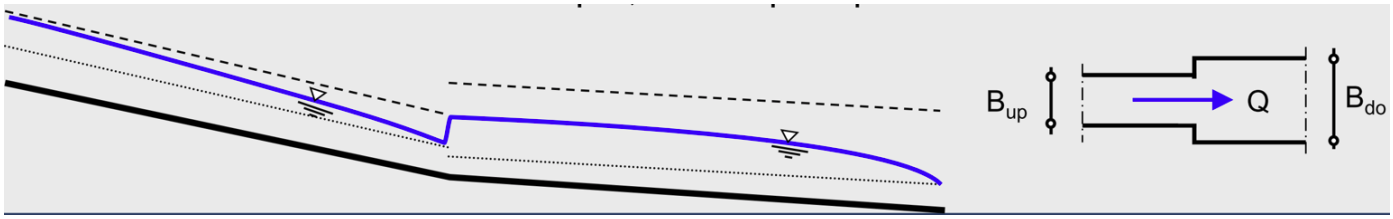
FLUME 4 – FRICTION, SINGLE LOSS WITH BORDA-CARNOT

DESCRIPTION

This example illustrates friction losses and a single loss occurring when the cross section of a flume abruptly changes.

Given:

- Q = 1.5 m³/s, H = 1m
- Downstream:
  - $h_2 = h_{gr}$ (critical flow depth)
  - I_s = 1 ‰
  - Kst = 50
  - B = 1.2 m
  - L = 50 m
- Upstream:
  - I_s = 5 ‰
  - Kst = 75
  - B = 0.8 m
  - L = 50 m

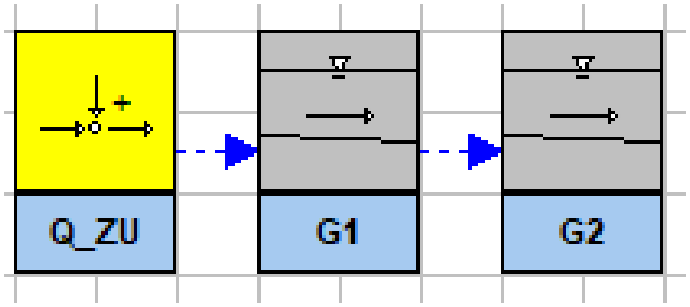


TASK

Determine the normal and critical depth, flow depth upstream / downstream.

SYSTEM ABSTRACTION IN HYBEKA

The system is very simple. To represent it, we only need a flow changer to represent the inflow into the flume and two open channel elements for the flume itself.



