CityWat – Software for integrated modelling of the urban water cycle

Problems

- Model users (e.g., water and wastewater managers and environmental regulators) cannot track water and pollutants through the water cycle, making it difficult to understand system impacts of their decisions.
- Current models (e.g., InfoWorks ICM) are too inflexible simulate modern design options that are interconnected at a systems scale.

What does CityWat do?

- Brings together drainage and water resources planning
- Evaluates infrastructure based on service delivery and in-river impacts
- Enables modelling of sewer spills with minimal data/computing power

How does CityPlan-Water do it?

- By focussing on information transfer between sub-systems, CityWat ensures models of different sub-systems are compatible.
- By strategically reducing model complexity, CityWat enables a detailed representation where it matters and 'good enough' every else – providing fast and integrated simulations
- By using a physically based modelling philosophy, a wide range of options and scenarios can be explored.

How can you use CityWat?

We are creating a generic and expandible modelling framework based on CityWat (WSIMOD) that is useable by anyone with Python programming experience. We are looking for money to create a GUI! All current CityWat case studies are open-source:
https://github.com/barneydobson/citywat
https://github.com/barneydobson/cwsd_partition
https://github.com/barneydobson/cwsd_demand

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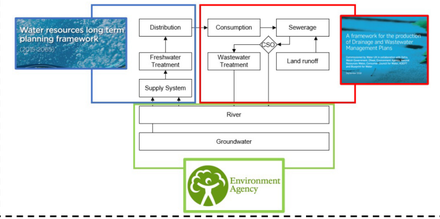
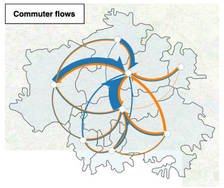
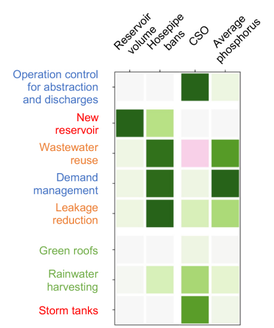
CityWat combines the disparate sectors of water supply, wastewater and the environment into a unified framework:
https://doi.org/10.1088/1748-9326/abb050



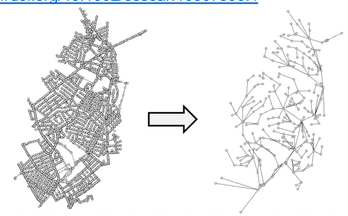
CityWat strategically simplifies to enable detailed investigation into specific questions (e.g., how do changes to commuter impact water quality):
https://doi.org/10.3389/frwa.2021.641462



CityWat provides physically based evaluation for a range of nature-based, management focussed, infrastructure upgrades and traditional water cycle interventions:
https://doi.org/10.1088/1748-9326/abb050



CityWat uses graph theory to provide a realistic but reduced complexity sewer network representation:
https://doi.org/10.1002/essoar.10507590.1



CatchWat – software for integrated modelling of the catchment water systems

Problems

- Current water quality management at a catchment scale lacks a more efficient strategy that coordinates urban-rural measures
- Existing integrated models (e.g. HYPE) cannot simulate the integrated urban water cycle.

What does CatchWat do?

- Simulate physical processes in the whole pollutants pathway
- Develop coordinated management strategies via simulating urban-rural measures' effects (e.g. fertilisers reduction and enhanced wastewater treatment)
- Test management strategies and evaluate their performances in water quality improvement

How does CatchWat do it?

- By integrating a variety of conceptual models, including HYPE and CityWat, and expanding the contextual modelling boundaries
- By parameterising interventions on physical processes embedded in urban-rural water cycles
- By developing and simulating scenarios with various combinations.

How can you use CatchWat?

