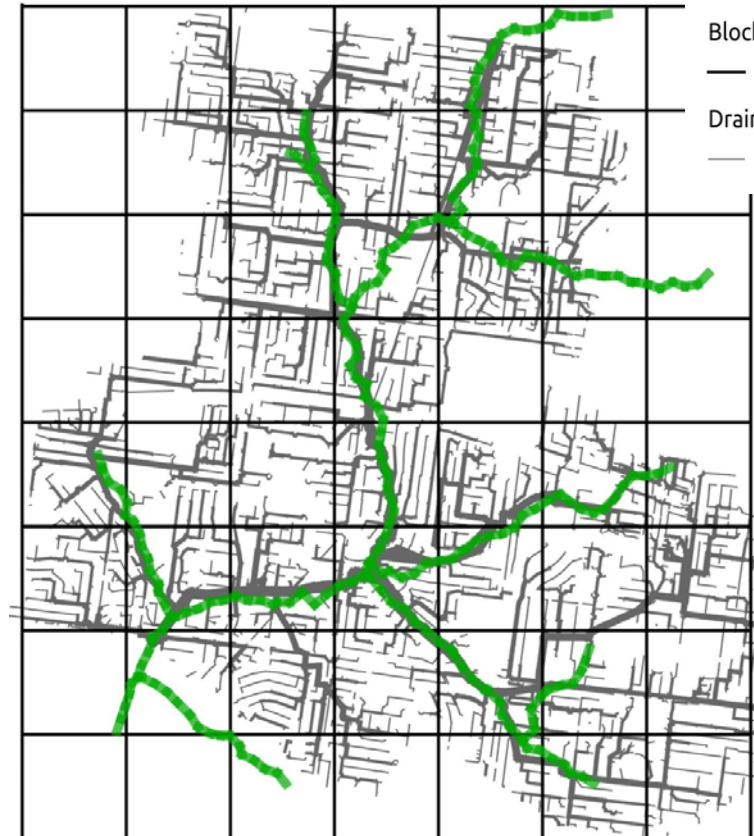
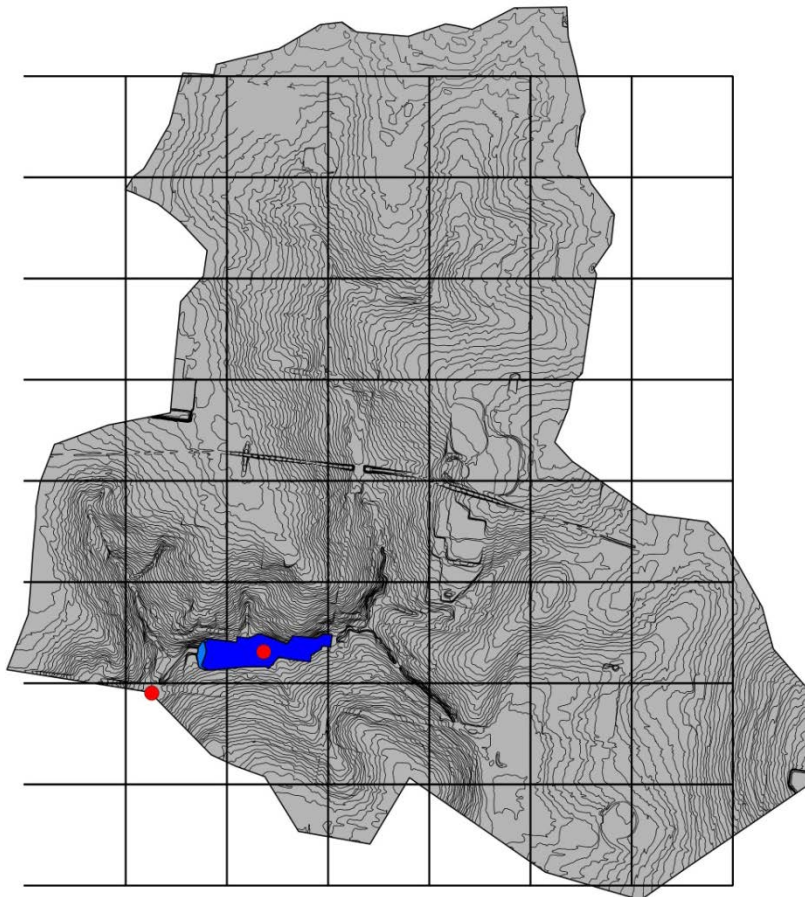