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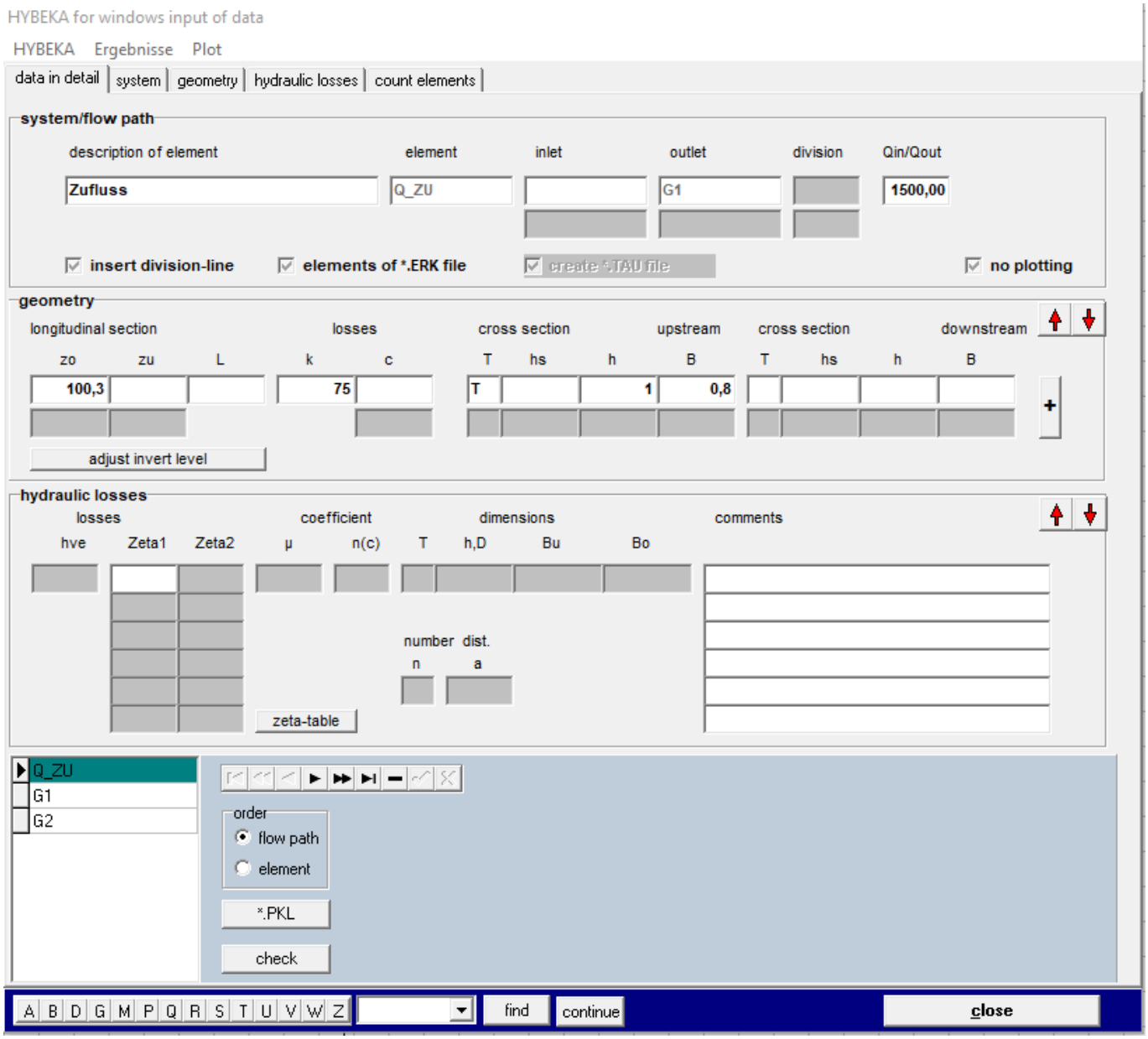
DATA INPUT

General settings:

waterlevel at end of system	[masl]	

