UKWIR 2019-20 Research Programme Summary

Proposal Reference	Project Title	Background	Objectives
AM1163	**Long Term Performance of Plastic (PE) Pipes**	Plastic pipes with a design life of 50 years have been in widespread use in the United Kingdom (UK) water industry for more than 30 years. Data available on life expectancy of these pipes is not based on real time analysis leaving the water industry unable to accurately predict the remaining life of these assets. A study was initiated by UK Water Industry Research (UKWIR) and Loughborough University with Engineering and Physical Sciences Research Council (EPSRC) funding 3 years ago on real time analysis on testbeds of plastic pipes. There are still aspects of the study that need to be completed. The data from previous studies indicate that the performance of PE pipe is likely to be limited by the performance of joints - electrofusion joints in particular. This has resulted in initiatives to improve site practices in the forming of these joints and this project provides an opportunity to confirm the effectiveness of this strategy.	The objective of this work is to: - Expose the pipes at testbeds, which have been used in typical service conditions for more than 60% of their design lifetime. Assess for 'creep' followed by exhumation and analyse sections of the uPVC, MDPE and PE100pipes. - Use the analysis results to evaluate the long term performance of plastic pipe and joints. - Confirm the effectiveness of the initiatives used to improve electrofusion jointing. - Provide the Water Industry with a risk assessment for ageing plastic pipes and joints.
AM1166	**When is 'surface water removal' the most cost beneficial solution?**	Removing surface water from foul or combined sewers offers a number of benefits, both in terms of reducing operational expenditure and flows (and subsequent flooding and spill frequency), as well as offering wider community benefits. There is an increasing appetite across the water industry to consider and deliver such interventions to help manage a range of drivers, but this appetite is not matched by an in depth understanding of the scenarios and catchment characteristics that make surface water removal options more cost beneficial than traditional engineering solutions.	This would be considered using actual case studies, examining where the costs associated with sustainable interventions were less than the traditional engineering alternatives. The investigation should consider, but not be limited to, the following factors: - Sewer hydraulics (and flow contributions) - Different drivers (including the spread of drivers within a catchment) - Stakeholder involvement (and financial contributions) - Wider benefits - Scale of intervention - Soil conditions / type - Proximity of watercourses - Commercial / residential / rural land use - The proportion of the driver accounted for (i.e. consider partial delivery of solution)
CL1173	**Integrating UKCP18 with UKWIR tools & guidance**	UKWIR has developed tools for 'water resource planning', 'drainage planning' and 'guidance on adaptation' for the water industry. These are based around UK climate projections developed by the Met Office, which is now going to release the latest projections, UKCP18, with increased capabilities and grid square resolution. Thus, there is a need to ensure that UKWIR tools remain relevant. This project will ensure that the industry utilises the best information to make service and asset investment choices to deliver value for money.	The objective of this project is to: - Provide understanding and guidance to the industry in using UKCP18 outputs - Provide clarification of any major issues and risks that companies need to be aware of for current tools and approaches - Review of UKWIR tools, a plan and scope for updating tools in a way that will support water resource and drainage planning through Ofwat's Price Review 19 (PR19) and for future investment planning periods.
CL1174	**Carbon, Sustainability, circular economy, natural capital, net positive....where are we and where should we be?**	The UK Water Industry has always been spirited to promote sutainability and create a significant positive contribution to society. It has been continually discussing and working in areas to achieve it but there is no study which captures this achievement, positive impacts and ultimately the net contribution of the sector. The Water industry has added expectations of government, regulators, NGOs and customers for a long term sustainable approach that will support society across the challenges of the coming decades. In particular, circular economy and natural capital are the latest areas that customer investment fora are increasingly seeking information on. Thus this project will provide the evidence that the Water industry as a sector is socially, environmentally and financially responsible and help to map out the current position and further improvement that can be done.	The objectives of this project are to: - Identify the importance of placing sustainability concepts, carbon, natural capital etc at the heart of business plans. - Develop ways to describe the sustainability of the sector, across companies and in comparison with other service providers. - Identify if there is a need for common metrics to update sustainability communications - Identify the industry's peformance and provide ideas for further improvement.

