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Indicators for evaluation of critical land use areas

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Indicators for evaluation of critical land use areas



Contents:

Part 1: Indicators for evaluation of surface runoff disposition

Part 2: Results of Project „Sealed Areas“ –

a prosperous cooperation between



and



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Evaluation schemes presented are based on results of field investigations from about 25 catchments /regions in the eastern alps and include detailed plot analysis :

- **Sprinkling experiments**
- **plant analysis**
- **analysis of soil physical properties**
- **way and intensity of land use**



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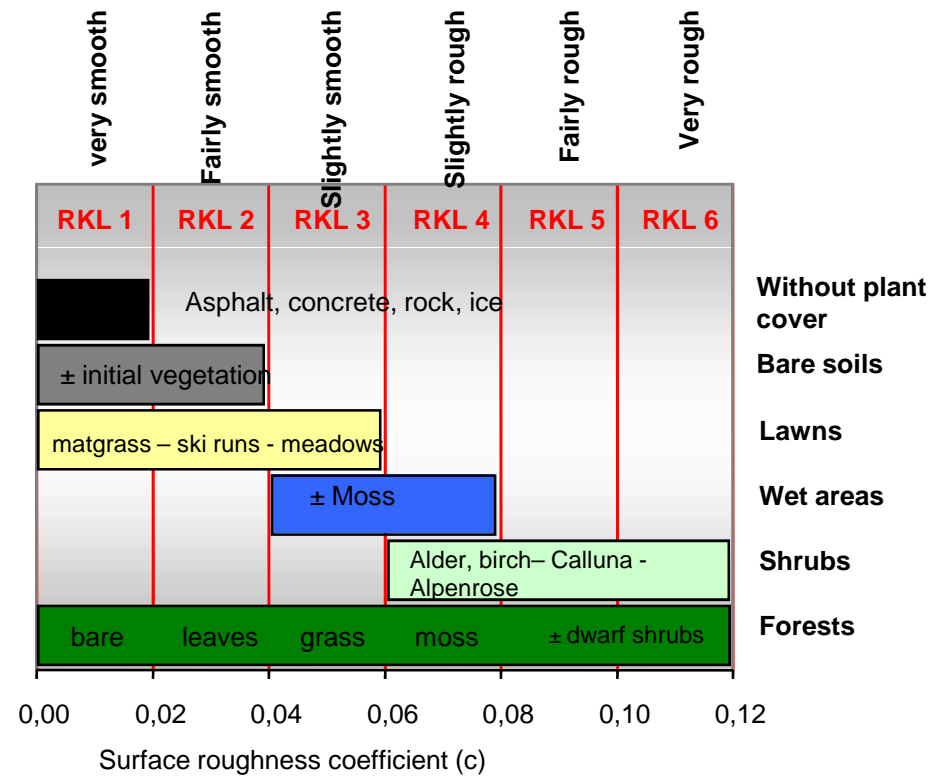
Indicators for evaluation of critical land use areas



Aim: Class of runoff coefficients

| Runoff coefficients (AKL) | Surface runoff in % of precipitation |
|---------------------------|--------------------------------------|
| 0 | 0 |
| 1 | > 0 – 10 |
| 2 | > 11 - 30 |
| 3 | > 30 - 50 |
| 4 | > 50 - 75 |
| 5 | > 75 |
| 6 | 100 |

Surface roughness class





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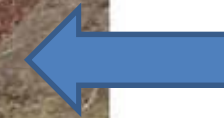
1) Indicators



Vegetation



Way and intensity of land use



Soil (physical) properties



Geological properties



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Indication by plants

Humidity
Compaction



Campanula barbata
(Bart Glockenblume)

1 - 2



Trollius europaeus
(Trollblume)

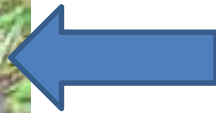
3 - 5



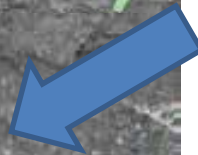
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Indicative functions of soils



Coarse grained soil – rich in skeleton –
extreme-very high conductivity



Loose soil: medium grained to fine grained
– conductivity high-medium

Dense soil: Poor in skeleton or skeleton
embedded in matrix
conductivity = low-very low





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Way and intensity of landuse:

Cropland - maize



| | | | | | | | |
|-----|---|---|---|---|---|---|---|
| AKL | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| RKL | 1 | 2 | 3 | 4 | 5 | 6 | |



Very low plant cover (<< 70%)



Very high runoff and erosion potential



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Evaluation



Differences in runoff between:

- Forests – woodland



- Grassland



- Cropland



- Sealing





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Manual for evaluation of runoff disposition

