Supplement to "Overtopping-induced failure of non–cohesive homogeneous fluvial dikes: effect of dike geometry on breach discharge and widening"

Run ID	Conf. ID	Target Q_{in} (l/s)	Actual Q_{in} (l/s)	F (-)	S_u (-)	S_d (-)	L_k (m)	L_k / w	μ (-)
1	A	25	24.6	0.082	2	2	0.15	0.5	1
1-R	A	25	24.5	0.081	2	2	0.15	0.5	1
2	B	25	25.1	0.071	1.5	2	0.15	0.5	0.9
3	C	25	27.0	0.090	2	1.5	0.15	0.5	0.9
4	D	25	25.3	0.084	2	2.5	0.15	0.5	1.1
5	E	25	26.9	0.089	2	3	0.15	0.5	1.2
6	F	25	24.9	0.083	2	2	0	0	0.8
7	G	25	24.5	0.081	2	2	0.3	1	1.2
8	A	40	40.3	0.134	2	2	0.15	0.5	1
8-R	A	40	40.7	0.135	2	2	0.15	0.5	1
9	B	40	40.8	0.116	1.5	2	0.15	0.5	0.9
10	C	40	40.9	0.136	2	1.5	0.15	0.5	0.9
11	D	40	40.7	0.135	2	2.5	0.15	0.5	1.1
12	E	40	44.0	0.146	2	3	0.15	0.5	1.2
13	F	40	40.9	0.136	2	2	0	0	0.8
13-R	F	40	41.6	0.138	2	2	0	0	0.8
14	G	40	43.4	0.144	2	2	0.3	1	1.2
15	A	55	56.1	0.186	2	2	0.15	0.5	1
16	B	55	55.8	0.159	1.5	2	0.15	0.5	0.9
17	C	55	55.1	0.183	2	1.5	0.15	0.5	0.9
17-R	C	55	56.6	0.188	2	1.5	0.15	0.5	0.9
18	D	55	55.7	0.185	2	2.5	0.15	0.5	1.1
19	E	55	56.5	0.187	2	3	0.15	0.5	1.2
20	F	55	56.0	0.186	2	2	0	0	0.8
21	G	55	56.6	0.188	2	2	0.3	1	1.2
22	H	55	59.0	0.196	2	2	0.6	2	1.6

Table S1 List of experiments Q_{in} = inflow discharge in the main channel; F = initial Froude number in the main channel; 1:S_u = channel-side dike slope; 1:S_d = floodplain-side dike slope; L_k = dike crest length; w = dike height; μ = standardized dike volume per unit width.