CL1177	**UKWIR GHG workbook update 2019 (CAW v14)**	The water industry has a key responsibility to report its annual operational carbon footprint. This is supported by the UKWIR Green House Gas (GHG) emissions workbook, which is updated annually to take account of changes in UK GHG emission factors and to reflect the agreed boundary of emissions that are within the scope of water company activities. The workbook has enabled the industry to produce robust, evidenced and credible carbon reports keeping its customers informed and engaging with regulators and government.	The objective of this project is to provide an updated GHG emissions workbook that enables the industry to report and manage emissions in line with UK Government guidance, latest emission factors (annually updated) and the agreed boundaries of water company activities.
DW1202	**Micro-plastics in Drinking Water**	The presence of micro-plastics in the environment is an area of growing concern for Water Industry, Regulators, Government and Customers. The World Health Organisation (WHO) has started to look at the possible health impacts of micro-plastics. However, very little is known on their impact on the treatment process or removal by the treatment process for the provision of drinking water to customers. UKWIR is currently undertaking a pathfinder research project in 2018/19. This project will build on the findings of this current project with regard to further investigating the removal efficiency of micro-plastics by the water treatment process.	The objective is to develop an understanding of the following : - Ways to identify micro-plastics present in the raw water. - Methods to measure the level of micro-plastics in a water sample. - Methods to remove micro-plastics from the raw water. - Establish if the current treatment processes efficiently remove them. - Establish if micro-plastics enter the potable water supply from the pipes the water travels through.
L1195	**Impact of Customer-side Leakage Approaches**	It is estimated that about 25% of the leakage within a water distribution network is located on a customer's property and occurs within the pipe that is not the responsibility of the Water Companies. However, this is still included in the leakage figures that water companies report to regulators. The customers can be divided into household and non- household. For household customers, water companies offer a range of solutions from providing free advice to free repairs. There is limited understanding of how these different policies ultimately impact on reported leakage levels and overall cost to the business. For non household customers, water companies don't provide free repair services as a part of their standard customer leakage policy. However, with the opening of retail market, communication with non-household customers has become difficult, slowing down the leak repair and increasing the level of leakage. Water Companies are also increasingly installing smart metering which identify leaks with very low flowrates. This has challenged the industry to find such small leaks, which are not cost effective to repair, and can be difficult to locate.	This project will look at the different customer side leakage policies in operation across the UK (and abroad) and assess their impact on leakage levels, customer service and costs. It would consider both unmeasured and metered customers, and consider rented properties as well as owner occupied. It will look at the smart metering technology being adopted and consider the impacts on both the water company and the customer of not repairing the smallest of the leaks, considering both the cost of water to the Company and the customer. This project will also identify ways to minimise supply pipe leakage in the retail market.
