# UCD School of Civil Engineering
# Dooge Centre for Water Resources Research

# Water Quality Modelling in Dublin Bay, Ireland

A.Corkery[1] *, G. Gao[1], J.J. O' Sullivan[1] C. Muldoon [3], L. Reynolds[2], L. Sala-Comorera[2], N. Martin [2],G.M.P. OHare[3], W.G. Meijer[2], B. Masterson[2]
[1]*UCD School of Civil Engineering,* [2]*UCD School of Biomolecular and Biomedical Science,* [3]*UCD School of Computer Science*
*aisling.corkery@ucd.ie

## Introduction

The Acclimatize project focuses on identifying and quantifying pollution streams at designated 'at-risk' bathing waters in two complementary environments: a large-scale urban environment and a rural agricultural environment. The project will assess the impact of pollution in these waters through a dynamic period of climate change (Fig. 1).

**Figure 1. Ongoing water quality monitoring in Acclimatize project**

The large-scale urban environment is represented by the 'at-risk' bathing waters of Sandymount, Merrion and Dollymount strands in Dublin Bay, Ireland. Bathing water quality is strongly influenced by weather conditions, in particular rainfall and solar radiation. Climate change will affect the amount, intensity and timing of precipitation and may therefore, adversely impact on future bathing water quality. Local economies and communities that rely on excellent bathing water quality to sustain tourism and local employment can also be affected by such changes. Furthermore, climate change can also impact bathing waters in different ways, depending on the origins of pollution.

## The Dublin Bay Model

The Dublin Bay model is a dynamically linked catchment-3D coastal model, which uses inputs from the Dublin Drainage Model to take account of urban sources of microbial pollution and a catchment model to account for microbial pollution from both rural catchments and urban streams (Fig. 2).

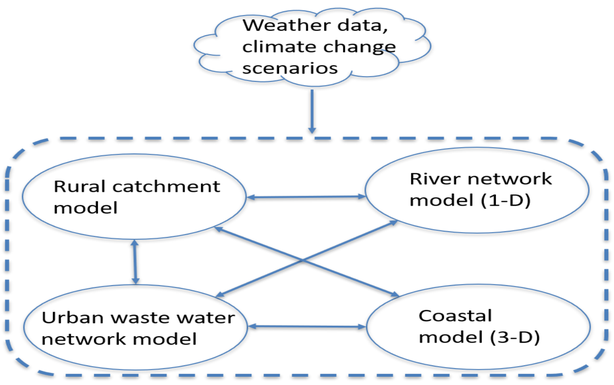


**Figure 2. Schematic of model integration**

## Calibration of Catchment Model

- An extensive fieldwork programme captures microbial pollution during storm events (Fig. 3). This data was used to calibrate for E. coli and intestinal enterococci (IE).
- A telemetric system provides data for the calibration of the MIKE11 catchment model (Fig. 4).

