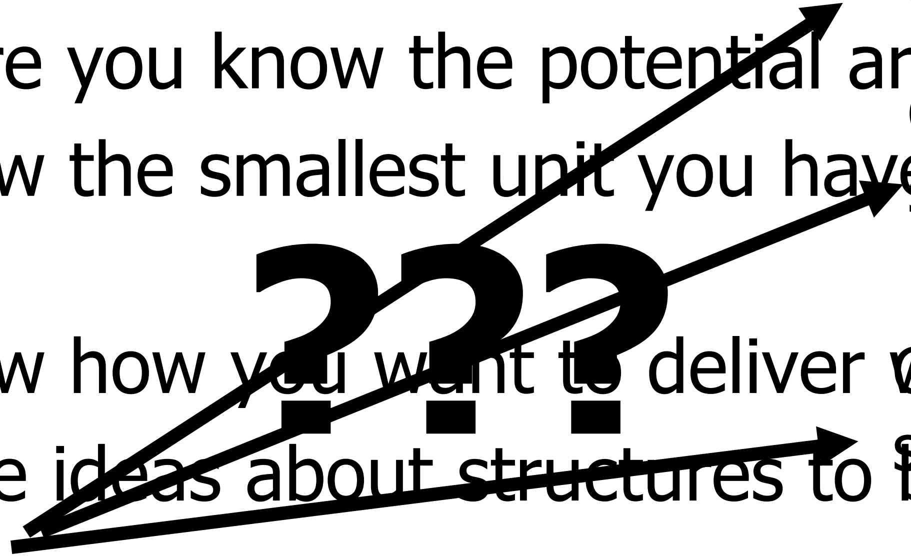
Irrigation: main system layout

Ordering the disorder?

- You know water demand and water availability
- Therefore you know the potential area
- You know the smallest unit you have to deliver water to
- You know how you want to deliver water
- You have ideas about structures to be applied



- It’s time for the canals!

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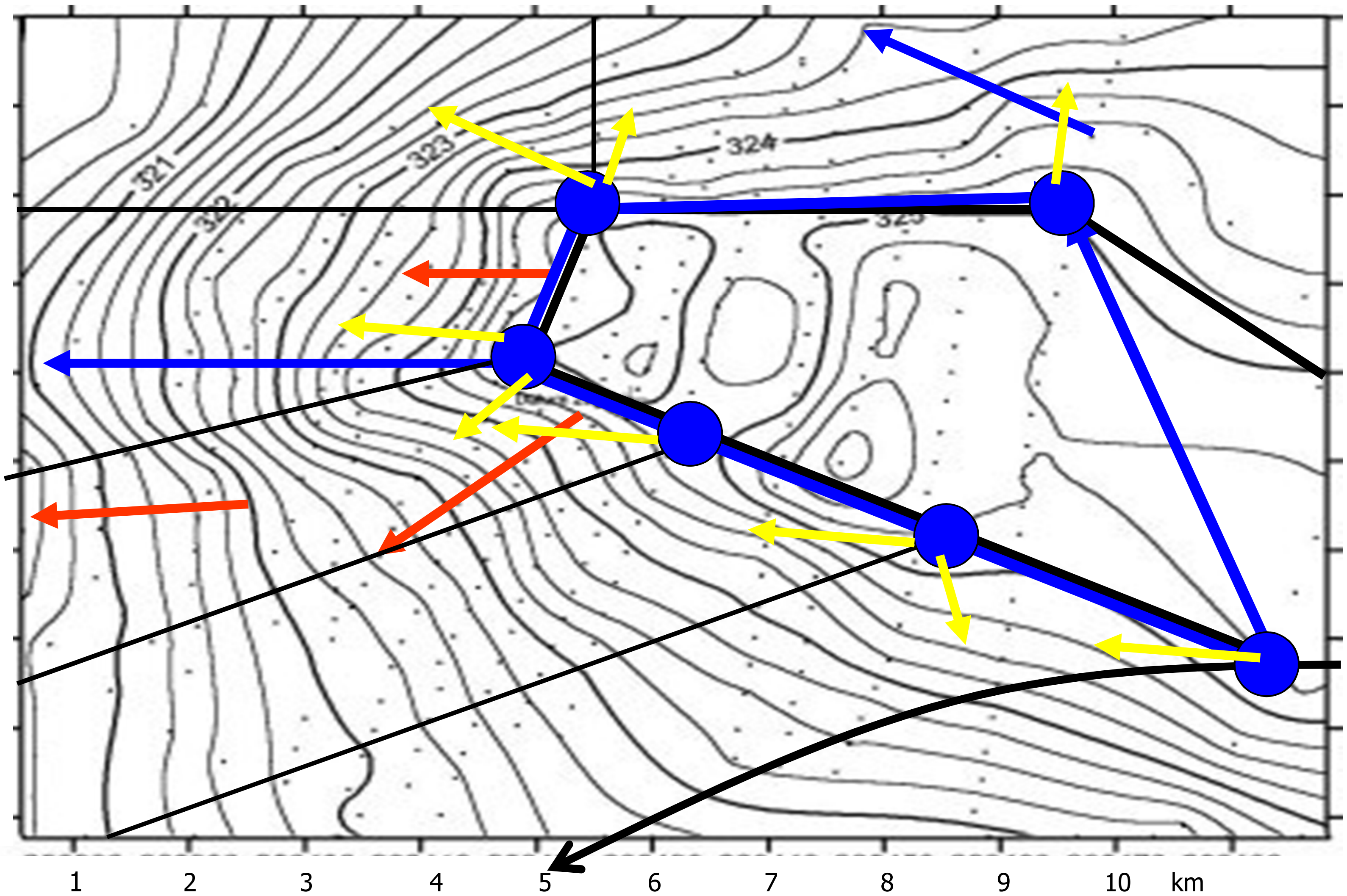
Main issues

- **Layout of the main system**
  - Every canal above tertiary units
  - Determined by natural terrain and units