SL1199	**Is there a risk to human health or the environment from possible microplastics in biosolids which are applied to agricultural land?**	The water industry relies heavily on the application of biosolids to agricultural land which is considered to be a best practice. However, there are very few studies on the fate and behaviour of microplastics in biosolids. There is a growing need to understand the fate of land-applied microplastics, the extent and magnitude of human and (terrestrial) animal exposure and uptake and transfer of microplastics via food chain. This work will provide an evidence base to underpin the continued recycling of biosolids to agricultural land and quantify any potential risks to the environment and human health. UKWIR's current project, 'Sink to River - River to Tap - A review of potential risks from nano-particles microplastics' will provide a base on the presence, amount and potential source of microplastics in biosolids which can be used for this comprehensive study. This project will be completed in 2 phases. Phase 1 will be focussed on developing analysis methods and collecting data and phase 2 will be to understand the environmental fate of biosolids on land.	Objectives: **Phase 1** - Develop robust, repeatable and affordable sampling and analytical methods for determination of microplastics and fibres in biosolids and soils. - Obtain data on typical concentrations of microplastics in UK biosolids and soils. - Obtain data on other potential sources of microplastics and fibres to soils, so that contributions from biosolids can be contextualised. **Phase 2** - Acquire information on environmental fate i.e. transport in soil, uptake by crops/biota, accumulation in the food-chain etc. - Acquire information on microplastic and fibre degradability and leaching/binding of chemical compounds. - Undertake quantitative or semi-quantitative risk assessments for biosolids applied to

SW1205	**Ground Infiltration Modelling - better scientific understanding**	Groundwater infiltration is a major factor in determining water quality failures and designing sewer network and storage volumes. But, there is a lack of scientific understanding about the ground infiltration flow entering a sewer network. This leads to inappropriate or over conservative solutions being delivered. Although there are currently algorithms built into modelling software, in many cases this is considered to be 'black box'. Further understanding would help ensure that these algorithms are based on sound scientific evidence and are properly calibrated to reflect as close to reality as possible. More confidence in the model will provide a better tool to influence other stakeholders in both surface water management and environmental quality schemes	Objectives: - To obtain a better understanding of groundwater infiltration. - To provide better algorithms for hydraulic models (especially sewer models), specifically during extreme/ design events. - To identify all the factors affecting groundwater infiltration including but not limited to rainfall, change in water table, drying or wetting of sub surface elements. - To achieve a greater confidence in model predictions of spill frequency or storage requirements - To investigate the impact of groundwater infiltration on extended discharge from combined sewer overflows and its difference from flooding. - To develop a Best Practice Guide with standard profiles and design parameters
WM1214	**Asbestos Cement water mains deterioration and failure prediction models**	In the UK, there is approximately 50,000km of Asbestos Cement (AC) water mains, 60% of which have been in service for over 50 years, the majority (approximately 66%) being small diameter, 100mm or less. With time, it has been noted that the failure rate of AC mains is increasing, demanding the need of replacement which can cost around £5 billion. Several studies have identified that the principal failure mechanism of AC water mains is: - exposure to conveyed water that has an aggressive nature, typically low alkalinity - exposure to aggressive soils, typically low pH - failure of the joints, typically due to microbial attack on the natural rubber joint rings All of the above deterioration mechanisms are directly proportional to time, i.e., the longer the exposure, the greater the level of deterioration. Whilst there may be opportunities to extend the life of such pipes through lining and pressure management, these interventions are unlikely to be a success due to the small diameter and long-term exposure to the aggressive conditions that has already taken place. If the level of AC main failures (pipe and joints) continue to increase, this will impact on the number of interruptions to supply and levels of leakage. This project will be a collaborative project with the Water Services Association of Australia (WSAA).	The project will look at: - Carrying out a nationwide review of the AC mains - Support stage 1 - Development of Deterioration and Failure Prediction Models from the Water Services Association of Australia (WSAA) project. - The UK project will focus more on joints than the pipe, unlike WSAA project. - If possible, support stage 3 - Verify Pipe Deterioration and Failure Prediction Models from the WSAA project.