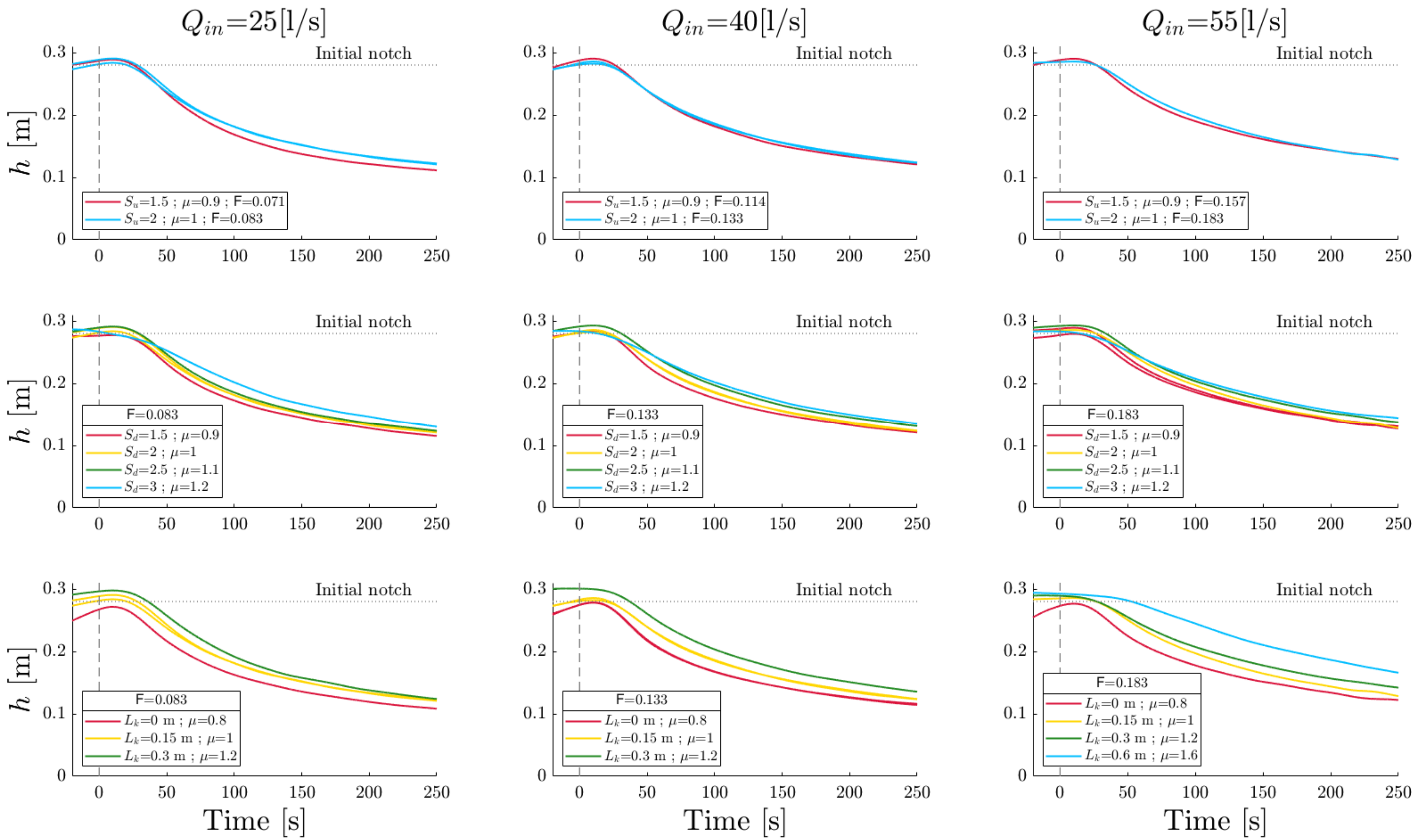

Figure S1 Evolution of the water level in the main channel for all tested geometric configurations and inflow discharges. The represented water level is a weighted-average of the measurements at gauges G1, G2 and G3 (Figure 1a), as detailed in Section 3.1 of Rifai et al. (2017). In each plot, parameters not specified in the legend are set as in the reference Configuration A (S_u = 2, S_d = 2, L_k=0.15m). Origin of time axis corresponds to the start of Stage 1. Curves of identical colour in a same panel refer to repeated tests.

