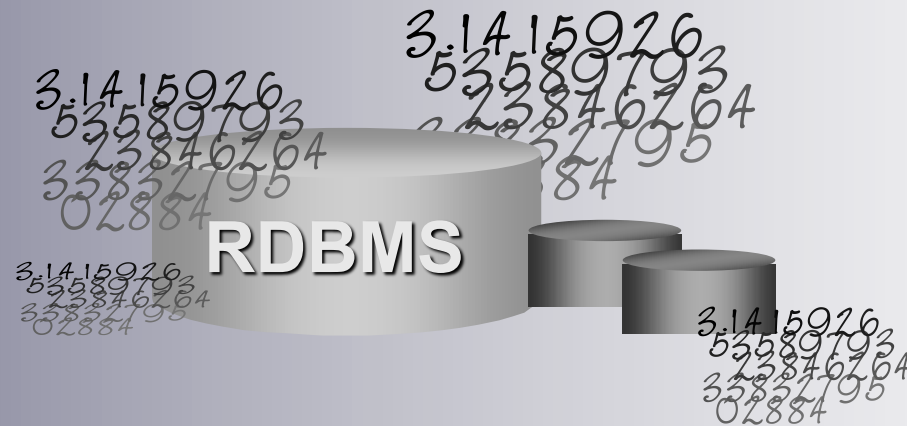



Data, Data, Data

Essential Segment of Hydroinformatics





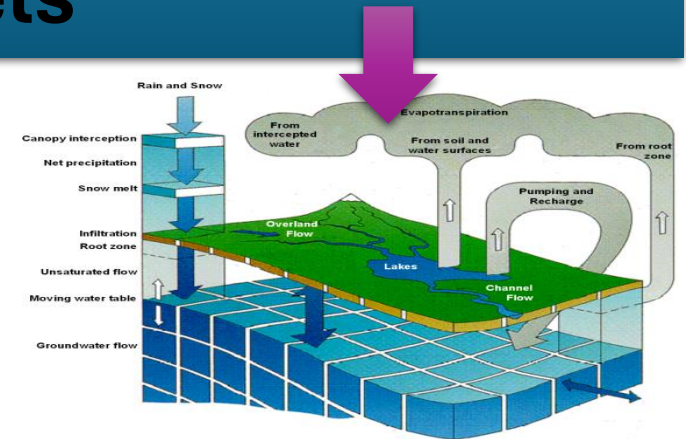
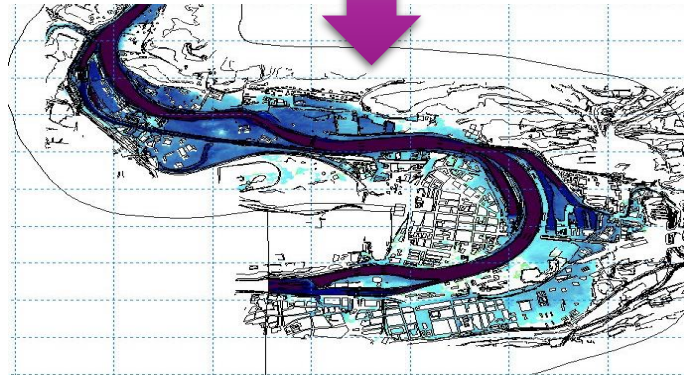
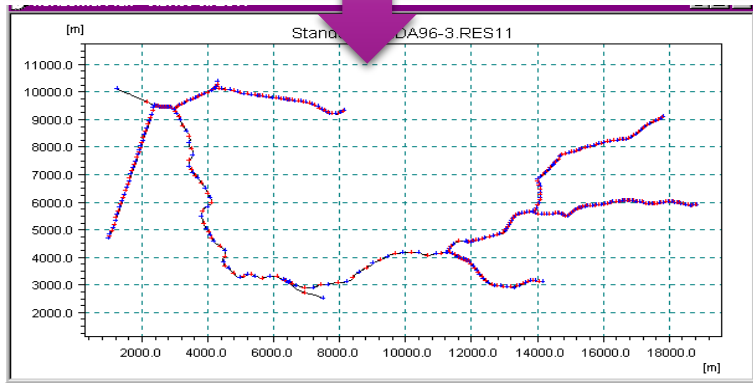
"Since post-industrial organisations will be faced with increasing environmental complexity and turbulence, organisation's need to process information and make decisions will be substantially increased" (Huber, 1984).

"IT is the primary element that organisations use to anticipate, react and respond to environmental change and to align their structures with the changed environment," (Haefner, 1992)

Data for simulation model

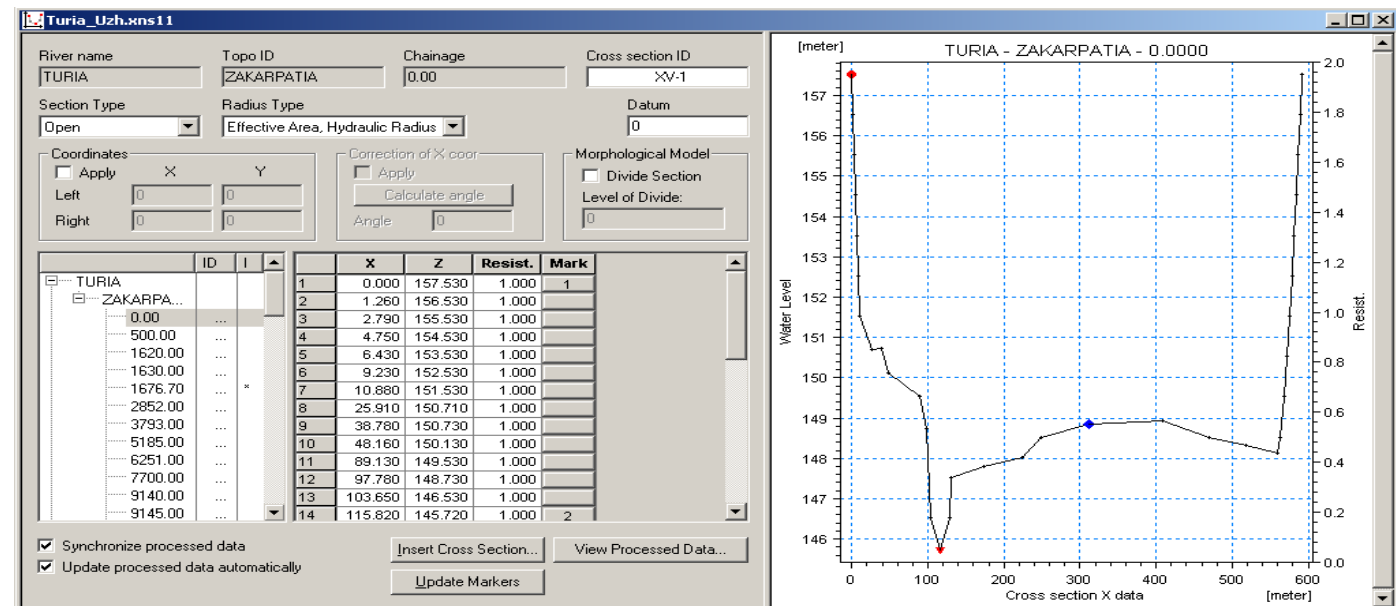
1. Structural data
2. Processes data
3. Supplementary data
4. Model parameter data

1D, 2D, 3D simulation models



Structural data (sewer system)

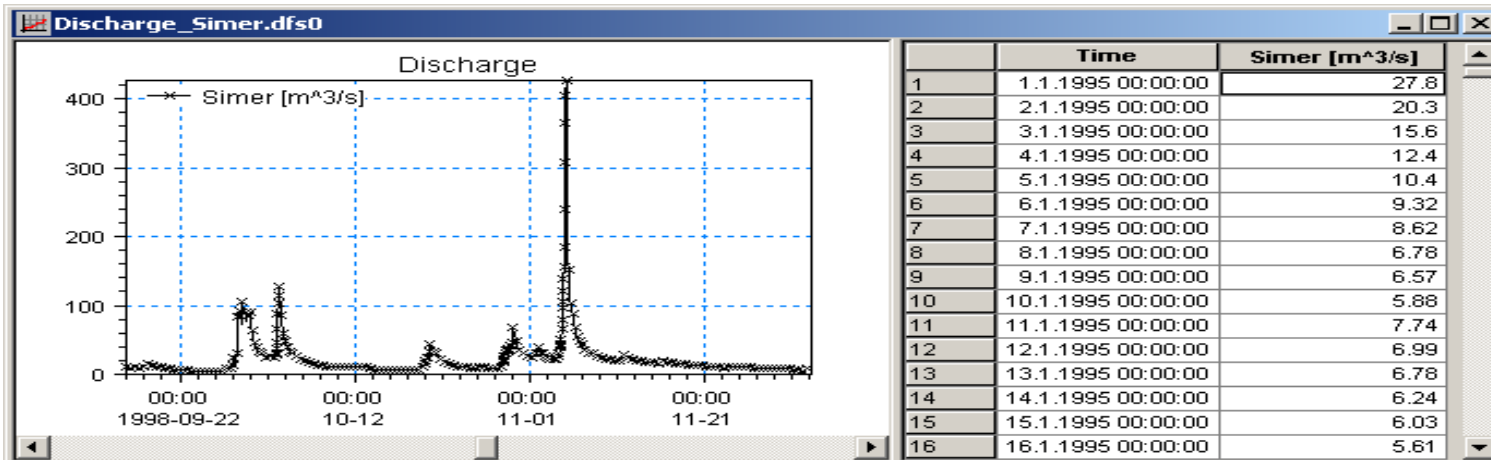
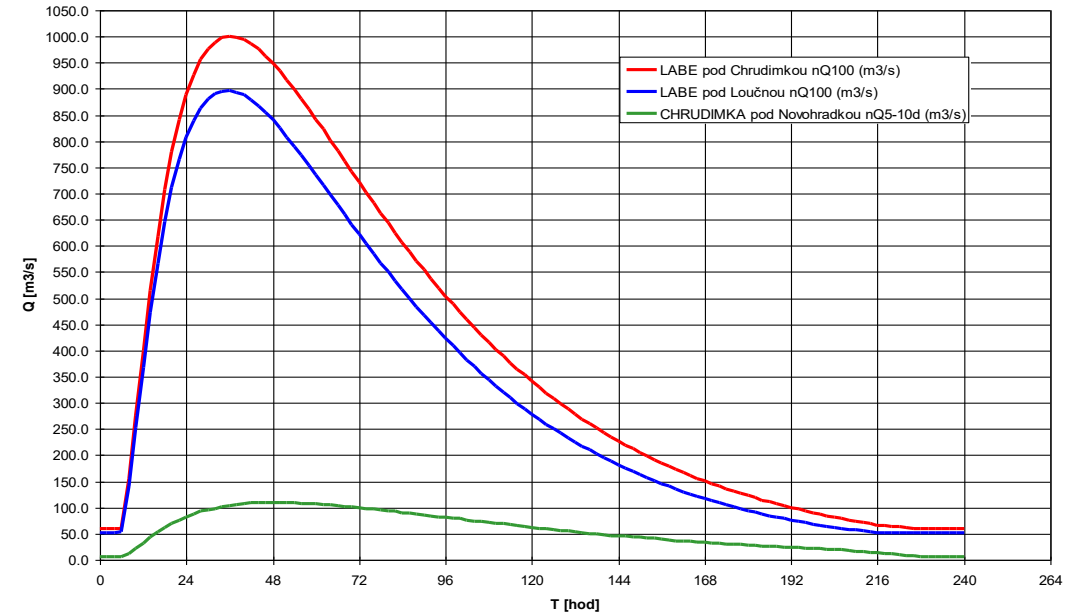
1. manhole (X,Y,Z1,Z2, DN)
2. pipe (X,Y, DN, slope, Z1, Z2, material)
3. pump (X,Y,Z, Q/H curve, operation rules)
4. CSO (X,Y,Z, dimensions, Crest L+h)
5. Basins (X,Y,Z, dimensions)
6. Outlets (X,Y,Z, Water h)
7. topological connections
8. ...



Process data (historical or measured)

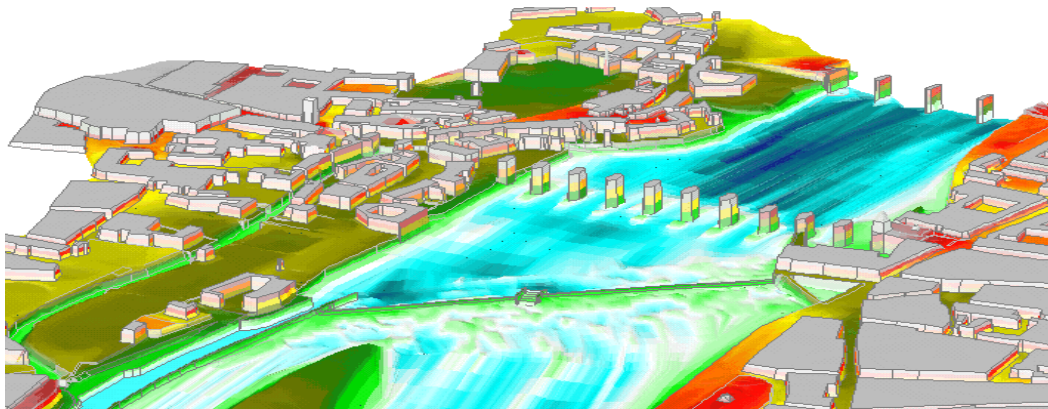
1. Q,H,P, i, time series
2. Structure opening/close graphs
3. Q/H curves
4. Diurnal variation time series
5. WQ data
6. Other ...

nQ100 - Varianta I.



