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Model SWAT as an integrated management tool in water catchment Švihov

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Project introduction



Technology Agency
of the Czech Republic

- Supported by Technology Agency of the Czech Republic (TACR)
- **„A comprehensive approach to reducing water pollution by reactive forms of phosphorus and nitrogen within a hydrologically defined part of the Švihov water reservoir catchment area“**
- Project time: 6/2014 – 6/2017

Water catchment of Švihov water reservoir

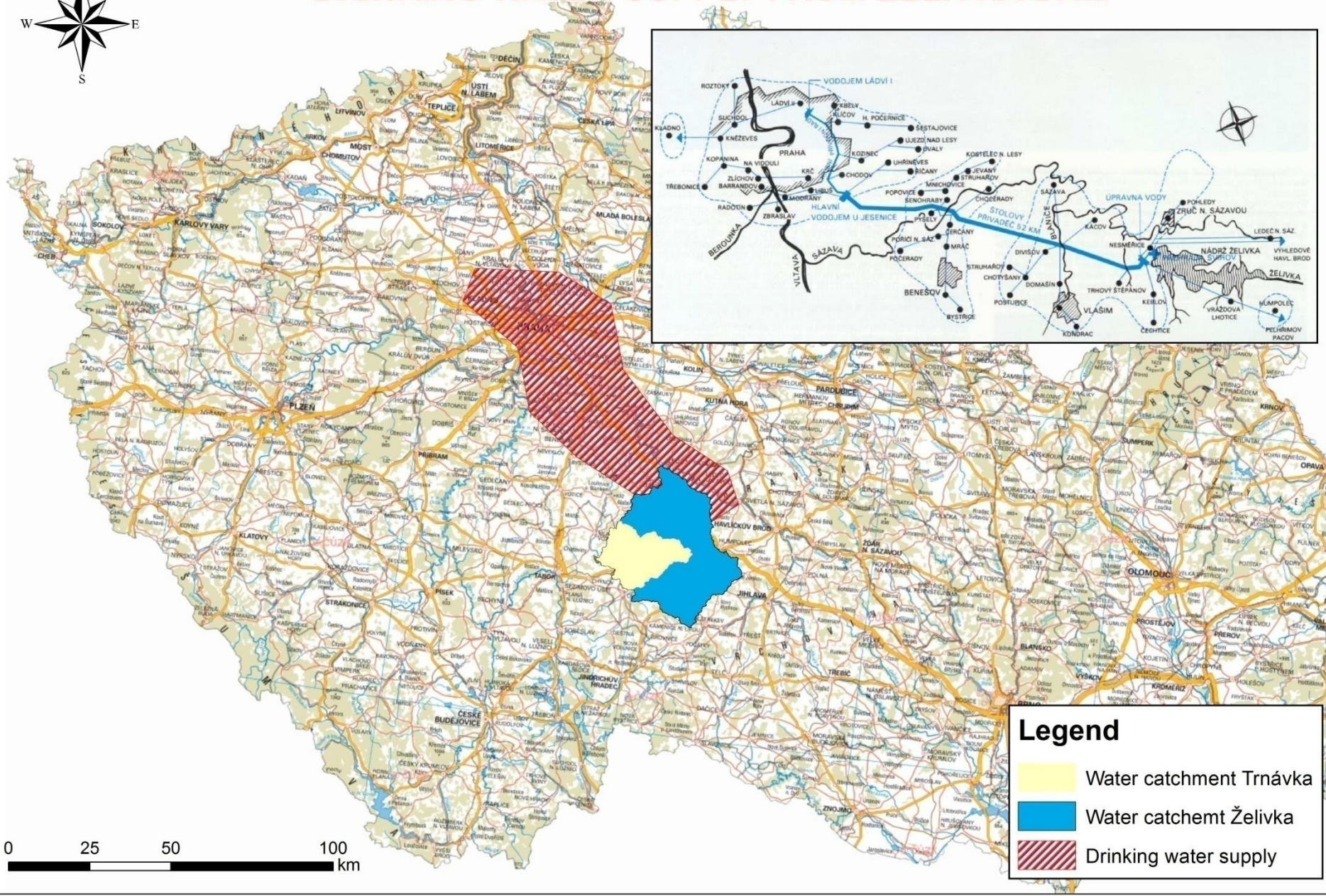
- Area 1178 km²
- Drinking water supply for 1.5 mil. people
- Pipeline system:
 - Tunnel length: 51 km
 - Diameter: 2.6 m