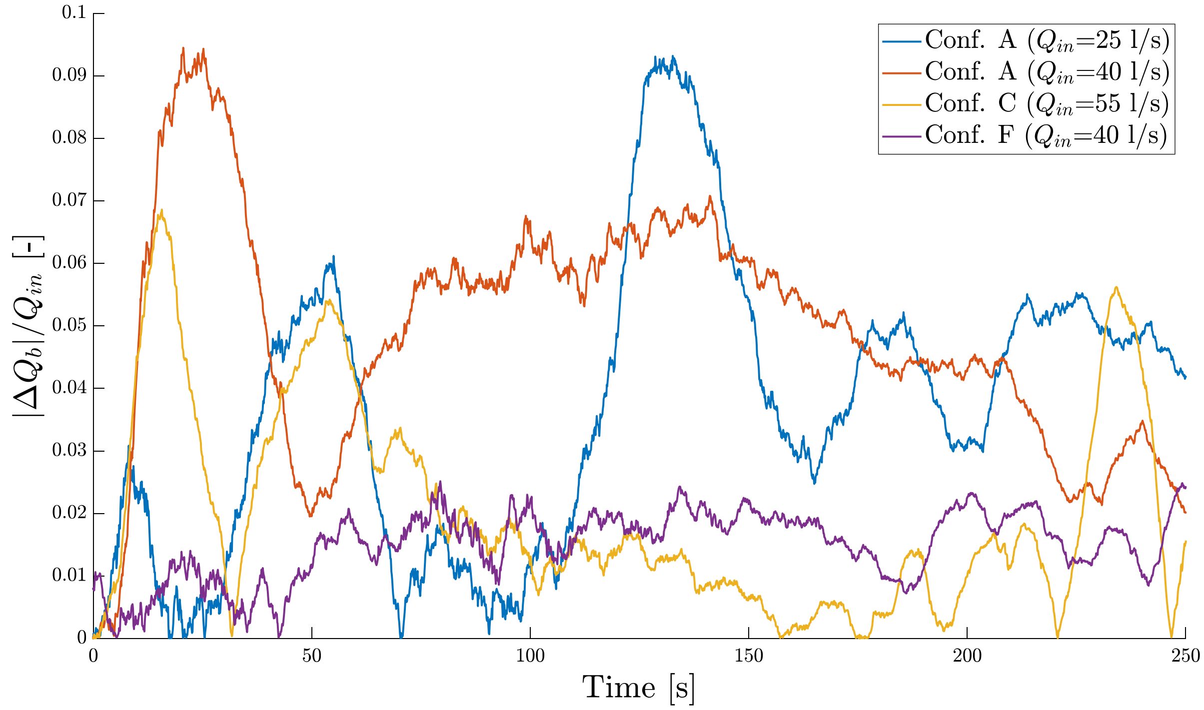

Figure S2 Difference in the breach discharge Q_b between repeated tests, normalized by the inflow discharge Q_{in}.

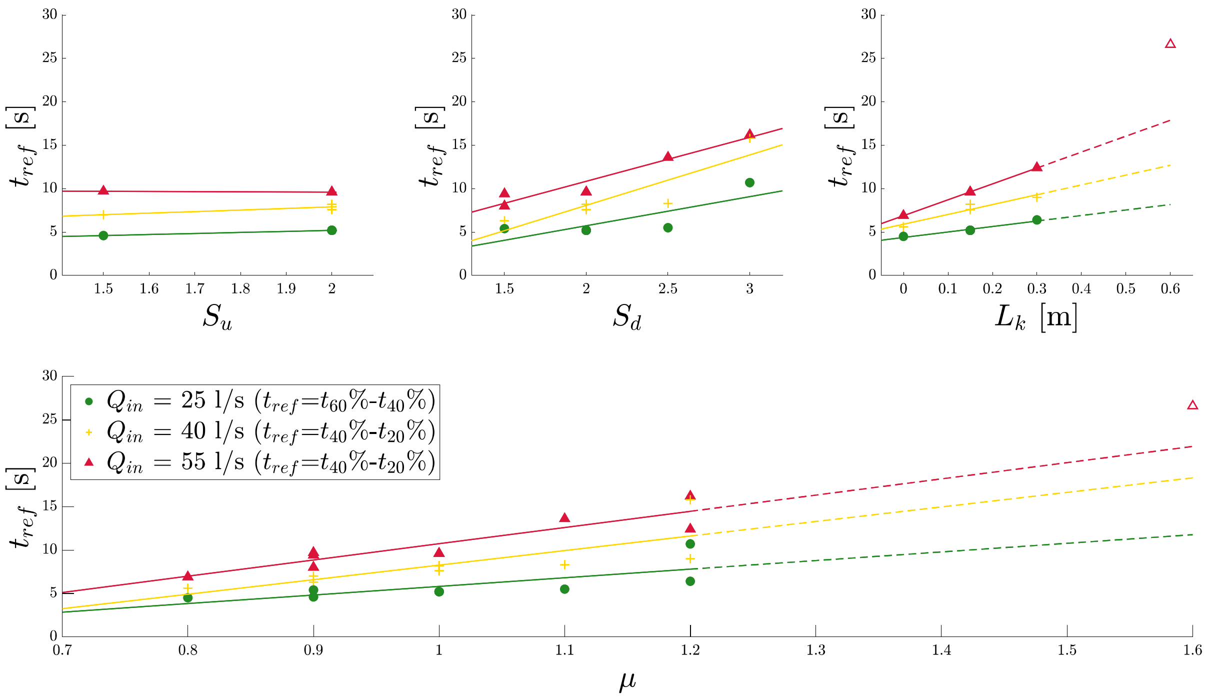

Figure S3 Characteristic rising time of the breach hydrograph as a function of dike geometric parameters. See Text S1 for more information about the reference time definition. Note that Configuration H (L_k = 0.6m, μ = 1.6) was disregarded for the linear interpolations, as the corresponding results are off-scale compared to all other tests. A change in the slope occurs probably for 0.3 m < L_k < 0.6 m (i.e., 1.2 < μ < 1.6); but the present data is not sufficient to properly capture it.