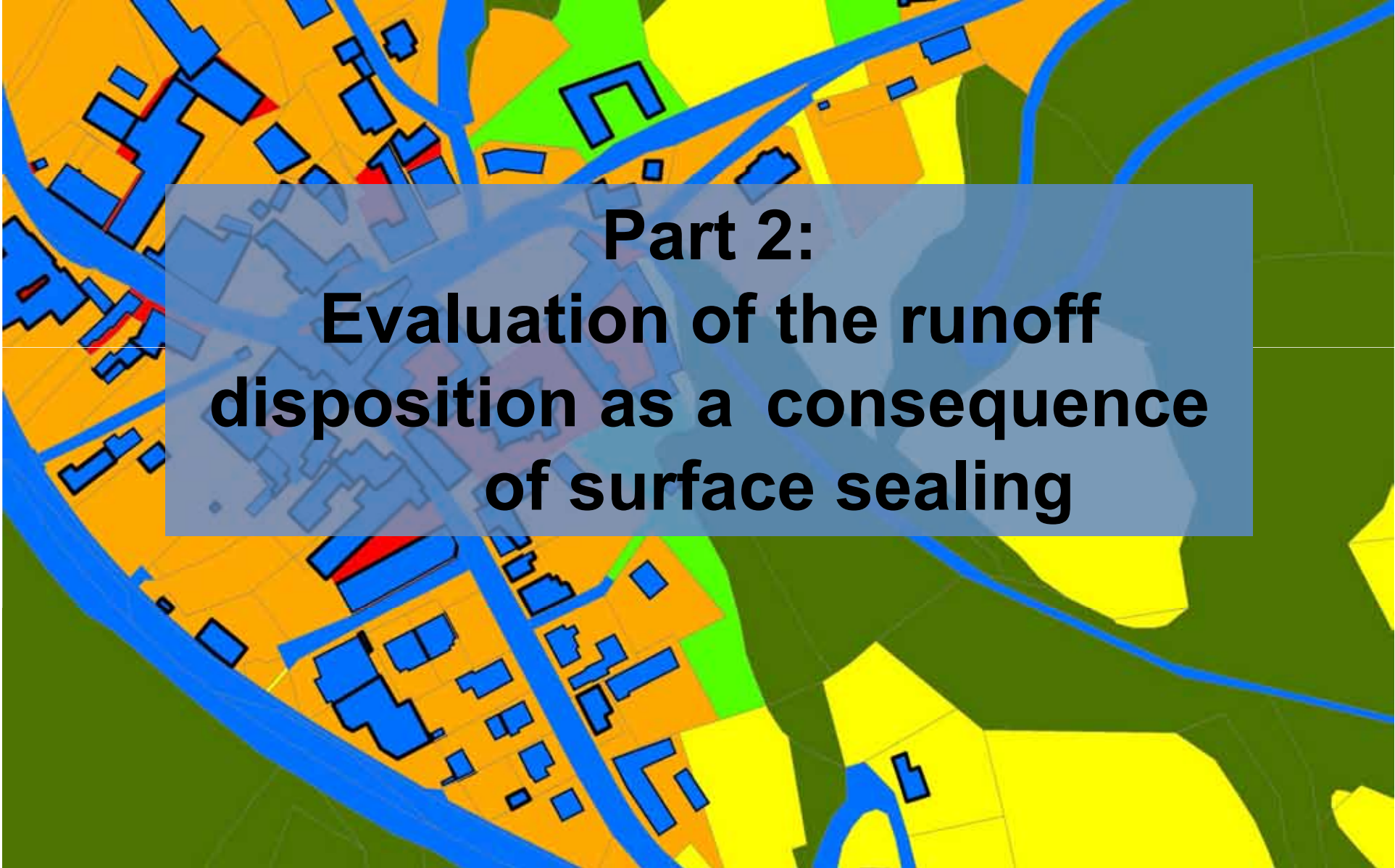
Realistic worst case = recurrent design event





