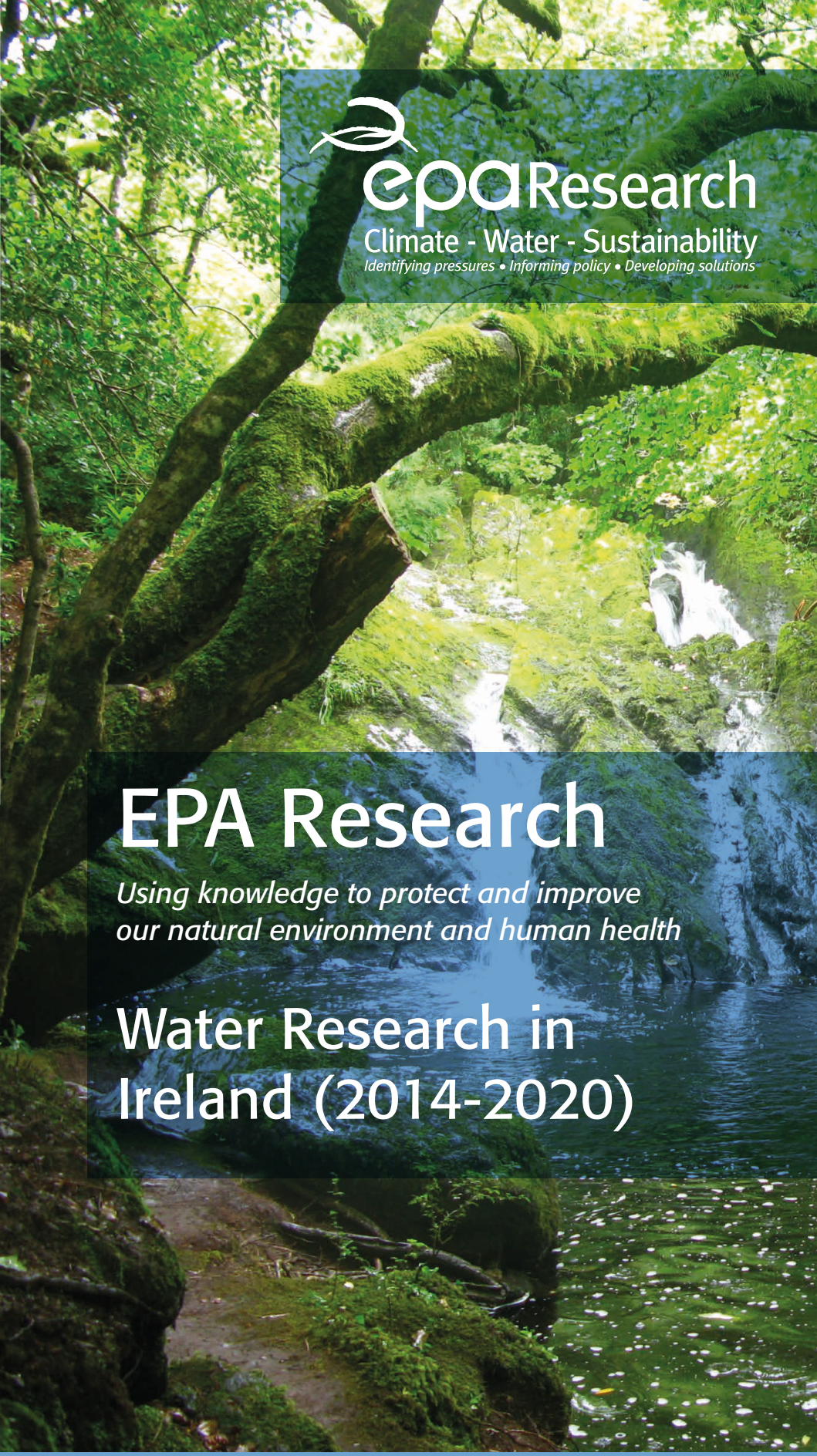

epa Research
Climate - Water - Sustainability
Identifying pressures • Informing policy • Developing solutions

EPA Research

Using knowledge to protect and improve our natural environment and human health

Water Research in Ireland (2014-2020)

Comhshaol, Pobal agus Rialtas Áitiúil
Environment, Community and Local Government

Ireland's waters are one of our major natural resources. Plentiful availability of good quality water offers a significant competitive advantage to sectors such as agriculture, industry and tourism, but is a resource that must be carefully managed. Improving water quality status is a national priority for Ireland.