15 9 2004

Source: www.vmap.cz

DRINKING WATER SUPPLY FROM ŽELIVKA DAM



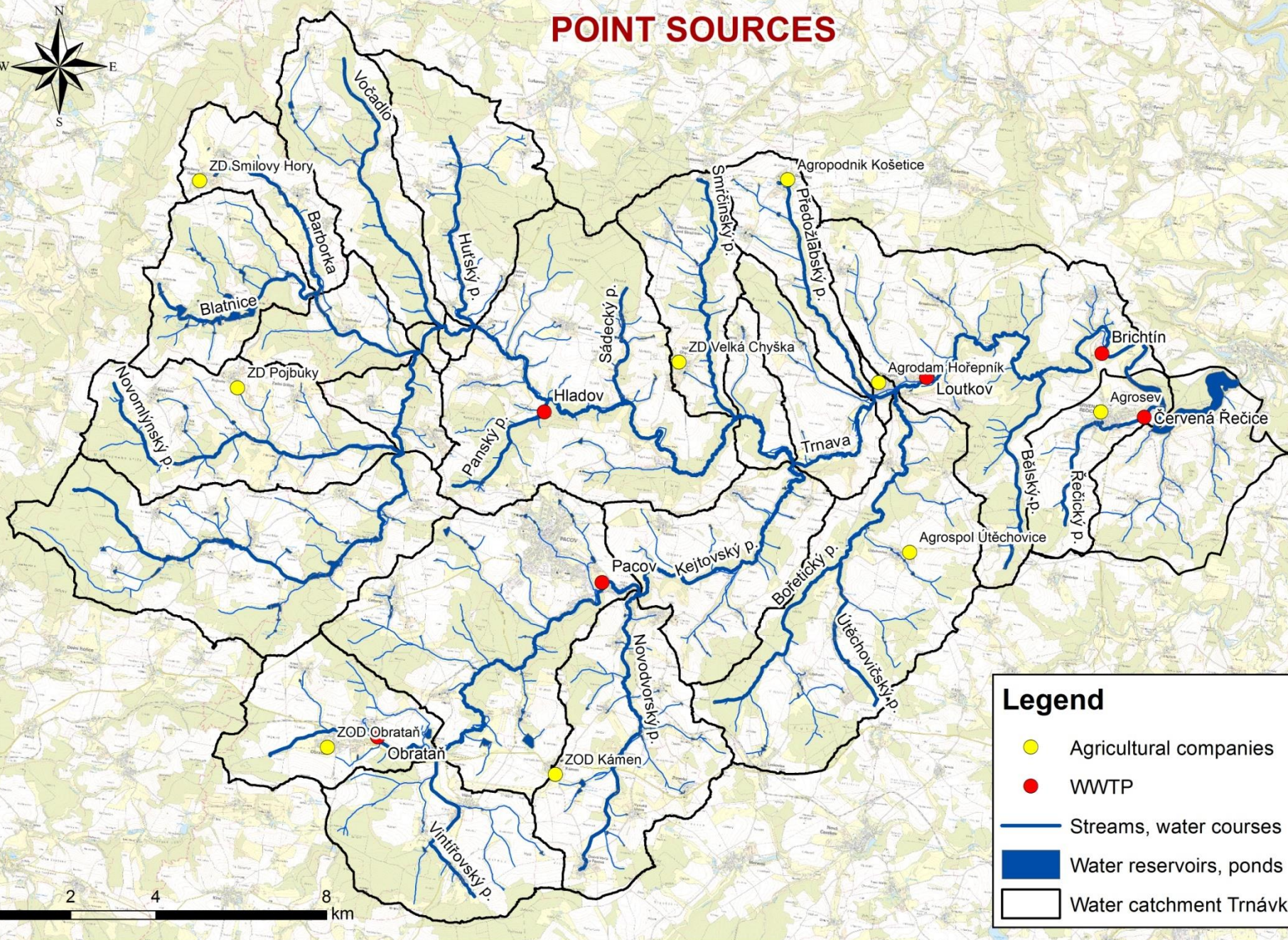
0 25 50 100 km

Point sources

- Waste water treatment plants (WWTP)
- Constructed wetlands
- Villages without WWTP
- Agricultural farms



