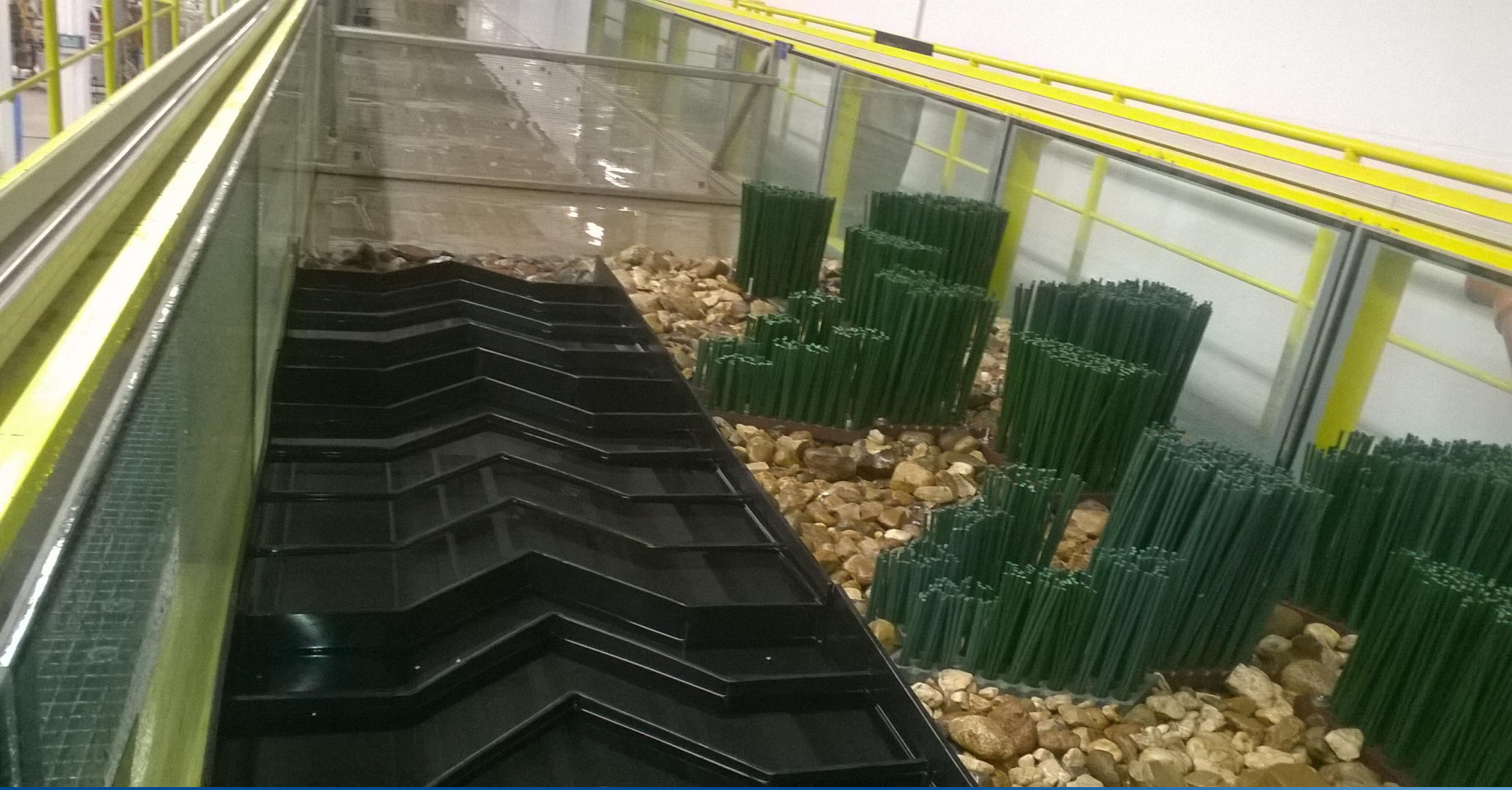
Jun 23rd, 4:30 PM - 4:45 PM

Session B6: Hydraulic Design of an Innovative Baffle-Brush Type Fish Pass

Serhat Kucukali
Çankaya University

Reinhard Hassinger
University of Kassel, Dept. of Civil and Environmental Engineering

Werapol Bejranonda
University of Kassel, Dept. of Civil and Environmental Engineering



Hydraulic design of an innovative baffle-brush type fish pass

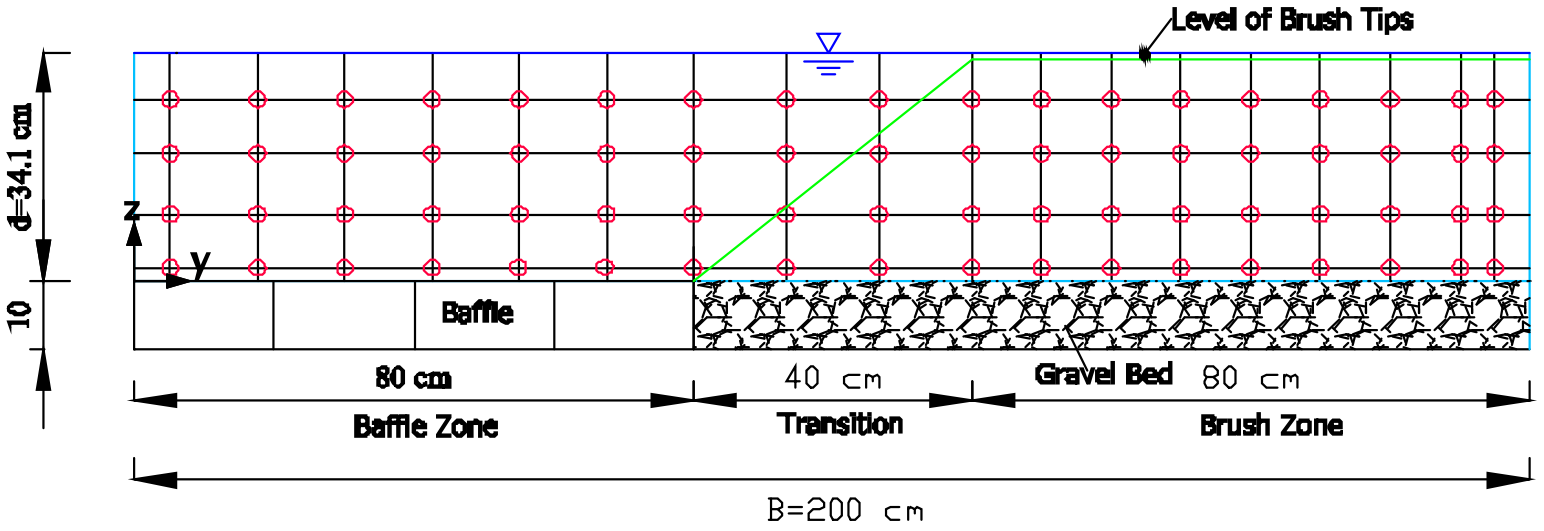
Dr. Serhat Kucukali
Civil Engineering Department
Çankaya University