The Environmental Protection Agency (EPA) Water Research programme has a strong focus on policy and has been driven by national regulations and European Directives. Policy-related research plays a vital role in ensuring that EU and national policies are implemented in the most cost-effective manner. A sustained water research programme is an essential component of Ireland's role in protecting its water resources and meeting its requirements under water related EU directives and national policies.

The research programme of the EPA is based on three pillars that represent key research priorities associated with protecting Ireland's environment.

PILLAR 1	***PILLAR 2***	***PILLAR 3***
Water	*Climate*	*Sustainability*

Between 2007-2015, the EPA Research Programme has funded over 100 Research Projects, with a total commitment from the EPA of approximately €20m. The range of projects funded includes desk-studies, scholarships, fellowships and large-scale multi-annual and multi-partner awards.

EPA Research's water pillar deals with groundwater, surface water, transitional and coastal water; as well as wastewater, drinking, bathing and shellfish waters.

The EPA Research Water Research programme 2014-2020 is carried out under the following five thematic areas:

- Theme 1: Safe Water;
- Theme 2: Ecosystem Services and Sustainability;
- Theme 3: Innovative Water Technologies;
- Theme 4: Understanding, Managing and Conserving our Water Resources;
- Theme 5: Emerging and Cross-cutting Issues.

Theme 1: Safe Water

Water quality and human health may be threatened by emerging pollutants, priority substances, endocrine disruptors and emerging risks such as pathogens (including antibiotic resistant bacteria and viruses), cyanotoxins and nanomaterials. Key knowledge gaps remain concerning their environmental behaviour in surface water, treated waters and groundwater, and their impact on human health through the irrigation of crops, water supply, distribution and storage in rural or urban environments. In addition, water quality and supply can be threatened by climate change, natural hazards and extreme events such as droughts and floods.

Theme 2: Ecosystem Services and Sustainability

Water demand and availability pressures, amplified by climate change (including the apparent changing frequency and severity of extreme events such as floods and droughts) have increased the stress on water bodies and associated ecosystems. The environment doesn't exist in isolation; it both affects and is affected by many aspects of our lives. Environmental resources and ecosystem services are direct inputs into the economy (EPA, 2012). The concept of ecosystem services is based upon the assumption that there is a connection between good ecological status and the provision of several benefits, such as water supply, food supply, biodiversity, landscape value, and others, and it is already used by some managers and decision makers as a powerful tool for building and implementing programs of measures. Approaches using ecosystem services could therefore potentially support Water Framework Directive (WFD) objectives.

Theme 3: Innovative Water Technologies

Innovative technologies are required by the water industry to create products and services. This thematic area will contribute to improving the quantity and quality of water bodies, such that our resources will be used in a more efficient way; and gain a better understanding of the socio-economic aspects, governance and behavioural changes associated with this area. The objectives of this research area are aligned with the aims of the European "Resource Efficiency Roadmap".

Theme 4: Understanding, Managing and Conserving our Water Resources

This thematic area will contribute to better use and protection of water resources, by gaining a better understanding of the potential impacts of human activities, such as abstractions, discharges and land-use on groundwater, rivers, lakes, estuaries and coastal waters; of the views of local communities and the ways of encouraging behavioural change; and of the means of minimizing these impacts. Particular attention will be

given to pressures on water arising from agricultural activities. Regulatory measures are essential tools to ensure compliance with environmental standards of water quality and quantity. Understanding the mechanisms leading to improved water management will lead to better policy design, implementation and adaptation.

Theme 5: Emerging and Cross-cutting Issues

This thematic area will include the multi-agency transboundary programme of research on the environmental impacts of Unconventional Gas Exploration & Extraction (UGEE).[1] This research area will also cover the emerging policy and implementation research needs in relation to the implementation of the WFD, as well as marine research considerations in support to the formulation and implementation of policies over the period 2014-2020.