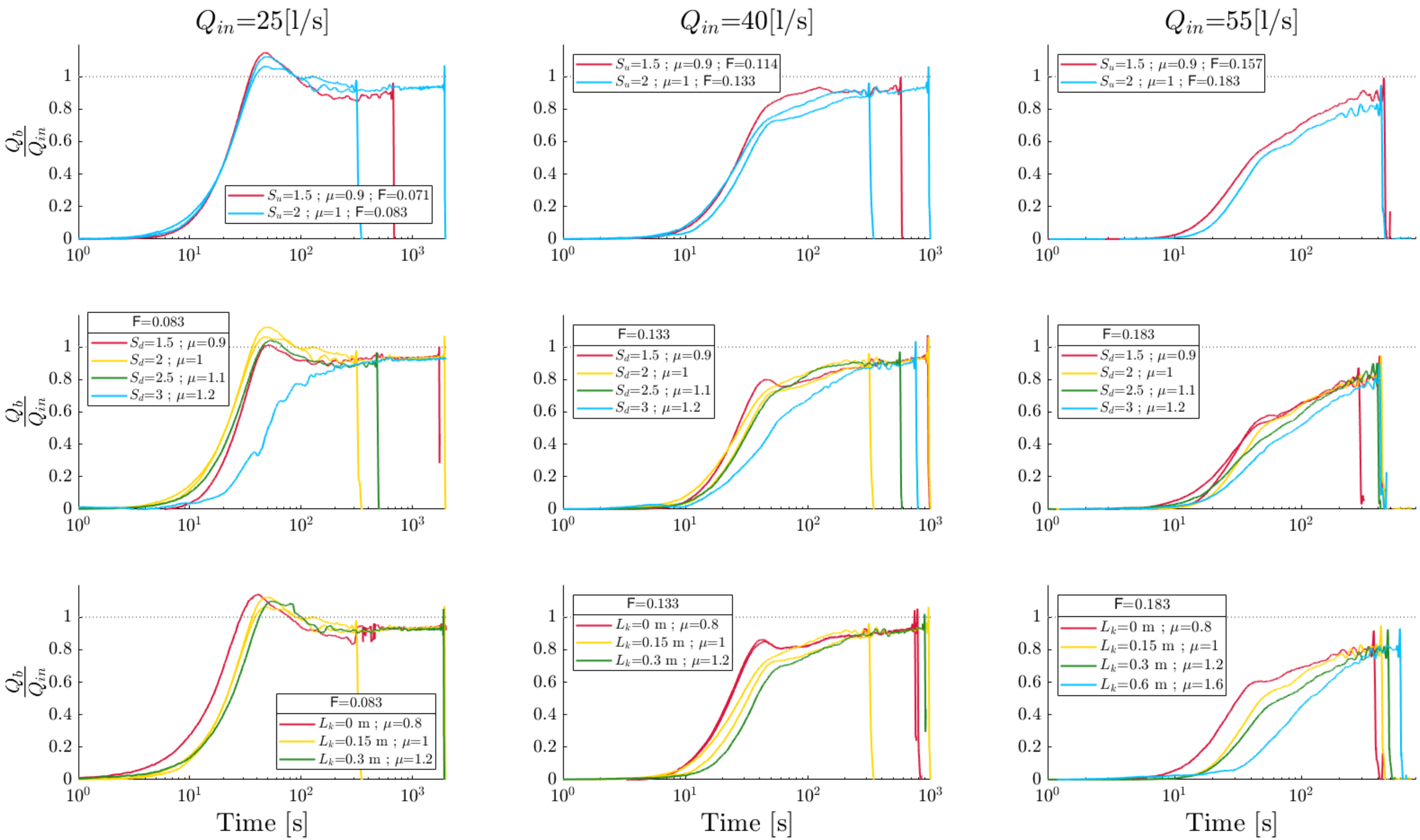

Figure S4 Evolution breach discharge Q_b to inflow discharge Q_{in} ratio. Time is represented on a logarithmic axis, enabling a better appraisal of quasi-equilibrium breach discharge. Sudden drops in the breach discharge correspond to the end of the tests (the pump being stopped). Origin of time axis corresponds to the start of Stage 1. Curves of identical colour in a same panel refer to repeated tests.