POINT SOURCES



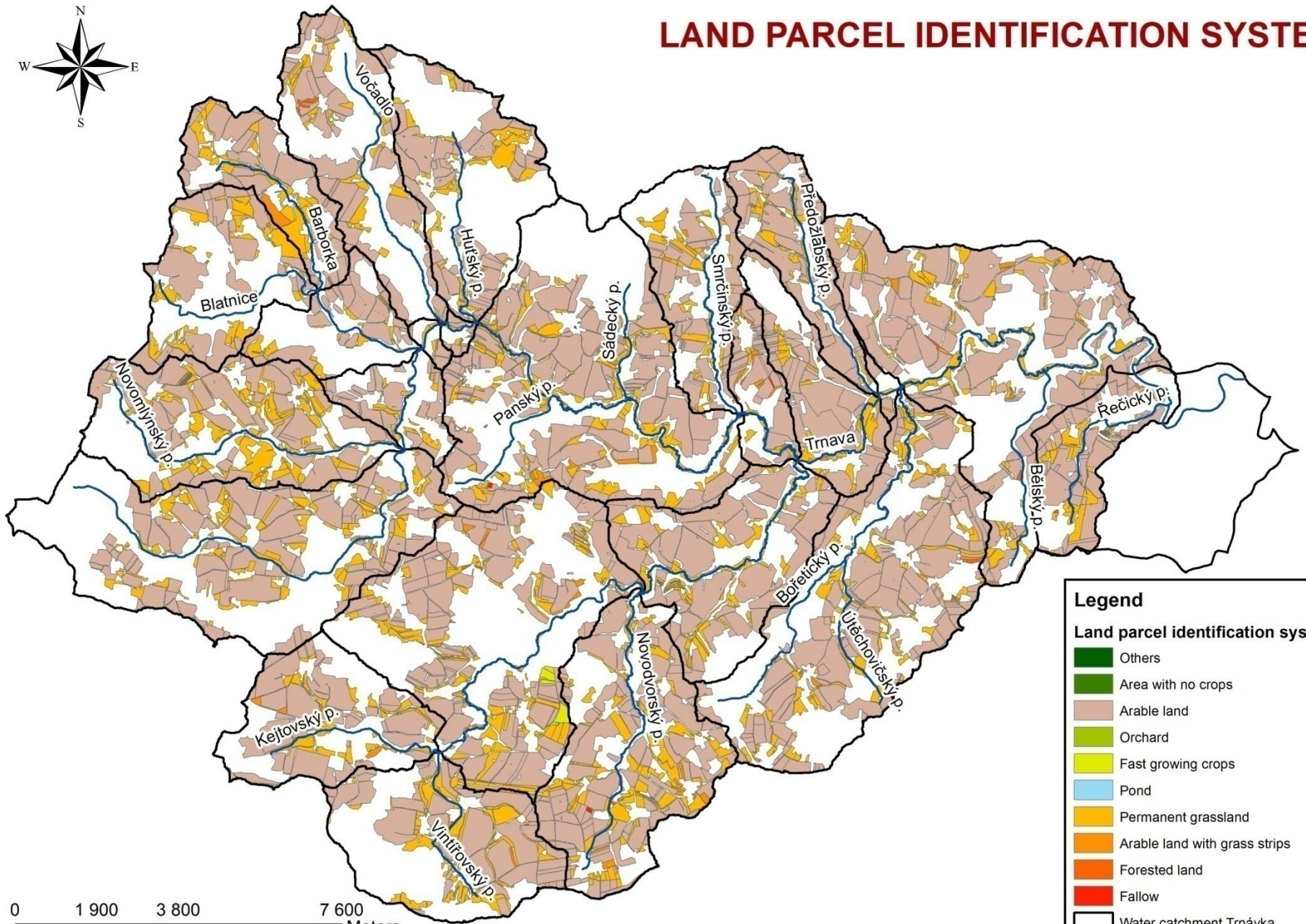
Legend

- Agricultural companies
- WWTP
- Streams, water courses
- Water reservoirs, ponds
- ▭ Water catchment Trnávka