Multi- and inter-disciplinary research is required on these themes, with expected social, economic, technology, environment and policy impacts. These thematic areas also reflect EPA Research's effort to align, where relevant, its programme with the international Strategic Research Agenda which was launched by the Water Joint Programming Initiative[2] in May 2013.

Linkages

- Synergies and enhanced collaboration with other national funders is a key objective of the research programme which is facilitated by the Water Research Coordination Group set up by the Environmental Protection Agency (EPA) and Enterprise Ireland (EI) in 2010. Members include; Department of the Environment, Community and Local Government, Marine Institute, Science Foundation Ireland, Irish Research Council, Department of Agriculture, Food and the Marine, Office of Public Works, Geological Survey of Ireland, Industrial Development Authority, National Parks and Wildlife Service, Inland Fisheries Ireland and Irish Water.

- A number of critical international linkages have also been established to promote Irish environmental research into the international arena including enhanced participation in the European Research Area (e.g. Horizon 2020, Joint Programming Initiatives, European Innovation Partnership). By ensuring that Ireland is represented in significant European initiatives related to Water, the EPA will promote an increased efficiency, critical mass and impact of water research in Ireland.

1 UGEE Joint Research Programme website: **www.ugeeresearch.ie**

2 Water Joint Programme Initiative **www.waterjpi.eu**

Key Achievements

- Contributions from research under the WFD include the development of novel methodologies for the characterisation of waterbodies and determination of reference baseline conditions. Detailed analysis of the impact of WFD-related research projects has indicated that 62% of projects demonstrated a high level of policy impact.
- A cluster of research projects on eutrophication has provided scientific data to support appropriate measures or actions for use in the implementation of national policy for reducing phosphorus and nitrogen losses to waters from agricultural sources. Findings from this work provided the basis of existing advice and measures for reducing nutrient losses from agriculture to water.
- Researchers funded have developed new research capability and have provided timely knowledge and assistance to local & health authorities in dealing with significant health scares and outbreaks.
- A state-of-the-art experimental wastewater treatment plant at Tuam, Co. Galway, has been established through EPA funding with the co-operation of the National University of Ireland, Galway (NUIG) and Galway County Council. The facility will advance the development of environmental protection measures nationally and facilitate the testing of novel technologies and practice-based training & education.
- The EPA research team has published a number of documents on the value for money from the investment in water research.[3,4]
- The EPA funded research into Marine Noise, resulting in a key achievement with a research report[5] forming part of Ireland's Marine Strategy Framework Directive (MSFD).
- The EPA has funded research that has greatly increased our knowledge on the transport and attenuation of pollutants through the landscape (PATHWAYS project). This has led to the development of Catchment Support Management Tools (CSMTs), which will inform the next round of WFD characterisation of water bodies and the tailoring of appropriate Programmes of Measures.
- The EPA is a partner on the EU Joint Programme Initiative on Water – Challenges for a Changing World (JPI Water) and has co-funded research projects with our European partners.[2]

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3 An evaluation of the role of EPA research in the Water Framework Directive implementation in Ireland. Wemaere, A. et al., Biology and Environment: Proceedings of the Royal Irish Academy, 109B, 385–402. (2009).

4 Providing a framework for accountability and learning in Environmental Research IPA Administration, vol. 55, no. 4 (2008), pp. 159–170. G O' Leary, R Boyle, B Donlon, L Sheils.

5 EPA STRIVE 96 report "Assessment and Monitoring of Ocean Noise in Irish Waters" Dr Joanne O'Brien and Suzanne Beck GMIT **https://www.epa.ie/pubs/reports/research/water/STRIVE%20Report%2096-J.OBrien.pdf**

Recent Water Research Publications[6]

