Dec 13th, 1:30 PM - 3:10 PM

Optimisation of Fishway Entrance and Exit Conditions Using Physical Modelling: SARFIIP Pike Floodplain Regulator and Fishway Designs

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Optimisation of Fishway Entrance and Exit Conditions Using Physical Modelling

SARFIIP Pike Floodplain Regulator and Fishway Designs

By: Steven Slarke (Jacobs), Ivor Stuart (DELWP) and David Pezzaniti (Australian Flow Management Group, UniSA)

13 Dec 2018

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Aims of this Presentation

- Pike SARFIIP – Overview of the Tanyaca Creek and Pike River structures and fishway designs.
- Overview of fishway physical modelling at the UniSA AFMG facilities.
- Requirements for positioning the downstream fishway entrance in the right location and maintaining integrity of attraction flows to the fishway entrance, emphasising:
  - Entrance attraction, and
  - Fishway passage
- Discussion of the costs and benefits of physical modelling.

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Pike Floodplain

Pike Floodplain,
Renmark, SA

Source: Google Maps

Rainbowfish

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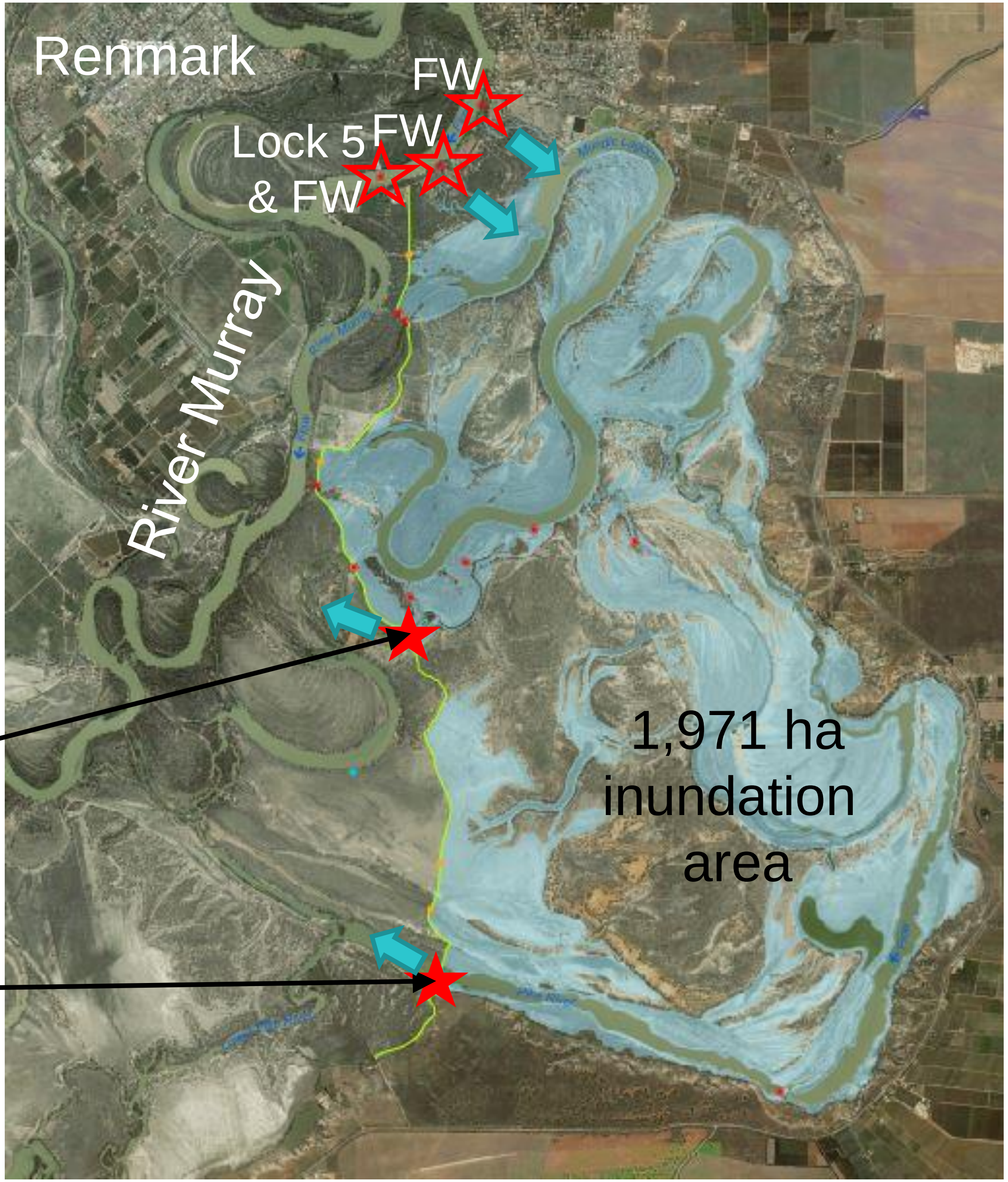
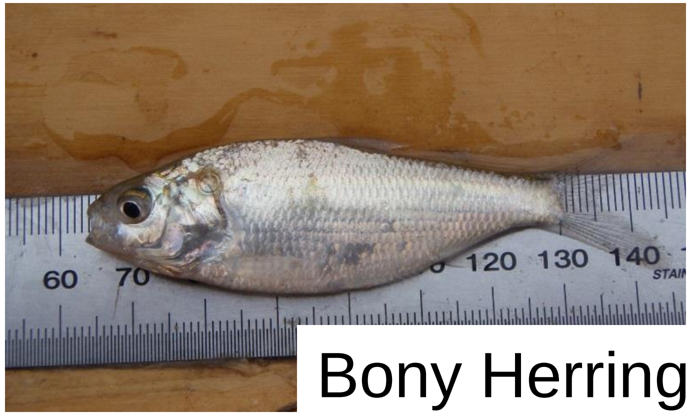
Pike SARFIIP



Tanyaca Creek Regulator and VS Fishway

Pike River Regulator and VS Fishway



Bony Herring

Project aims:

1. Restore floodplain health through managed inundation watering.
2. Restore fish passage connectivity.

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Fishway Designs

- Regulator designs at Tanyaca Creek and Pike River the same therefore one physical model to suit both sites.
- Vertical slot fishways at each site:
  - Tanyaca Creek fishway design $\Delta H = 2.55$ m
  - Pike River fishway design $\Delta H = 1.55$ m
- Fishways designed to pass small, medium and large-sized native fish (20 to 800 mm long).

