Diagnosis for buffer zone implementation

Detailed practical approach

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Foreword (1)

"What is simple is false.
What is complicated is unusable"

Paul Valery (1871 – 1945), French poet and philosopher

However, to take into account the local situation for buffer implementation - even with imprecision, for economical reason - will generally be more efficient for water protection than standard locating and sizing

Foreword (2)

What follows has be freshly prepared for the Prowadis training and has not yet be used.

Please, be indulgent and positive: your appreciation and remarks will help us to improve this presentation

A. Position of the diagnosis for buffer zone implementation in the global diagnosis process

A prerequisite in the the diagnosis for buffer implementation: the transfer diagnosis

The pesticide transfer diagnosis (presented by Arvalis) will:

- supply different maps: relief, geology, soils, drainage network, land use and type of crops, …
- identify runoff and treatment periods (and their superposition)
- charactarize the soil in term of water transfer (the "arrows") and the situations with significant runoff
- identify the priority sub-catchments in term of transfer risk

The diagnosis for buffer implementation

- **It has to complete the transfer diagnosis:**
  - with observation and mapping of obstacles for buffer efficacy (hydromorphy, short-circuits as ditches, tile drainage, …)
  - With observation and mapping of all ready existing buffers (meadows, woods, grassed strips, …)
- **It has to use the rationale fo buffer choice** (decision tree)
- ***With round trips between it and the sizing process***

What efficacy of BZ to look for?
The problem

- Efficacy: % reduction of flux after crossing the BZ (water, SS, N, P, pesticides, …)
- Pesticides : mostly linked to water (except high Koc and erosive conditions)
- Difficulty for definition of an efficacy level
  - Depends on the objective:
    - *Water supply: responsability of the water manager, resource catchment scale*
    - *Biological quality: little catchment scale*
  - Available quantitative tool at BZ scale (but not for other mitigation measures): *certainly not perfect, but existing!*
  - **No quantitative tool available to transform an objective at the catchment scale in an objective at BZ scale**

➔Proposal of a pragmatic and qualitative approach

B. The approach

Two contradictions to solve:

- action scale vs diagnosis scale
- catchment planing vs farmer's decision

1. A proposal to solve these contradictions (1)

- The scale for an action plan: **dozens or hundreds km² (or even thousands!)**
- The scale for buffer implementation: **a few km²**

What follows tries to take into account this difficulty and is based on two simple considerations:

- ***The desk design is much faster than terrain …***
- ***The acquired experience in a given area may helps considerably to progress***

➔- Round trips between desk and terrain for the area pre-planning ➔ Global action (technical and financial) plan discussed with all stakeholders

- And final validation at very local scale on the terrain for a definitive local planning (with each farmer)

1. A proposal to solve these contradictions (2)

Consequences in term of realization and training:

- **Pre-planning**: consultants with an experience in "rural engineering" – advanced training (location and sizing)
- **Local adaptation** in relation with the farmers: "proximity" advisers

2. Precision exigence for data acquisition

- The different data have various degrees of exigence for acquisition:
  - Climate is unique, except on very wide areas (or very hilly)
  - Intercepted impluvium area (or field length), slope or short-circuits are very local, …
- The local data can stand a remote acquisition (impluvium area, length …) or require terrain observation (hydromorphy, short circuit, except large ditches, …)
- **As for transfer diagnosis, water movement is the key of buffer diagnosis: its understanding by the mean of a typological approach (strongly linked to soil typology) may considerably limit the time consumed on the terrain**

3. Resource catchment and diagnosis catchment

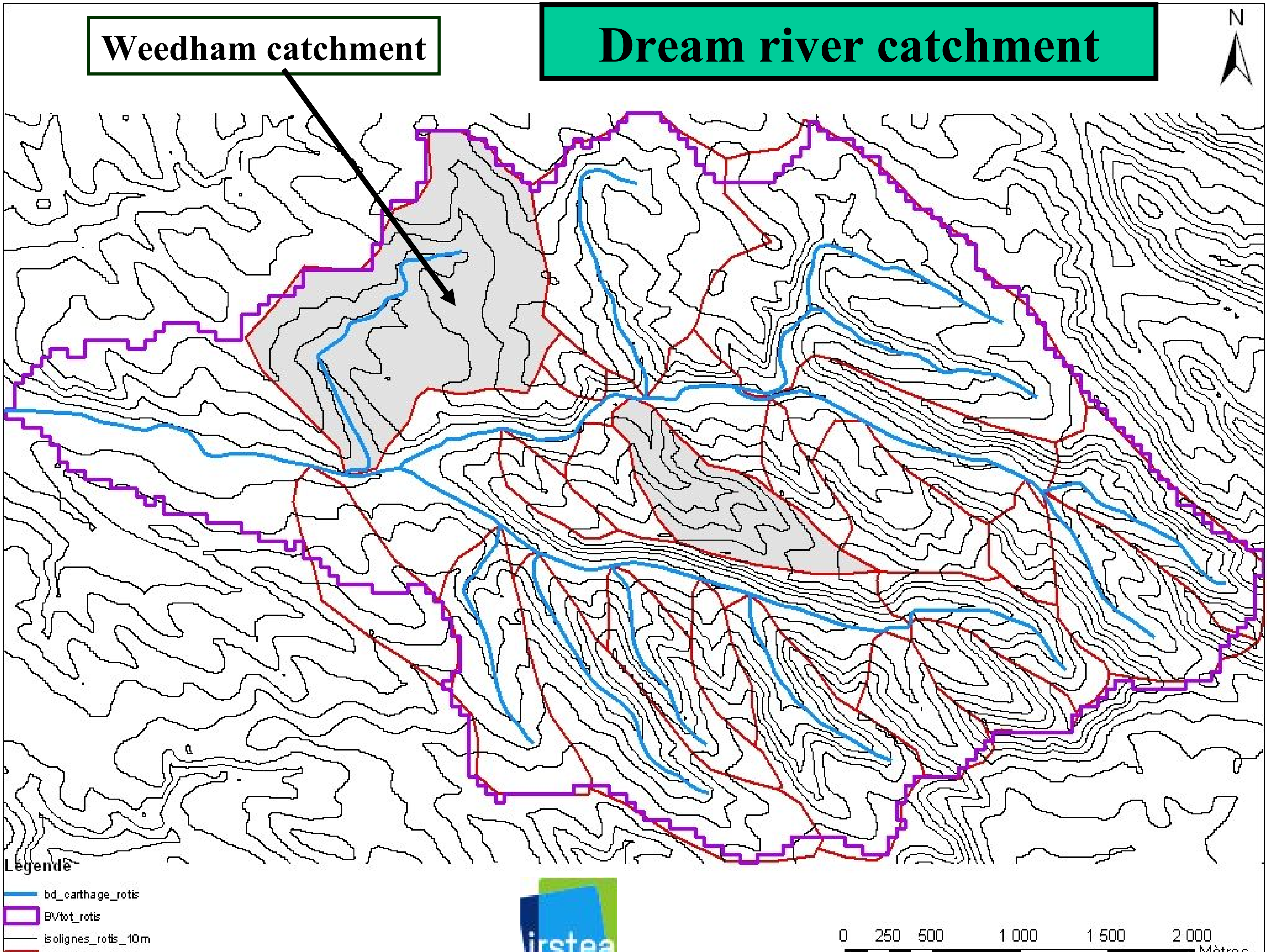
- Resource catchment (RC): action plan scale, **~10 to ~1000 km²**

  Diagnosis catchment (DC) : diagnosis scale, **a few km²**
- Little RC: **directly shared in DCs**

  Medium RC: one **intermediary catchment** (IC) level

  Large RC: **two IC levels**

[orders of magnitude, to be adapted to the heterogeneity]



Weedham catchment
Dream river catchment
N
Légende
bd_carthage_rotis
BVtot_rotis
isolignes_rotis_10m
0 250 500 1 000 1 500 2 000
Mètres

4. Diagnosis process (1)

On RC or IC

- 1) Riparian diagnosis along the streams (ST, permanent and intermittent): a priori, along the water courses of the whole RC if small (or along ST of the IC)
- 2) Identify a typical DC (or two)

On the DC(s) [see examples]

- 3) Superpose on a map : relief, soil-subsoil systems (interpreted in term of water movement type), land use (drainage network, crops, meadows, grass strips, forests, roads and paths, …)
- 4) assess the efficacy of **existing** buffers with the sizing tool *[can also be performed in 11)]*
- 5) understand the water movement on the slopes of the DC
- 6) implement buffers "on the desk"
- 7) **Terrain: verification of all precedent steps**

4. Diagnosis process (2)

- 8) Return to the desk and validation/corrections thanks to the terrain observations

Possible break here to implement buffers at this scale: validation of the definitive plan in relation with farmers – May be recommended in case of a first experience

On RC or IC

- 9) Desk extrapolation to the whole RC (or IC)
- 10) Verification rally in the RC (or IC): car + punctual stops (with the auger!)
- 11) Definitive pre-planning for the RC or IC
  - BZ type and localization
  - Sizing

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4. Diagnosis process (3)

After the pre-planning

Possible break here to implement buffers at this scale: validation of the definitive plan in relation with farmers –Recommended if BZ implementation is already experimented, but not yet a routine

- 12) From the IC to the medium or large RC : iteration of the same process
  Acquired experience will accelerate the process

C. Efficacy and sizing

What efficacy of BZ to look for?
The problem

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➔Proposal of a pragmatic and qualitative approach

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What efficacy of BZ to look for?
A pragmatic approach

1°) Identification of a flux reduction on the RC (water manager) – eventually with seasonal adjustment

2°) Spatial adjustment between DC (taken into account the level of transfer risk) – and intermediary steps if IC (large catchments)

3°) Adapt in the DC accounting the risk level of fields or groups of fields (position and size)

Example

- Global efficacy for the DC: 70%
- Diffuse transfer along a permanent stream: 80 %
- Transfer to a temporary stream in non flowing period: 50%
- Interception of runoff by a downhill field: 30%
- ….