UDM: First developments





Masterplan: Main Trunk



Main Trunk DANCE4Water

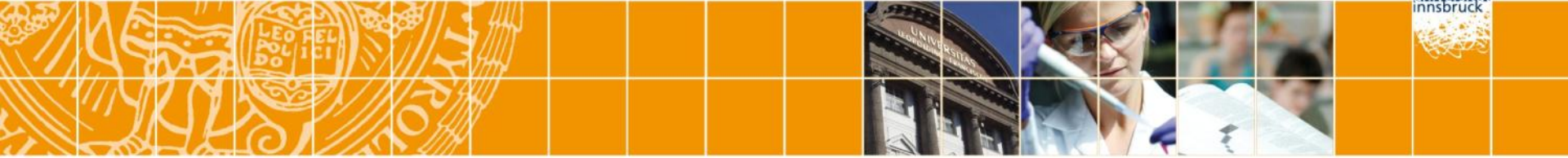


Blocks

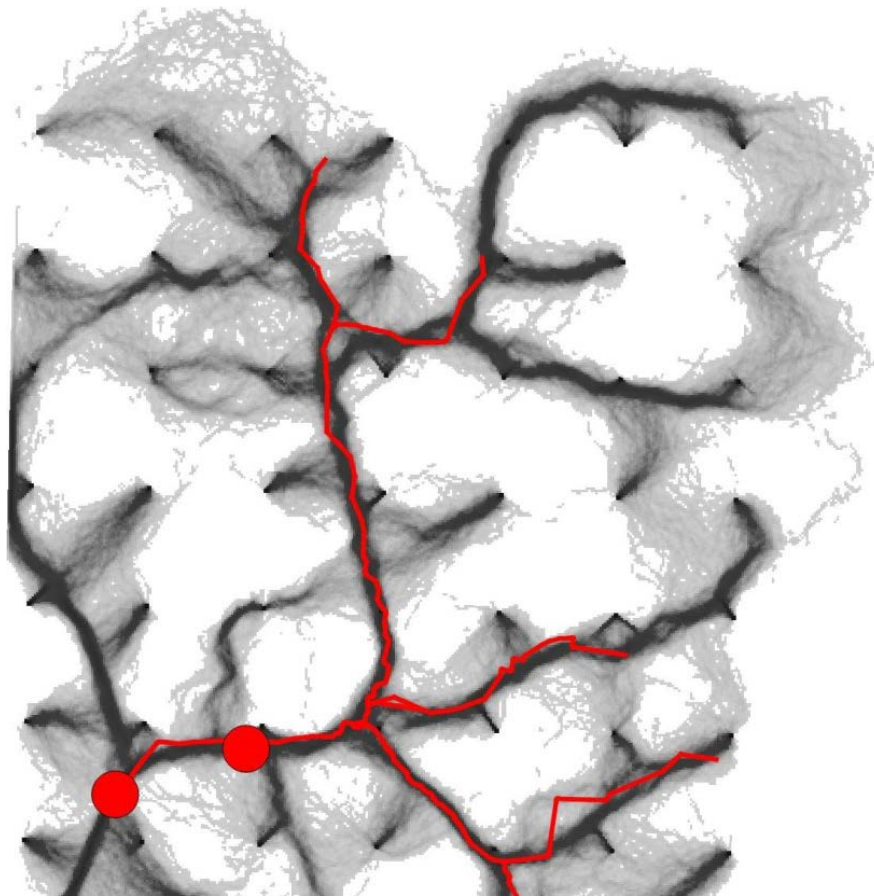


Drainage Network





Masterplan: Main Trunk



Main Infrastructure



— Main Trunk

Drainage Traces DAnCE4Water

□ 0

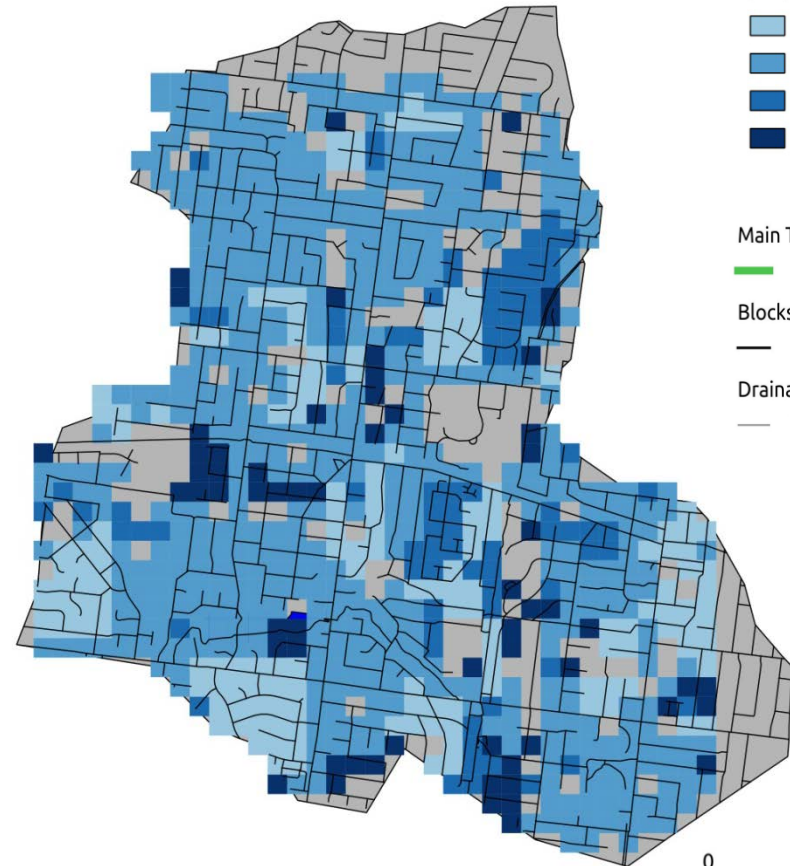
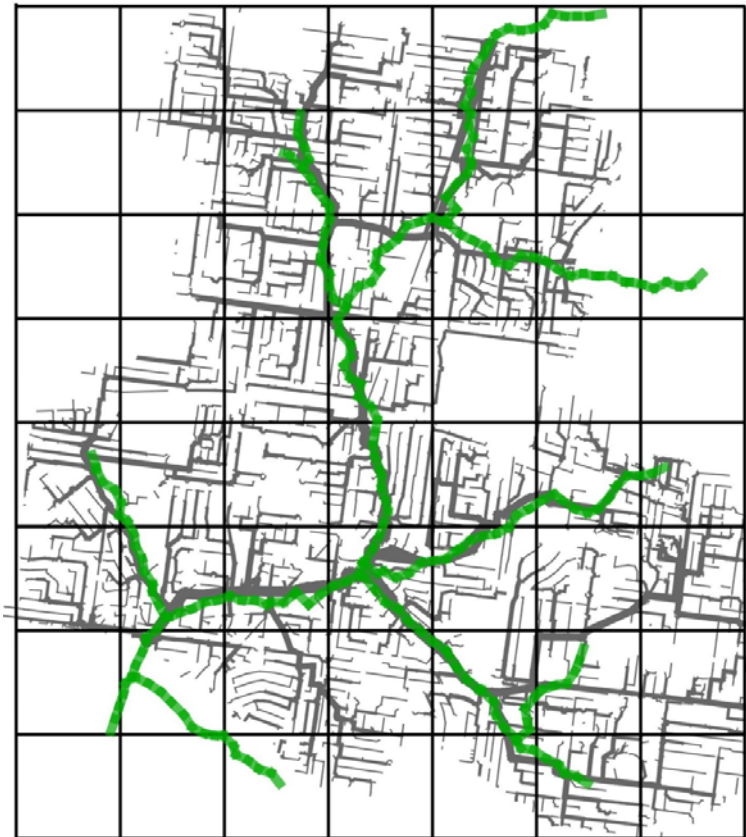
□ 1