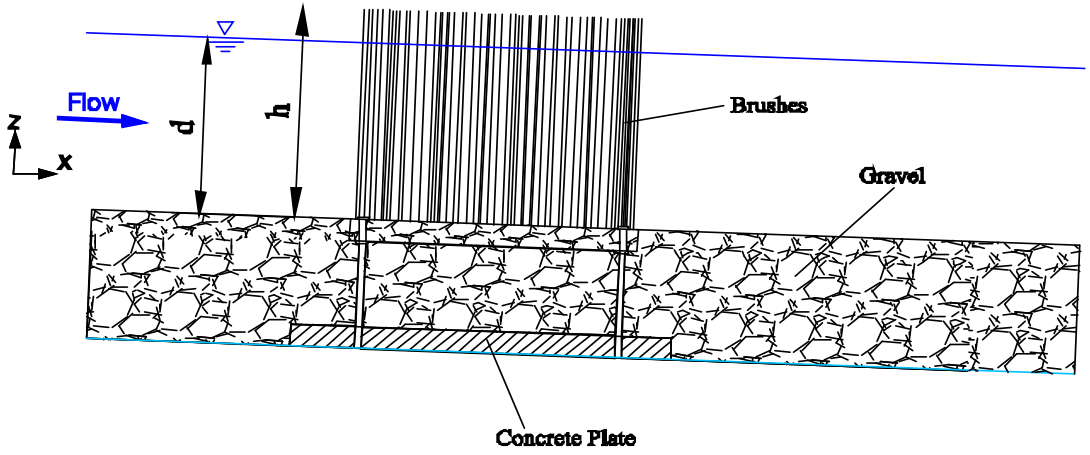
Fish Passage 2015 Conference
22-24 June 2015, Groningen

Physical Model of the Baffle-Brush type Fish Pass

Hydraulics Laboratory and Testing Facilities, University of Kassel

Physical Model of the Baffle-Brush type Fish Pass





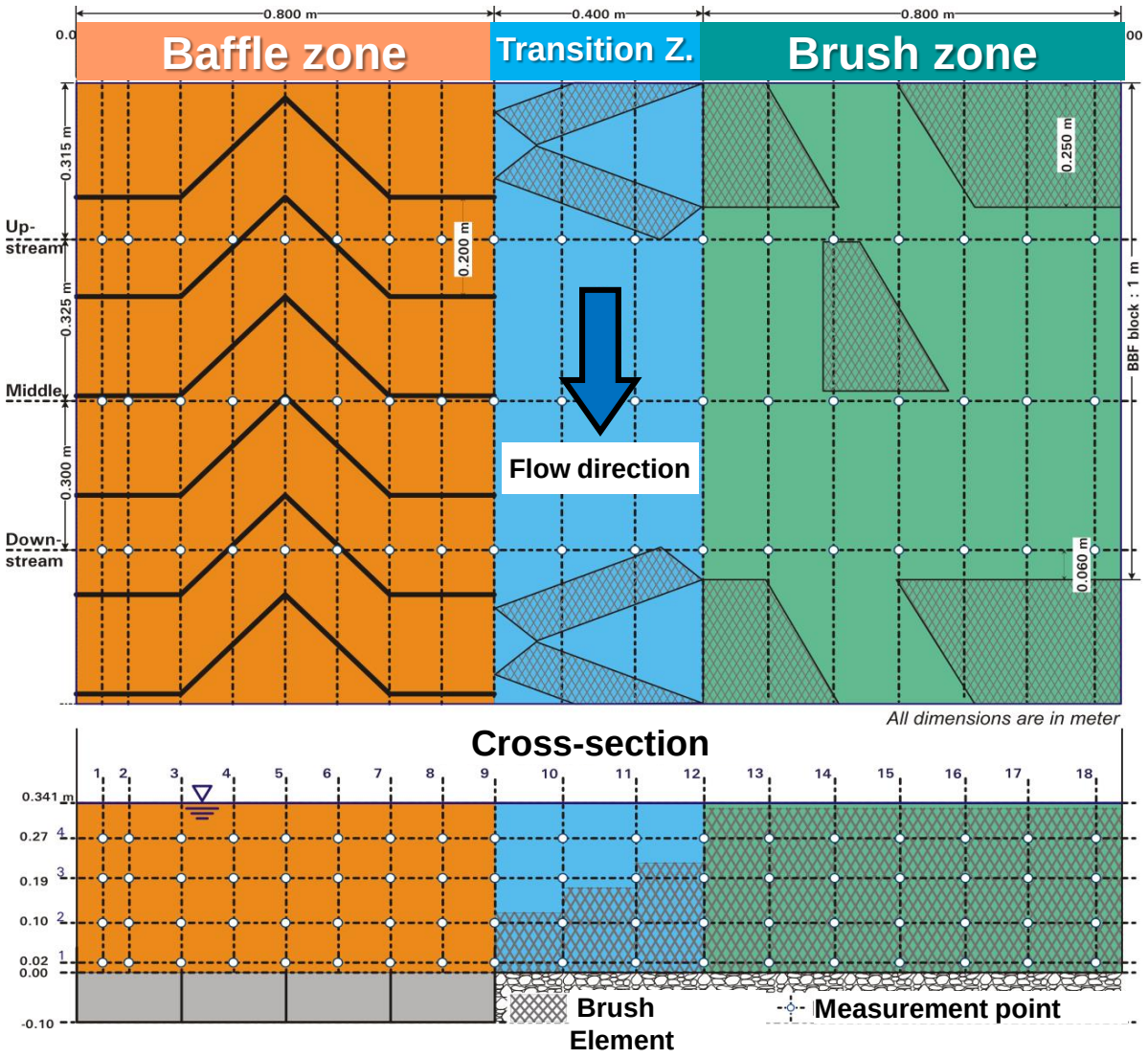
Bed Slope=4%

Flow Conditions and Test Results

d [mm]	Q [l/s]	d/h	U [m/s]	Re	Fr	ΔP [W/m^3]
147	100	0.45	0.34	5.0E+04	0.23	133
193	149	0.58	0.39	7.5E+04	0.2	152
232	202	0.7	0.44	1.0E+05	0.19	171
264	252	0.8	0.48	1.3E+05	0.18	187
295	304	0.89	0.52	1.5E+05	0.18	202
320	351	0.97	0.55	1.8E+05	0.17	215
341	400	1.03	0.59	2.0E+05	0.18	230
358	446	1.08	0.62	2.2E+05	0.18	244
374	499	1.13	0.67	2.5E+05	0.18	262
389	551	1.18	0.71	2.8E+05	0.19	278

Notes: Q=discharge, d=uniform flow depth, h=height of the brush element, U= depth-average flow velocity, Re=Reynolds number, Fr=Froude number, ΔP=energy dissipation per unit volume.