Iteration with the sizing tool: if sizing of the BZ is not admissible, propose complementary in-field mitigation practices (but qualitative!)

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C. examples

The dream river catchment

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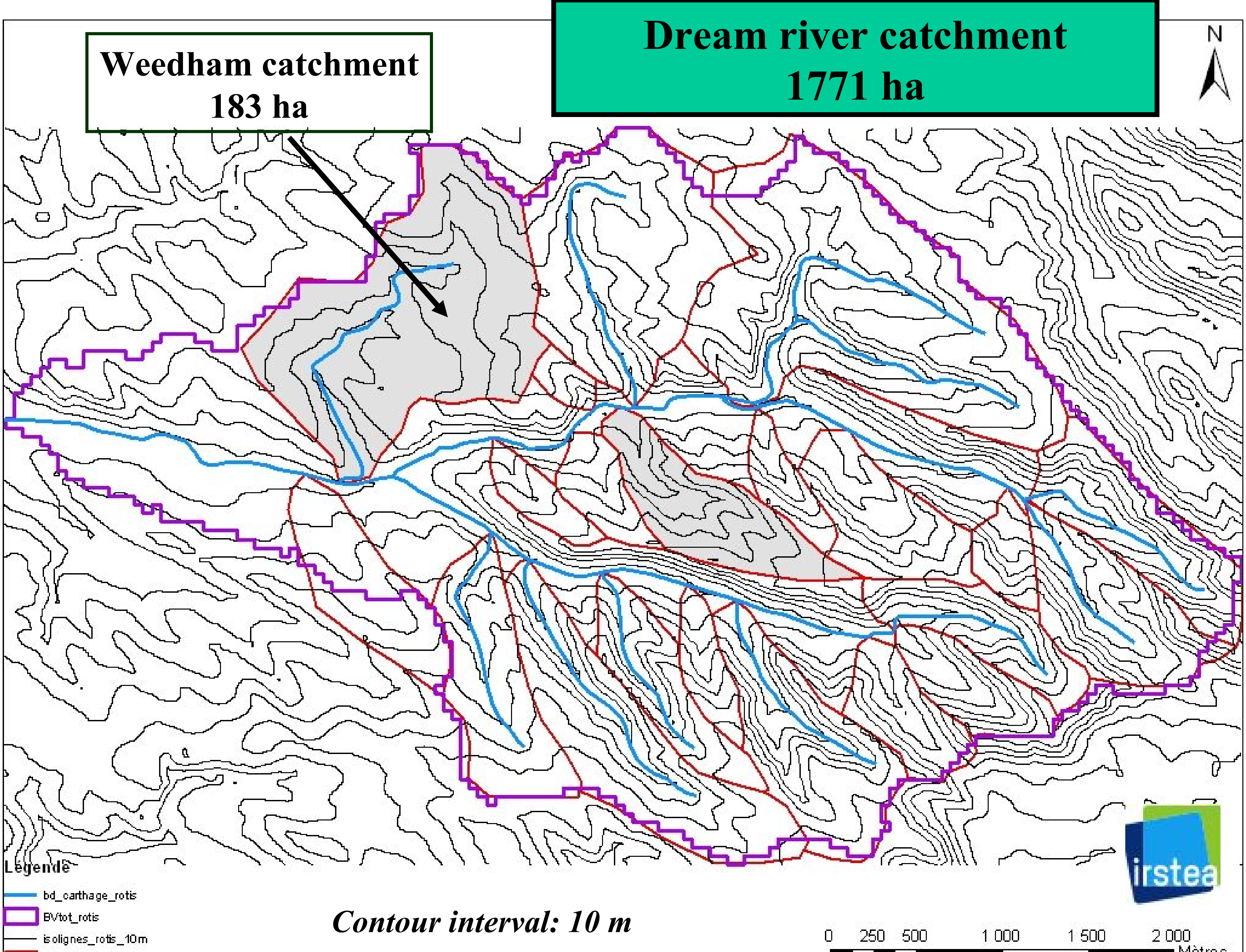
The design of the examples

- A real DEM (or nearly: intrapolation from 50m to 5/10m), common to the different cases
- Annual crops, some meadows and woods, no perennial crops: also common to all cases
- Two fictive climatic scenarios
- Two fictive geo-pedological scenarios

➔ ***Four study cases***

Not the real life, but realistic situations:

basis to adapt the rationale to real catchments


Weedham catchment
183 ha
Dream river catchment
1771 ha
N
Légende
bd_carthage_rotis
BVtot_rotis
isolignes_rotis_10m
Contour interval: 10 m
0 250 500 1 000 1 500 2 000
Mètres

The climatic scenarios

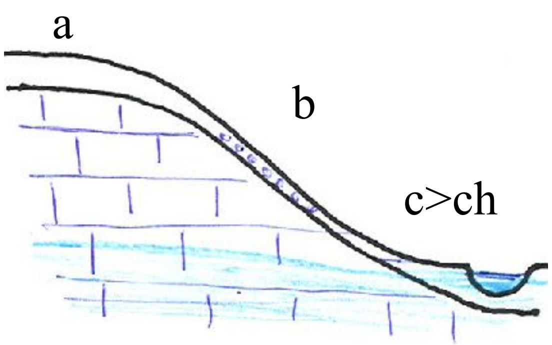
- **C1: "oceanic" climate :**
  - Rainfalls more or less rather well shared along the year
  - Winter mostly rainy

- **C2: "mediterranean" climate**
  - Dry winter and summer
  - Rainy spring and autumn

Very rough characterization, but sufficient for the examples

The geo-pedological scenarios (1)

- **S1: silty "healthy" (oxygenated all the year) soil on a calcareous permeable substrate**
  - a: deep soil (> 80 cm), on plateaus and top of hills, highly capping; hortonian runoff generating and erosive: erosion has to be controlled, mostly due to spring intense rainfalls
  - b: shallow silty soils, variable depth (to 20 cm)
  - c: silty-clayey alluvial soils in valleys
  - Ch: hydromorphic variante of c, along water courses



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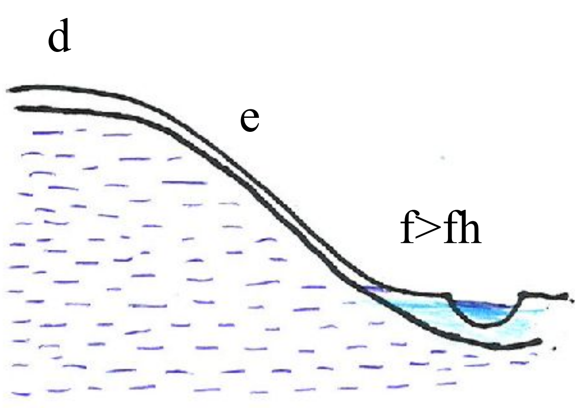
The geo-pedological scenarios (2)

- **S2: silty temporary hydromorphic soil on an impermeable substrate**
  - d: deep soil (> 80 cm), on plateaus and top of hills, medium capping, hortonian and saturation runoff generating; pseudo-gley (brown-red spots) appearing at ~ 50 cm; possible presence of tile drainage
  - e: silty sloppy shallow soils, hydromorphy inverse of slope
  - f: silty-clayey alluvial soils in valleys
  - fh: hydromorphic variante of f, along water courses