■ 60

■ 350



Input: Agent Based Model



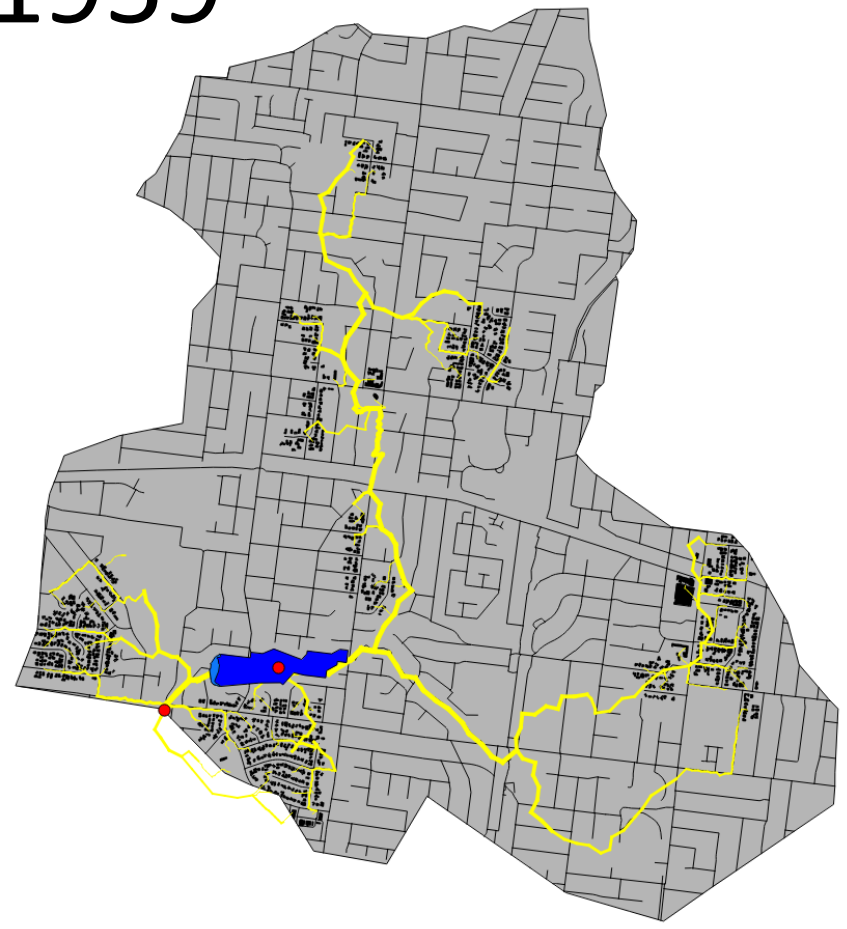
- Year Built
- no Data
 - 1940 - 1960
 - 1960 - 1980
 - 1980 - 2000
 - 2000 - 2009