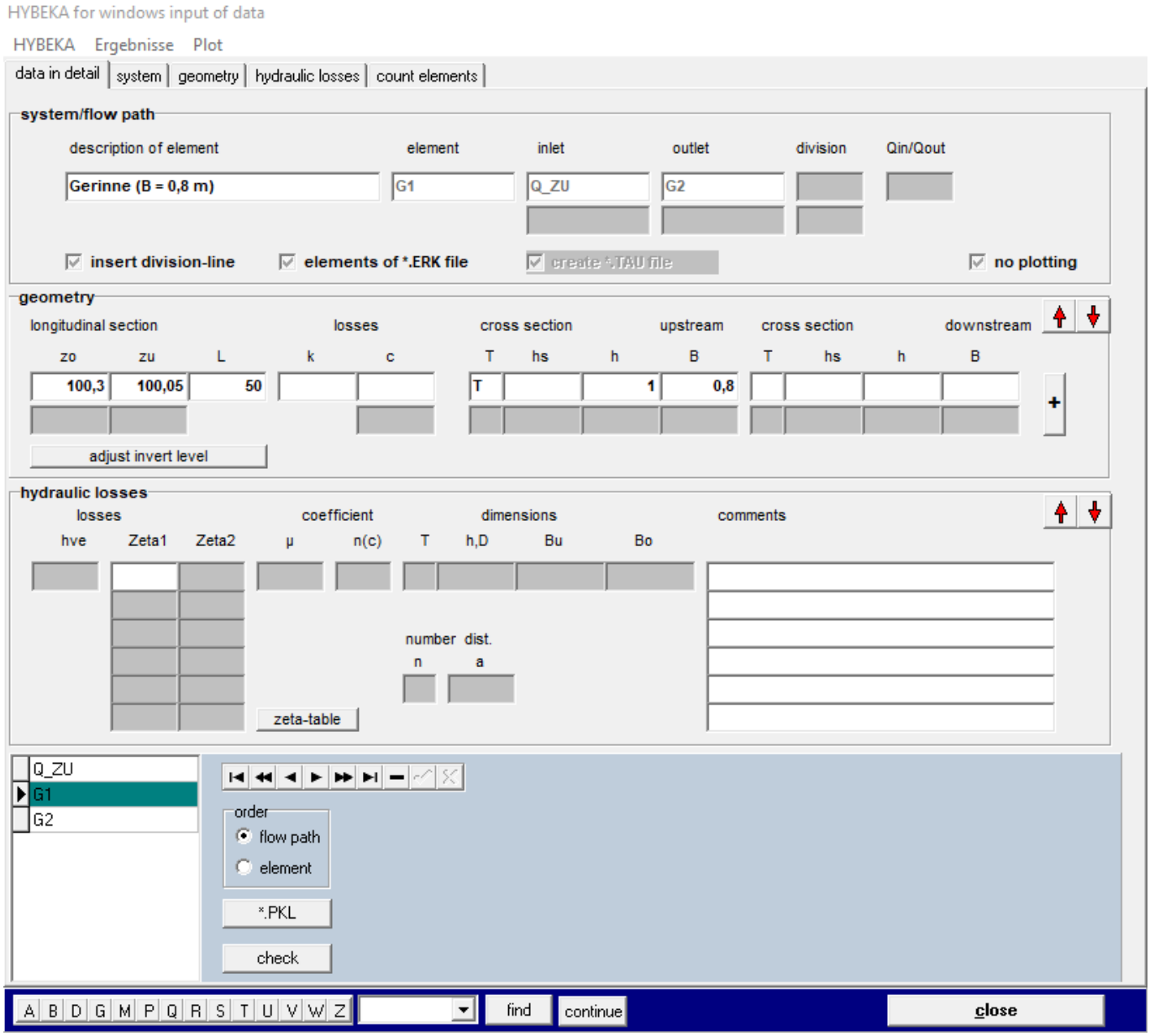
The water level at the system outlet is left empty and critical flow depth will be used as starting point.

Flow changer Qzu:

