Quantifying hyporheic flow at gauging stations

During periods of low flow, hyporheic flow can account for a large part of the flow in a river channel. Yet there is no method for measuring it.

Quantifying the hyporheic flow at river gauging stations will complement surface flow measurements. It will increase our understanding of how rivers contribute to flows. This is particularly important during periods of low flow.

Project description

The hyporheic zone is the porous sediment beneath and beside a water body. It is where groundwater and surface water mix. Hyporheic flow is the dynamics and behaviour of water in this zone. It is important for surface water/groundwater interactions, water quality and riparian habitat.

Currently no method is used for quantifying hyporheic flow at gauging stations. With a method to measure hyporheic flow through downstream cross-sections, rating curves could be developed to estimate hyporheic flow at gauging stations. This is particularly relevant for periods of low flow, as hyporheic flow can be a major proportion of these flows.

The method would likely include:

- a technique for identifying sites where hyporheic flow is significant at low flow, using data such as River Styles. This data would need verification against local information. Site visits, or WaterNSW hydrographic site assessments (including discontinued sites) could provide such verification.
- the use of shallow piezometers upstream and downstream of selected river channel cross-sections. The water level measurements from the piezometers made during low flow periods could quantify the changes in water head.
- an approach for quantifying the hydraulic properties of the hyporheic zone. These properties used with the piezometer data could then be used to develop rating curves that estimate hyporheic flow.

Use of project outcomes

Low flows in different rivers are hard to compare if one river has hyporheic flow at the gauge, and the other does not. The measuring (or gauging) of surface water in rivers is only part of the picture. Including hyporheic flow in river flow measurements gives the real flow in a river channel. Also, including the hyporheic flow in flow measurements will provide a better understanding of:

- which rivers contribute water (part of which moves through the hyporheic zone) in low flow conditions
- what water is available to the environment (and users where allowed) in dry conditions
- how similar low flows are between catchments (with different levels of hyporheic flow), providing for transferability of low flow knowledge between rivers.

This knowledge will help to:

- determine low flow access conditions for licensed water users
- identify the risk of reduced quality of refuge in riverine habitats
- estimate the reliability of low inflows from tributaries into major rivers
- improve calibration of low flows in hydrology models
- understand the relationship between connected alluvial and river systems
- understand the water quality inputs/processes of the hyporheic zone.

Project delivery

Potential candidates for this project include both undergraduate and postgraduate students with an understanding of fluid mechanics. Knowledge in measuring water levels, flows and pressure heads is desirable. It particularly suits those studying physical geography, civil engineering, or hydrology.

We can break the project into smaller projects to suit the knowledge and skills of students, and the time available. The project could be several undergraduate or honours-type projects. Or it could be undertaken as a larger postgraduate project.

Contributors will need to carry out fieldwork in rivers, abiding by Workplace Health and Safety requirements.

Timing/proposed timeframe

The Department of Planning, Industry and Environment—Water will oversee the project.

The work needs to occur during a range of flow conditions, from low flow to no visible flow.

The project will be managed to fit with the study program being undertaken.

Location

The project could span gauging stations across NSW, or a single region such as the Hunter Valley.

Contact

For more information on this project, contact water.science@dpie.nsw.gov.au

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