Non-point sources

- Land Parcel Identification System (LPIS)
- Complex system of agricultural land
- Source of information about agricultural land in the Czech Republic
- Fertilizer calculation from dominant crop
- Under management of Ministry of Agriculture
- Data available for free download
- <http://eagri.cz/public/app/lpisext/lpis/verejny/>

LAND PARCEL IDENTIFICATION SYSTEM

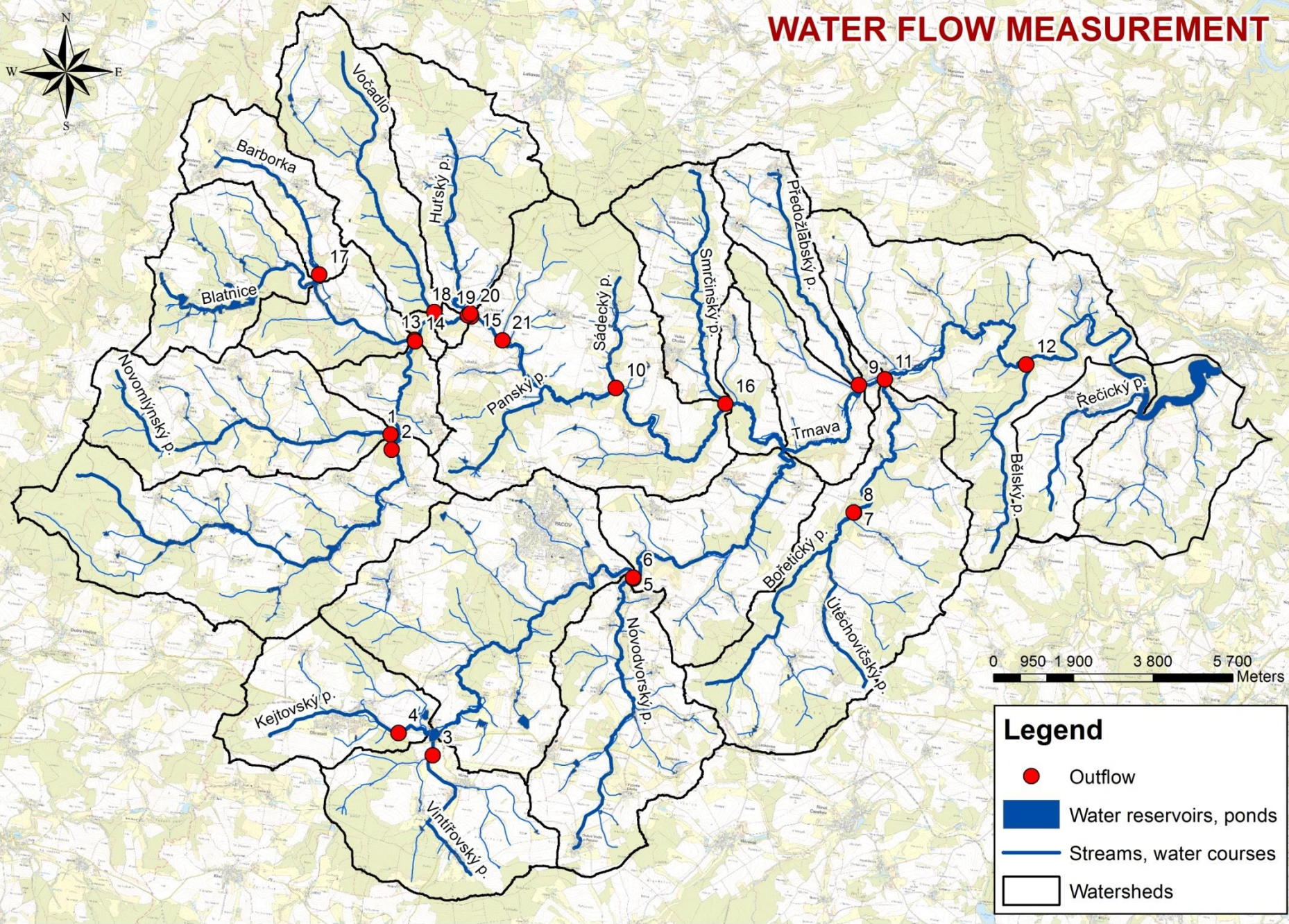


Measured profiles – hydrological part

- 21 measured profiles (by hydrometer)
- Measurement of important water courses
- Acquired data:
 - Input data for water balance
 - Part of calculation of water pollution



WATER FLOW MEASUREMENT



Measured profiles – chemical part

- Nutrient measurement in streams
- Historical (247) x Measured (125) profiles
- Profiles named according to the hydrological number of measured stream
- Chemistry monitoring: P-PO₄³⁻, P_{total}, N-NO₃⁻, N_{ammonia}, COD
- All data from field research
- Determination of endangered watersheds by high nutrient loads
- Subwatersheds divided by combination of outflow and chemistry