- **Capacities of main system**
  - Losses
  - Rotation
  - Statistics

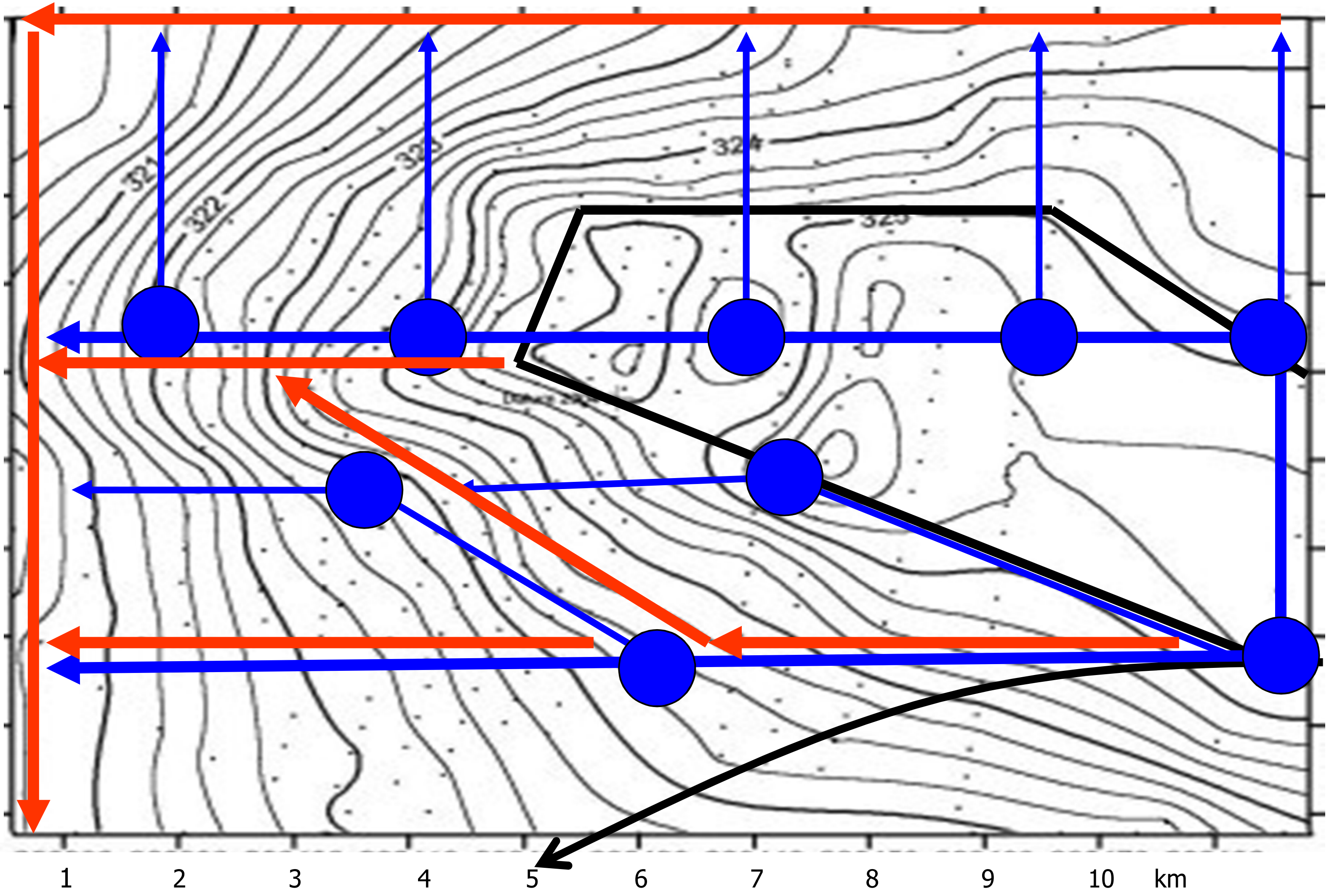
- **Behavior of the main system**
  - Hydraulic flexibility
  - Operational flexibility
  - Reaction times

Layout



(contour lines in meters)

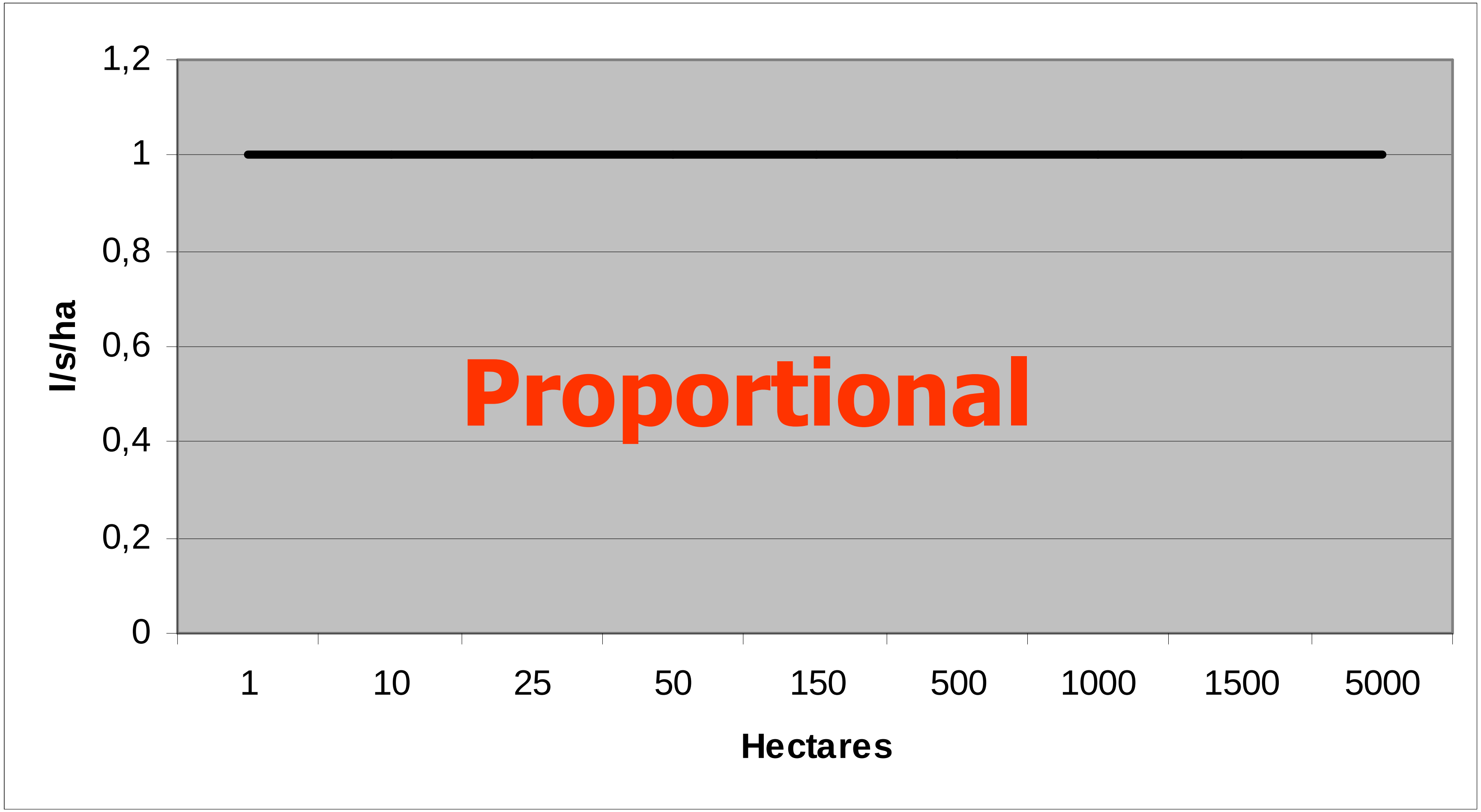
Layout



(contour lines in meters)

Q at a certain level is not necessarily the sum of all Q's at lower levels.