Catfish

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Fish of the Pike Floodplain

Unspecked hardyhead

Golden perch

Australian smelt

Silver perch

Murray cod

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Physical Modelling Aims

1. Identify and / or confirm optimal arrangement of the downstream fishway entrance in relation to the regulator gate positions at the *'limit of upstream fish migration'*
   - Normal flows, managed inundation and flood flows
2. Assess the suitable flow conditions for fish attraction and if required, design solutions to achieve ideal conditions.
3. Confirm optimal location for upstream exit to avoid fish recirculation back over the regulator gates.
4. Confirm the capacity of the fully opened regulator gates at 3,000 ML/d.
5. Confirm potential operational requirements.
6. Assess any potential safety issues.

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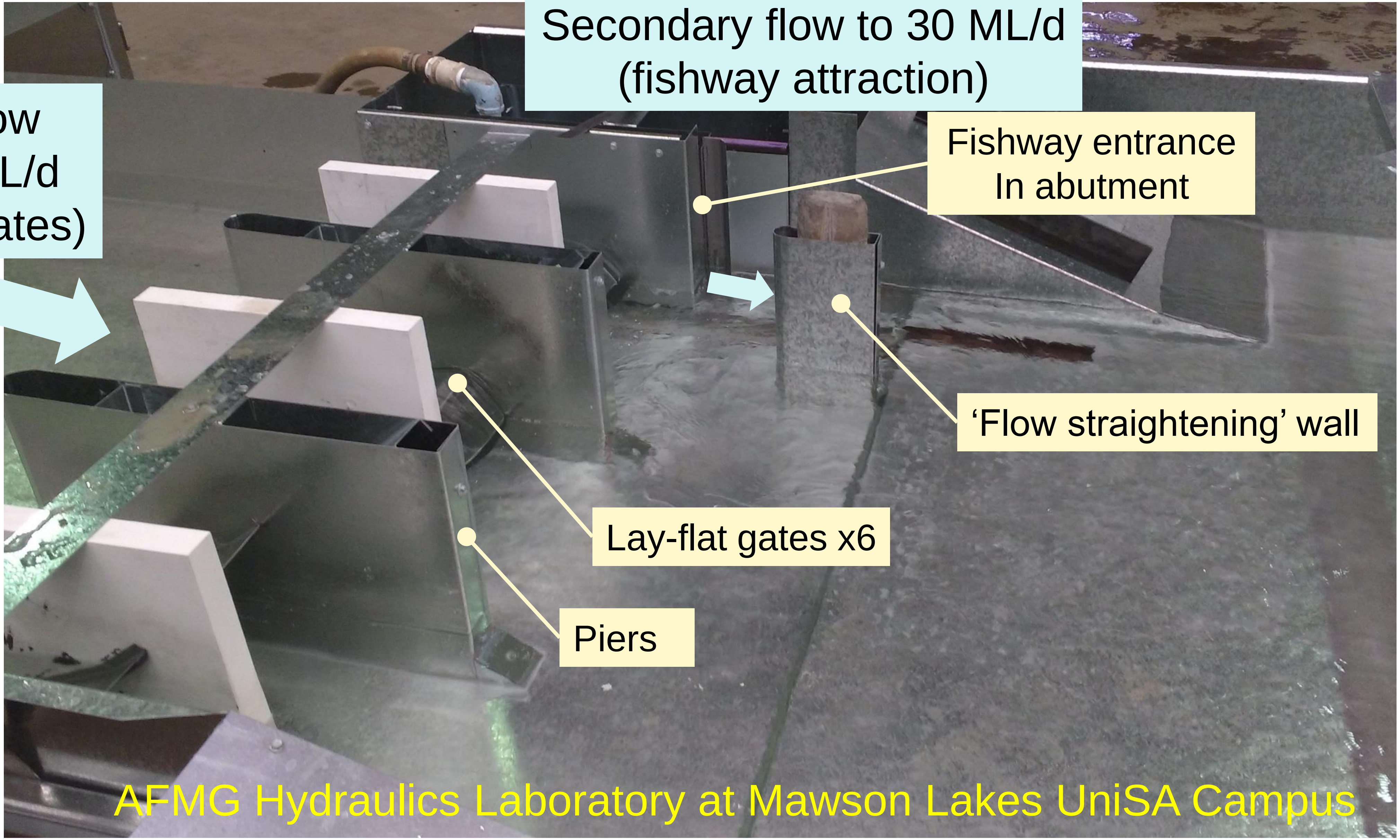
Pike Regulator / Tanyaca Regulator Scaled Physical Model