Supplementary Data

- Cadaster data
- aerial photos, orto-photos
- Paper and digital maps
- technical maps of cities
- Digital terrain model
- Demographical data
- Other ...



Model parameters

- Time of Concentration
- Roughness coefficient
- Initial loss
- Impermeability data
- Calculation time step
- Model selerity ...
- Head and friction loss

The screenshot displays three windows from a software application:

Time-Area (A) [Base]

Catchment ID: Catchment_23807_ ...

Catchment area: 0.135

Imperviousness: 100.00

Hydrological parameters

Parameter set: ZALESNENA_PLOI ... Edit

Use local parameters

Time of concentration: 3

Reduction factor: 1.00

Initial loss: 0.0400

Time-area curve: TACurve 1 ... Edit

Time-area coeff.: 1.00

Catchment	Impervious	Parameter	Use local pa	Time of con	Reduction f	Initial loss	CoeffNo	Time-area c	Time-area c
Catchment_2	100.00	ZALESNENA	False	7	0.90	0.00060	TA-Curve	0.33	<Null>
Catchment_2	100.00	ZALESNENA	False	7	0.90	0.00060	TA-Curve	0.33	<Null>
Catchment_2	100.00	ASFALT_BET	False	7	0.90	0.00060	TA-Curve	0.33	<Null>
Catchment_2	100.00	ASFALT_BET	False	7	0.90	0.00060	TA-Curve	0.33	<Null>
Catchment_2	100.00	ZATRAVNEN	False	7	0.90	0.00060	TA-Curve	0.33	<Null>
Catchment_2	100.00	ZATRAVNEN	False	7	0.90	0.00060	TA-Curve	0.33	<Null>
Catchment_2	100.00	ZATRAVNEN	False	7	0.90	0.00060	TA-Curve	0.33	<Null>
Catchment_2	100.00	ZATRAVNEN	False	7	0.90	0.00060	TA-Curve	0.33	<Null>
Catchment_2	100.00	ZATRAVNEN	False	7	0.90	0.00060	TA-Curve	0.33	<Null>
Catchment_2	100.00	ZATRAVNEN	False	7	0.90	0.00060	TA-Curve	0.33	<Null>
Catchment_2	100.00	ZATRAVNEN	False	7	0.90	0.00060	TA-Curve	0.33	<Null>

Outlet head loss

Head loss ID: Flow-Through Manf

Data set

Method: Classic

Loss coefficient: Km 0.25

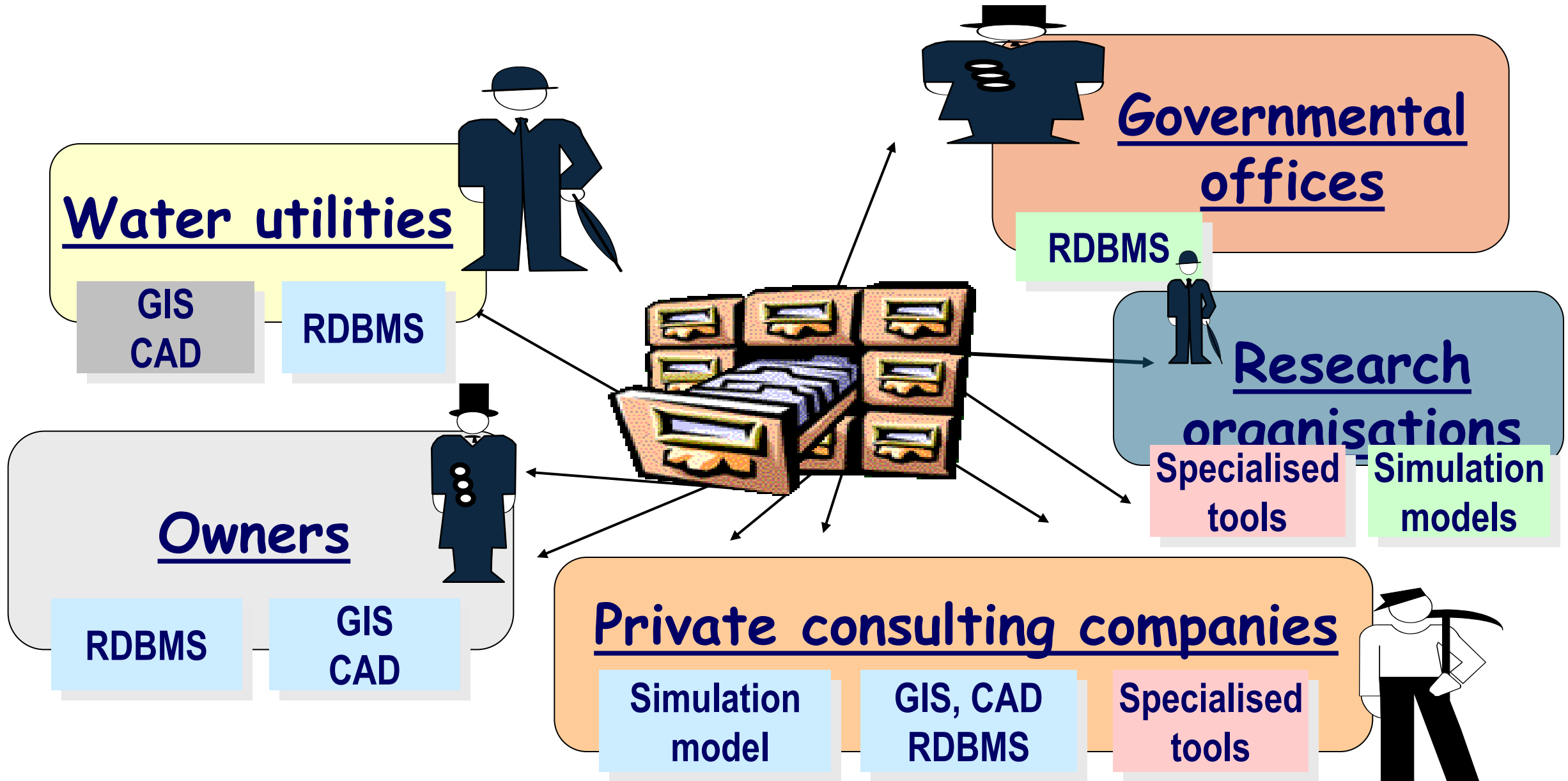
Effective node area: msm_LossPar.EffAreaNo

Head loss ID	Method	Coeff units	Loss coeffi	Effective no	Max. loss li
Flow-Through	Classic	Km	0.25	Calculated Ef	Water depth
MOUSE Class	Classic	Km	0.25	Full Node Are	Water depth
MOUSE Class	Classic	Km	0.25	Full Node Are	Velocity hea
MOUSE_Effe	Classic	Km	0.25	Calculated Ef	Water depth
MOUSE_Effe	Classic	Km	0.25	Reduced Cal	Water depth
MOUSE_Ener	Classic	Km	0.50	Full Node Are	Velocity hea
MOUSE_Mea	Mean Energy	Km	0.25	0	Water depth
MOUSE_No_	No Head Los	Km	<Null>	0	Water depth
MOUSE_No_	No Head Los	Km	<Null>	0	Water depth
MOUSE_Orifi	Classic	Km	0.50	Full Node Are	Water depth
MOUSE_Roun	Classic	Km	0.05	Full Node Are	Water depth
MOUSE_Shar	Classic	Km	0.50	Full Node Are	Water depth
No Cross Sec	No Head Los	Km	0.00	0	Water depth
Weighted Inlet	Mean Energy	Km	0.25	Full Node Are	Water depth

H W coef: 120

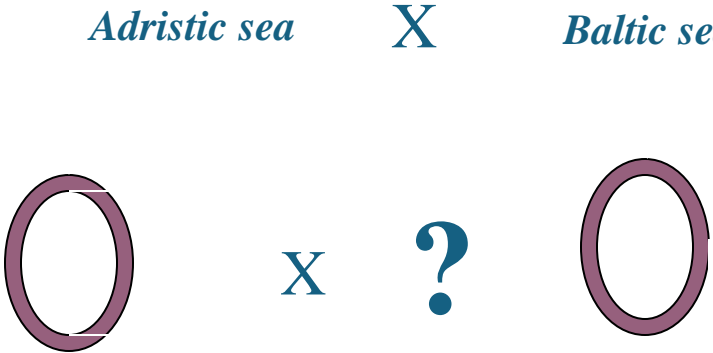
Material ID *	Manning's n	Eq. roughne	H-W Coef
Cement Mortar	77.0	0.001000	120
Ceramics	70.0	0.002500	110
Ceramics MOUSE	69.9	<Null>	<Null>
Concrete (Normal)	75.0	0.001500	120
Concrete (Normal)	69.9	<Null>	<Null>
Concrete (Rough)	67.0	0.015000	85
Concrete (Rough) M	69.9	<Null>	<Null>
Concrete (Smooth)	77.0	0.013000	95
Concrete (Smooth)	69.9	<Null>	<Null>
Iron (cast)	77.0	0.013000	110
Iron (wrought)	65.0	0.003500	100
Iron MOUSE	70.0	<Null>	<Null>
KorytoTynskyPotok	14.3	0.070000	<Null>
KorytoTynskyPotok	50.0	0.020000	<Null>
NEZNAMO	83.0	0.012000	100
Other MOUSE	35.0	0.100000	60
Plastic	125.0	0.008000	150
Plastic MOUSE	83.3	<Null>	<Null>
Stone	77.0	0.013000	100
Stone MOUSE	80.0	<Null>	<Null>