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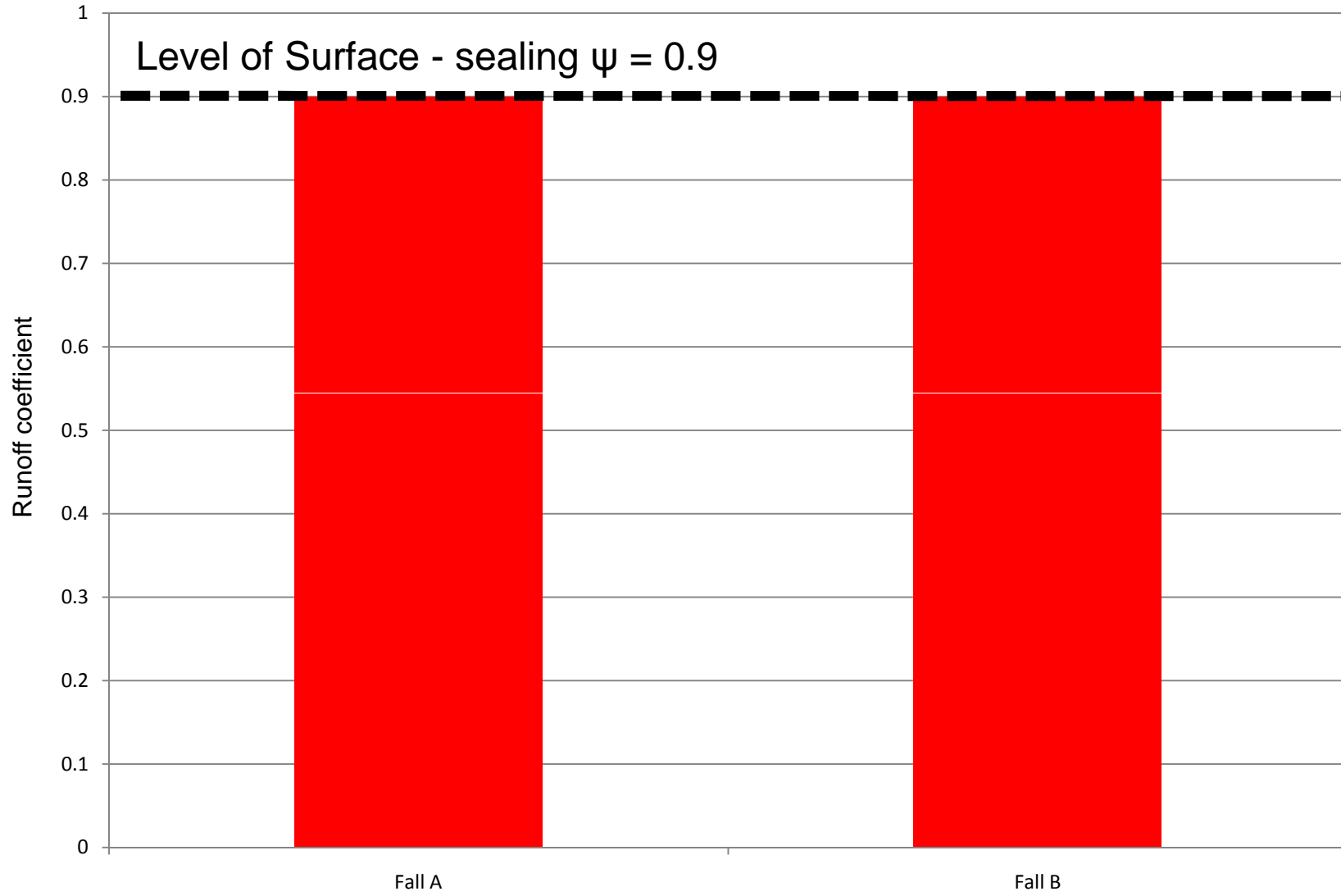


