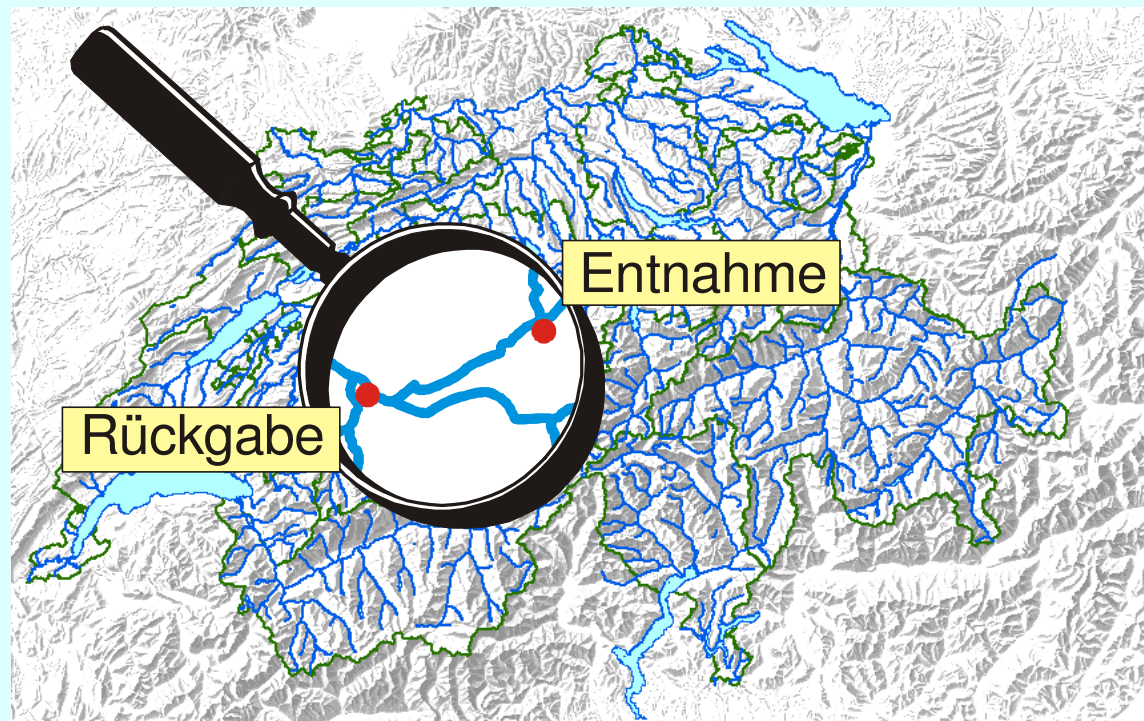


GIS-based Identification of Potential Sites for Small Hydro Power Plants



Yvo Weidmann, Geomatic and Software Engineer

Depending on the client, the objectives may be different.