Model data sources

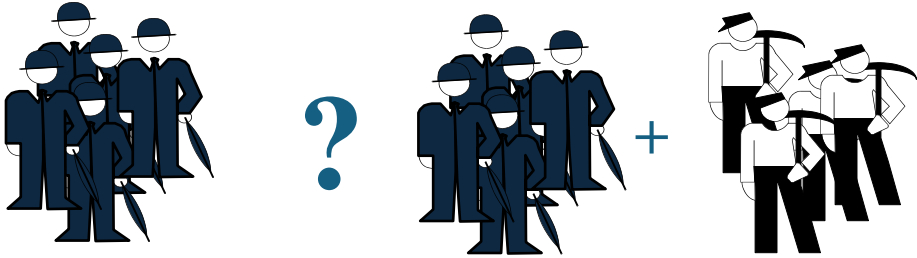


Data interpretation

■ Sewerage network data



■ Number of inhabitants

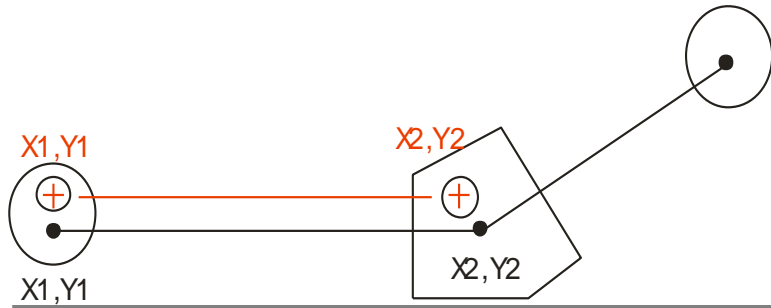


■ Nepropustné plochy

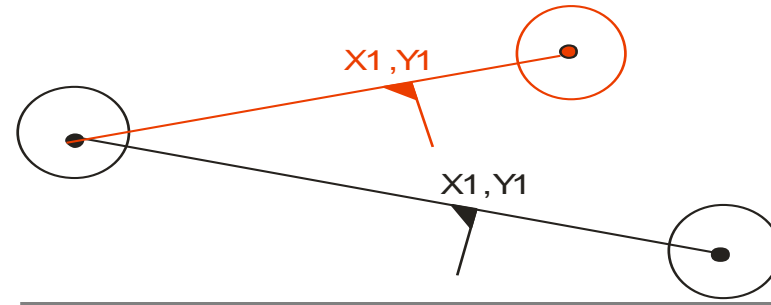
Návrh x **Realita**

Data interpretation problems

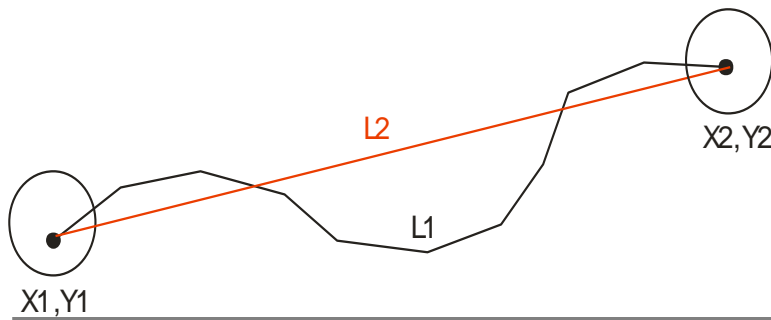
Geodesy



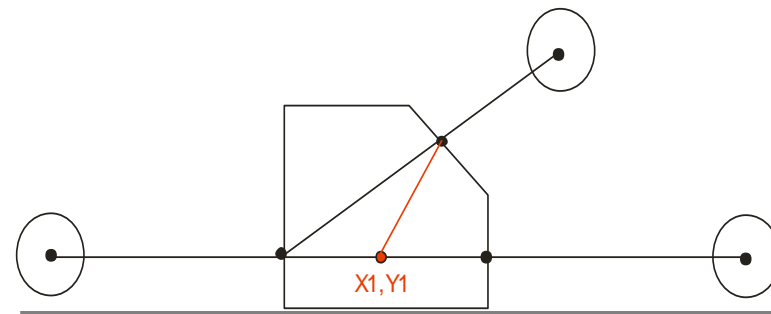
Relative distances



Topology

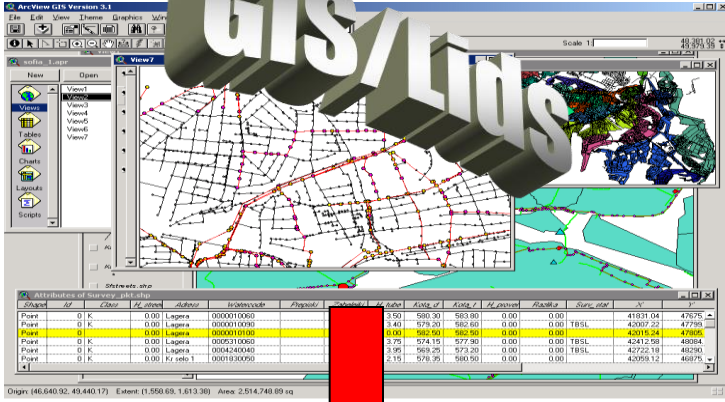


Structures

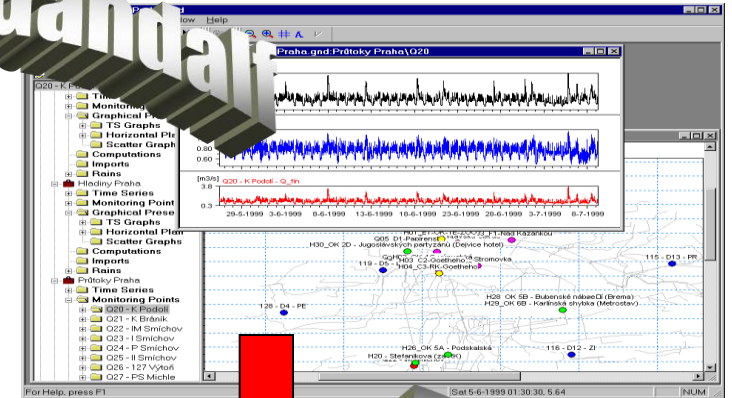


Data integration Challenges (Prague case)

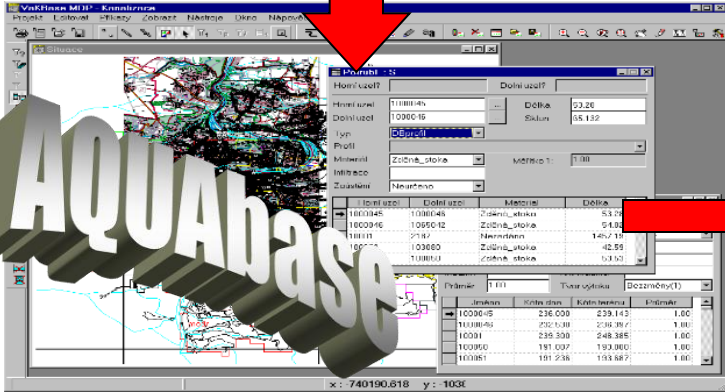
GIS/Map



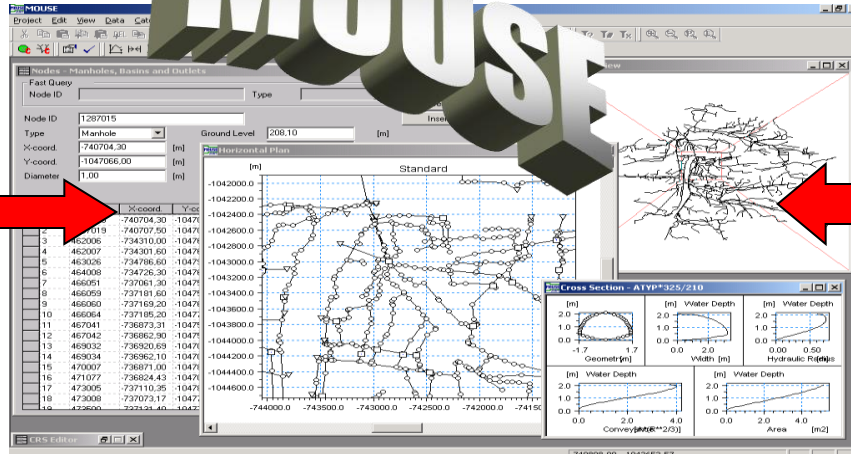
Gandalf



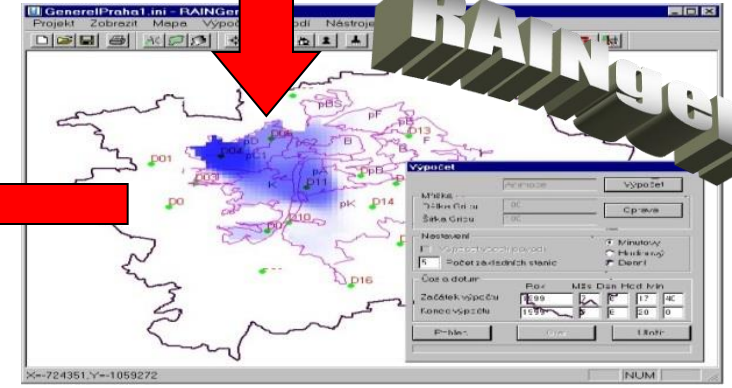
AQUAbasa



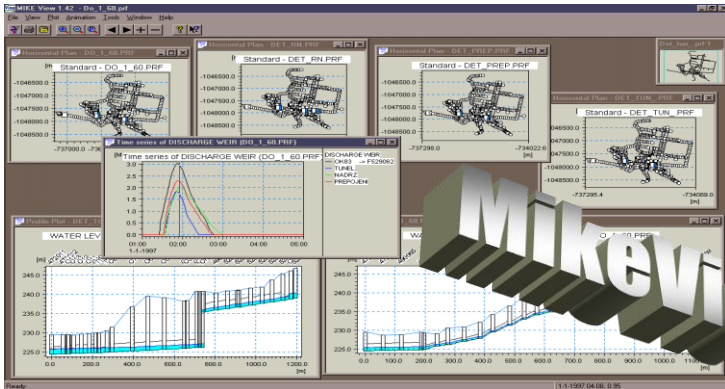
MOUSE



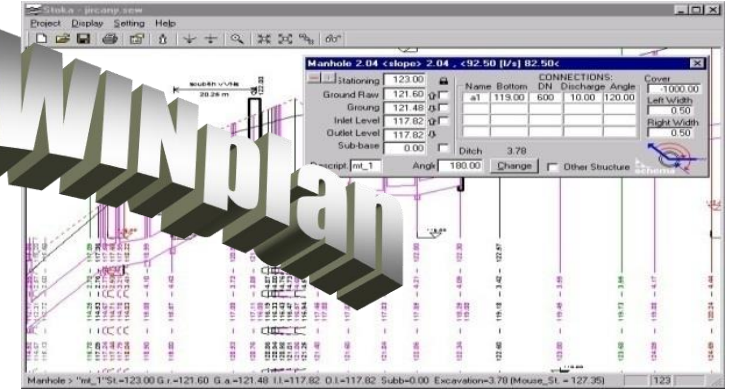
RAINOG



MIKEVIEW

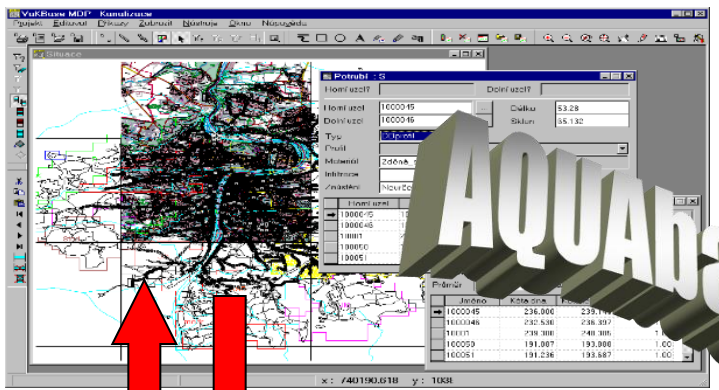
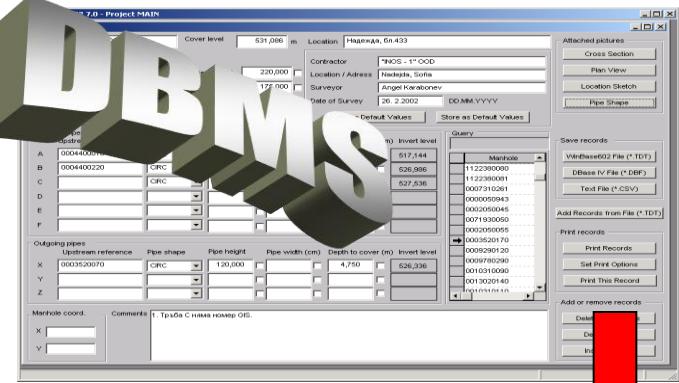


WINplan

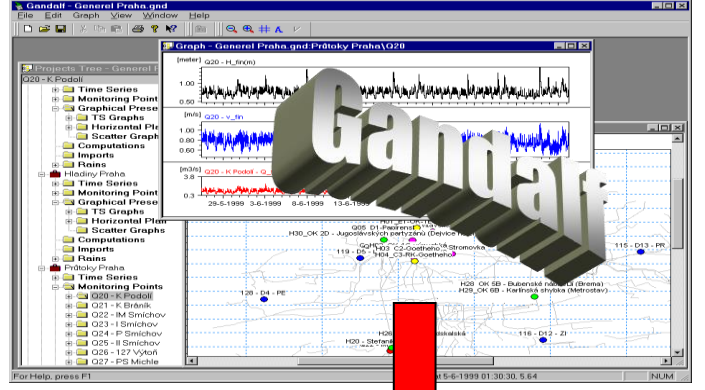


Data integration challenges (Sofia case)

DBMS

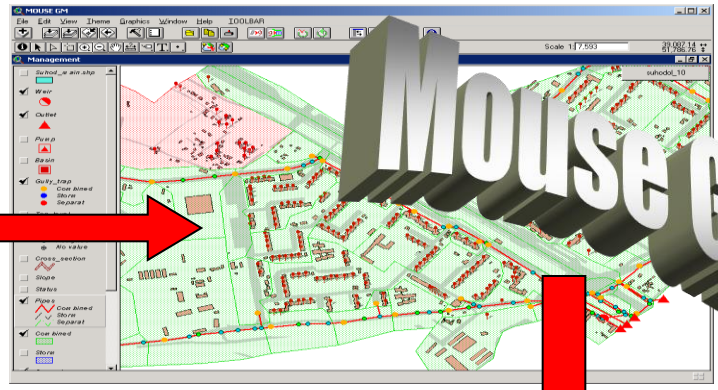
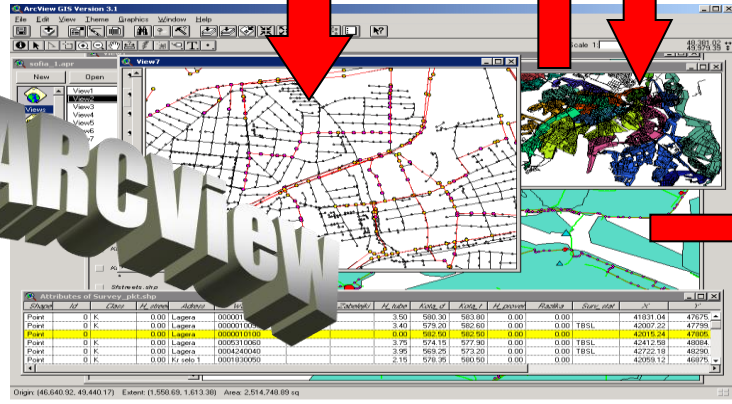


AQUADATABASE



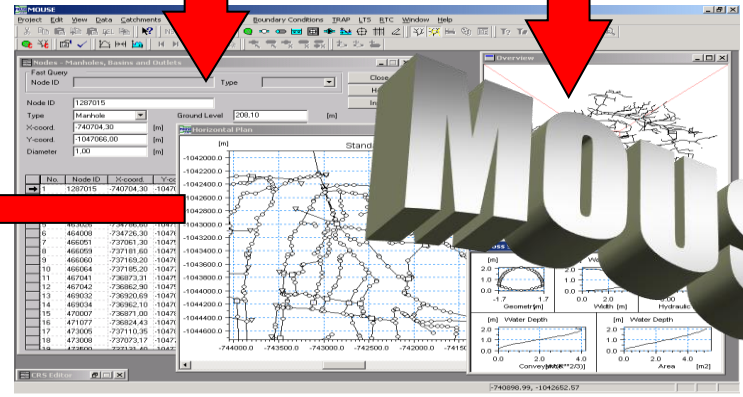
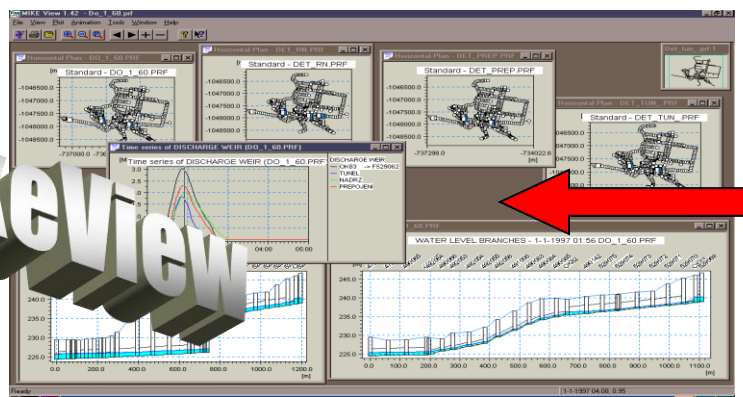
Gandalf