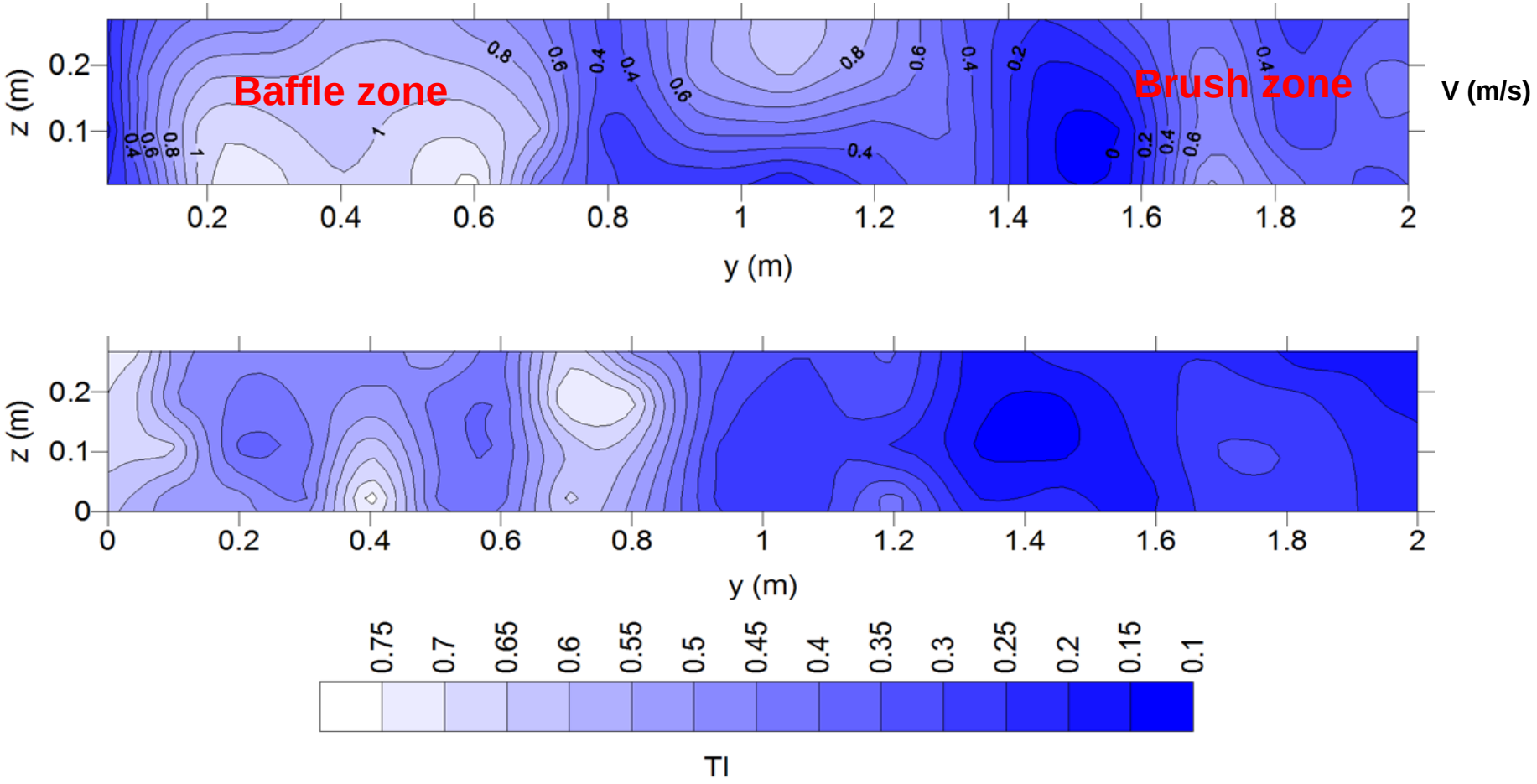
Baffle-brush fishway (BBF) : Concept



Hybrid design

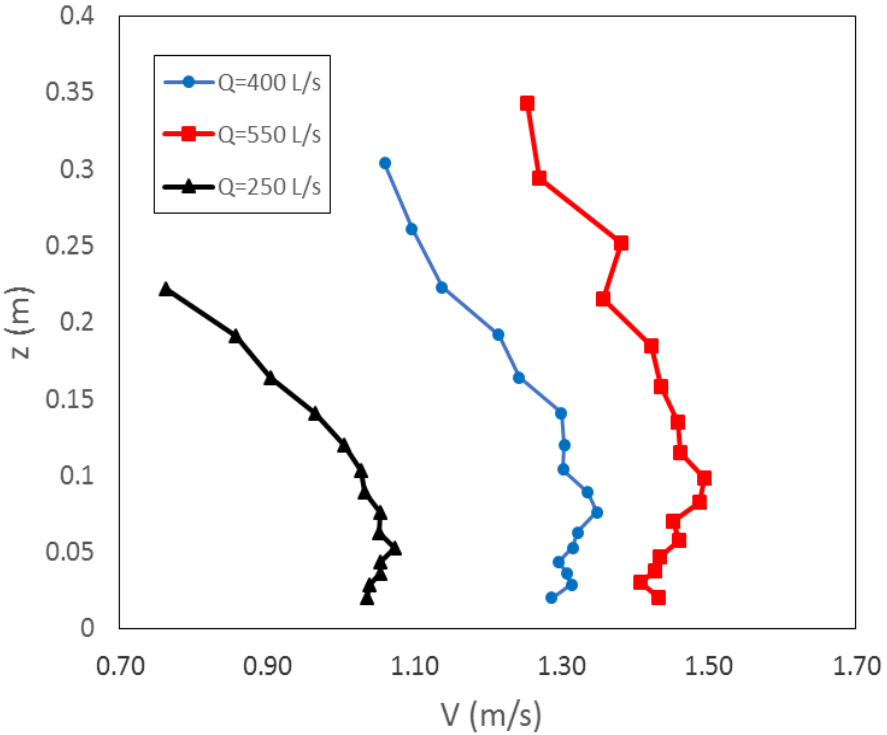
- High turbulent flow in the baffle zone
- Low-velocity flow field in the brush zone
- Transition zone with increasing bristle length