**Part 2:
Evaluation of the runoff
disposition as a consequence
of surface sealing**



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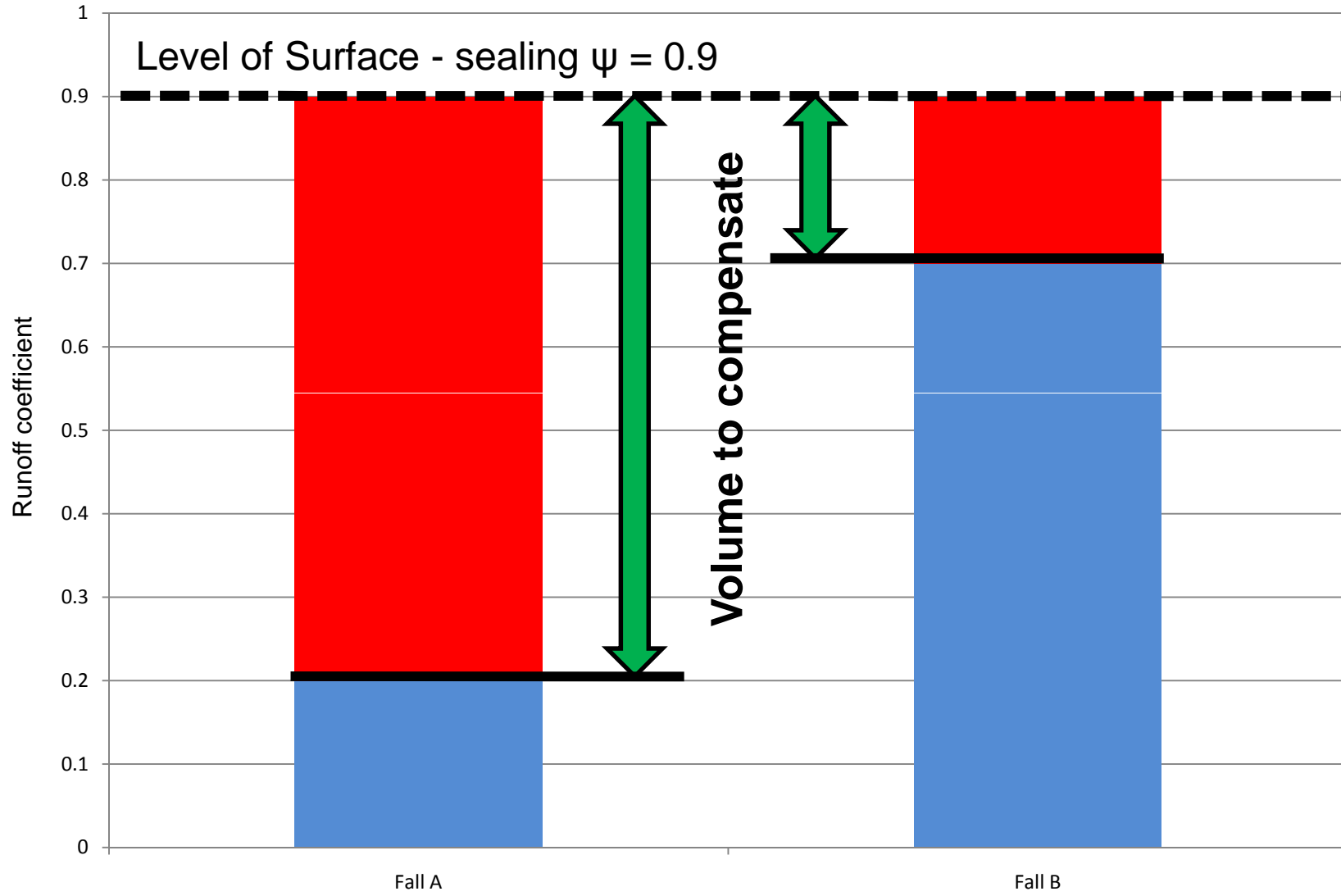
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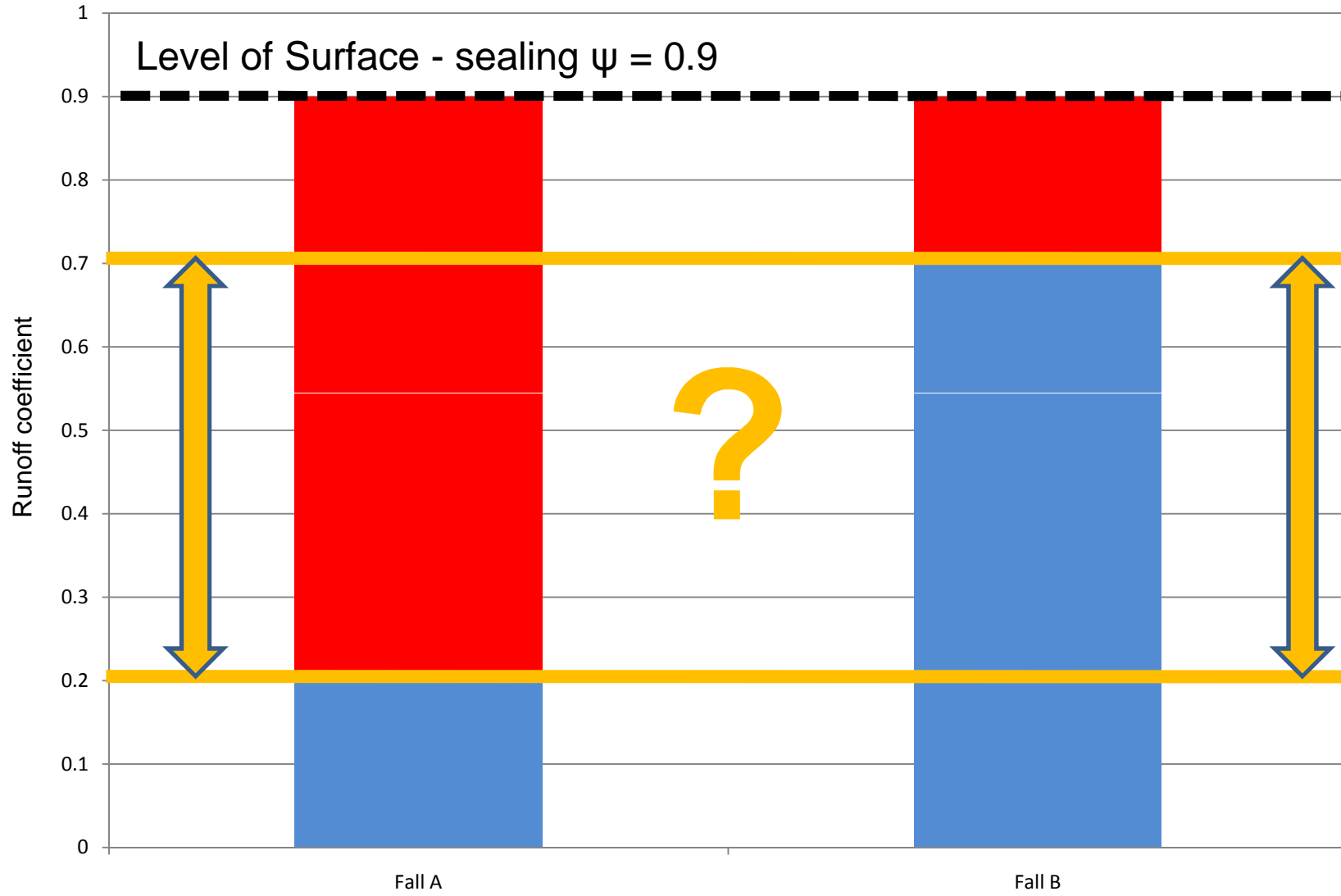
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Development of a **manual to evaluate the effects of sealing** on surface runoff during heavy rain events