ARCVIEW



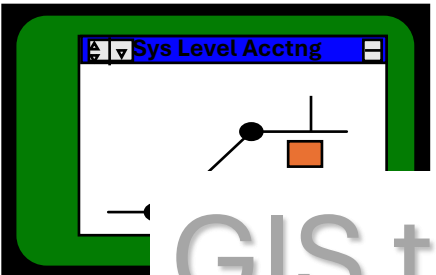
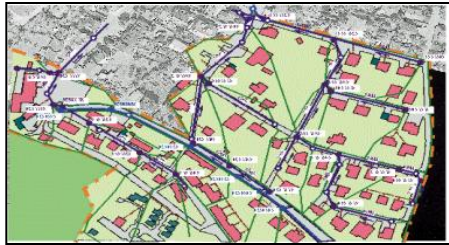
MOUSE GW

MIKEVIEW

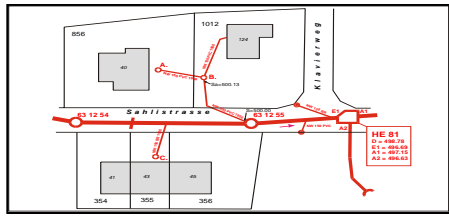
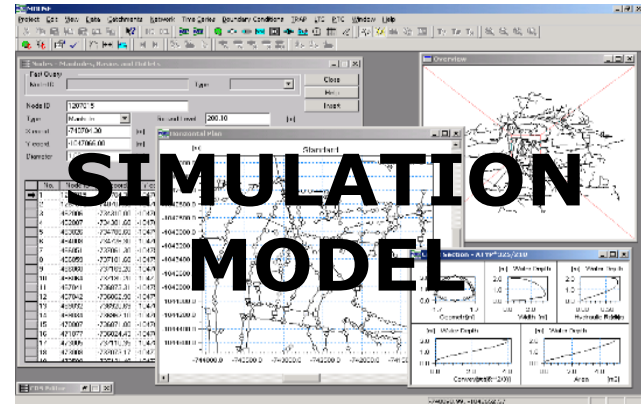
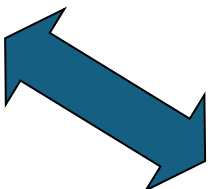


MOUSE

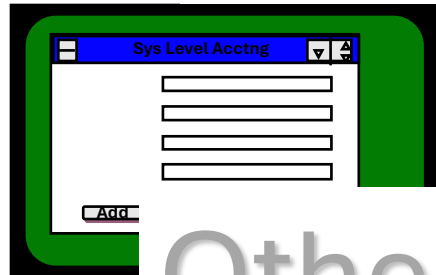
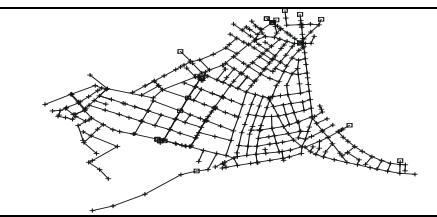
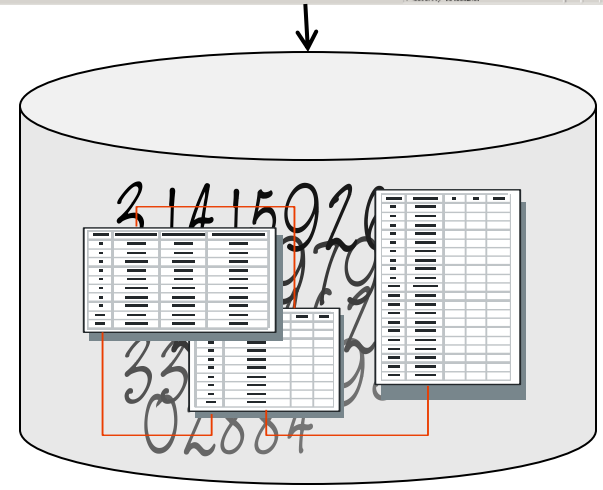
Data integration needs



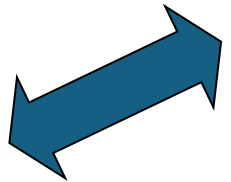
GIS tools



CAD tools



Other tools



Databases

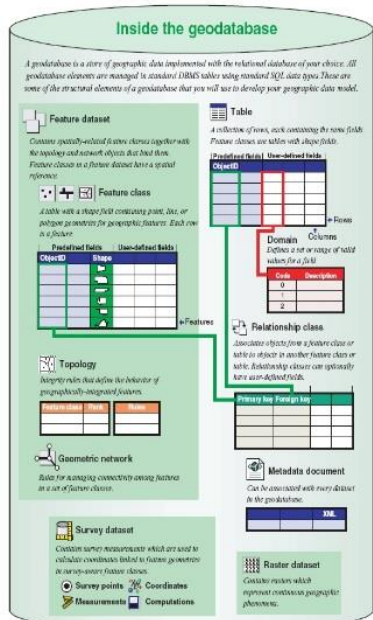
Use of Databases

- organization and backup and data management (table and view)
- prioritization of user access (banks, PIN)
- core or base for simulation and GIS tools
- fast data selection and sorting
- analysis of selected data (statistics)
- binding of individual objects and their attributes in accordance with their purposes (sewer GIS data example)

Graphical Databases - GIS systems

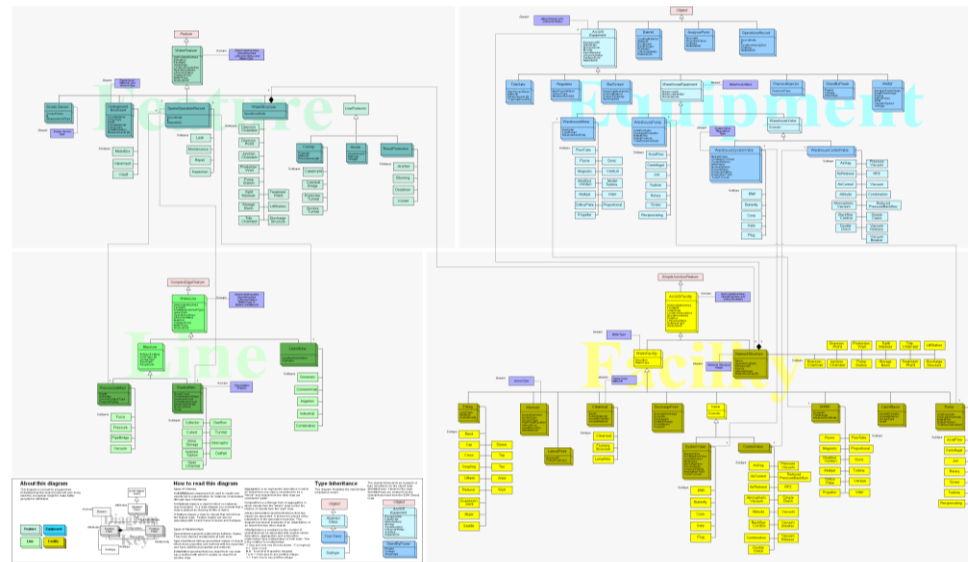
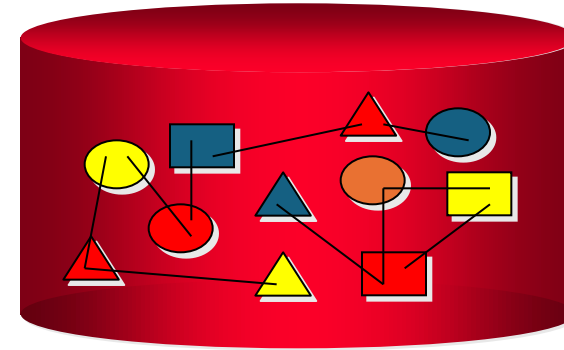
The screenshot displays the ArcMap interface for a water distribution network. The main map shows a network of pipes and water treatment plants (WT) across a region including Nikolaevo, Slatina, Goran, Bahovitsa, Presyaka, Kazachevo, Hlevene, Gorno Pavlikeno, Prel, Dabrava, Ablanitsa, Balgarene, and Stefanov. The map is overlaid with various GIS layers, including water distribution, demand allocation, and water junctions. A legend in the bottom-left corner provides details for the 'Frax' and 'WT' layers. A data table in the bottom-right corner shows a list of features with columns for ID, Type, Name, Date, and other attributes.

ID	Type	Name	Date	Other
17	Polyline	17	<Null>	<Null>
19	Polyline	19	<Null>	<Null>
20	Polyline	20	<Null>	<Null>
28	Polyline	28	<Null>	<Null>
31	Polyline	31	<Null>	<Null>
32	Polyline	32	<Null>	<Null>
39	Polyline	39	<Null>	<Null>
41	Polyline	41	<Null>	<Null>
42	Polyline	42	<Null>	<Null>
43	Polyline	43	<Null>	<Null>
44	Polyline	44	<Null>	<Null>
45	Polyline	45	<Null>	<Null>
47	Polyline	47	<Null>	<Null>
48	Polyline	48	<Null>	<Null>
49	Polyline	49	<Null>	<Null>
50	Polyline	50	<Null>	<Null>
51	Polyline	51	<Null>	<Null>
52	Polyline	52	<Null>	<Null>
53	Polyline	53	<Null>	<Null>
54	Polyline	54	<Null>	<Null>
55	Polyline	55	<Null>	<Null>
56	Polyline	56	<Null>	<Null>
57	Polyline	57	<Null>	<Null>
58	Polyline	58	2% per year	1/1/2011



Database and Data Models

Data model is a mental interpretation of real world structure into the structure of database entities and relations



Other data aspects

- Data : **Garbage in – Garbage out**
- Data **life time**
- Modeling - **60-70% work with data**
- Random and systematic **errors**
- Data **import/export** aspect
- **Data storage** and use
- Data **volumes**
- **Data processing** – raw data, processed and verified data
- Data **presentation** and **interpretation**
- Data – **monetary value**
- Data acquisitions - **surveys**

Data communication challenges

Data formats- vector and raster data, ASCII x BIN x RDB,...

Data structures – time series, summer/winter calendar, structures

Data in/exports- network topology, coordinate systems, units, data conversion

Data manipulation – data volumes, data management, redundancies, updates

Generic – data price, units, formats, semantic misunderstanding, HW, SW



Unproductive, timely and financially demanding activity, danger of random or systematic errors, problem of continuity and data updates