Velocity and Turbulence Intensity (TI) Contours

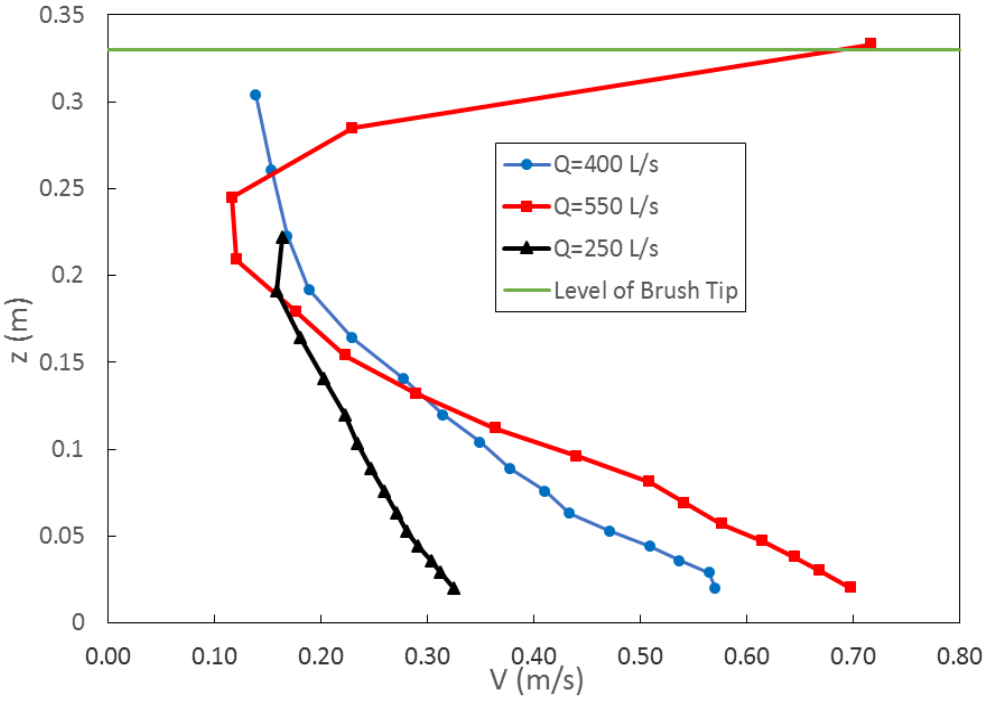


y-z plane at x=4.40 m for Q=400 L/s.