Capacities: example 1



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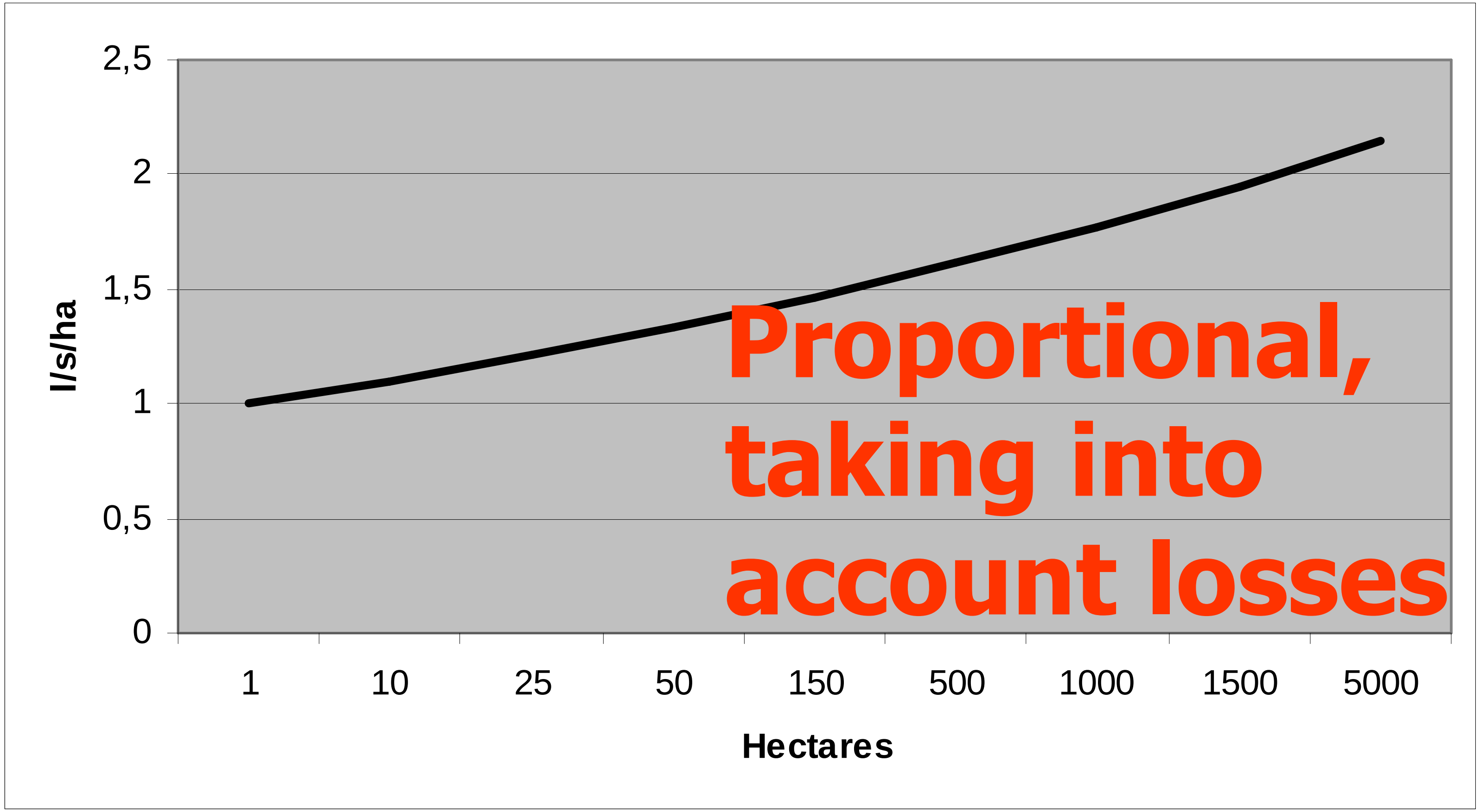
Capacities: example 2



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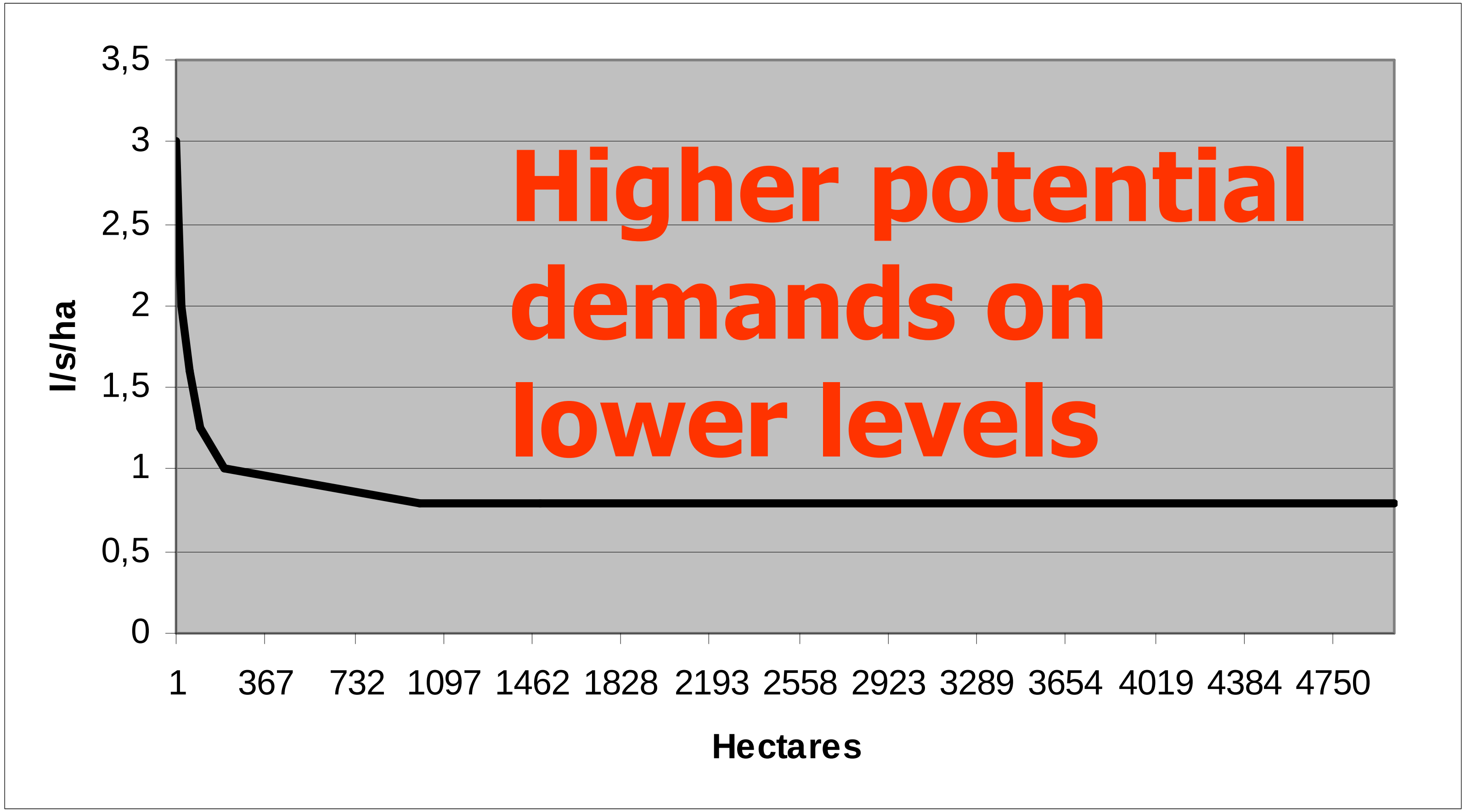
Capacities: example 3