investor

Evaluation of potential sites for small hydro power plants

Report of possible capacity

Identification of interesting areas for new power plants

public authorities

Base information for political decision makers

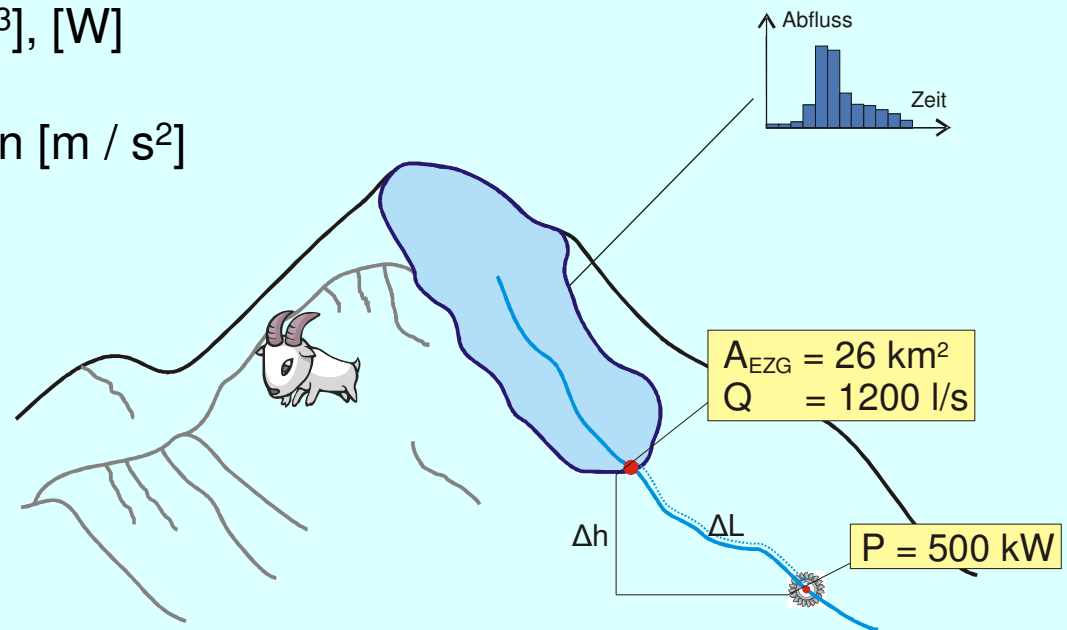
Tool for approval process

Overview of potential hydro power

The hydroelectrically potential of a stream is defined through the runoff and the head.

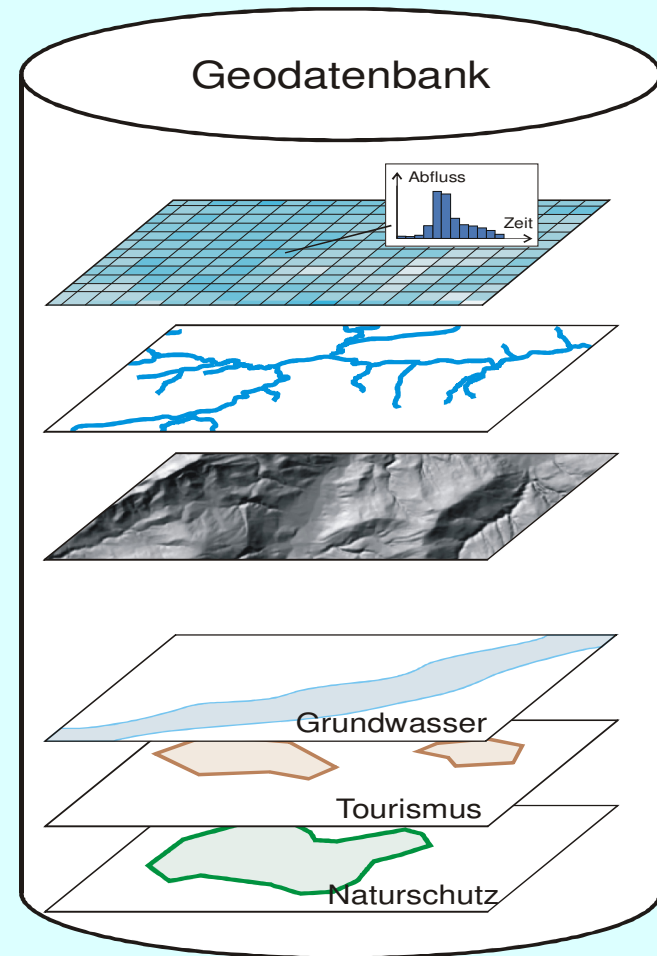
$$P = \rho \cdot g \cdot Q \cdot \Delta h \cdot \eta$$

P	Rated power [kg · m ² / s ³], [W]
ρ	Density [kg / m ³]
g	Gravitational acceleration [m / s ²]
Q	Runoff [m ³ / s]
Δh	Head [m]
η	Efficiency