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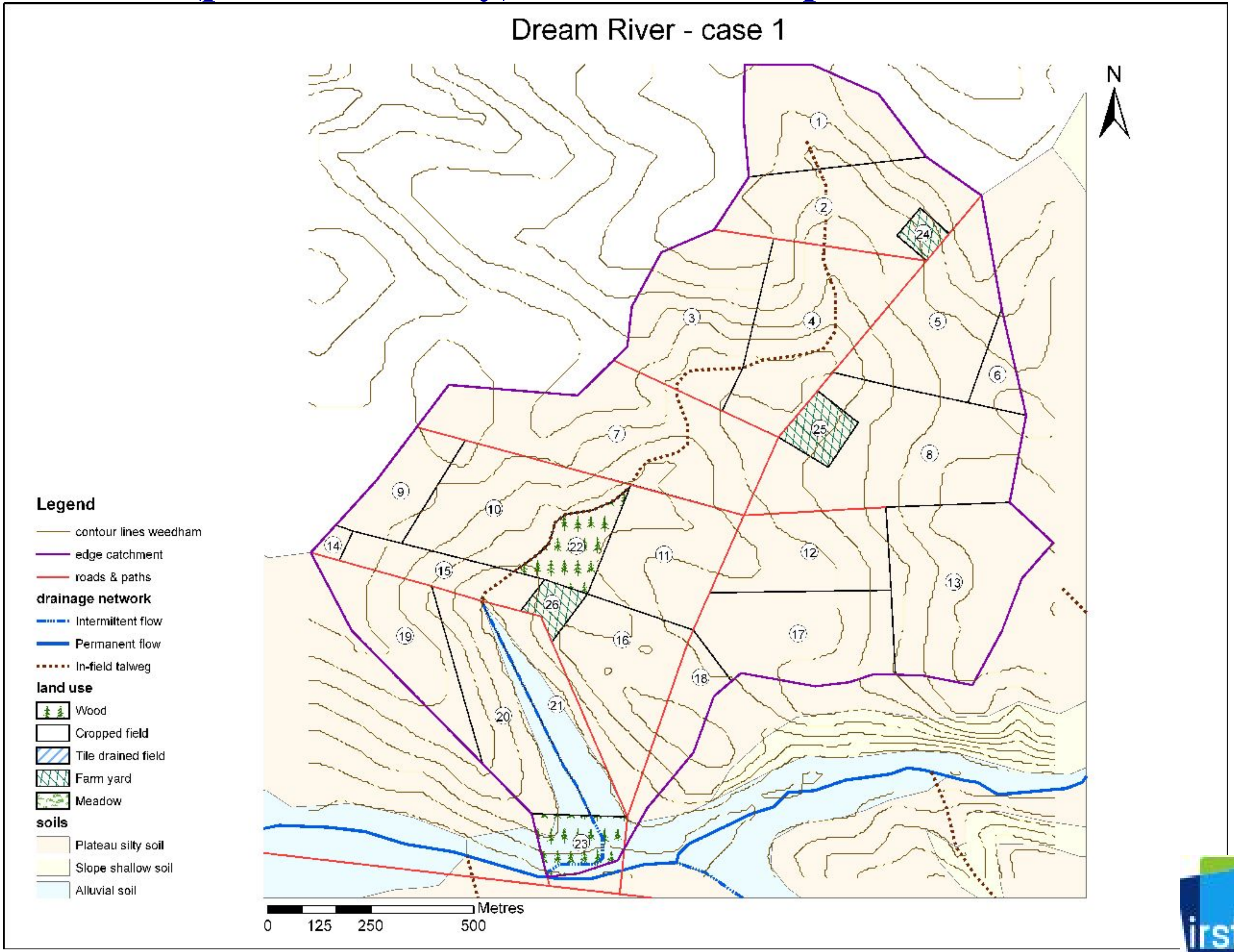
Result: four study cases

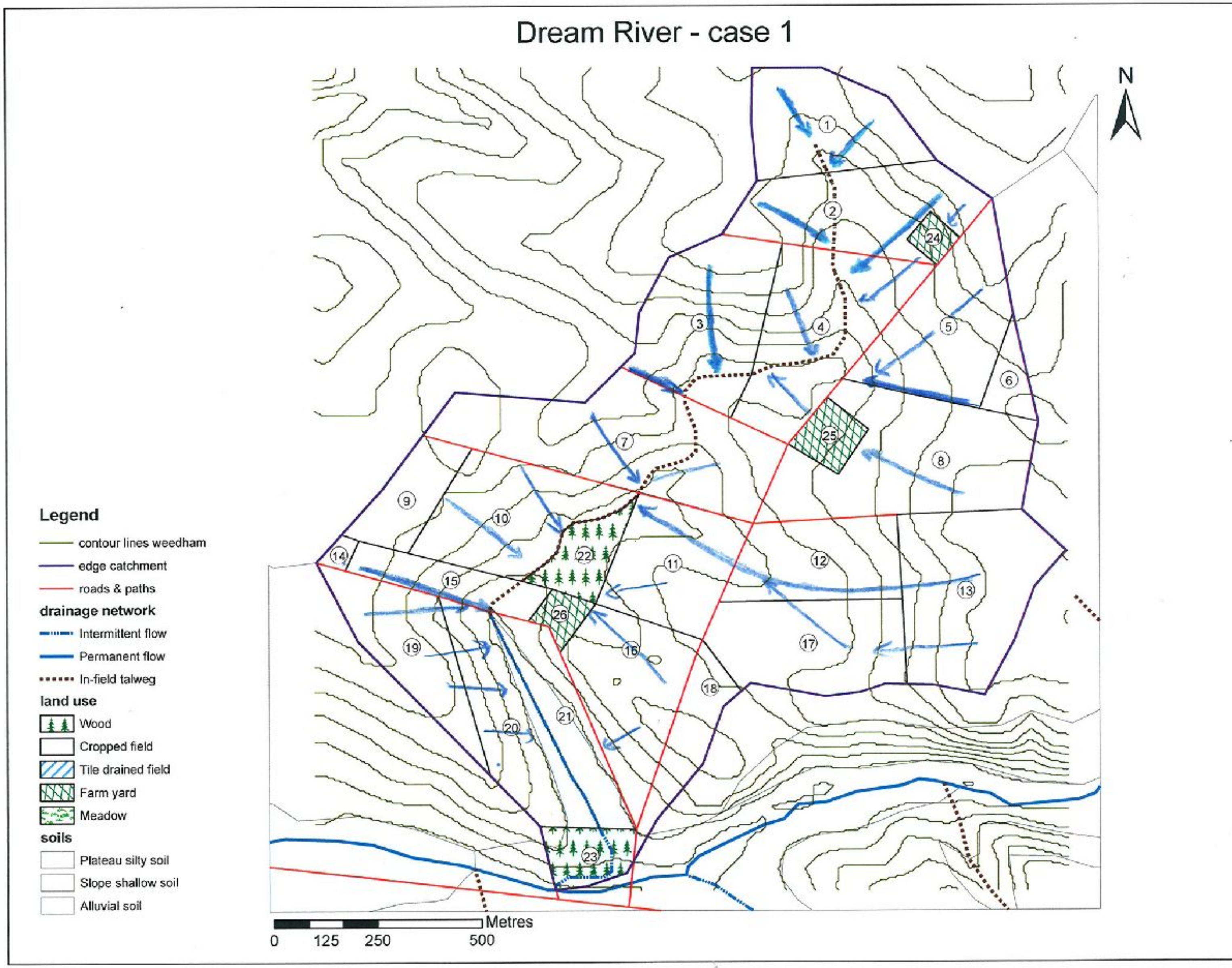
- **Case 1: S1+C2 "permeable dry"**
- **Case 2: S1+C1 "permeable wet"**
- **Case 3: S2+C2 "impermeable dry"**
- **Case 4: C1+S2 "impermeable wet"**

- **Variations according to the case**
  - Status of **drainage network** (permanent ST, intermittent ST, cropped talwegs)
  - **Size of the fields**
  - **Proportion of non cropped land** (meadows, woods)