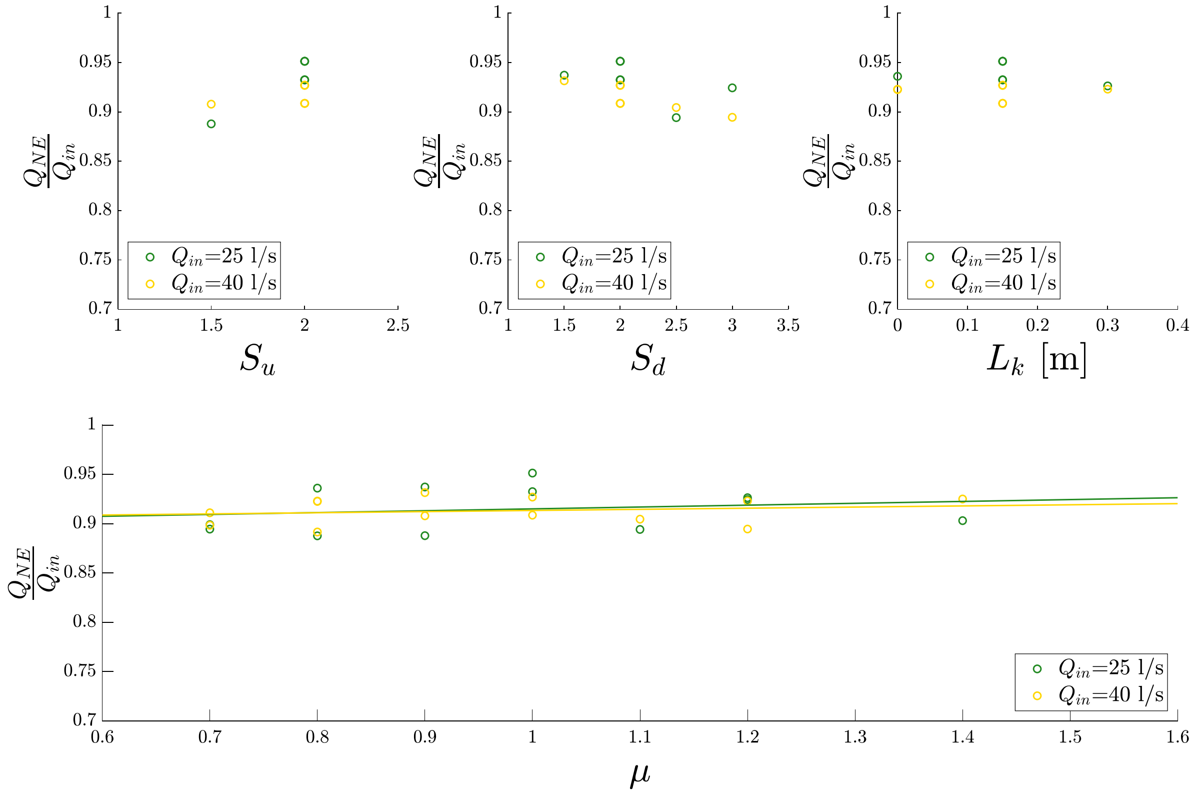

Figure S5 Quasi-equilibrium breach discharge Q_{NE} normalized by the inflow discharge Q_{in} as a function of the geometric parameters for lower and intermediate inflow discharges (Q_{in} = 25 l/s and Q_{in} = 40 l/s). See Text S1 for more information about the reference time definition.

Text S1

The characteristic time t_{ref} displayed in Figure S2 is defined as the time needed for the relative breach discharge (Q_b / Q_{in}) to increase by 20 % during Stage 1. To account for different patterns in the breach hydrographs (e.g. the transition between Stage 1 and Stage 2 occurs earlier for larger values of Q_{in}), the following specific definitions were used:

- $t_{ref} = t_{60\%} - t_{40\%}$ for Q_{in} = 25 l/s,
- $t_{ref} = t_{40\%} - t_{20\%}$ when Q_{in}=40 l/s and 55 l/s

where notation $t_{X\%}$ refers to the time at which Q_b / Q_{in} reaches X %. For each test, Figure S5 shows the values in the breach discharge evolution which were used to estimate the characteristic time t_{ref}, in accordance with the definitions given above.