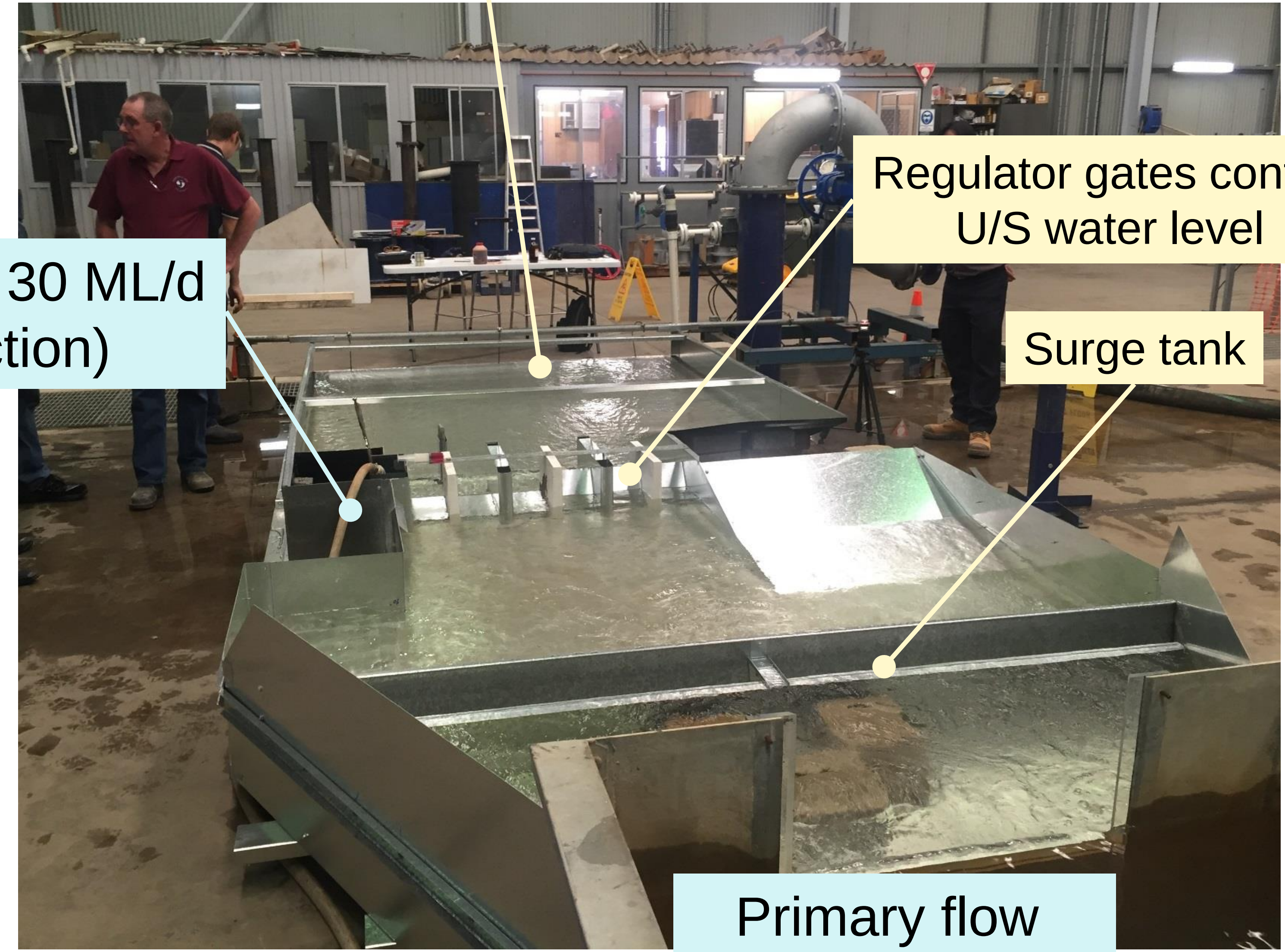
Primary flow to 3,000 ML/d (regulator gates)

1:15 scale based on Froude No. similarity

Steel plate construction



Model Features



1:15 scale based on Froude No. similarity

Steel plate construction

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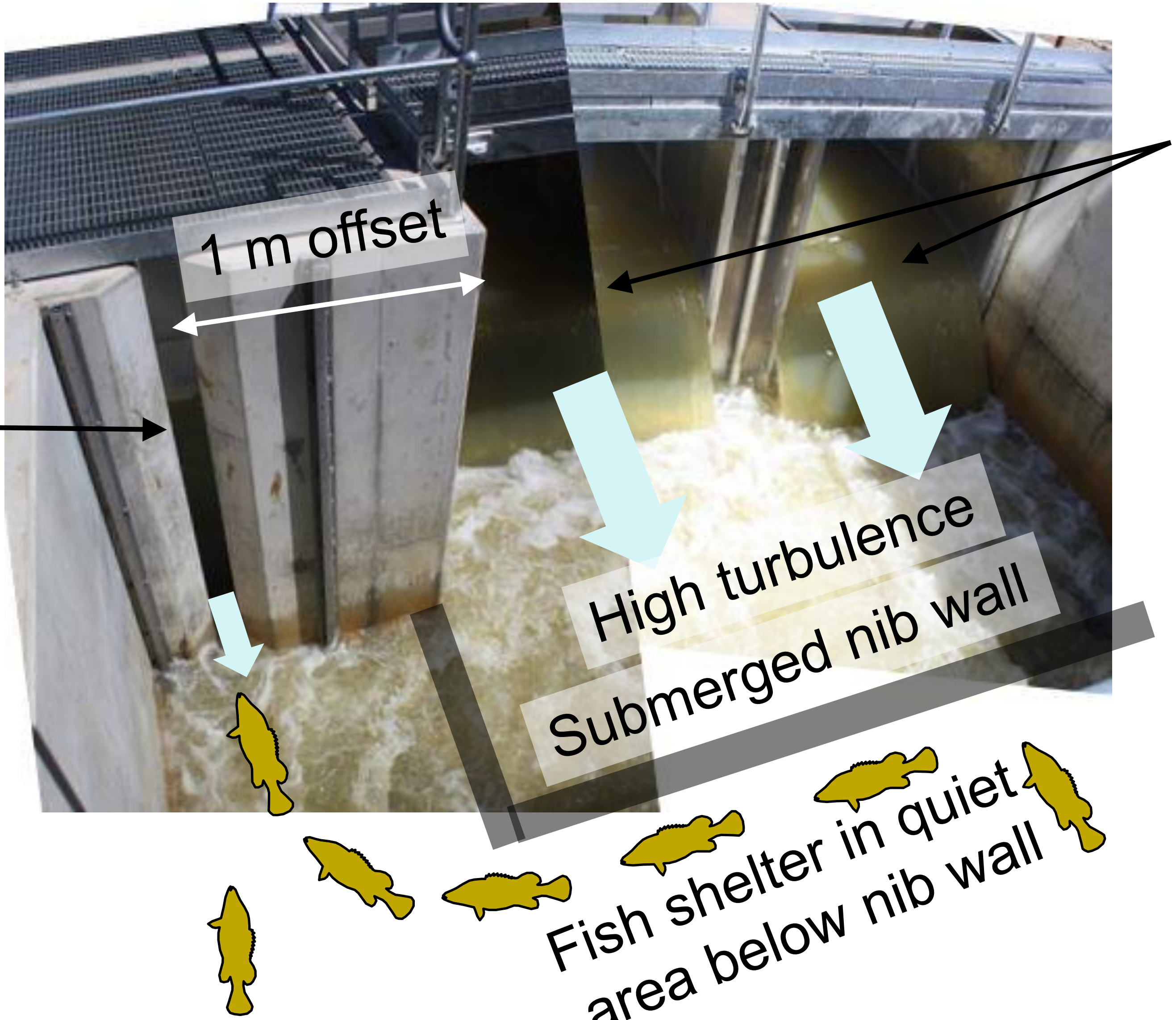
Basis of Entrance Design (Successful Design Precedent)