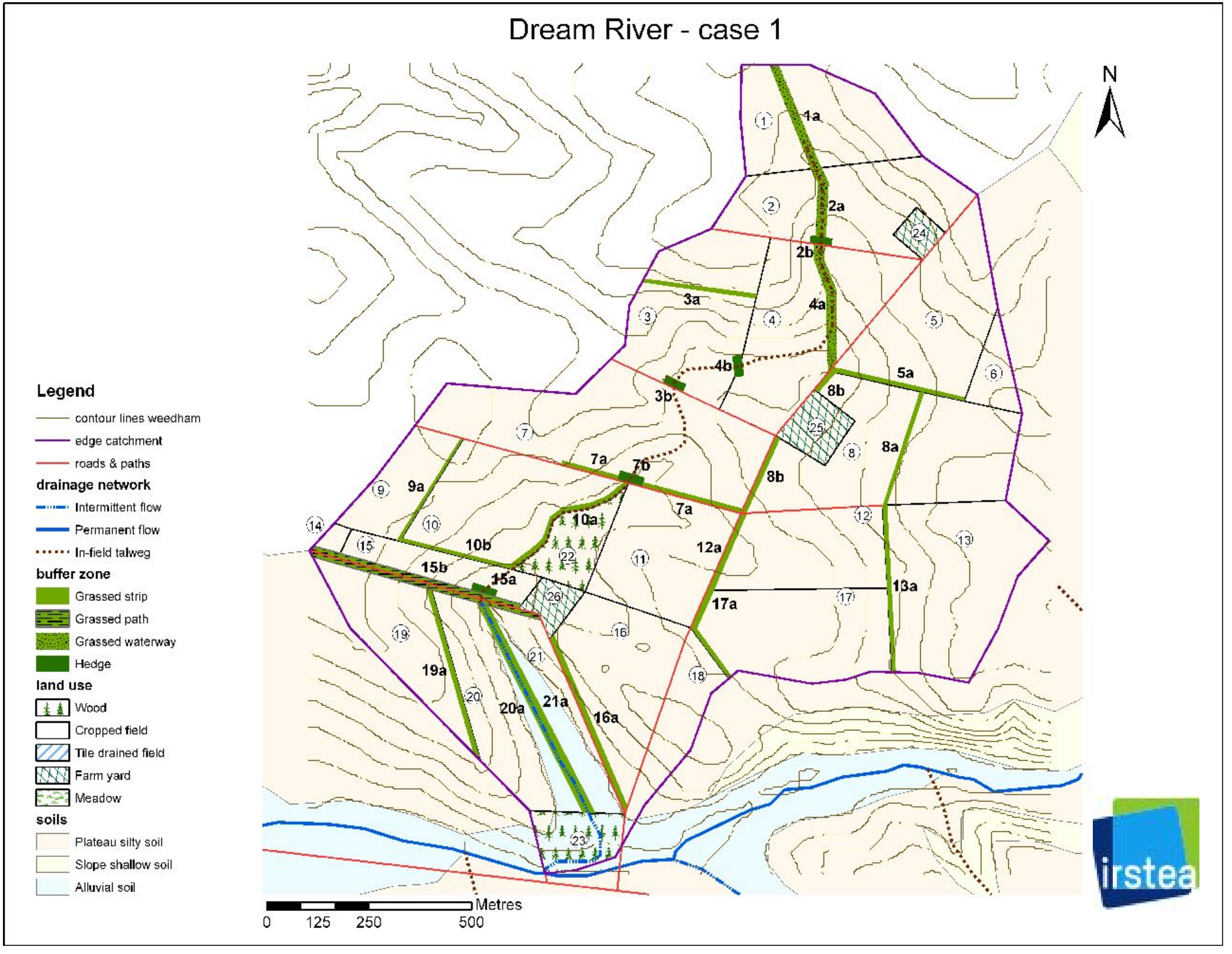
Case 1 (permeable dry) before BZ implementation



Case 1 (permeable dry): main waterways



Case 1 (permeable dry) after BZ implementation



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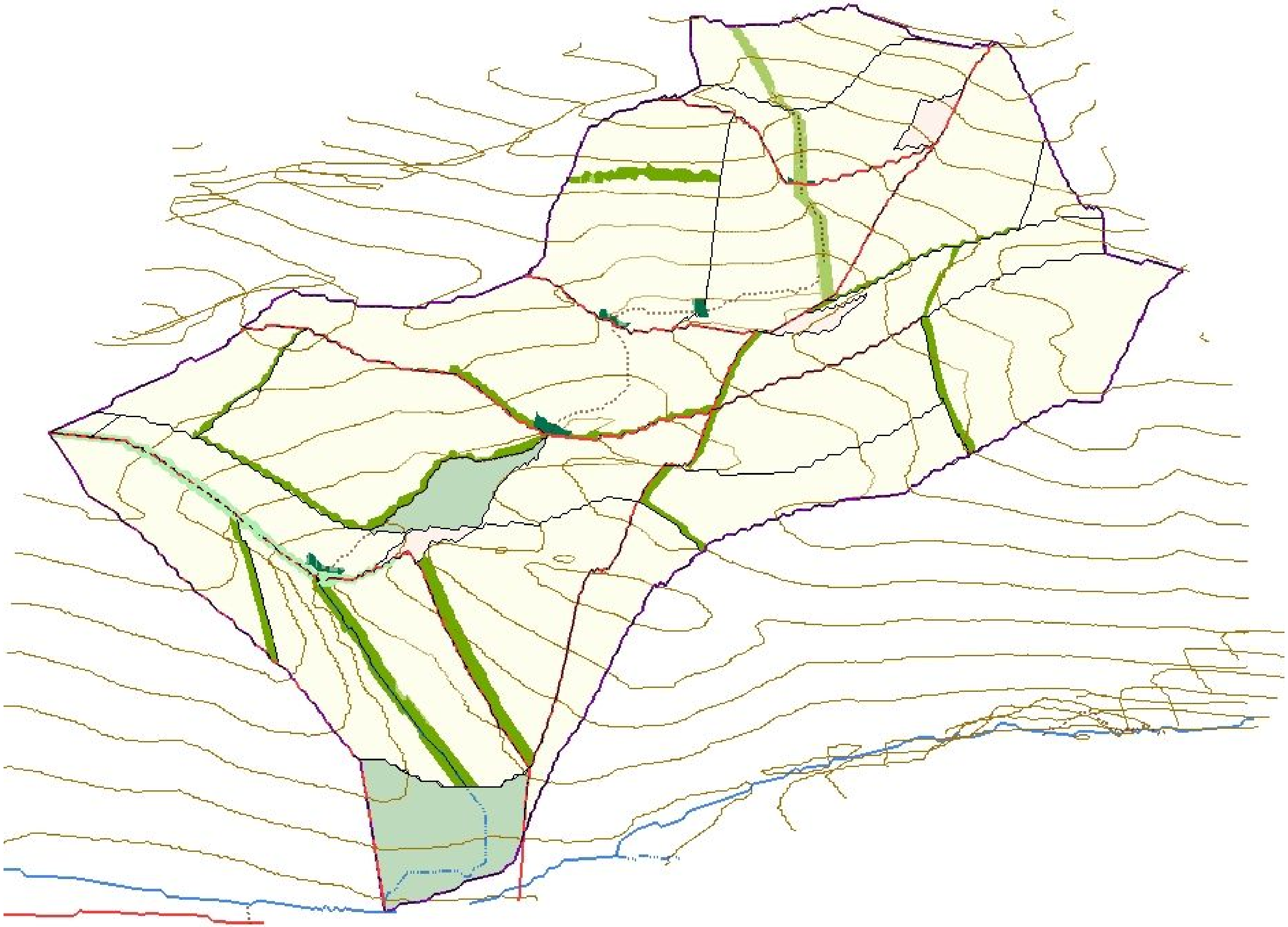
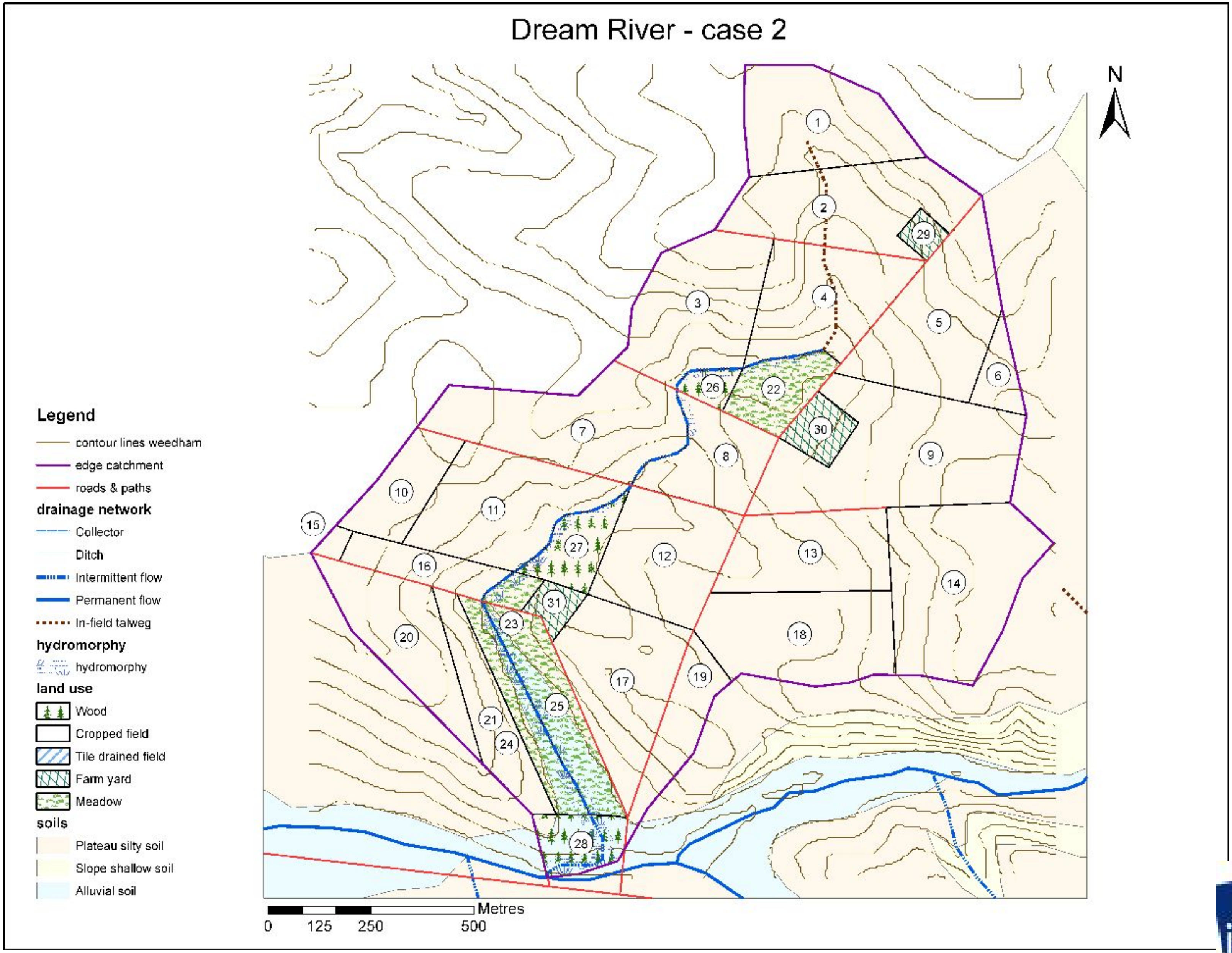
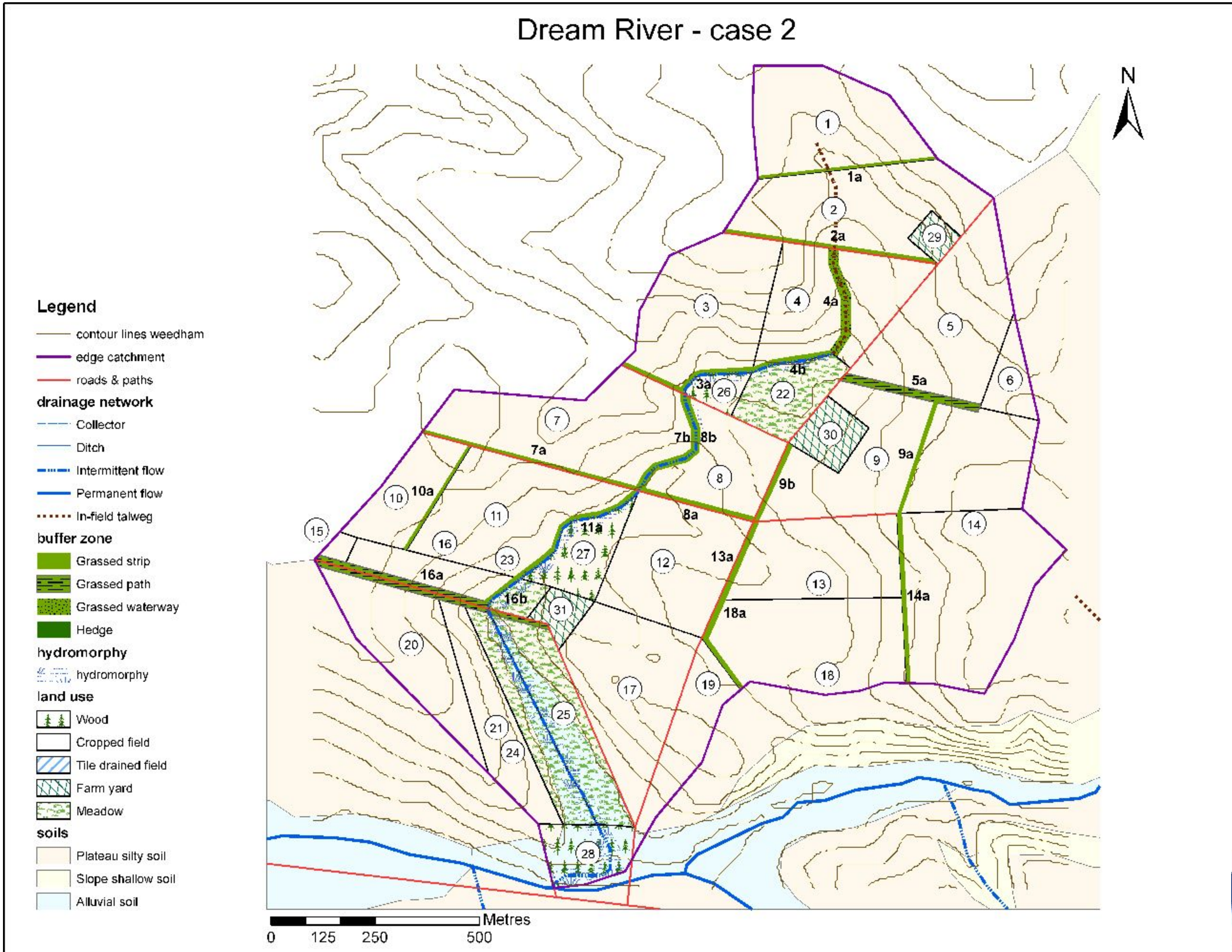
Case 1 (permeable dry) after BZ implementation - 3D