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Capacities of the drainage system

Loads on the system: rainfall of 100 mm in 2 hours

- Assuming an irrigated area of 5000 hectares, this would give a volume of

5,000,000 m^3

But: how to discharge this volume?

- In 2 hours: 694 m3/s
- In 5 days: about 6 m3/s

- Water will be stored in the system: on the fields, in the canals, in the soil **(?)**

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Drainage capacities: decision time

- The load: how often does it occur? Probability?
- Design a drainage canal for a certain maximum Q with freeboard, and allow a higher Q at times (without freeboard)?
- Need to drain the irrigation supply? For example when nobody wants to irrigate?
- Furthermore: like with supply canals, the sum of all individual canals does not have to be the same as the maximum drainage discharge capacity.

Like with the peak demand for soil preparation!

In short: enough to decide.

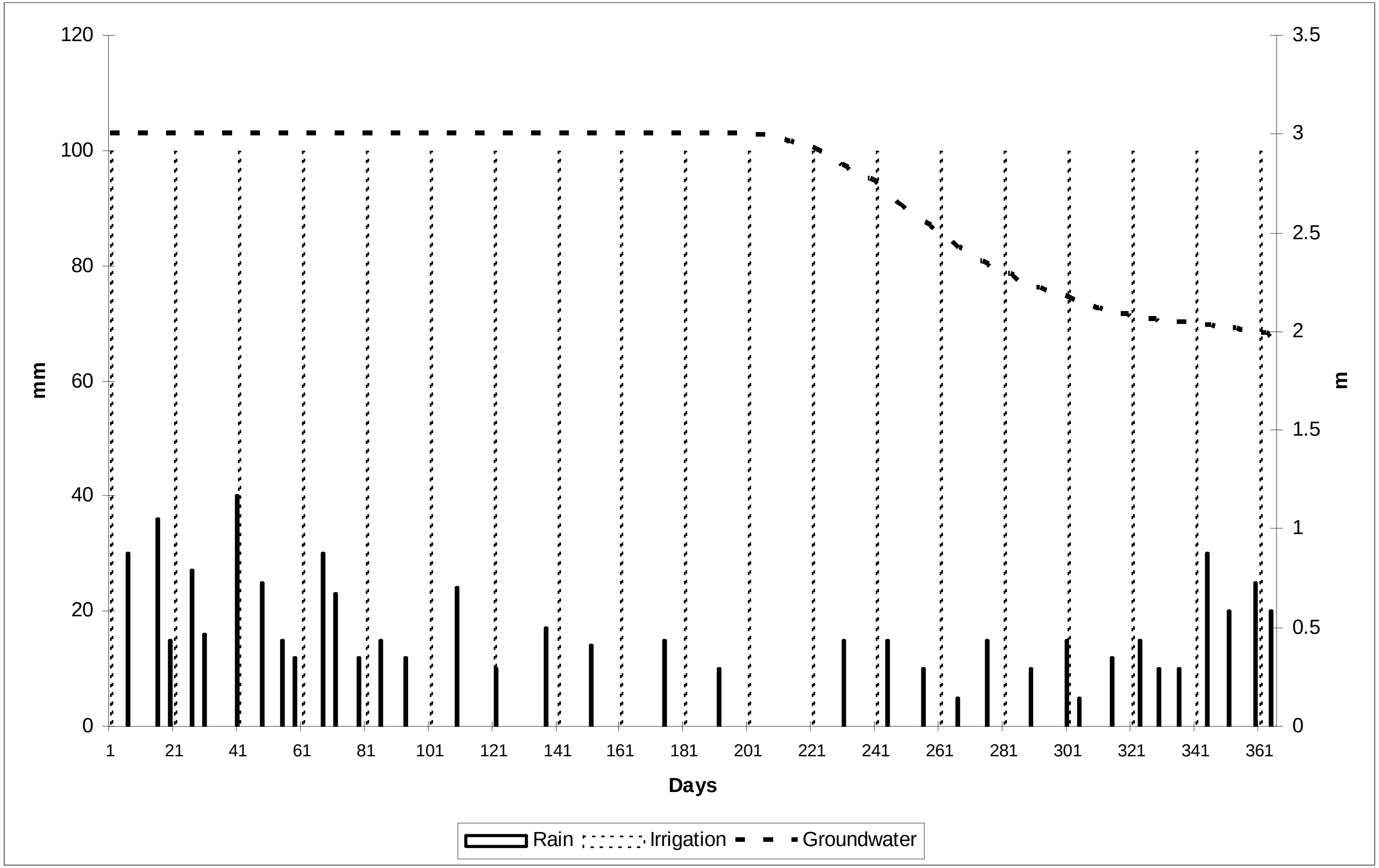
Again……

Three rainfall scenarios

- Rainfall is showers (about every 10 to 15 days)
- Rainfall averaged over all the days
- Rainfall in showers with maximum shower at 100 mm/day

- All other parameters equal
  - Irrigation at 100 mm per 10 days
  - Silty loam
  - Initial groundwater at 3 meter below surface