Organisation	Principal Investigator	Title	Report number
National University of Ireland Galway	Stephen Hynes	What's our water worth? Estimating the Value to Irish Society of Benefits Derived from Water-Related Ecosystem Services: A Discrete Choice Approach	Research 127
Teagasc	Cathal Buckley	Are we willing to pay for good river Water Quality? Willingness to pay for achieving good status across rivers in the Republic of Ireland	Research 129
University of Dublin, Trinity College	James Wilson	Biological Effects and Chemical Measurements in Irish Marine Waters	Research 134
University College Dublin	Theo De Waal	Towards developing a Cryptosporidium Monitoring Proposal	Research 137
King's College London	Gillian McEneff	Pharmaceuticals in the Aquatic Environment: A Short Summary of Current Knowledge and the Potential Impacts on Aquatic Biota and Humans	Research 142
Galway-Mayo Institute of Technology	Brian Quinn	Pharmaceuticals in the Irish Aquatic Environment	Research 143
Maynooth University	Bernadette Alcock-Earley	The Protection of Water Resources: Developing Novel Sensor Materials	Research 144
Athlone Institute of Technology	Neil J Rowan	Development of a pulsed light approach as a novel solution in drinking water treatment	Research 145
National University of Ireland Galway	Dearbháile Morris	CapE -Capture, Extract, Amplify: A Rapid Method for Monitoring Large Water Volumes for Pathogenic Contaminants	Research 151
University College Dublin	Theo De Waal	Cryptosporidiosis: Human, animal and environmental interface	Research 152
University College Dublin	Wim G. Meijer	Identifying the Biological and Geographical Origins of Faecal Contamination	Research 153

Water Research Projects funded 2014-2020

Safe Water

University College Dublin	Michael Bruen	Flood Warning technologies for Ireland
Athlone Institute of Technology	Neil J Rowan	Investigation of the implications for Ireland of emerging standards on pharmaceuticals in receiving waters
University of Dublin, Trinity College	Liwen Xiao	Investigation into the causes, impacts and measures to deal with algal blooms in Vartry Reservoirs
Maynooth University	Fiona Walsh	Stopping Antibiotic Resistance Evolution in the Environment (StARE)
University College Dublin	Enda Cummins	Tracking & assessing the Risk from Antibiotic Resistant genes using Chip technology in surface water (TRACE)
University College Dublin	Eoin O'Neill	Communicating Risk Based Enforcement (Acronym: Relay_Risk)
Ryan Hanley Consulting Engineers	Michael Joyce	Quantify the Effect of Lead Pipe Removal on Lead Concentrations in Drinking Water
National University of Ireland Galway	Dearbháile Morris	Economic Assessment of the Waterborne Outbreak of Cryptosporidiosis in Galway, 2007
University of Dublin, Trinity College	Laurence Gill	Assessment of disposal options for treated wastewater from single houses in low permeability subosoil
University College Dublin	Wim. G. Meijer	Development of Microbial Source Tracking Techniques
National University of Ireland Galway	Dearbhaile Morris	DeTER: Detection, Toxicology, Environmental fate and Risk assessment of nanoparticles in the aquatic environment*
National University of Ireland Galway	Martin Cormican	Hospital effluent: impact on the microbial environment and risk to human health?*
Galway-Mayo Institute of Technology	Rick Officer	Scope, fate, risks and impacts of microplastic pollution in Irish freshwater systems*
University College Dublin	Michael Bruen	WARNDIS: Extreme events and disaster warning*
Maynooth University	Conor Murphy	Societal transformation and adaptation necessary to manage dynamics in flood hazard and risk mitigation (TRANS-ADAPT)*

6 EPA Water Research Publications and Downloads **http://www.epa.ie/pubs/reports/research/water/**

* All projects labelled with an asterisk (*) are water related projects funded under the Sustainability, Climate and Green Enterprise Pillars of the EPA Research programme.

Ecosystem Services and Sustainability

Organisation	Principal Investigator	Title
University College Dublin	Mary Kelly-Quinn	Incorporation of Ecosystem Services values in the Integrated Management of Irish Freshwater Resources – ESManage
Agri-Food & Biosciences Institute	Donnacha Doody	A Systematic and Participatory Review of Research on the Impact of Agriculture on W2ater Quality
Dublin City University	Lorna Fitzsimons	Increasing Resource Efficiency in Waste Water Treatment Plants
University College Dublin	Mary Kelly-Quinn	Assessment of the impacts of forest operations on the ecological quality of water (HYDROFOR)
National University of Ireland Galway	Stephen Hynes	Valuing the significant ecosystem services provided by Irish coastal, marine and estuarine habitats*