We are creating a more flexible modelling framework (WSIMOD) CatchWat for catchment planning and nature-based solutions that is useable by anyone with Python programming experience. All current CatchWat case studies are available on request

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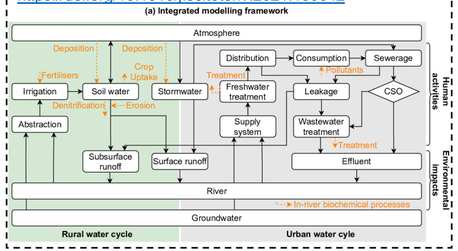
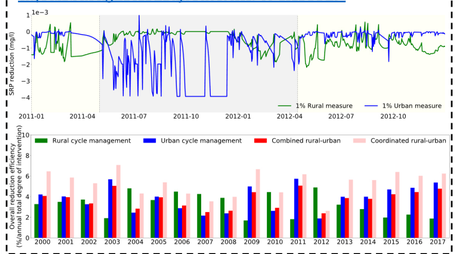
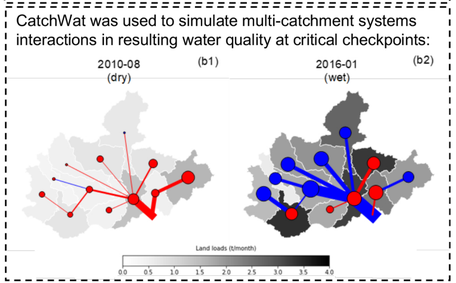
CatchWat integrates physical processes embedded in urban-rural water cycle at a catchment-lumped scale:
https://doi.org/10.1016/j.scitotenv.2021.150642



CatchWat was used to compare coordinated and uncoordinated urban-rural management strategies:
https://doi.org/10.1016/j.scitotenv.2021.150642



CatchWat was used to simulate multi-catchment systems interactions in resulting water quality at critical checkpoints:



CatchWat was used to test multi-catchment coordinated scenarios for more efficient loads reduction allocation:

CityPlan-Water – Design and evaluation framework for Water Neutrality at a city scale

Problems

- Projected new urban development in cities will reduce Urban Water Security (UWS) and increase the impacts on the existing urban water system.
- Water Neutrality (WN) seems difficult to be understood and assessed by urban planners and other key stakeholders.

What does CityPlan-Water do?

- Provides a new concept for Water Neutrality (WN) and the impacts from new urban developments at a city scale.
- Applies WN design options to different scenarios based on future urban planning.
- Evaluates WN at a city scale for a series of urban design scenarios through the Water Neutrality Index (WNI).
- Informs about the opportunities of offsetting the new impacts inside vs. outside the new development area.

How does CityPlan-Water do it?

- By integrating the CityWat integrated water management evaluation model with GIS spatial data.
- By developing urban design scenarios based on the 10-year projected housing target in London.
- By scoring UWS indicators (water demand, flooding and water quality) based on WNI percentages and specific targets.

CityPlan-Water is used to test the Water Neutrality Index (WNI) for several Water Neutrality scenarios at a city scale.

	Urban consumer demand	Urban flood risk	River water quality	WATER NEUTRALITY INDEX (WNI) - %
(A) Efficient appliances in new homes	35	4	25	
(B) 80% green roofs in new homes	0	35	8	
(C) RWH in new homes	18	8	10	
(D) RETROFIT Stage 1	100	51	84	
(E) RETROFIT Stage 3	105	100	99	

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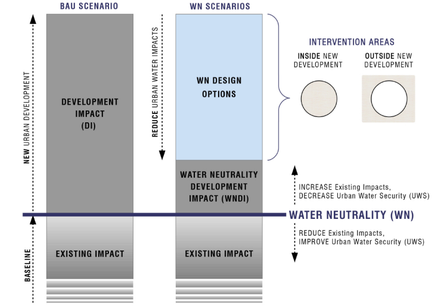
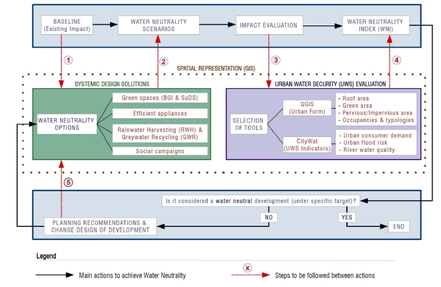
In CityPlan-Water, a new concept for Water Neutrality (WN) and the Development Impacts (DI) at a city scale is provided.



CityPlan-Water integrates Water Neutrality (WN) systemic design solutions with an Urban Water Security (UWS) evaluation toolkit, all being spatially represented in a GIS tool.



CityPlan-Water studies urban form properties relevant to Water Neutrality at a city scale from a detailed spatial dataset in GIS. These urban form maps are developed by our team.