Case 2 (permeable wet) before BZ implementation



Case 2 (permeable wet) after BZ implementation



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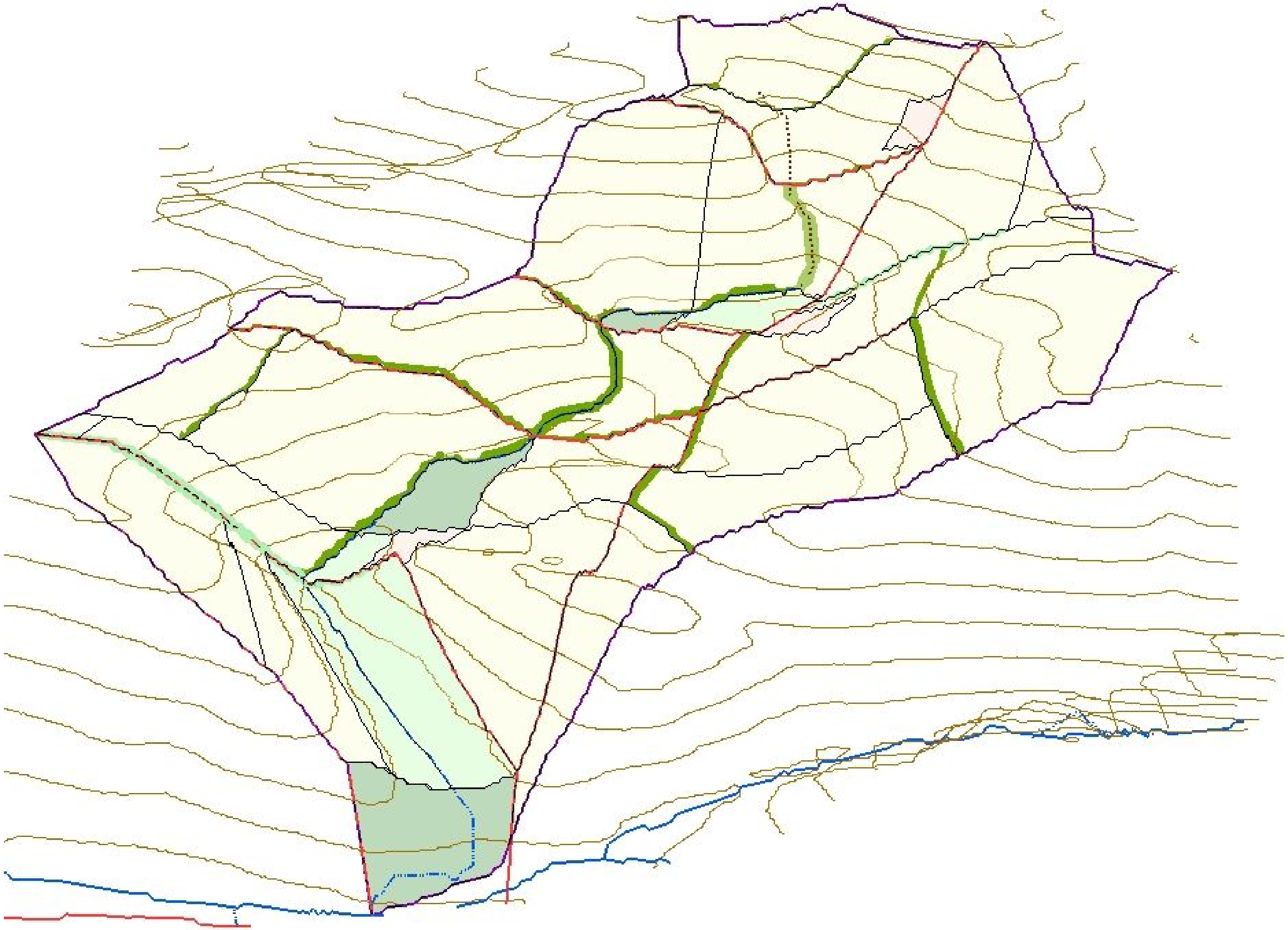