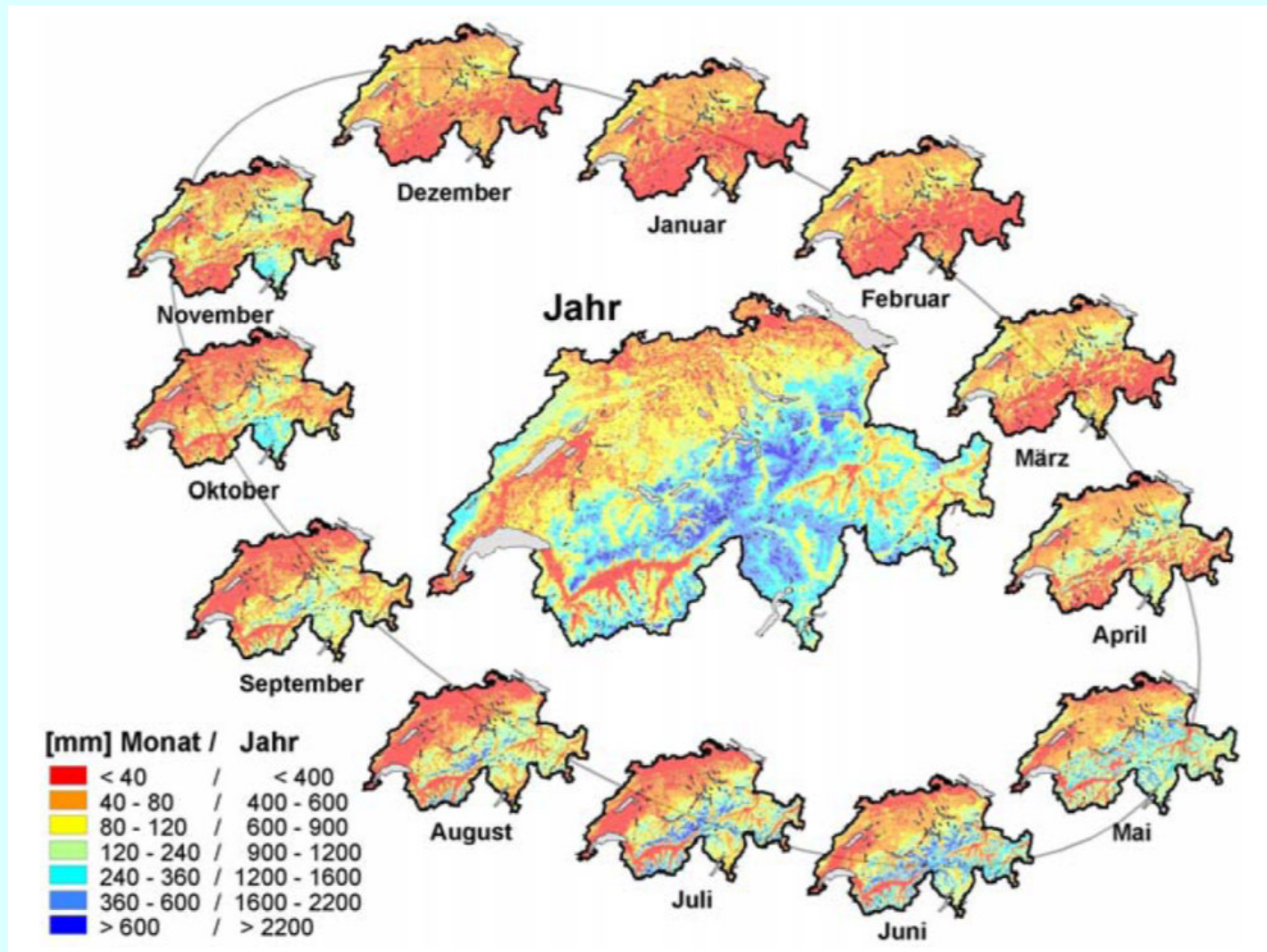
The used geographical data are available and can be retrieved from the government

- Mean monthly runoff
- Digital stream network
- Digital terrain model
- Additional factors (national parks, natural resorts, groundwater bodies, avalanches, ...)
- Existing hydropower plants