Development of a **tool to calculate the increasing amount of surface runoff**



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Realistic **best** properties

- Evaluation of the maximal increasing amount of surface runoff due to changes of land-use
- Evaluation under traditional and local common cultivation and land-use
- Comprehension of the bordering and surrounding areas

Realistic **worst** properties

- Evaluation of surface runoff under realistic worst conditions
- Evaluation of the current land-use and cultivation
- Evaluation of the estimated unit



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Realistic **best** properties



St. Konrad, BF2, $\Psi_{\text{const}} = 0$

Realistic **worst** properties

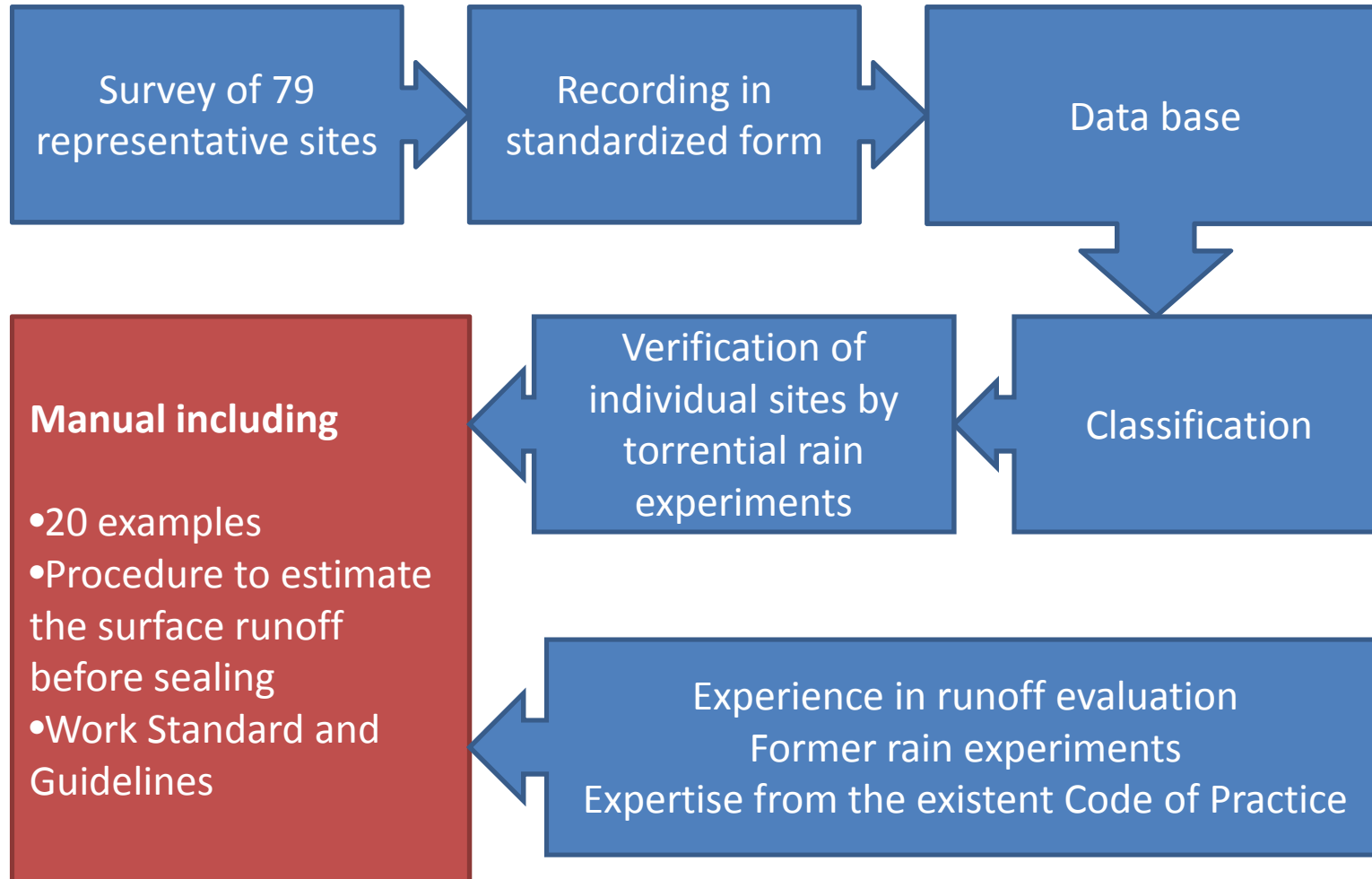


St. Konrad, BF1, $\Psi_{\text{const}} = 0.57$



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Beispielstandort 8 Mähwiese