Deep Creek Regulator & VS Fishway (Pike)

VS fishway entrance

Lay-flat regulator gates



20,700 fish (7 native species) trapped 03 to 12 Nov 2016

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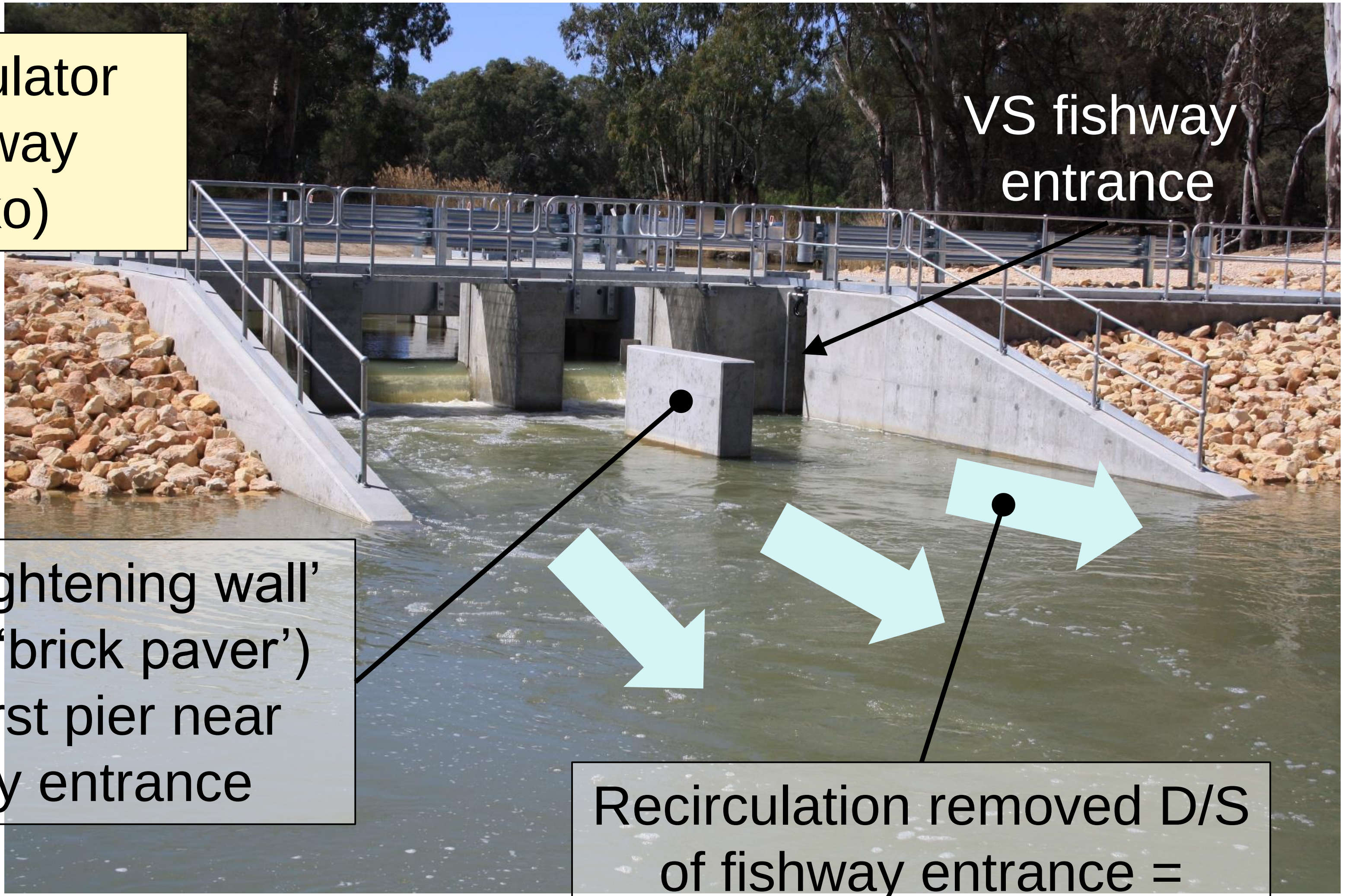
Basis of Flow Straightening Wall Design (Successful Design Precedent)

Bank J Regulator
& VS Fishway
(Katarapko)



‘Flow straightening wall’
(AKA the ‘brick paver’)
D/S of first pier near
Fishway entrance