Rain in showers



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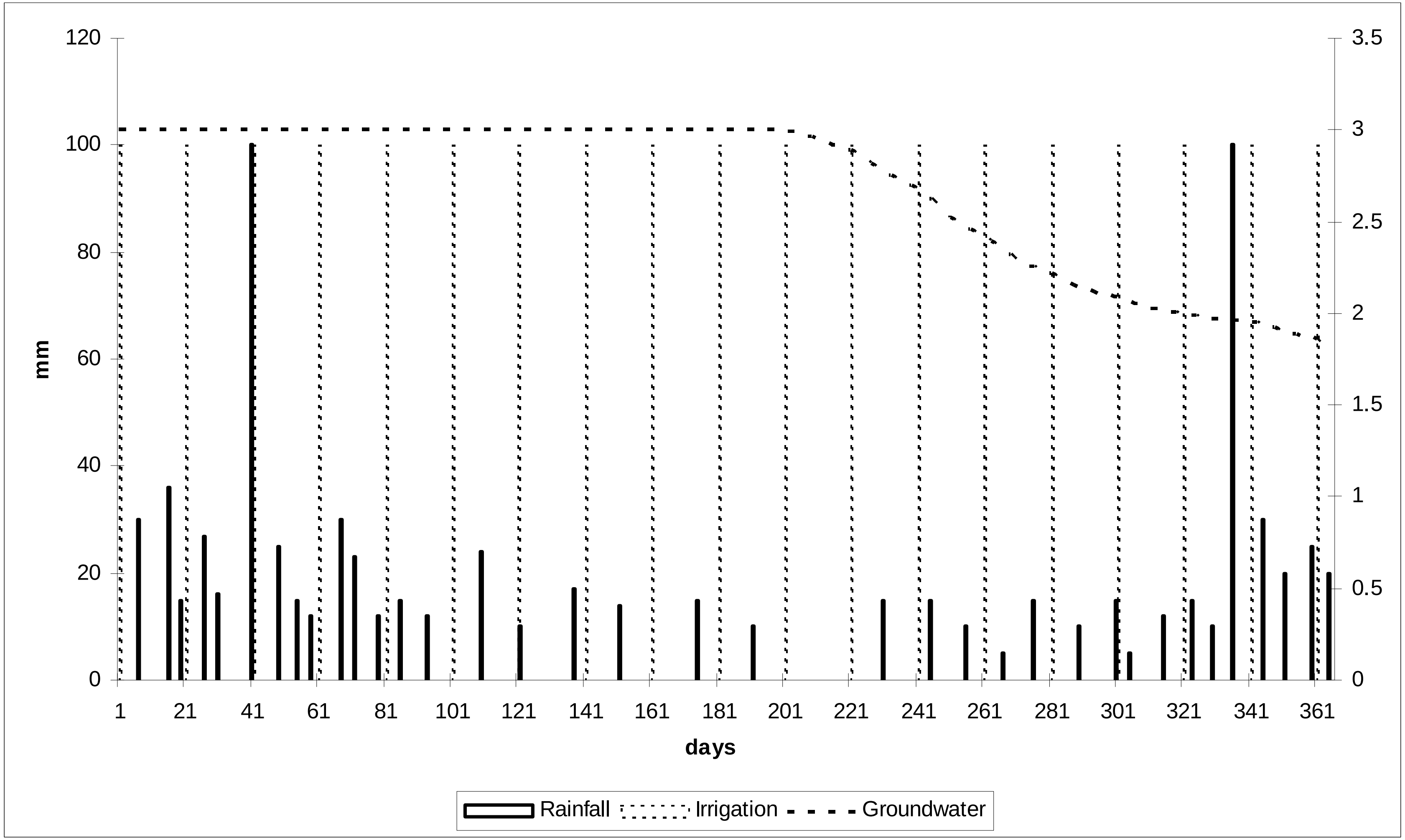
Showers plus maximum



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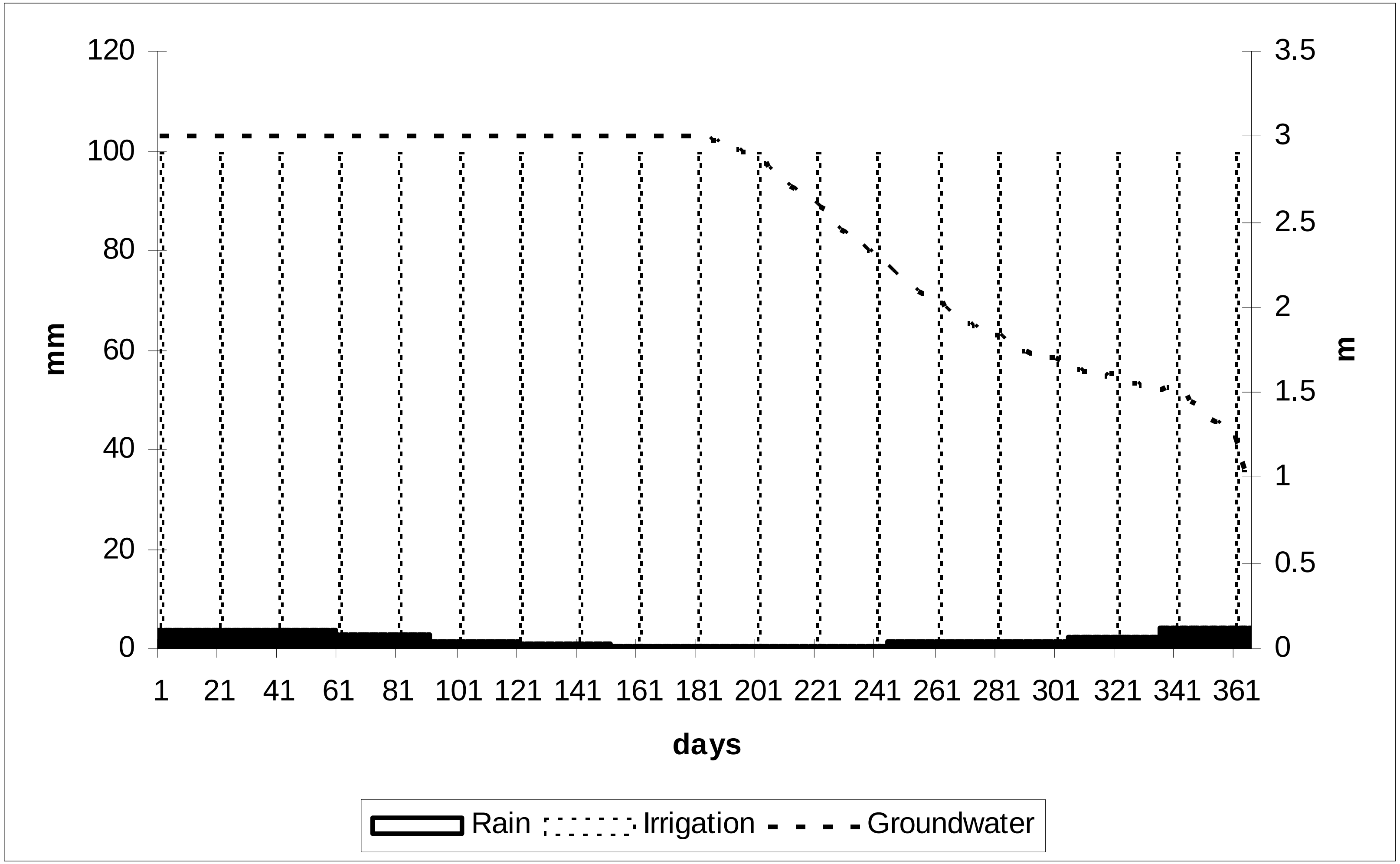
Average