Gruppe: Bsp (Frees, Stand, 227) | Adresse: Standort, 31 | ZL: 41120 | T: 22140 |

Vegetation
Mähwiese
Mehrschichtig
Feldwiese mit Puschelzungen

Genutz/Nutzung
Herbstwiese, mittlere Intensität

Boden
Podsolgrey, biotig,
in Trockenperioden Schwundrisiko

Bodemert
Lehm (L)

Lagerung Feldwiese/Grünland

Durchlässigkeit des Bodens gering

Geologie
Grundmoräne

Fluss Flusslinie

Festigkeit Lockerschotter, Sand

Hydrologische Bewertung

Abflusskoeffizient (AKZ)

| | | | | | | | | | |
|---|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 0 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 | 90-100 |
| | | | | | | | | | |

Näher unerschließbar, oberflächennaher Zwischenabfluss mit geringer Verzögerung

Reibungskoeffizient (REZ)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | | | | | | |

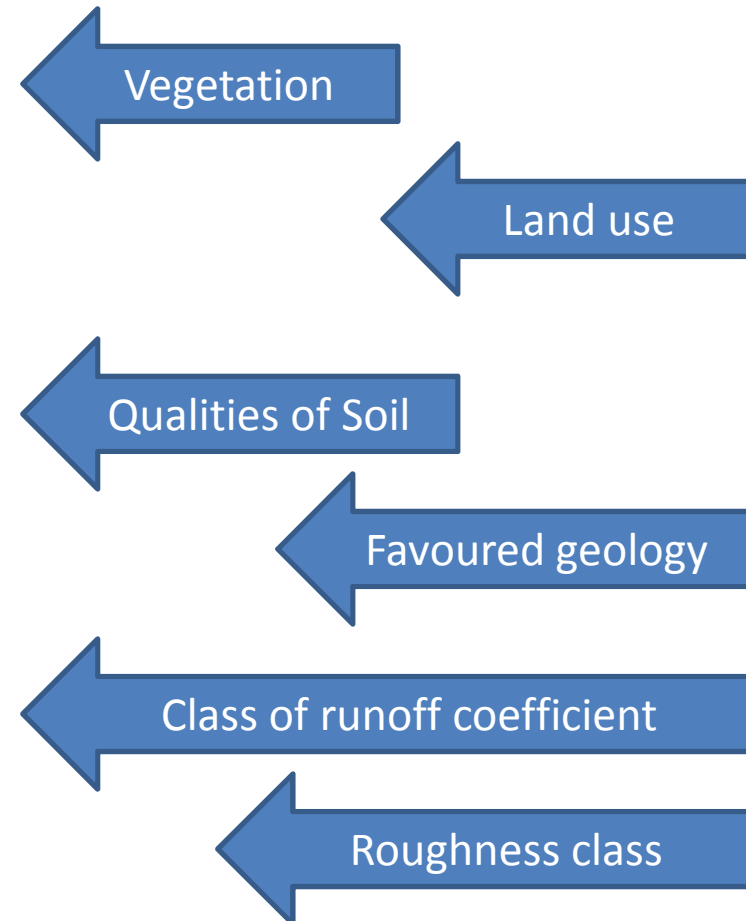
Nach Mäh (Streu) (Gras) und bei Herbstwiese
strukturelle Deckungsgrad = 70% bis 90% REZ 2