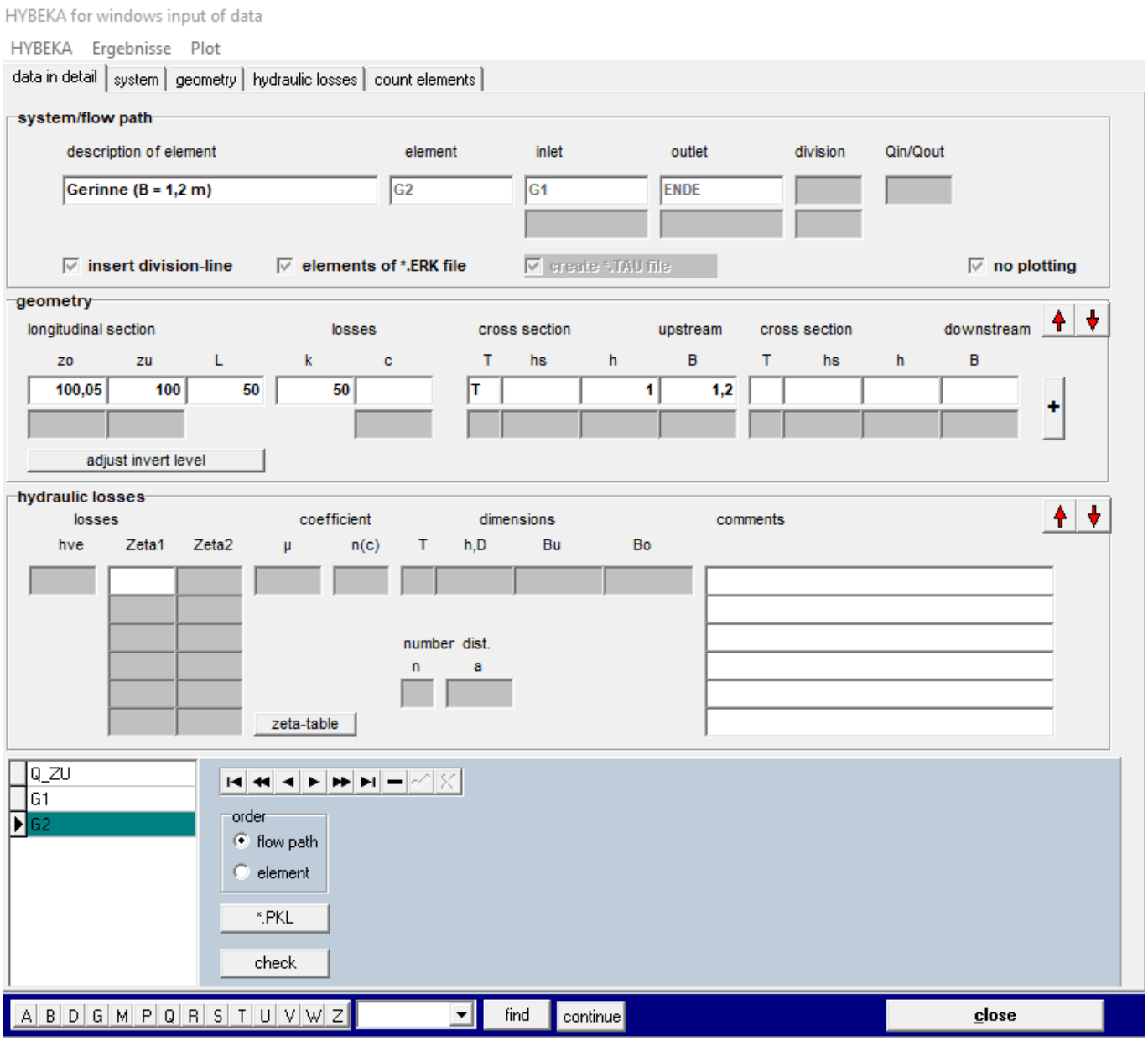


Note: zo is chosen arbitrarily.

Flume element G1:



Flume element G2:



RESULTS:

	i	element	0	discharge	length	invert	board level	water level		wetted cross-sectic	velocity	energy level	shear stress	Pr	losses [m]				comment
				[m³/s]	[m]	[masl]	[m]	[m]	[masl]	[m²]	[m²/s]	[masl]	[N/m²]	o/g	frict.	single (1)	single (2)	transit.	
▶	1	Q_ZU	1	1,500	0,000	100,300	1,000	0,838	101,138	0,67	2,24	101,393	13,47	o				0,000	
	1	G1	1	1,500		100,300	1,000	0,838	101,138	0,67	2,24	101,393	13,47	o	0,273	0,000			V
	2	G1	1		50,000	100,050	1,000	0,738	100,788	0,59	2,54	101,117	17,64	o				0,078	V
	1	G2	1	1,500		100,050	1,000	0,888	100,938	1,07	1,41	101,039	10,96	o	0,225	0,000			
	2	G2	1		50,000	100,000	1,000	0,542	100,542	0,65	2,31	100,813	31,70	o				0,000	gr V

The critical water depth is 0.542 m. The flow depth downstream is 0.888 m and upstream is 0.838 m.