WM1215	**Review of the UKWIR National Mains Failures Database**	UKWIR developed the National Mains Failure Database for water distribution mains and sewers more than a decade ago. This has helped the industry to achieve better understanding of failure behaviour, act as a source of company specific data and help in more research and development of national models. However, with time the input of information into the database by Water Companies has dropped, as has its usage. Data entry is considered time-consuming and reporting is a challenge. Thus, there is a fundamental need to go back to basics and carry out a full review of the options for streamlining and upgrading the extremely valuable platform.	Objectives: - To go back to basics and re-state the business case for its creation. - To upgrade the platform to meet individual company demands. - To identify and link the cause of the failure which is currently not available in the database
WW1222	**Microplastics - continuation of 2018/19 UKWIR project "Sink to river- river to tap"**	Microplastics is a topic of considerable public and stakeholder interest. Taking the lead, the water industry wants to understand the potential risks posed by the emerging contaminant and act appropriately in advance. This project will build on the ongoing 2018/19 UKWIR project "Sink to River - River to Tap - A review of potential risks from nano-particles & microplastics" which is going to provide understanding of the fate and behaviour of such particles during transport and wastewater treatment. It will also aid the 2020 Chemical Investigation Programme (CIP) and benefit the industry in identifying source control measures and treatment options to continue providing environmentally sustainable services to the public. Thus, the continuity required to both build on the 2018/19 project and help inform the CIP project will be fulfilled by this project.	This project is to ensure continuity between projects, help inform the industry and be clearly seen to be taking 'microplastics pollution' seriously. It will ensure that we continue to gather robust information to understand what role the water industry does or can play in addressing microplastics pollution.

WW1225	**Modelling a dynamic and uncertain future – preparing SAGIS for changes in climate, PR24, RBMP Cycle 3 and Brexit**	Source Apportionment Geographical Information System (SAGIS) is a tool developed by UKWIR that helps in quantifying the pollutant load from different sources in UK surface waters. It is primarily used by the industry and regulators in Asset Management Planning (AMP) and River Basin Management Planning (RBMP) and will remain so until at least the year 2027. It is used to determine permits for wastewater treatment works (WWTW) discharges and identify future investment needs. The value of SAGIS and associated decision supporting tools is related to the data contained within the tool and the extent to which it incorporates the latest knowledge (scientific and political). This project will therefore focus on preparing the system for the future by including assessments of climate change, PR 24, RBMP cycle 3 and Brexit.	This project will focus on: - Functionality enhancements in terms of river flow estimation and percentile concentration values for a number of determinands (e.g. ammonia, BOD, DO) - Responding to needs identified via ongoing scoping studies. For example, incorporating an ecological quality prediction module, raw water pesticide concentration data, new sectors and determinands etc. - Understanding the impact of Brexit on environmental legislation and target environmental quality standards currently used in the tool
WW1226	**Antimicrobial Resistance (AMR)**	Increasing Antimicrobial Resistance (AMR) is a global concern as it poses a major threat to public health, i.e., many antibiotics may stop working if resistance continues to spread. The United Nations has appealed to countries to take a co-ordinated approach to investigate the root cause of AMR across multiple sectors. As part of the UK national strategy to combat AMR, there is a possibility of increased regulations for the routes of potential release. Some studies have shown that bacterial ecosystems downstream of Wastewater Treatment Works (WWTW) discharges show an increase in AMR. This is primarily due to release of bacteria that are already resistant or the release of antibiotic resistance genes that are then incorporated by environmental bacteria and not the discharge of antibiotic residues in effluent. A better understanding of the extent of resistant bacteria discharged from the WWTW and the link to anti-microbial resistance in the environment is needed. One of the key issues (after development of new antimicrobials) is preventing or limiting the release of resistant organisms to the environment. WWTWs are an obvious contender and although conventional WWTWs achieve significant bacterial reductions, this may not be sufficient to reduce the risk. Hence a better understanding of the effectiveness of conventional processes is required.	Objectives: - The primary aim is to quantify the effectiveness of various tertiary/disinfectant treatment options on AMR activity. We also want to be assured that conventional treatment methods are not adding to the problem of AMR. - To understand what indicator methods are most appropriate to apply for a wider survey, if needed (e.g. are Coliforms the best measure? Is there a reliable marker of AMR which can act as a proxy for detecting multiple types of resistance genes?). - To evaluate the environmental significance of AMR activity in effluents. Work is already being undertaken in Wales that will contribute to this assessment. - To understand the drivers of increased resistance in the environment.