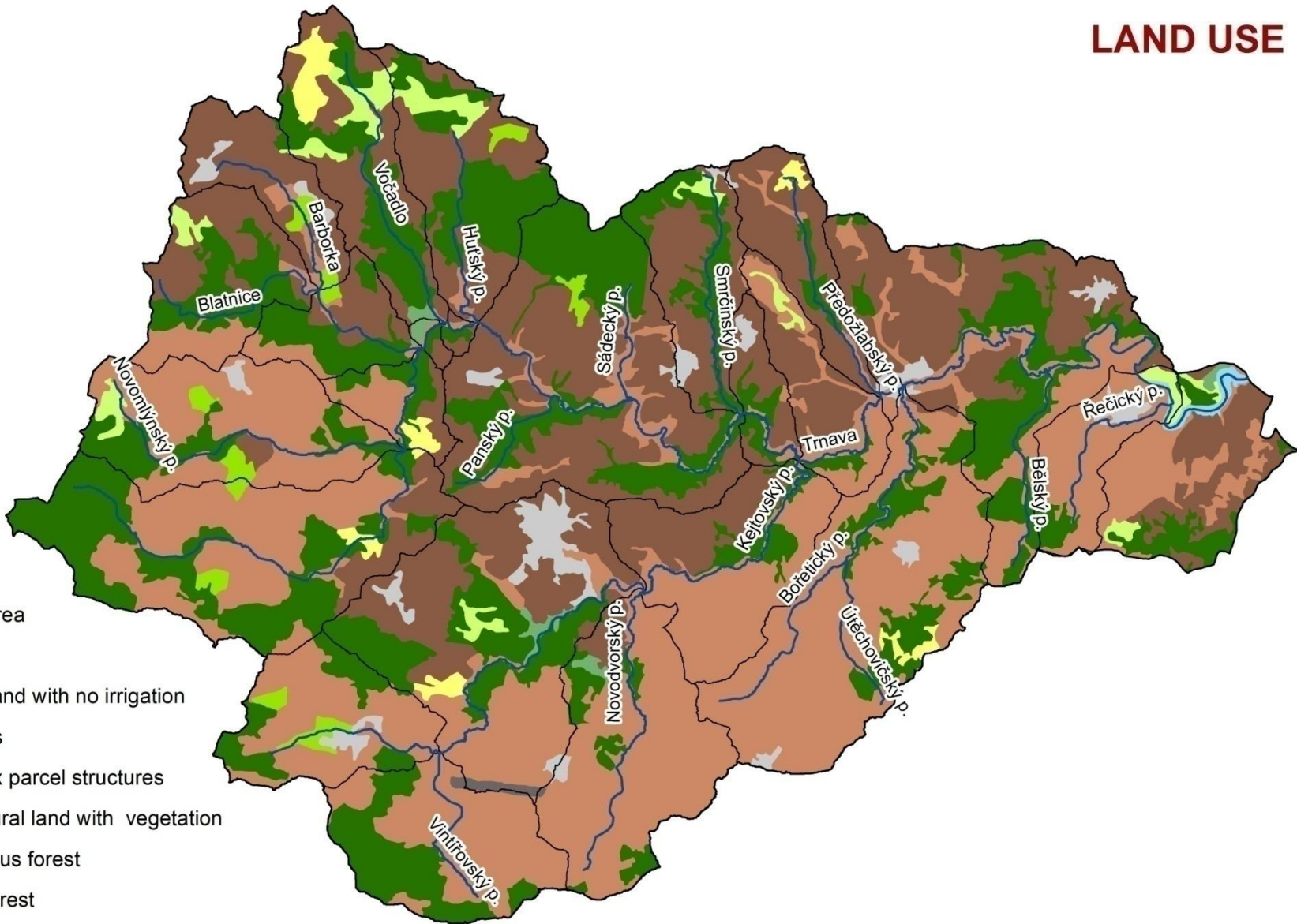
Profile Evidence

- Each profile has its own list of properties
- Catalogue of evidence cards
- Measurements will continue in chosen profiles (according to level of pollution)

Data for SWAT

- Public
 - Available for download (Corine, HEIS VUV, LPIS,...)
- Non – public
 - (weather data, soil map, management, outflow, chemistry,...)
 - For free (for research purpose)
 - Available upon request (PVL)
 - Paid
 - Available upon request and payment (CUZK)

LAND USE



Legend

Corine Land Use

- Urban area
- Airport
- Arable land with no irrigation
- Pastures
- Complex parcel structures
- Agricultural land with vegetation
- Coniferous forest
- Mixed forest
- Forests and bushes
- Water