Recirculation removed D/S
of fishway entrance =
positive attraction flow

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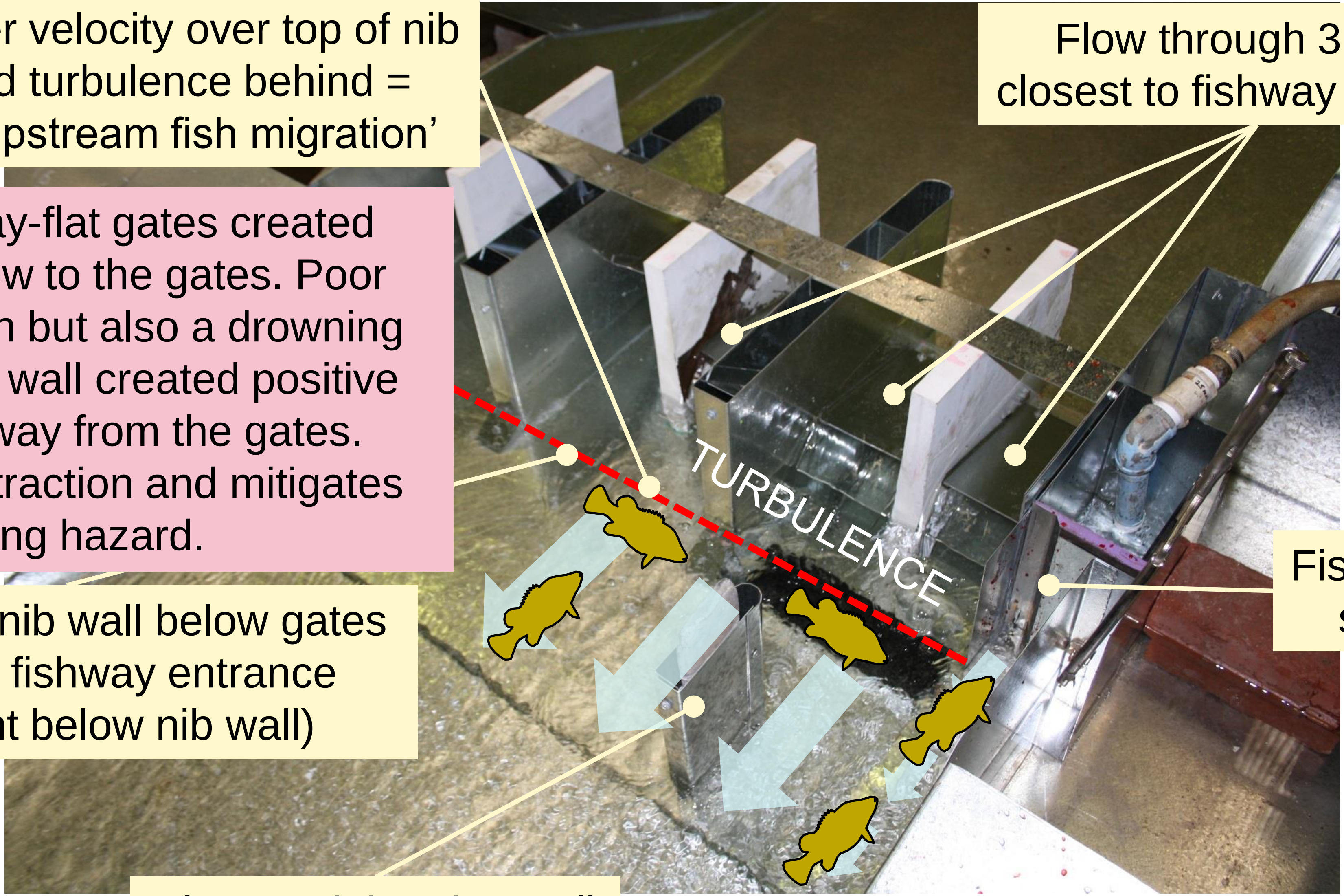
Normal Conditions (Flow = 400 ML/d and ΔH = 1.15 m)

High water velocity over top of nib wall and turbulence behind = ‘limit of upstream fish migration’

Flow through 3 gates closest to fishway entrance

Safety Issue: Lay-flat gates created surface back-flow to the gates. Poor for fish attraction but also a drowning hazard. The nib wall created positive surface flows away from the gates. Good for fish attraction and mitigates potential drowning hazard.



Fishway entrance set back 1 m

600 mm high nib wall below gates aligns with fishway entrance (quiescent below nib wall)

Flow straightening wall

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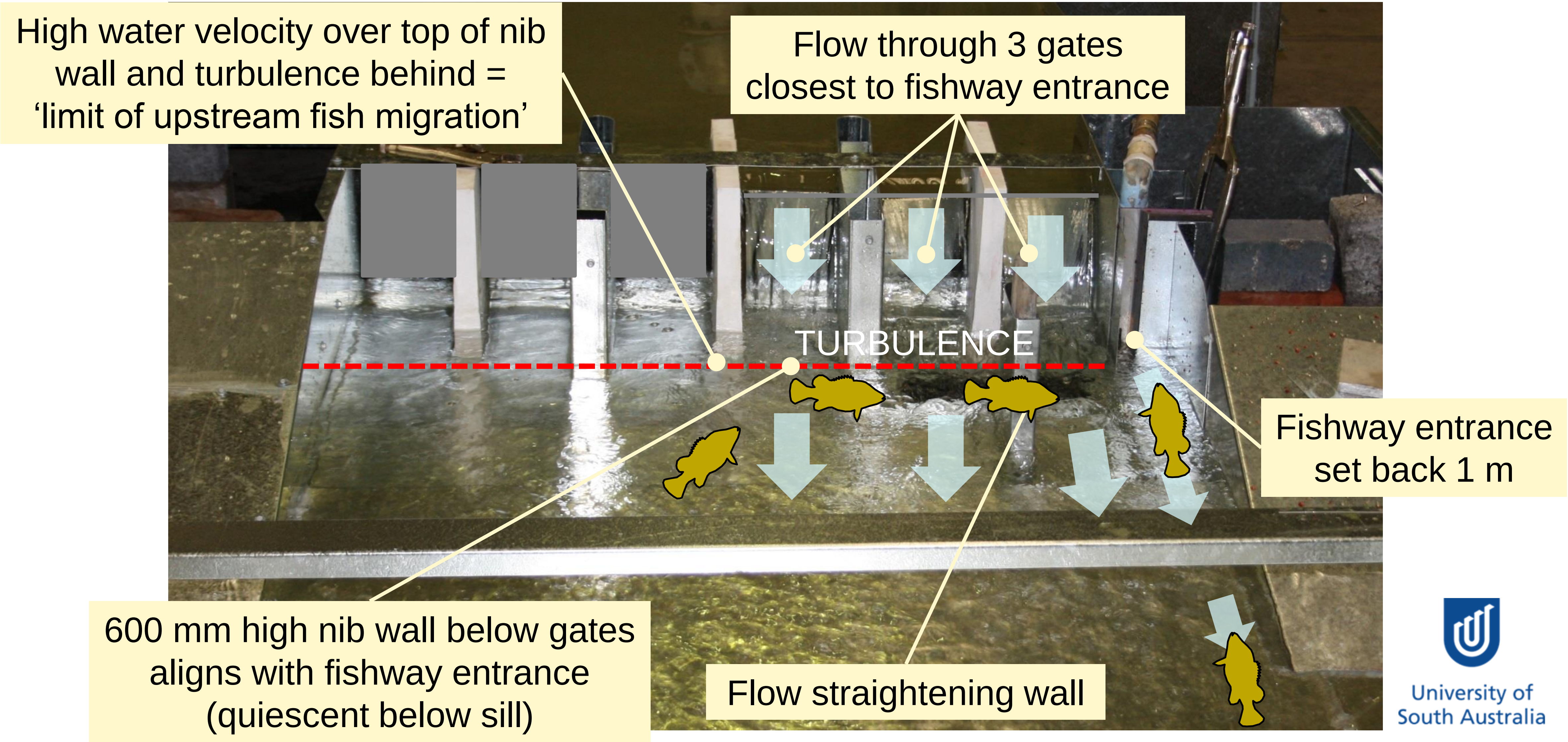
Maximum Managed Inundation (Flow = 400 ML/d, ΔH = 2.55 m)