Mean monthly runoff

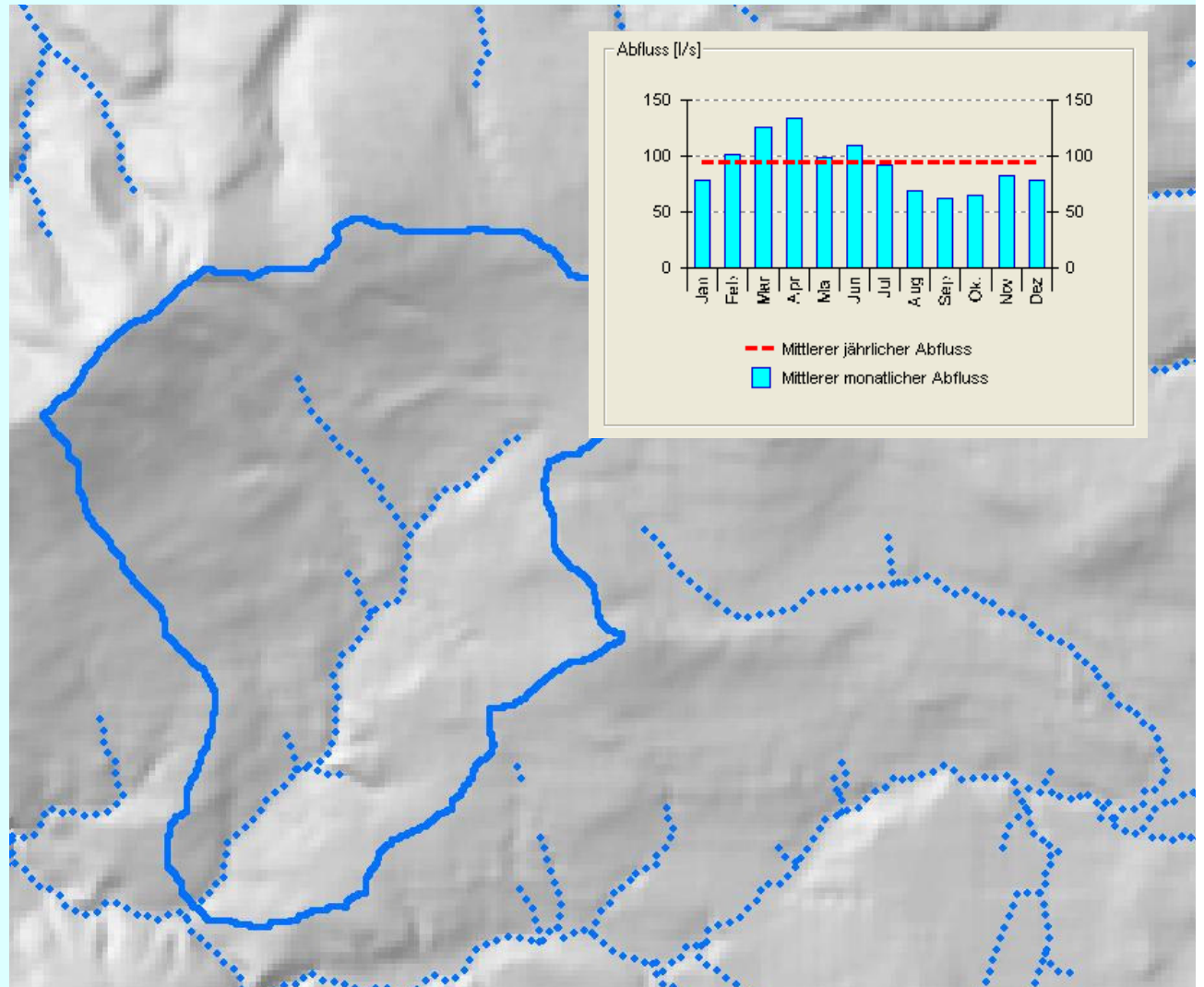
Nationwide information on mean annual and mean monthly runoff.



For each single point along the streams the watershed and the monthly and yearly runoff will be calculated.