Velocity profiles for different discharges

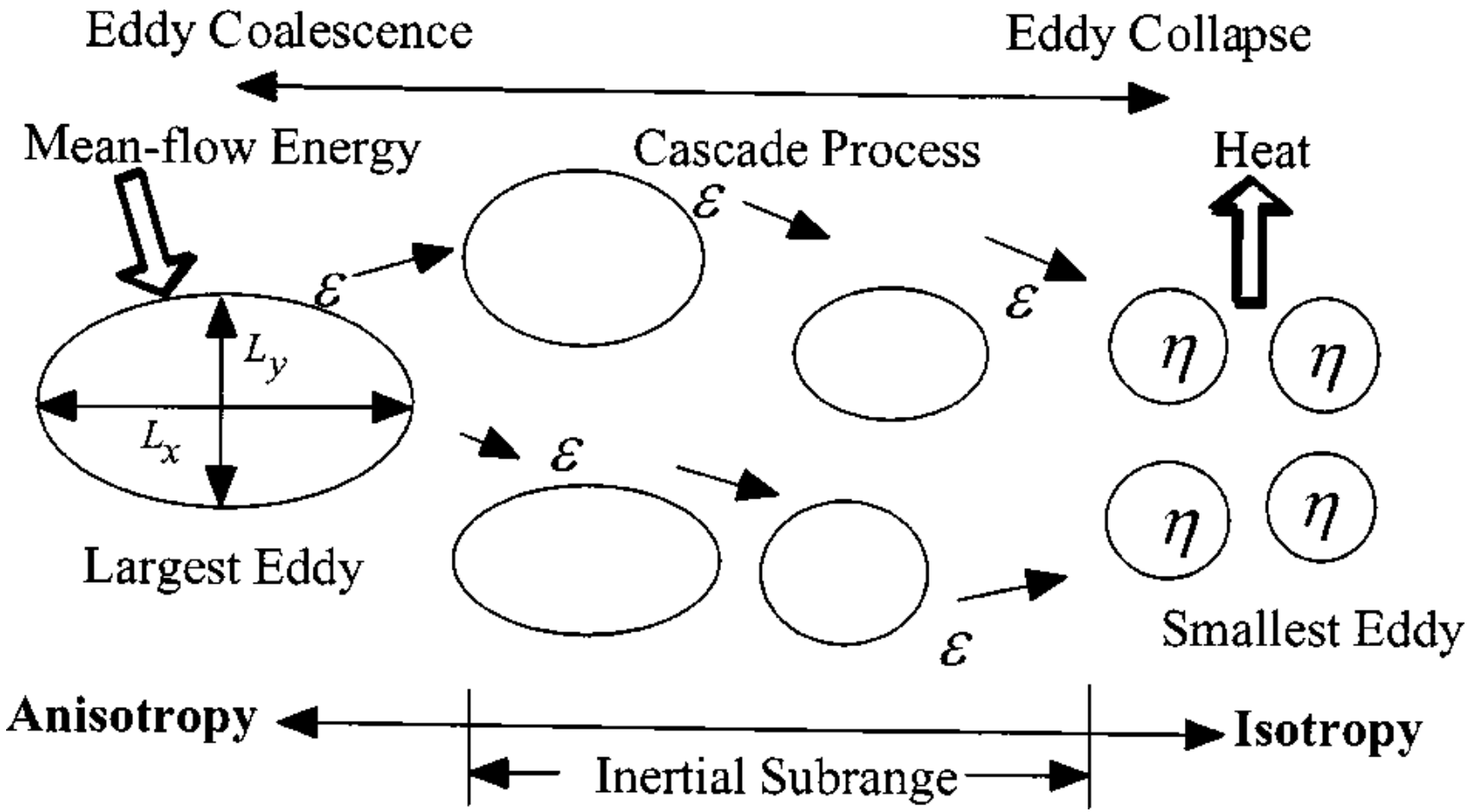


Baffle zone



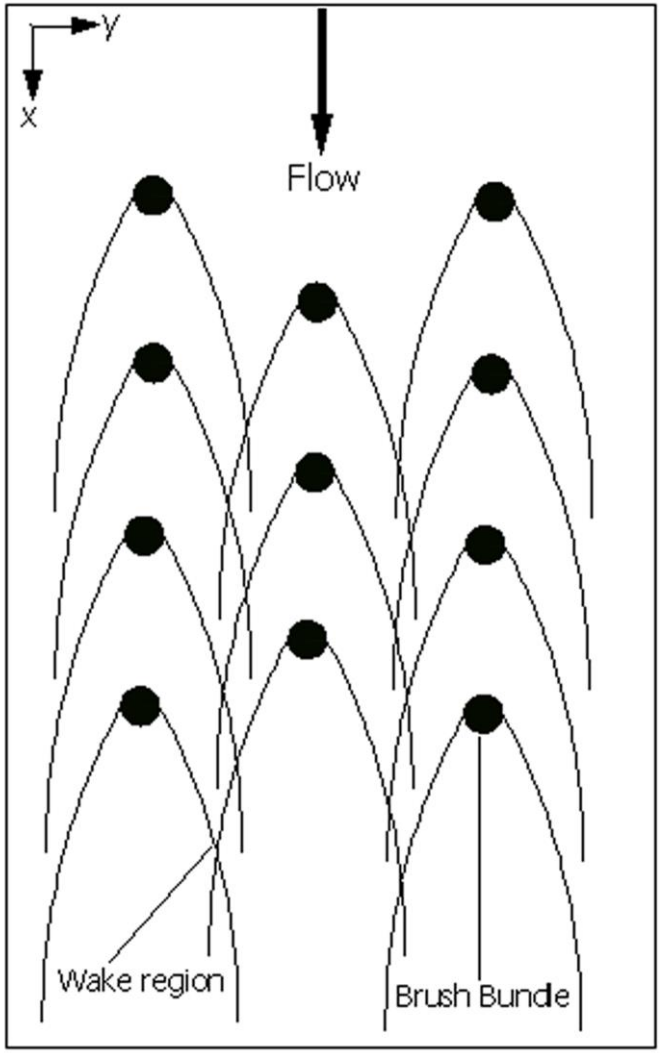
Brush zone

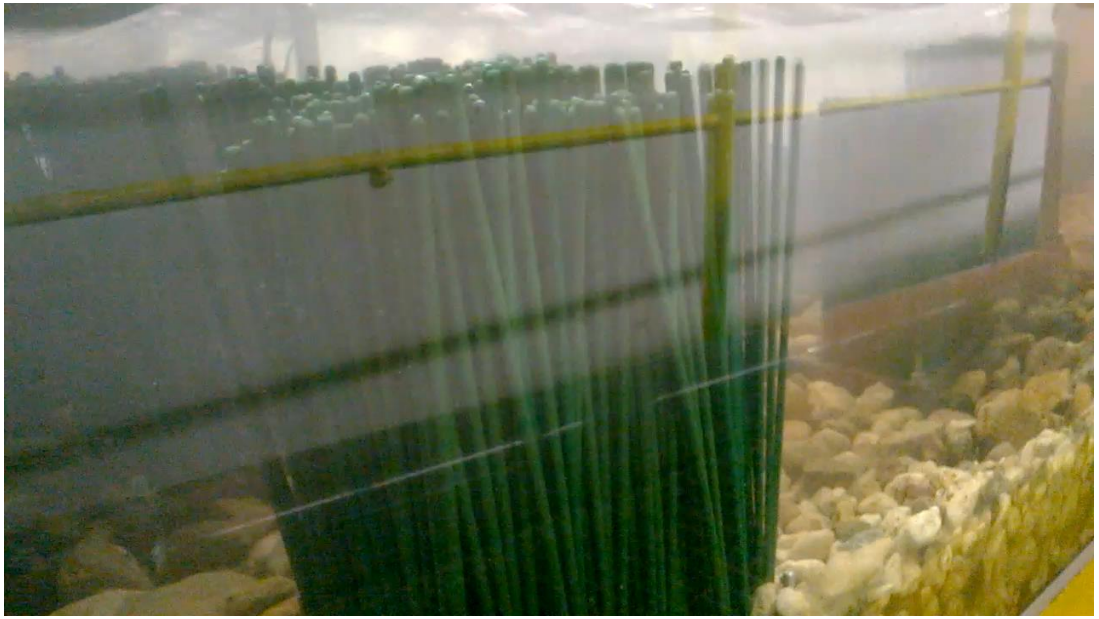
Energy Cascade Process



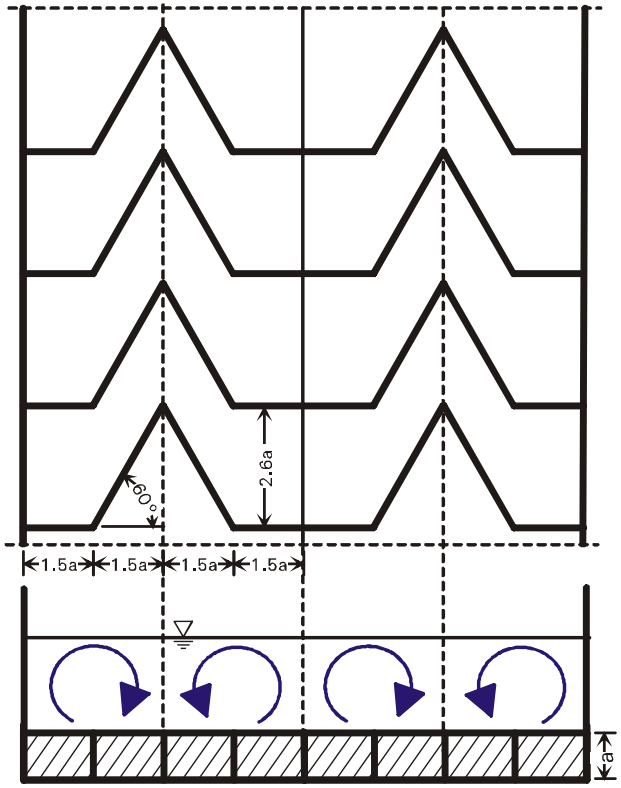
Adapted from Nezu (2005)