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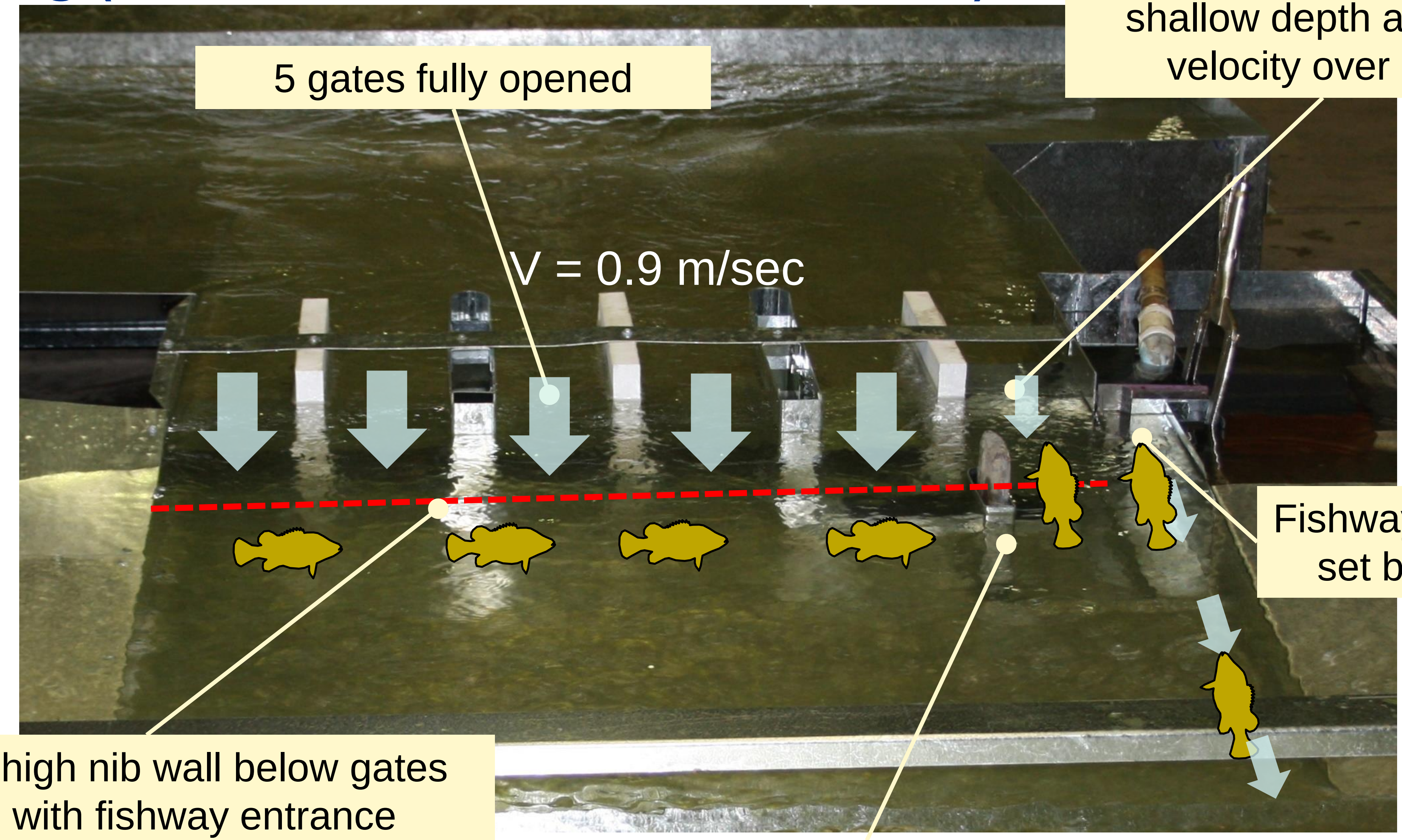
Flooding (Flow = 3,000 ML/d, ΔH = 100 mm)