Calculation of watershed for every single point

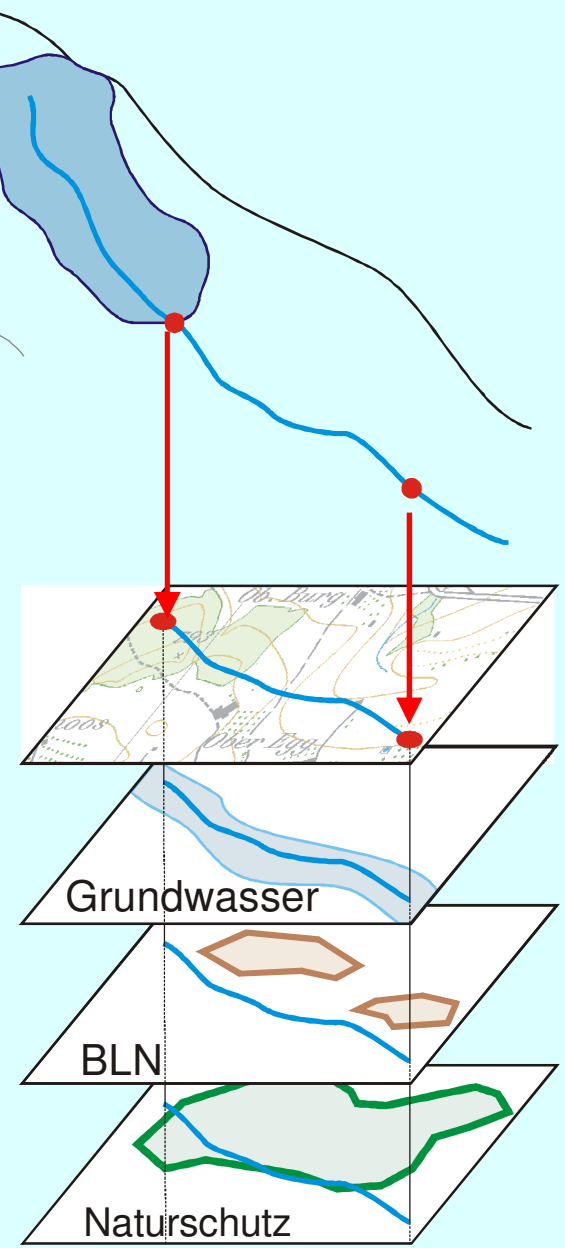
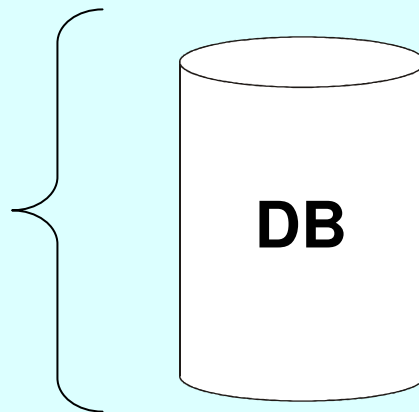
Calculation of monthly and yearly runoff