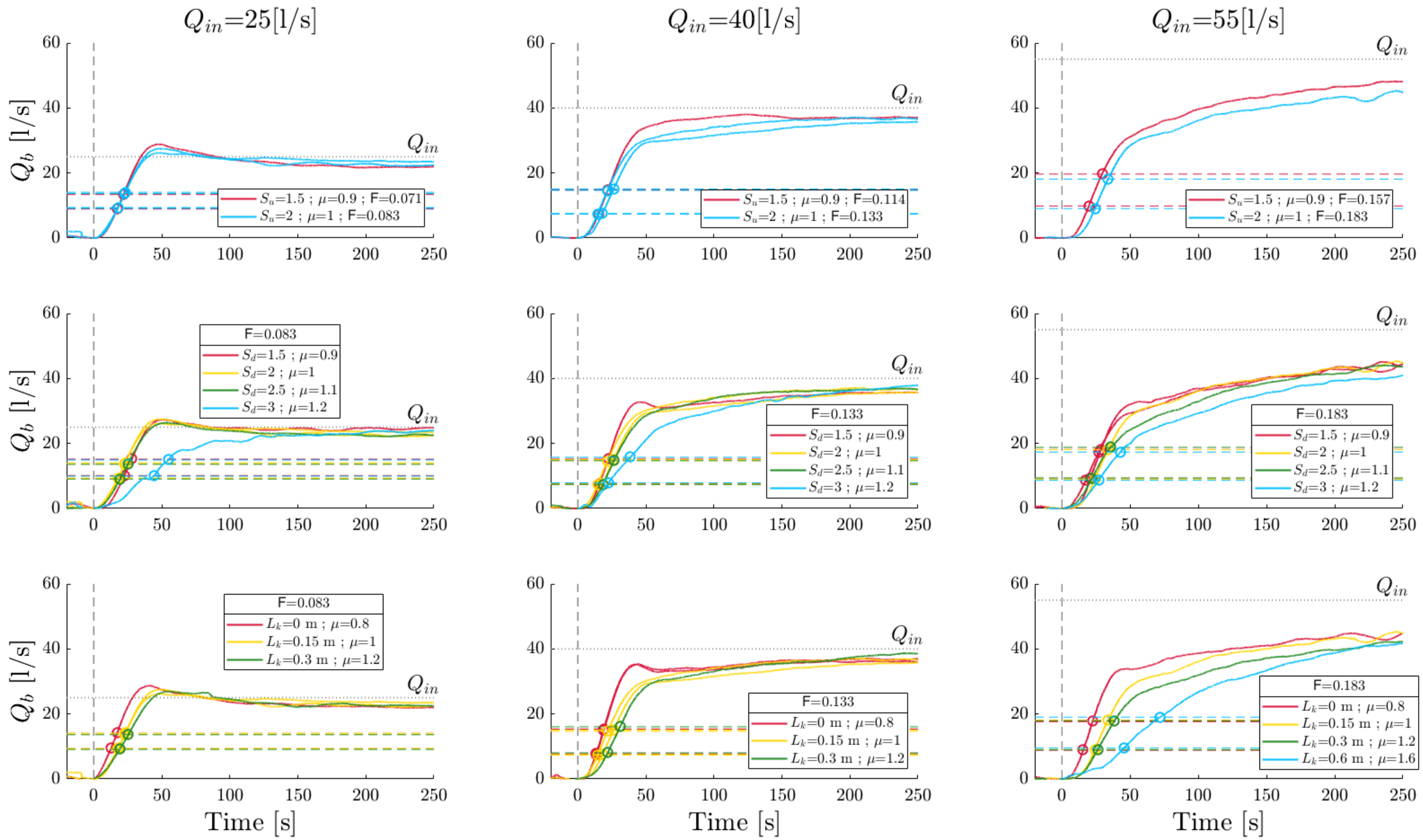

Figure S6 Evolution of the breach discharge Q_b for all tested geometric configurations and inflow discharges. Values of breach discharge which were used to estimate the characteristic time t_{ref} are highlighted by horizontal dashed lines and by circles on the breach hydrographs. Origin of time axis corresponds to the start of Stage 1. Curves of identical colour in a same panel refer to repeated tests.