- Main Trunk DAnCE4Water
- Blocks
- Drainage Network



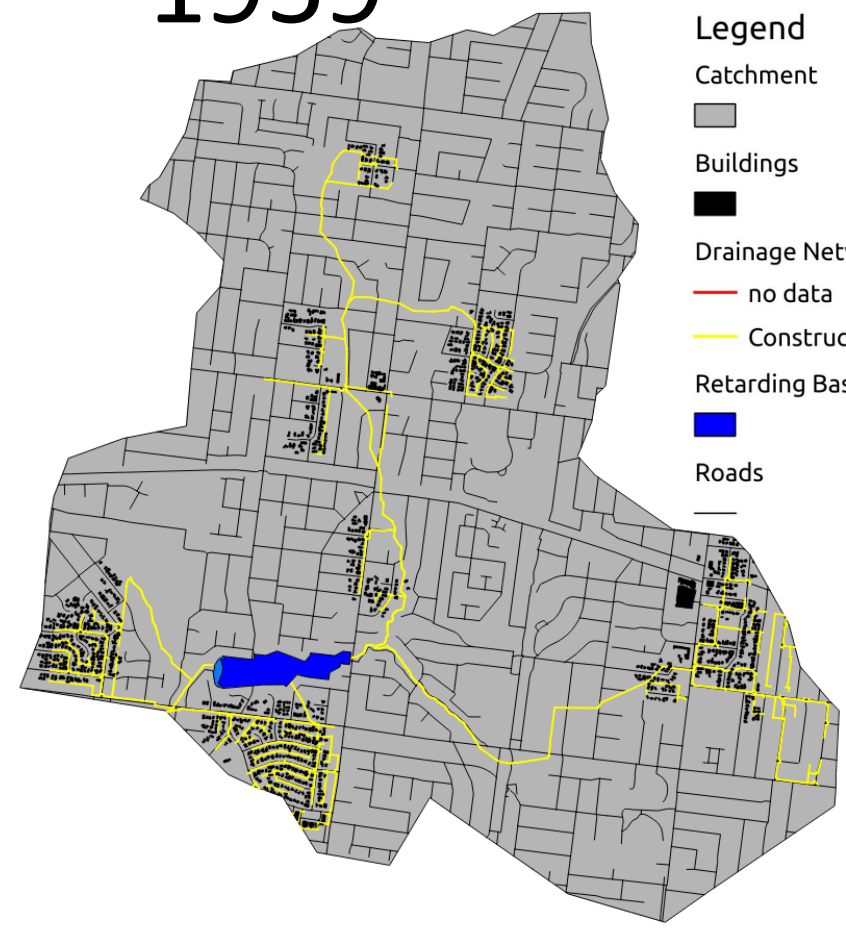


1959



generated

1959

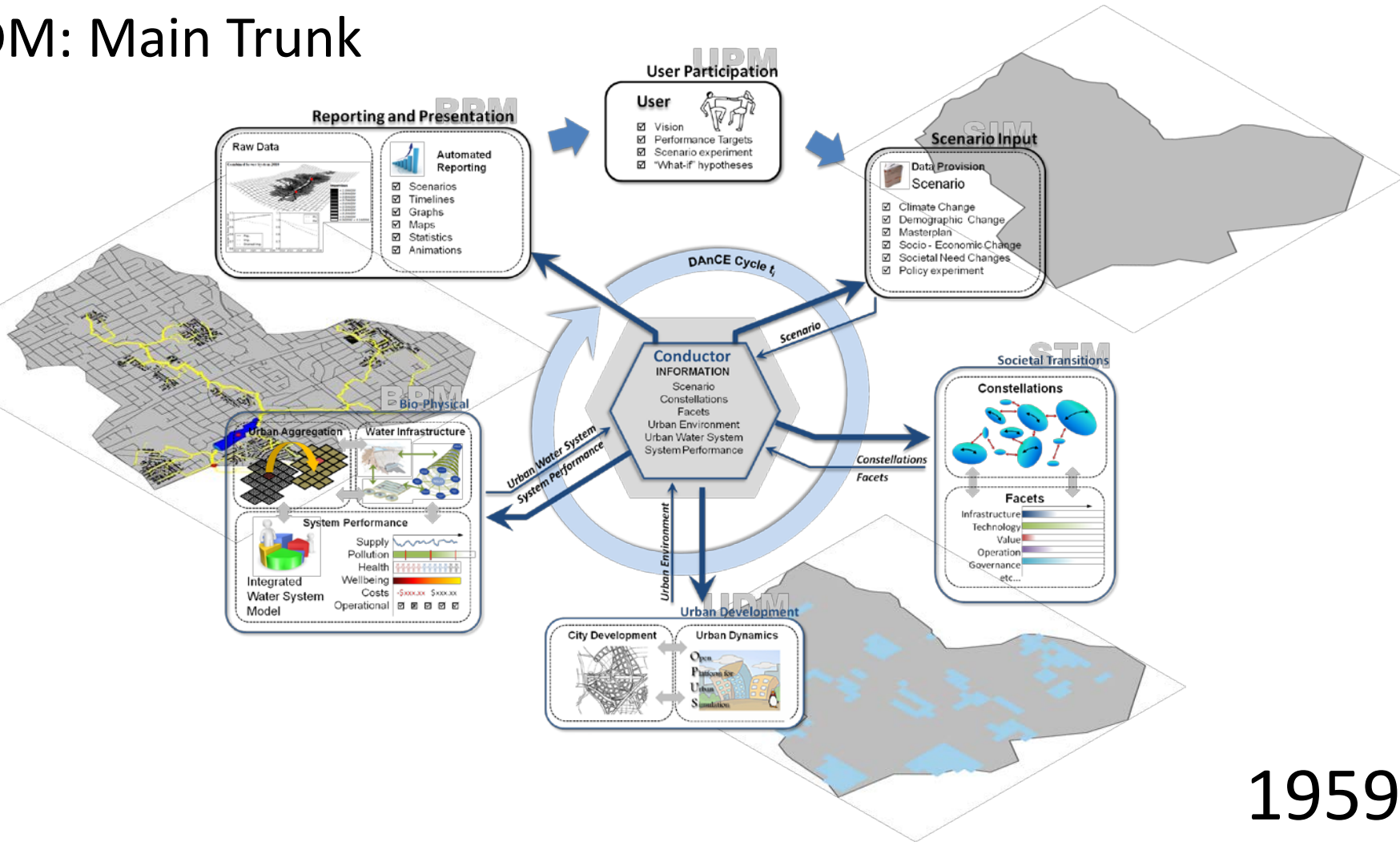


case study

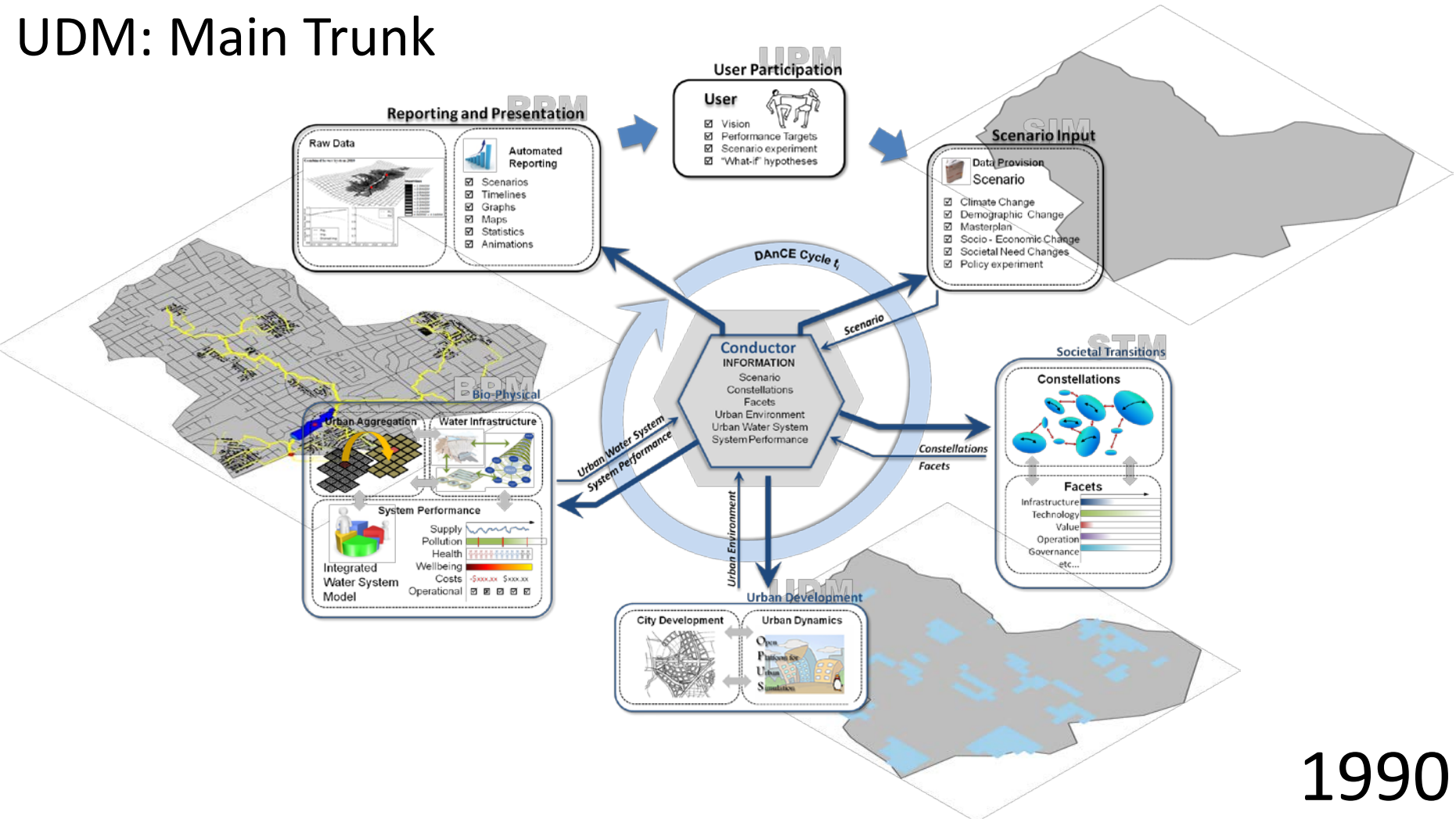
- Legend**
- Catchment
 - Buildings
 - Drainage Network
 - no data
 - Construction Date
 - Retarding Basin
 - Roads