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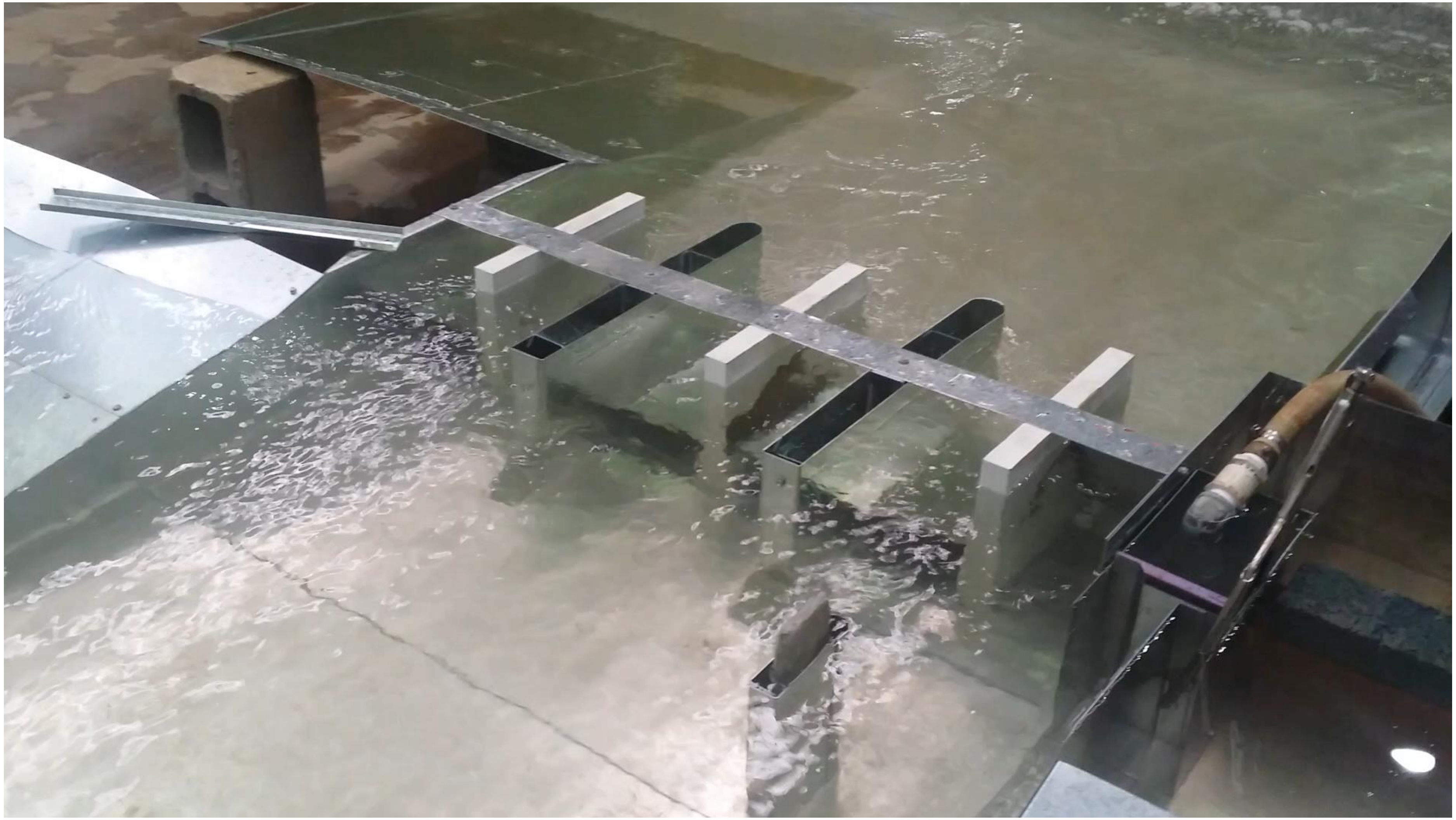
Flooding



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Tools of the trade: Velocity Meter and Dye

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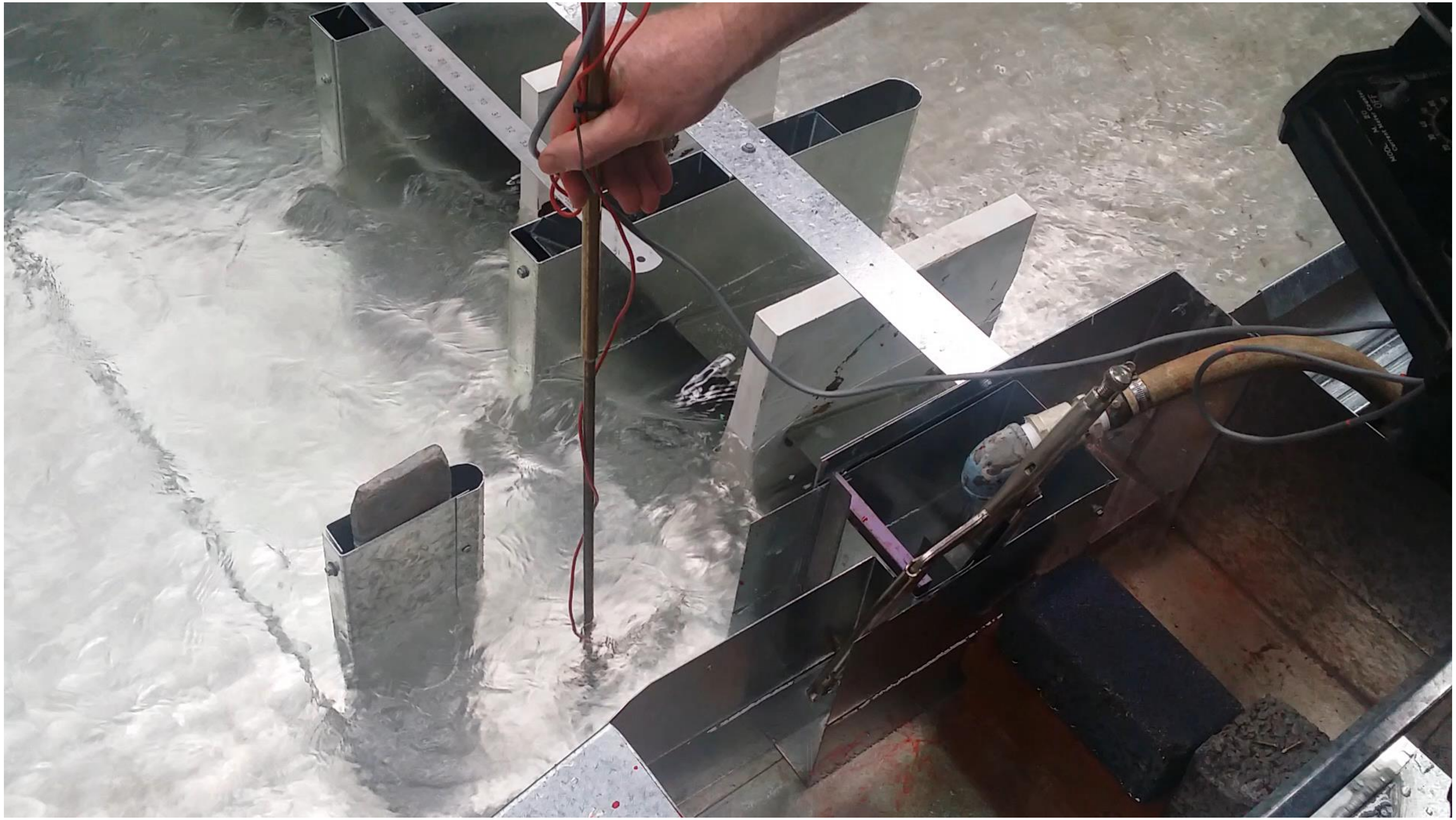
Assessing Integrity of Attraction Flows