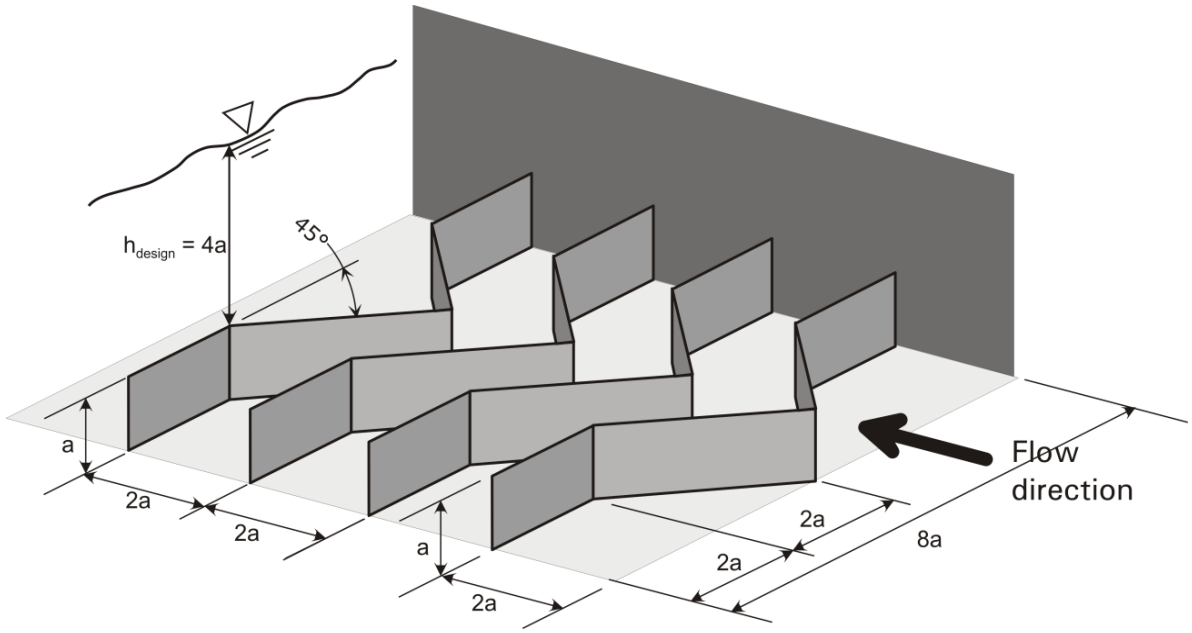
Energy Dissipation in Brush Zone



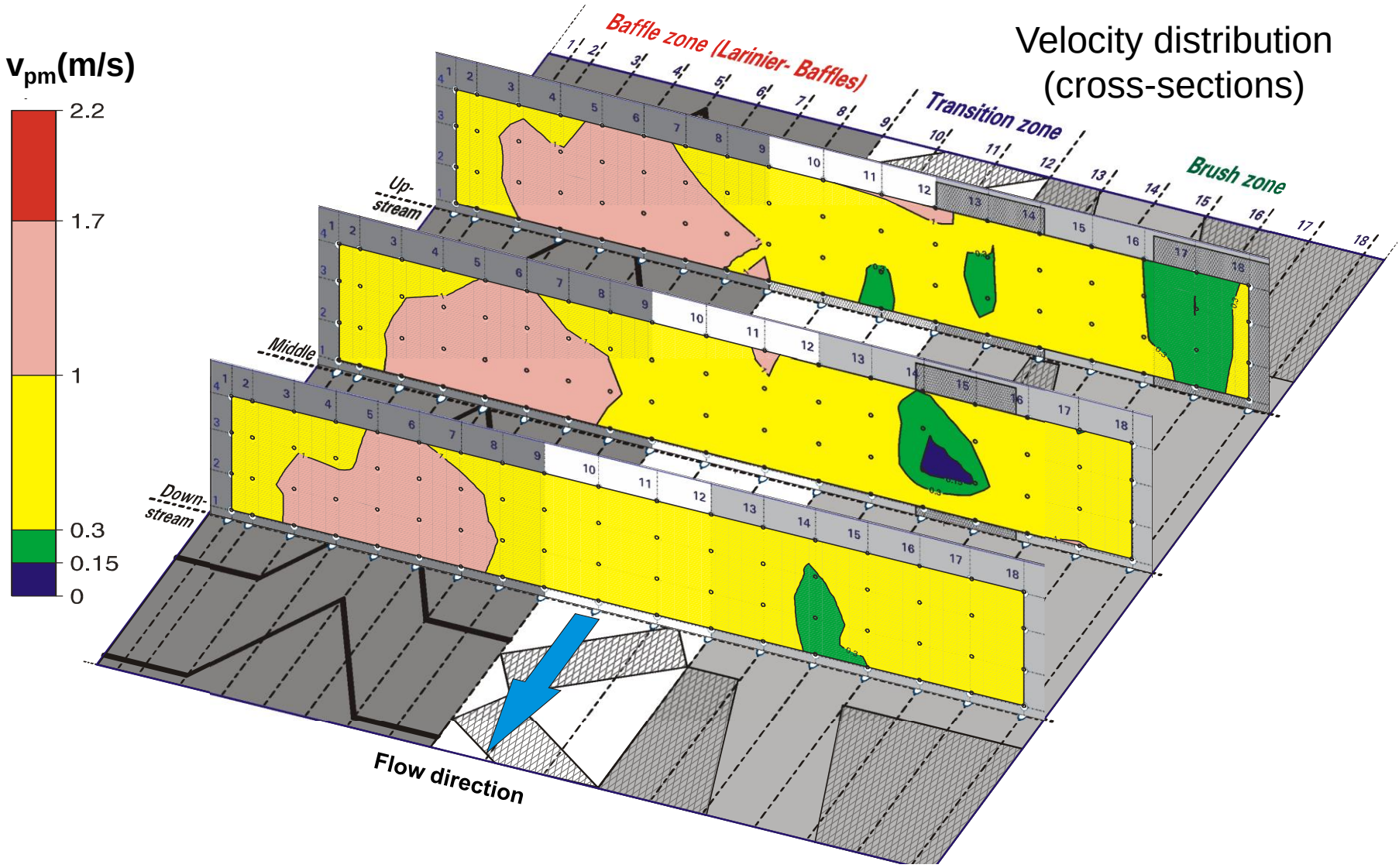


Energy Dissipation in Baffle Zone

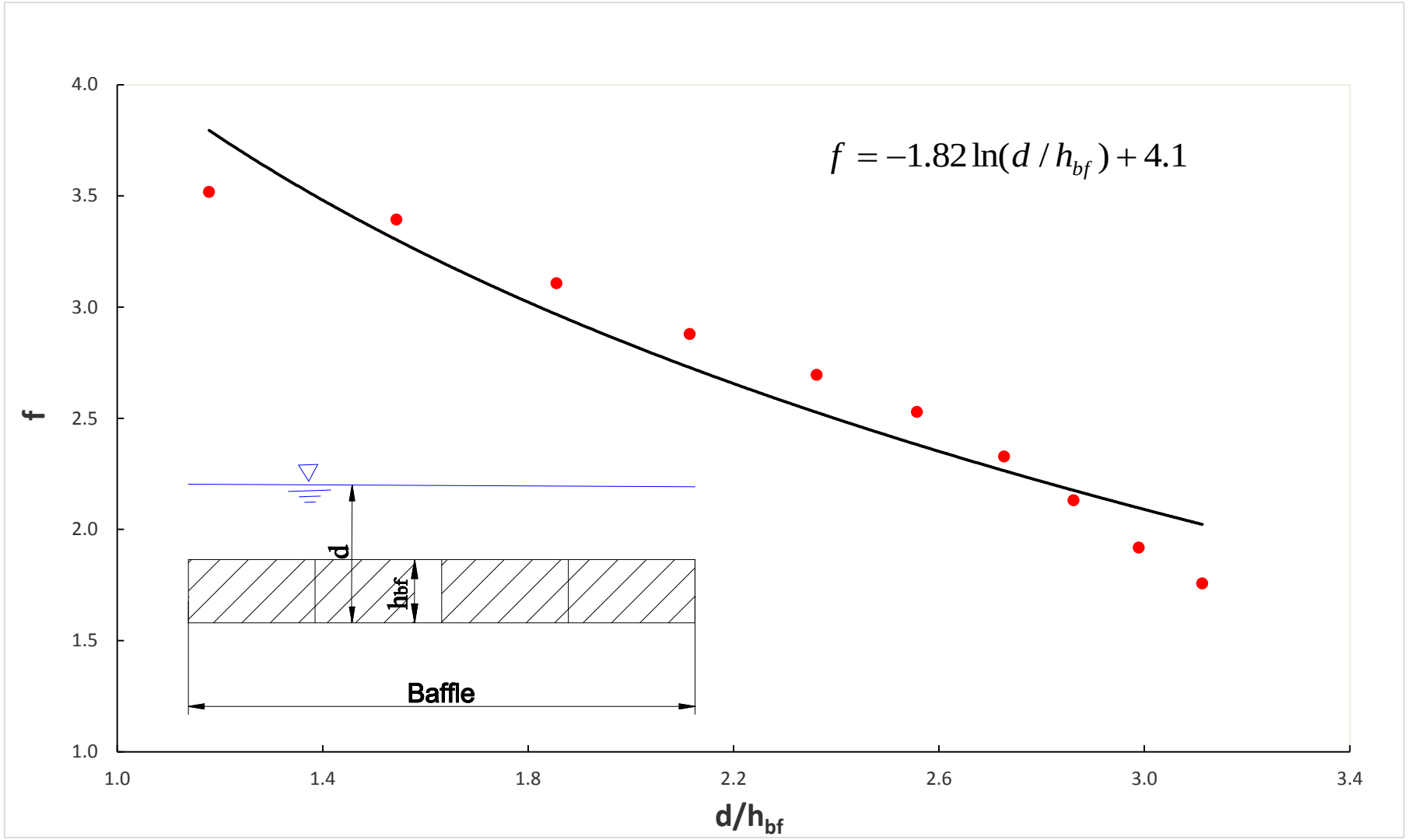




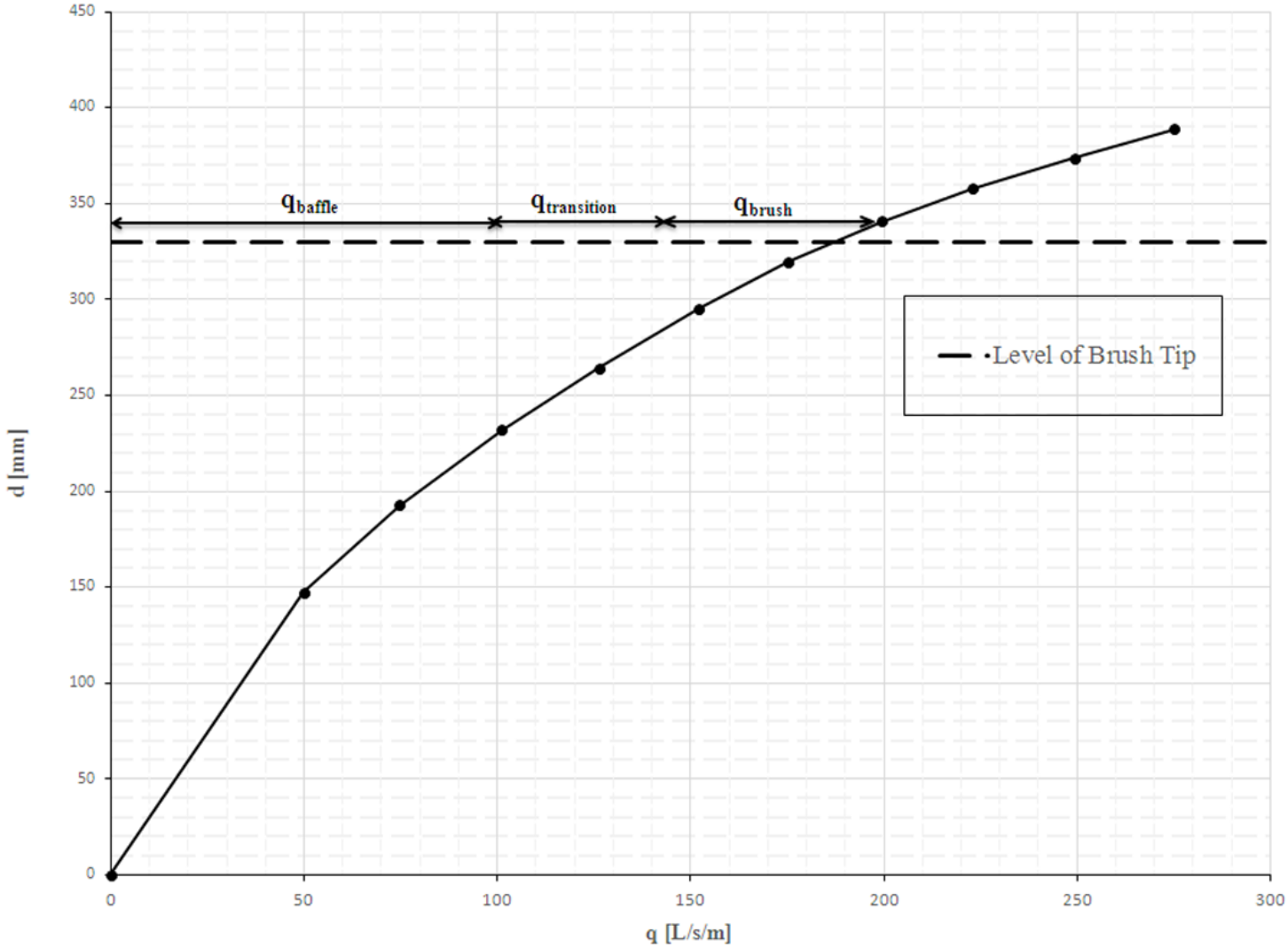
Baffle-brush fishway (BBF) : Experiment



Darcy-Weisbach Friction Factor
(Applied for the Complete Baffle-Brush-Fish Pass)

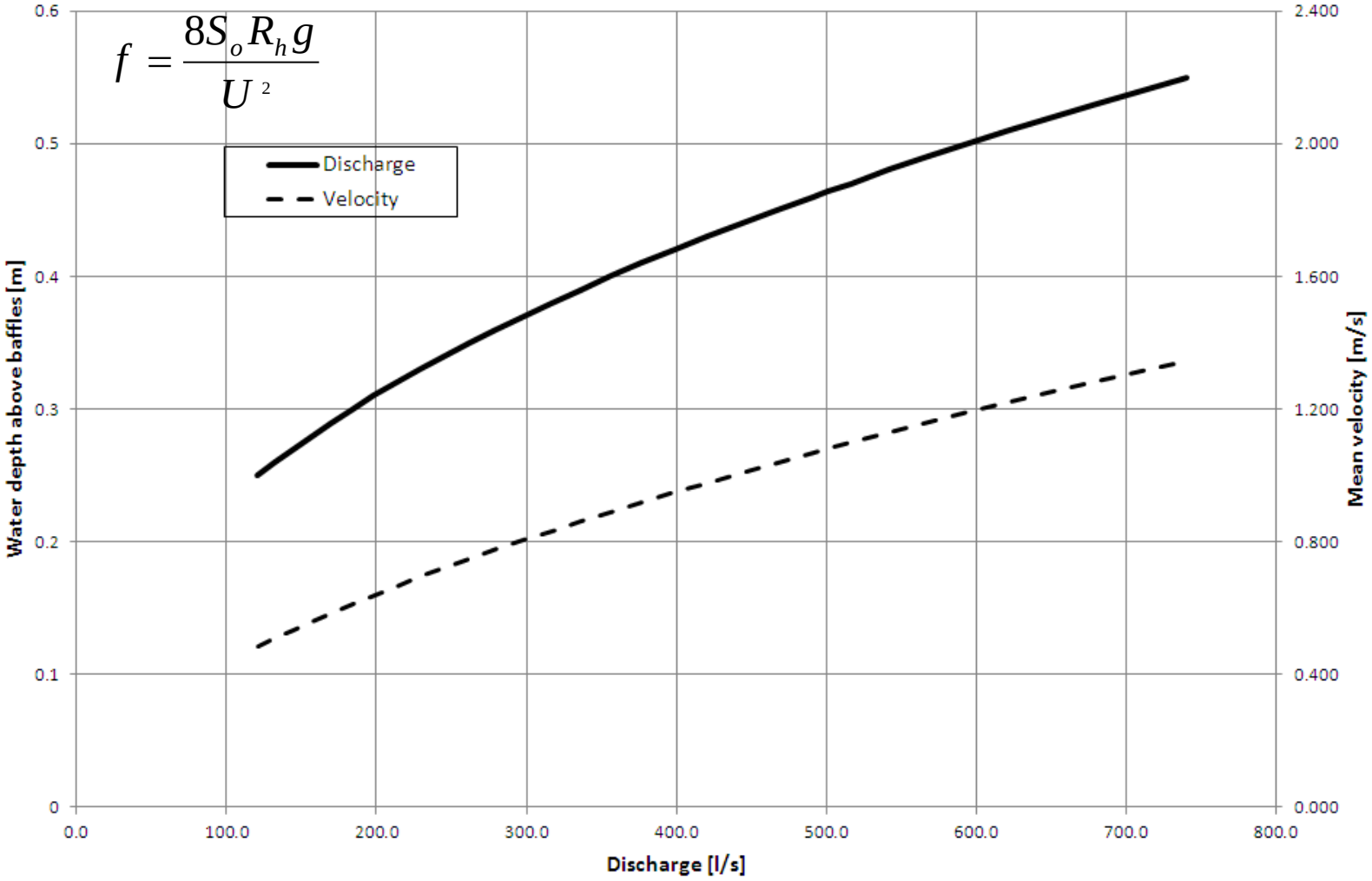


Discharge Rating Curve



Hydraulic Design Diagram

$$f = \frac{8 S_o R_h g}{U^2}$$



Conclusions

- Baffle-brush fish pass fulfill the requirements of an efficient fish passage by providing tranquil flows ,sufficient flow depths, and different migration corridors with no obstructions for different fish species
- The flow characteristics start with an intensely turbulent flow above the baffles and change continuously to the calm and less turbulent flow pattern in the brush strip
- The main advantage is, that all the parts of this fish pass type can be scaled-up in order to adjust it to almost any demand based on the model test results without extraordinary cost

Thank You

Reference:

- Kucukali S. and Hassinger R., 2015. Hydraulic model test results of baffle–brush fish pass. Proceedings of the ICE - Water Management, 1–6.

Dr. Serhat KUCUKALI
E-mail:
kucukali@cankaya.edu.tr