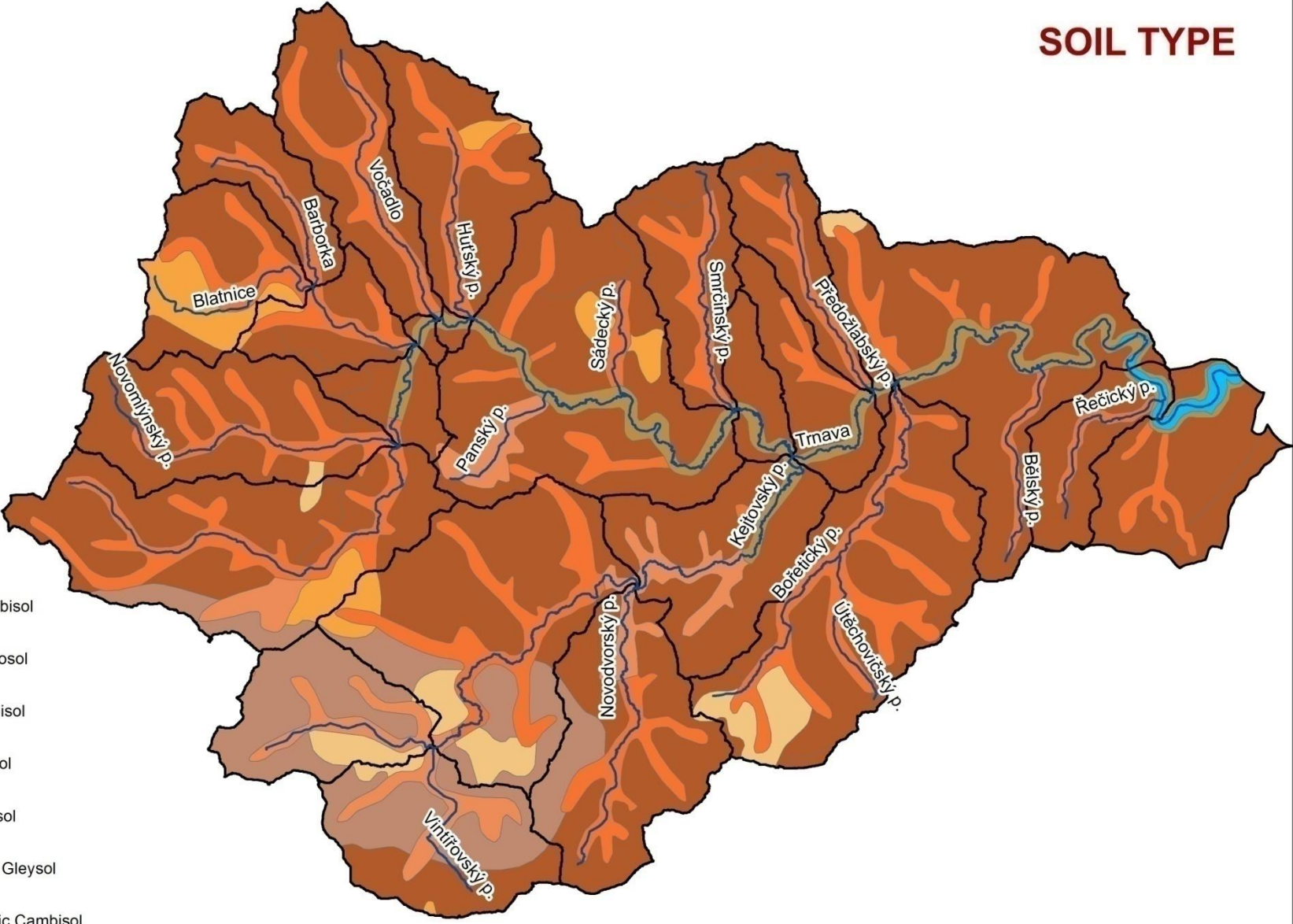
0 2 100 4 200 8 400 Meters

SOIL TYPE



Legend

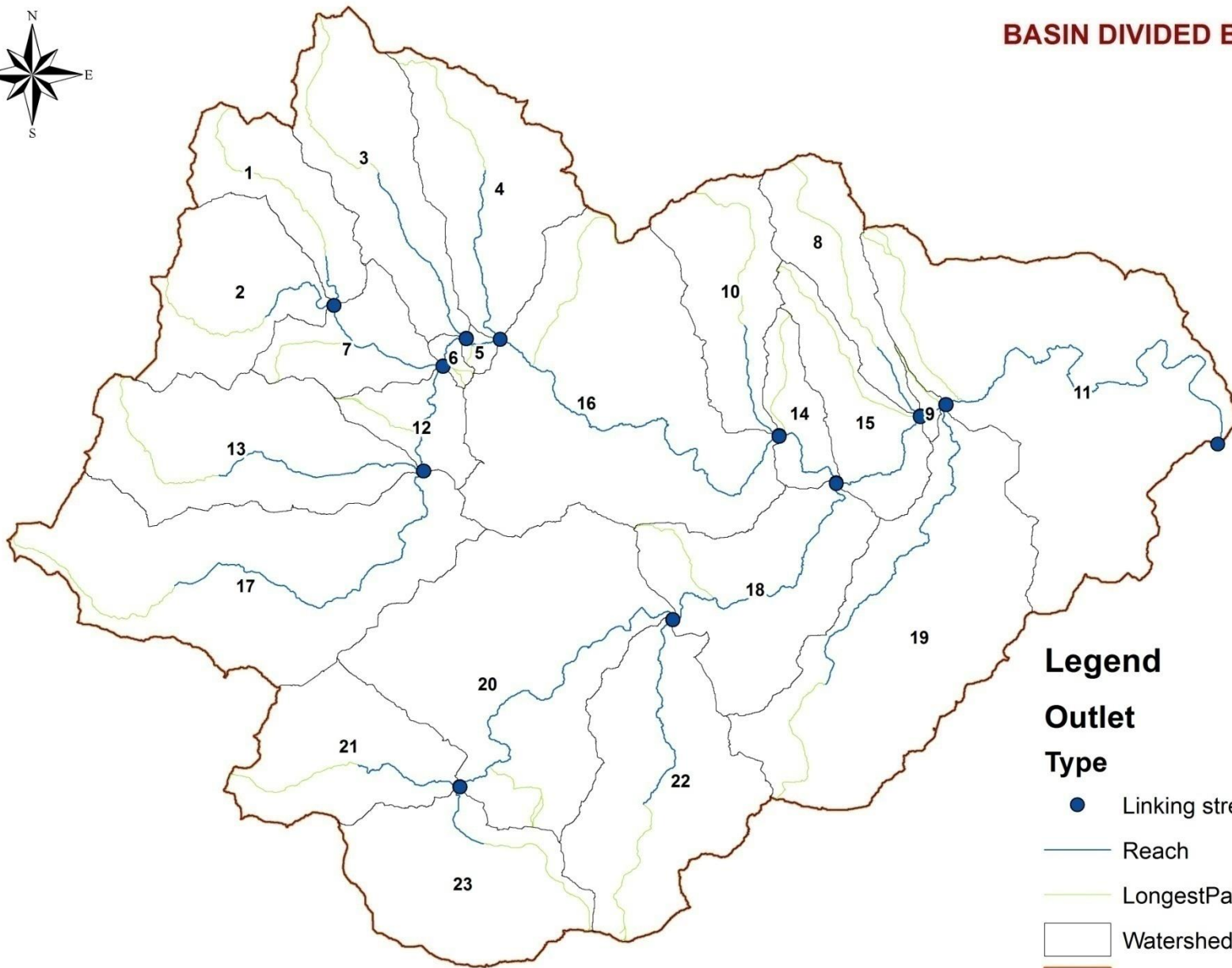
- FAO
- Dystric Cambisol
 - Dystric Planosol
 - Eutric Cambisol
 - Eutric Gleysol
 - Gleyic Fluvisol
 - Histo-humic Gleysol
 - Stagno-gleyic Cambisol
 - Water