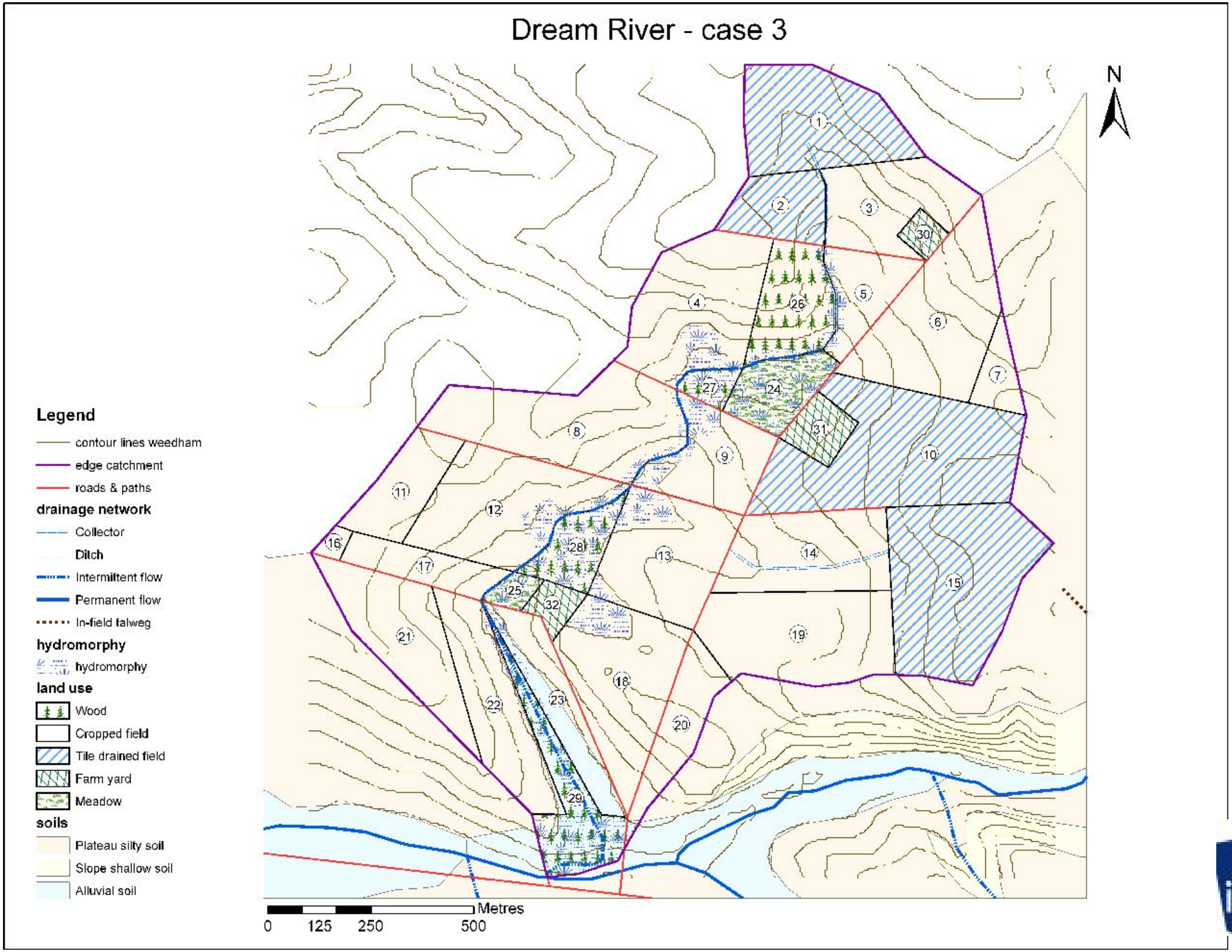
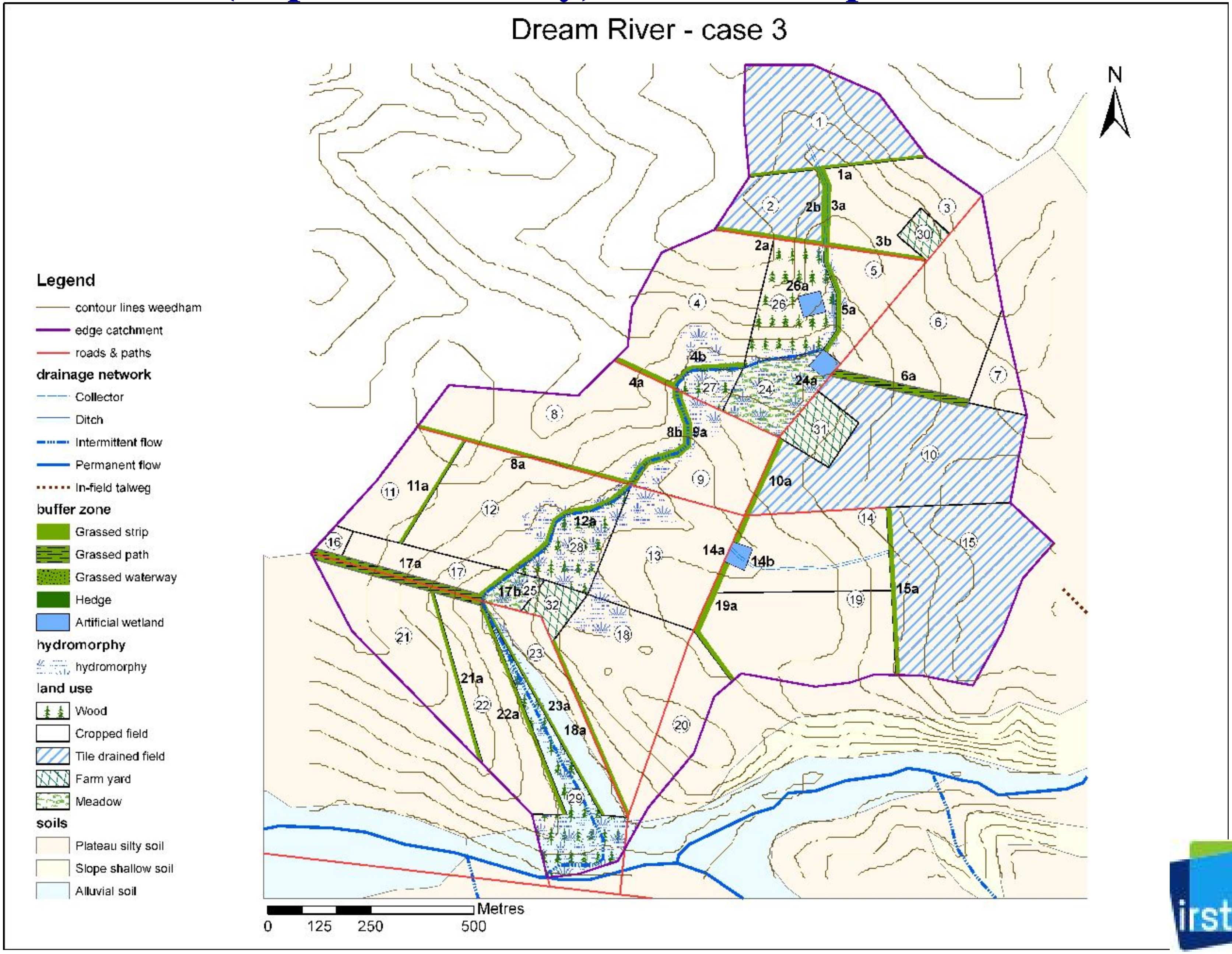
Case 2 (permeable wet) after BZ implementation - 3D



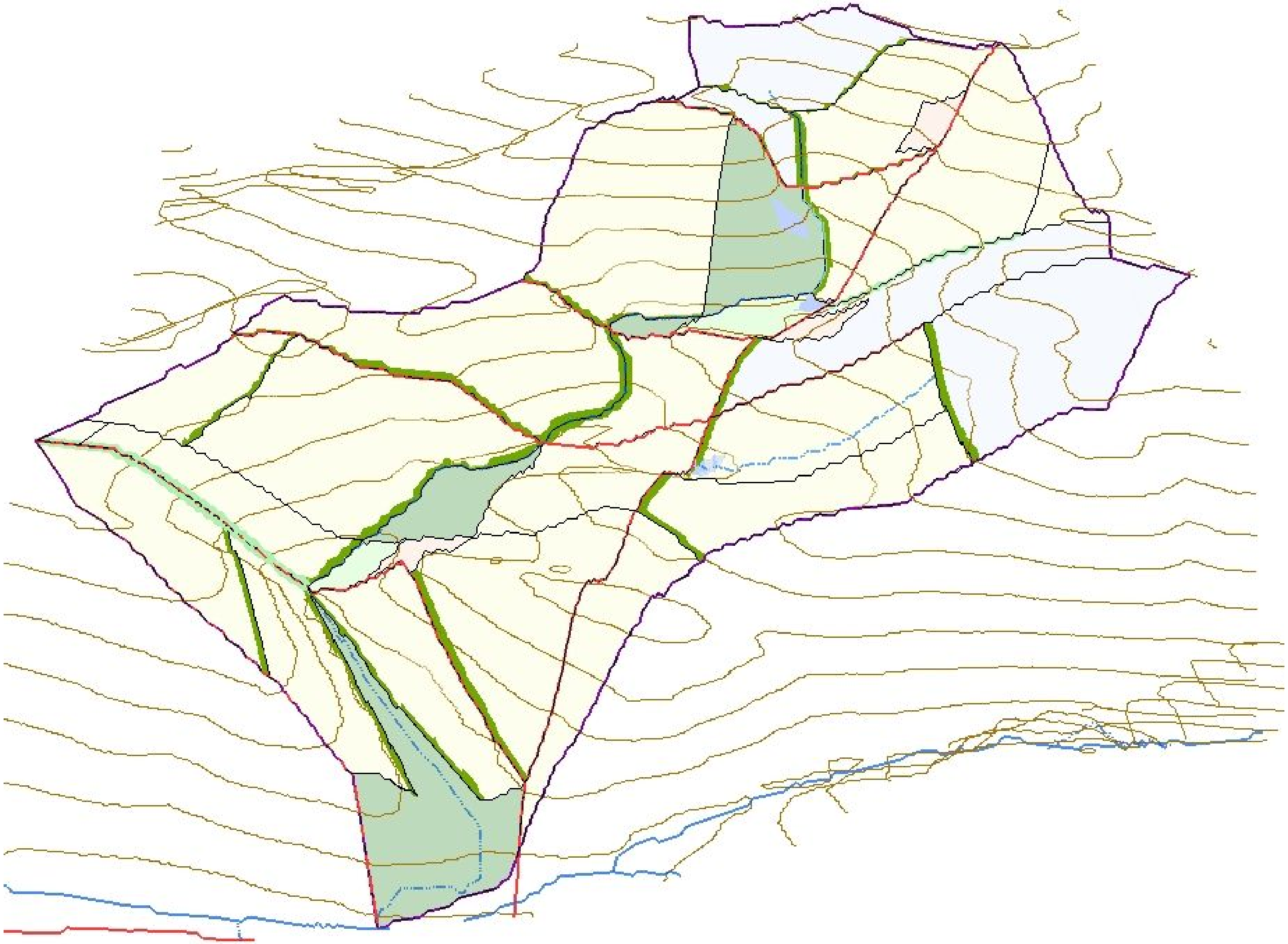
Case 3 (impermeable dry) before BZ implementation