Innovative Water Technologies

Organisation	Principal Investigator	Title
University of Limerick	Gary Walsh	Identification and evaluation of phosphorus recovery technologies in an Irish context
Queen's University Belfast	John McGrath	Phosphorus from wastewater: Novel technologies for advanced treatment and re-use
Dublin City University	Lorna Fitzsimons	Optimal design and operation of small-scale wastewater treatment plants: the Irish case
University of Dublin, Trinity College	Liwen Xiao	Technologies for monitoring, detecting and treating overflows from urban wastewater networks
Dublin City University	Fiona Regan	The role of passive sampling in screening and monitoring of new and emerging chemicals
University of Dublin, Trinity College	Jean Wilson	Combining Earth Observation and Geochemical Tracing Techniques (CONNECT) for groundwater detection and evaluation in Ireland
Dublin City University	Anne Morrissey	One-step drinking water treatment using nanofiltration and nanostructured composites
Central Solutions Ltd	Alice Morgan	Water Management at Industrial Facilities in Ireland*
National University of Ireland Galway	Rory Monaghan	Thermodynamic modelling of energy recovery options from digestate at waste water treatment plants*

Understanding, Managing and Conserving our Water Resources

Organisation	Principal Investigator	Title
Teagasc	Daire Ó hUallacháin	Cattle Exclusion from Watercourses: Environmental and socio-economic implications (Acroynm CONTROL)
IRD Duhallow	Fran Igoe	Delivering Integrated Water Management through the bottom-up approach: A critical analysis
Dundalk Institute of Technology	Alec Rolston	Towards Integrated Water Management (TIMe)
University of Dublin, Trinity College	Ian Donohue	Development of an ecohydrology framework for setting environmental flow standards for Irish rivers
University of Dublin, Trinity College	James Wilson	Biological Quality Element validation for Tidal Freshwater Transitional Waters in Ireland
Dublin Institute of Technology	Ahmed Nasr	Analysis and Modelling of the Hydrological Behaviour of Small Irish Catchments
University of Dublin, Trinity College	Liwen Xiao	Assessment of natural organic matter (NOM) and ptaquiloside in Irish waters
Botanical, Environmental and Conservation Consultants Ltd	Philip Perrin	Saltmarsh Angiosperm Assessment Tool Ireland (SMAATIE)
University of Dublin, Trinity College	Laurence Gill	The impact of on-site wastewater effluent on rivers and wells
University College Dublin	Michael Bruen	Measurement of sediment and silt flux in rivers, benefits of enhancement measures and policy implications (SILTFLUX)
Queen's University Belfast	Raymond Flynn	Assessing, modelling and managing water and contaminant movement along pathways (underground and over-ground) from the land surface to aquatic receptors, including the roles of contaminant transport and attenuation. (PATHWAYS)
Dublin Institute of Technology	Conor Norton	Towards an Integrated Policy Framework for Marine Spatial Planning in Ireland*
Trent University	Julian Aherne	Assessing the influence of trans-boundary air pollution on Irish lakes and soils*
National University of Ireland Galway	Eugene Farrell	From source to sink: the response and recovery of coastal catchment ecosystems to large perturbations*

Emerging and Cross-cutting Issues

Organisation	Principal Investigator	Title
CDM Smith	Alan Hooper	EPA/DCENR/NIEA Research Programme related to the Environmental Impacts of Unconventional Gas Exploration & Extraction (UGEE)

* All projects labelled with an asterisk (*) are water related projects funded under the Sustainability, Climate and Green Enterprise Pillars of the EPA Research programme.

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FURTHER INFORMATION

Over 100 research reports have been published by the EPA in the past 10 years in the area of Water – (policy support for WFD, novel treatment technologies etc.)

Further details on the EPA research programme are available at the following link: **http://www.epa.ie/researchandeducation/research/researchpillars/water/**

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Check out the EPA Secure Archive for Environmental Research Data (SAFER): **http://erc.epa.ie/safer/**

Subscribe to our EPA Research newsletter by entering your email address into the online subscription box: **http://www.epa.ie/researchandeducation/research/**

Check out DROPLET, to search and view Ireland's nationally funded water research database at the following link: **http://erc.epa.ie/droplet/**

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