DEM

- Data from Czech Cadastre
- The model is based on the data acquired by altimetry airborne laser scanning of the Czech Republic territory between years 2009 and 2013
- total standard error is 0.18 m of height in the bare terrain and 0.3 m in forested terrain
 - [http://geoportal.cuzk.cz/\(S\(xf3scprgzfxvsqoy3r5i1uwj\)\)/Default.aspx?lng=EN&mode=TextMeta&side=vyskopis&metadataID=CZ-CUZK-DMR5G-V&mapid=8&menu=302](http://geoportal.cuzk.cz/(S(xf3scprgzfxvsqoy3r5i1uwj))/Default.aspx?lng=EN&mode=TextMeta&side=vyskopis&metadataID=CZ-CUZK-DMR5G-V&mapid=8&menu=302)

BASIN DIVIDED BY SWAT



Legend

Outlet

Type

● Linking stream added Outlet

— Reach

— LongestPath

□ Watershed

□ Basin

0 1 350 2 700 5 400 8 100 Meters

Data for calibration

- Povodí Vltavy state enterprise
 - (<http://www.pvl.cz/en>)
 - Data in monthly step for 14 years
 - Chemical properties in 6 monitored profiles (water quality)
 - Water flow in 1 monitored profile

Management

- Corn, Rape, Potatoes
- High rate of erosion
- High surface runoff
- Calibrated model + different management = optimal combination
- Fast growing wood, grassland, etc...

Directive Water Management Plan

- „The aim of water management planning is the improvement or maintaining of the so called good status of surface and subterranean water and aquatic ecosystems“
- WWTP, point sources, etc... - in detail
- Agricultural management – in general
- **SWAT** = Agricultural management in detail



should make directives more efficient


The Nitrates Directive

- Defines limits for fertilizing for different crops
- Protection of waters against pollution caused by nitrates from agricultural sources
- Obligatory for this area – catchment of drinking water reservoir
- Changes at least every four years



Discussion

- Is SWAT acceptable as an integrated management tool?
 - Improve management (efficient for farmers)
 - Data quality (not precise)



Thank you for your attention.