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Benefits of Scaled Fishway Physical Modelling in Sheet Metal Plate

1. Opportunity for design engineers to work directly with fish biologists and clients.
2. Ability to get the fishway entrance (and exit) in the right locations.
3. 'Real time' assessment of regulator / fishway hydraulics and ability to quickly adjust the model.
4. Determination of operational requirements.
5. Cost competitive with CFD modelling:
   - Pike model cost (AFMG at UniSA) = $28k
   - Engineering plus biology = $12k
   - Total = $40k (Note: all costs subject to design requirements)
     - 4 weeks construction time + 2 days testing
6. Modelling represents 0.01% of total construction cost.

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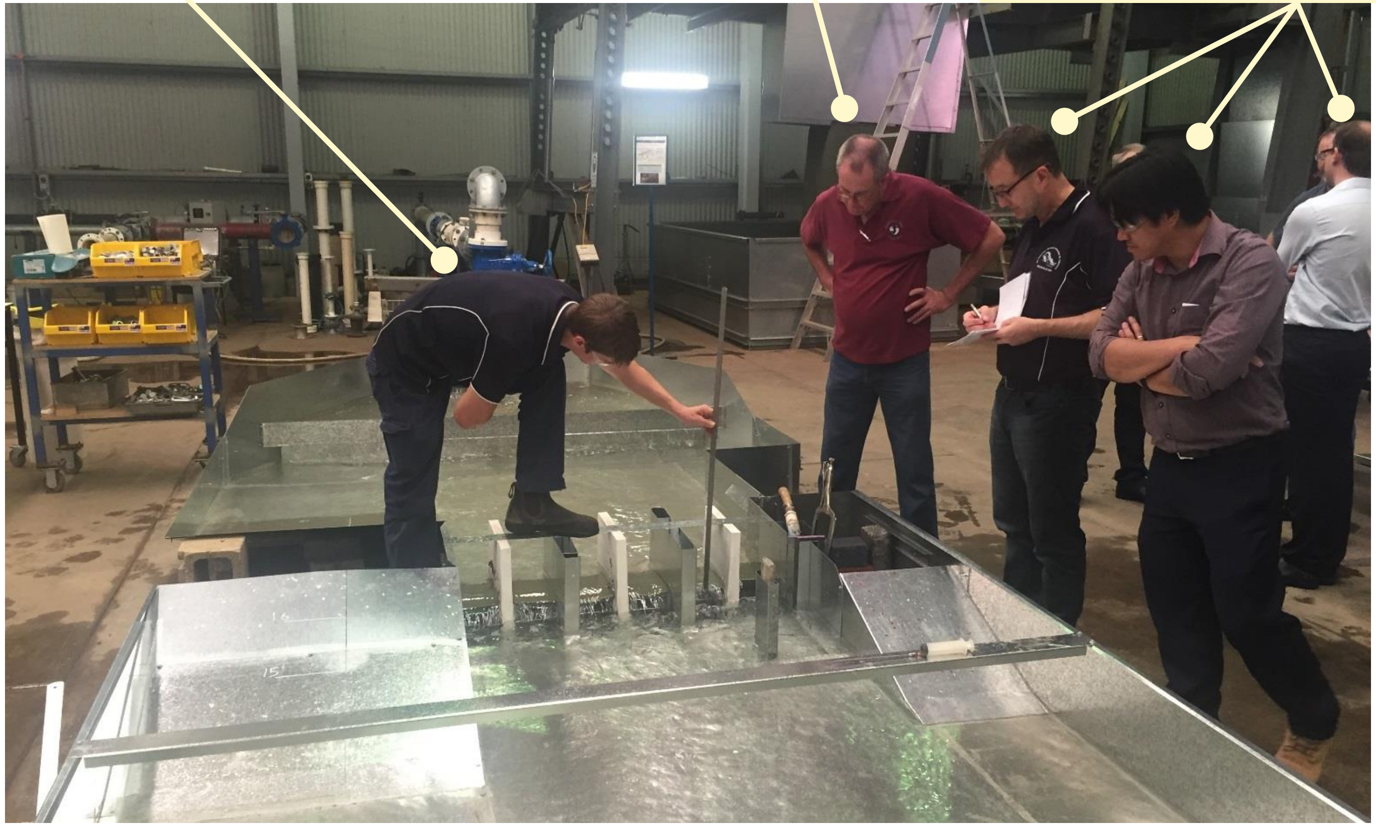
Pike and Tanyaca structures currently being built

Thank you

AFMG lab technician

Client

Jacobs design engineers and fish biologist



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