

TMA 4195 Mathematical Modelling SHOCKS ON THE SURFACE OF FLOWING WATER

HEK, October 2007

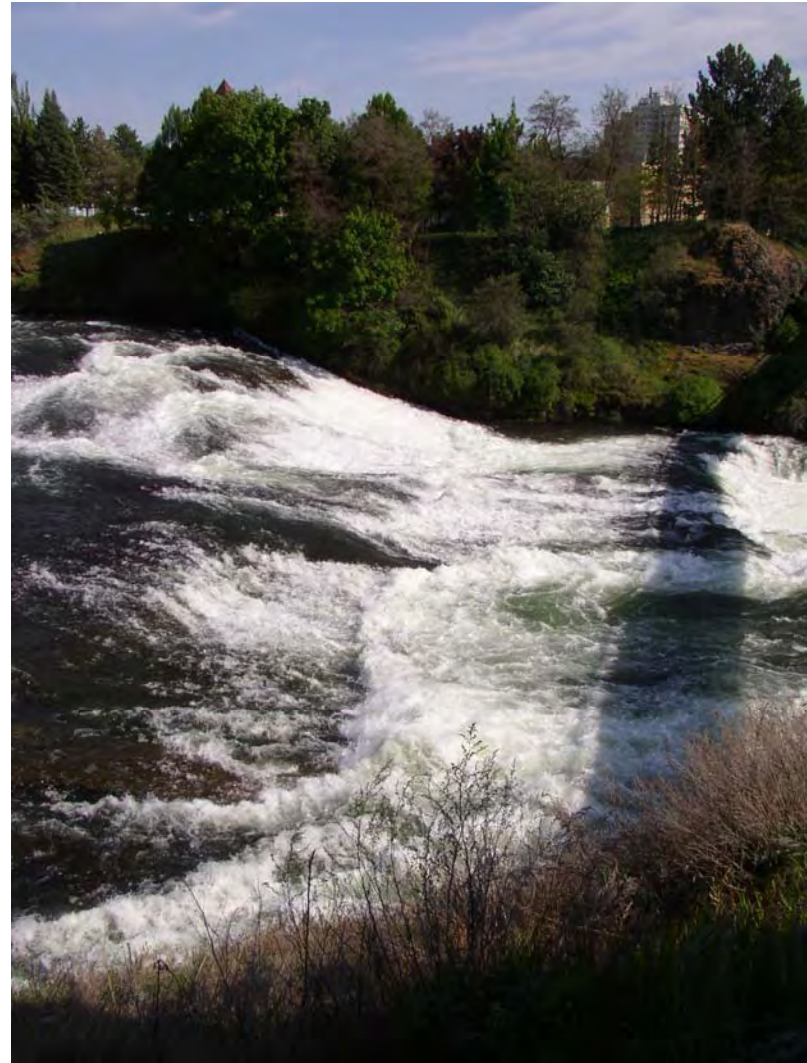
- Hydraulic Jumps
- Tidal Bores
- Roll Waves

More information: [Wikipedia!](#)