Abbildung 1: Mähwiese

Abbildung 2: Beregnung

Abbildung 3: Bodengröß

Example from manual





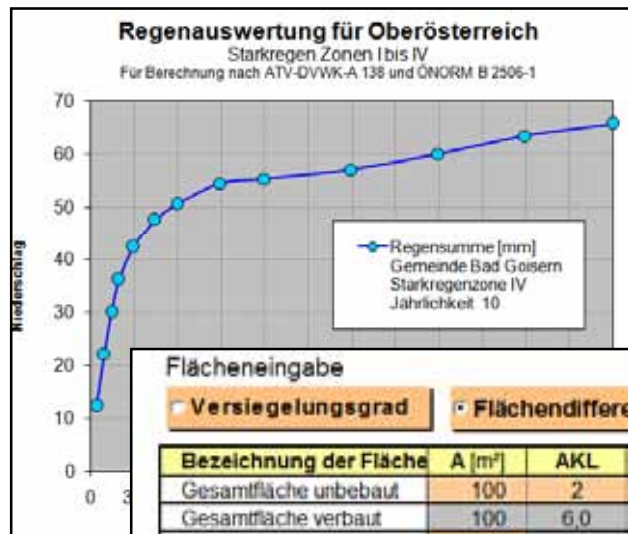
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Tool to calculate the effects of surface sealing

Precipitation + conditions before and after surface sealing + technical measures



Flächeneingabe

Versiegelungsgrad Flächendifferenzierung

| Bezeichnung der Fläche | A [m²] | AKL | RKL | Ψ |
|------------------------|--------|-----|-----|------|
| Gesamtfläche unbebaut | 100 | 2 | 4 | 0.19 |
| Gesamtfläche verbaut | 100 | 6.0 | 1.0 | 1.00 |
| Dachflächen | 100 | 6 | 1 | 1.00 |
| Asphalt, Betonflächen | | 6 | 1 | 1.00 |
| dichte Kiesflächen | | 5 | 1 | 0.85 |
| lockere Kiesflächen | | 4 | 1 | 0.63 |
| Rasengittersteine | | 4 | 2 | 0.63 |
| Sportrasen | | 4 | 2 | 0.63 |
| lockere Rasenflächen | | 3 | 3 | 0.40 |
| Gartenbeete | | 2 | 3 | 0.19 |

Versiegelungsgrad [%] 100

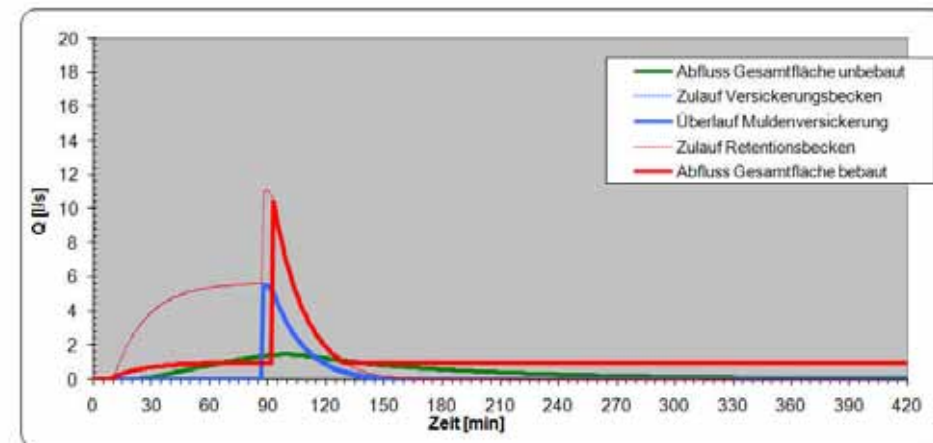
| Bezeichnung der Fläche | A [m²] | h [m] | AKL | RKL | Ψ | HQ [l/s] | V [m³] | ΔV [m³] | ED [h] |
|------------------------|--------|-------|-----------------|-----|--------|----------|--------|---------|--------|
| Gesamtfläche unbebaut | 1 000 | | 2 | 3 | 0.19 | 2 | 12 | | |
| Gesamtfläche verbaut | | | 4.5 | 2.0 | 0.74 | 15 | 49 | | |
| Fläche zu versickern | 500 | | | | | | 32 | | |
| Versickerungsmulde | 40 | 0.50 | Durchlässigkeit | | mittel | 0.2 | 20 | -12 | 47.9 |
| Fläche zu retendieren | 500 | | | | | | 28 | | |
| Retentionsbecken | 20 | 1.00 | Drossel | | | 1.0 | 20 | -8 | 9.7 |

Hochwasserspitze unbebaut (Richtwert für die Drosselung): 1.8 HQ [l/s]

Richtwert Retentionsvolumen: 28 V_{Ret} [m³] 2.8 V_{Ret} [m³/100m²]

Überlauf Versickerungsmulde! 5 HQ [l/s] 12 V [m³] 90 D [min]

Überlauf Retentionsbecken! 10 HQ [l/s] 8 V [m³] 90 D [min]



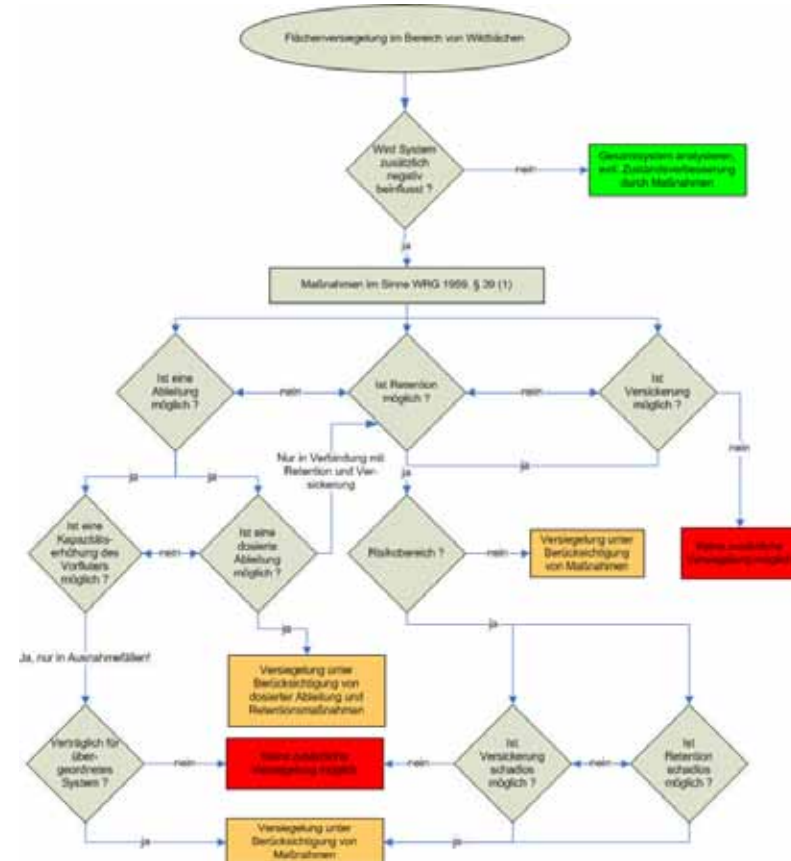
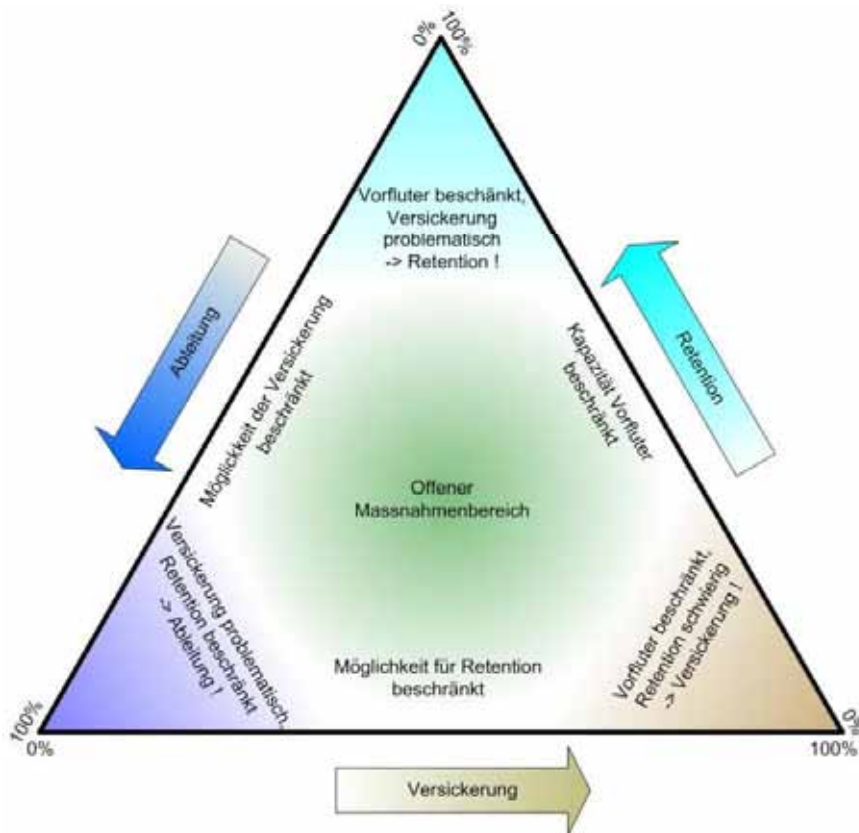


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Guidelines and Decision matrix to design technical solutions





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The prosperous cooperation with the Austrian Avalanche and Torrent Control Service (Section Upper Austria and Territorial Unit Salzkammergut) is gratefully acknowledged.

Thank You for Your Interest!