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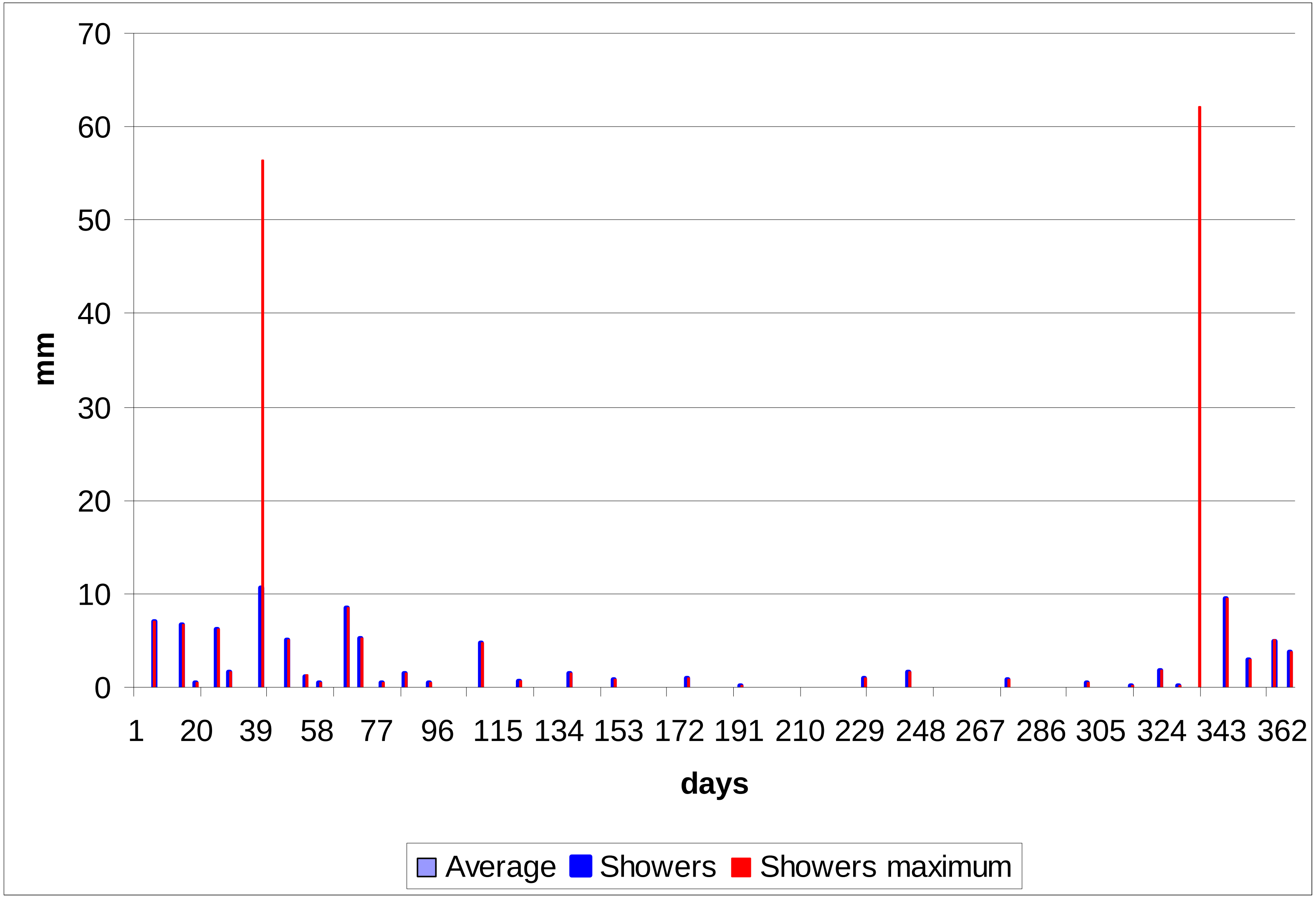
And the runoff??



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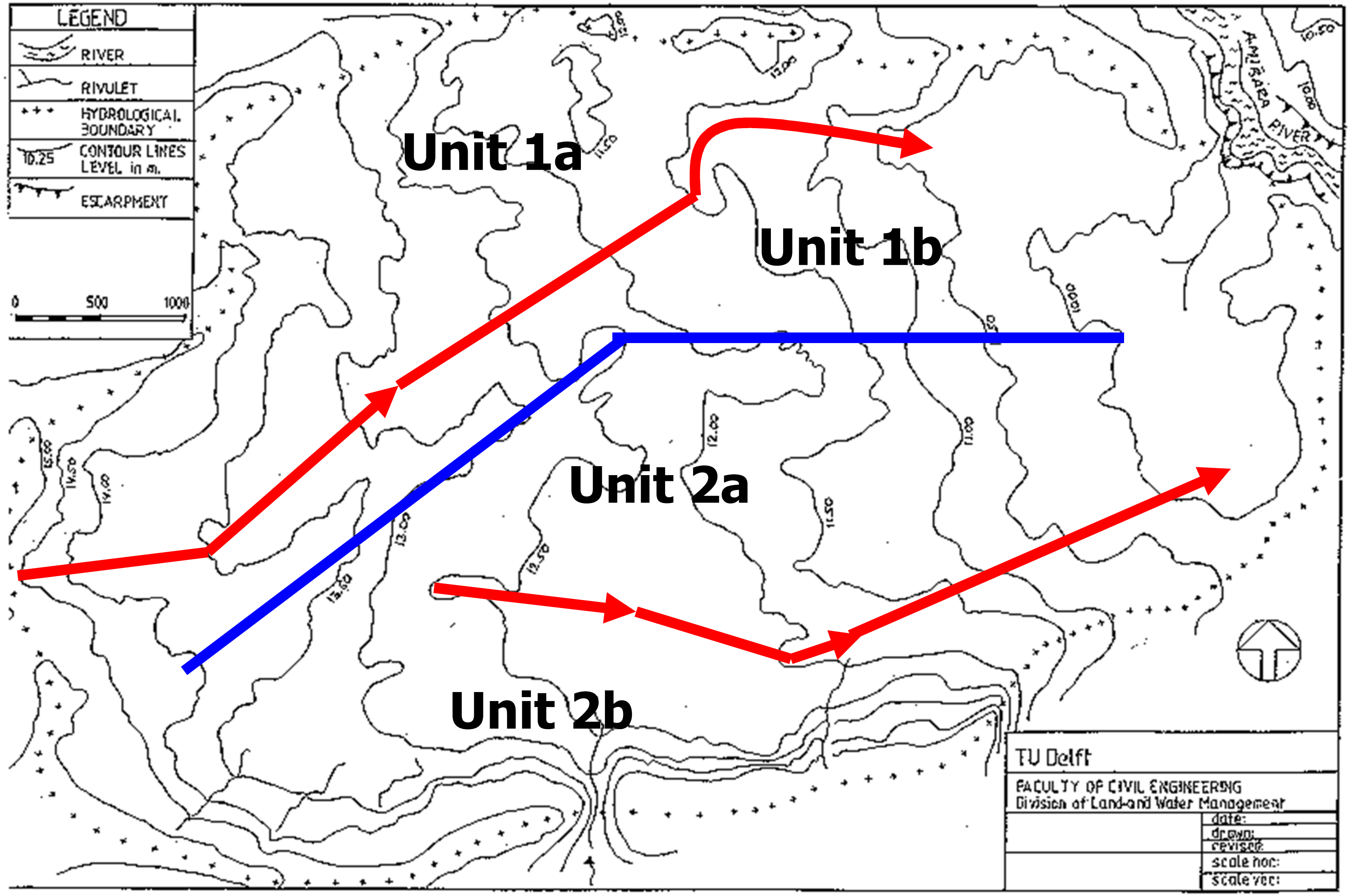
Layout