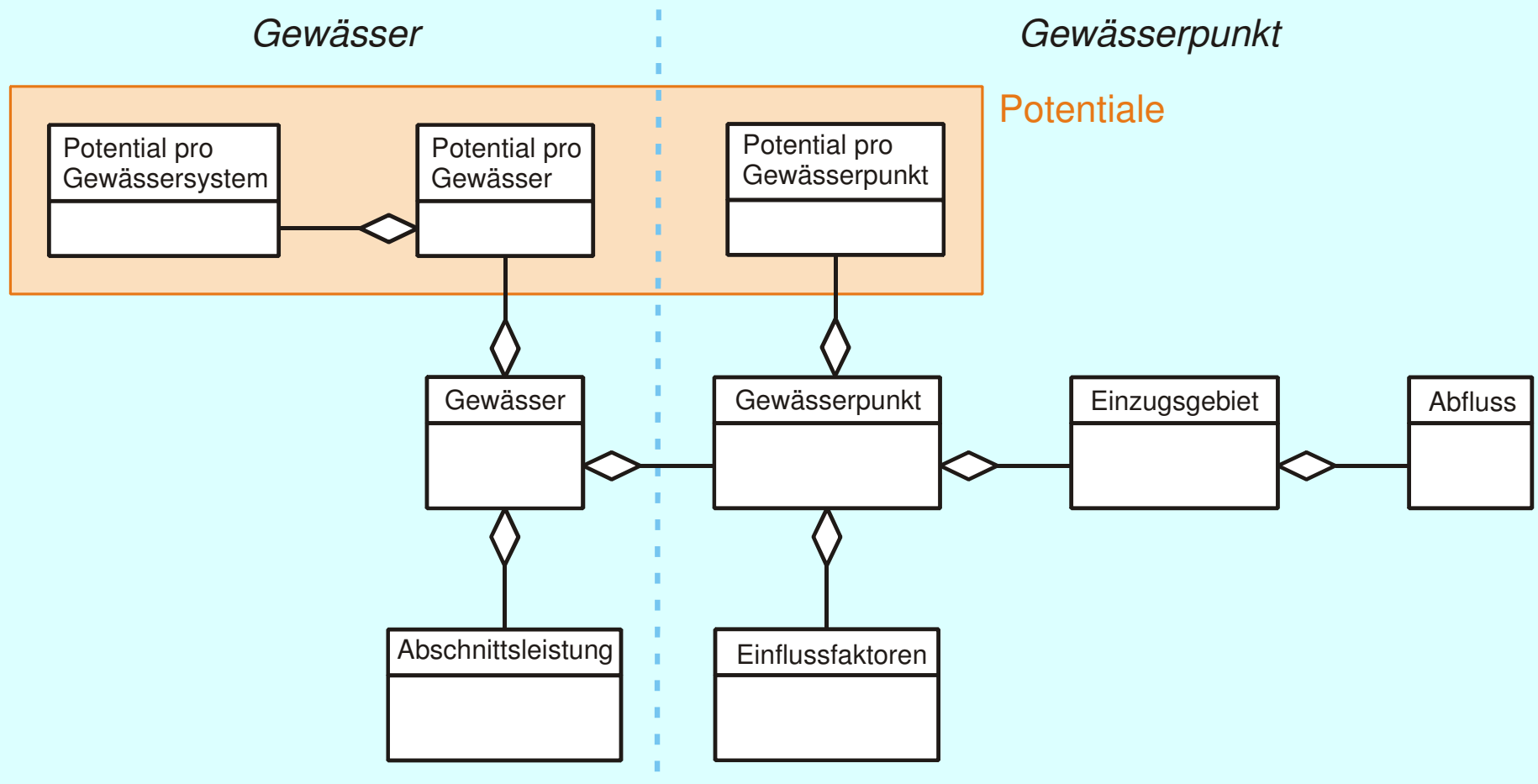
Identifying of additional factors on each single point along the stream trough spatial analysis.

Definition of three classes:

- **Influencing factors**
- **Kill factors**
- **Existing hydropower plants**



All results are stored within a relational database system and are available for further investigations.