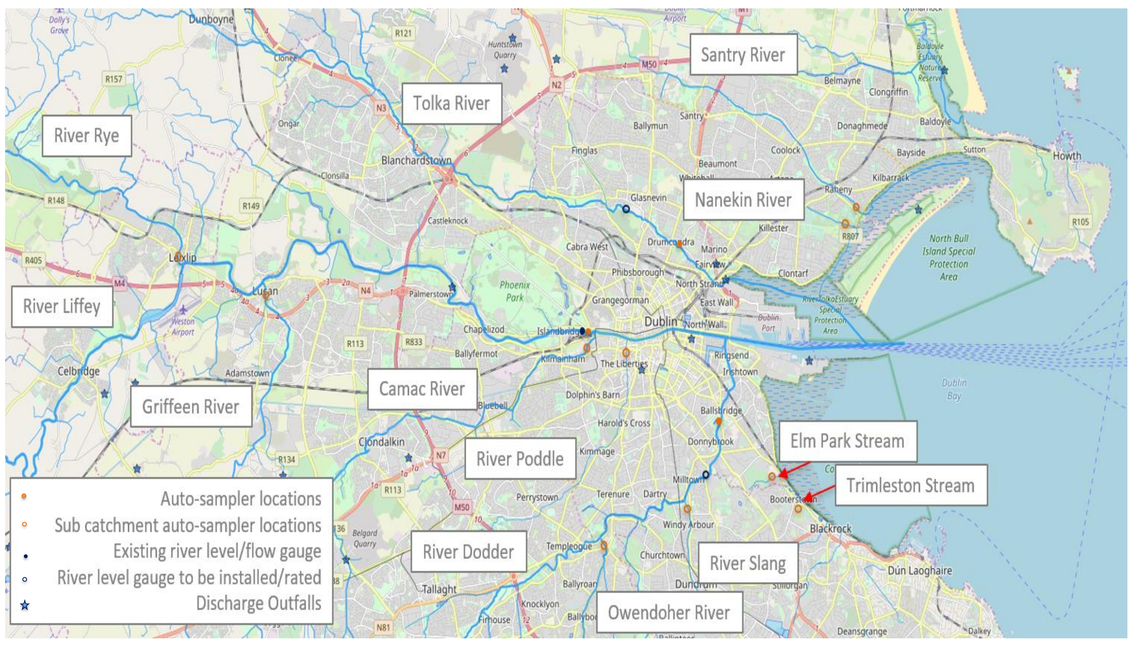


**Figure 3. Catchment sampling locations and river gauges**

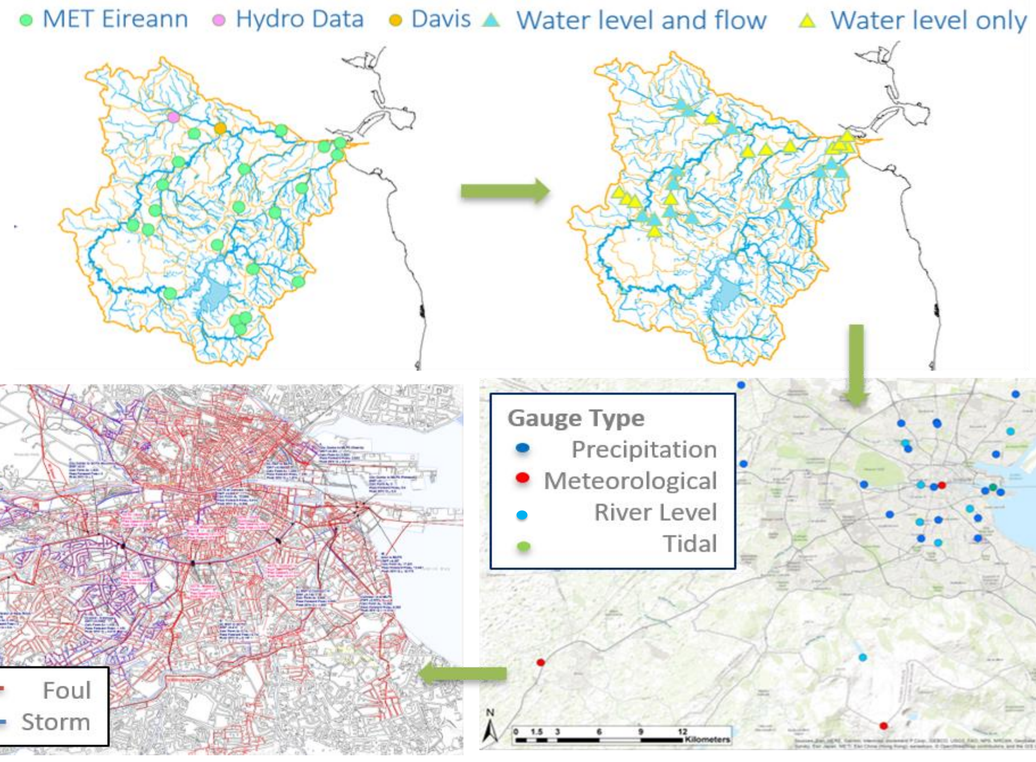


**Figure 4. Telemetric systems and urban drainage network**

## Development and Calibration of Coastal Model

- Development of finite element mesh to define bathymetry using data from numerous sources (Fig. 5).
- Collection of tidal current and water quality data using ADCP, salinity and temperature profiles, together with water quality data from grab sampling.
- Calibration of current speed and velocity with observed ADCP data.
- Calibration of water quality parameters with sampled data.