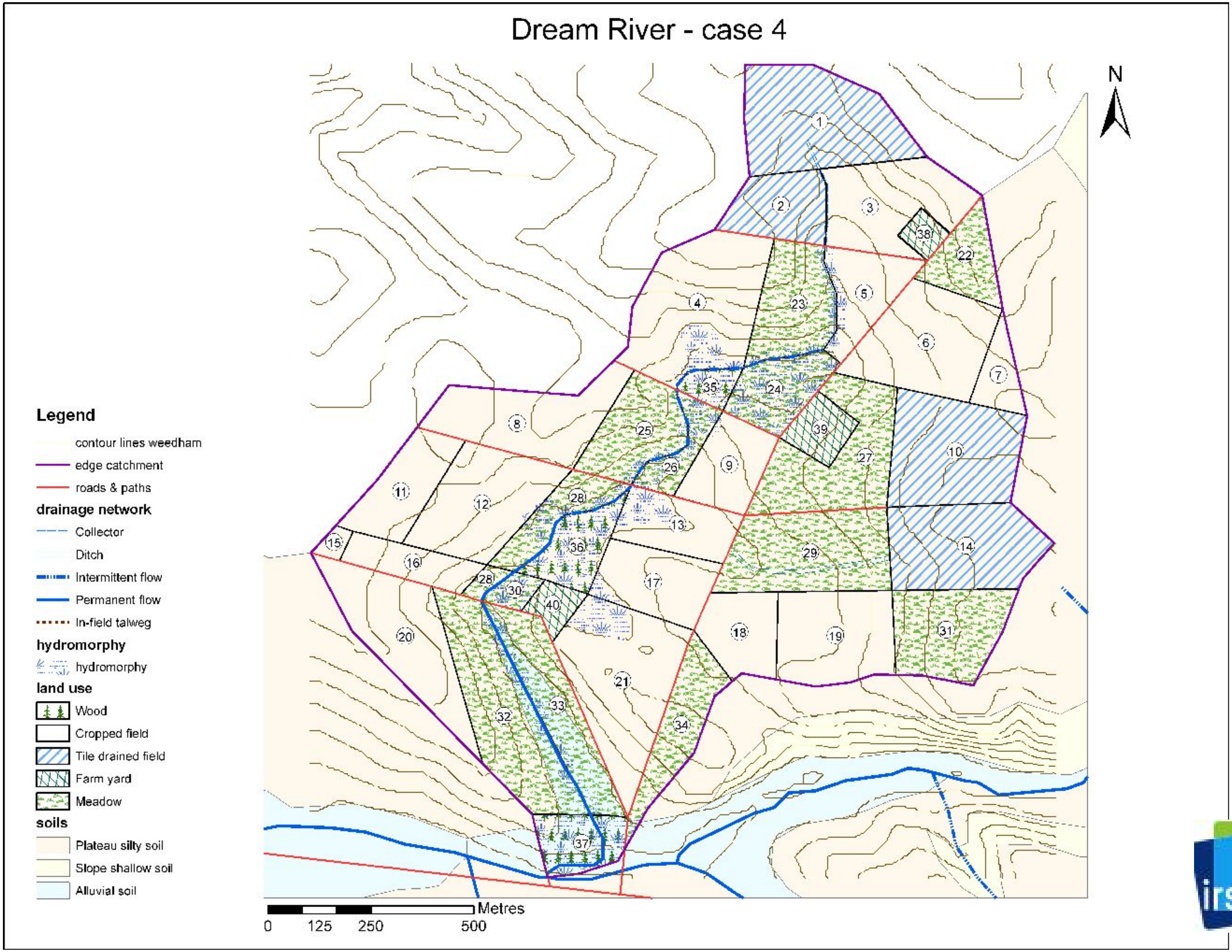
Case 3 (impermeable dry) after BZ implementation