Overview 1:100 000

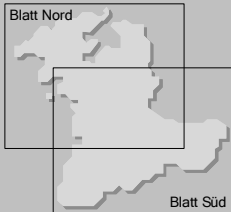


Blatt Süd

Wasserkraft-Potenzialstudie
Kanton Bern

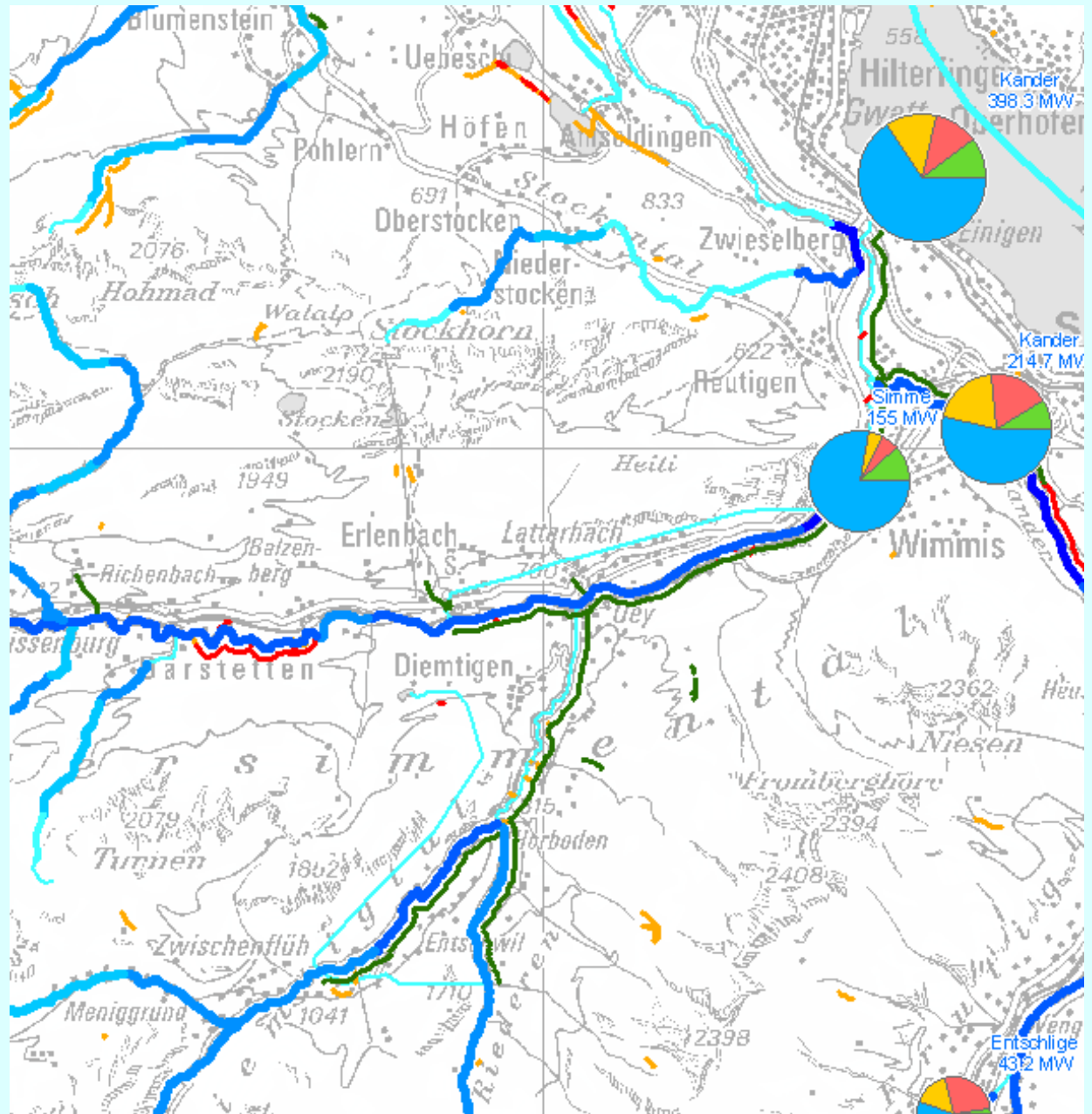
1:100 000

Ausgabe 2009



AWA
Amt für Wasser und Abfall

Bau-, Verkehrs- und
Energiedirektion
des Kantons Bern



Calculation of possible sites for small hydropower plants with arbitrary capacity:

- 0.5 MW, 1.0 MW, 2.0 MW

Consideration of technical, ecological and economical limitations:

- Efficiency ($\eta = 0.7$)
- Volume of water during certain period (Q_{120})
- Maximum length of pipe (depending on capacity)
- Sensitivity on change in runoff ($Q_{120} \pm 20\%$)