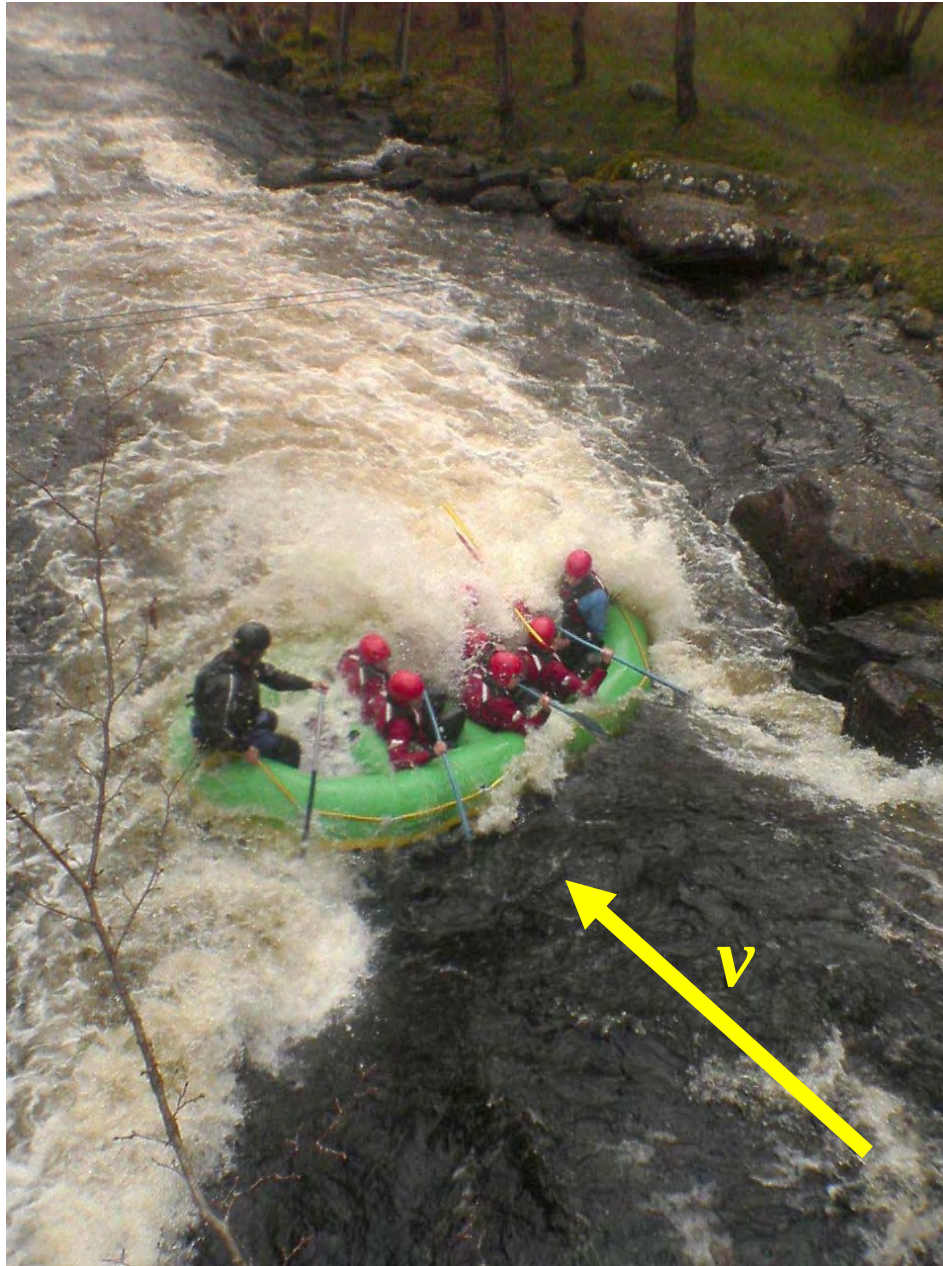
HYDRAULIC JUMPS



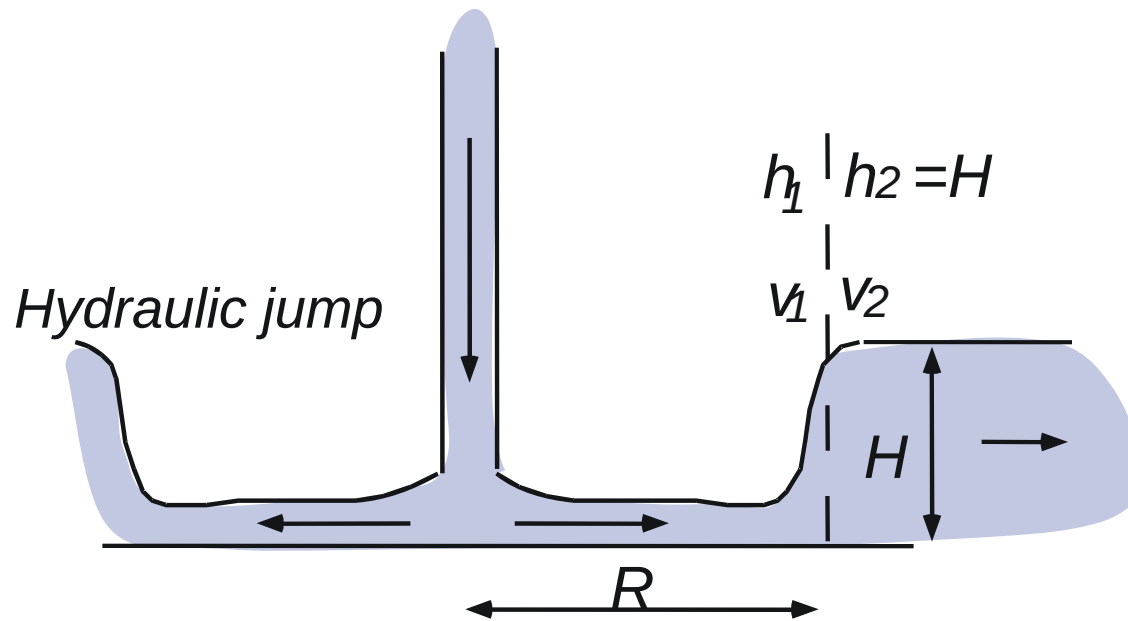
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Canolfan Tryweryn,
Wales
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Shock Conditions:

Mass

$$v_1 h_1 = v_2 h_2$$

Momentum

$$v_1^2 h_1 + \frac{1}{2} h_1^2 g = v_2^2 h_2 + \frac{1}{2} h_2^2 g$$

Energy

$$gh_1 + \frac{v_1^2}{2} = gh_2 + \frac{v_2^2}{2} + gh_L$$

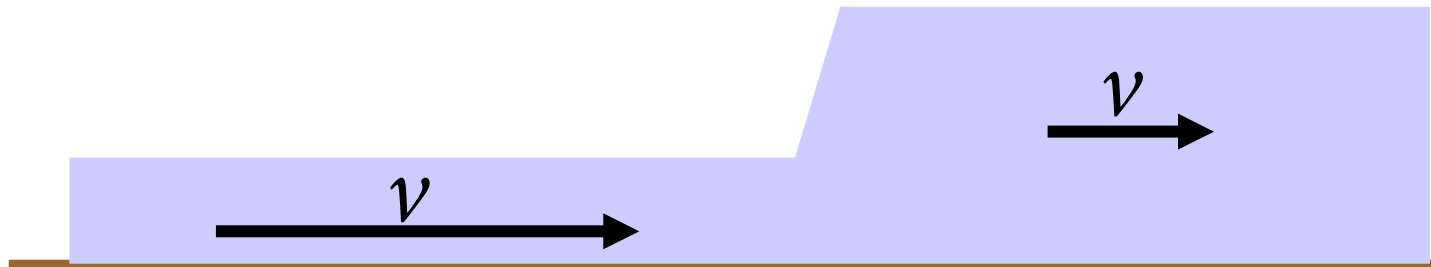
"Head loss"
(energy
dissipation)

Supercritical flow

$$Fr = \frac{v}{\sqrt{gh}} > 1$$

Subcritical flow

$$Fr = \frac{v}{\sqrt{gh}} < 1$$



$\sqrt{gh}$ is the *surface wave velocity*

Fr is the *Froude number*

TIDAL BORES

Examples of steep water fronts in rivers
(From: <http://www.uq.edu.au/~e2hchans/>)

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The tidal bore on the Qiantang River near Hangzhou, China, also known as the Hangchow or Hangzou bore



Mascaret on the Dordogne river, at Vayres (au port de St Pardon, France) (© Fabrice Colas, 2000)



Dordogne river



Petitcodiac river, near Moncton (Bay of Fundy, Canada)



The Severn Bore

<http://www.severn-bore.co.uk/>



The tidal bore in Turnagain Inlet, Upper Cook Inlet,
Alaska Photographer: Mr. Steve Nicklas, NGS/RSD

ROLL WAVES



(A. Fowler)



Spillway from Llyn Brianne Dam, Wales