Concept Plan SP 2022-034

Using Swan Canning Estuarine Response Model to optimise oxygenation plant efficiency

BCS Rivers and Estuaries Science

Project Core Team

X X **Supervising Scientist** Kerry Trayler
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Project status as of March 8, 2023, 3:20 p.m.

X X Pending project plan approval

Document endorsements and approvals as of March 8, 2023, 3:20 p.m.

X X
Project Team granted
Program Leader granted
Directorate granted

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Program

BCS Rivers and Estuaries Science

Departmental Service

Service 6: Conserving Habitats, Species and Communities

Background

Nutrient and organic loading to the Swan Canning river system is a priority issue for the waterway that has impacts on water quality, ecological health and community benefit. Excess nutrients (phosphorus and nitrogen) and organic loading enter the river system through groundwater, drainage and catchment runoff. These promote algal blooms and low oxygen conditions, which in turn places stress on fish and other aquatic life and can contribute to fish kills.

Water quality improvement plans are in place to improve environmental outcomes in the medium-term. In the short-term, oxygen relief is provided through oxygenation plants in four targeted locations throughout the waterway. These plants increase the dissolved oxygen concentration and provide oxygenated refugia for biota.

Key performance indicators (KPI's) are in place for the oxygenation program. These are applied at the operational level to ensure oxygen levels are meeting concentrations essential for supporting aquatic life. They are also reported to the Minister for Environment as a KPI target for the River Protection Strategy requiring that >80% of all individual dissolved oxygen measurements in the oxygenation zone are above 4mg/L.

For the oxygenation plants to meet these targets they need to be tailored to work at maximum efficiency. Two oxygenation plants are located in the Upper Swan estuary at Guildford and Caversham. This area of the river is tidally influenced, which affects biogeochemical processes and oxygen dynamics. These factors make it difficult to estimate the water balance and the corresponding oxygen demand, which influence the efficiency of oxygenation operation.

Aims

This project aims to apply a 3D hydrodynamic biogeochemical deterministic model to improve oxygenation in the Swan estuary. The Swan Canning Estuarine Response Model (SCERM) developed by UWA in collaboration with DBCA will be applied. This will require development of a localized domain that will be validated using data collected by the oxygenation team in Conservation and Ecosystem Management. Once the local domain model is validated, it will be used specifically to address the following questions:

1. What is the impact of different river conditions on the extent of the oxygenation plumes?
2. How do salt wedge dynamics influence oxygen distribution?
3. Can efficiency of the plants be improved by changing the current diffuser locations?
4. Under climate change scenario in 2030, is there a need to alter or add to the oxygenation plants capacity to improve or maintain the estuary water quality?

Expected outcome

Optimisation of the Oxygenation Plant Operation (Guilford and Caversham)

Strategic context

Strategic Direction: Discover - Develop adaptive management tools to promote ecosystem resilience to the impacts of climate change and other threats.

Science Strategic Goal: Mitigation of pressures and threats to ecosystems and associated values is evidence based and effective.

BCS Approach: Undertake research to understand and mitigate the pressure and threats acting on terrestrial, aquatic, estuarine and marine ecosystems.

RES Program objective: Evaluate and support approaches to improve or maintain water quality and habitat.

Swan Canning River Protection Strategy: Undertake intervention works and / or programs to improve and maintain water quality.

Expected collaborations

Management of the oxygenation plant occurs through the Rivers and Estuaries Branch, Conservation and Ecosystem Management. It is anticipated that the oxygenation team will contribute to the validation of the local model domain through the provision of in-river data.

UWA AquaticEcoDynamics (AED) Research Group Lead: A/Prof Matt Hipsey:

The AED group developed and has provided the repository of the latest SCERM generation (v7) at GitHub. The repository uses the TUFLOW-FV 3D finite volume (FV) hydrodynamic model.

BMT Global (TUFLOW Developer) Lead: Dr. Michael Barry:

BMT has adopted the UWA developed AED water quality modules into TUFLOW-FV WQM and link to Sediment Transport Module (STM), in two-way linkage. To ensure the continuity of the project, it is anticipated, commercial TUFLOW-FV WQM and STM are purchased with support for the project provided by BMT global.

Proposed period of the project

Sept. 1, 2022 – Sept. 1, 2024

Staff time allocation

to | X | X | X |

Role	Year 1	Year 2	Year 3
Scientist	0.5	0.5	
Technical	0.2	0.1	
Technical	0.2	0.1	
Collaborator	0.05	0.05	

Indicative operating budget

to | X | X | X |

Source	Year 1	Year 2	Year 3
Consolidated Funds (RES): software, data	150654255		
Salary: Scientist (external fund) + Technical	60268+47472	60268+23736	