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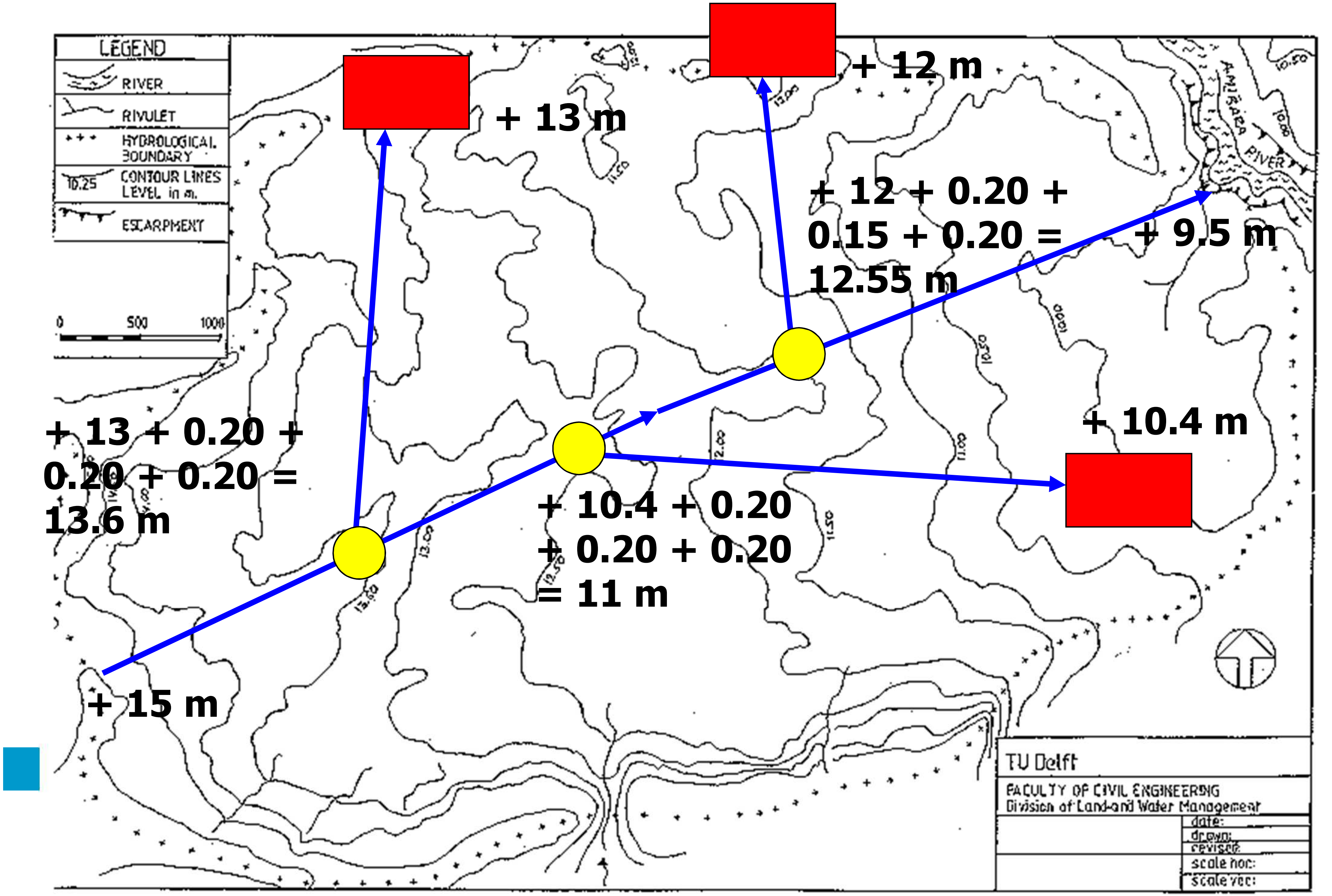
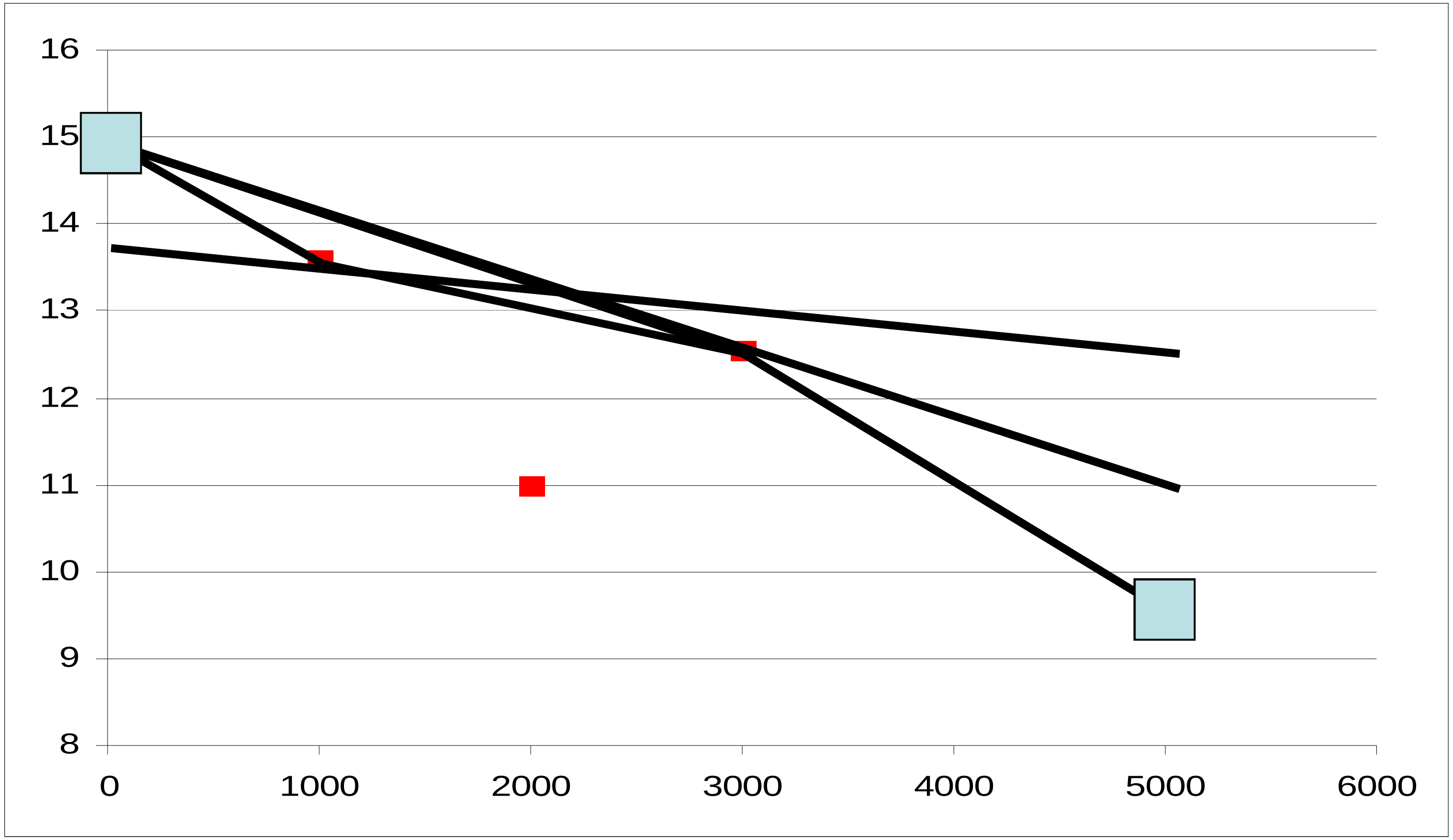
Water levels in the system??