Case 3 (impermeable dry) after BZ implementation - 3D



Case 4 (impermeable wet) before BZ implementation



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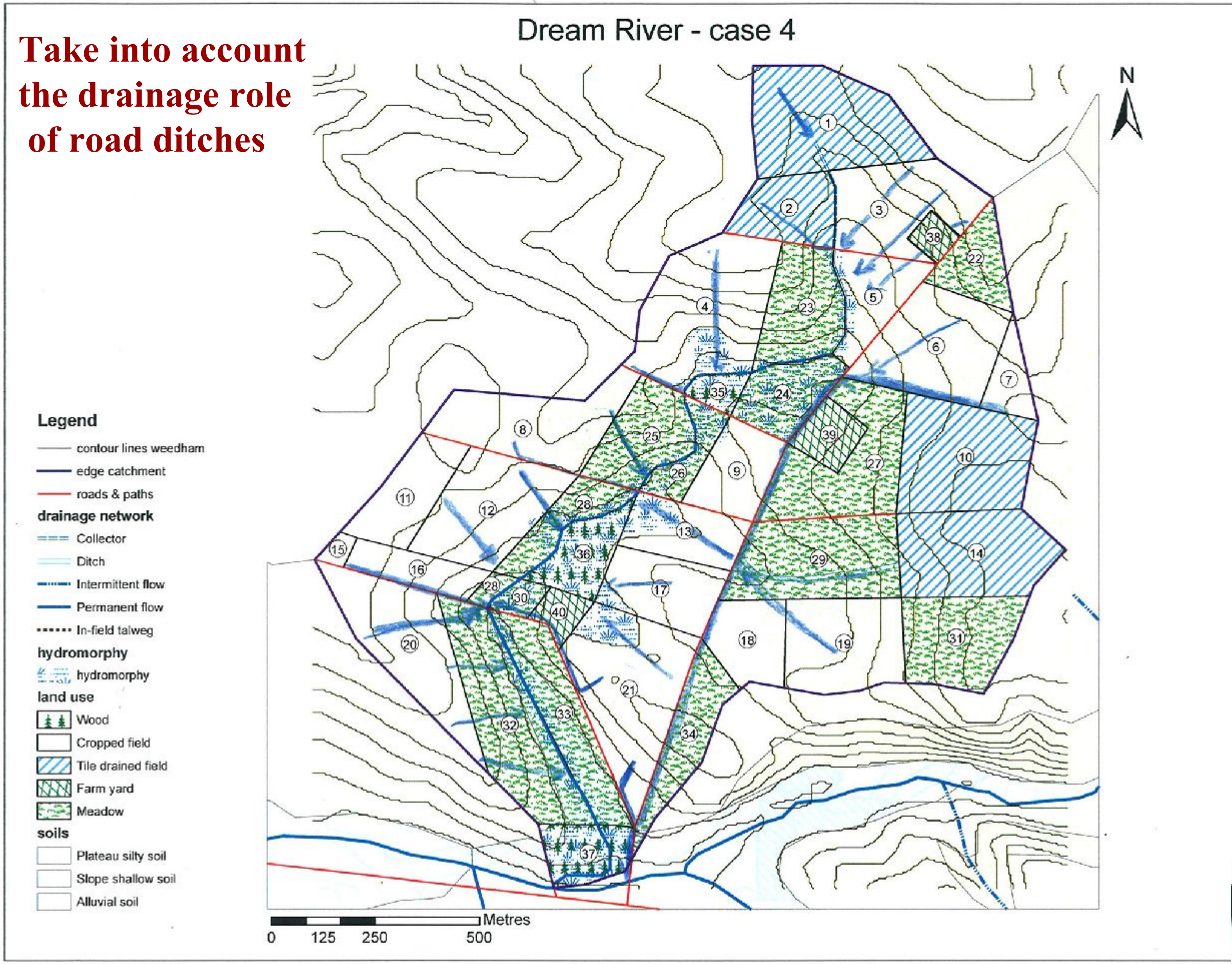
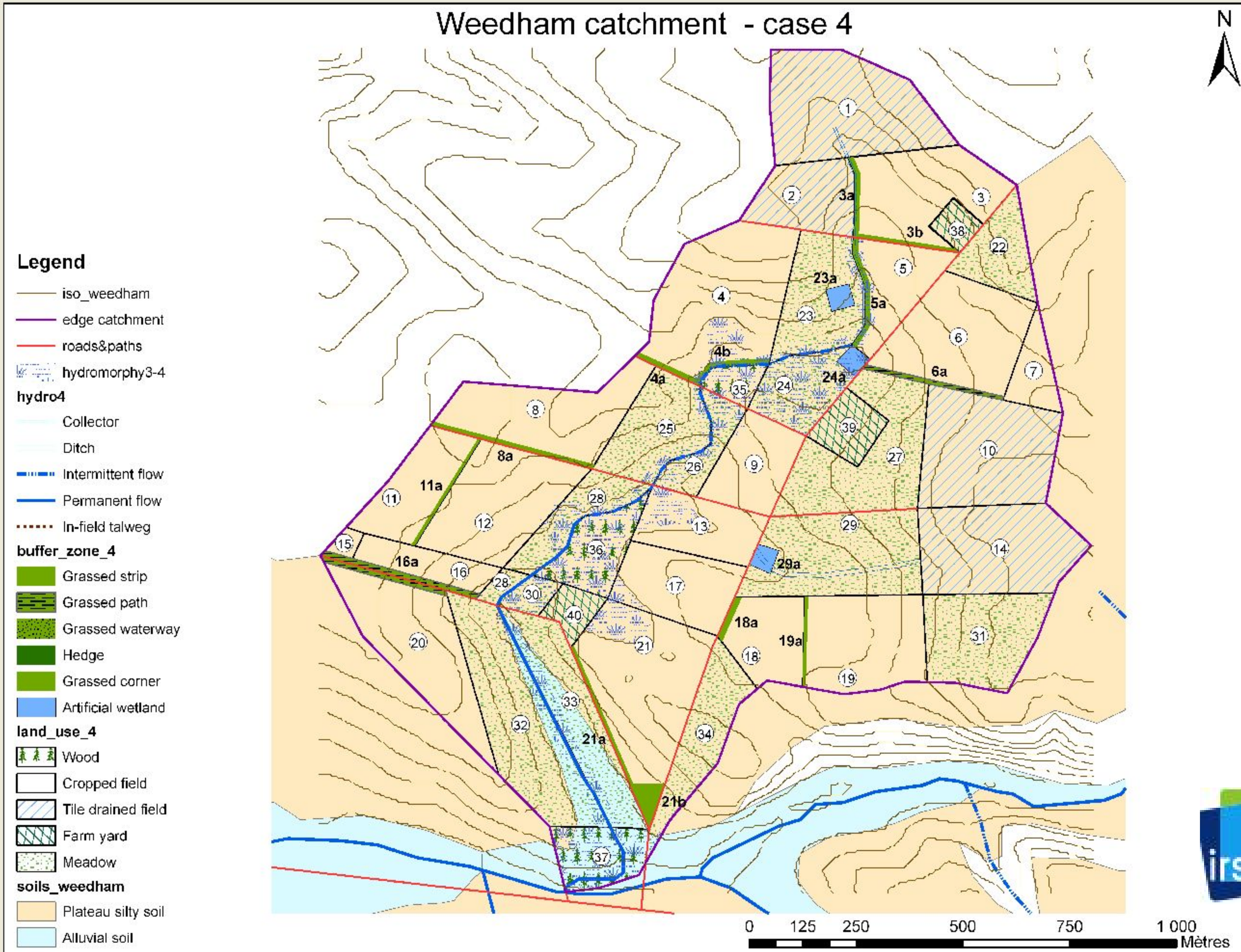
Case 4 (impermeable wet) : main waterways

Take into account the drainage role of road ditches



Case 4 (impermeable wet) after BZ implementation



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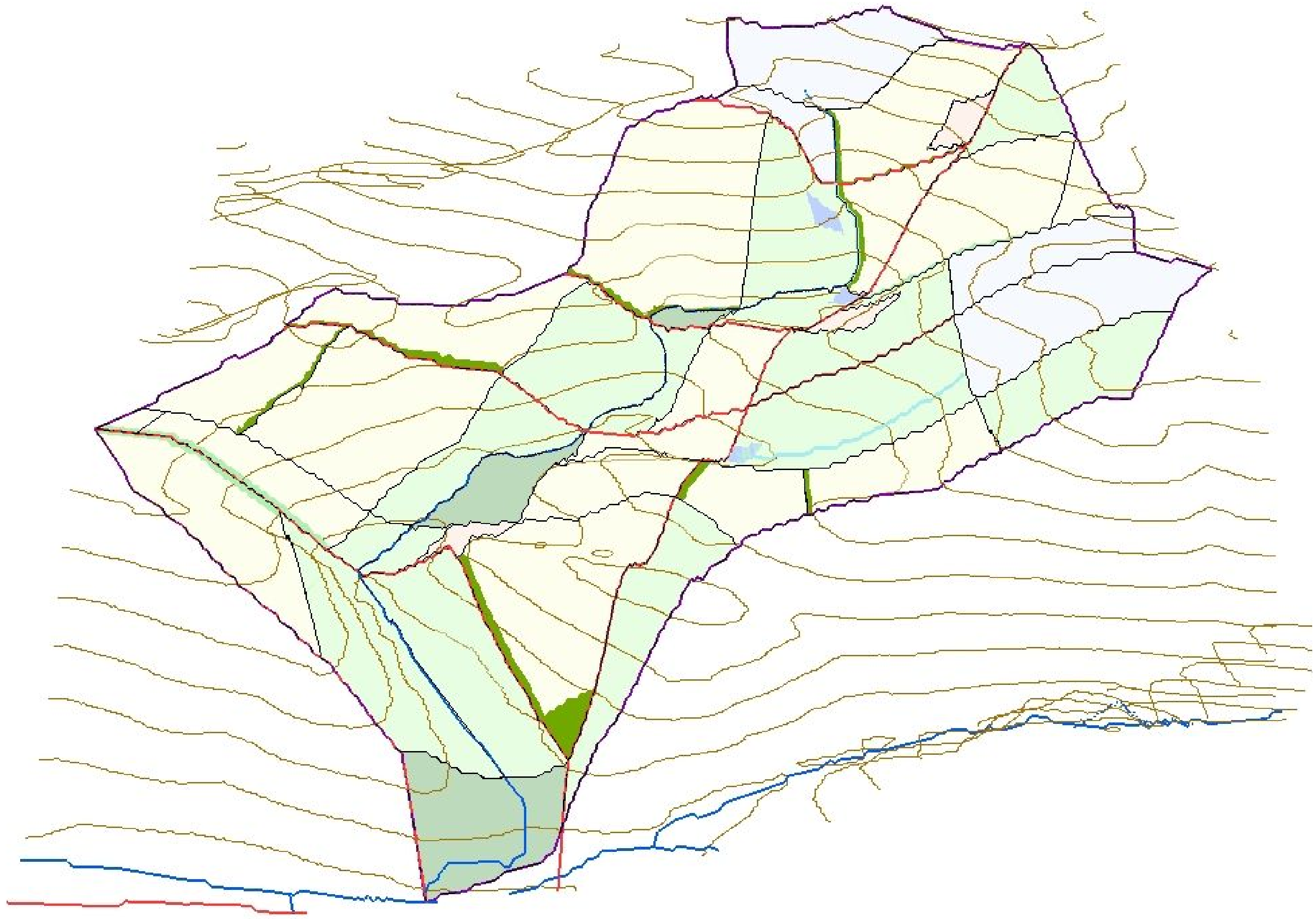

Conclusion

- Some knowledge is to be acquired and references to be known: beyond that, it is mostly a matter of **common sense and capacity of observation**
- **The most important is to observe and understand the water way between the rainfall event and the oulet in a stream - in general and in local applications:**
  - 1°) on and in the soils, in a "vertical"point of view (the "arrows")
  - 2°) on the surface of the catchment, in a "lateral" and "surficial" point of view, from diffuse to concentrated runoff
- The riparian diagnosis is quite simple, but time consuming: tray to look for help of local technicians
- The decision tree of the whole catchment diagnosis is mostly a tool to acquire a comprehensive view of all possibilities; practically, it is not so complicated to apply
- **The start will probably be slow, but experience may accelerate the process**

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Thank you for your attention!

The Technical Support Runoff
and the rodents of the buffer strip wish you: