

Governance and Infrastructure in the Water Sector: Towards Successful and Just Interventions

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ABSTRACT

This thesis addresses the interface between transformational infrastructure interventions and the governance regime that surrounds them. It adopts the view that governance shapes these interventions and that their prospects of success are improved by understanding the governance sphere they will have to operate within. A transdisciplinary stance is adopted seeking to embed governance issues directly into engineering projects. The area of focus is transformational engineering projects in the UK water and wastewater sector, although it is anticipated the principles could apply to other utility services and other jurisdictions. The outcome of the study is a governance framework that supports project teams in navigating this interface to better understand the formal and informal rules that will shape the project and, vice versa, to identify areas where governance itself needs to adapt.

The academic grounding is taken from the synthesis of two, often disparate, bodies of work around Socio-Technical Systems (STS) and Socio-Ecological Systems (SES), looking at the wider systems affected by technical advances. It progresses these studies by suggesting an improved integration with the concept of justice, for 'just' as well as 'successful' interventions, and supports calls for 'water justice' as an advance on the current sustainability paradigm. Academic theory is tested and applied through direct engagement with a transformational engineering project (the Pipebots project), and interviews, a survey and a focus group with participants operating within the wider sector. The result is a framework that draws on, and integrates, both theory and practical experiences.

However, the conclusions go further. Through engagement with the sector in designing the framework, routes and barriers to innovation are exposed. The formal access routes into the

water sector for innovators via R&D may be considerably less effective than informal routes through operational and engineering teams. An understanding of governance networks is also seen in inventive solutions seeking to re-work administrative, disciplinary and physical boundaries to achieve a breadth of multi-dimensional social and environmental objectives.

Overall, the full strength of the regulatory regime is exposed, often overwhelming market drivers or even wider environmental goals. Through the study, evidence is provided of a disjunct between aspirational policy and existing granular law on the ground. It finds the regulatory pull is more often towards narrow problem framing and away from projects with wider social and environmental benefits, the opposite of what is required to address the ‘wicked’ problems of the Anthropocene. This casts a new focus on the driving force and direction of utility regulation in the UK as it illuminates projects more likely to be selected, and business cases more likely to be accepted, than may otherwise be envisaged. It goes on to offer suggestions in terms of principles and regulatory re-framing to rectify the imbalance as well as routes to access the sector. It is submitted that this represents an original piece of work that will advance the study of transformational infrastructure interventions and their interface with governance. Work on this study has so far prompted two journal publications¹, ², and one publication-pending³, with more in progress. These documents reflect the author’s thinking and work on this project at various stages of the process. As fundamental parts of the research journey, these documents have been adapted and incorporated into this thesis.

¹ Shrimpton, E. A., Hunt, D. and Rogers, C. D. F. (2021) 'Justice in (English) Water Infrastructure: A Systematic Review', *Sustainability*, 13(6).

² Shrimpton, E. A., Hunt, D. V. L. and Rogers, C. D. F. (2022) 'A Governance Framework for Implementation of Scientific and Engineering Innovation in Buried Infrastructure Systems', *Frontiers in Sustainable Cities*, 4.

³ (Pending) Shrimpton, E.A., Hunt, D. and Rogers C.D.F. working title, Micro-Robotics within Potable Water Pipelines: Navigating Regulation 31, submitted.

DEDICATION

To Evie (Robin), my daughter and 'study buddy', my husband James for his steadfast support and Oswin (our dog) for companionship whilst tucked away writing this thesis.

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TERMS AND ABBREVIATIONS

AMP	Asset Management Plan
Anthropocene	The period of time during which human activities have had an environmental impact on the Earth regarded as constituting a distinct geological age – <i>Merriam Webster</i>
AREA	The AREA framework for Responsible Innovation - <i>Anticipating</i> consequences, <i>Reflecting</i> on the work, <i>Engaging</i> stakeholders and <i>Acting</i> accordingly (p.19)
CSO	Combined Sewer Overflows
DEFRA	UK Government's Department for Environment Food and Rural Affairs
DNK	Do Not Know (Ch 8)
DWI	Drinking Water Inspectorate – regulator for potable water quality in England and Wales
EA	Environment Agency – non-departmental public body and regulator established to protect and improve the environment in England
IAD	Ostrom's Institutional Analysis and Development (IAD) Framework (p.22)
Justice	The equitable distribution of benefits and burdens, due process and respect, enhancing capabilities for all living things (see page 36)
GM	Genetic Modification
Governance	The sphere created by rules (formal and informal), networks, processes and relationships, underscored by justice principles, that drive the water and wastewater sector forward and into which the project will need to integrate or influence to be successful (see page 14)
MLP	Multi-level perspective
Multidisciplinary	The drawing of knowledge from different disciplines but staying within disciplinary boundaries (Choi and Pak, 2006)
NBS	Nature-Based Solutions
ODI	Outcome Delivery Incentives, measures of performance assessed through Ofwat.
OEP	The Office for Environmental Protection – a new UK public body to protect and improve the environment by holding the government and other public authorities to account (covers England, Northern Ireland and reserved matters across the UK).
Ofgem	The Office of Gas and Electricity Markets - the energy regulator for Great Britain
Ofwat	The Water Services Regulation Authority - the regulator for the water sector in England and Wales
RI	Responsible Innovation
SDGs	Sustainable Development Goals
SES	Socio-Ecological Systems
SETS	Socio-Ecological-Technological Systems
STS	Socio-Technical Systems
Transdisciplinary	Integrating disciplines and transcending traditional boundaries (Choi and Pak, 2006)
TRL	Technical Readiness Level
WFD	The Water Framework Directive 2000/60/EC addressing the status of water bodies across EU member states.

1 INTRODUCTION

This study supports projects in the water and wastewater sector (the sector) as they make the transformational changes to infrastructure needed to combat increasing water stress. To improve the chance of a successful implementation, this study explores the position that technical change should be addressed together with governance rather than in isolated disciplinary silos. The aim is to devise a governance framework to support project teams as they navigate the complex governance regimes that surround their projects, integrating governance issues into the technical challenges of a project. The framework seeks to ensure that governance opportunities around new infrastructure are maximised, potential hurdles anticipated and overcome, and feedback encouraged so governance can adapt and improve in response.

Water is a life-essential resource. To distribute it justly and effectively there needs to be both infrastructure and rules. Rules are in place to help counter the ‘tragedy of the commons’, where human nature, if left unchecked, may deplete the very resource it relies upon to survive (Hardin, 1968). Those rules, formal and informal, are part of a governance system. How governance is organised and what rules it contains may change with geography, political will and requirements but what remains the same is the need to meet the societal goals of the jurisdiction, balancing competing interests, uses and rights with never-ending costs and the search for funds. Different models are used, all seeking to get the balance right, negotiating the politics and institutions of State or private ownership, financial support and rights-based models amongst others, with arguments raging over the extent each successfully balances economics with social and environmental goods.

Whatever the model, the overarching goal of water governance and infrastructure, and what it has to achieve, has become more sophisticated overtime. Governance goals have developed alongside the growing realisation that it is a system that touches virtually every aspect of human life. Its earlier years as tool for water security gave way to mounting interest in public health, sanitation and wastewater management, in turn leading to flood management paradigms, conservation and more recently sustainability (Ashley *et al.*, 2013). These early paradigms have not been abandoned; their scope has been expanded. Similarly, it is argued in this study that the sustainability paradigm should itself be expanded to include new thinking about water justice ensuring not only the sustainable use of resources but its equitable distribution allocated with respect and due process.

The challenges the sector currently faces in meeting these goals cannot be underestimated and the time for new ways of thinking has arrived. In the UK, as in many jurisdictions, water infrastructure needs to adapt to water stress triggered by the challenges of changing climate and weather patterns, irreversible ecosystem damage from long-term mismanagement, ageing and leaking pipes, changing demands, shifting demographics and urbanisation (Milman *et al.*, 2021; Environment Agency, 2020; OECD, 2015). These amount to substantial environmental, technological and social shifts with each shift impacting upon the other. This is alongside congestion, above and below ground, as the space for interventions competes with existing infrastructure and ownership rights. Business as usual is no longer an option and new and innovative infrastructure interventions are called upon to address these issues and increase the resilience and sustainability of the system (Ofwat, 2019).

However, it is not enough for science and engineering to devise a technological solution. Technological change and governance are closely connected. The acceptability and success of a proposed technological solution is heavily influenced by the governance regime that surrounds it (Barraque *et al.*, 2017; Flynn and Davidson, 2016; Rouillard *et al.*, 2016; van Vliet *et al.*, 2011). Further, it is not necessarily the lack of technology that holds back change, but whether there is a supportive governance system, so supportive formal and informal rules, that can help it develop and become embedded (Goodwin *et al.*, 2019; Frijns *et al.*, 2016). Cognisance of the wider governance regime at project level is therefore indicated.

Gaining that cognisance is not straightforward. The governance position is particularly acute in the water sector. In the UK, the sector sits within an extensive and complex governance regime (Walker, 2014; Osbeck *et al.*, 2013). Regulation has resulted in a complexity that may fall outside the expertise or knowledge of a project team, an obstacle for innovators recognised by the UK Government (Dept for BEIS, 2021; Dept for Business Energy and Industrial Strategy, 2019). Nonetheless these are issues that will impact on how problems should be framed, the design of a project, its acceptability or even its legality. It requires a view of the project beyond the immediate technological challenge, and the expertise of project team members, into its impacts and wider context.

A framework offers support to project teams by flagging governance questions for assessment, drawing in the issues that may need to be addressed. In doing so, it encourages the transdisciplinary⁴ thinking and wider problem-framing needed when addressing

⁴ This study uses the terms multidisciplinary and transdisciplinary as defined and discussed by Choi and Pak with multidisciplinary referring to the 'drawing of knowledge from different disciplines but staying within disciplinary boundaries' and transdisciplinarity as 'integrating disciplines and transcending traditional

complexity and the ‘wicked’ problems of the Anthropocene (Cosens *et al.*, 2020; Jensen, 2020). Governance does not address technology in isolation but presents a lens into the social and environmental priorities of its jurisdiction as it sets policies and rules to tackle water stress. Governance frameworks for infrastructure policymaking, strategy setting and top-down decision-making are easy to identify (e.g. Lovell *et al.*, 2022; Hall *et al.*, 2016; Ward *et al.*, 2012). Frameworks to engage with the governance interface, live and on-the-ground, are harder to find, with the lack of tools to support project teams in addressing issues beyond their immediate technical challenges noted (e.g. BSI, 2020).

This leads to a lack of practical support for innovators in science and engineering and a gap in the literature. Although no directly applicable framework already in existence has been identified, what has been noted is an extensive body of literature and learning that can be drawn upon to help design such a framework. Two distinct threads of literature dominate, that relating to Socio-Technical Systems (STS) and that relating to Socio-Ecological Systems (SES; Smith and Stirling, 2010; Foxon *et al.*, 2009). STS is seen in studies on the implementation of new technologies into a social system, for example, the management of infrastructure change and social norms and preferences in the context of an urban water re-use scheme (Goodwin *et al.*, 2019). SES is seen in the relationship between social systems and natural resources, for example modes of governance of water to improve the resilience of supply in the face of climate change (Clarvis *et al.*, 2014). Both accept the need for a systems approach, albeit concentrating on social and technological systems for STS and social and ecosystems for SES. Despite some common ground, STS and SES have developed from different academic

boundaries’, Choi, B. C. K. and Pak, A. W. P. (2006) ‘Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness’, *Clin Invest Med*, 29(6), pp. 351-364.

disciplines, problem-framing and interests. This study also looks to a recent body of work, namely SETS (Socio-Ecological-Technological Systems), that is transdisciplinary in nature and starts to synthesise the two.

There is a further governance issue to address and that is the place of justice as an active and visible component of the governance system. In making the infrastructure changes needed, justice seeks to ensure that a distribution of resources is equitable, decided through due process and with respect for all stakeholders (Schlosberg, 2007). On reading the literature for this study however, reference to the concept of justice seemed remarkably infrequent. The author is not alone in noting its relative absence in work addressing water infrastructure or water governance (Holstead et al., 2018; Özerol et al., 2018). This seeming absence is even more difficult to understand when compared to its high visibility in the energy field and the acknowledgment of the need for a ‘just’ transition in the context of energy and carbon net-zero (Healy and Barry, 2017; Sovacool et al., 2017; UNFCCC, 2015). In the energy field at least, justice and a ‘just transition’ expressly underpin the requirements of the governance system around infrastructure. The anecdotal finding of a lack of justice thinking in the sector is therefore explored further and the incorporation of justice principles is expressly considered.

To address these issues Chapter 2 sets out the research question and hypothesis, embracing the interconnectivity between governance, justice and infrastructure. As the detailed rules of governance are particular to a jurisdiction, Chapter 3 sets out the current context and nuances of the governance regime in the UK and also addresses the lack of cohesive justice thinking within the jurisdiction of interest. A critical review of the literature in Chapter 4 examines the extent to which the aims, research questions and hypothesis have been addressed by others.

From the literature, the study turns to the research methodology in Chapter 5 where the literature themes are developed further. The methodology is constructed to create a framework that is grounded in academic thinking, draws upon experience from within a research project and informed by data gathered from, and evaluated by, the wider water sector.

The methodology starts with the author's learning experiences within a project seeking to make transformational changes in the sector, the Pipebots project. The Pipebots project is a multidisciplinary project seeking to transform how the water and wastewater pipes are inspected and maintained by using swarms of autonomous miniaturised robots (see Pipebots, 2022). In introducing advanced robotics into water infrastructure, understanding the formal rules and informal values and norms within the governance regime is a key aim of the project (Pipebots, 2019). Involvement with the project offered a rare opportunity to explore experiences and ideas within a live, multidisciplinary project and was therefore utilised as an opportunity for immersion in a project's issues in real-time.

The Pipebots project discussed in Chapter 6 is used as a 'laboratory' for experimentation before going forward with firmer ideas and understanding into the sector itself. Sector views and experiences are gathered through semi-structured interviews before taking the results of those interviews to a wider audience via a survey. The results of the semi-structured interviews and the survey are discussed in Chapter 7 and 8, respectively. The final component of the research methodology takes the resulting framework, drawn from the literature, Pipebots, semi-structured interviews and survey and tests it before a sector focus group. The focus group, consisting of individuals who would be asked to use the framework, is the final test to see if the themes, discoveries and insights gleaned through the research journey result

in a document that would be valued by those asked to use it. The findings of the focus group are set out in Chapter 9.

In drawing the study together the discussion in Chapter 10 takes the research findings and answers the research aim and questions. In addressing how governance could improve it does so from two perspectives, firstly from a project team and then from the governance regime itself. By focussing on a project team the impacts of governance can be directly assessed, and likewise, may illuminate what changes could be made to the governance system to support 'just' interventions. The conclusion in Chapter 11 sets out the areas for further study and addresses the extent the hypothesis is made out with ideas about how it could be re-framed.

2 RESEARCH

The study has the following aim, questions and hypothesis.

2.1 RESEARCH AIM

To create a governance framework to support the implementation of ‘just’ infrastructure interventions, focussing on transformational projects in the UK water and wastewater services sector.

2.2 RESEARCH QUESTIONS

- a. Drawing on a literature review and data gathered from the sector, what aspects of governance, or governance themes, appear relevant to a project team seeking to bring about transformational change?
- b. Using a systematic literature review, how prevalent are themes of justice in literature addressing governance and water infrastructure in this jurisdiction?
- c. Drawing together governance and justice themes, how might these themes be operationalised into a framework; what questions should a project team be prepared to address?
- d. Through validation and testing via a focus group, what can we learn about how the proposed framework will be viewed and received; what barriers might it need to overcome?
- e. In answering these questions, what can we learn about how governance could be better ‘engineered’ to encourage the implementation of just interventions – interventions that

meet the environmental and societal goals needed to address the challenges of the Anthropocene?

2.3 **HYPOTHESIS**

Governance shapes projects and can be shaped by projects. Harnessing governance has the potential to support just interventions and reflects the wider social and environmental goals of a jurisdiction.

3 CONTEXT – GOVERNANCE AND JUSTICE

This Chapter discusses what is meant by governance in the context of this study and addresses why justice, if it is absent from the debate, should be expressly referenced.

There are a multitude of different water governance regimes utilised around the world as different jurisdictions seek to manage and finance their water and infrastructure needs. Although the forms of governance utilised may be similar (e.g. law, policy, norms), the forms that dominate in a particular jurisdiction, and how those forms are drafted and applied, may vary. To put this study into its context therefore, the governance regimes are discussed here with a focus on the nuances of the UK regime.

Governance regimes can range from market-based structures, State-owned operations, decentralised and commons ownership models in a community setting, and hybrid variants in between (Bakker, 2007; Bakker, 2003). The allocation of property rights and ownership of water services is different in each, from private enterprise and the commoditisation of water services (some argue the commoditisation of water itself (e.g., Barlow, 2010). the State mechanisms of public ownership through to exclusive club or commons models (Strang, 2016; Bakker, 2007). Arguments continue over the best model, often stirring very strong feelings around power, affordability or accountability (Right2Water, 2021; Global Water Partnership, 2017;). These debates underpin the political nature of water and water services (Strang, 2016; Watson *et al.*, 2009) as each jurisdiction balances the need for affordable access to a precious resource, the sustainability of supply and the need for investment in infrastructure.

In the UK, mention must be made of the controversial privatisation of the water sector in England in 1989 as this impacts on the network of bodies around the project and the forms of

governance it will need to navigate (Water Act, 1989). Following privatisation, the daily running of services passed to water companies, mostly as market-based, profit-making enterprises (Ofwat and DEFRA, 2006; Water Act, 1989). Governance controls were put in place, enforced by new regulators, to moderate the needs of shareholders (and encouragement of investment) with affordability and service for the public, now 'consumers' (Ofwat and DEFRA, 2006). The aim was to encourage the market-based system to behave in a way commensurate with the societal goals of the day, whilst maintaining investor confidence (e.g. Ofwat, 2015).

Each governance regime fundamentally shapes the opportunities and challenges around resource management (DeCaro *et al.*, 2017). Whatever the perceived merits of the governance regime chosen, the overarching regime determines which of the forms of governance (e.g. policy, law, regulation, informal agreements, norms) are most favoured for that jurisdiction and what behaviours are sought to be controlled. This impacts on the people involved in governance, how they govern and so who a project team may need to be aware of and involved with. The remit of regulation has expanded considerably in the UK since the early days of privatisation and its initial focus on financial controls (Centre for Competition Policy, n.d.) The regulatory impacts that a project may need to navigate are likewise expanded. Policy influences in the water sector are wide-ranging from international policies and treaties recognising water governance as a global issue, an example being Sustainable Development Goal 6 (SDGs; UN, 2015), to the water usage norms, behaviours and expectation of the 'consumers' on the ground. The governance regime has expanded and developed as a result and now includes wide-ranging objectives addressing consumer satisfaction, sustainable development and resilience and, it is anticipated, into stricter environmental targets (Centre

for Competition Policy, n.d.; Ofwat, 2020). This recognises the integrated nature of water systems with its social and environmental impacts.

The UK regime arguably embodies the essence of the term 'Government to governance', as the change from top-down Government control of public functions to governance by a network of institutions (Walker, 2014; Osbeck *et al.*, 2013). This results in an array of bodies involved within the governance structure including international bodies, a range of regulators, water companies, service suppliers to the sector, non-government organisations (NGOs) and lobbying groups, local authority and direct Government controls, the public as consumers and wider society impacted by ecosystem services (see Osbeck *et al.*, 2013, p. 64). Engaging with governance involves engaging with a range of actors.

Governance is therefore a term where its dominant forms, institutions and application may differ in different settings. A definition is required that acknowledges its variables but is clear enough to encapsulate its meaning. As it is term applied to many contexts there is no single definition of governance although many have been suggested, influenced by a sphere of interest or problem-framing (e.g. OECD, 2015; Barbazza and Tello, 2014; United Nations Development Program, 1997) . Rhodes, a highly-regard scholar on network governance, notes this issue and suggests that a definition suitable for a study can be designed but must have key features common to others and must add something to the debate to further develop the concept of governance (Rhodes, 2017).

To add to the debate, an absence of justice thinking is a notable, potential gap to be addressed in any chosen definition. Justice is considered in more detail in Chapter 4. For the present it is noted that in addressing water stress, a new intervention may be sustainable and resilient,

but that does not mean it is 'just' (Neal *et al.*, 2016). Infrastructure distributes resources, so a decision about a new infrastructure intervention is also potentially a decision about resource distribution. Resource distribution asks justice questions of who is allocated what amount, how, at what cost and for what uses, or how tensions between competing interests (including human and environmental) should be resolved (Neal *et al.* 2014; Rawls, 1999). Further, the most vulnerable in society, human and non-human, generally suffer the most when ecosystems are under stress (Dasgupta, 2021, p. 376). In addressing water resources, how are the needs of the most vulnerable understood and power asymmetries accounted for? These are questions of justice to be addressed as part of a governance regime (Neal *et al.*, 2014).

Questions about the distribution of a resource become increasingly important when that resource is under stress (Dasgupta, 2021). Pre-existing problems can surface that were hidden in times of abundance. This is an issue that will affect the UK. As the UK's National Infrastructure Commission noted in 2018:

The risk of households having their supplies rationed because there is not enough water is significant. Large and densely populated parts of England have lower annual rainfall than Sydney and Mexico City. (NIC, 2018, p. 7).

This may impact some regions more than others, specifically the higher density South-East England, not as occasional inconveniences but long-term water stress (Environment Agency, 2020). Is the UK, a country not yet used to the on-going realities of persistent water stress, alive to justice issues when tackling infrastructure needs in these times of change?

Drawing this together, the Biermann (2014) definition of governance contains common features of governance definitions including formal rules, informal rules and networks of

actors steering a sector towards its goals, and appears in line with this study. It is adapted below to represent the water sector. Due to the possible lack of justice thinking and its potential importance, justice is inserted expressly into the definition rather than an implicit part of a governance system. Governance in the context of the water sector and for the purposes of this study is therefore:

the sphere created by rules (formal and informal), networks, processes and relationships, underscored by justice principles, that drive the water and wastewater sector forward and into which the project will need to integrate or influence to be successful.

Justice becomes a fundamental concept against which the forms of governance (including regulatory requirements in a heavily regulated regime) are assessed and judged. This acknowledges governance for a project team as a complex system of networks, relationships, rules and goals that seek to drive the industry forward, justly. A project must successfully navigate all of these components.

4 CRITICAL REVIEW OF THE LITERATURE

In viewing infrastructure and governance in a system with technical, human and ecological components, two well-established bodies of literature come to the fore, Socio-Technical Systems (STS) and Socio-Ecological Systems (SES). These are bodies of work that have grown up from different disciplines and problem-framing and focus on the interconnectivity of social-technical systems and social-ecological systems, respectively. However, infrastructure is combination of social, technological and ecological systems. It can be viewed as a technology drawing in and distributing a natural resource for the benefit of society. With this in mind, recent studies seek to synthesise these two bodies of work and look at socio, ecological and technical together. This new body of work, referred to as SETS, is also considered. These are broad bodies of literature, often conceptual in nature, and the emphasis will be on areas that address governance and transformational change. The Chapter then progresses to explore the prevalence or otherwise of justice thinking in the literature and addresses how a justice lens may advance thinking on project and solution selection.

4.1 SOCIO-TECHNICAL SYSTEMS (STS)

STS provides the academic basis and support for this study by emphasising the interdependency of governance and technology, stressing that they cannot be considered in isolation from one another. It also provides potential themes to address in a framework.

STS explores the coupling of social systems and technical systems and explores how they are interconnected and co-formed. It is said to be heavily influenced by work in the 1980s on the

evolution of infrastructure systems noting that rather than purely technical components, infrastructure incorporates a range of institutions, politics, geography and laws (Bolton and Foxon, 2015; Hughes, 1993). It is not possible to understand a technological evolution in technical terms alone.

Through STS, social factors are seen as embodied in technology, influencing how they interact with one another (Rip and Kemp, 1998). The social sphere includes the governance regime which in turn can accept or hinder new technologies and experimentation (Bos and Brown, 2012). In this way infrastructure and governance are intimately connected in a network and co-evolve as part of a system (Hughes, 1986). Using Pipebots to illuminate the point, how the governance sphere adapts to an innovative technology 'living' in the potable water supply is a live consideration, including the existence of enabling policies to encourage investment in new technologies, compliance with the legal regime keeping potable water 'safe' and the impact on societal norms around the use and perceived purity of drinking water. The success or otherwise of a Pipebot is connected to how it responds to this sphere and likewise governance and societal systems may adapt and change with their introduction.

In looking at transforming to a sustainable world, STS thinking explores how the co-dependency between social and technical creates established structures that can struggle to adapt with the need for transformational change – from path dependency and lock-in, to incumbents and inertia (Wolfram and Frantzeskaki, 2016). These theories have been further developed in the sub-set of STS literature around 'transitions research'; how technology can move society from an unsustainable state to a sustainable one (Loorbach *et al.*, 2017; Foxon, *et al.*, 2009). Introducing innovative technology can involve disrupting the social sphere, or

adapting a governance arrangement, to allow the new to be embedded and accepted (Loorbach *et al.*, 2017; Rip and Kemp, 1998). Technology is viewed here as a disruptor to the socio-technical system, breaking down existing structures with the incumbent technology and new structures being formed.

Applying this to infrastructure, the systems around new transformative infrastructure require an amenable governance system. A water sector example includes water meters and how the governance system encourages the use of this technology to educate and alter behaviour and attitudes towards water (Hess, 2014). There may be governance through financial drivers or tackling values and behaviours through education programmes, and if that does not work more forceful forms of governance such as legislation could be deployed. Other examples include the introduction of forms of sanitation and their failure where social systems, norms and preferences are not addressed (van Vliet *et al.*, 2011). Examples of difficulties in bringing about the required 'disruption' also include those in water re-use schemes requiring not only the risks to water safety to be assessed and managed through education, training and governance, but norms, risk perceptions and behaviours to be addressed alongside (Goodwin *et al.*, 2019). There is a complex mix of formal and informal governance mechanisms at play.

A representation of the transformative journey of new interventions is assisted through the Multi-Level Perspective (MLP) model (Geels, 2002). The MLP seeks to track the journey of a new intervention from its creation and development in a secure environment or laboratory, termed the 'niche', its emergence into the incumbent 'regime' and then, if successful, embedding into the everyday 'landscape' (Geels, 2011; Geels, 2002). Studies explore these phases and movement from one to the next, including the governance conditions that may

support that process (El Bilali, 2019; Geels, 2002). It is a model and as a model, inexorably, does not reflect the complexities of a real system. It has been criticised as such for not reflecting the impact of agency or for its emphasis on movement from niche upwards rather than the full possibilities of landscape and regime change (El Bilali, 2019; Genus and Coles, 2008). With these limitations in mind, the MLP remains a useful, visual aid, particularly when viewing technology and governance side-by-side.

The MLP can be applied to other aspects of the system, including governance (Loorbach *et al.*, 2017). Governance and law have hierarchical structures with higher forms of governance instruments having more weight and being more difficult to change than others (Garmestani *et al.*, 2019). With a governance regime, for example, one may see the 'niche' where rules, relationships and standards influence the design phase in the lab, to the 'regime', in this instance being the regulatory sphere around water governance, and into the 'landscape' where it must align with the Constitution and Laws of the land; at each level the governance instruments generally being more strictly enforceable. It is possible to see, through this framing, that different tools of governance may impact at different stages of a project. For example, standards may be developed to show product safety in the niche phase. In the regime, sector regulations may need to be complied. Law and values, including property ownership and rights, may need to be tackled as it is built and embedded in the wider landscape. This shows both technology and the touchpoints with governance moving and changing alongside one another.

In relation to a project team in its 'niche', a particular sub-set of literature around Responsible Innovation (RI) is raised. RI addresses the responsibilities of a project team seeking to make

change. This takes the STS principles of socio and technical relationships directly to the door of projects themselves as under RI, these are not issues for society after the engineering job is done, but a fundamental part of the development process; a project team is not divorced from the outcomes it produces but is responsible for them (Groves, 2015). It places responsibility on science and engineering to consider the wider impacts of its work (Stilgoe *et al.*, 2013).

The RI literature also provides frameworks, albeit covering a more limited arena, recognising the need and relative lack of tools to support project teams. It provides an opportunity to use some of the thinking within RI frameworks in the study. The AREA framework, for example, devises a list of questions around *Anticipating* consequences, *Reflecting* on the work, *Engaging* stakeholders and *Acting* accordingly (Stahl, 2018; Stilgoe *et al.*, 2013) and asks that those questions and reflections be incorporated into project plans and strategies. The frameworks are not designed to provide the answers for this research and they do not offer questions or guidance on governance, forms of governance or norms outside of the public arena. They are however supportive of the research goals in providing project level support and may offer ideas for inclusion in a framework.

Despite the potential benefits of RI, the placing of these RI-type responsibilities on project teams is not universally accepted. New science may feel hampered or feel its space for exploration is diminished. There may be a degree of uncomfortableness with the multidisciplinary approach of considering social science issues within technological development. The latter, for example, is starkly explored in a study addressing engineering and social science in the US (Leydens *et al.*, 2012), a study where conflict comes to the surface.

However, reflection is needed on why RI came into being in the first place. It is said to have been prompted by issues such as the public response to genetic modification (GM) and concerns from the robotics or nano-tech communities that their innovations may be similarly rejected (Winfield and Jirotko, 2018; Boden *et al.*, 2017). There are perceived wider benefits to science as well as society in adopting an RI approach by addressing public trust, inclusion and ensuring mutual understanding when developing new technologies (Macnaghten and Chilvers, 2014).

One way of resolving any disciplinary tension may be to consider RI as more applicable to some projects than others, disruptive technologies rather than incremental change, for example (Tait, *et al.*, 2017); it seems sensible to assign a greater RI alignment with those projects seeking the more dramatic societal change. Additionally, thought may be given to the timing of its application, allowing some scope for early Technical Readiness Levels (TRL) in the 'niche' relatively unhindered (Tait *et al.*, 2017), before AREA (Anticipate, Reflect, Engage and Act, see page 19) is applied with more vigour later. Either way, for the disruptive innovations addressed in this study, consideration could be given to integrating RI into a governance framework particularly as a means of exploring informal rules and the societal norms and values that arise from the governance regime alongside its use in developing engagement plans and strategies to address them.

In summary, through the placing of technology and society as intimately interconnected, STS supports the view that governance (as a social system) and infrastructure (as a form of technology) need to be considered together, not in isolation. The MLP offers a model to consider an innovation's progress and can be adapted to show how different forms of

governance may impact at different scales. The literature also suggests that RI could be helpful for transformative projects generally. RI may assist if science and public trust are to move forward together with a better understanding of one another and could be included in a framework. These themes will be taken forward into the research phase of the study.

4.2 SOCIO-ECOLOGICAL SYSTEMS (SES)

STS appeared as the predominant body of literature when reviewing issues of technology, infrastructure and society. However, the framing of infrastructure for the purpose of this study is as a conduit between society and ecosystems. It is a form of distribution of a natural resource. To not have ecosystems as an equal weighted part of the governance assessment could miss a key component of the system. An area to explore to re-balance the narrative is SES as the body of literature addressing the interrelationship between ecosystems and society. This Section focusses on the work within SES studies that address governance.

SES acknowledges that the governance regime around a natural resource impacts on its sustainability (Walker *et al.*, 2004; Dietz *et al.*, 2003). A sub-set of SES studies, around 'adaptive governance' has parallel threads to the systems thinking of 'transitions research' of STS but significant differences in line with the different disciplinary thinking and focus (Foxon *et al.*, 2009). In adaptive governance, it is not the disruptive framing of transitions research, where new technology interrupts structures and forms new ones, but adaptation through engagement, learning and responsiveness to the environment (Smith and Stirling, 2010). The objective of adaptive governance is not to breakdown structures, as with transitions research, but to flex and bend with change through learning and adaptation. In this way governance cannot be rigid and contain a resource, treating it as static, but must adapt to the changes that

inevitably take place. Governance here accepts a system that is adequate for purpose, not necessarily 'optimised' (Chester and Allenby, 2019).

Ostrom's Institutional Analysis and Development (IAD) Framework seeks to understand the social mechanisms and rules around a natural resource which impact on its sustainability and challenges the perceived inevitability of the 'tragedy of the commons' (Hardin, 1968; Ostrom, 1990). IAD suggests a complex interaction of social and ecological factors are at play impacting on the use of the resource (Ostrom, 1990; Ostrom, 2011). It embeds the need for an understanding of setting, context and place and of the biophysical components of the resource - factors generally lacking in the STS literature (Smith and Stirling, 2010). The complex interaction lends itself to systems thinking and encourages solutions that encapsulate wider environmental and social benefits and impacts. The importance of these components is seen in the progress of water governance, for example in the move from single issue management to a catchment-based approach (DEFRA, 2013) or the use of Integrated Water Resource Management (IWRM; UNEP, 2022). This recognises that the generation of solutions can depend upon problem-framing and where the system boundaries for consideration are set. This flags the potential importance of scope and problem-framing in governance, infrastructure and project planning.

IAD addresses the community and relationships, the rules-in-use and the 'action situation' where these components interact (Ostrom, 1990; Ostrom, 2011). The concept of rules-in-use, as opposed to rules-in-writing may be of particular note here. The water regime in the UK is very heavily regulated, with multiple institutions, making the resultant volume of rules impressive. In a study of the water-energy-food nexus in England, one study identified 2700

potential regulations, not all of which were likely to apply in practice, together with many unwritten rules (Larcom and van Gevelt, 2017). This presents a problem for a project team. One project team cannot know all of the rules that are relevant – but its network might. Adaptive governance does not require perfect answers but of building up capabilities through the development of actor networks (Smith and Stirling, 2010), drawing in knowledge and enhancing the resilience of the system. The quality of the actor network, and drawing upon it, is also seen in literature around the successful development of a project from its niche (Caniëls and Romijn, 2008), a neat link back to STS thinking.

Knowledge and learning have a powerful role to play in adaptive governance studies. A project may not have all of the answers but it may have systems and networks in place to respond, learn and adapt. This is important to an SES as there is inherent uncertainty and inevitable change that cannot always be anticipated. Trying to tie-in and prevent change is not possible; instead, learning improves the prospects of successful adaptation and responsiveness to that change, increasing system resilience (Pahl-Wostl, 2009; Walker *et al.*, 2004). Pahl-Wostl explores the concept of triple-loop learning for adaptive capacity in resource governance (2009). In brief, single-loop learning is described as learning through incremental change without challenging underlying assumptions (sometimes noted as ‘doing it right’), double-loop is said to re-visit assumptions (‘doing the right thing’) with triple-loop learning going further and tackling underlying values and the frame of reference (Pahl-Wostl, 2009; Flood and Romm, 1996). The need to be open to learning and reflection, acknowledges that governing a complex adaptive system is difficult and unpredictable; even with a well-intentioned regulatory regime, there may be emergent features that are undesirable or even unjust (Neal *et al.* 2014). Transferring this thinking into a framework may involve review mechanisms for

the project beyond whether the project is meeting its goals, or implementing the right processes, to reflection on whether its original premise remains valid.

Adaptive governance studies focus heavily on informal relationships, rules and networks, and learning within those structures, and fewer studies address the role of stricter forms of governance such as formal law (Garmestani *et al.*, 2019; Hill Clarvis *et al.* 2014). This is another potential gap in knowledge. In the UK water sector, the governance regime is heavily regulated through formal law. This is the form of governance that dominates in the regime, providing certainty and enforceability. How the law, with its certainty if not rigidity, is able to flex and adapt to a complex adaptive system and become adaptive governance is less clear (Cosens *et al.*, 2020). Although studies are limited, suggestions include that the law should be drafted to be flexible in some way, implemented at the lowest administrative level practicable (termed 'subsidiarity'), or include planned periods of reflection (sometimes termed 'legal-sunsets'; DeCaro *et al.*, 2017; Hill Clarvis *et al.*, 2014). The extent the law meets these challenges and flexibility is achieved, in the experience of those in project teams, may be of note at the data gathering stage of this study.

Following this summary of SES and governance, the inexorable question is where does technology fit into thinking in this area? In answer, the place of technology within SES studies is not agreed or defined (Ahlborg *et al.*, 2019; Markolf *et al.*, 2018). To address this, recent bodies of work seek to integrate technology into SES in a more coherent way (McPhearson *et al.*, 2021; Ahlborg *et al.*, 2019; Janssen *et al.*, 2019; Markolf *et al.*, 2018). An example of this which can be aimed squarely at infrastructure is SETS (Socio-Ecological-Technological-System; Markolf *et al.*, 2018). SETS is a lens to show the social, ecological and technological aspects of

a system together, to encourage a more comprehensive view of their interactivity and enhanced problem-framing (McPhearson *et al.*, 2021). It involves understanding the interactions within SETS to connect initiatives around each component together and with a wider eye on trade-offs and unintended consequences (Branny *et al.*, 2022).

Exploring this, a recent SETS study draws on the disaster management literature as a mechanism to help identify lock-in and vulnerability (Markolf *et al.*, 2018). Analysing systems that catastrophically fail can provide powerful illustrations of the consequences of systems under extreme stress and the resilience issues and fault lines that stress exposes. These fault lines are not just technical but social and environmental. Examples cited include Hurricane Katrina which, from a purely physical perspective, was a 'natural' hazard triggering a breach of flood barriers - but the catastrophic results are arguably laid at the door not of the natural event, but of inappropriate reliance on hard infrastructure and its risk management capacity, poor planning and lack of foresight in response policies, ineffective governance institutions and embedded societal inequalities (for a detailed study see Daniels *et al.*, 2006).

Studies such as these remind us of the complex connection between ecosystems, society and technology and the catastrophic results that can flow from an imbalance in that relationship (Smith, 2013). They highlight the potential of infrastructure systems that can deplete capitals and increase vulnerability if the complex connections with institutions and structures are not acknowledged. Vice versa the same interconnectivity may improve livelihoods if access to facilitating infrastructure is addressed (e.g. DFID, 1999). That SETS is at its early conceptual stage is acknowledged, but it does help underpin the rationale for projects that embrace SETS thinking particularly around infrastructure decision making (Markolf *et al.*, 2018). What it does

not yet do is provide a framework for a project team embracing that framing. This study seeks to take the current position with the literature forward.

There is a further aspect of SETS to acknowledge. SETS notes that the academic literature around SES and STS has developed from different disciplinary perspectives and SETS embraces the integration of this thinking and transdisciplinarity (Markolf *et al.*, 2018; McPhearson *et al.*, 2021). The benefit of transdisciplinary thinking has been recognised as a means of tackling the ‘wicked’ problems of the Anthropocene, through a systems and complexity mindset (Chester and Allenby, 2019) and where no-one discipline can hold the answers (McPhearson *et al.*, 2021). It can open-up opportunities for wider problem-framing for wider social and environmental benefits (Leach *et al.*, 2020; Rogers, 2018) and sits alongside a call for the reduction of disciplinary silos (Marchant, 2020; Chester and Allenby, 2019; Markolf *et al.*, 2018). It is not just the practical integration of two strands of literature but an acknowledgement that research may benefit from drawing learning from disciplines and perspectives together.

Drawing this together, there is recognition of the benefits of integration of technology into SES thinking (Ahlborg *et al.*, 2019; Markolf *et al.*, 2018) and transdisciplinary thinking more widely around infrastructure (Janssen *et al.*, 2019; Markolf *et al.*, 2018); infrastructure planning and problem framing would benefit from embracing social, environmental and technological aspects together. The disaster literature highlights the (catastrophically) negative consequences of failing to address other components of the system. More positively, there are opportunities that arise from embracing those components through a change in

problem-framing and to bring innovative ideas about appropriate solutions with wider and multiple social and environmental benefits.

More specifically, SES adds resource, place and system boundaries, networks and capability-building, and learning to the themes that impact on governance (Pahl-Wostl, 2009; Ostrom, 1990). It also flags questions over the forms of governance that dominate and how they operate in practice, from the project team's perspective, when seeking to sustainably govern a natural resource. These themes will be taken forward into the research phase of the study.

4.3 SYSTEMATIC LITERATURE REVIEW - JUSTICE

On reading the literature, references to justice, or even ethics or equity for this jurisdiction, seemed infrequent. This was acknowledged to be an anecdotal finding by the author, albeit the relative absence of justice thinking had been noted by others in reviews addressing the water sector (Holstead *et al.*, 2018; Özerol *et al.*, 2018). This was unexpected, particularly when contrasted with the prevalence of justice-thinking in the energy sector and high-profile discussions on next-zero and the 'just' transition (European Commission, 2020; Smith, 2017). The prevalence or otherwise of justice in governance of infrastructure in the sector is therefore explored via a systematic literature review⁵.

4.3.1 Review Process and Results

In determining the scope of the review, it firstly becomes necessary to be clear by what is meant by 'justice' and how this concept can be operationalised for application within a framework. As this study addresses the distribution of ecosystem resources to society, the

⁵ This Chapter contains a summary of the review with the full review and published article emanating from the review contained in Appendix 2.

principles of environmental justice are drawn upon, predominantly from the highly regarded works of Schlosberg, Collins, Niemeyer and Walker (Schlosberg, 2004; Schlosberg, 2007; Schlosberg, Collins and Niemeyer, 2017; Walker, 2012). Justice dimensions here are described as distribution, process, respect and capabilities. Distributive justice flows from the work of Rawls (1999) as the equitable distribution of resources. With infrastructure distributing natural resources, an equitable distribution would appear highly relevant, if not fundamental, to infrastructure planning. Procedural justice addresses how decisions over distribution are made alongside a third dimension, Recognition (or Respect), which ensures that all stakeholders are heard in that process (Schlosberg, 2007).

The justice dimensions offer another lens when looking at transforming infrastructure systems. Conflict and trade-offs are almost inevitable when addressing a transformational change but the justice dimensions ask that those changes in the distribution are equitable and, in determining that share, a due and fair process with representation is undertaken. By looking at justice through the lens of the first three dimensions (Distribution, Process, Recognition), potential imbalances in fairness and equity can be highlighted 'illuminating causes of conflict' and better dialogue and understanding encouraged (Sikor *et al.*, 2014, p. 529). These dimensions trigger questions over distribution and process that could be drafted into a framework to reduce hidden prejudices and injustice.

That undercurrents of bias or hidden prejudices exist is highlighted in issues of socio-economic and racial inequalities in access to safe drinking water that have emerged in the US, for example (Marcillo *et al.*, 2021). This is despite the US being a high-income country with extensive infrastructure and governance regimes in place. It also highlights how there can be

a regulatory regime in place, but the outcome is not necessarily just. The US example shows that there is no space for complacency in any jurisdiction over the efficacy of a justice system. In the absence of justice questions clearly being asked and openly answered it is impossible to say similar biases do not exist elsewhere. The avoidance of complacency is of particular importance when a regime is subject to extraordinary change, transformation or stress, as with water services in the UK. In those circumstances, previously hidden issues may surface that may not be addressed in existing thinking and structures.

There is a fourth dimension of justice and this relates to the issue of capabilities, developed through separate works of Nussbaum and Sen (e.g. Sen, 2010; Sen, 2005; Nussbaum, 2004; Nussbaum, 2002). The concept of capability justice seeks to encourage the conditions necessary for living things to thrive, not just survive. It includes and extends beyond the three dimensions of justice to directly address quality of life. The concept of capability justice arguably aligns with the concept of ‘liveability’, *societal and planetary well-being within the context of low-carbon living and resource security* (Leach *et al.*, 2013), and may offer a useful link to discussions in that area. It also raises questions over which living things are given primacy to thrive when there is a conflict, and the extent human life is prioritised over non-human life in this respect (Schlosberg, 2012; Schlosberg and Collins, 2014). Justice can provide a system to help resolve those conflicts.

Having identified four dimensions of justice, a systematic literature review was undertaken to identify and evaluate the extent justice considerations were evident in the governance of water infrastructure. A single jurisdiction was chosen, England, as that is the remit for the

study, and to enable the results to reference back to a specific regime, in this case the controversial privatisation of water services.

The review specifically included grey literature alongside academic and conceptual papers.

The following search terms were identified:

- Water OR blue OR sew* (to allow for sewage, sewerage);
- Infrastructure OR intervention OR construction;
- Governance;
- UK OR “United Kingdom” OR Britain OR England⁶.

Three databases were used—Web of Science, ProQuest and Compendex (Engineering Village)—with a view to ensuring multiple disciplines were fairly covered. A prescribed review process was adopted (Yigitcanlar *et al.*, 2020). The results in detail are included in Appendix 2 which include the full narratives around the results.

In summary, of the 36 articles meeting the criteria and taken forward for analysis, only three contained an express reference to justice. These three articles were labelled Category A. In analysing the three articles which contained a reference to justice, justice was not a core theme in any of them and pervaded the articles to varying degrees. To underscore the point, of the 36 articles considered, 27 expressly referred to sustainability. This suggests that

⁶ Although the jurisdiction of interest was England, Britain and the UK were included in search terms. This was because despite the ongoing process of devolution, shares common elements of governance and articles of potential relevance to England could otherwise be excluded

concepts, such as sustainability, can become embedded in thinking – and clearly have. The use of justice as a term used in water infrastructure is significantly less prevalent.

Due to the very low return rates alternative terms such as ‘equity’ ‘rights’ and ‘equality’ were looked for and this revealed a further 8 studies mostly referencing ‘equity’. These articles were labelled Category B. The number of articles in this category is again a low figure and is surprising, particularly around ‘rights’. The prevalence of ‘water rights’ issues in other jurisdictions has been noted, and with the privatisation of water in England a strong reaction to the regime was anticipated (e.g. Berge *et al.*, 2018; United Nations, 2010; Bakker, 2007). The reasons for the lack of a reaction fall outside the remit of the study, although conceivable explanations include the comparative low cost and less acute water stress in contrast to other jurisdictions – at least in the past (the cost of living is currently increasing (Ofwat, 2022a) and water availability can no longer be guaranteed; it may be a rise in water rights and justice narratives will follow). Ethics again was not a prevalent term. Ethics presents a link between justice thinking and codes such as RI. It places responsibility on a project to address these issues within its own structures and this may be a connection to make when drafting the framework. Again it does not appear those considerations are regularly discussed.

Following the low returns, the remaining texts were analysed for broader justice-type themes and a possible further 8 studies were identified. These were labelled Category C. The remaining texts were labelled D and E, D representing the texts not in A to C but which reference ‘sustainability’ and E representing any remaining texts. Table 4.1 shows the texts as allocate to each Category A-E.

Table 4.1: Justice Review Categories

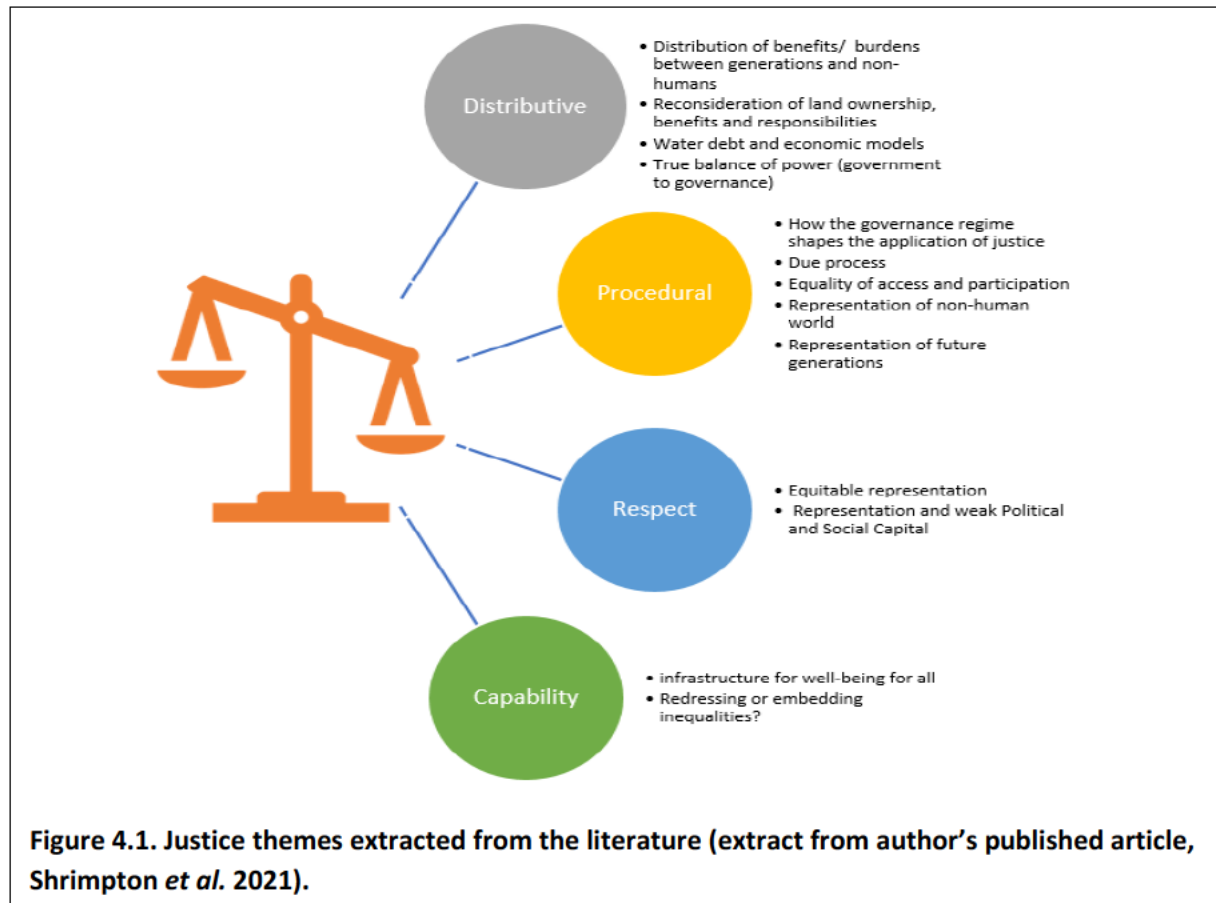
Category	Description	Number	Identity
A	Contains express reference to 'justice'	3	(Brown <i>et al.</i> , 2010; Strang, 2016; Thaler and Priest, 2014)
B	Is not included in A above, but does contain express references to 'equity', 'equality' and/or 'rights'	8	(Collins, 2012; Goytia <i>et al.</i> , 2016; Guy and Marvin, 1996; Liang, Deller and Hviid, 2019; Molyneux-Hodgson and Balmer, 2014; Perrotti, Hyde and Otero Peña, 2020; Speight, 2015; Wells, 2019)
C	Is not included in A or B above, but does contain references to justice themes	8	(Broich, 2007; Frijns <i>et al.</i> , 2016; Holt and Baker, 2014; Melville-Shreeve <i>et al.</i> , 2018; Murrant <i>et al.</i> , 2017; Piper, 2014; Roberts, 2007; Sharp, Macrorie and Turner, 2015)
D	Is not included in A to C above, but does reference 'sustainability'	13	(Bar-Isaac and Walker, 2018; Brown, Ashley and Farrelly, 2011; Browne, Jack and Hitchings, 2019; Charlesworth, Warwick and Lashford, 2016; Goodwin <i>et al.</i> , 2019; Gunasekara <i>et al.</i> , 2018; Heptonstall, 2010; Rodda, 2009; Spiller <i>et al.</i> , 2012; Ward <i>et al.</i> , 2012; Ward and Butler, 2016; Willis, Scarpa and Acutt, 2005)
E	Is not included in A–D above	4	(Bankoff, 2013; Millington, 2014; Tresidder and White, 2018; Williams, 2008)

Categories A to C were taken forward for review. The overall conclusion drawn was that justice thinking in this context is rarely expressed but not entirely absent. There is some justice-type terminology and thinking but it is not routine nor does it present a coherent thread running through the literature. The range of use of the terms and synonymous terms was considerable and a lack of sophistication in the justice discourse is suggested.

4.3.2 Discussion

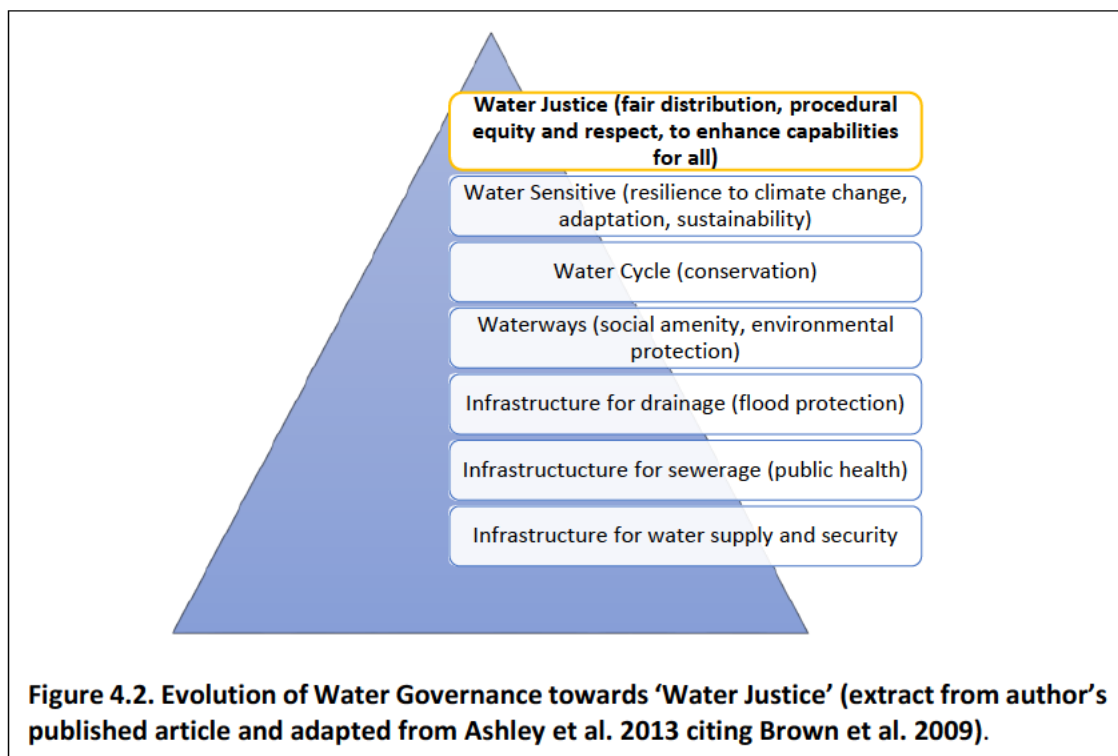
Although justice was rarely expressly referenced it was possible to identify strands of justice-type themes. These strands were scattered throughout the texts rather than part of a cohesive

discussion. To address this Figure 4.1 is an attempt to represent the strands and show how they could be re-focussed and invigorated around justice dimensions.



The overall potential is that justice thinking here could be an advance on the concept 'sustainability'. Justice is not necessarily in conflict with sustainability and instead asks for questions on a new system to take sustainability and go a step further. It asks for thinking beyond sustainability into a just transition to sustainability. Instead of this advance, there is the possibility that sustainability has become synonymous with 'just', i.e. if a project improves the sustainability of a resource it is considered fundamentally 'good'. However, justice improves upon the concept of sustainability by having in its scope a broader range of societal and environmental needs and raising those issues directly and explicitly (Neal *et al.*, 2016). To

illustrate the need, with any change, even to a more sustainable or resilient system overall, there can be those that gain and those that do not. How that is decided, how all groups (including non-human) are heard and accommodated and how those gains and losses are distributed by the new infrastructure is a matter of justice within the governance regime (Neal *et al.*, 2014).



This supports studies advocating for water justice as an advance on current water governance paradigms (Neal *et al.*, 2016; Neal *et al.*, 2014). Paradigms around water governance have grown and advanced over time as emergent features of the system become problems or as problems are re-framed. For example, water governance goals have developed from security of supply to the inclusion of sewerage and public health, to flood protection and more recently to resilience and sustainability (Ashley *et al.*, 2013; Brown *et al.*, 2009). Water justice could be a further strand to progress that thinking. Figure 4.2 depicts the paradigms suggested and

adds an additional level, that of water justice, depicting this as an advance on sustainability. It seeks to show water justice as the next nudge forward in water governance embracing past paradigms and advancing them.

In other arenas this does not appear to be a contentious assertion. It is noted that there has been an express and deliberate insertion of 'justice' into the sustainability agendas through the concept of a 'just' transition to more sustainable practices, albeit most often linked to carbon net zero (e.g. UNFCCC, 2015). This implicitly accepts the need for justice issues to be highlighted beyond sustainability. Its inclusion in the governance of energy transitions is noted (e.g. Jenkins *et al.* 2018) and has also been explored in climate science (e.g. McLaren *et al.*, 2016) and the transport sector (e.g. Pereira *et al.*, 2016) amongst others. Re-thinking justice has also been raised directly in SETS studies around transformations to a 'good Anthropocene' (McPhearson *et al.*, 2021). It appears timely for any gap to be addressed in the water sector.

Drawing on these works, the inclusion of justice questions has been advocated in the energy sector and that method can be considered for the current framework (Jenkins *et al.*, 2018). In this way questions are used as prompts to decision-makers for reflection or to address issues considered key. This is an approach taken forward in this study.

To conclude, the systematic review suggests an absence of a coherent articulation of justice in water infrastructure and governance in this jurisdiction. The inclusion of justice thinking has the potential to ask further and deeper questions of a project and the potential to enhance and improve upon the dominant sustainability thinking. Questions of whether projects are justly moving towards sustainability are otherwise unanswered, or at least issues are not openly voiced. This gap can be addressed in the framework. In articulating that gap the

dimensions of justice can be drawn upon as themes, framing questions for projects around equitable distribution, due process and respect and enhancing capabilities for all living things. As with RI and ethics, these are issues considered to be within the remit of projects themselves to explore, not detached or isolated from the project's goals.

4.4 LITERATURE REVIEW THEMES

To draw the literature reviews together, themes are identified and collated. The cumulated themes are drafted and articulated as follows:

1. **The Governance Regime and its Regulations.** The politics behind the choice of regime recognising the influences this has on the structures, actors, networks and relationships involved in rule making.
2. **The Forms or tools of Governance.** The tools of governance at its various levels, with the overarching Justice/Constitution for the jurisdiction, formal Law, sector specific regulation, informal codes and social norms – or a decision not to govern at all. This includes how adaptive those rules are, particularly formal law.
3. **Networks.** The influencers, regulators, stakeholders and contacts that influence and inform the particular regime. The network of actors the project may be able to draw upon to fill knowledge gaps and enhance capabilities.
4. **The Resource.** How is the resource itself viewed, how are the boundaries of the system defined and how may that affect the policy, rules, social norms and behaviours to be considered? Where system boundaries exist how does this define the project, problem-framing, trade-offs and understanding of other systems?

5. **Technology and rules.** Applying innovative technology to that system, what rules and policies are in play to support this development and how do they impact on the project and its business case? How may RI and AREA (Anticipate Reflect Engage Act) be used to inform a project's strategy when considering the impact of the innovative technology?
6. **Justice.** How does the project address justice issues of distribution, procedure, respect, and capabilities – and when, including at what TRL stage? Are the project's own ethics embedded in an RI code?

And once those questions have been explored:

7. **Iterative Processes (learning):** How should the governance be adjusted (refined and enhanced, interpreted, better articulated) using triple-loop learning ? What can we learn from each project about how better to harness governance to best effect? How can the framework itself be improved?

These cumulated themes drawn from the literature review represent potential governance areas for a project team to engage with. These are to be taken forward.

5 METHODOLOGY

This Chapter provides an overview of the research design and rationale. A mixed methods approach has been adopted. This incorporates the Pipebots project and the three point plan (interviews – survey – focus group). The Chapter goes on to explain how this plan advances the literature review towards a validated framework supported by theory and practice.

5.1 ETHICS

The study followed and implemented the University of Birmingham's ethics process and guidelines throughout. Copies of the approval documents are exhibited in Appendix 4.

5.2 DESIGN OVERVIEW

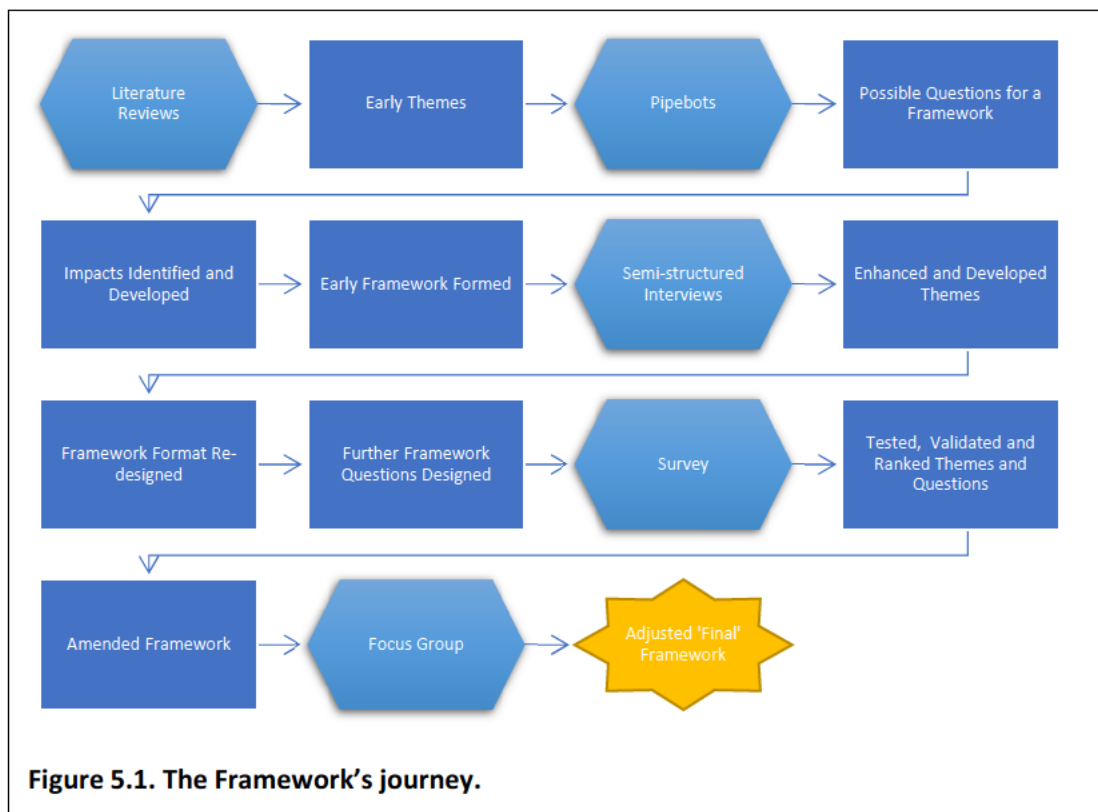
The research methodology takes the themes generated by the critical analysis of the literature and develops them by incorporating the experiences and perspectives of those working in the sector. The design draws on the author's experiences within the Pipebots project during which questions and areas where the framework could impact on a project started to materialise.

Following this formative stage, data are collected using a mixed-methods approach as a means of both compensating for weaknesses or biases in a single method and to triangulate results (Denscombe, 2010; Creswell, 2009). A sequential, exploratory design is adopted which allows for themes to be identified before being tested more widely (Creswell, 2009). The predominant, qualitative, method of in-depth structured interviews gather individual experiences of working on transformational projects in the sector. The findings are then taken to a wider audience via a survey. The survey is used as a means of testing the themes generated

and compensating for any perceived issues of a dataset from a relatively small pool of participants (18 interviews; Denscombe, 2010).

At each stage, with new themes and insights emerging, the formative framework is adjusted and refined. Following the survey, the results are incorporated into a final framework that is put before a focus group for their views and evaluation. The results from the survey and interviews are, therefore, further validated and triangulated using a focus group to test the resulting governance framework (Vehovar and Manfreda, 2017; Krueger and Casey, 2015; Denscombe, 2010).

The framework's journey is depicted in Figure 5.1. This shows the developmental journey of the framework as it is formed from initial ideas and developed through the research process, leading to the final version at the end of the process.

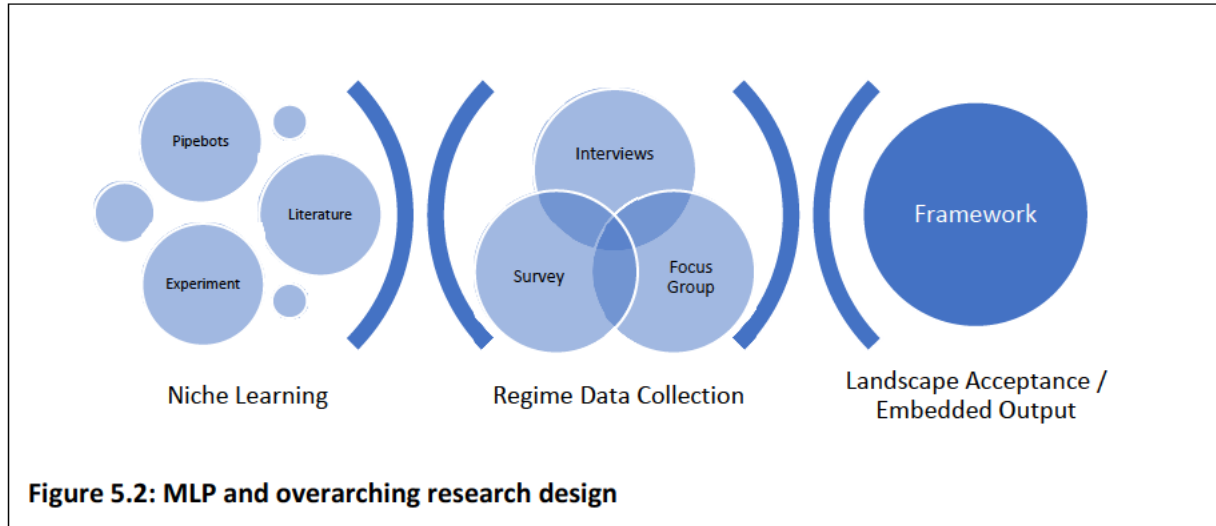


By following this plan, the data gathered at each stage are reflected upon and integrated into the framework. The influence of the research process is discernible with each stage triggering new thoughts and adaptations. To further illustrate the framework's journey, a selection of the iterations of the framework from its early origins to the 'final' version, post-focus group, is included for reference in Appendix 1.

There is a further way that the literature has shaped the project. The research design itself draws on the learning and thinking from the literature review. The MLP model, introduced in Chapter 4, has influenced the research design and planning as it follows a new intervention from experiment to embedding as part of the fabric of a system (Figure 5.2). The MLP follows a new technology's progress through niche – regime – landscape. The research design can be viewed with the MLP in mind. In parallel to the MLP, the study and framework starts with the experiments and exploration of ideas in the 'niche'. This represents preliminary work and learning within the Pipebots project and through the literature reviews. The Pipebots project is discussed in detail in Chapter 6 and in short Pipebots provides an opportunity for exploration and experiment and allows first-hand experience of a relevant project in real-time as well as introduce the project to governance ideas. Involvement with Pipebots helped form the early framework as well as ideas around how the framework may impact on certain areas of a project. This early framework from the niche was taken forward into the next stage of the study.

These ideas are then explored further in the wider sector through the semi-structured interviews and then seeks validation of those findings via a survey with a wider pool of

participants in the 'regime'. Together this gains an understanding of participant experiences as they create a new system.



Finally, the research design seeks to test and embed the final framework ready for the 'landscape' through engagement with the focus group. The focus group consists of participants that would be a target group to use the framework in transformational projects.

The individual methodological approaches for the interviews, survey and focus group are discussed in turn in Sections 5.3 to 5.6 inclusive. The actual data and results of each stage of the research plan are discussed separately and in more detail from Chapters 6 to 9 inclusive.

5.3 SEMI-STRUCTURED INTERVIEWS-THEMES

The predominant method chosen for the study is qualitative data on governance issues via semi-structured interviews from those that have undertaken transformational projects in the sector. The perspectives and experiences of those undertaking project work are gathered to allow current and future project teams to learn from their experiences and provide the sort of detail not suited to quantitative measurements (Silverman, 2017; Braun and Clarke, 2006).

This approach allows for deeper, richer and a more nuanced understanding of the governance issues that have been experienced by project teams. It also allows an insight, not just into governance and policy in writing, but how that translates to the experiences of a team seeking to make transformational changes.

The form of questioning, being semi-structured, allows for themes to be explored without the restrictions of a rigid set of questions, and allows further themes to emerge (Denscombe, 2010). There is a further reason for this approach and that is one of communication. This is a transdisciplinary study with a range of professionals, and the meanings attached to words may differ. 'How did governance affect your project?' may have subtly different meanings to participants and their meaning needs to be understood to interpret and compare their answers. There is also the practical issue of ensuring that the language used in the framework is comprehensible across disciplines and this can be better informed and aided by face-to-face, responsive dialogue as opposed to fixed, structured questions; in effect educating the author as the dialogues progress.

The participants were selected from contacts of the University of Birmingham School of Engineering, through the author's secondment with a government body engaged with the sector, through contacts with the wider Pipebots network of external stakeholders and through snowballing from existing participants. The criteria for selection were project engineers and managers, consultants or regulators with current, personal experience of projects seeking to make a transformational change within water or wastewater infrastructure. The project experience was to be outside of Pipebots to ensure that a range of

projects and experiences were gathered and to temper any inadvertent over-emphasis on issues that may be particular to Pipebots.

In total 18 interviews were undertaken covering sector companies across the country, water sector innovators, consultants, suppliers and Government agencies. The interviewees discussed projects they had been involved in and achieving 18 interviews provided a good range of projects to be analysed. To give an insight into the range, the projects discussed are anonymised and summarised in Appendix 5. Although there is no ideal number of interviews a research study exploring interview numbers through systematic saturation (where interviews take place until no new datasets are uncovered) noted saturation of results after 12 interviews, and broad themes discernible after 6 (Guest *et al.*, 2016). Although each context differs, in a homogenous pool of participants as in the present case (same sector and same governance regime), this is a reasonable endorsement of the number of participants (18) interviewed in this study.

As the interviews took place during the Covid pandemic the interviews took place online using Zoom. Each participant was sent information, participant and consent sheets in advance and informed consent was obtained in each case. The interviews were recorded both through an audio recorder and through the Zoom system as a back-up. The author transcribed the transcripts to allow for good immersion with the text. Anonymised copies of the transcripts are included in Appendix 5. The interviewees were given an opportunity to withdraw from the study up to 14 days after the interviews had taken place (no interviewees chose to withdraw).

The research design acknowledges that a criticism of qualitative research can be its perceived lack of reliability or consistency (Silverman, 2017) or potential for anecdotalism (Bryman,

2016). These concerns are addressed by the application of thematic analysis to the interview data, thematic analysis being a method for identifying, organising and reporting on patterns (called themes) within texts (Braun and Clark, 2013). A thematic analysis is designed to be replicable and systematic rather than intuitive. Themes can be generated in response to the data and also guided by concepts from the literature (Goodwin *et al.*, 2019; Fereday and Muir-Cochrane, 2016; Braun and Clarke, 2006). It is a suitable tool for finding patterns in data, particularly larger volumes of data, which may not be discernible on reading and allows for hidden patterns to be uncovered.

The transcripts were thematically analysed applying a process endorsed by Braun and Clark (2013). The interview transcriptions were firstly analysed and words, thoughts or phrases were coded. The coding was simply a form of labelling. The coding was undertaken by reading the texts and marking up words, thoughts or phrases relating to governance, hurdles or opportunities. This was done and re-done several times until no new codes were identified.

The coded sections of texts were then organised into like groups. These groupings of codes gradually coalesced into themes. One of the difficult areas to overcome was the interconnectivity of the codes and themes, as many of the codes could coalesce around different ideas. Organising the data was a time-consuming process and involved several readings of the interview transcripts but was beneficial as through the re-review of the texts using coding, similar thoughts and phrases were revealed and patterns detected that were not apparent on initial perusal.

The next part of the process was to create narratives around chosen themes as a means of coherently summarising and communicating each theme. Narratives were drafted by collating

all of the coded comments, issues and thoughts around a theme together and drafting a commentary to encapsulate the common threads or conflicts. These narratives are used to explain and understand the themes and governance impacts on projects in more detailed way. The results of this process are presented in Chapter 7.

As well as written narratives, visual representations of the data were explored. This was an addition to the original methodological approach and came about because of the connectivity between the themes. This prompted thinking about how these connections could best be understood and communicated. A way of expressing and exploring the themes in alternative ways was explored. Kumu⁷ diagrams were settled upon to help visualise interconnectivity where that was deemed a useful communication aid. The results of this process are also discussed in Chapter 7.

5.4 SURVEY – THEME VALIDATION AND RANKING

Following the semi-structured interviews, the results were validated in two ways, a survey and then a focus group. The survey was used to test the themes generated by the literature review and the interviews. In this way the importance, or otherwise, of the themes was tested and ranked before a wider audience (Creswell, 2009). The survey was designed to validate the findings of the interviews and seek to remove the potential for the skewing of the data towards views that may prove to be marginal (Denscombe, 2010).

In designing the survey, the principles of good survey design were considered with principles relevant to an online survey format (Vehovar and Manfreda, 2017; Trochim, 2006). The

⁷ Kumu being freely available software used to connect ideas in a visual / diagram form.

questions were determined by the statements generated from the interviews (Creswell, 2009). The principles and systematic series of choices suggested in designing a survey by Trochim were then utilised (2006) which prompts thought and decision making at each stage of the process from mode of survey through to final roll-out.

Firstly, regarding the mode of survey, an online questionnaire distributed via email was selected. The online system was chosen as it had administrative advantages in terms of distribution, monitoring and collation of responses and as it was considered intuitive and easy to access by professional participants (Vehovar and Manfreda, 2017). The online system chosen was the JISC platform endorsed through the University of Birmingham. As well as administrative advantages, the online system enabled the anonymity of participants through its 'token' system, i.e. respondents are identified via a system-generated token not by personal information such as their name or email address. Ethical requirements on informed participation, consent and mode of withdrawal were included in the design.

Issues of bias or participants feeling they needed to provide 'helpful' answers was considered (Creswell, 2009). This issue could be most prevalent amongst Pipebots participants in view of the author's role on the project. To address this, responses were anonymous, and answers could be split between Pipebots and non-Pipebots participants ('Stakeholders') to ascertain if there were any significant differences that could not otherwise be explained. Bias was also minimised by the online system supporting greater 'depersonalisation' (Sapsford, 2007, p. 97); rather than an email emanating direct from the author in support of a PhD, a link was sent from the JISC software framed as a request for their thoughts and guidance on governance and innovative projects.

It was acknowledged that one of the known limitations of an online system is a low response rate, with the literature suggesting response rates have declined further over time (Zhang *et al.*, 2017; Daikeler *et al.*, 2019). A recent study directly researching the issue of response rates and incentives, for example, achieved a response rate of around 20% and lower than may historically have been expected (Zhang *et al.*, 2017). It is widely acknowledged that there is no correct minimum % return rate to validate a survey although 30 participants has been suggested as a dataset capable of dissection and interrogation (Denscombe, 2010).

To put this into context, the survey for this study was not designed to provide evidence of a consensus view across the sector but to see if the literature and interview findings are recognised within a wider pool of participants (Denscombe, 2010). A response rate in the order of 20% and 30 plus participants would appear to accord with current expectations, likely to be achieved and to provide the degree of validation required.

Secondly, the types of questions and their content were reviewed in line with Trochim (2006). The idea behind the survey was to test the themes generated by the interviews. In designing the survey questions the themes were drafted into statements for testing (Creswell, 2009). The survey asked participants to rank the importance of those statements. The idea behind this was to seek insights both into the extent the findings so far were recognisable to, and representative of, a wider proportion of the sector, but also for the possibility of understanding the relative importance of the statements against each other.

As well as the substantive sections of the survey (Q4-8), the survey questions included participant questions based upon experience and area of expertise (Q1-3). The participants

were asked whether they were part of the Pipebots project so that data could be compared against non-Pipebots participants⁸.

There was also some experimentation included in the survey. How to address whether participants' views had changed over time was a challenge. For questions 4 to 8, additional and voluntary questions asking how views may have changed were included to try to address how any involvement with Pipebots may have impacted on perceptions. This was particularly aimed at Pipebots participants and acknowledges that the author was an active member and potential influencer of the project, not a passive observer. The author anecdotally noted a change in views as work progressed and ways of obtaining more objective evidence or accounting for impacts were considered. It is acknowledged that asking participants to answer retrospectively, as was done here, can be weak as recollection can be faulty or the past reconstructed (Sapsford, 2007). Aware of this issue, alternative designs were considered including time sensitive design where questions are repeated over designated time periods. The alternative design options were not available to this study due to the study starting after Pipebots had commenced and being substantially shorter than the Pipebots project. The questions were not considered pivotal but of potential interest so were included (and responses in the pilot monitored). To check for bias, the design of the survey still allowed for views from Pipebots and non-Pipebots participants to be compared and any differences noted in the data review.

⁸ Demographic data was not sought. The value of demographic data for the purposes of the project was not made out. The demographics of the sector as a whole is not known so the extent the data gathered would be representative would also be unknown.

Thirdly, leading on from the questions was the response format (Trochim, 2006). As ranking was required a Likert scale was adopted. In deciding about the range, a neutral option was included as a forced 'for' or 'against' response was not considered desirable and a 5 points scale selected (Saunders *et al.* 2019; Creswell, 2009). There may also be a range of respondents with varying degrees of knowledge and again rather than force a response a 'do not know' (DNK) option was included. At the end of a set of questions, free text options (non-compulsory) were included to allow for thoughts or queries.

Fourthly the placement and ordering of the questions needed to be considered (Trochim, 2006). The opening questions were straightforward opening questions (Saunders *et al.* 2019). The bulk of the questions that followed were organised in line with a discovery made during the Pipebots project. During framework experiments within the Pipebots project the potential areas of impact of governance on a project were noted. Governance was seen to impact on the project's design, strategy, business case or network. This is explored and explained in Chapter 6 and in looking at governance in this way questions could be organised into sections under each impact, so statements that related to a potential business case impact were ranked together for example. This was considered a helpful tool for presenting as well as organising the themes and data.

Once the survey was designed, and the mode of delivery determined, the survey was piloted with six volunteers and feedback sought. A particular focus of the survey design was understanding the questions and phrasing, prompting thought on who would provide the information and how the questions might be perceived (Cossa, Barker and Almstrum, 2021). As a result of the pilot some adjustments were made to phrasing and format errors were

corrected. The 'views changing over time' answers seemed to work. The survey was then piloted again. Following the second run, the survey was considered fit for roll out.

Finally, in terms of the survey process and participants, this study had the advantage of being granted permission to use the Pipebots project stakeholder contact list⁹. As a high profile project, the list provided direct access to representatives from most water/wastewater companies in the UK, suppliers and consultants, scientists, academics, regulators and commercial innovators. In total 269 names were uploaded. After removing duplicated contacts and administrative staff the list consisted of **247** names. In total **55** responses were received, a response rate of at least **22%**¹⁰.

During the roll out, a limit of three reminders were sent to participants. Reminders were only sent to participants that had not already responded (this was another administrative feature enabled by the online system). The number of reminders sent to participants was limited as part of the internal ethics of this study, in line with the spirit of RI. The study did not wish to add to unwelcome email traffic, with email reminders and survey fatigue being noted as a possible reason for ever decreasing survey returns (Sammut, Griscti and Norman, 2021).

The responses were filtered and analysed using a combination of JISC software and Microsoft excel. This allowed a thorough immersion in the data. Additional tools such as SPSS were

⁹ The Pipebots list had been compiled by the project manager as part of the project's outreach programme and was GDPR compliant. Names were only included with the express permission of the contact and for the purposes of disseminating information and seeking input from the stakeholders (the remit of which covered this study).

¹⁰ The online system did not collate failed email delivery (e.g. due to spam filters). The 22% figure is therefore the lowest % rate as it assumes all 247 emails were delivered.

discounted as unnecessary to meet the survey goals and excessive in view of the sample size. The results are discussed in Chapter 8.

Following the survey and the interviews the framework was re-visited, re-drafted and presented to the focus group.

5.5 FOCUS GROUP – FRAMEWORK VALIDATION

The second form of validation flowed from the survey to refine the ‘final’ framework and test the results before a focus group; the idea to place the framework before those likely to use it, to gauge their thoughts and responses to the questions it contains as well as how it could be used in practice. The work of Krueger and Casey (2015) was drawn upon to plan and design the focus group session.

A focus group was the chosen method to validate the framework as there was a clearly defined object to be discussed (the framework) which would directly affect participants (as project engineers and operators) lending itself to a clearly defined discussion topic amenable to a group format (Denscombe, 2010). In contrast to interviews, a focus group was considered more likely to encourage engagement with the framework and stimulate thinking and dialogue (Denscombe, 2010). It also allows for differences of opinion to be aired and debated and thoughts can be stimulated and deepened by others in the group. It was felt that a more dynamic engagement with the framework was likely to be achieved.

The participants were selected in hand with a gatekeeper within a water and wastewater company. The selection criteria was those engaged with designing and implementing transformational projects in the sector. Working with the gatekeeper, a good cross-section of

potential participants across the business were identified. In total 4 participants volunteered to take part – a project engineer engaged in transformational projects, an engineer within the innovation team, a landscape engineer engaged at the very beginning and end of projects and a senior member of the climate and resilience strategy group with insights into future corporate and industry strategy. Participants were provided with participation and consent information prior to the session and informed consent obtained. Participants could withdraw up to 14 days after the session (no participants withdrew).

The design of the questions and the questioning route during the focus group session was drawn from the work of Krueger and Casey (2015) and involved opening, introduction, transition, key and ending questions. A plan showing the design of the session is included in Appendix 7 and was also circulated to participants in advance.

In designing the session, tips to encourage a relaxed dialogue and engagement with the framework were drawn from Krueger and Casey (2015), especially around encouraging active engagement with a policy document. The simple, but effective, suggestion was for the participants to be able to draw and write on the document to answer questions. Activity sessions were therefore planned around two questions. The first was to highlight framework questions in green that the participants liked, did not routinely ask themselves or which they found thought-provoking. The second was to highlight in pink questions the participants did not believe should concern them, they saw disadvantages in including or they would like to change. This proved an effective tool in that it was easy to apply and appeared to encourage a depth of reading and engagement with the text. The participants handed over their scripts at the end of the session and anonymised copies are included for reference in Appendix 7.

The group sizing enabled the group to be 'managed' by a single person (namely the author) and ensure all views could be captured. The session was also recorded to ensure the author could actively listen to the participants rather than concentrate on note taking. The results are described in more detail in Chapter 9.

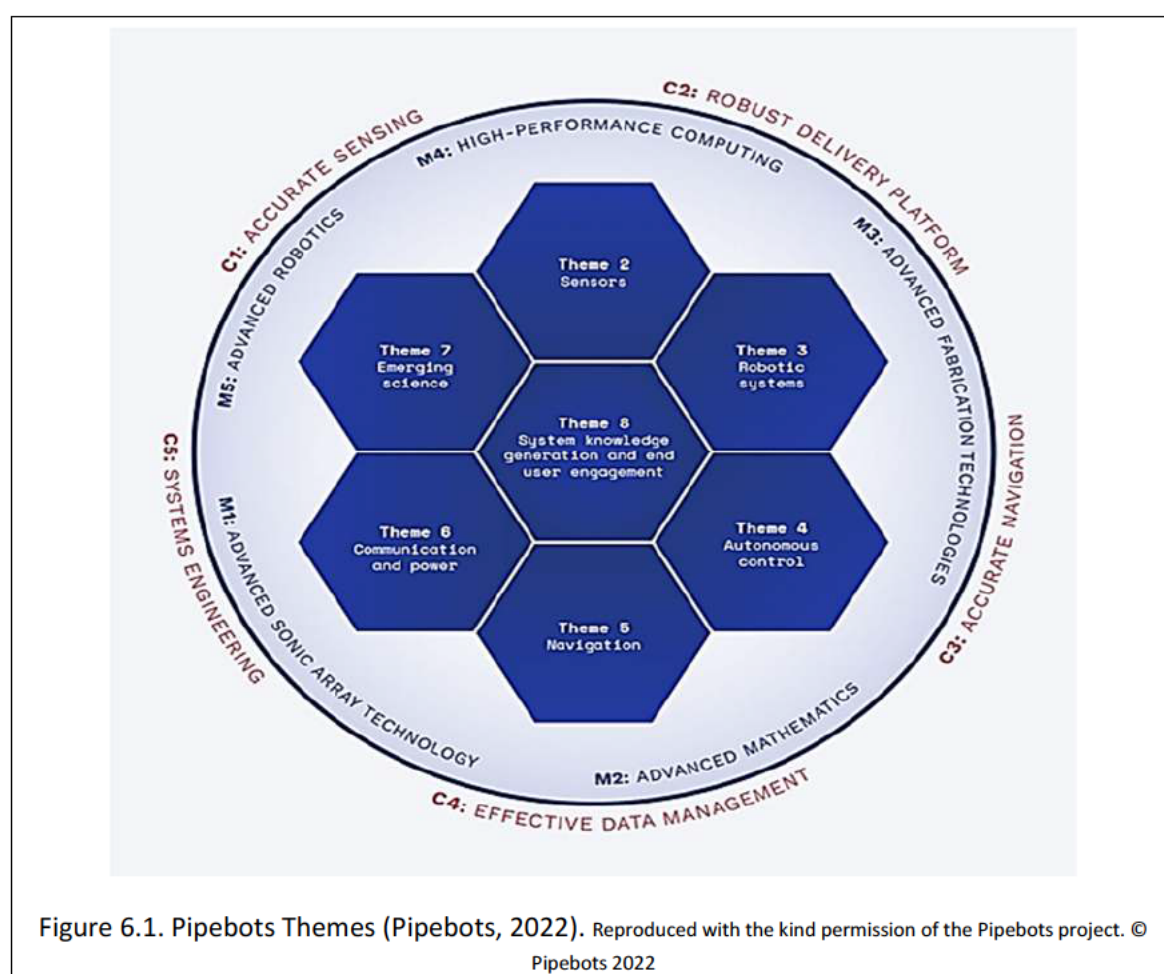
5.6 SUMMARY

The research methodology develops the results of the critical review of the literature by integrating themes generated from academic thinking with experiences and perspectives from the sector via Pipebots experiences, interviews, a survey and a focus group. The plan takes the framework to a wider level from formative niche to regime to landscape. Each individual level draws on recognised methodological approaches and has an overall design seeking to integrate theory and practice, with each component enriching the other. At each stage, a review of a working draft of the framework is prompted and the framework reconsidered and refined, the aim being for these stages to lead to a useful and validated framework that draws on new thinking as well as current, practical experiences from within projects themselves. The following Chapters 6-9 inclusive explain the results of each stage in more detail.

6 PIPEBOTS: LEARNING AND EXPERIMENTING IN THE ‘NICHE’

Working within the Pipebots project provided space for learning and experimentation and was a momentous opportunity to work with different disciplines on a relevant project for the sector. During this phase, ideas drawn from the literature were developed and trialled. How ideas were developed prior to moving into the remainder of the data gathering stage (interviews-survey-focus group) is explained here. It shows the early development of ideas from the literature review into a formative framework that is then taken forward into the balance of the research plan.

6.1 PROJECT OVERVIEW



The Pipebots project is a multidisciplinary academic research project tasked with designing a swarm of micro-robots to live in potable water and wastewater infrastructure (Pipebots, 2022). The project consists of around 50 academics and researchers, mostly engineers and scientists, and works closely with its industry stakeholders. There are 8 teams (referred to as Themes; Figure 6.1) across four UK Universities.

The author was given the opportunity of working as part of a team of researchers and academics on the Pipebots project as a member of Theme 7. The author brought a legal background and training to the project.

6.2 GOVERNANCE CONTEXT

The Pipebots project, and similar projects across the country, are driven by policies pushing for a reduction in leakage from the infrastructure network. To put the potable water issue into context, leakage of water from the public supply network in England has been estimated at a staggering 2,900 MI, or 20% of mains water, every day (NIC, 2018). This amounts to a substantial degree of waste both economically and environmentally. As a precious and increasingly vulnerable resource, reducing the amount of water lost through leakage is key to ensuring the resilience of the water supply system and reducing stress on the environment (Ofwat, 2020). Governance drivers have been put in place to address the issue including the UK Government's 25-year environment plan which seeks to reduce leakage by 15% by 2025 (DEFRA, 2021b). This target is itself a step towards the longer-term target of 50% reduction by 2050, with Ofwat (the economic regulator for the water sector in England and Wales) agreeing commitments with the sector to meet those targets as part of the regulatory cycle (Ofwat, 2022a).

To give an idea of scale of the problem, the length of the pipe network has been reported at over 346,000 kilometres (Water UK, 2020). This is a pipe network that has grown organically over time and one of the many challenges is identifying where in the vast, and critically ageing, underground network the leakages are occurring. This in itself represents a time consuming and expensive task. The conclusion drawn is that innovation is necessary to address the size of the problem whilst reducing the overall costs of leakage detection (NIC, 2018).

In addition to the recent drivers for leakage detection and innovation there are pre-existing rules and regulations governing what can and cannot be implemented in the network. These rules provide the boundaries the new innovations must operate within – or the boundaries that must change. Most significantly, the Pipebots must be safe in terms of their interaction with the existing network. For potable water for example, the Pipebots will have to meet safety standards and obtain prior approval under Regulation 31 of The Water Supply (Water Quality) Regulations 2016 (as amended). This is a Statutory Instrument providing the regulatory framework for the drinking water quality of the public supply in England (The Water Supply (Water Quality) Regulations, 2016) and is enforced by the Drinking Water Inspectorate (DWI). They constitute a niche set of regulations that focus on the safety of the potable water supply in England as far as public health is concerned.

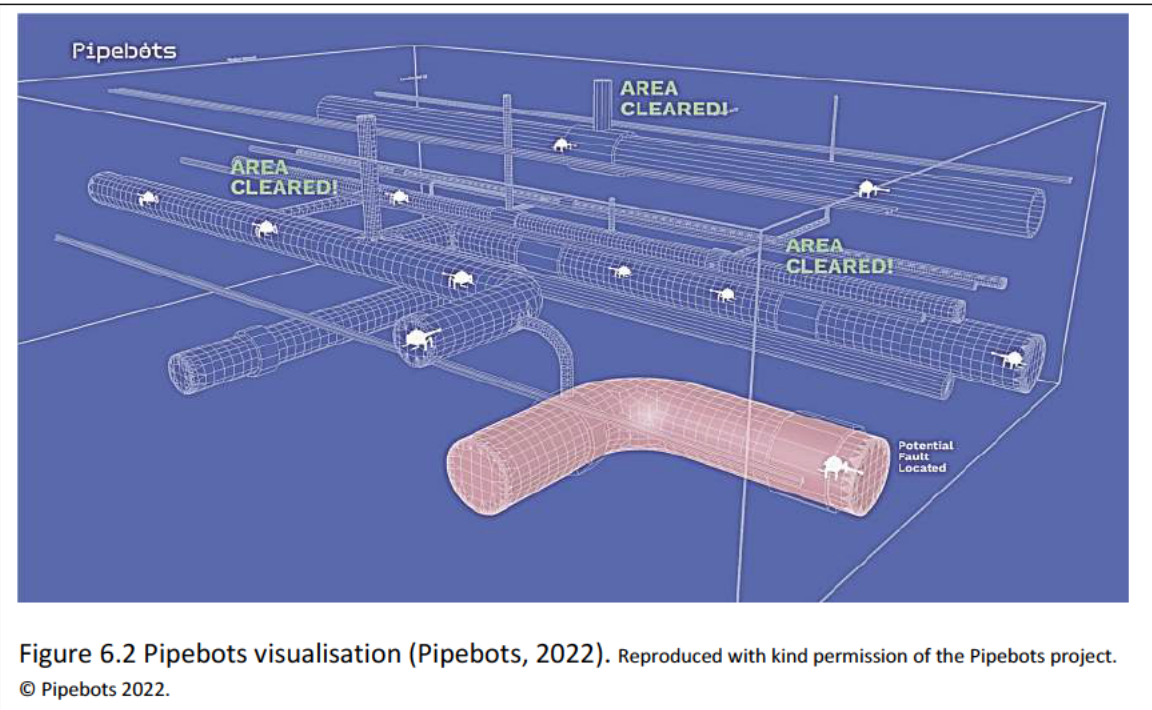
Regulation 31 strictly sets out what substances and products can and cannot be introduced into the water supply and provides the framework for an approval process for new substances and products. Pipebots must be granted prior approval under Regulation 31 before they are introduced into the potable water network (DWI, 2020b). The test and authorisation processes under the regulations were designed with chemical dosing and construction

products, such as traditional infrastructure tanks and pipework, in mind (DWI, 2017 section 2.1 and 2.2). How these rules and processes respond and adapt to complex structures such as a multi-component, autonomous robot, or even a swarm of robots, remains to be examined.

As well as potable water safety, safety issues include impacts on the sewerage system, Critical National Infrastructure implications, data collection and use and communication systems. Impacts can also be envisaged in the informal governance sphere around values and responses to the use of robotics in water networks, and more. The extent the existing regime and rules conflict with the governance policy drivers for change are likely to be exposed by projects such as Pipebots and this will be explored if, and when, it arises.

6.3 THE PIPEBOTS PROPOSAL

The Pipebots vision is for micro-robots to be equipped with sensors to detect leaks and provide data on the integrity of the pipework, Figure 6.2. The project intends to transform the asset management of water and wastewater infrastructure by moving away from current business models. These models often rely upon tethered systems, such as CCTV deployed by operators through a manhole. This system is physically limited, by the length of the tether, time intensive, as the area scoped is similarly limited meaning multiple deployments along a pipe system, and relies upon the gathering of visual data for subjective interpretation. A Pipebots system would collect real-time, continuous data unrestricted by tethers and would include systems to interpret and grade the data collected.



The hoped for advantages of a Pipebot system, as opposed to a traditional system, are to extend the length of time they can operate for, improve the accuracy of the condition data in terms of type and location, and extend the distance they can cover and re-cover over time.

The Pipebots project is currently in development stage Technical Readiness Level (TRL) 1-3. Whilst the Pipebots project itself is believed to be unique in terms of its proposed solution to leakage and asset management, it is one of a number of projects rising to the innovation challenges set for the sector and, as such, is likely to resonate with other similar projects going through early TRL stages.

6.4 PIPEBOTS AND THE GOVERNANCE FRAMEWORK

At an early stage of the Pipebots project, and prior to the author's involvement, it was recognised that to bring about transformational change, the task for Pipebots extends beyond the technical challenges of designing a swarm of autonomous micro-robots. The new system needs to understand and integrate with complex Critical National Infrastructure as well as be accepted by the complex governance sphere. The governance issues were to be addressed

under Theme 7, the goals of the theme including Work Package 7.3 Enabling the Transformation – Engineering the Systems of Governance, and at 7.3.8:

Analyse all formal (e.g., legislation, regulation, codes & standards) and informal (e.g., societal attitudes, ethical issues, operational & practice norms) systems of governance relating to pervasive sensing using miniature robots, identify barriers to deployment and engineer mitigation strategies (including proposing a set of principles of internal governance, to align with 7.3.5¹¹ and 7.3.6¹², and to guide the design).

Outputs: Future-proofed pervasive sensing systems with a compelling business case for changes to practice, bespoke business models to prove their efficacy and proposals for their governance. (Pipebots, 2019)

This itself provides an insight into governance perspectives at the initial stages of the project. The framing of governance here is negative; it is about identifying barriers, not where governance can be harnessed or supportive.

As a multidisciplinary project, encouraging thinking amongst the themes that governance is not (always) a burden was considered by the author as potentially important for communication and positive engagement. It is also apparent from the literature review, that

¹¹ 7.3.5. States as follows: Establish a common vision for pervasive sensing and world leading research capabilities in Autonomous Sensing for Buried Infrastructure in the UK. Bespoke facilitated team workshops, held as substantial sessions of full team meetings, will be used to develop: the vision; cross-team understanding of the principles and cultures of each discipline; a 'map' of the team's learning; and a unique capability in this domain.

¹² 7.3.6 States as follows: Create the business case for change in pipeline asset-management practices based on a multi-dimensional value framework, progressively integrating the outcomes from each Theme.

the number of potential rules would be vast and even if identified may not be useful to know or may not even apply in practice (e.g. Larcom and van Gevelt, 2017). There is a potential for a project to be crushed by the sheer volume of rules, many of which may not be enforced in practice. This is recognised by the UK Government itself and in addressing this has expressed concern about projects seeking external advice on these issues, specifically,

third parties over-interpret regulatory requirements and deter innovation – with the effect that business investment is diverted into compliance activity rather than R&D,

(Dept for Business Energy and Industrial Strategy, 2019).

In parallel to work to identify the rules therefore, a framework was considered to guide a team through the maze to help identify what was important and what could support as well as hinder the project's goals. The Pipebots project and literature review did not reveal an existing framework to support the work. The literature review was therefore supplemented by a systematic literature review using the Web of Science Database for open access documents for the terms 'infrastructure', 'governance' and 'framework' in the abstract. The results were filtered to exclude anomalous categories and titles of no relevance to the study. The remaining list of journal articles are included in Appendix 3 and were reviewed. A wealth of material was contained in the articles, including the more limited RI frameworks, but no directly applicable and comprehensive framework was identified. This was anticipated as the literature was noted to be mostly conceptual in nature with fewer practical or applied tools at this level. In the absence of an applicable framework a new governance framework was therefore needed and coincided with work on this study.

What also became apparent whilst working on this package, were differences in understanding of terms such a 'governance', despite its wide use within the project. Whereas a general understanding of the term was evident, what forms of governance were included and what were not, differed. An informal pilot survey was undertaken amongst colleagues to test this experience further. This pilot confirmed subtle differences in what was understood by the term governance. Asking about governance experiences, for example, may have a different meaning between different participants. This suggests care should be taken in the deployment of the term 'governance' in the data gathering stage of the study, particularly when asking questions of participants.

6.5 THE FORMATIVE FRAMEWORK

The Pipebots project presented as an opportunity to test ideas as they developed through the literature review, using Pipebots as a lab or 'niche', in line with MLP thinking; the MLP model, as discussed in the literature review, used here in a novel way as part of the research process with the preliminary framework being tested in the niche before taking it forward.

This approach also recognises the transdisciplinary nature of the study, with the author spending time learning and working across the disciplines within Pipebots to understand the new science, how technical issues interact with governance and the sector more widely, and terminology, norms and perceptions, amongst other experiences. The Pipebots project provided a space for learning and experiment. It gave a clear context for governance theory to be explored and early potential hurdles (for example over language) to be identified. It provided an opportunity to sense-check early ideas and to link theory to its practical application.

In the experimentation, nascent themes had been generated and articulated from the literature review. To take the themes forward an approach seen in the energy justice sector was utilised. This advocates for a series of questions to be created as a tool for decision-makers to prompt thinking around new interventions and to incorporate themes into their decision-making processes (Jenkins *et al.* 2018; Sidortsov and Sovacool, 2015).

In designing the questions the themes following the literature review (governance regime and regulation, networks, resource, technical, justice, iteration) were considered alongside the forms of governance (justice, law, regulation, policy, norms etc). These themes and forms of governance considered together enabled a series of questions to be drafted. These questions sought to embody the essence of the themes and covered the following:

- From STS and SES, the nature and scope of the project, technology and resource together, the boundaries (in this case split between waste and potable water)
- How the benefits of the project and its scope, align with public policy
- The principles of justice with which the project aligns
- The use of an ethics or RI code
- Areas where the project may meet formal law (where law traditionally offers protection e.g. health and safety, property, environment)
- The nature of the governance regime and regulation; e.g., market-based
- The network around the project
- How the project helps its target users meet their statutory duties (regulation)

- Mechanisms to learn and understand societal values and norms

The Pipebots project provided an opportunity to test the early framework and the questions. The questions were applied to Pipebots using the author's knowledge of the project and drawing on Pipebots colleagues where necessary. An early draft of the questions is included in Appendix 1, (alongside later iterations of the framework).

When the questions were answered the results were initially viewed through the lens of the MLP (1-3 below). However, an alternative means of categorising the response, looking at impacts, also materialised (4 below).

Firstly, using the MLP as a lens:

1. **Legal 'landscape' issues.** The framework prompted a discussion on the legal landscape at an early stage, particularly around property rights, data and infrastructure security. This included a range of issues from the implications of a transfer of data from below to above ground and the legal position of the robots 'escaping' from the pipe. These were issues around the general law of the land, applicable to everyone, not sector specific regulation.
2. **Regime issues.** The regulatory regime, the laws specific to the sector, highlighted practical issues over regulation and procurement contracts, which were not otherwise observable from the literature. They also brought to light and prompted education and discussion around the pivotal piece of legislation impacting on a Pipebot in potable water Regulation 31 (Water Supply (Water Quality) Regulations, 2016). As discussed, this regulation and its associated suite of advisory notes controls substances, including a Pipebot, that can be added to the potable water supply system. There are strict and onerous controls and

processes to be complied with. However, within the advisory notes was an abridged process that could be used subject to the dimensions of the final design of the Pipebot as well as lists of pre-approved substances (DWI, 2018). A discussion on this regulation was presented to the teams including an advice note and a webinar prepared by the author. The discovery of the abridged process, previously unknown to the technical teams, makes a connection between the design of a Pipebot and a reduction in regulatory red tape. The advice note and subsequent presentation is included for reference in Appendix 8.

3. **Niche issues.** These were predominantly discussions around an appropriate RI code to include public engagement. The response to the approach to RI codes varied within the project with voices for and against. Some did not believe RI was an issue for the project at all whilst others embraced it. This suggests the thinking behind the codes may not always be accepted or at least, not always prioritised.

Alternative to the above was a means of organising and considering the answers through impacts:

4. **Impacts.** The responses to the framework questions also could also be categorised according to their impact on the project. This was considered a useful form of categorisation emphasising the effect of governance on a project and so its potential importance more directly. To illustrate, the following impact categories were identified, with examples:

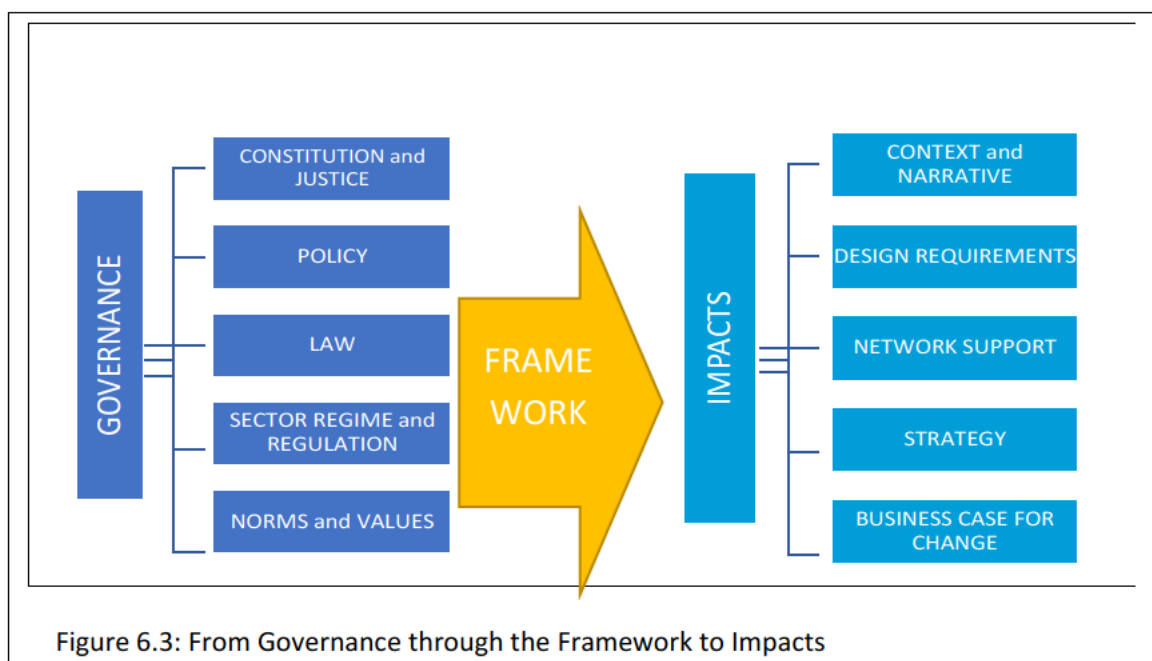
- a. **Context and Narrative:** around the resource and its spatial distribution, as well as the regime governing it, with problem framing and solution options altering with the boundaries of the system of interest; noting clear governance differences between

water and wastewater applications with different rules applying and with water and wastewater mostly being governed separately.

- b. **Networks:** In looking at the stakeholder list representing the project's network, connections to regulators proved to be a notable absence. The need for regulator insights were numerous. As an example, the current regulations governing potable water were not drafted with the use of miniaturised robots in mind, prompting the need for consideration of how this new application may be viewed by the DWI (DWI, 2021).
- c. **Design Requirements:** As raised in point 2, the regulations on drinking water quality in England provide the opportunity for testing requirements to be abridged subject to calculations on the surface area of the final robot (Water Supply (Water Quality) Regulations, 2016). This was information provided to the design team at an early stage and enabled questions to be raised to the DWI (once the network had been expanded). It provided a previously unappreciated opportunity to design-out more onerous governance issues.
- d. **Strategy** There were a number of strands here, including: the extent there were network gaps to be filled; the extent an RI code would be accepted and adopted and how this could address justice and societal concerns around robotics; a review of policy leading to further training within the teams on the issues around digital twinning and how Pipebots may engage and benefit from a national infrastructure digital twin initiative.

- e. **Business Case:** How the current governance regime and landscape supports (or hinders) the case for change and how this can be utilised by a project. There were strong policy drivers supporting the project, for example. There were however signs of governance inertia prompted by the regime which may need addressing such as through procurement contracts and through rigid, rather than adaptive, legal frameworks.

The impacts (a-e) are represented in Figure 6.3 and show the potential impact areas of the governance framework on a project. This was considered a breakthrough moment in terms of the communicating the potential for the benefits of the framework and the integration of governance to be more clearly articulated to a project team. It was decided to try to utilise this finding in how the framework was presented or organised.



6.6 DISCUSSION

The application of this formative framework to Pipebots gave insights at two levels.

At the first level, it shows the potential of the framework to incorporate aspects of governance into a technical project with direct results. These results followed only a single, informal application of the framework at a single point in time suggesting there is even more potential for discoveries and integration as the project progresses.

At the second level looking at the results more widely, the answers to the framework questions could themselves be collated into impacts. This may have more meaning to a project team. Rather than phrasing the results as governance issues, the impacts refer to issues that matter to the project design, strategy or the business case for example. Further, there were signs that the framework has the potential to draw-in and encourage communication amongst teams and so augment transdisciplinarity between the different skill sets. The framework prompted reflection and dialogue across teams.

As well as these positive insights there were also signs of potential barriers. A negative view of governance could hinder engagement or see governance as a hurdle to be overcome rather than as an opportunity. Further, there was some ambivalence towards RI in some quarters and more might be expected. Whilst it has its supporters, RI is not universally accepted and the same could be anticipated about the framework itself. There may be different views on the focus of engineering and science within projects, particularly at the early TRL stage.

6.7 SUMMARY

The Pipebots project was used as a grounding for preliminary experiments and to test the idea of having a framework that could be used within a project team. It was not at this stage, nor intended to be, a fully formed framework. It was more simply a testing ground for the ideas similar to the niche phase of a technological development. It was used as a space to start to

test the theory, the efficacy of the idea and the potential for it to apply and have impact in a practical setting. A space to understand and explore was particularly helpful for transdisciplinarity with different terminologies and approaches.

Particular points to take away were being able to see the potential benefits both directly to a particular project and also to see how the framework could be communicated and developed further. In terms of the latter, the idea of organising the framework around impacts will be taken forward alongside continued thought about how the potential barriers can be overcome, accepting that inevitably, universal acceptance is unlikely. There were also glimpses of a lack of holistic governance of the water cycle (separate systems particularly for potable water) and the potential for existing strict laws to be at odds with the flexibility required for transformational innovation – an issue for adaptive governance principles to evaluate.

This grounding and preliminary insights from the literature reviews and the Pipebots project will be taken forward into the next data gathering stages with the wider sector.

7 SEMI-STRUCTURED INTERVIEWS

This Chapter collates the data from the semi-structured interviews and presents the findings. It highlights the, sometimes overwhelming, strength of the regulatory regime that governs the sector together with the positive and negative emergent outcomes that flow as a result. These results will be taken forward, tested and expanded upon in Chapters 8-10.

7.1 PROCESS

To recap, 18 semi-structured interviews took place with those engaged with transformational projects in the sector. Of the 18 participants, 11 were from water or wastewater companies covering the North, Midlands and South regions of England and the remaining 7 were from governance agencies, consultants, innovators or contractors. A summary of participants' job role and the projects they discussed are included in Appendix 5. Despite the range of participants their individual experiences were very similar with common issues arising. Where there are differences these are noted.

The interview texts were thematically analysed. Coding the texts started with a straightforward review of the texts to look for wording or phrases around governance, hurdles and challenges. Rather than discrete ideas it was found that each of the themes interconnected, the boundaries of one overlapped with others. Thought was therefore given to theme selection and how the results could be coherently presented. Each theme below is chosen to highlight a particular aspect of the regime relevant to the research and then interpreted from two perspectives. The first perspective considers what the findings mean for a project, the framework and how governance can be harnessed for best effect. The second

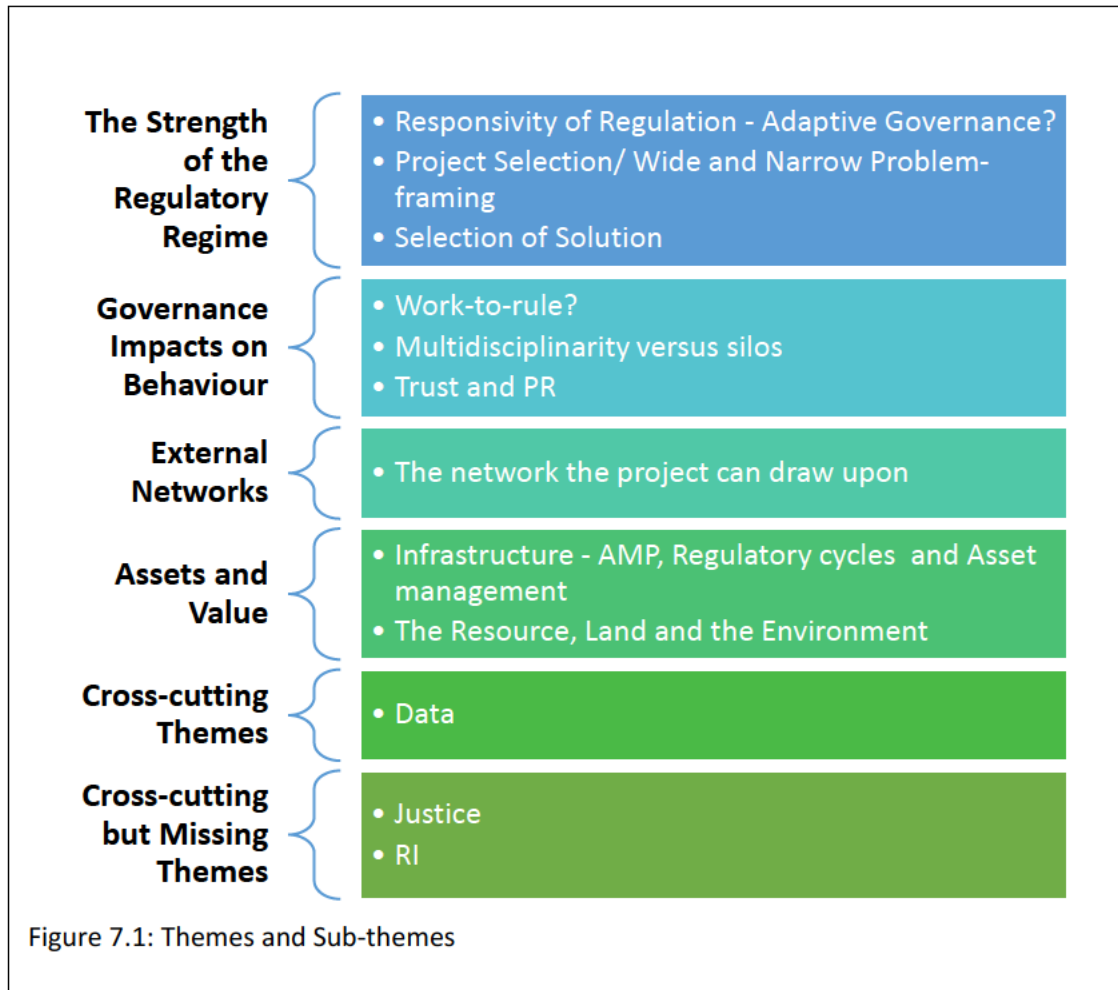
looks at what the governance system achieves and how it may need to change and adapt to allow for the required transformational changes. After each section a discussion on what this theme means for a **Project** and what this means for **Governance** are included.

As the coding advanced the importance not only of what was said but its context, the projects in issue and the phrasing became more significant. In collating the codes into themes and considering their presentation, the types of project and quotations which illuminated thinking were also collated. These were all drawn together in order to explain and understand the nuances of each theme.

7.2 THEMES

The themes and sub-themes categorised following the interviews are listed in Figure 7.1. Each of these themes and sub-themes are discussed in this Chapter. In doing so, the discussion on each theme is exemplified with quotations from participants¹³.

¹³ The quotations are printed as spoken by the participant save where editing is required to ensure anonymity. Edits are clearly marked in parenthesis []. If there are different views held amongst participants these are expressly noted and conflicting quotations included.



7.3 THE STRENGTH OF THE REGULATORY REGIME

Whilst different themes emerged through the thematic analysis process it became clearer as the texts were analysed that there was in fact one overwhelming, pervading theme from which most others were linked. This theme was the influence and strength of the regulatory regime.

It was anticipated that in a heavily regulated sector, the regulatory regime would be a factor in shaping, hindering or supporting innovative projects. What was not anticipated was how significant a factor it was. It was anticipated in a market-based regime that economic drivers would dominate, albeit tempered with regulatory constraints and requirements. Whilst

economics was an important driver behind projects, regulation was often considered paramount. One participant summing up reasons for a project noted,

is there a statutory or regulatory driver to do this? And that is often at the top of the pyramid in terms of a sort of a reason for somebody to do something, that's often the absolute top.

This comment was not an isolated example. All of the projects discussed had strong regulatory drivers. Examples ranged from nutrient removal which were entirely driven by regulatory and licence requirements, wildlife protection driven by regulatory requirements and wastewater management projects again driven by the regulatory regime. Most were undertaken as they had to be done to comply with the regime, albeit the projects explored different solutions to meet the requirements. This key finding and its nuances are expanded in the sub-themes.

PROJECT: *As will be seen, the picture is one of a heavily regulatory-led regime. This suggests for a framework and project team seeking change, that setting out a clear alignment with a regulatory driver would benefit a business case, where possible. Whilst economic considerations are a factor, this suggests that a business case resting solely upon economic benefits may not be enough. This is potentially at odds with a regime described as market-based and will be explored further.*

GOVERNANCE: *In terms of the governance regime itself, strong regulatory drivers could be upheld as a success of governance over the market. Despite the regime being a privatised and market-based system, the regulatory driven projects suggest governance may be successful in tempering the market with Government's will. However, sub-themes were illuminating in exploring this issue further. These sub-themes served to illustrate and expand upon the point,*

stressing the potential adverse impacts as well as design, strategic and business case considerations under this major theme.

7.3.1 Responsivity of Regulation – Adaptive Governance?

Formal law and regulation were the most often quoted source of governance impacting on projects. The extent formal law can flex with the needs of a complex adaptive system was an issue highlighted in the adaptive governance component of the literature review in Chapter 4. Adaptive governance requires responsiveness and an inherent ability to adapt to change in a timely way. Projects and experiences where this clearly did or did not occur were gathered to explore the extent adaptive governance principles were evident.

One set of regulations was mentioned by those addressing potable water projects and was also mentioned by innovators and consultants because of its general notoriety, ‘Regulation 31’ – being in fact termed a ‘*nightmare*’ by one participant. Regulation 31 refers to Regulation 31 of the Water Supply (Water Quality) Regulations 2016 (as amended) and often called the Drinking Water Regulations. It applies to potable water and restricts what can go into water supplies, controlling the materials with which potable water infrastructure can be constituted. It is an important and strict safety tool; necessarily so, as it deals with the safety of the country’s potable water supply. It was raised as the most significant regulation by participants (warranting special mention in any framework), particularly in relation to its impact on the design of anything impacting potable water infrastructure and the systems for regulatory compliance that have to be adhered to.

Regulation 31 will have a significant impact on Pipebots but also other similar projects seeking to reduce leakage. Regulation 31 will strictly impact on what materials can be used within

those pipes. There was frustration with the regulation not keeping up with advances in materials and with its slow processes. As one participant put it,

[] from the [regulator], he'll tell you regulations were supposed to be updated every five years, every 10 years maximum. That was in 1993. And they haven't been updated since then, and they were based on stuff from the 60s and 70s anyway.

The regulation was considered static rather than responsive or adaptive. There have been significant advances in technology and materials over the last decade. There is a risk that if regulation does not keep pace with change and innovation it effectively stifles it.

This was not just a Regulation 31 issue. There were further and more general examples,

I think there's also a point that the industry invested a lot of money during maybe the 1980s, 90s, or maybe some of the early 2000s, in producing lots of industry standards. Water industry specifications and standards, WRC wrote lots of these. At the time they were current and up to date, but a lot of them haven't been updated, so actually if you look at some of these, they actually don't reflect current technology and things like that.

And another noted '*regulation always being behind*', while another saw this translated into enforcement processes,

It's the old school reliable traditional methods of assessing if water quality is safe or not, whereas nowadays we've got flow cytometry, we can count individual numbers of cells and whether they are intact cells or non-intact

cells, but regulations are still like, grow this on a plate for 48 hours and see what happens.

The narrative around this theme became one of strong but unresponsive and out-of-date formal laws and a static and fixed regulatory regime.

PROJECT: *For a framework, Regulation 31 would be worth a special mention for potable water projects. It also suggests that if the project wants to use innovative new materials or techniques, particularly in potable water, then engagement with the regulations at an early TRL stage is sensible to understand how they impact on the design and choice of materials as well as the strict regulatory processes the project will be subjected to.*

GOVERNANCE: *If the sector is regulatory led, as is suggested by the narratives so far, then that regime needs to be up to date if it is to manage the complex adaptive system of water infrastructure as well as embrace innovation. A failure to adequately cater for the possibility new materials and innovative technologies, for example, can stifle their use and instead entrench existing materials and systems. The suggestion is that dominant parts of the regulatory regime, including its enforcement, are out-of-date; there is a danger that the out-of-date embeds rather than challenges the status quo and does not support adaptation and flexibility, contrary to adaptive governance principles.*

7.3.2 Problem-Framing/ Project Selection

There was an array of different legal and regulatory rules on display across the projects discussed, from issue specific regulations around wildlife protection and to nutrient removal (Phosphorus and Nitrogen) through to river catchment and wider scale issues around the Water Framework Directive (WFD; European Parliament and Council Regulation (EU), 2000),

water transfers, new hard infrastructure and resilience. An anonymised summary of projects is included in Appendix 5. According to participants, the regulatory regime had a strong link to the projects chosen – and conversely what was not chosen. This issue arose in discussions where participants were disappointed about the project or solution selected and what was not taken forward.

Project proposals that aligned with regulatory requirements were more likely to be adopted. Conversely project proposals that did not meet a regulatory requirement were less likely to be selected. This may be considered a success of governance, governance leading the sector towards societal goals. However, analysing the comments gathered around this theme more closely, provided examples of where ‘good’ projects were not being taken up because they did not meet a regulatory requirement – **even if that project provided benefits to the business, society and the environment**. To give an example, a participant noted a business-as-usual preference was used as an easier path, avoiding regulatory testing and red tape, and that this was behind the lack of selection of some projects,

*we're just going to keep using what we can while it's available. We don't
have to do any additional funding for testing or writing up any new
contracts.*

Another noted a project being rejected despite favourable test results because,

*on the compliance piece they're saying you know, at the end of the day it's
not a parameter that's regulated,*

this point being relevant to project selection. The project was not adopted as it was not measuring something useful for compliance purposes. It may be helpful for efficiency, water or asset management more widely but it was not a regulatory requirement¹⁴. Another still noted the impact this had on innovation in the UK,

there isn't any real opportunities in the UK, and this was obvious 10 years ago... every drinking water system in the UK talks to [] and says, yeah it's great, we love what you're doing, we're very happy with it. Are you going to install it? No, because we don't have to

and further

they were like, well nobody requires us to actually have it so we're not going to have it, because it will expose a whole bunch of things that we don't want people to know... You know, very popular technology, but there's no requirement to have it in the UK so nobody wants it.

The latter comment underlines a cynical side to compliance, one of working-to-rule and selective data publication. This is explored in later themes below. For present, even if this degree of cynicism is not replicated universally, the implication from the comments as a whole remains that even if an innovation provided data that would improve ecosystem health or could be used to enhance efficiency, it would not necessarily be accepted unless it also showed compliance with a regulation. In contrast, an innovation that directly addressed a

¹⁴ As an aside, the lack of wider data gathering is also discussed as a cross-cutting theme later

discrete regulatory issue, but had none of the wider benefits, had a far higher chance of being taken up.

This adjusts the narrative first proposed in Section 7.3. It first appeared that regulation was more important than money in project selection. The position may be more subtle. The participant data suggests money may be a significant driver behind project selection and money will be spent on projects, but only where it is necessary to comply with the regulatory regime.

PROJECT: *For a project team this suggests that projects may struggle to be taken up without a clear regulatory driver behind them. This could be the case despite the projects manifest benefits for people and planet. If a clear regulatory driver is absent, strong alternative business cases will need to be seriously explored with the sector to find the traction needed for a project to be progressed. It may be that alternative jurisdictions with different governance drivers could be considered.*

GOVERNANCE: *The narrative for this theme starts to show that projects that seek multiple benefits, in line with solving the complex, multi-faceted problems of the day, may be hindered by a regime which prefers single issue compliance. Under this theme there are also the beginnings of links to data issues, what is valued, gathered and what is enforced, flagging its potential as a cross-cutting theme.*

FURTHER: *This theme highlights a difficulty for a framework. To guide a project team, compliance with the regulatory regime must be flagged. This could, however, serve to further embed the status quo by encouraging narrow, single-issue projects that comply with and not*

test the regime. Adaptive governance principles around learning could be drawn upon to answer this conundrum by incorporating principles of learning and challenge into the governance framework. Flagging regulatory dominance - but prompting challenge where necessary - will be explored when drafting the next iteration of the framework.

7.3.3 Selection of Solution

The thread of regulatory hurdles was reinforced and expanded upon in this sub-theme. The regime not only impacted on the 'problems' that were prioritised but also on the connected issue of the choice of solution, particularly around the certainty of that solution. A participant, talking about alternative solutions for a project, in this case available nature based solutions (NBS), commented upon the fact the regime imposed a very tight timeframe,

So why did we not do it [NBS] on this project is the specific question you're asking so, we had quite a tight timeframe to deliver in, so we have to deliver by []. So compared against our normal projects, it was much faster, so the room for error in terms of going back round the loop if innovation didn't work, what else can we do, was non-existent. Risk.

There were other occasions where participants noted the time demands for compliance meant alternative options could not be considered. On asking a participant whether the regulatory-prompted response was the best one,

there are some things you can do, but from a risk point of view, say there's certain biological processes you could put in, or innovation processes you could look at, but in terms of surety of achieving the outcome that we set

*out to achieve, and doing it for the best whole life cost, yes, the option for
the best one*

There are both time pressures and concerns over risk influencing project choice. In terms of risk, it was not suggested that alternative solutions posed a risk to health and safety in themselves. In the context of the discussion, the risk was the risk of non-compliance with a rule.

More concerning were examples of regulatory-prompted solutions which had the potential, according to participants, to do more harm than good overall. Five participants discussed projects around nutrient removal and their links to permit limits for Nitrogen and Phosphorus in water supplies, although these issues also cropped up generally. Criticisms of the regulatory forcing of solution choices were raised by government agency, innovators and water companies alike.

*[on discussing regulations for nutrient removal] the whole system hinges on the
certainty of delivering a quantifiable reduction, even though you know even that
amounts to sort of bean counting in my mind.*

And another two participants on the same topic,

*I just don't feel like the direction of travel of going lower and lower and
lower and lower and lower is something that's going to be sustainable,
because all it means is we're going to be dosing more iron, so more iron's
gonna be produced, which has a massive carbon impact on the
environment*

and,

*this new process that was coming in was more energy intensive and
bringing in a whole host of new chemicals with it.*

The views expressed were that regulation was seeking to force innovation by lowering permissible limits, but those limits had extended beyond the science available to achieve that goal – at least through sustainable means. This coupled with short time-scales meant innovative schemes were side-lined for tried and tested but energy and chemical intensive existing regimes. This issue was most succinctly, and damningly, put by another participant discussing the business-as-usual approach to nutrient removal as opposed to NBS,

*They [regulators] need to be certain about delivering something that has
literally no ecological benefit as opposed to be uncertain about delivering
something that has a high benefit potentially.*

In this instance the project discussed by the participant had been a ‘success’ as the nutrients had been removed to the degree required. The goals of the project, driven by regulation, had been met – however in the view of the participant, this % deduction provided no benefits to the ecosystem as a whole and was a hollow victory. These comments connect to issues around regulatory enforcement. Strict regulation requires enforcement. Enforcement requires resources and a means of checking for compliance. A single or simple data point, such as levels of nutrient removal being easier to test for, but not necessarily better, than a set of wider regulatory data points for the ecosystem as a whole, was favoured.

There were other examples of the regulatory processes driving solutions away from wider potential benefits. For example,

if under current statutory process ... is a one hit wonder, so you basically say improve the sewage works with this amount, that treatment, that result. It's not very good at seeing a big picture, multi-benefit scheme that involves lots of elements and more than one company, and involves not only wastewater, but water resources. The process isn't designed to deal with something like that

Along with concerns raised over single-issue attitudes, this alludes to a siloed approach to water management with a continued separation of water and wastewater processes, again contrary to multi-benefit and circular economy schemes.

In examples provided, there were missed opportunities for wider benefits, and further suggestions that compliance was doing more environmental harm than good. There was also a dominant governance driver around potable water quality at all costs, continuing the idea of the separation of water and wastewater thinking.

So, if, for example, we could demonstrate that we could meet a water quality benefit but the way we do it would be by causing a significant carbon footprint, increasing flood risk, whatever, then you just do it, that's the position. Even if you have an option that maybe didn't quite hit that water quality benefit but actually delivered a far improved carbon perspective, it aligned to other benefits.

Another participant discussed how they had been seeking to look at problems differently to try to address a pollution issue not just through an end-of-pipe solution, but to go further back to the multiple causes of the problem and the more complex picture of cause and effect –

wider problem framing and solution generation. In doing so barriers were hit on trying to progress this with regulators, in the view of this participant,

Certainly, when we pushed [Ofwat] for a broader approach to environmental value and social value to be considered in what's being delivered, then that's never been really viable, so it's quite focused on, the view is you absolutely must deliver water quality benefit, not environmental benefit, and if you can then maximize other environmental, social benefits through that and then great, but that's all an additional thing. There's no real view of taking a broader picture of the environment in the round.

and further,

we're looking at then how we can try and make value based decisions rather than purely cost based decisions, but equally, one of the things Ofwat have also been very clear on is water companies should only be paying for benefits delivered that are core to what water companies should be doing.

Ofwat's approach, according to the participant, stems from the financial underpinning of the privatisation of the sector, the drive for efficiency and for accountability to customers for money spent, that money being authorised for core water company activities only. In an example of this, a participant explained how they had been seeking a wider catchment-based approach to a pollution problem by engaging with stakeholders in the catchment including farming communities. As it was a novel approach for the time, the participant explained there

were no guidelines issued by the regulator but the scheme was endorsed by them in principle. A year down the line guidelines were eventually published which, in the view of the participant (from a water company), made the project untenable. The water company wanted the regulator to take into account the social and environmental value and impacts of a project in the accounting. Without that 'credit' the projects were said not to be financially viable. The tension for the regulator was a drive to keep costs for customers down and to ensure that water companies do not incur expenditure that benefits others and not customers directly. From the regulator's perspective, according to the participant, the improvements were issues that the farming community should address rather than water customers pay for. The project was therefore halted even though was proving successful in terms of reducing pollution.

The complexity of arrangements in relation to funding projects in the sector and the reality of with whom and why decisions were reached is not within the remit of this project to unpick. The comments do however highlight the regime requirement for water companies to ensure they only incur costs related to water company activities and to keep costs to their customers down. This begs the question who is best placed to make the improvement if it is not the water company. As a participant put it,

But actually taking that broader view of what is the most efficient way to deliver the best value from a societal point of view is the best thing to do, and if it's deemed that a water company is the right person to deliver that because that they're well placed to do it and efficient, and that's a great thing. If it's deemed the local authority is the right person to deliver it because that comes through taxation and is more transparent, or

whatever, then that's a great thing, or if it's deemed that actually you want private industry to do it then because they can do it more efficiently, then equally that's a great thing, but actually having that joined up approach to that whole societal value across all of the different things from natural, society, human etc and taking those decisions has got to be the best overall outcome at the lowest sustainable cost from a country point of view.

With some exceptions discussed in later themes, the overall picture was of innovative solutions with wider benefits for the ecosystem as a whole facing significant hurdles rather than being embraced through the drafting of the regulations and their enforcement, and from the position of water companies running for the benefit of customers and shareholders not the wider community. The frustration of participants ironically shows a positive side to the narrative of this theme, that the sector does contain many thinkers and doers that are able and willing to do more (albeit currently hampered in doing so).

PROJECT *Despite regulatory hurdles there appears to be a willingness within the sector to engage with multiple benefits schemes such as NBS and an acknowledgement of their potential benefits over traditional solutions, in some instances. Regulatory framing, timing and certainty of results appears to be a factor operating against these schemes from a governance point of view.*

Despite the above, some of the projects discussed did manage to navigate the regime and embrace multi-benefit schemes with positive results. Pointers on how this was achieved, against these governance drivers, need to be pulled out and explored in later themes.

GOVERNANCE *Despite current policies encouraging innovation, the practicalities on the ground as a result of the regulations are that tried and tested regimes are often preferred by default over innovative, new schemes. They can be quicker, provide a greater degree of certainty and clarity, and are easier to govern. Inevitably there are greater risks with innovative solutions in terms of compliance and uncertainties over performance. At present, particularly around nutrient removal, there are time and certainty issues around projects such as NBS for example. A governance system that embraced adaptive governance principles would encourage, not discourage, learning and experimentation, again suggesting a lack of flexibility in the current governance regime.*

There is also the pragmatic question of who is best placed to achieve the wider environmental and social benefits some innovative schemes could bring. As recently reported in the media, there is an alleged enforcement crisis within the Environment Agency with farming breaches not being addressed (Crisp, 2022). Whilst the approach to ensure water companies do not exceed their remit and spend to protect customers is understandable, there was a pragmatic solution on offer by a water company that was not (or perhaps could not be) taken up. The water company provided a pragmatic rather than an optimised solution, the former being acceptable by the adaptive governance literature. The water company was effectively addressing some of the farming issues the regulator does not have the capacity to enforce for overall environmental benefits.

Instead the regime has a primary economic focus around affordability to the immediate customers as consumers, as opposed to the benefits to wider society as a whole. This appears likely to continue with comments on this issue being reiterated in the Ofwat PR24 consultation

(Ofwat, 2020) and forms part of the traditional remit of Ofwat as the financial regulator protecting consumer's pockets. It arguably embeds silos and pockets of environmental management rather than holistic (and pragmatic) solutions.

In short, there is a tension here between the economic drivers that underpinned the beginnings of the governance regime and the holistic societal and environmental goals it now strives to achieve.

7.4 GOVERNANCE IMPACT ON WATER COMPANY BEHAVIOUR

Although the formal regulatory regime dominated the projects, less formal forms of governance, such as behaviours and norms flowing from the regime, were also evident.

7.4.1 Work-to-rule?

The regime could be seen to shape attitudes. As was started to be alluded to in earlier themes, there was a strong motivation towards compliance with what was likely to be enforced by the regulators – even to the point where what was being asked for and enforced did not make sense. Rather than challenge there was evidence of resignation towards regulatory requirements.

One of the most extreme examples came about when discussing a sudden change in a project plan driven by a regulator re-think – despite the existing plan being the tried and tested solution. On asking why the original solution was abandoned,

Now what I've heard on the grapevine is that another water company or another area where [] had installed these themselves the strobe lights were

installed backwards, so instead of flashing down there, they flashed the other way. And a lot of [] decisions are based on maybe a flawed project... We used them in the past, but if [] aren't accepting them, there's nothing you can do. It was quite a surprise; you've gone for maybe a 200, 300, 400 thousand pound project to a 3 million pound project so it's increased the cost tenfold to the job.

Despite concerns by the participant at the time, the regulator was not challenged. The impacts of this change were huge, driving the project from costs of hundreds of thousands of pounds into a project costing millions of pounds. There was acceptance of the change of plan, despite private concerns. The issue is not whether the regulator was correct to change the plan (and researching that issue falls outside the remit of this study). The issue is whether the lack of channels for challenge, fear of enforcement and/or blame is hindering sensible queries. A potential answer is evident from a comment by another participant on why there was no challenge in a comparable situation,

it's from the regulator, people don't think that there may be in the future, something could be done to make it different, it's always seen as accepted

Another participant acknowledged the problem of passivity and how the regulations were set up but also pointed to the regulatory approach,

EA's regulatory people words were, 'we're in a strange situation where the regulation doesn't really drive the best environmental outcome'. But that wasn't said in a way of, that's a massive problem and needs to be sorted out,

it was said in a way of, and therefore we just have to deliver the regulatory obligation.

To balance the narrative, the participant noted there was limited data for the EA to rely upon hindering the enforcement options available to them and that their budgets had been cut. Nonetheless, these points together suggest a staggering work-to-rule within some elements of the regulatory regime.

PROJECT *It suggests project teams within the water sector may need to reinvigorate channels for constructive debate and challenge to improve future projects. This could be something picked up in the governance framework.*

GOVERNANCE *There appears to be a degree of endemic malaise within the sector driven by a rule-based system that can be inflexible and dogmatic. The result is a work-to-rule mentality in some instances. It also suggests constructive dialogue and challenge between regulator and regulatee could be improved. Whilst it cannot be proven that the regulator's decision to change plan in the example given was incorrect, the lack of avenues for challenge despite the vast additional costs is staggering, underpinning the strength of the regulatory regime and the will for compliance.*

7.4.2 Multi-disciplinarity versus Silos

In exploring issues around work-to-rule another example surfaced, this time within a water company and disciplinary silos. In an example, a participant talked of errors over where a project was sited, issues the participant was aware of prior to implementation, his comment being,

I'll do as I'm told. And I think we're all like that, even my boss. Is kind of, it's come from engineering, if it doesn't work. It doesn't fall on our shoulders; it falls on them. That can be a kind of negative, because if it wasn't like that, we would've all fought harder, made more noise about it being the wrong place.

This was a not a team sharing responsibility, but defensive silos between engineering, R&D and operational teams. On exploring evidence of this theme further, attitudes towards and between different disciplines also materialised. To highlight the polarised views, whilst talking about some of the wider benefits of a particular project, one engineering-focussed participant commented,

... out of the four w's I don't do what or why, I do, how and when. And sometimes I don't do when, I do how. So I don't really know what Ofwat would say, so you'd have to ask my colleagues.

And further when discussing wider social impacts,

I would imagine there are, but, as I say, I'm very blinkered... I don't see the bigger picture. You've seen it, I've admitted it. But everybody I talk to are people in my world. I admit that I find myself in management meetings about some subjects and I go all fish-eyed because I'm a civil engineer, with a passion for what I do.

The participant's focus (and job satisfaction) was on resolving the immediate technical challenge before them. The participant had developed a considerable and impressive niche

expertise and professional pride and care in the job that was being done and was keen to limit 'distractions' of the regime and landscape.

There were contrary perspectives keen to counter a siloed mentality. For example, another engineering-focussed participant expressed similar views but said those views had been tempered by early influences from a respected line manager,

*what he was trying to advocate was that if you gain a better understanding
you become multi-disciplinary you appreciate what other [are] people
doing, how they work, what their needs are you will be a better player
within the organisation.*

Explaining the problem as he saw it (as an engineer himself),

*as a set of people engineers, particularly maybe scientists too, are quite
rigorous and follow a line of like working within the framework ... I'm guilty
as charged again. Engineers and scientists like to work alone because they
know what to think, it's all happening in their head. They don't need other
people conflicting with what their thoughts, the ideas are a challenge.*

There is a significant difference between the personal values, norms and behaviours between these two viewpoints. The difference between the two approaches suggests a difference in problem-framing: one developing a niche expertise through narrower, less distracted, problem-framing; the other engaging with wider problem-framing addressing the social and environmental impacts of his work and with a clear drive to improve the position of his catchment for his customer, thereby providing potentially greater benefits but being more

complex. Both clearly have their significant benefits although, as discussed, it is arguably the narrower view which is being endorsed by the governance regime.

From the project managers, the approach of engineering as a discipline was viewed as a tendency to lose sight of the bigger impacts and potential – and also lose engagement with a wider network,

Some of our engineers get focused on the engineering and don't always see. And I think that's why a lot of these jobs get given to me because I'm not an engineer, I'm the project manager. I am a biologist. I use a lot of third party liaison. In AMP 4 and AMP 5, I am continually speaking with the Environment Agency, Natural England, planning authority, landowners. I think I understand how those other third party issues can impact on a project. I've got Civil Engineers and mechanical engineers to do the engineering, but they do that for me and I do that. But sometimes when you speak to them, they don't see that bigger picture, they just focus on their little bit.

And further,

it's that tunnel vision of engineers. They just want to build stuff and design stuff, they don't want to do that and understand how the third party's going to impact that. They haven't got that breadth of view on how to deliver stuff.

Another participant, discussing what he thought was 'over-engineering' on his project described the technology, which was still not working at the time of the discussion as innovators selling to engineering a "*golden unicorn*", further commenting on blinkered visions,

and so the engineering department very much led this. They were sold this thing, oh we want this, because it will be brilliant in the future, basically, and I think everyone except them accepted it was going to cost more.

The criticisms were not solely at the door of engineering; reticence on the part of operational teams was also noted, an example being:

The operational staff in a wastewater environment, operational environment, they tend to be quite set in their ways I suppose. It's very, very unionised sort of atmosphere, no one really wants to put heads above parapets. So in our department, we know there's a drive to innovate and as engineers you want to put some new stuff in. And there's bright sparks in operations, but I think they just want things to work, they know they work and it's going to cause them not much hassle, they're not going to be at 2.00a.m. unblocking a pump.

Initially the depth of disciplinary silos was a surprise, particularly the often passionately held conflicting views, but on reflection, these issues had been alluded to in the Leydens, Lucena and Schneider (2012) study from Chapter 4, which recognises disciplinary silos. This also corroborates experiences, albeit less adversarial, within Pipebots and shows a tension between narrow and wide problem-framing preferences. In the context of a strong regulatory regime they were also understandable. Participants alluded to operational teams having to

withstand the worst of real-time pressures to comply with regulatory requirements; a tough regulatory regime for operators and an innovation failure leading to missing of targets and non-compliance. In contrast, for technically focussed engineering, the ability to focus and develop niche expertise can be difficult if engaged with the messy context of the wider regime and landscape.

Nonetheless, along with examples of silos came a desire by some for multidisciplinary working and collaboration. This was apparent between disciplines. Examples include from engineering,

this is where the multidisciplinary approach comes in..., I wanted to work with people with knowledge of disciplines like an electrical engineers, mechanical engineers, because they know how the mechanical equipment works and operates and control it.

And another participant,

And that short circuited so many learning curves by talking to other water companies.

A project management participant extended the idea, noting the importance of better internal collaboration not only to generate ideas but to embed them particularly with operational staff,

And I think that's probably a wider point to make is, if you don't get the people on the ground brought into stuff, things like automatic control systems, when something does go wrong, they get switched off.

The need for collaboration extended to internal relationships within the business and the need to do more to take down silos if transformational change was required within the whole and wider system.

In an example, a participant talked about how his project had gone wrong and why he felt that was the case,

in this case also recognising the level of transformation which was organisation-wide, which meant that actually our steering groups, I think needed to be more than just the [city] oriented ones, but actually whole business wide,

and further commenting,

it resulted in a bit of almost needing to really understand the processes within different directories and different departments of the business, because these are the areas where the benefits for the projects could be unlocked.

The above frank comments were in the context of a project which had suffered from ‘mission-creep’. It started with a small project to undertake remedial work and transformed over time to a new potable water network. The project was far more extensive in scope, time and money and involved a change in the mineral content of the water delivered to customers. This would have an impact on taste for consumers and also, with the change in its chemical composition, would impact on some manufacturing processes in the area. It also involved new operational systems and an understanding of their interconnectivity. The participant put mission-creep

down to a failure to engage adequately with all operational systems and processes from the start and only seeing the additional potential impacts and benefits too late in the day. The participant felt that the project management, costs and time suffered as a result. This was coupled with a failure to properly appreciate the connectivity of the water bodies affected. The participant felt the failing was where the boundaries of the project were originally delineated and this could have been exposed earlier through engagement with the wider internal network.

PROJECT *There is an alternative framing of this theme and that is one of boundaries - disciplinary and physical. The framework could address both by encouraging engagement with a range of internal teams (through internal and external networks) and a pause to reflect upon system boundaries. Whether all disciplines consider it their role or will instead go "fish-eyed" is a values and behaviour matter that may require addressing for successful implementation. Not everyone will embrace a framework, although an approach that is reflective not prescriptive may have a better prospect of success.*

GOVERNANCE *Boundaries can also be delineated by a governance regime. By encouraging and pressing for wider social and environmental benefits in projects, a governance regime could encourage and seek to encapsulate the potential for greater benefits early on. At present however, there is a regulatory reluctance for financial credit to be given to water companies for projects that exceed the strict remit of a water company. The participants provide examples of where this fundamental underpinning and narrow framing are inhibiting projects with wider social and environmental benefits.*

Ultimately these are issues about the basis of the governance regime at its core philosophical level – who should be paying for the wider benefits – water company customers, taxpayers, beneficiaries, polluters? These are issues the proposed governance framework cannot solve but can work towards. It can seek to embed transdisciplinary thinking to solve ‘wicked’ problems by encouraging a challenge to the status quo to resist incumbent business-as-usual approaches where they can be improved upon. It can at prompt thinking and ask questions of a project at an early stage.

7.4.3 Trust and Public Relations (PR)

Also within water companies were insights around the issue of Public Relations (PR), closely connected to issues of trust. At the time of one interview the news around Southern Water¹⁵ was still circulating strongly,

But also, and recent events haven't helped us as a water company, you know the Southern Water debacle with them very, very bad for the industry, and we are feeling it now. I got a phone call today from a problem that we're having with one of our treatments at [...]there's a problem with one of the odour control units and they've got somebody to fix it, they've got a plan to fix it. And, but locals are now on social media discussing all sorts of conspiracy theories.

There were examples of seeking public trust and confidence in line with regulatory requirements and customer satisfaction metrics, but more often they manifested themselves

¹⁵ For details see, Environment Agency (2021) *Record £90m fine for Southern Water following EA prosecution*. online: UK Gov. Available at: <https://www.gov.uk/government/news/record-90m-fine-for-southern-water-following-ea-prosecution> (Accessed: 18th May 2022).

as issues between water companies and also with their regulators. In a privatised regime, water companies are generally competing and rival entities. Trust between water companies was said to be improving, with recent efforts being made, such as through the Ofwat Innovation Fund¹⁶, to encourage collaboration, but this was not universally the case. Comments from different participants include,

the other big one within the water industry, is the 'not invented here' syndrome okay. So here we go this is, this is the famous quote on it, which somebody said at the conference and I kind of picked up on it, because it's such a great one but it's the water industry has more pilots than Gatwick, more trials than the Old Bailey. That sadly is extremely true.

In adaptive governance, trials and experiments are encouraged. The number of trials does not in itself suggest a problem, there needs to be room to fail and learn. There is a clearer problem however if the same trials are repeating, a problem being that a new innovation has to be trialled in every water company with one company not accepting or sharing another's results or trials for PR's sake. This was not just an issue of data gathering but particularly around wanting to be seen to be innovative.

And again, you know, having been here a while I've seen trial after trial after trial on the same things and you like think well you know okay has anything changed, you know. I am conscious that it is a bit like a publicity thing and want to seem to be innovative and you know.

¹⁶ Ofwat (2022c) *Water Innovation Competitions*. online: Ofwat. Available at: <https://www.ofwat.gov.uk/regulated-companies/innovation-in-the-water-sector/water-innovation-competitions/> (Accessed: 18th May 2022).

And another participant also noted.

[on a new piece of tech] We want it, we want to be the first. It [the water company] won an award a couple of months ago. Some people were over the moon at winning this award, when at the time it didn't work which was embarrassing.

and further

But they [the water company] wanted the shiny thing and they wanted to do it now on this site where many other sites would have been appropriate. But then they wouldn't have been the first. Another water company would have got there first.

It should be noted that whilst this was a common theme, there was one participant with a competing view who did not recognise the issue over trials so the 'not invented here' syndrome may vary between water companies and individual experiences.

PROJECT *This theme suggests that one set of trial data for one company may not open the doors to the others, an issue an external innovator may need to be aware of. Successful tests with one company may need to be replicated over and over again with others. It may also suggest that being in-tune with drivers, particularly around what might enhance the water sector's PR or innovation portfolio, may be a strategic issue to enhance in the business plan.*

GOVERNANCE *The issue over 'not invented here' syndrome appears recognised by Ofwat (Ofwat, 2019, p. 10), and is starting to be addressed with better collaboration between water companies encouraged. As collaboration between competing businesses may not happen*

naturally, this is an example of where the governance system has to tackle the natural behaviours endemic in a market-regime to encourage the behaviours it wants to see.

7.5 NETWORKS

Evidence of network governance was predicted by the literature and evident in the interviews. Networks were used to solve problems, understand the 'rules of the game' and understand the language and nuances of the sector. The need to understand rules-in-practice as opposed to all rules-in-writing, as suggested by the literature review, was endorsed. The general complexity of the legal environment and processes were noted, particularly the impact this had on small start-up innovators. These include the procurement and contractual legal processes for contractors through to the language and understanding of the sector.

The issues faced by innovators was recognised. A participant from within a water company summing up the position,

We don't make it easy for them. Because we're a large organisation that doesn't move very quickly, so when you've got a small sort of one or two man band, they're trying to get this kit in, they're desperate for the order but we're making them go jump through all these hoops, and all this governance, and all this process and it's like, you can almost see the sort of light in their eyes dying as you go through the process.

And another commenting upon this from an innovator's perspective:

it's a really, really small company, so things like applying on an official website and having to put in almost like a job application, you know, having to put in

loads of forms, loads of proof, loads of case studies and so on. It can be really difficult to find the time for that, even though it makes it more accessible...Like the Ofwat innovation fund scheme, I don't have the capabilities to go for something like that. Lots of the companies have people who their full-time job now is to chase up those applications and so on.

And another breaking through where there are existing contracts in place,

they originally came to us because they were trying to ingress into the water industry. They were approaching these water companies and telecom companies directly and they just didn't want to hear about it really. They said you're not coming on to our networks if you haven't got the right training or anything like that in place. We've got these contracts set up.

The legal issue of procurement contracts came up as affecting projects on three occasions. There was an entrenchment towards existing networks and difficulties in breaking-in where legal structures, such as procurement contracts and their regulation, were in place. Another participant commented further on the same theme and how this impact coupled with the regulatory cycles,

the water company might be really keen on it and they might say, this is really excellent, but actually the majority of the water companies have long-standing or long running tier one contractor agreements. So actually you can't just bring in a new technology, actually, probably the person with that idea needs to talk to the contractors and actually the contract might say, well for the next five years we're working on this contract with [] so we're not actually interested in anything new for five years. Come back to

*us in five years' time when we've got to show some innovation to the client
and we might be interested.*

When asked about the biggest hurdle for an innovator, one participant commented,

*I mean from a day to day perspective, and you've probably had everyone say
this, is the procurement*

The picture painted was of cumbersome procedures and legal hurdles through formal procurement and contractual processes.

When coding the texts, a distinct theme around legal hurdles and procurement contracts was considered and could be justified by the above quotations. However, whilst this could be a theme in itself, networks came into play to offer a solution and it was decided to keep the procurement sub-theme under the network theme as a result. To explain the point, when looking at ways to support innovators in this legal minefield, a participant highlighted that those with an existing fixed-term contract, termed framework contracts, were a useful source of access into the network. Those with framework contracts were used as access points for innovators, rather than a barrier. The reason given was that those with a framework contract were keen to keep hold of it. An attraction for water companies at the next round of negotiations for renewed contracts was the new innovations they could offer. These suppliers were becoming part of the access route for new, smaller companies.

A participant provided an example where they acted as an intermediary and provided an access route for an innovator, an innovator that had, until that point, made no progress, commenting how difficult it was in the UK,

it's been like six years since I first discovered the company and started working with them. And it's only really been in the last two years that we've started to take it forward to a lot more in the UK, because they've been working externally and found it's a lot easier with technology and patents to get into rounds in say, the USA and Spain.

The participant's project brought the innovating company into the sector through use of its existing framework contracts. The intermediary provided a conduit, or a safe 'niche', for the project to be developed before being taken forward into the regime. This was an example of an innovator finding the right person within a network. It also suggests that if a project is struggling looking outside the UK to other jurisdictions could be a useful strategic tool; the network need not only be UK based.

There were other discussions on the network to support an innovator. As one participant put it,

I think often if they find the right person to talk to, they will get listened to. Another part of it is that they don't often have, especially if they're coming from slightly outside of the water sector, they don't have the knowledge or the right language or understand the background.

Networks helping with communication and nuances of the sector being highlighted by the participant. In looking at getting to the 'right person', the route was not necessarily with the pre-ordained, R&D route set-up by water companies,

you really need some champion within the [water] company, and ideally that champion needs to be not in the R&D department, but somebody responsible for the operations side of thing.

and another,

Actually sometimes the innovation team route seems the slowest possible route of all. It's much easier to go to somebody out in the business who has got the problem themselves, because if they see the solution in it and it ticks their boxes, they'll probably say yes straight away.

PROJECT *The importance of networks was suggested by the literature and endorsed by the comments. It appears that a mix of R&D, operations as well as engineering input and experience should be included in the network to ascertain the best innovation route for a water company (which may not be the rule or process in writing – but the practical way forward in practice).*

For teams outside of the sector, the need for the framework to flag the possibility of existing procurement contracts is also indicated. To turn this issue into a potential solution, rather than a constraint, these contracts could be construed as part of the network and understanding the opportunities this might bring could form part of a strategy plan to expand a project's network. Either way, the existence of procurement contracts, the parties involved and the date for renewal could form part of the strategic enquiries of a project team.

GOVERNANCE *Networks appear as a way of navigating the complexities of the regime for a suitable, if imperfect, solution. This was anticipated by the literature and seen in practice here. It suggests this is given a prime focus in the framework.*

The legal rules and contractual principles around procurement of large infrastructure projects are complex, involving as they do the spending of significant sums of public or consumer's money and use of critical national resources. Counter-fraud, bias and accountability are necessarily controlled by legal measures in many instances. The law can provide necessary certainty and enforceability. The outcome however can be a difficulty for inexperienced players seeking entry into the market and a fix towards incumbents and the status quo.

The prevalence of procurement and framework contracts may also suggest another trend. Choices are being made to manage risk by water companies through the use of outsourcing and framework contracts. The costs of innovation could therefore rest on these service provider entities rather than the water companies. There was insufficient data to address the impacts of this governance issue further in the narrative, but this could form part of a further project in the future.

7.6 ASSETS AND VALUE

The regulatory regime for the sector rotates around the Asset Management Plan (AMP) and price review cycles. The AMP and price review cycles refer to the water industry's 5 yearly cyclical price setting and business plan regime agreed, managed and enforced by Ofwat. This is a key and important mechanism for regulatory oversight, addressing investment and spend within the sector alongside the balancing of profits with cost to the consumer. Despite the accepted need for regulatory oversight in the regime, criticisms of the regime, particularly

around it promoting cyclical rather than steady, long-term investment, are well-rehearsed and long-standing (e.g. HM Treasury, 2012). As the critique of the regime is long-standing and solutions sought, it was not known whether problems had been tempered over time and this was explored.

Budgets and budget cycles impacting on projects was expected and noted,

*firstly, money is a constraint okay and let's be, to be frank about it, we have
a budget that we've set for five years that says this is how we're going to
spend our money...And that within a regulatory recycle can be really hard
so you know you're in a situation where you go okay I've got to spend
200K...*

Next was the issue of timing. There was consensus that the regulatory cycles were factors that impacted on whether a project was taken up or not – specifically related to a project launch needing 'good' timing. For example,

I think it was at the end of an AMP they wouldn't have done it.

Similarly choosing your moment to put forward a project,

*... you have these nest eggs and kind of like say well when is the right time
to let them fly.*

However, there were some less obvious impacts, including barriers hindering more radical research or research which had a long lead-in time,

something that I found was quite a barrier was the whole AMP system set up. I really quite struggled with that as a set up with my research that I was doing, because it was very blue skies, it was very this isn't something that's going to be happening next year or the year after in five years' time. This isn't something that's we're doing today but we're doing it's for like 15 years or 50 years down the line.

The impacts on staffing and knowledge retention were also noted,

I've lived through one AMP cycle. It was lots of work going on, and then a few years later, they started getting rid of people, really bad to see. Now we're suffering the absolute pain of just having too much work, too many projects in the middle of the AMP...So we lose staff at the end of each cycle and the same happens every AMP or thereabouts...

Another commented,

they are rotating people so much that they don't really get anybody who has the expertise.

Knowledge loss through a project impacted by the AMP cycles was noted.

Ironically, and despite being called Asset Management Plan, the consequences of the above did not appear to be driving strong asset management in the view of participants. The participants with projects connected to asset management and hard infrastructure talked passionately around this issue,

there's a large portion of what we're doing at the moment that is funded for reason of improving the water courses, improving the quality of effluent, but in terms of managing our asset base and making sure that we're managing our risk and the condition of our assets, there's challenges within that and there's probably some projects, some areas that do need funding, but the works never seem to quite get that funding because of the way its allocated to us, the drive that we're measured on the regulations.

Another explained,

it was a very lean plan, and I think the scope to do lots of capital maintenance work and improving sites that are sort of not necessarily linked to ODIs is limited.

ODIs being a reference to Outcome Delivery Incentives, performance measures set by Ofwat¹⁷. The participant further commented.

the pot it goes down on is the capital maintenance fund because it's not a regulatory requirement, so you start drawing down on that, and then the budget, the amount you have to go in there and fix stuff gets less and less and less.

This was a view endorsed by another participant talking about funding and regulatory direction,

¹⁷ For further information see: Ofwat (2022b) *In-period ODI determinations*. online: Ofwat. Available at: <https://www.ofwat.gov.uk/regulated-companies/price-review/in-period-odi-determinations/> (Accessed: 19th May 2022).

I think there's a few [wastewater plants] that you walk around and think Jesus, you need to go and put some investment to this place. Because stuff just isn't working, but it seems like, at the moment, some sites are in the bracket of, unless something catastrophically fails, we can't go and we haven't really got the money to go fix it.

It is not within the remit of this study to unpick the decision-making around funding, AMP or ODI arrangements for the projects discussed. The arrangements are complicated with a range of actors, with different drivers, involved. However, all of the participants engaged with asset management had similar views in relation to the outcome of these processes and where these projects sat in the order of priorities. The participants who commented on this area linked the regulatory cycles to negative impacts on innovation, the loss of knowledge from redundant staff and asset maintenance projects being less likely to get funded. However, there was one participant whose comments suggest that the issues may run deeper than the regulatory pull. The participant, with over 40 years in the sector, talked directly of the lack of value given to assets,

And it's for the water companies and the staff to really value the assets that they've got, not just see them as a way of generating some income, this year, next year, but see them as a core part of what enables us to run our civilisations the way we do.

This participant viewed his role as a public servant and he associated infrastructure in a similar way. He continued with a sense of a crisis waiting to happen,

And if you look at the replacement cost of all of our sewers, it's hundreds of billions of pounds. But everybody hopes that they won't be sitting holding the parcel when the music stops, and they'll pass it on to the next person.

This participant's comments happened to be revisited by the author during the UK's unprecedented heat wave in Summer 2022. The subsequent mix of drought alerts, flooding and sewage overflows show a system unequivocally under stress and the participant's comments (from a water company) about '*when the music stops*' appear particularly prescient. The point to note is that these comments have not come from media exposés or public concern but direct from within the sector, including those managing the assets from within water companies themselves. It is accepted the position in relation to finance of the sector is complex. It is not possible to unpick the regime mechanisms in detail to interrogate these representations, but the suggested outcome of a perceived priority to managing assets is worthy of further investigation.

PROJECT *Participant comments suggest that regulatory cycles continue to impact on projects and a team should be alive to those cycles. The sector runs on its own time-frames and a project's timeframes may need to adjust as a result. This may be especially prudent for projects outside the sector seeking to improve the asset base; the project needs approval at a suitable time in the budget setting phase.*

GOVERNANCE. *Despite the long-standing concerns about the regulatory cycles, problems continue. The consequences of low maintenance priorities over time can be leaking, inefficient assets and reduced capacity for such as stormwater overflows, or as put by a participant, someone will be footing the bill at some point 'holding the parcel when the music stops'. There*

is a suggestion that it is the regulatory cycle that is influencing funding away from maintenance projects, but to be certain further studies would be needed into the water sector and Ofwat negotiations and how the higher echelons of the water sector and Ofwat are valuing its asset base in its funding allocations.

As an aside, it may not be formal regulation that solves this, it may be more informal governance mechanisms that prompt change. At the time of writing, public concerns over wastewater disposal, sewage dumping at sea and bathing water quality are gathering momentum (e.g. Harvey, 2021; Laville, 2021; The Wildlife Trusts, 2021), suggesting a call for re-prioritisation from customers/consumers/citizens that may influence the governance regime in the coming months and years. The comments from participants share rather than counter those concerns, suggesting at least some level of sector support. Concerns over the state of the asset base actually exist within the sector itself. The suggestion is that those that work in the sector are not seeing the investment they feel is necessary into the asset base and the reasons for this are governance and funding mechanisms, at least in part.

7.7 THE RESOURCE, LAND AND THE ENVIRONMENT

Moving from the technical aspects of the system, the asset base and hard infrastructure, the question then arises as to how the environment and the water resource is valued. This is a component of an SES and how the environment, land and the water resource were framed and valued was considered.

The governance regime has been impacted by the global climate crisis, for example through international agreements such as the SDGs as well as noticeable impacts of climate change on water supplies. A changing policy approach from central Government was noted,

Okay, and effectively the government turned around and said that was fine for back then, but it's no longer acceptable, we have London is the 8th most likely capital city to run out of water, okay there's no do nothing option here, we need to be driving down leakage below any kind of economics it's not about that anymore it's about sustainability.

However, it was not just direction from policy. The impacts of climate change were visible and that in itself was invigorating prompts for action,

In the past 10 years I've seen a lot of dry weather situations and drought, very low levels in the reservoirs. We aren't getting the rainfall we used to get all year round. We're having to keep the reservoirs full. So we're trying to protect the reservoirs as much as we can.

The projects linked to climate change were mostly projects linked to the sustainability and resilience of the supply. There were no projects discussed that had carbon neutrality as their focus although participants commented that carbon calculations had to be included in their assessments. In terms of those assessment the physical characteristics of water, its location, hydrology and the siting of infrastructure with land availability was a feature of the projects, as anticipated by the SES literature.

There were two particular projects discussed by two participants that highlight the issues under this theme. They are also projects with multiple benefits, innovative thinking and worked across networks and local jurisdictions. They are highlighted here as examples of where the dominant drivers of regulation, prone to steer projects away from multiple-benefit schemes, were overcome.

Water Transfer Scheme

The close connection between value, land use and water was most clearly illustrated by a water transfer scheme. The scheme involved the construction of a new water basin¹⁸. It is of note that earlier attempts to gain approval for the project to benefit the water company's own customers had not been successful, in part because of the relative abundance of water within its boundaries relative to need. The difference with the new scheme was that the new water basin was not to be built directly for the benefit of its own customer but would provide water for an area of far greater need – the water company's neighbour. The basin was to be built on its land but for the benefit of a neighbouring water company. In looking at why the water company wanted to push the project forward the participant explained that the reason for the project was not resilience of supply, it was not the water that was valued per se, but the land that accommodated it and its ability to generate a financial return. The new water basin was seen as a worthwhile investment turning unused land into capital and/or income generation.

Whilst the water basin's construction is a significant event in itself, what was novel was the legal structures behind it. The water basin was being built on land of one water company (the

¹⁸ Full details of the scheme are not provided to protect anonymity.

donor company) but for the benefit and use of another (the donee company). This was not a case of water transferring from the abundant north to the depleted south, but between direct neighbours because of where administrative land and water boundaries had been set. The water and access land needed to improve the resilience and sustainability of the supply was not available in the jurisdiction of the donee water company, but within the borders and remit of another. The positioning of boundaries between water companies had been drawn up decades earlier and the artificial nature of the governance regime and its man-made administrative borders, meant contractual and other regulatory arrangements had to be put in place for water in one water company's 'jurisdiction', to be stored on land for the benefit of another water company's customers.

There are questions over how profits for this enterprise should be calculated. These customers would all be based in England, in adjacent parts of the country. It is conceivable that the water bills would be influenced by this arrangement, with one set benefiting from the investment paid for by another – acknowledging however that the scheme would be closely monitored and regulated by Ofwat. The participant was asked if the scheme was likely to mean water was more expensive than if the donee water company could have constructed the scheme itself, to which the reply was '*yes that is a fair comment*' although also noting the controls Ofwat would put in place to control or prevent that. Either way it is a convoluted mechanism arising as a result of a privatised structure and administrative boundaries being at odds with ecosystem and natural boundaries.

In addition to the legal novelty, the ingenuity of the project itself and its wide-reaching benefits were apparent and also provides insights into benefits of wider problem-framing. The

driver for the project, according to the participant, was not wider social and environmental benefits in the first instance, but the benefits to the donor company of gaining a return on land. It was looking for an opportunity to utilise the land that drove the vision. That is not to say that the potential for wider social and environmental goals was not grasped. The wider benefits were substantial. The benefits of the scheme to donee-customers was a more sustainable and resilient water supply. There were also significant wider benefits still around improvements to local green and blue space for local residents, an improved environment enhancing biodiversity, improvements to a local levelling-up agenda as well as local highways issues. The participant explained these benefits were used to enhance the attractions of the scheme (projects to gain approval having failed in the past) to secure its chances of approval and acceptability. Market drivers together with harnessing helpful components of governance resulted in innovative thinking deriving multiple benefits for customers and the environment.

Circular Wastewater Scheme

The second project was created as a means of moving water to where it is needed and the re-thinking of wastewater as an asset. At its simplest, the project involved taking wastewater from one water body to re-fill a river upstream¹⁹. It was a complicated scheme involving multiple sites, agencies and jurisdictions. The participant explained that a group of water companies and local authorities had disparate issues around wastewater processing, quality of water bodies and water abstraction. A project to address all of the issues was a scheme involving NBS with social and environmental benefits through improved green and blue space,

¹⁹ Full details of the scheme are not provided to protect anonymity.

enhanced ecosystem services and biodiversity as well as improved sustainability and resilience of the water supply.

The biggest difficulty, according to the participant, was having the knowledge and vision to bring all of these apparently disparate problems across boundaries together and then forging the network to frame the problem widely enough to capture its potential. Once that network had been brought together the potential for solutions to multiple problems developed including the disposal of wastewater by one addressing dangerous river abstraction levels by another; the project used problems in one catchment as a solution for another. It needed a visionary with oversight over the whole area to see potential solutions and it also involved the re-framing of wastewater as a potential asset. It highlights how different solutions can arise if the initial problem is framed sufficiently wide.

The participant discussed how those engaged with the scheme had very different drivers for progressing the project although the huge cost of traditional alternative schemes was said to be a major issue in the project's favour. A hurdle was the experimental nature of the project and uncertainty of the outcomes for regulators, compared to existing systems. The overall benefits however were so significant to help persuade regulators.

PROJECTS *These projects suggest wider reaching benefits around water resilience and sustainability can be achieved through motivation, networks and wider problem-framing but also a visionary who can see beyond water company boundaries and bring networks together. There were regulatory drivers and market forces behind the projects with one project representing an investment and the other being an alternative to a more costly, traditional solution.*

The circular scheme was also the only project around the circular economy discussed by participants, in this instance wastewater, although participants did refer to the possibility of its use in nutrient removal schemes in the future and reframing burdens into benefits. The projects discussed rarely had circular economy or resource re-use issues in mind with projects still predominantly being either potable or wastewater focussed, but not both. Nonetheless the innovative circular wastewater scheme shows the benefits of holistic water management, wider problem-framing and solution generation.

GOVERNANCE *Both projects were about the use and value of land as well as water. Solutions were dependent on geography and place in keeping with SES studies and support the literature review on the value of SES in thinking about socio-technical systems such as governance and infrastructure. They were both projects that framed the problem widely and were able to push passed the artificial administrative borders.*

The two projects show that projects that achieve greater and wider social and environmental benefits can succeed within this governance regime. It is not however easy. What appears to be required is mix of an ability to think beyond boundaries (physical and administrative), alternative solutions that are dauntingly expensive, a visionary and/or an engaged network and the utilisation of policy alignments such as resilience, to support the case for change. There is a sense that these achievements are despite the governance regime not as a consequence of it but at the same time it shows how seeking policy alignment such as around resilience (harnessing governance as a positive tool) and engaging with the networks can pay dividends.

7.8 NEW AND CROSS-CUTTING THEME - DATA

Within the themes were threads of a cross-cutting theme around data that pervaded a number of aspects of the governance regime. This was not a theme predicted by the literature review but materialised through the coding exercise.

Issues around data and data management appeared throughout the interviews, described by a participant as the '*new gold*'. Generally, it was the lack of data that caused concerns, rather than too much data and its attendant bureaucracy. This has already been seen in Chapter 7.3.3 around the ease of enforcement of discrete data points in contrast to wide-ranging ecosystem benefits with multiple points of reference. There were further challenges for innovators, however, as part of the governance regime. As put by one participant,

there was a real challenge that water companies didn't really understand the baseline conditions that they had in terms of how much energy were they actually using, how much chemicals are they actually using, so that when somebody did put in a more advanced control system, there wasn't an easy comparison between the before and the after,

and further,

not having the baseline data, you have some frustration, but it also maybe creates a bit of people not believing necessarily the benefits that can be achieved and the cost benefits of it, especially when then you get the sales team within some of these companies quoting really big numbers.

The lack of baseline data in the above examples resulted in an inability to fully calculate the benefits of a change to the system; there was no 'before and after' to compare. The position in the UK was said by two participants to be in contrast to the situation in the US, where in their experience, data was not only collected but was publicly accessible. The governance regime around data is therefore more supportive in the US, in their view, with the rights of the public enshrined in US law. In contrast, there is said to be no such requirement or clear picture of ecosystem health in this country, only pockets of data. One participant commented,

Why should they do it? Well, one, in the US and Spain, this is all information in the public domain. And it saves on actual operational costs to stay in compliance, and the regulators in Spain, for example, they allow it for reporting. So it will go live on the website for the general public, it will go live to the regulator for reporting, and it will go live to the two companies who have the interest with the water. So it's open and in the general public. In the UK, there is no requirement to do, there is a requirement to do one single test at exit of the plant. Fill in form and submit that to the regulator. And when there's nobody checking, you don't know whether that's in compliance.

Similar comments arose around accountability and the lack of complete data allowing 'green-washing' through the selective presentation of results.

There are operational, monitoring and evaluation concerns with the lack of baseline data but further comments from participants expanded the narrative around data further, a pressing

problem being how to manage, process and integrate the data into existing systems. As one participant put it,

the main pushback that I've had so far with the project is people are saying, it's a really good [tech], really reliable, the maintenance you've got that down to a tee, but they're kind of saying we don't know what to do with the data. They don't know how to integrate it into their control philosophies. Or on the compliance piece they're saying you know, at the end of the day it's not a parameter that's regulated.

This is a reference back to both operational integration and regulatory drivers and the links seen around strong regulation and networks in earlier themes. This highlights the pervasive nature of this theme.

There was a glimpse within this theme of how data could connect to justice issues. In particular how data on the environment could be considered as feedback, or, phrased another way, a voice for the environment. In procedural justice terms, this voice could be considered as a form of participation; a way in which the state of the environment is made 'visible' and acted upon. As identified by a participant,

the problem with the ecosystem, is it can't talk for itself

and further wanting to understand changes to the environment better to make better decision,

I mean the only way you would know be if you put sensors in the system and the means of having a feedback loop if you like.

There are two ways of looking at the narrative around data from the participants' comments. The first is that the lack of baseline data can represent real problems. It can prevent an innovation proving its worth by an inability to show improvements in the data and so its full potential and value. It can lead to selective reporting and opportunities for 'green-washing'. It can also leave our understanding of the state of an ecosystem sadly lacking.

The second looks at the issue the opposite way. If lack of data are a problem, there are considerable improvements that could be gained within the regime if data collection and governance underwent a re-think within the sector. A re-think could consider the data that are actually needed, not to comply with a narrow regulatory parameter but for good ecosystem health.

A single example of this in action arose during the discussions of one participant's project around the 'sentient catchment' a project seeking to gather a wide range of data for a better understanding of changing conditions, weather patterns and the like and so improve the environmental performance, around sewerage flows. The project was premised on the basis that there was simply not enough information to optimise performance and protect the environment, and the project was devising a system of sensors to improve that knowledge. When asked about how the project had got off the ground it was explained that the way to garner support, and so funding, was to get the public on side with education campaigns which in turn gave them good customer metrics and enabled them to convince regulators on spend.

It is acknowledged that unlike the two projects discussed at 7.7 this project was still at an early stage and was significantly less costly. It does however align with those projects by not allowing itself to be shackled by narrow parameters and was driven by a visionary participant,

looking beyond those regulatory requirements. It is also of note that the participant talked of embracing wide problem framing and a multi-disciplinary approach in the way the project was conceived and progressed.

These were not the only examples of the pervasive nature of comments around data. Data issues were mentioned in connection with security, particularly software security, with water infrastructure being an issue of Critical National Infrastructure with the strongest safeguards required. There were also issues more generally around risk, suggesting risks were sometimes hidden as a result of the lack of data and as a result, changes not initiated and the *status quo* maintained.

PROJECTS *To help visualise this theme a kumu diagram was prepared linking participant's comments from the interviews together. This is presented in Figure 7.2, with key themes in orange. As an example, the issues around narrow regulatory parameters can be seen in the diagram through the following connections:*

- *Narrow regulatory parameters to*
- *Narrow measures of success to*
- *Narrow fields of data collection to*
- *Lack of baseline data to*
- *Insufficient data on environmental status and change to*
- *Lack of voice for the environment and justice considerations*

Connections can also be seen in hurdles for multi-benefit schemes and links to the embedding rather than challenge of the status quo. Looking at the links can also show the potential for

change and how these levers may be reversed. For example, improvements in wider regulatory framing may improve data generation and could encourage multiple benefit schemes.

How the data generated by a project will be gathered, integrated with existing systems and utilised should be part of the strategic plan, including how it aligns with regulatory targets.

There may even be a time when a project exceeds its immediate requirements and takes an RI opportunity to gather data beyond immediate regulatory requirements to feed into a fuller picture of ecosystem health supporting an environmental justice agenda.

GOVERNANCE *Data were a cross-cutting theme and in drawing the strands together illuminates the consequences of a tight regulatory regime and vice versa, levers to initiate change. In a regulatory system where what is valued is what is measured a tight, narrow regulatory framing appears to result in narrow data gathering and narrowly-focussed projects. Conversely, it suggests that regulatory change could bring about data improvements that can have a positive impact on the drive for projects with multiple benefits, just innovation and healthier ecosystems.*

Figure 7.2 Kumu Diagram: Data

The diagram illustrates the relationships between various data-related concepts. The central nodes are 'Regulation', 'Data', and 'Justice Issues'. 'Regulation' is connected to 'Regulatory Vision and Priorities (the Regime)', 'Impact on solutions chosen', 'Projects chosen with strong regulatory drivers', 'Projects less likely if no regulatory driver', 'Hurdles for Projects with wider or Multiple Benefits', 'Difficulty in proving success', 'Lack of Baseline Data', 'Landscape drivers (e.g. climate change and resilience)', 'Insufficient data on environmental status and change', 'No voice? No data providing feedback on status', 'Justice for the Environment? lack of active participation', 'Social Justice - reduced opportunity for active participation', 'Reduced bottom-up drivers for change', 'Reduced visibility: No stimulus for social pressure groups', 'Lack of data protocols (landscape and niche level)', 'Security issues', 'Hidden risks', 'Embedded status quo', 'Resigned passive behaviour, lack of challenge', 'Outdated methods of data collection for enforcement', 'Reduced funding', 'Ease of enforcement concerns', 'Build up of rigidity and complexity of regulation', 'Power of regulation', 'Enforcement Difficulties', 'Narrow Regulatory Parameters', 'Narrow measures of success', 'Narrow fields of data collected', 'Hides behind lack of data (reduced accountability)', 'Lack of value ascribed to additional data', 'Lack of Drive for Data Collection (if no regulatory requirement)', and 'Regulation'. 'Data' is connected to 'Hurdles for Projects with wider or Multiple Benefits', 'Difficulty in proving success', 'Lack of Baseline Data', 'Landscape drivers (e.g. climate change and resilience)', 'Insufficient data on environmental status and change', 'No voice? No data providing feedback on status', 'Justice for the Environment? lack of active participation', 'Social Justice - reduced opportunity for active participation', 'Reduced bottom-up drivers for change', 'Reduced visibility: No stimulus for social pressure groups', 'Lack of data protocols (landscape and niche level)', 'Security issues', 'Hidden risks', 'Embedded status quo', 'Resigned passive behaviour, lack of challenge', 'Outdated methods of data collection for enforcement', 'Reduced funding', 'Ease of enforcement concerns', 'Build up of rigidity and complexity of regulation', 'Power of regulation', 'Enforcement Difficulties', 'Narrow Regulatory Parameters', 'Narrow measures of success', 'Narrow fields of data collected', 'Hides behind lack of data (reduced accountability)', 'Lack of value ascribed to additional data', 'Lack of Drive for Data Collection (if no regulatory requirement)', and 'Regulation'. 'Justice Issues' is connected to 'Hurdles for Projects with wider or Multiple Benefits', 'Difficulty in proving success', 'Lack of Baseline Data', 'Landscape drivers (e.g. climate change and resilience)', 'Insufficient data on environmental status and change', 'No voice? No data providing feedback on status', 'Justice for the Environment? lack of active participation', 'Social Justice - reduced opportunity for active participation', 'Reduced bottom-up drivers for change', 'Reduced visibility: No stimulus for social pressure groups', 'Lack of data protocols (landscape and niche level)', 'Security issues', 'Hidden risks', 'Embedded status quo', 'Resigned passive behaviour, lack of challenge', 'Outdated methods of data collection for enforcement', 'Reduced funding', 'Ease of enforcement concerns', 'Build up of rigidity and complexity of regulation', 'Power of regulation', 'Enforcement Difficulties', 'Narrow Regulatory Parameters', 'Narrow measures of success', 'Narrow fields of data collected', 'Hides behind lack of data (reduced accountability)', 'Lack of value ascribed to additional data', 'Lack of Drive for Data Collection (if no regulatory requirement)', and 'Regulation'.

7.9 ABSENT THEMES

This leads into discussions on justice more widely. There were two themes anticipated by the literature review around justice and RI which were not fully identified or corroborated by the interviews.

7.9.1 Justice

Issues of ethics, equity and justice issues were not raised unprompted by participants as drivers behind projects although justice issues were apparent between the lines of the texts. For example, in relation to choices between customers and the environment one participant, openly and frankly commented,

I mean it's not a great thing to say, but if you've got a choice of discharging into place, which is in plain public view and any pollutant load and one which is not and people seldom go and never need notice it, which would you choose to do? It's obvious isn't it.

This was expressed in discussions on a project around wastewater discharge, regulatory compliance and PR. In this case with two options to discharge, the one out of public view is more likely to be chosen even if more detrimental to the environment. This supports arguments that the environment does not have a voice, contrary to ideals of participatory justice. It highlights the hidden behavioural consequences of the regime for the environment with social and customer focussed PR and regulatory controls.

There was only one example of a positive justice driver and that was indirect. The example was linked to the 'levelling-up'²⁰ agenda; levelling-up of opportunities being intrinsically linked to issues of distributive justice. The issue materialised when a participant was applying to a competition for grant funding. How the project supported levelling-up appeared as a question on the competition proforma. The levelling-up agenda was not a driver for the project but had to be addressed to meet the grant criteria. In doing so, the participant said their project was likely to impact on smaller diameter pipework, more likely in urban environments and in turn more likely to impact poorer communities. On that basis the criteria could be fulfilled. Whilst there was no evidence from this study of a drive towards levelling-up there was at least a suggestion, in the form of the funding request, that those sorts of policies are starting to be seen and could drive positive behaviour or thinking.

On asking direct questions around justice, two further issues were articulated. The first addressed where money would best be spent, the issue being expressed as whether to make some modest improvement to poor, ecosystem-depleted and predominantly urban areas or with the same money raise a good ecosystem to excellent status often in rural or more affluent areas. One participant commented,

I know the agency have a bit of a thing about this I know. And they feel that with WFD they need to improve everywhere and to improve rivers in inner cities, so people can enjoy them and all that. There is a conflict there I think if you haven't got enough resources to go around so do you say let's

²⁰ For the recent policy paper and UK Government interpretation of 'levelling-up' see Government, H. (2022) *Levelling up: the United Kingdom Executive Summary*. online: HM Government. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1052046/Executive_Summary.pdf (Accessed: 23rd May 2022).

get everywhere sort of fairly mediocre, or do you say no, we need some places that are really good you know where you have got these wilded catchments you know.

This stems from a tension between prioritising social improvements and what is best for the environment.

The second set of issues around justice discussed injustices along social lines,

Recent studies from America show where waste tips are located. A very high proportion are in the most disadvantaged communities. Now I'm not saying that we have the same planning systems here as they have in America. But there is a degree that I think you could say that that occurs. But at the same time you look at where the pressure has come from for, conversely, let's say bathing beaches, which has been in the old industrial area on the Wharf, so I don't think it holds true all the time. But there is an element of truth in there, but those areas that are socially deprived tend not to feature highly in terms of where money is spent to improve the environment.

When discussing consumer preferences and whose views were articulated another commented,

It's very much what's on their door and what's affecting their world and is that an issue with driving resources towards the haves rather than the have nots at all? Unfortunately, I think it does.

the participant commenting on the weight of communication from more affluent areas in participatory process. Further on participatory processes and planning another participant recounted a comment from a customer,

*Why are you building it here when there is a perfectly good Council Estate
over there?*

a comment underpinning prejudices on where development should be sited. Further, whilst no-one admitted to any prejudices during their projects there was an admission of pressure by some from more affluent communities where there was, generally, better articulation of, or means to articulate, their case.

PROJECTS *Justice themes were not clearly articulated within the projects but issues were discernible between the lines. The nature and extent of those issues was not possible to determine (as they are not being raised and addressed) but there are tensions between haves and have nots and between immediate social, future generations and environmental needs. This suggests a potential role for justice within a governance framework to seek to address these tensions, openly and accountably.*

GOVERNANCE *The issues here could be framed as issues of justice and power. From a social justice perspective, there appears to be some hidden slanting towards more affluent communities, although this is unlikely to be unique to the water sector. From an environmental perspective, the environment has a weaker voice when resources are allocated, again framing the issue as one of (uneven) power and participation.*

There is potential here for justice thinking as a tool to re-frame the issues. Justice and data together do not resolve these tensions but could more openly air them. For example, with procedural justice and respect with data improvements, the environment could have a more effective 'voice' within that system. The lack of a voice being viewed as an injustice that should be remedied. From a distributive justice lens, the full benefits and burdens of each policy approach would then be made plain as the trade-offs through the distribution of benefits and burdens are more fully articulated.

7.9.2 Responsible Innovation (RI)

There was no reference by any participant to any RI or ethical code impacting on any of their projects, to the best of their knowledge. For example, asking one participant a direct question about any particular ethical code they operated under they noted,

I mean, provisionally we're driven by needing to demonstrate efficiency in our activities to Ofwat and essentially on to our customer base, so initially our position is driven by demonstrating we're delivering whole life cost. The best whole life cost solution, so achieving our core objectives through for the lowest cost in the long run, essentially.

the drivers for the project being efficiency and customer value, these being the values that the project was striving for. Those values then become what is viewed as the 'right thing to do' with the most efficient options to achieve that goal being construed as the best. Another participant commented on similar lines when answering a direct question about companies adopting certain stances or ethical codes,

This is a really good question and it's something that I'm sure we'll see more of. I think a lot of the companies that I'm working with generally, they see the environmental benefit in what they are doing. And this sort of thing hasn't really come up at all. A lot of the companies are set up in the belief that they are doing the right thing, and this is a way of saving energy or carbon or less disruption to somebody or doing something in a better way... but I don't think people are generally talking about it in the way that you maybe said. And I think that's really interesting, I think that probably will come along more.

It suggests that 'doing the right' thing is conceived as meeting the project's objectives be it efficiency, sustainability, carbon reduction, etc. The wider implications appear less overtly considered.

Some participants were aware that their businesses had ethical codes but didn't know what they said nor were able to locate them easily,

I mean we've adopted gosh I mean I don't know we get some typically we get memorandum pushed around so many times and we have a massive list of corporate policies and procedures and ethics is part of it...I go to our corporate website, from time to time to see what they were saying to the public and I didn't know we're doing that. But then you go back through your emails and you realise, you were briefed you just forgotten about it.

with bureaucracy being a common complaint, for example,

There is so much potential that's being held back at the front lines because of dealing with the sheer scale of the bureaucracy that goes on. The processes that have been dreamt up now are just colossal.

although similar observations could undoubtedly be said of many other sectors.

PROJECTS *There were no overt ethical checks or balances discussed at a project level beyond the implicit endorsement of a project being 'good' if it complied with a regulatory requirement or a project's goals, whatever they may be. That is not to say the projects were irresponsible. Certainly the candid and dedicated participants did not give that impression. The difficulty is it not possible to say one way or another. It is not possible to say they were responsible if questions to address AREA have not been openly asked, explored and published. The extent the lack of project level ethical drivers is a replicable finding could be explored in the survey.*

GOVERNANCE *What remains is a set of projects that are often considered 'right' as they comply with project goals, most often regulations; those regulations being narrowly framed and focussed with an economic driver behind them. The whole RI ethics, project level responsibility and drive appears missing from the debate.*

7.10 SUMMARY: RE-VISITING THE FRAMEWORK:

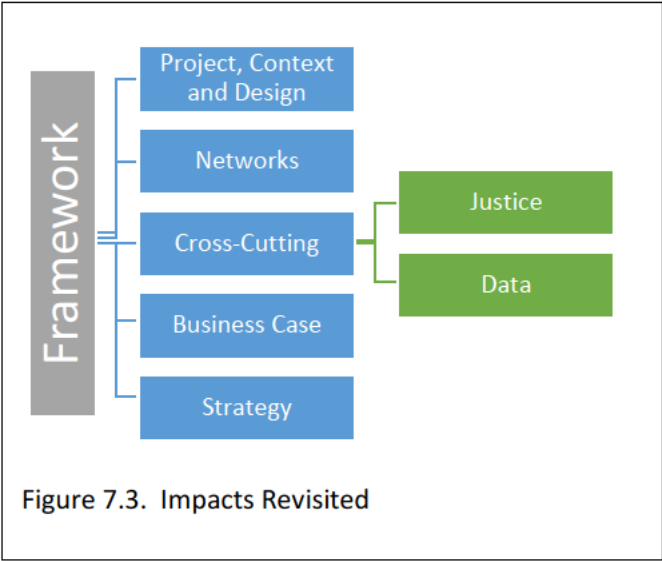
The themes and narratives generated by the semi-structured interviews start to highlight the governance issues that have impacted on innovative projects in the sector.

To draw the narratives together, there are very strong regulatory drivers. Regulation becomes the measure of success and when narrowly framed can lead to silos rather than holistic water management and multidisciplinary approaches. Silos can be within administrative boundaries,

within water company jurisdictions or even within disciplines. Conformity and (real or perceived) lack of ability to change feeds into a work-to-rule and risk averse environment. Control through regulation leads to increasing complexity which, together with silos and risk aversion, can lead to difficulties for outsiders accessing the system. The irony is that regulation becomes what is deemed right and negates wider justice thinking although vice versa, justice and data offer levers for change. Justice thinking brings new questions to the fore and data, through a change in regulatory focus, may offer the environment a clearer voice in decision-making and when addressing trade-offs.

These findings need to be assimilated and captured in the framework and the questions in the framework re-visited.

The results also suggest subtle adjustments to the impacts created during the Pipebots project could be made. The revised impacts can be viewed in Figure 7.3. The results are also written out and summarised with a view to capturing the essence of each theme and impact and integrating the findings so far (Table 7.1). These findings will be explored in the Survey



(Chapter 8) and the Focus Group (Chapter 9) and they will be expanded upon and discussed further in the Discussion in Chapter 10.

Table 7.1. Cumulated Impacts and Themes
<p>Project, Context and Design</p> <p>Perceived importance, or otherwise, of clear system boundaries; regulatory design parameters; internal teams and prevalence of silos; wide versus narrow problem-framing.</p>
<p>Networks</p> <p>Perceived importance, or otherwise, of networks; who needs to be in the network and how are they engaged with and managed including existing suppliers. How access into the sector is achieved.</p>
<p>Business case</p> <p>In supporting the business case for change identifying the importance of forms of governance (e.g. regulation, policy) relevant to the project.</p>
<p>Strategy</p> <p>Addressing the impacts of the regime in project planning; strategies for filling gaps in the network; awareness of contractual/procurement issues and their opportunities; addressing regime specific regulation and cycles in the project plan.</p>
<p>Cross Cutting Themes</p> <p>To explore whether the lack of justice thinking exhibited is representative; the use and potential of data; perceptions of data benefits and uses; perceptions of ethics or RI codes and their potential.</p>
<p>Framework</p> <p>How a framework might be perceived and potential hooks for acceptability; Opportunities for challenge and how it avoids embedding the status quo, where necessary.</p>

8 SURVEY

Although eighteen semi-structured interviews were undertaken with those engaged in transformational sector projects, there remains a potential for their experiences to be unrepresentative or unrecognisable by the wider sector. To address this, the research design was drafted to include a follow-up survey to test the findings of the literature review and semi-structured interviews before a wider audience. It was also an opportunity to test issues that arose when analysing the interview data, for example, around justice and data themes. This Chapter discusses the results of the survey which obtained the views of 55 sector representatives.

8.1 SURVEY RESULTS

The full survey results and analysis tables are attached in Appendix 6. This Chapter summarises the results in Sections 8.1 and 8.2, before going on to address three key questions in Section 8.3:

8.3.1 To what extent does the survey validate the literature and interview findings?

8.3.2 Does the survey cast any further light on 'data' and 'justice' themes?

8.3.3 How can the survey responses be used to hone and adjust the framework?

The Chapter concludes by addressing any limitations of the data findings so far (cumulated with the results of the interviews) and the proposed next steps in Section 8.4.

8.1.1 Interpretation

Questions 4-8 contained the substantive issues for participants to comment upon. Participants were asked for their views upon the degree of importance, or otherwise, of a number of statements related to business cases, strategies, design and context and networks. It was anticipated there would be a range of responses and consensus was not expected (nor necessary). What was looked for was a recognition of the relevance of the statement within the participant group as part of the mixed methods approach, to compensate for any perceived issues with the smaller number of semi-structured interviews and as a form of triangulation of results (Denscombe, 2010). The survey sought to verify whether the findings from the 18 interviews were recognised by the wider pool of participants engaged in the survey. The survey answers were analysed looking at where a statement was considered critical/ important to a project in questions 4,5,6 and 8 or highly significant/significant in question 7 with the discussion focussing on the differences in ratings between statements (Saunders *et al.* 2019).

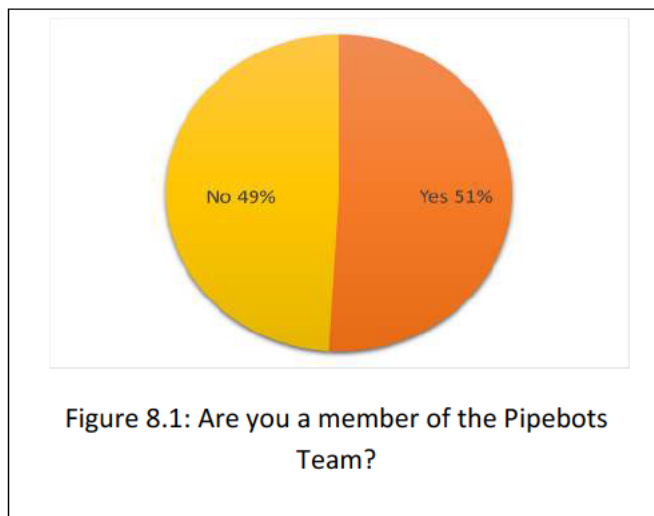
In some instances, the spread of data also provided insights. Where this is the case, the mean average figures were calculated using 1-6, with 1 being of highest importance, 5 lowest importance and 6 'Do Not Know' (DNK). Where large numbers of DNK answers may have distorted this data, figures excluding DNK were also calculated for comparison.

In addition to compulsory questions, each question had an optional free text response for participants to add any additional thoughts or explanations. It also enabled any queries to be noted. These options were frequently taken up by participants and extracted comments are included below.

8.2 DATA

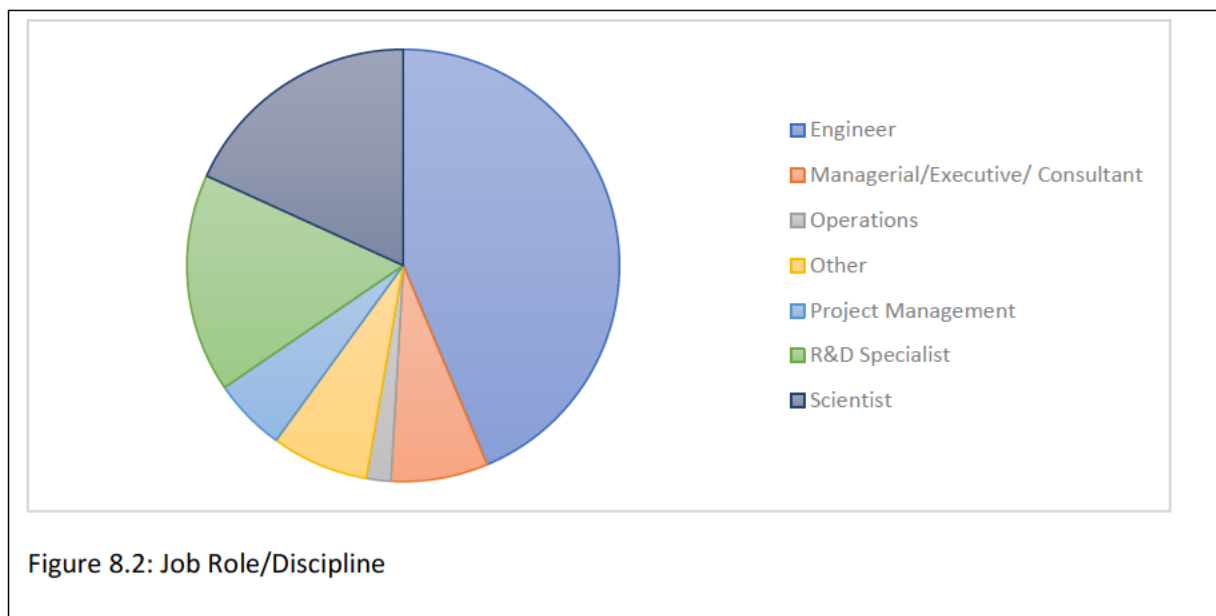
8.2.1 Questions 1-3: Participant Information.

Participant information was gathered in questions 1-3. This asked participants about their role and background and also recorded the numbers that were involved directly in the Pipebots project. The responses suggest a breadth of relevant experience and expertise.



The apportionment between Pipebots and external stakeholders shows there were broadly equal numbers of Pipebots to stakeholder participants, 28 to 27 respectively. For ease of reference these groups are referred to as 'Pipebots' and 'Stakeholders' hereafter.

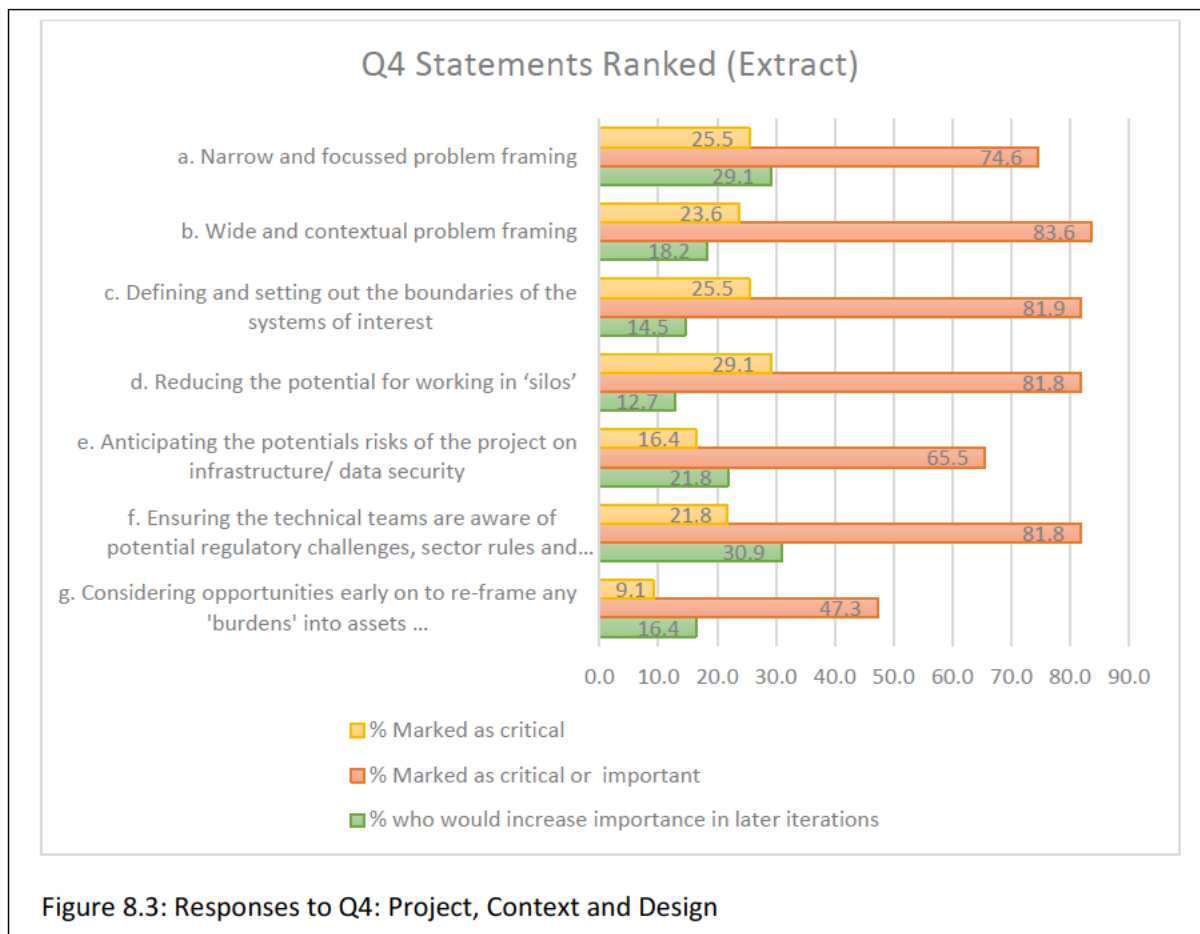
There were 34 participants in science and engineering (10 and 24 respectively). The balance of 21 participants identified as R&D, managers, operations, project management with two 'others'.



8.2.2 Question 4: Project, Context and Design Requirements.

Q4. IN YOUR VIEW, HOW IMPORTANT IS IT FOR PROJECT TEAMS TO FOCUS UPON THE FOLLOWING DURING THE EARLY* STAGES OF THE PROJECT? (*UP TO AND INCLUDING VALIDATING PROOF OF CONCEPT):

Question 4 addressed statements around the project, its team and the context. The question was specifically framed around importance at the early stages of a project with a follow up question around whether views would change with later TRL stages of a project. Participants were asked to score each statement as critical, important, neutral, not important, irrelevant or do not know (DNK). The results are summarised in Figure 8.3.