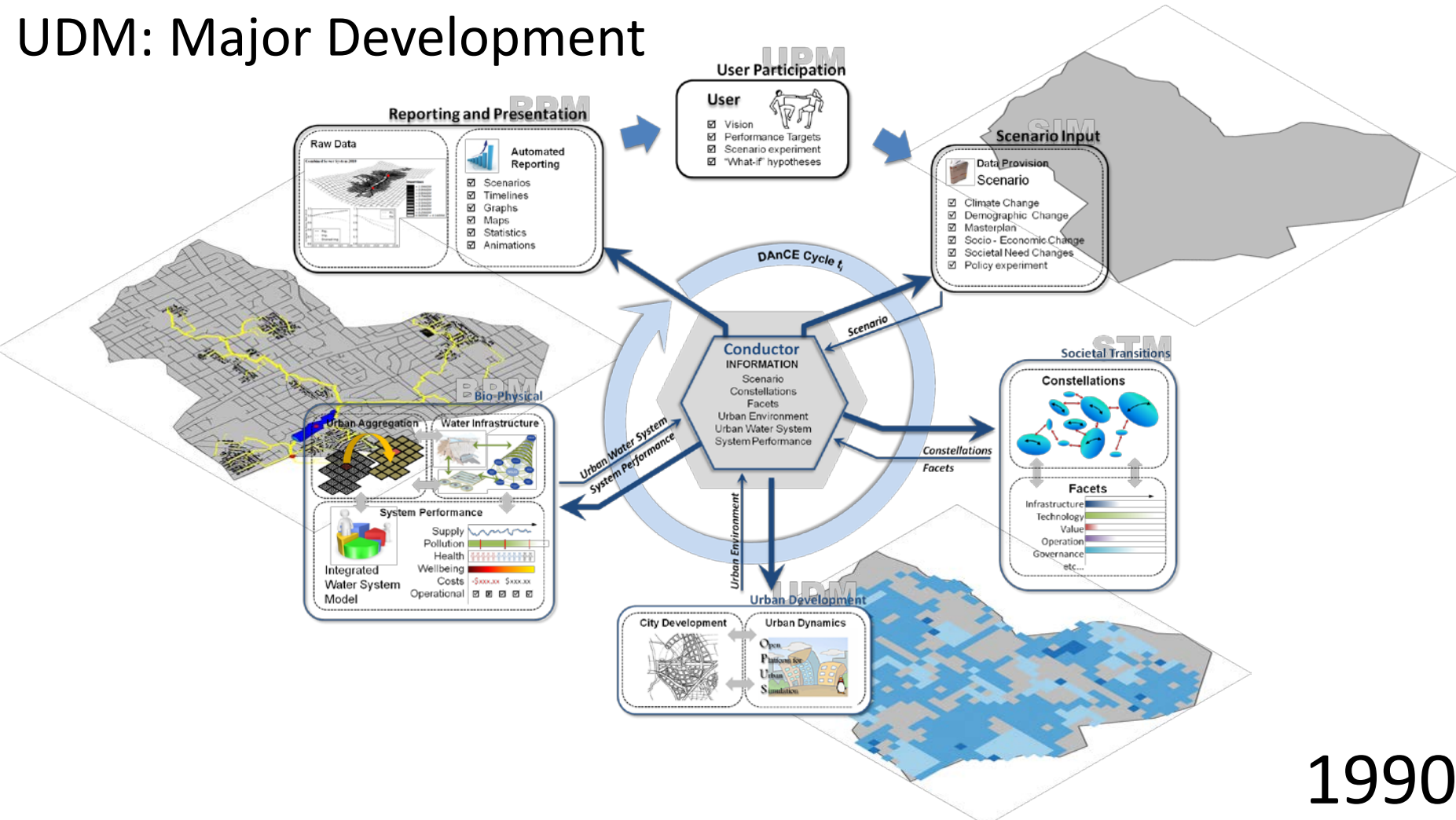
UDM: Main Trunk



UDM: Main Trunk

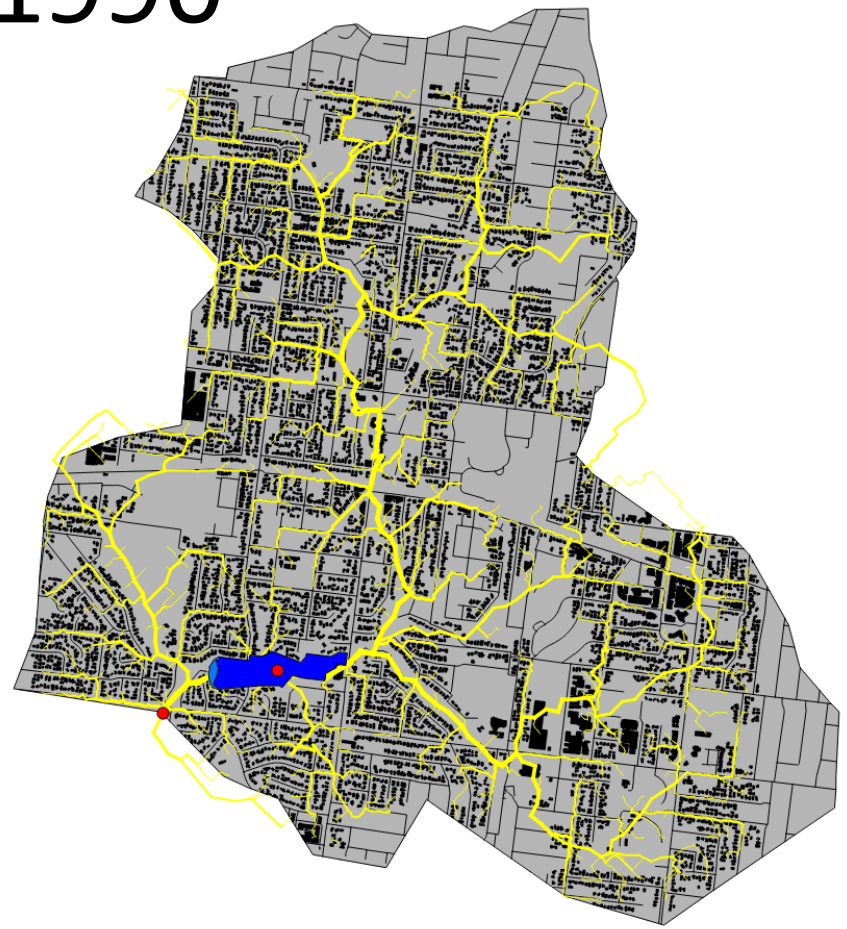


UDM: Major Development



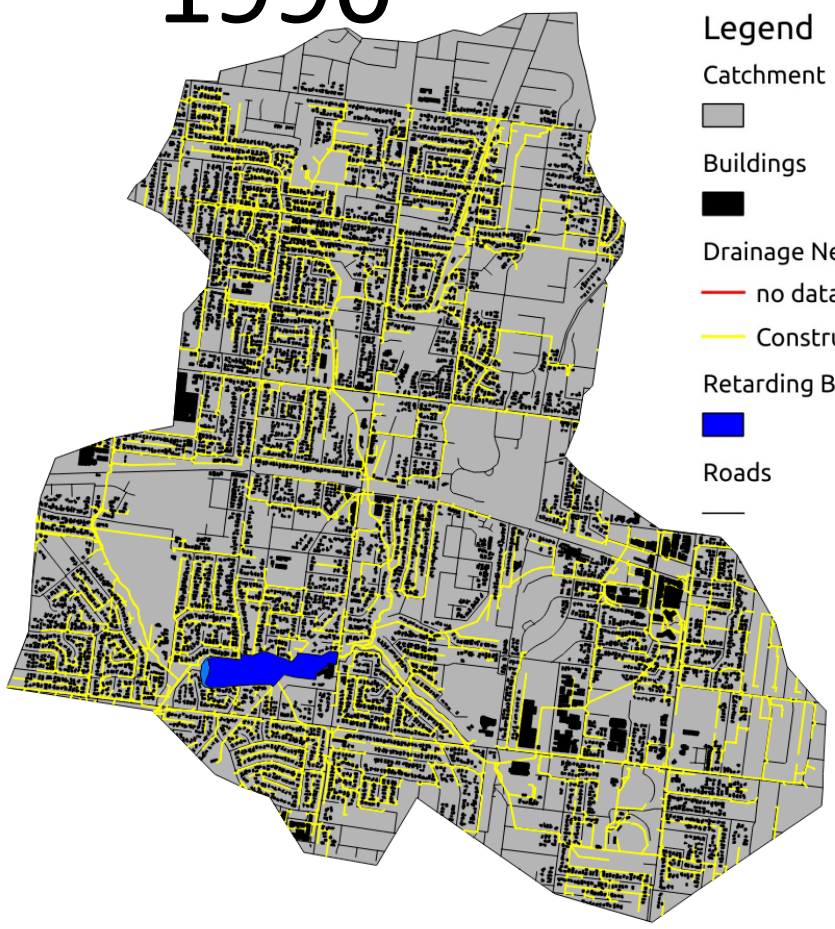