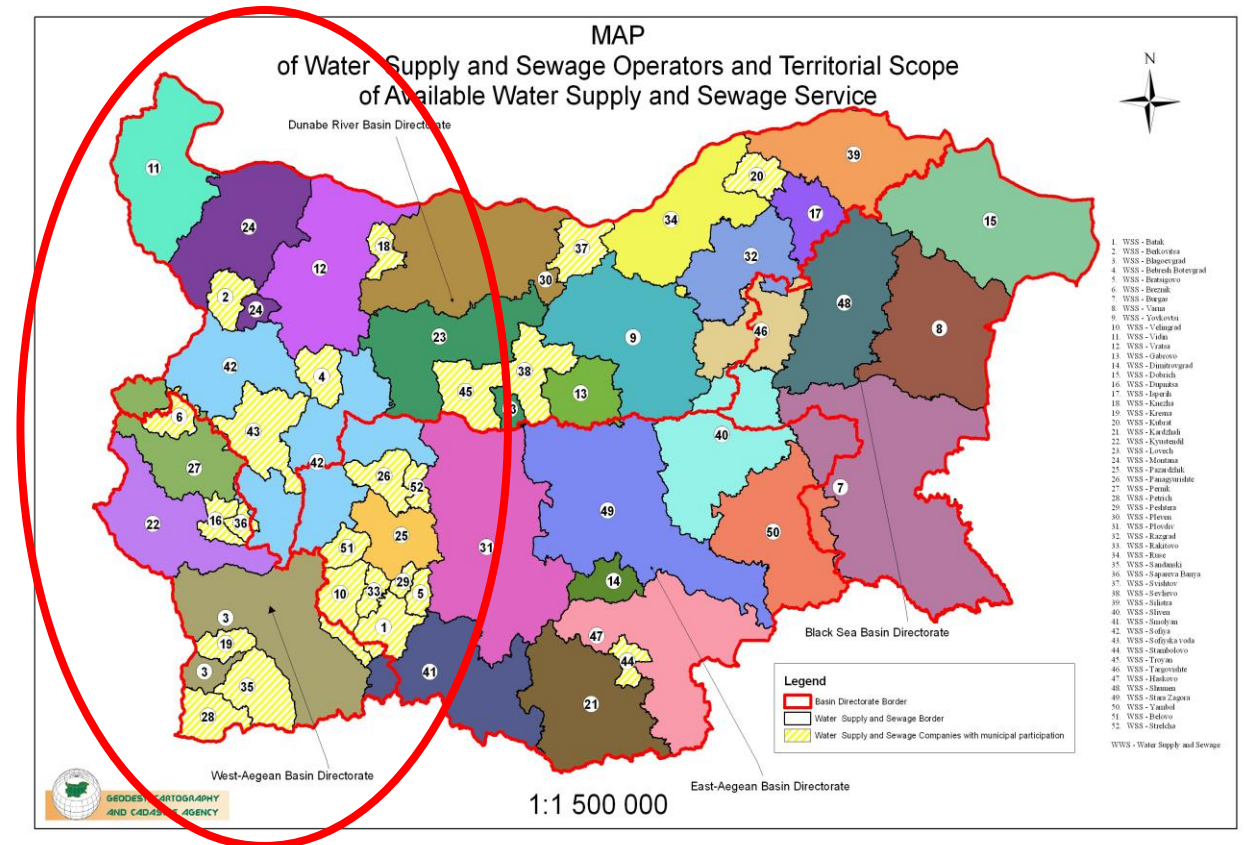
Data and Project Documentation



Case study – Western region project

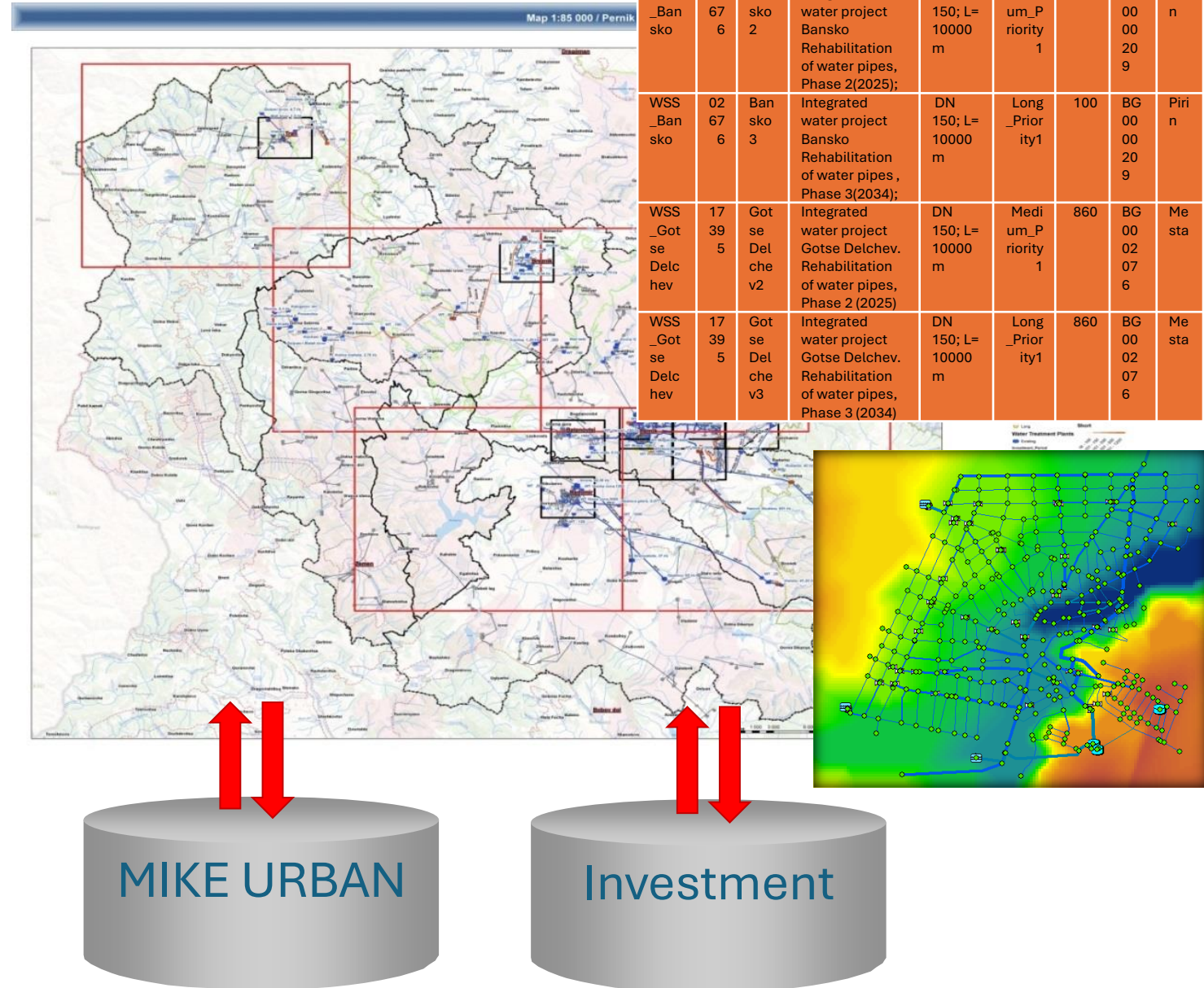
PREPARATION OF REGIONAL WATER AND WASTEWATER MASTER PLANS FOR WESTERN REGION - MIDP-MP-QCBS3 – 2012-2013

- Client: MRDPW
- Beneficiaries: Municipalities + WU
- Duration: **18 months**
- **DHI, NIRAS, RAMBOLL, SCG, AQP**
- **DHI: Full water supply RMP**
- 19 regions (out of 52)
- Settlements above 2000 PE: **118**
- Total population: **1 166 000 inhabs.**
- Total area size: **40 000 km²**



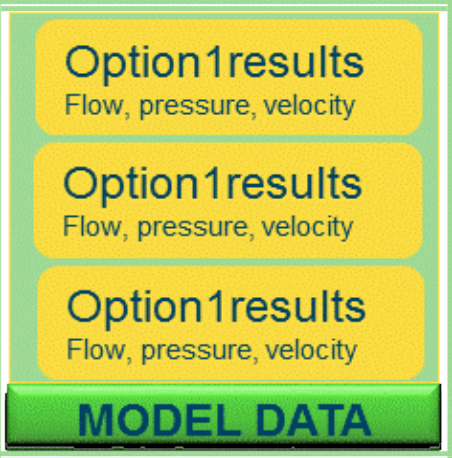
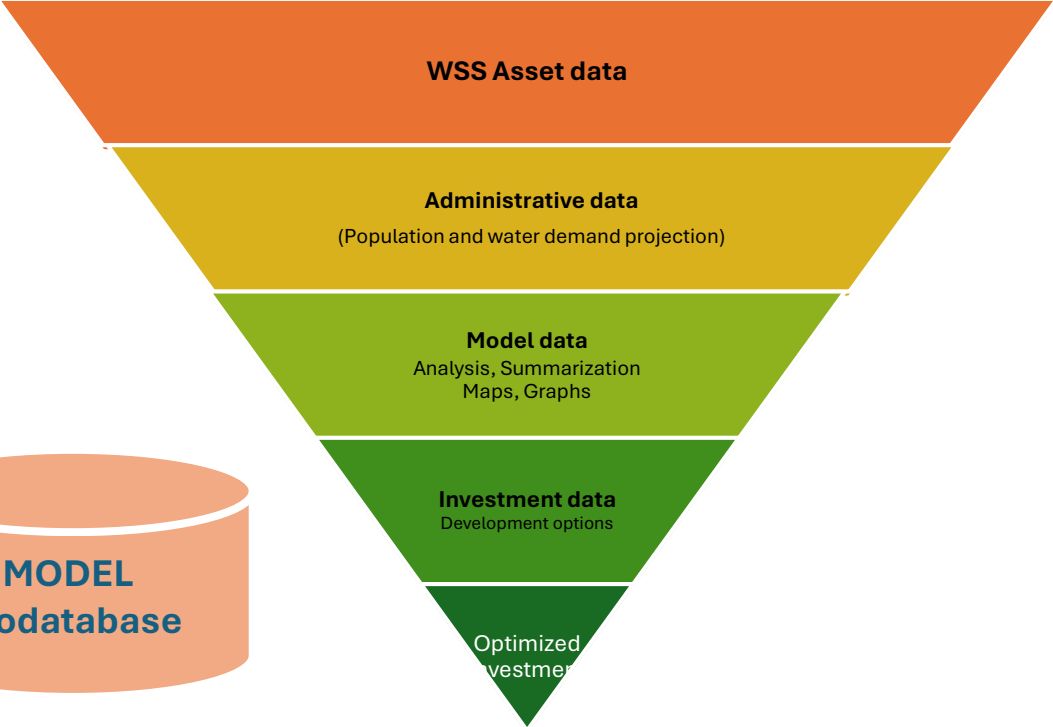
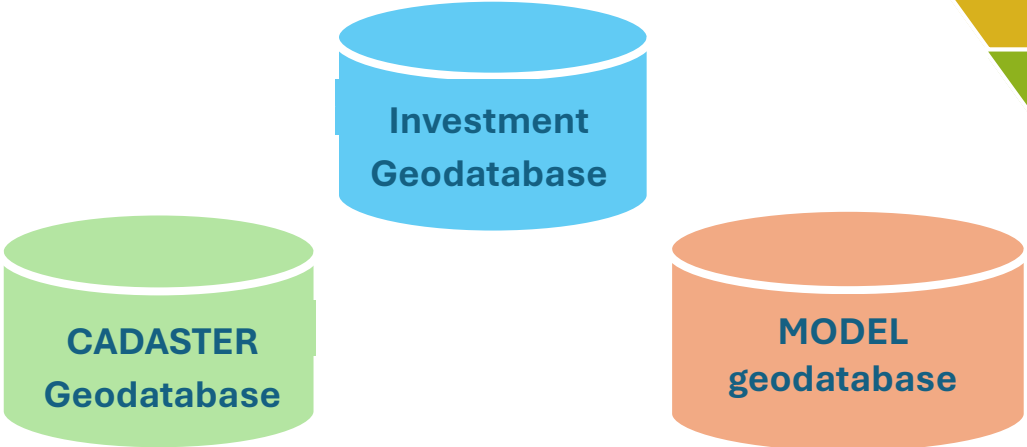
Use of spatial (GIS) data

1. Coordinate systems WGS84
2. GIS x CAD data files
3. GIS Layers
 - a) Cadaster
 - b) Settlements (EKATE)
 - c) JAICA (rivers, regions, etc.)
 - d) Street maps (or alternative)
 - e) Natura 2000
 - f) Model results !!!
 - g) ...
4. Connection to Investments
 - a) Automatic data updates



Basic project data structure and storage

1. Digital processing of all data from A to Z
2. GIS based data structure
3. Core Water data
 - a) Asset data
 - b) Model data
 - c) Administrative data
 - d) Investment data



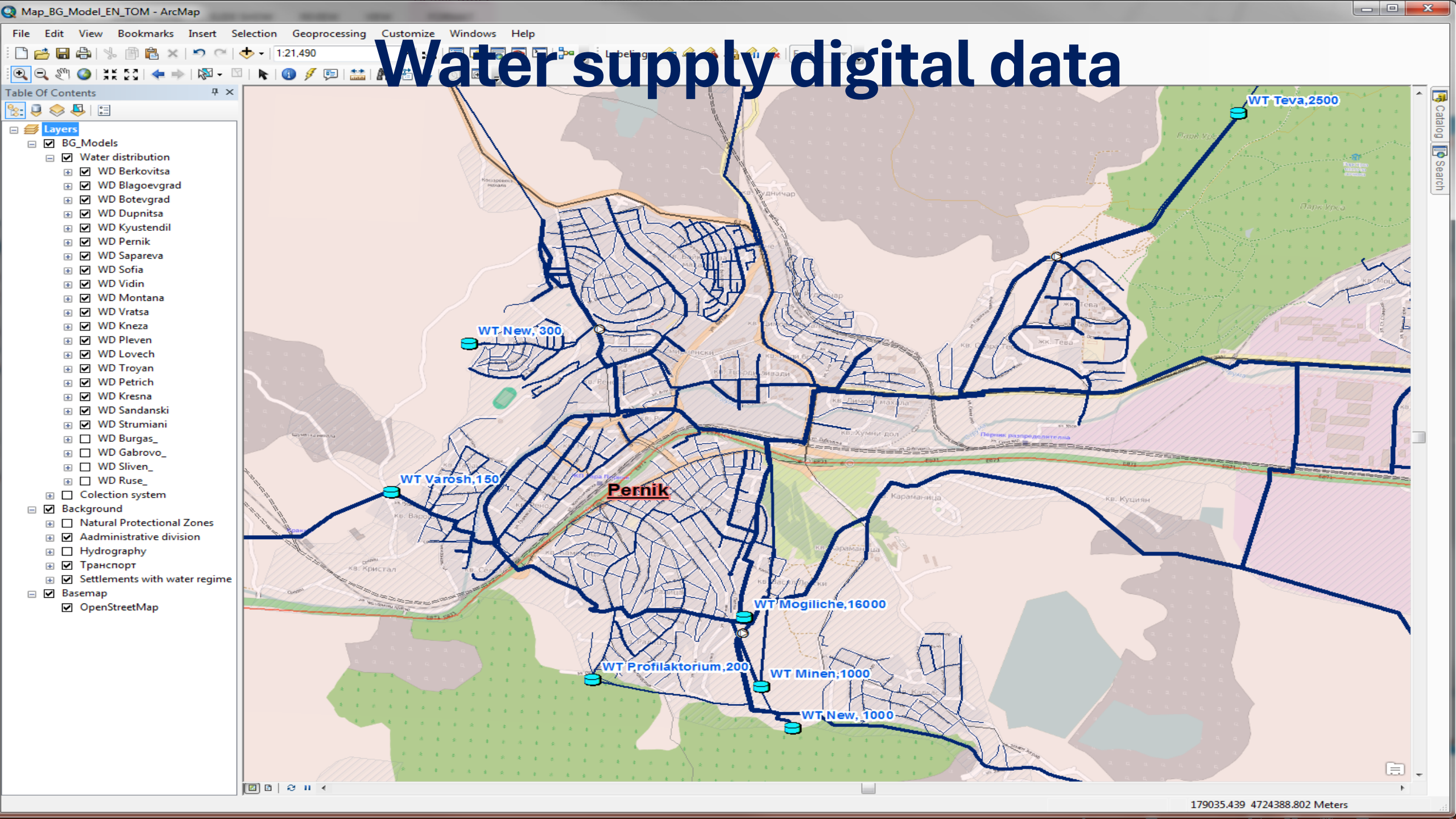
Data Collection activities

- ✓ 2 data digitization groups (6-8 persons)
- ✓ 5 data collection teams (15 persons)
- ✓ 2 monitoring teams (6-8 persons)
- ✓ Data collection period: 6 months



approx. 50-60 manmonths

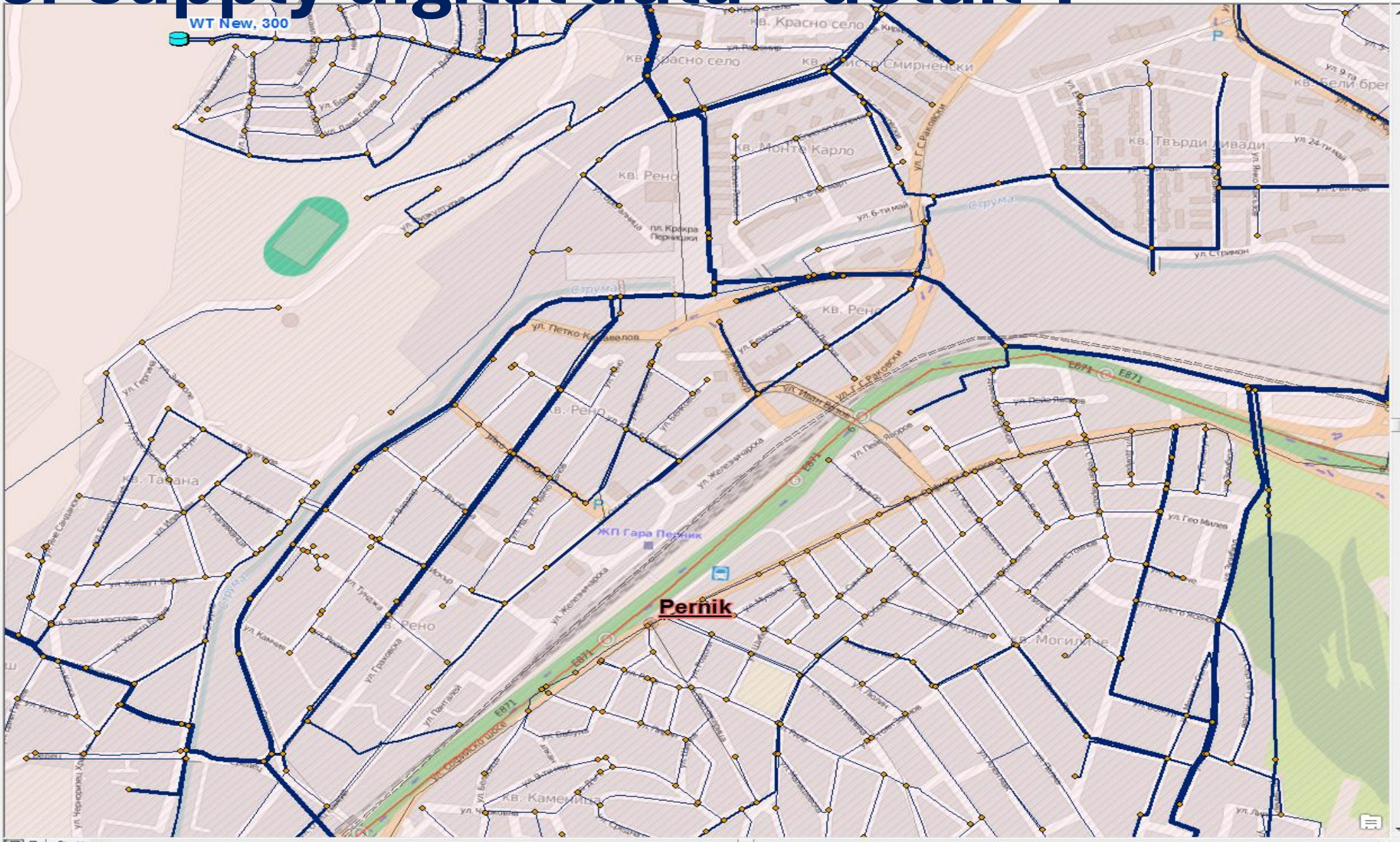
- 1. STRUCTURAL DATA**
 - a. pipes (X, Y, DN, Z, material)
 - b. pumps (X, Y, Z, Q/H curve,)
 - c. Reservoirs (X,Y,Z, dimensions)
 - d. Intakes (X,Y,Z, capacity)
 - e. Valves (X,Y,Z, operation rules)
 - f. topological connections
- 2. FUNCTIONAL DATA**
 - a. Q,P, time series
 - b. Q/H graphs
 - c. Water demand time series
- 3. OTHER DATA**
 - a. Cadaster,
 - b. DTM,
 - c. surveys, ...



Water supply digital data – detail 1

Table Of Contents

- Layers
 - BG_Models
 - Water distribution
 - WD Berkovitsa
 - WD Blagoevgrad
 - WD Botevgrad
 - WD Dupnitsa
 - WD Kyustendil
 - WD Pernik
 - WD Sapareva
 - WD Sofia
 - WD Vidin
 - WD Montana
 - WD Vratsa
 - WD Kneza
 - WD Pleven
 - WD Lovech
 - WD Troyan
 - WD Petrich
 - WD Kresna
 - WD Sandanski
 - WD Strumiani
 - WD Burgas_
 - WD Gabrovo_
 - WD Sliven_
 - WD Ruse_
 - Collection system
 - Background
 - Natural Protectional Zones
 - Administrative division
 - Hydrography
 - Транспорт
 - Settlements with water regime
 - Basemap
 - OpenStreetMap



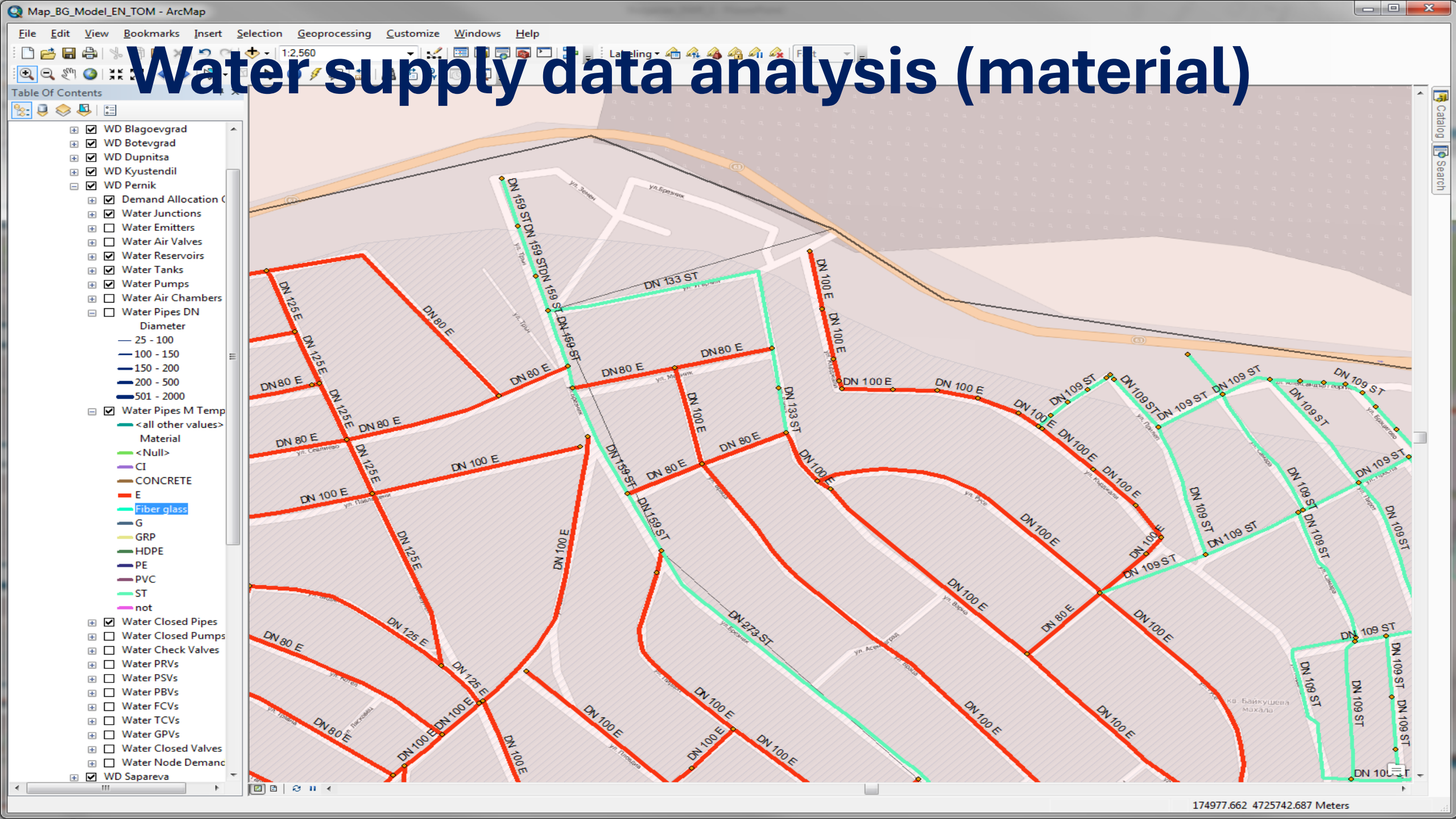
Catalog Search

Water supply digital data - detail 2

Table Of Contents

- WD Blagoevgrad
- WD Botevgrad
- WD Dupnitsa
- WD Kyustendil
- WD Pernik
- Demand Allocation (C
- Water Junctions
- Water Emitters
- Water Air Valves
- Water Reservoirs
- Water Tanks
- Water Pumps
- Water Air Chambers
- Water Pipes DN
 - Diameter
 - 25 - 100
 - 100 - 150
 - 150 - 200
 - 200 - 500
 - 501 - 2000
- Water Pipes M Temp
 - <all other values>
- Material
 - <Null>
 - CI
 - CONCRETE
 - E
 - Fiber glass
 - G
 - GRP
 - HDPE
 - PE
 - PVC
 - ST
 - not
- Water Closed Pipes
- Water Closed Pumps
- Water Check Valves
- Water PRVs
- Water PSVs
- Water PBVs
- Water FCVs
- Water TCVs
- Water GPVs
- Water Closed Valves
- Water Node Demanc
- WD Sapareva



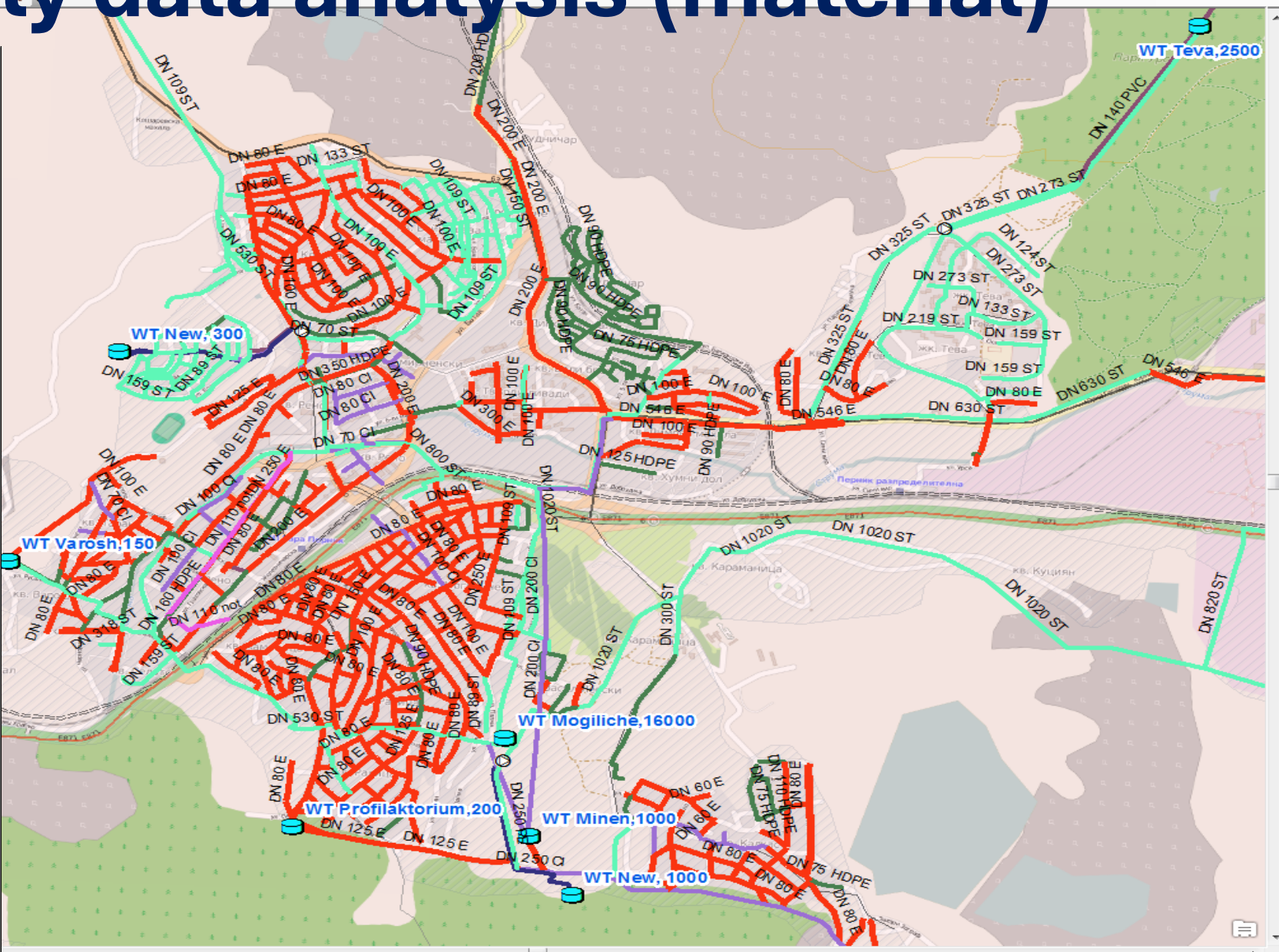


Water supply data analysis (material)

- WD Blagoevgrad
- WD Botevgrad
- WD Dupnitsa
- WD Kjustendil
- WD Pernik
- Demand Allocation (C)
- Water Junctions
- Water Emitters
- Water Air Valves
- Water Reservoirs
- Water Tanks
- Water Pumps
- Water Air Chambers
- Water Pipes DN
 - Diameter
 - 25 - 100
 - 100 - 150
 - 150 - 200
 - 200 - 500
 - 501 - 2000
- Water Pipes M Temp
 - <all other values>
 - Material
 - <Null>
 - CI
 - CONCRETE
 - E
 - Fiber glass
 - G
 - GRP
 - HDPE
 - PE
 - PVC
 - ST
 - not
- Water Closed Pipes
- Water Closed Pumps
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- Water PSVs
- Water PBVs
- Water FCVs
- Water TCVs
- Water GPVs
- Water Closed Valves
- Water Node Demanc
- WD Sapareva

Water supply data analysis (material)

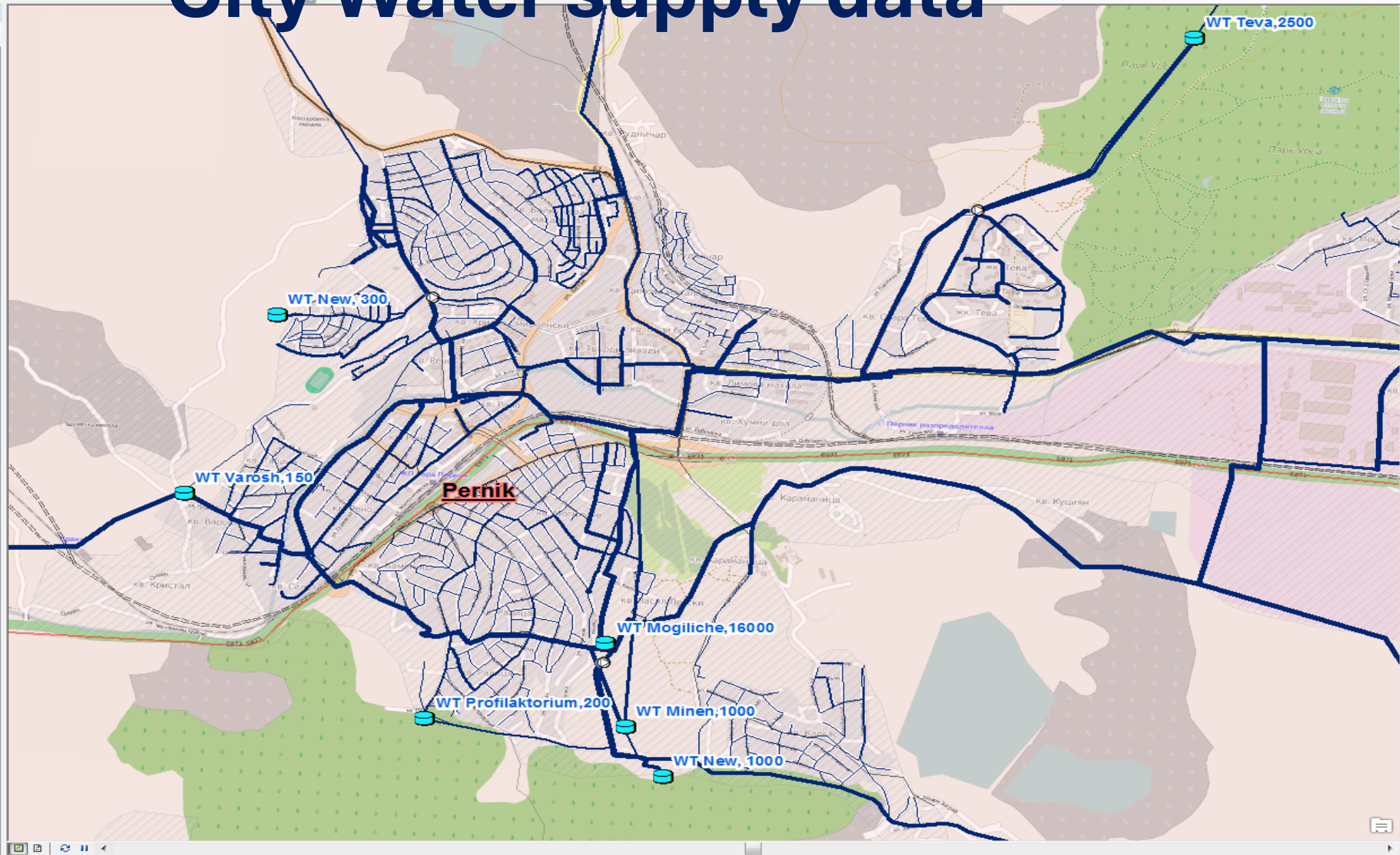
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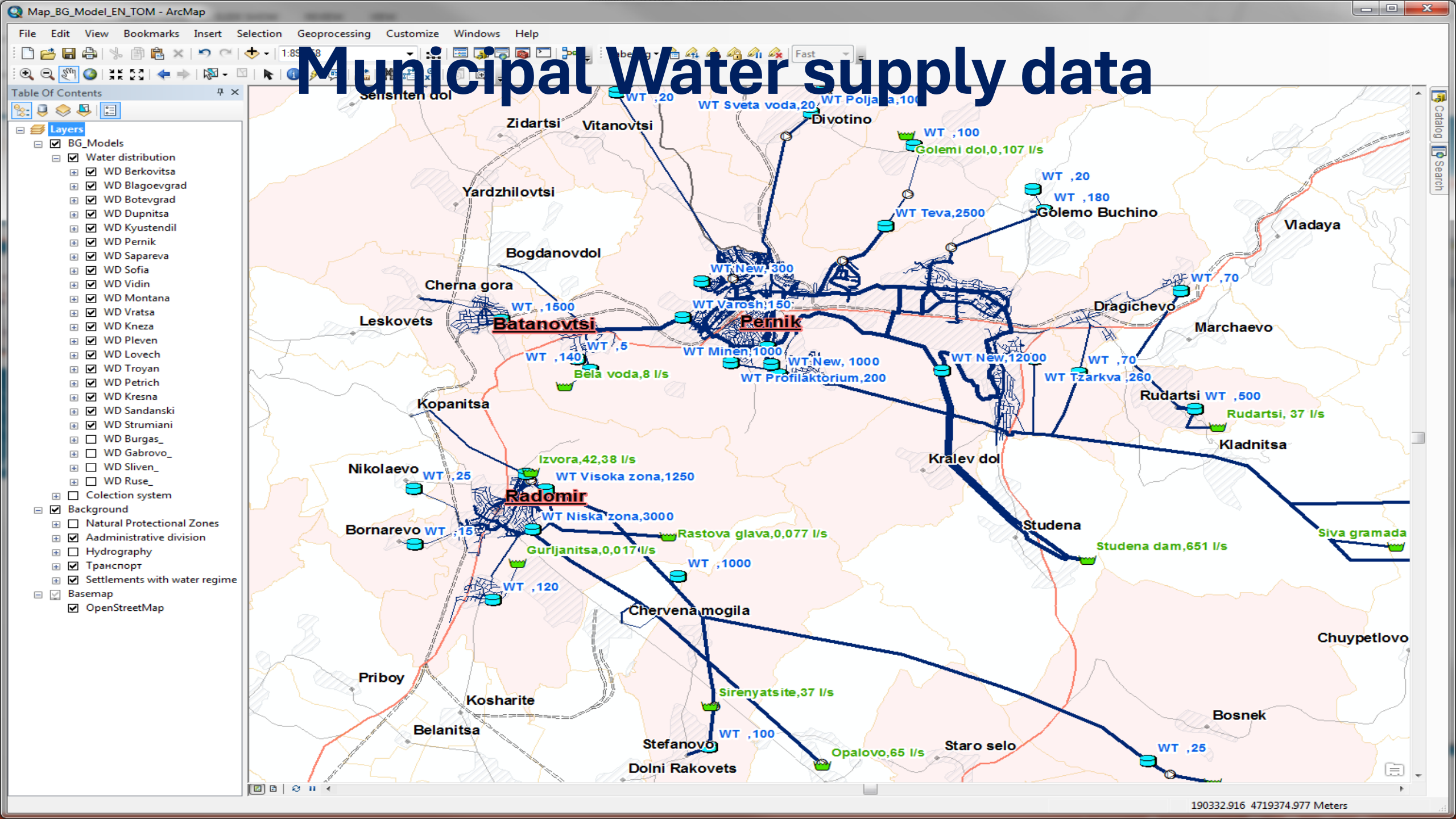


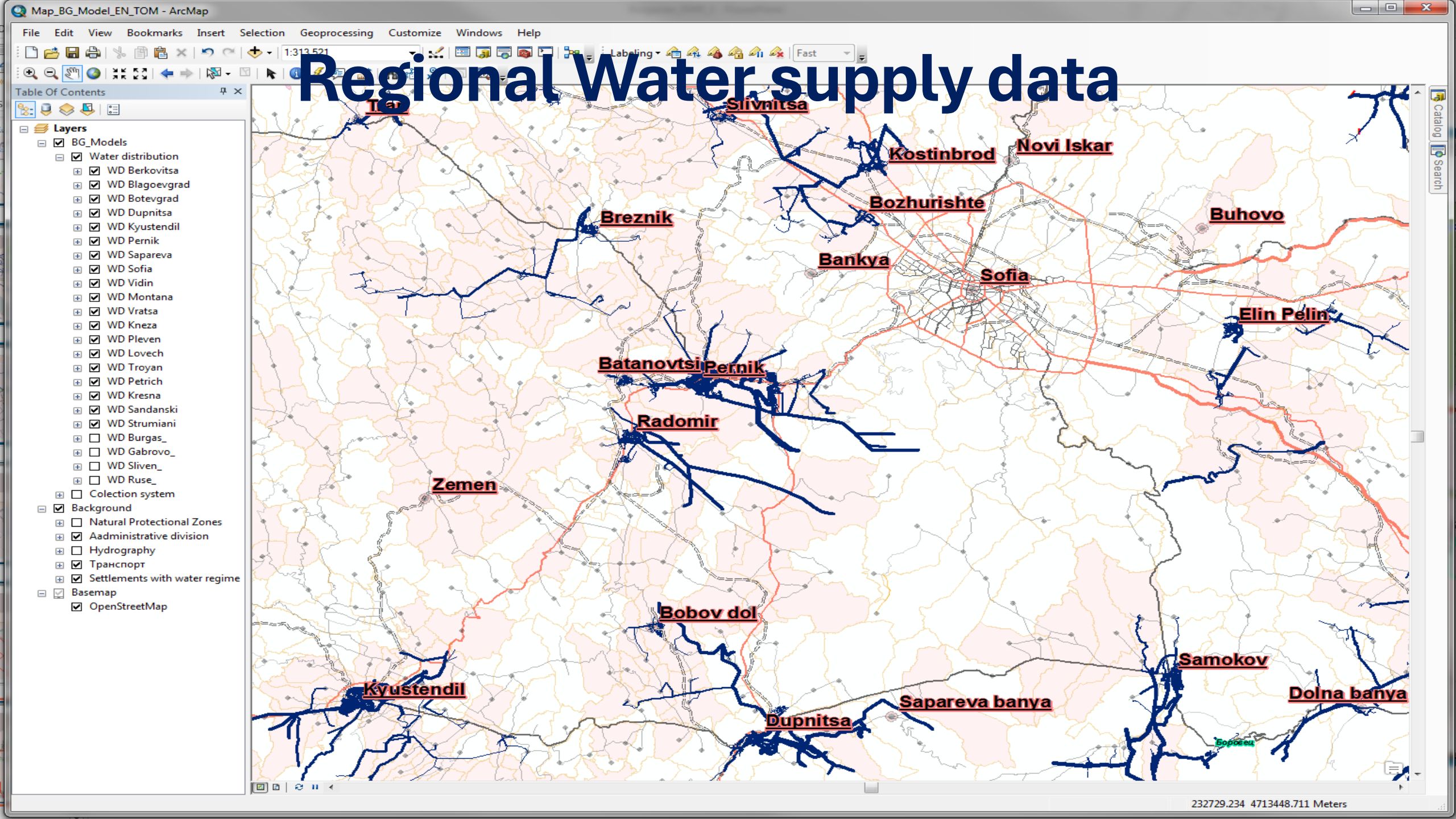
City Water supply data

Table Of Contents

- Layers
 - BG_Models
 - Water distribution
 - WD Berkovitsa
 - WD Blagoevgrad
 - WD Botevgrad
 - WD Dupnitsa
 - WD Kyustendil
 - WD Pernik
 - WD Sapareva
 - WD Sofia
 - WD Vidin
 - WD Montana
 - WD Vratsa
 - WD Kneza
 - WD Pleven
 - WD Lovech
 - WD Troyan
 - WD Petrich
 - WD Kresna
 - WD Sandanski
 - WD Strumiani
 - WD Burgas_
 - WD Gabrovo_
 - WD Sliven_
 - WD Ruse_
 - Collection system
 - Background
 - Natural Protectional Zones
 - Aadministrative division
 - Hydrography
 - Транспорт
 - Settlements with water regime
 - Basemap
 - OpenStreetMap

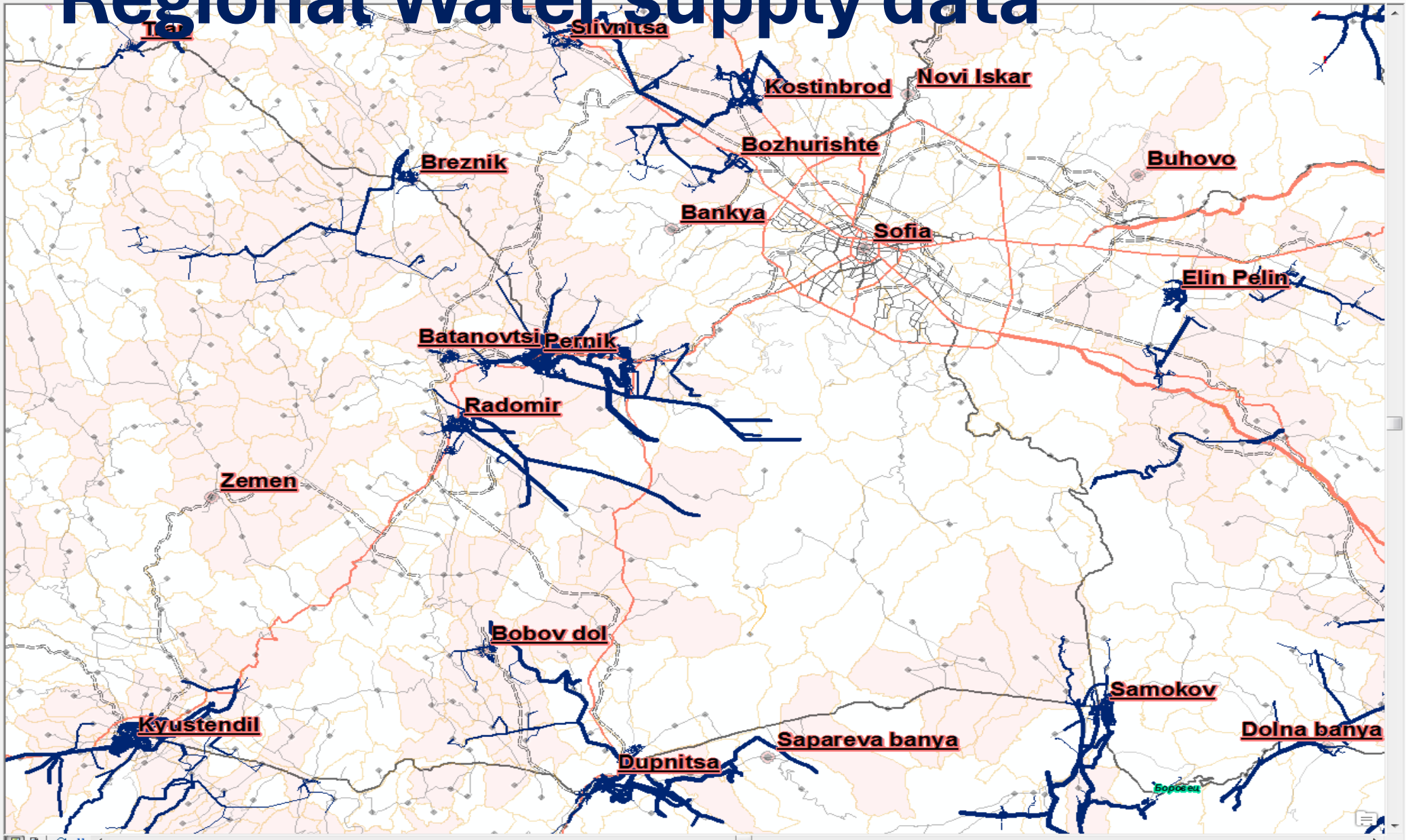




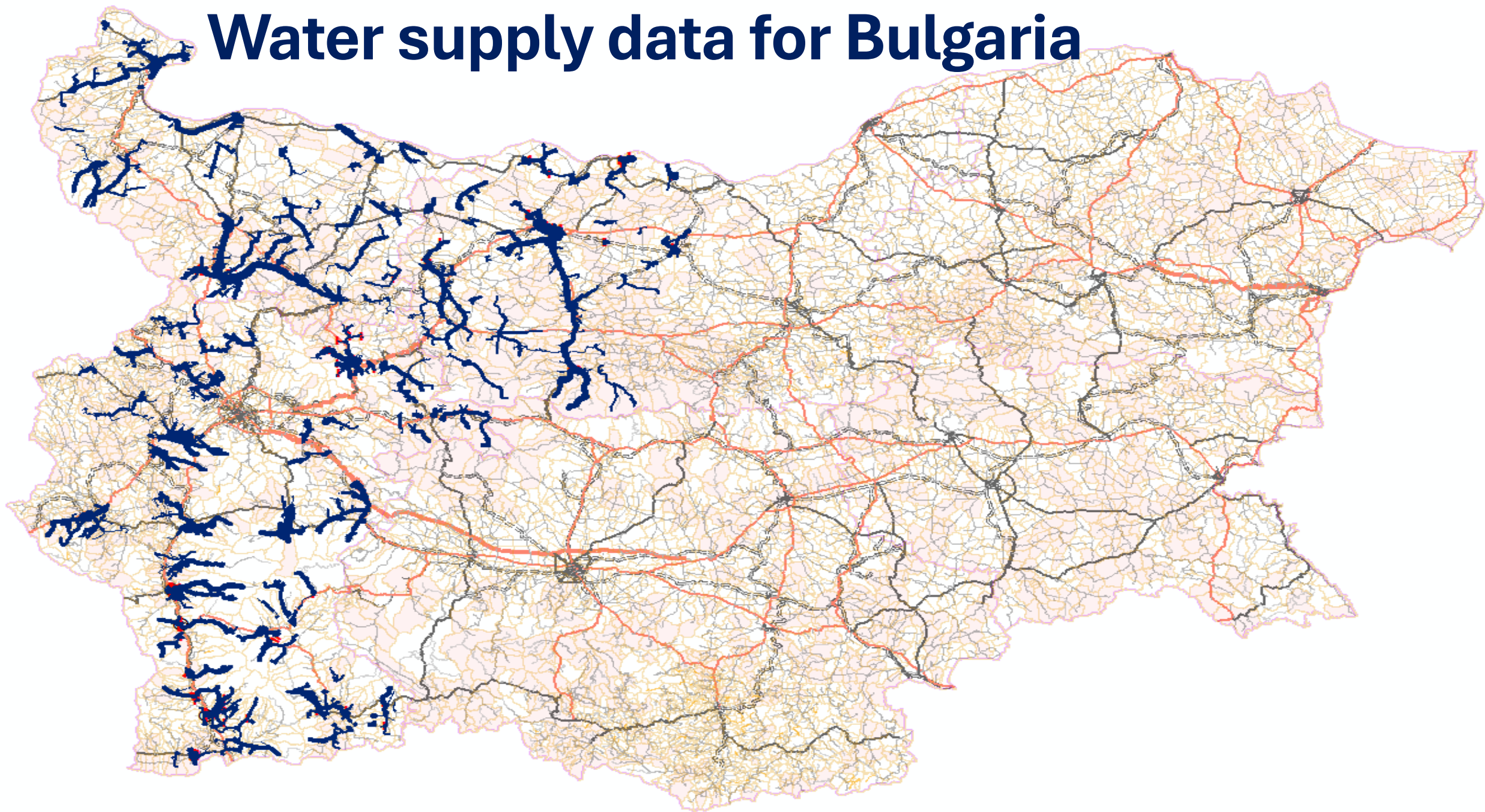


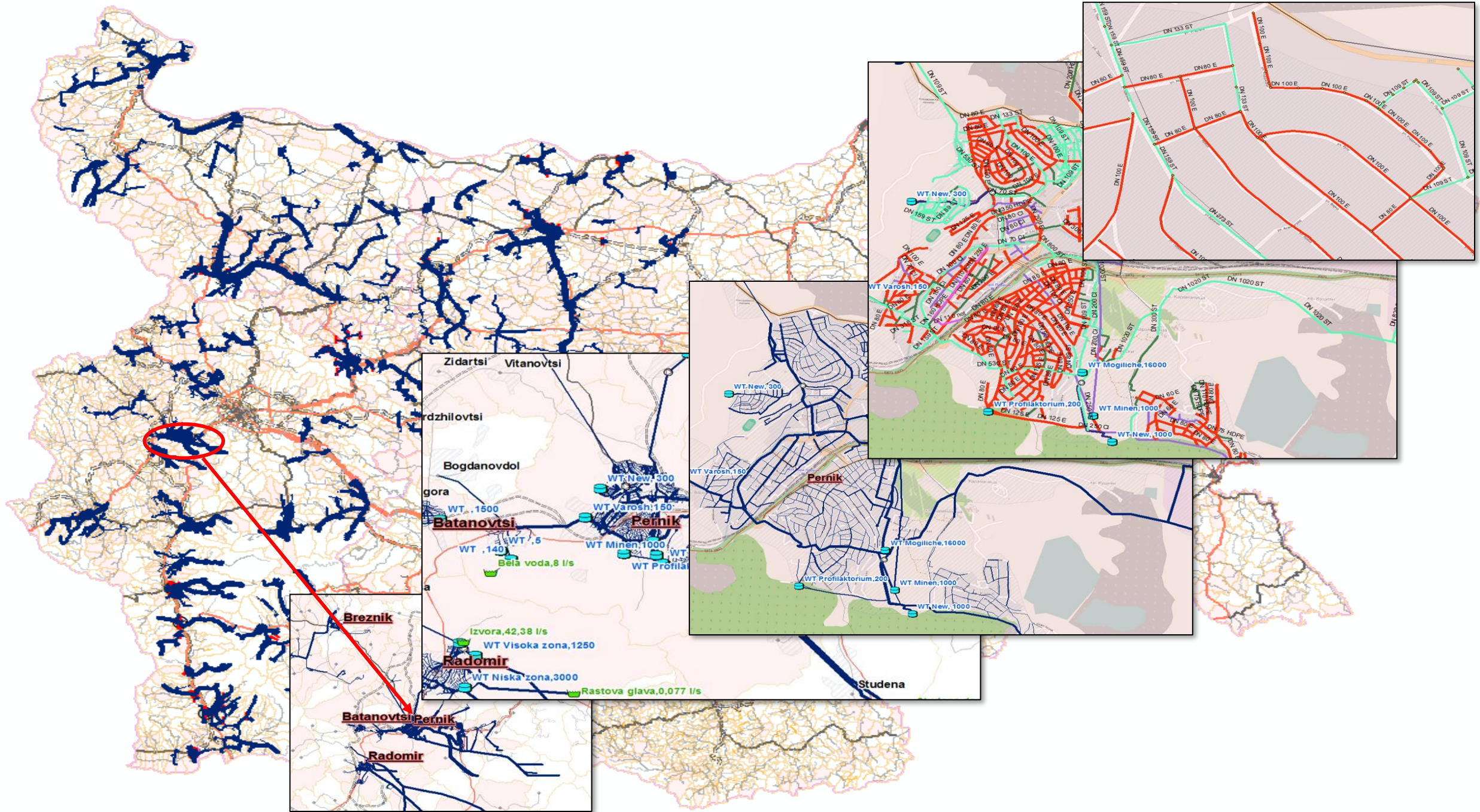
Regional Water supply data

- Map_BG_Model_EN_Tom - ArcMap
- File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
- 1:313,521
- Labeling Fast
- Table Of Contents
- Layers
- BG_Models
 - Water distribution
 - WD Berkovitsa
 - WD Blagoevgrad
 - WD Botevgrad
 - WD Dupnitsa
 - WD Kyustendil
 - WD Pernik
 - WD Sapareva
 - WD Sofia
 - WD Vidin
 - WD Montana
 - WD Vratsa
 - WD Kneza
 - WD Pleven
 - WD Lovech
 - WD Troyan
 - WD Petrich
 - WD Kresna
 - WD Sandanski
 - WD Strumiani
 - WD Burgas_
 - WD Gabrovo_
 - WD Sliven_
 - WD Ruse_
 - Colection system
 - Background
 - Natural Protectional Zones
 - Aadministrative division
 - Hydrography
 - Транспорт
 - Settlements with water regime
 - Basemap
 - OpenStreetMap



Water supply data for Bulgaria







All it is about data, but....

“Where is the wisdom ?
Lost in the knowledge...

Where is the knowledge ?
Lost in the information ...

Where is the information ?
Lost in the data...

Where is the data ?
Lost in the database ...”