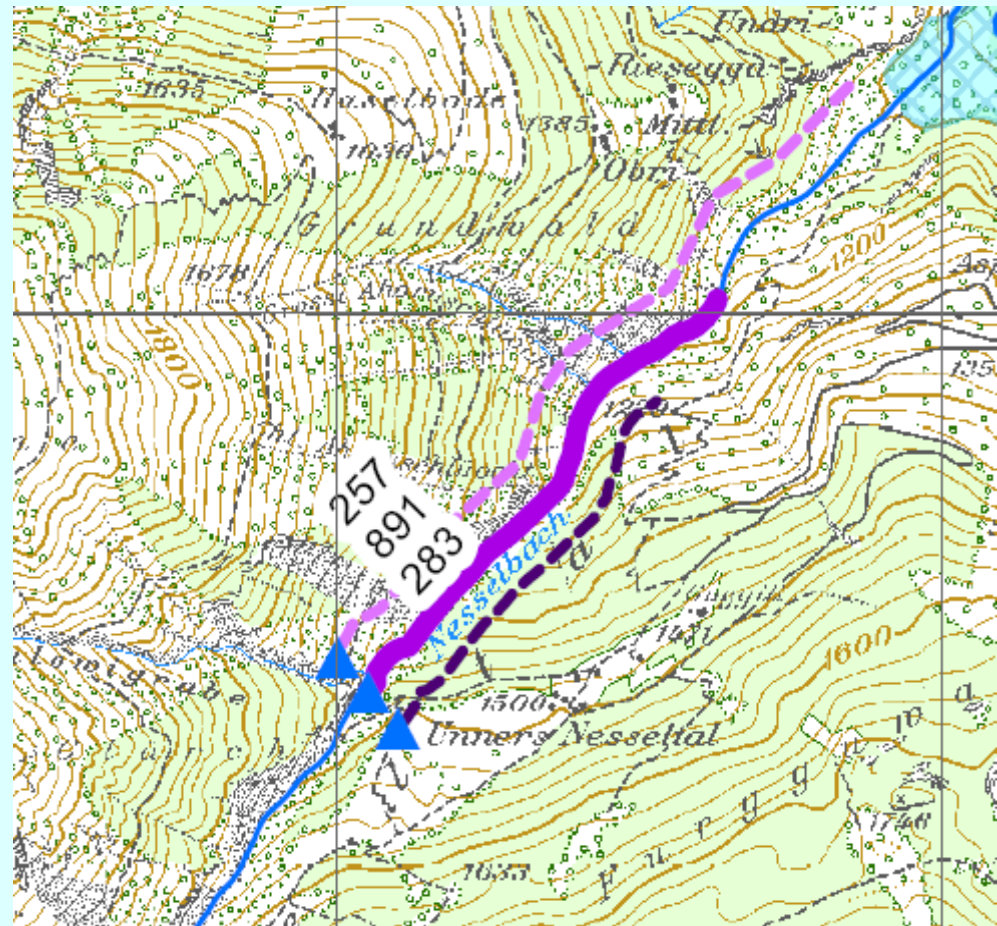
Presentation of the results:

- Maps of possible sites 1:25 000
- GoogleEarth

With the consideration of the variability ($Q_{120} \pm 20\%$) of the runoff the robustness of a site can be estimated.

Site detected with:

- $Q_{120} + 20\%$
- Q_{120}
- $Q_{120} - 20\%$



- Very detailed information covering of a whole area
- Data for further analysis
- Problem-oriented presentation of the results

- Elaboration of methodology with investors and public authorities
- Widely applied methodology
- Quality inspection of the results in the field

The methodology and the implementation was be awarded with the *Swiss Mountain Water Award 2008*

Thank you very much for your attention



Swiss Mountain Water Award 2008

Ein Wettbewerb zur Umsetzung von innovativen Wasserprojekten im Schweizer Berggebiet

GEWINNERZERTIFIKAT

Der Swiss Mountain Water Award, verliehen vom Netzwerk Wasser im Berggebiet, im Wert von 60'000.- geht an das Projekt

Flächendeckende GIS-gestützte Identifikation potentieller Standorte für Kleinwasserkraftwerke

Das Projekt wurde eingereicht durch **WaterGisWeb AG**

Landquart, 20. August 2008,
Pankraz Freitag,
Ständeratspräsident des Kantons Glarus und Präsident der Jury



...herzliche Gratulation!