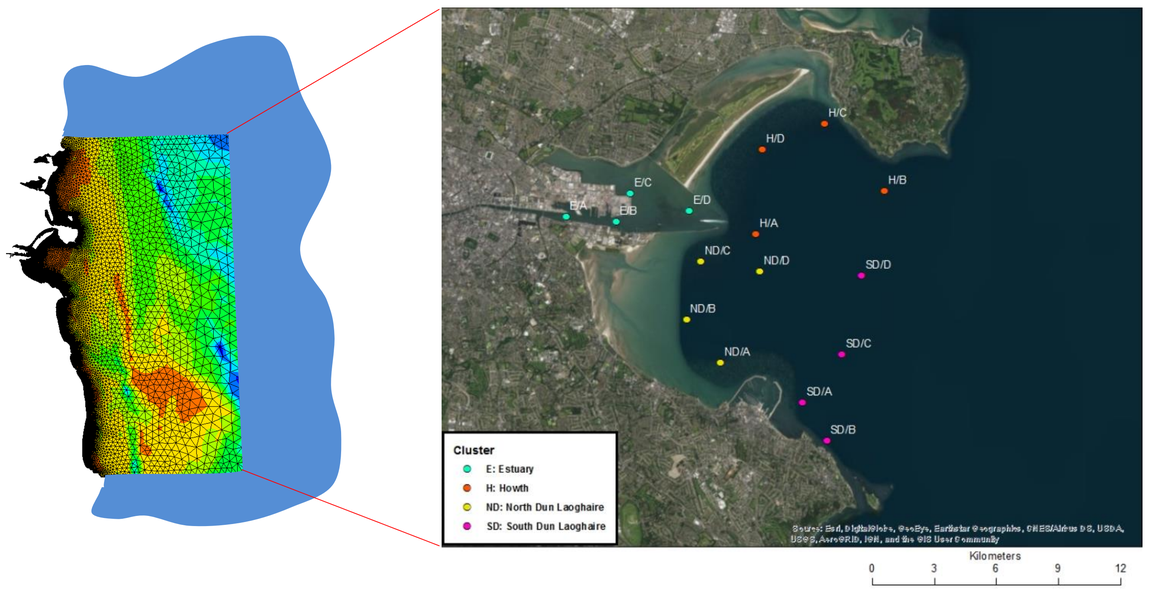


**Figure 5. MIKE3 FM mesh and coastal sampling points**

## Conclusion

Development and calibration of the catchment-coastal model is still ongoing. The collection of water quality samples in both the catchment and coastal zone is largely rainfall dependent and further water quality and hydrodynamic data is required to accurately capture the systems response to heavy rainfall events both in terms of river flows, changes in coastal currents and increases in E. coli and IE concentrations. As an example, the response of E. coli and IE in the Tolka and Dodder Rivers to a 2019 rainfall event is in Fig. 6.

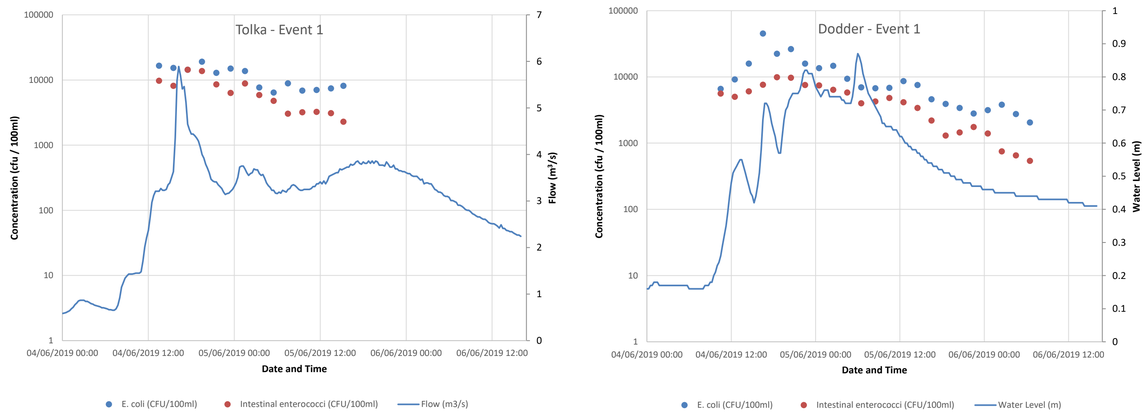


**Figure 6. Response of E. coli and IE to rainfall in the Tolka and Dodder Rivers**

Acclimatize
EU Funds: Ireland Wales Programme 2014-2020
Tionól Réigiúnach an Deiscirt Southern Regional Assembly
Ireland's European Structural and Investment Funds Programmes 2014-2020
Co-funded by the Irish Government and the European Union
Cronfa Datblygu Rhanbarthol Ewrop European Regional Development Fund