Thus required water levels are:



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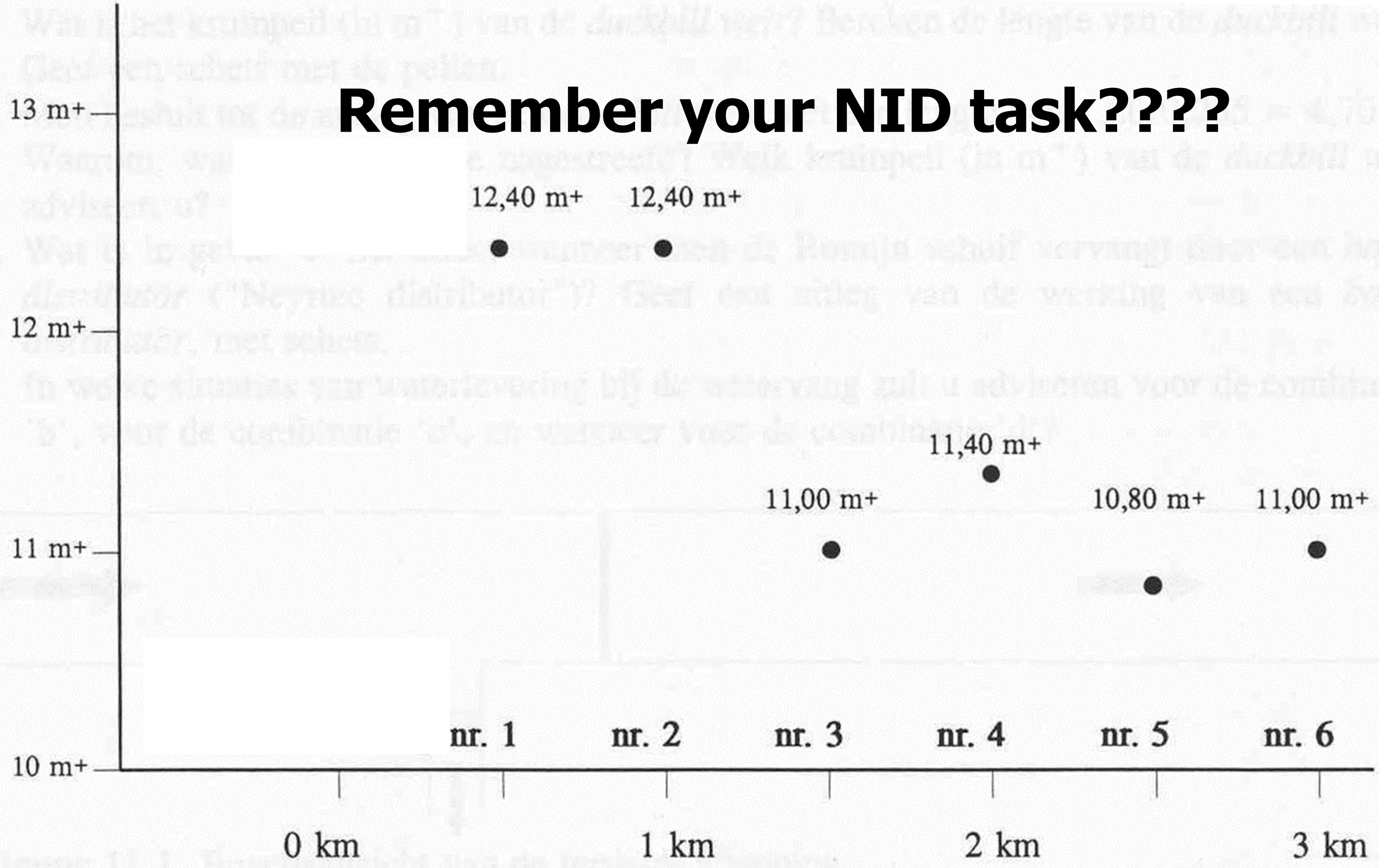
Remember your NID task????



Design a canal (calculate) and determine control structures for offtakes/canal. Each offtake requires 1 m^3/s in the peak season and may need less or nothing during the remaining months.

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Your own design

Issue 1: Water demand versus water availability

- Timing of the demand
- Timing of availability
- Amount of hectares to be irrigated
- Associated risk in balancing demand and availability

- **Issue 2: Bringing water to the field(s)**
  - Continuously, rotation, fixed turns, days, hours, what flow is available for farmers?
- **Issue 3: Grouping farmers or not - units**
- **Issue 4: Who decides?**
  - Water delivery
    - Demand-based, request-based, supply-based?
    - Upstream or downstream control?
- **Issue 5: Water control structures**
  - Discharge control, measurement, fixed or adjustable, sensitivity?

Dimensioning your irrigation system

- Take a typical stretch of your system
- Determine required water levels along this stretch, taking into account requirements from smaller canals, structures etcetera
- Determine available energy gradient per section
- Design canals and structures (steady flow)
- Check, check and check! What happens when Q is lower, or higher, or whatever (steady flow).