1990



generated

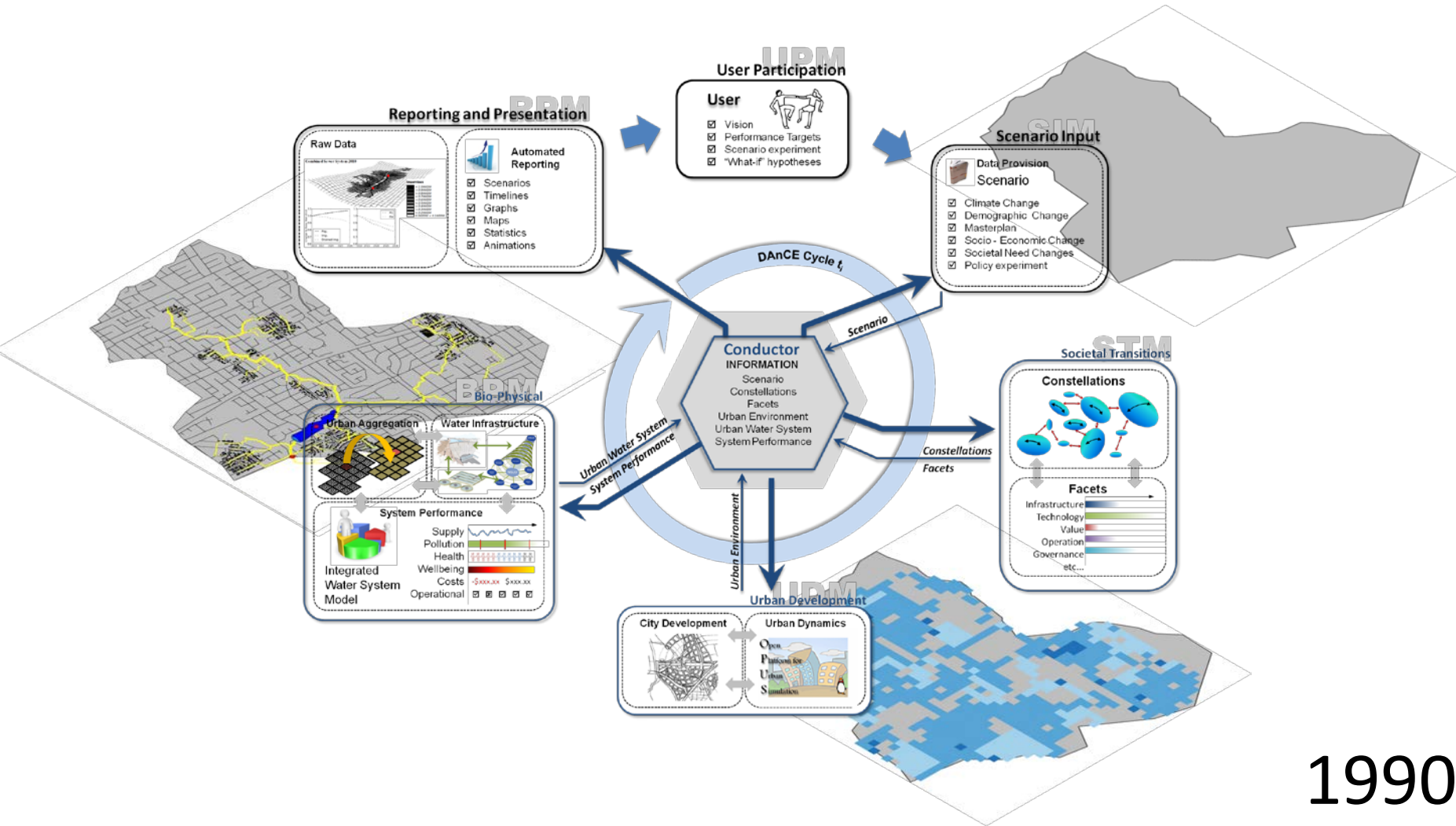
1990



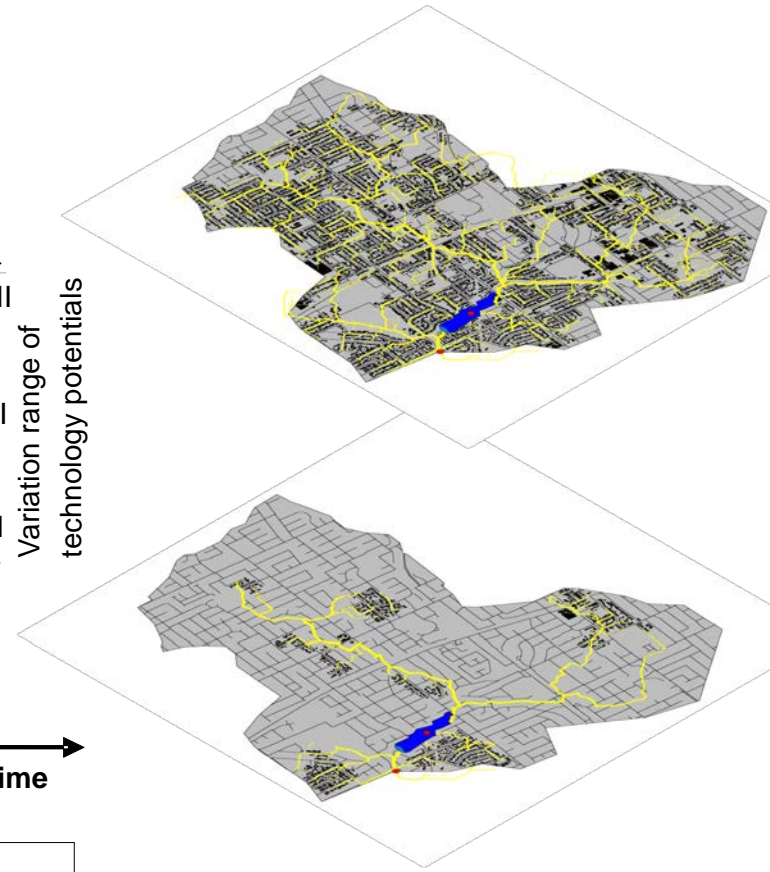
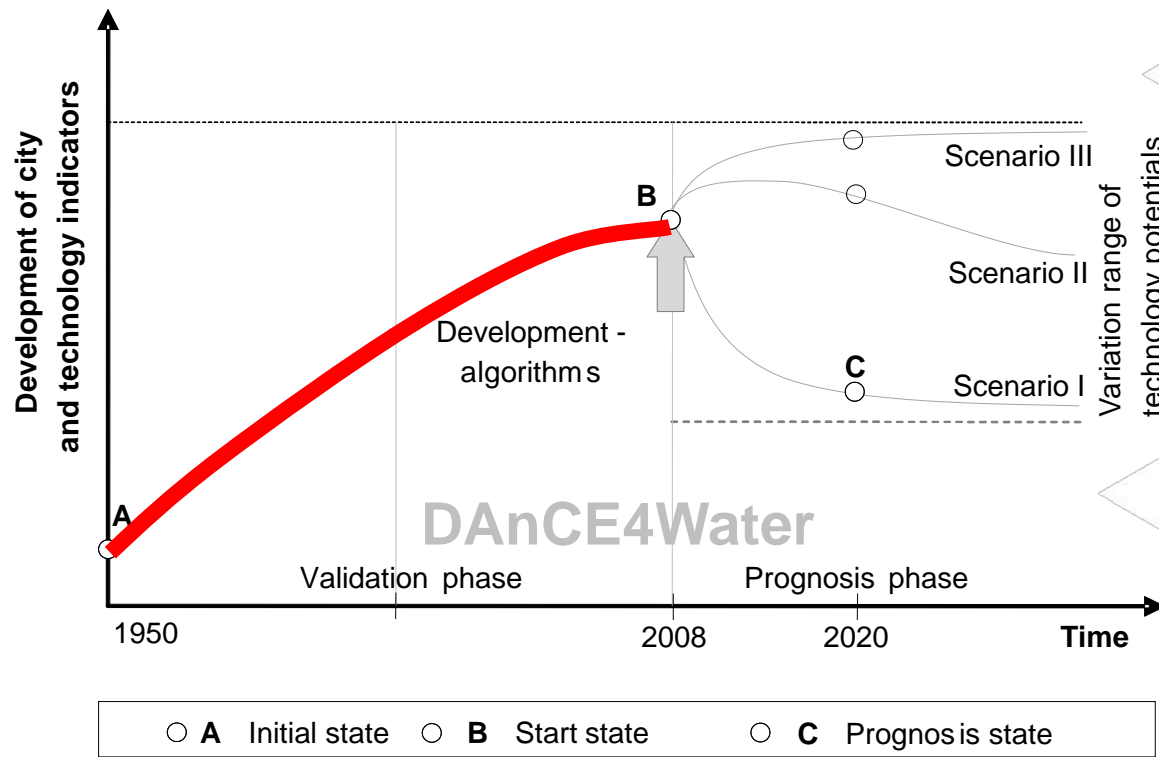
case study

- Legend**
- Catchment
 - Buildings
 - Drainage Network
 - no data
 - Construction Date
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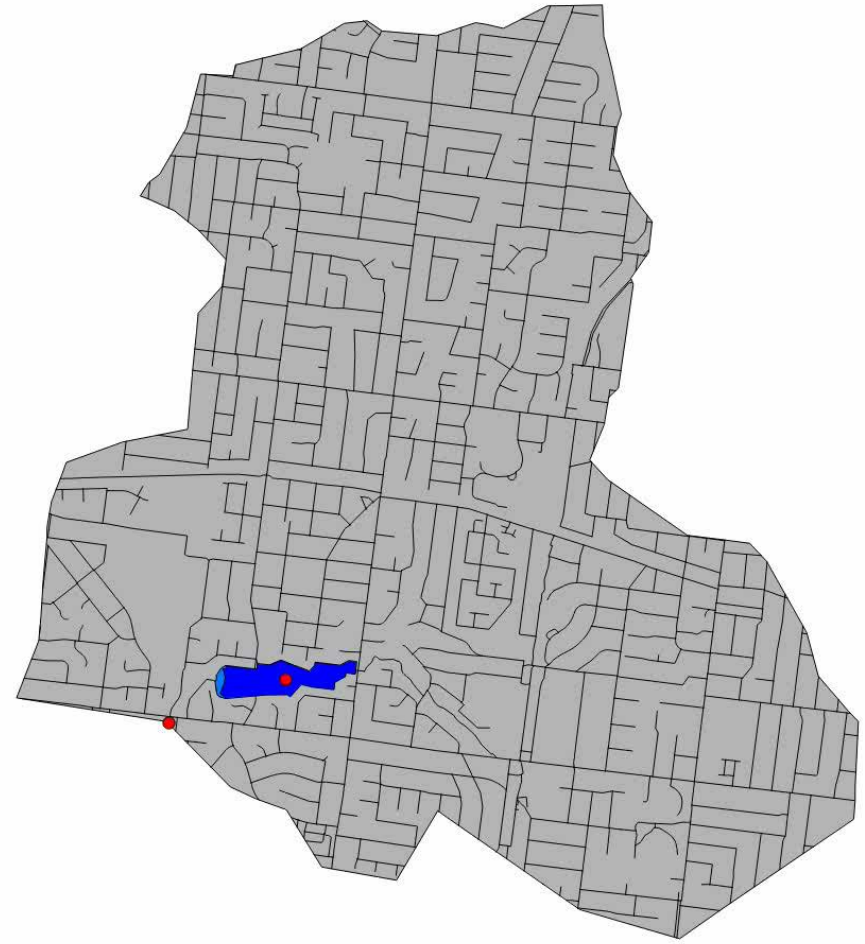


Conclusion

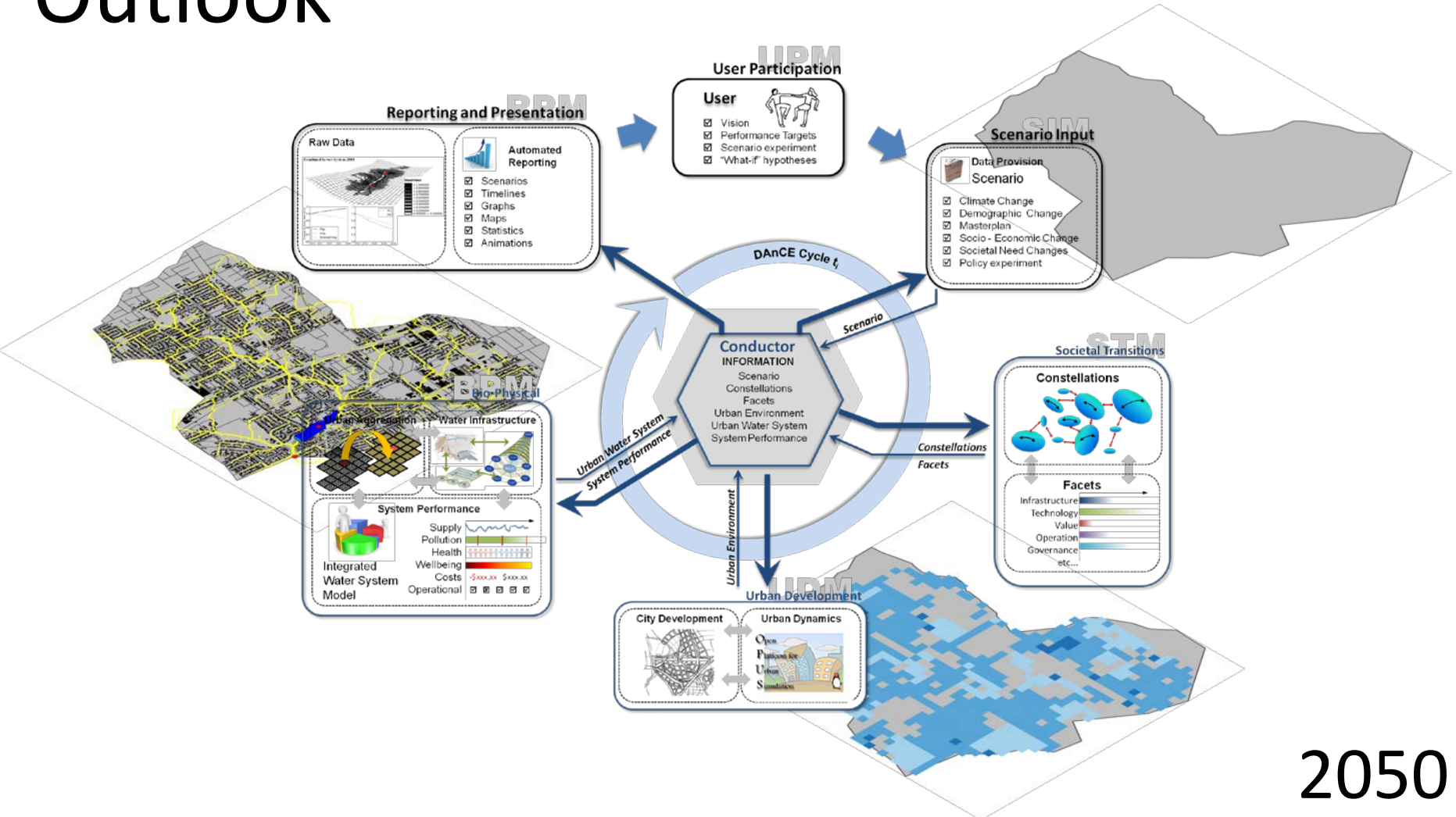




Conclusion



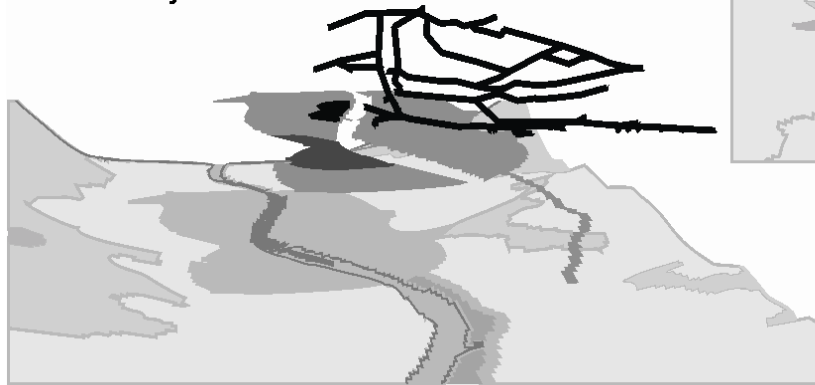
Outlook



Outlook

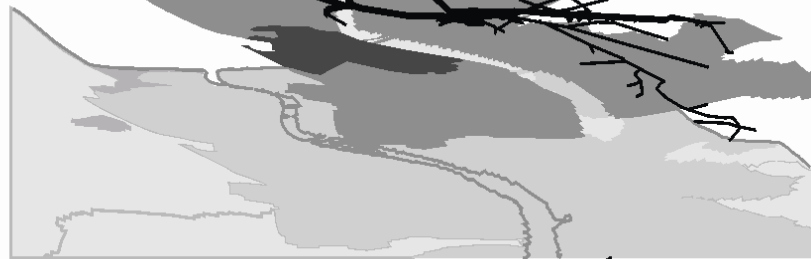
2010

city and infrastructure, generated virtual city or real world data



2020

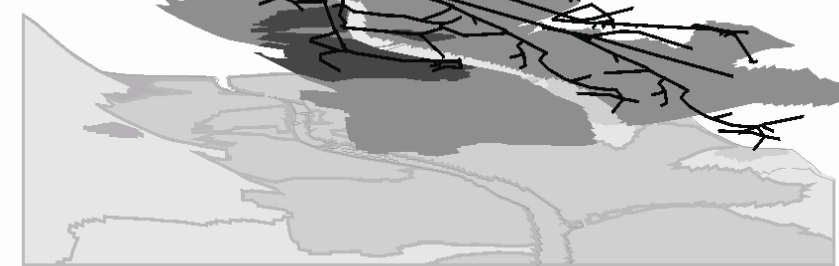
scenario A








2030...

2020

scenario B



2030...

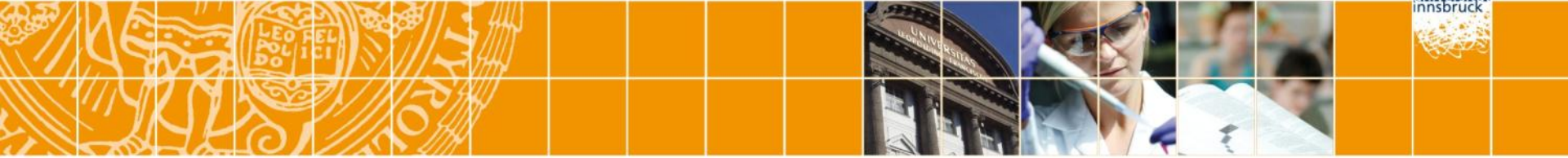
-  initial sewer system
-  sewer system (for e.g. new development)
-  digital elevation map and land-use
-  discontinuous urban fabric
-  continuous urban fabric

⋮
stochastic scenario generation



Software Tool for Integrated Modelling of Urban
Environments and their Infrastructure

<http://www.dynamind-toolbox.org>



Thank you for your attention!

Contact:

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University of Innsbruck

Unit of Environmental Engineering

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Technikerstrasse 13

6020 Innsbruck

Austria

christian.urich@gmail.com

<http://umwelttechnik.uibk.ac.at>