		Configuration ID	Q_{in} = 25 [l/s]	Q_{in} = 40 [l/s]	Q_{in} = 55 [l/s]
S_u (-)	1.5	B	A	C	C
	2	A	A	C	C
S_d (-)	1.5	C	A	B	C
	2	A	A	C	C
	2.5	D	A	C	C
	3	E	C	C	C
L_k (m)	0	F	A	B	B
	0.15	A	A	C	C
	0.3	G	A	C	C
	0.6	H	-	-	C
μ	0.8	F	A	B	B
	0.9	B & C	A	B C	C
	1	A	A	C	C
	1.1	D	A	C	C
	1.2	E & G	A C	C	C
	1.6	H	-	-	C

Table S2 Type of breach hydrograph obtained for each tested configuration.

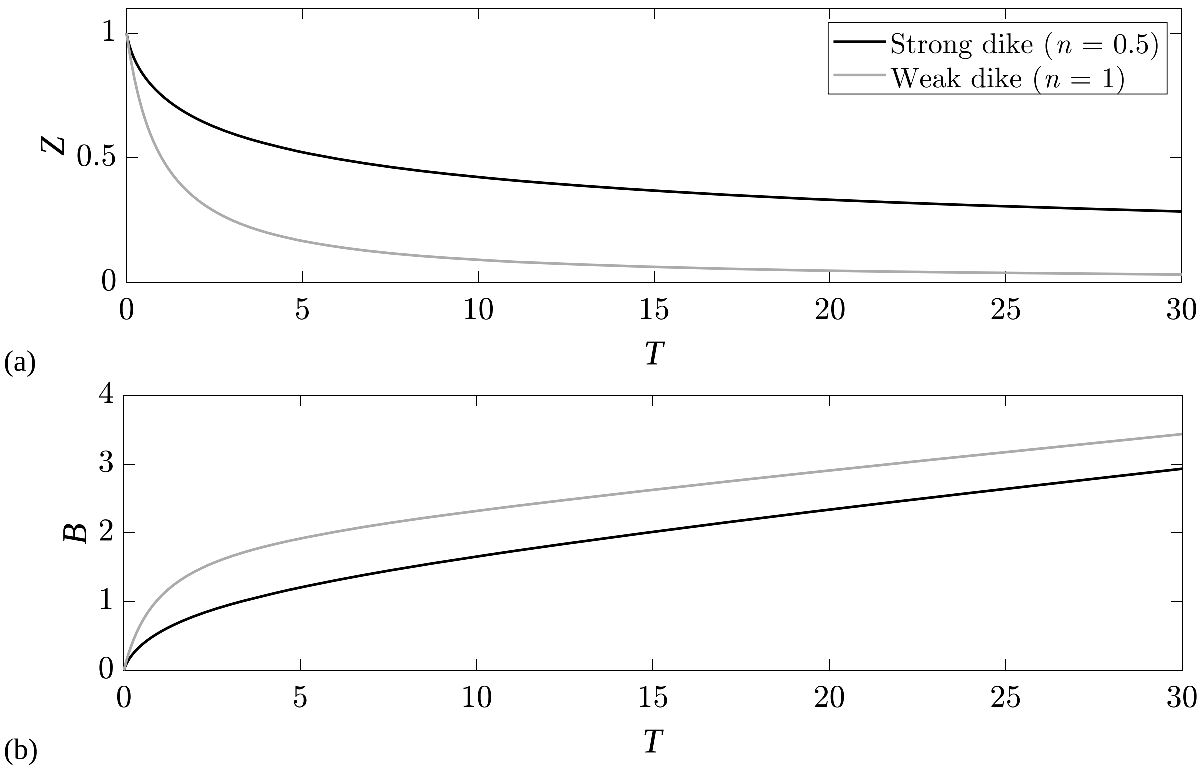

Figure S7 Evolution of the non-dimensional breach invert level Z (a) and non-dimensional breach width B (b) as a function of the non-dimensional time T in the simplified model.

	Q_{in} = 25 l/s	Q_{in} = 40 l/s	Q_{in} = 55 l/s
t = 0 s			
t = 40 s			
t = 100 s			
t = 250 s			

Table S3 Snapshots of experimental tests in Configuration A (S_u = 2, S_d = 2, L_k = 0.15 m) for three inflow discharges and at four different times.