Statements *a) and b)* were included as an experiment looking for trends connected to problem-framing preference; a distinction that was hinted at in the semi-structured interviews that impacted on the extent issues beyond the immediate technical challenge were prioritised and focussed upon. These statements asked the participants about their preference for narrow or wide problem-framing at the initial stages of a project. This statement was included as a tool for interrogating the data to see if those preferences influenced rankings and priorities in later sections of the survey. The results show:

- Narrow problem-framing was critical or important to 74.6% of participants;
- Wide problem-framing was critical or important to 83.6% of participants;

Whilst the statements were not mutually exclusive (several participants gave the same rating for both), the majority of participants showed a clear preference for one over the other. However:

- Nineteen participants would change preferences with later iterations of the project;
- When considering 'critical' and 'important' responses together, there was a slight overall preference for wider problem-framing from Pipebots participants. The difference was more striking when 'critical' only answers were considered:
 - Of the 14 participants that considered narrow problem-framing as critical, 10 were Stakeholders.
 - Of the 13 participants that considered wide problem-framing as critical, 10 were Pipebots.
 - 2 participants considered both critical (one Pipebots, one Stakeholder).

This suggests a trend towards wider framing within Pipebots as opposed to the wider sector. It is possible this difference is as a result of the work of Theme 7, but establishing causal links would require further data and analysis. It does suggest that the Pipebots view may not be the prevalent one in the wider sector.

On analysing how this preference influenced other choices in the survey, there were possible trends but none that could be confirmed. In fact, what was more noticeable was the range of responses and lack of clear 'factions' of groups of like-minded answers.

Statements c) *defining system boundaries*, d) *reducing potential for working in silos* and f) *ensuring technical teams were aware of potential regulatory challenges and sector rules*:

- All achieved very high ratings, with over 80% marking them as critical or important.
- For Statement f), *addressing regulation and sector norms*, the highest number of participants would further increase its rating in later iterations of the project, at 17 participants or 31%.

Statement (e), *anticipating risk on data and infrastructure security*:

- This achieved a low overall score in comparison to other statements at 65.5%, although 12 participants (21.8%) would increase the rating in later iterations of the project. This was anticipated as the question was specifically aimed at the early stages of a project during its formative, exploratory phases, however:
- There was a difference between Pipebots and Stakeholders ratings, with 12 critical/important rankings for this statement from Pipebots and 24 critical/important rankings from Stakeholders. The importance was clearly higher for non-Pipebots participants even

at early TRL stages and may represent a difference between those operating outside of the sector and those employed within it.

Statement g) *re-framing burdens into assets*, addressing the circular economy:

- This statement received one of the lowest % figures, achieving 47.3%, although 9 participants (16.4%) would increase the importance of g) in later iterations of a project.
- There were 5 DNK responses for this statement, DNK affecting the mean response calculation but still relatively few giving it a high rating.

8.2.3 Question 5: Networks.

Q5 HOW IMPORTANT IS IT FOR PIPEBOTS TO ACTIVELY ENGAGE IN DEVELOPING ITS NETWORK WITH THE FOLLOWING CATEGORIES OF PEOPLE?

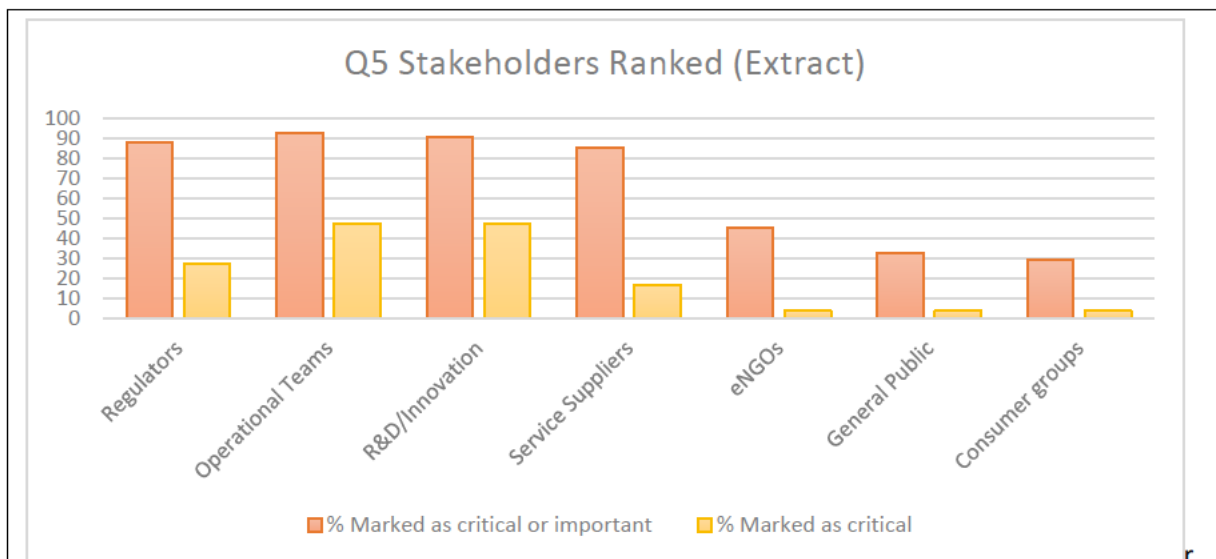


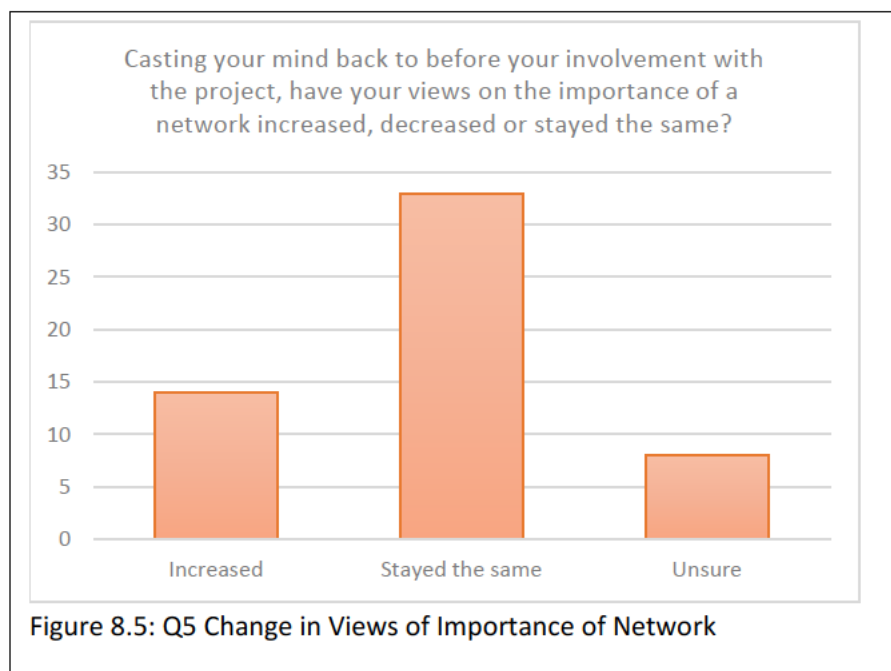
Figure 8.4: Q5 Externa Network: % Marked as Critical or Important for each Category

Participants were asked to rank each stakeholder group as critical, important, neutral, not important, irrelevant or do not know (DNK) to a network. The results are summarised in Figure 8.4. There was a clear difference between the degree of importance ascribed to each category of stakeholder. Some achieved scores of almost universally high importance and some the lowest scores in the survey:

- High ratings were achieved for Regulators (88.3%), Ops Teams (92.8%), R&D Teams (90.9%) and Existing Service Providers (85.5%).
- This is in contrast, to the % importance for eNGOs (45.4%), the general public (32.7%) and consumer groups (29.1%).

Participants were also asked whether their views on networks had changed views over time (Figure 8.5):

- 14 participants said their views of the need for a network had increased (6 Stakeholders, 8 Pipebots), with 33 staying the same and 8 unsure.

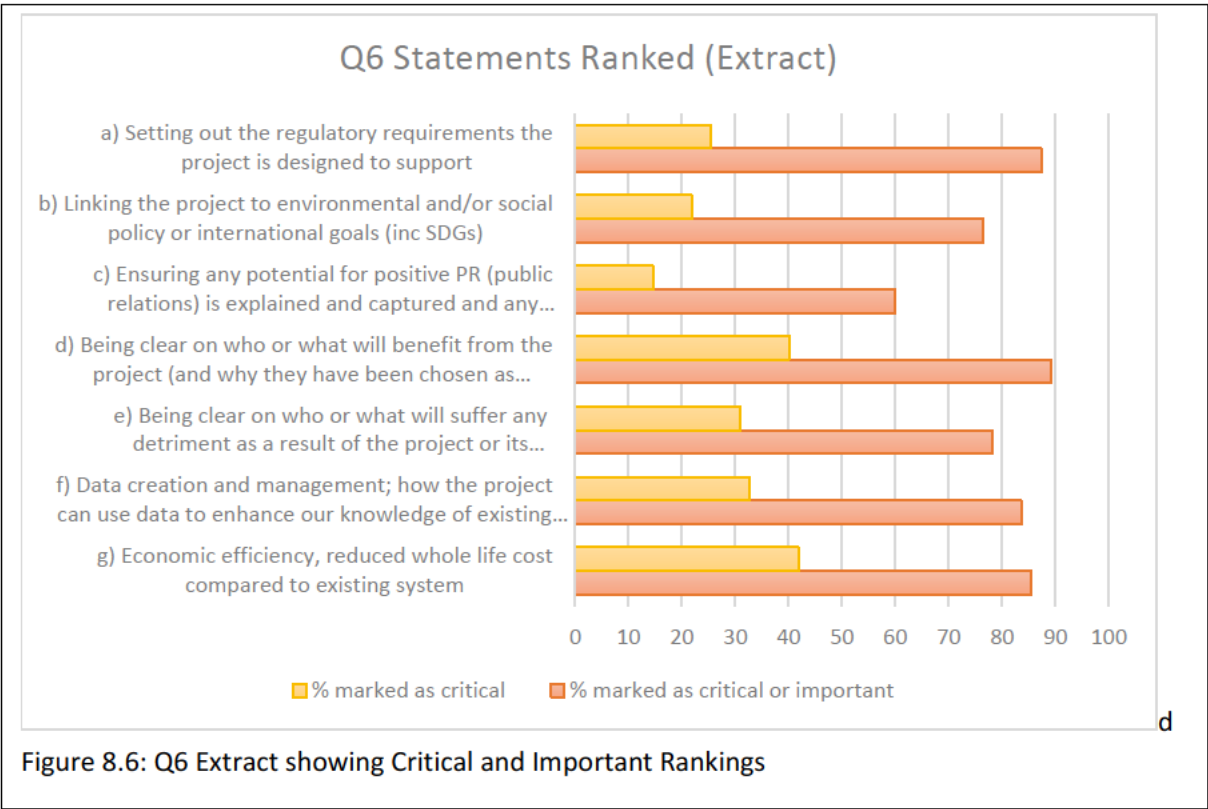


Additional suggestions for network expansion were made in free text responses, including professional associations, local authorities, media, funders, highway authorities, manufacturers, consultants and infrastructure designers.

8.2.4 Question 6: Business case for change.

Q6 IN SETTING OUT THE FOUNDATIONS OR BUSINESS CASE FOR CHANGE IN THIS SECTOR, HOW IMPORTANT ARE THE FOLLOWING ISSUES?

Participants were asked to score each statement as critical, important, neutral, not important, irrelevant or do not know (DNK). The results are summarised in Figure 8.6.



The survey participants supported the majority of the statements, with one relatively low response.

- Very high rating statements (over 80% critical or important) were achieved for *a) Setting out regulatory requirements* 87.3%, *d) Being clear on beneficiaries and why they are chosen* 89.1% and *f) Enhancing knowledge of systems through data creation and management* 83.6%.
- A relatively lower response was noted for *the PR statement c)* at 60%.

Statement g) was not a framework statement and was used as a comparator statement to provide an opportunity to gauge the relative importance of economic efficiencies against governance issues.

- 85.5% considered economic efficiency as critical or important, on a par with that achieved for regulatory issues and beneficiaries (87.3%).

It was anticipated that Statements d) and e) would achieve identical results. This was not the case:

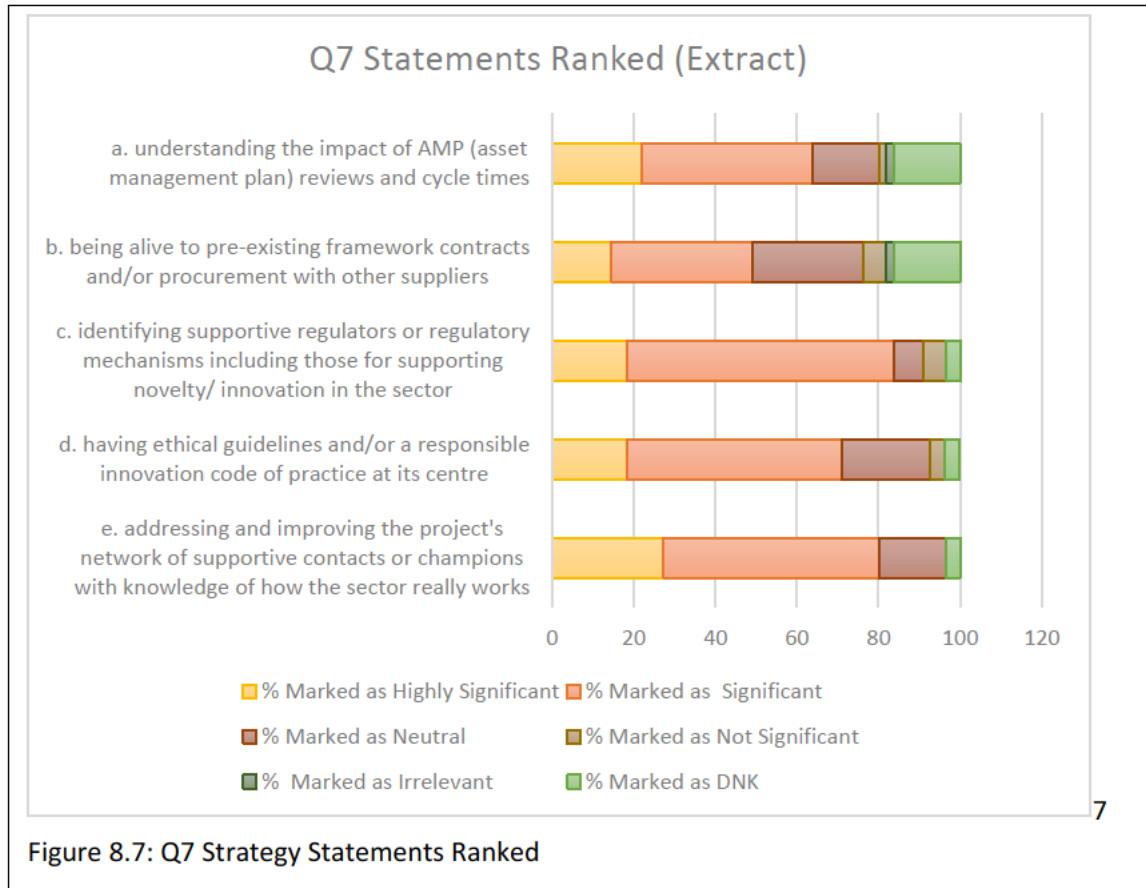
- a higher degree of importance attributed to *d) being clear on who will benefit and why they have been chosen* at 89.1%; in contrast to
- *e) being clear of those that may suffer a detriment and including strategies for mitigation* at 78.2%.

This is discussed further in the justice Section 8.3.2 below.

8.2.5 Question 7: Strategy.

Q7 WHEN WORKING IN THIS SECTOR, HOW SIGNIFICANT ARE THE FOLLOWING FACTORS GENERALLY TO THE SUCCESS OR OTHERWISE OF A PROJECT?

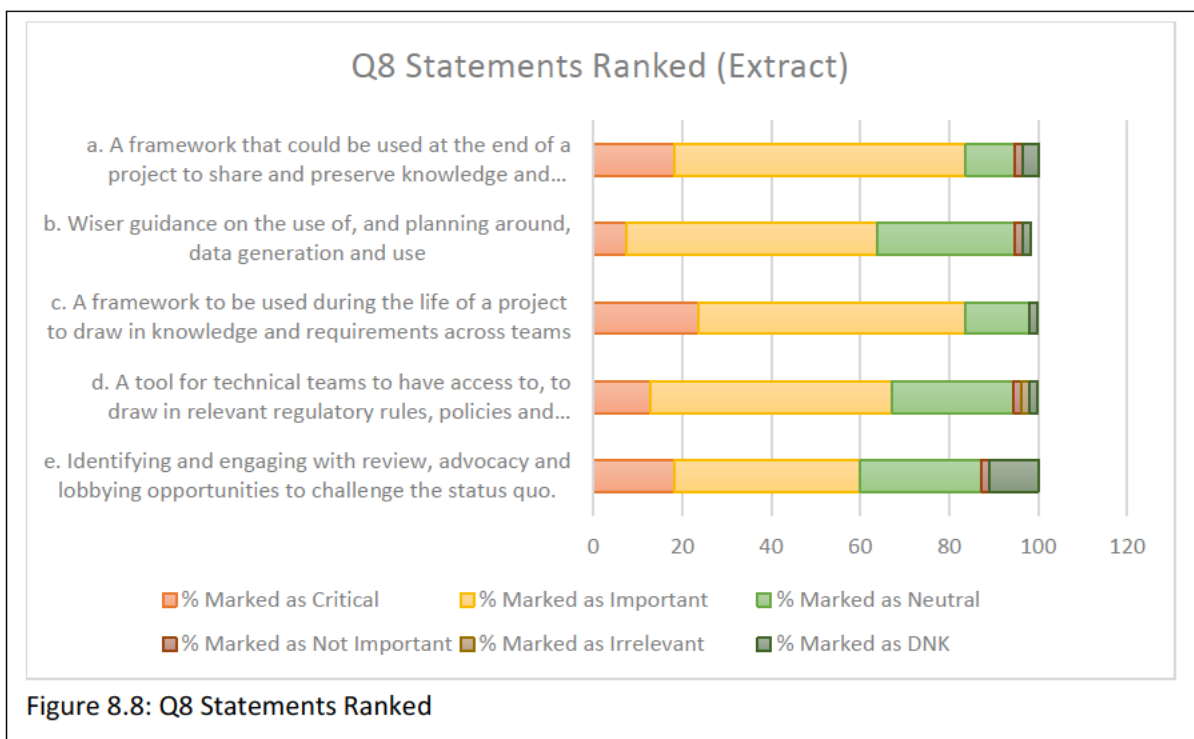
Participants were asked to rank the following statements as highly significant, significant, neutral, not significant, irrelevant or Do Not Know (DNK).



- The strongest support was for Statement e) *having a supportive network*, with 80%/44 participants giving it a highly significant or significant rating.
- *Identifying supportive regulators* at Statement c) and *having ethical guidelines* at statement d) were also strongly supported.
- The lowest score was for Statement b), *being alive to pre-existing framework contracts and procurement*, with only 49%/17 participants giving it a highly significant or significant rating. Further:

- Statement b) had the joint highest DNK response rate of 16.4. Even excluding DNK participants the statement would only reach 59%, although noticeably higher than the DNK inclusive figure.
- A free text comment however suggested the importance of framework contracts may be an issue for later iterations of a project when it is closer to market. The additional free text comment and strong endorsement from the interviews suggests it may be worth carrying forward for the focus group to consider.
- Statement a) *addressing the AMP (asset management plan)*, shared the joint highest DNK rate for this question with Statement b), but still reached 63.3%.

8.2.6 Question 8: Frameworks.



Q8 IN YOUR VIEW, HOW BENEFICIAL, IF AT ALL, WOULD THE FOLLOWING BE IN IMPROVING CURRENT AND FUTURE PROJECT PLANS?

Q8 addressed frameworks that could support current and future project plans. Participants were asked to rank statements as critical, important, neutral, not important, irrelevant or Do Not Know (DNK). The results are summarised in Figure 8.8.

All of the statements reached levels of approval of 60% or over suggesting the majority of participants support the framework goals.

- The framework goals with the highest levels of approval were a) *which shared and preserved knowledge for future projects* (83.7%) and c) *to draw in knowledge across teams during the life of the project* (83.6%).
- Frameworks that only addressed single issue around *advocacy and lobbying* (60%), *wiser guidance on data use* (63.7%) or *regulatory issues specifically for technical teams* (67.2%) had lower but still strong levels of support.

Free text comments provided some further illumination:

a. and d. are interesting and people have tried to do this before, but I've never seen it work for all sorts of reasons: e.g. people leave the project before the end and take knowledge with them; real knowledge needs context and I've never seen anyone capture context in a database

Maybe not so much the importance of these tools and guidance existing (in some cases they do) but ensuring that they are used and embedded.

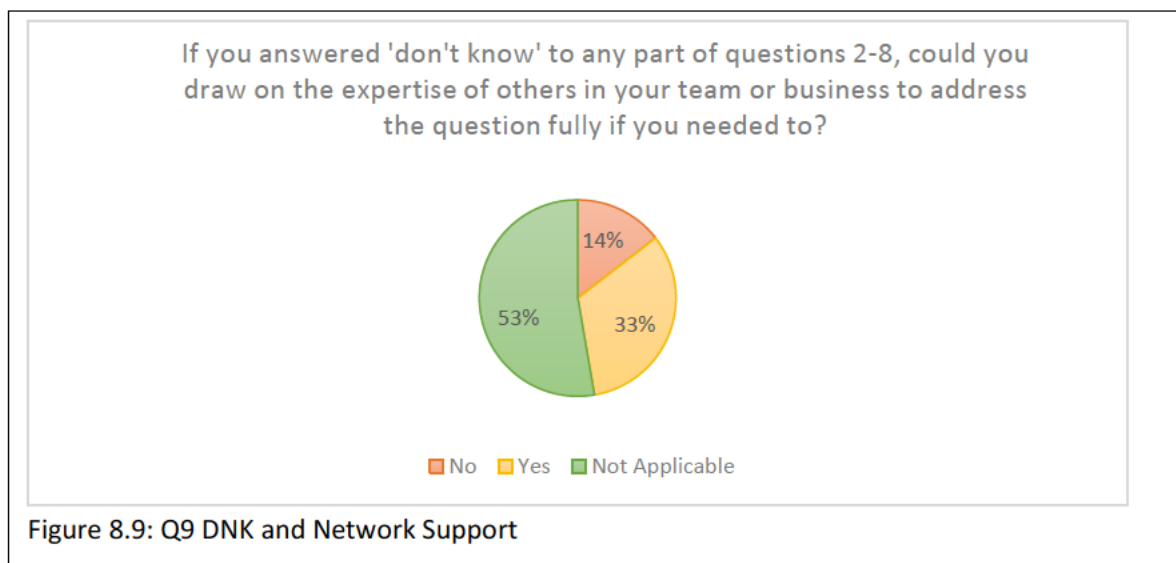
A framework will require buy-in from project teams and systems to support it both in terms of embedding into operational systems and recording the information.

8.2.7 Question 9: Available Network Support

Q9 IF YOU ANSWERED DO NOT KNOW TO ANY PART OF QUESTIONS 2-8, COULD YOU DRAW ON THE EXPERTISE OF OTHERS IN YOUR TEAM OR BUSINESS TO ADDRESS THE QUESTION FULLY IF YOU NEEDED TO?

Q9 addressed one particular consequence of a multidisciplinary framework – that by its nature it may need to be completed by more than one person. This section therefore asked about the resources the participants had available to them to find answers.

The responses suggest only small proportion of the participants could not draw on others for answers to the questions if needs be. This could be viewed as a barrier for that small proportion, or alternatively a strength of the framework if it can encourage the expansion of a network for those gaps in knowledge to be identified.



8.3 DISCUSSION

This section addresses the following questions in turn:

- **To what extent does the survey validate the literature and interview findings (8.3.1)?**
- **Does the survey cast any further light on ‘data’ and ‘justice’ themes (8.3.2)?**
- **How can the survey responses be used to hone and adjust the framework (8.3.3)?**

8.3.1 To what extent does the survey validate the literature and interview findings?

Almost all statements in Q4-8 achieved a high importance rating. This suggests support for the statements, generated from the literature and interviews, exists within the wider sector.

From Q4, the importance of addressing context and system boundaries, reducing silos and recognising regulatory challenges were all considered important – even at the preliminary stages of the project. One statement achieved one of the lowest responses in the survey and that was g) *re-framing burdens into assets*, a statement drawn from the interviews (Sections 7.3.3 and 7.7). This is looked at as a justice issue and the distribution and use of resources in Section 8.3.2.

From Q5 and Q7 the importance of networks is validated by the survey. *(It would be a useful exercise for Pipebots to test its stakeholder list against the categories identified in Q5, including the free text additions)*. Although the use of networks was endorsed, different groups received very different importance ratings. There was a clear distinction in how the groups were viewed. In the context of the Pipebots participants the relative lack of importance ascribed to the general public and consumer groups was surprising bearing in mind these are robots that will be introduced to the water supply where public support will be required. Possible

explanations are that the answers reflect the early TRL stage of the project with little concrete to discuss at this stage.

An alternative view on the public/network issues was inspired by looking back on the interview transcripts and noting that the public stakeholder issues in the projects discussed were all initiated by planning and land use issues. Pipebots differs from these projects in that it has less direct hard infrastructure and planning needs. In cases involving planning, engagement with the public follows a defined legal path through the planning system. Public engagement may be viewed by the sector in these terms, as an issue of ‘public engagement’ rather than ‘stakeholder networking’. Although the details of this falls outside the remit of the study, it is considered further in the Section 8.3.2 below when considering participatory justice and the nature of public engagement and co-design.

Q6 ranked the importance of governance factors in supporting a business case for change. The very high importance attributed to non-economic drivers, such as regulation, challenges the notion that business cases centre solely or predominantly around monetary drivers. It supports the findings from the semi-structured interviews that governance issues are strong drivers for change in this sector.

There were further insights into the view of regulation from two free text comments in Q6:

Pipebots must challenge and redefine the current regulatory framework, not be constrained by it.

Regarding regulatory requirements, these are almost certain to change with time.

The business case needs to be flexible enough to account for such change and ideally incorporate changes that are thought likely to happen.

And a similar comment from Q8:

Pipebots can and should change regulation, not be constrained by it

The first and third comments suggests regulation, in particular, is viewed negatively and as a constraint not a support – a position also seen in the Pipebots documents (Chapter 6). That governance systems need to understand and address this negative view appears necessary. In the interim, these free text comments may explain some of the minority responses giving lower importance attribution to regulation, for example, than the majority. The implication from those participants is that regulation is important but should not be taken into account – it should be pushed against, not aligned with, if progress is to be made. This more nuanced view suggests a delicate balance needs to be struck in a framework between being alert to governance issues versus being unnecessarily constrained by a static governance system that is unsupportive – or at least perceived to be unsupportive.

The second free text comments makes the critical point that the governance system will change. This prompted two flags for the framework. First, to reiterate that the framework needs to be applied more than once. Secondly, to ask the teams to be alert to new or pending policies – policies generally being a prerequisite to a governance change in direction. These may be issues the network can advise upon.

Two free text comments in Q7 also prompted a more nuanced review of the responses on AMP cycles:

Pipebots can and should help break out of the horrors of the AMP cycle, it must not be constrained by it

Responses to this would differ depending on expected timescales - e.g. some technologies might be ready for use immediately, others will take years of development to reach maturity. Pipebots potentially has elements of both. I've tried to answer for something in the middle. Aspects such as AMPs and frameworks would be critical for something close to market - maybe a sensor that could be used on an existing CCTV platform, but largely irrelevant for something that might be 15 or 20 years away from widespread deployment - e.g. robot swarms permanently in a network.

Similarly to comments over regulation, the first participant was keen to stress Pipebots should not be constrained by the 'horrors' of the AMP cycle – in other words a suggestion that it should not be taken into account (and therefore a low importance rating), not because it is unimportant but because it should not be allowed to hinder progress. It may also be the case that the importance of this would increase as the TRL stage increased as suggested by the second participant.

Both the comments on AMP cycles and regulations suggest a desire for tools that do not embed the *status quo* where change is needed. This supports the need for questions in the framework that do not just reflect what is important today but which prompt learning, review and improvement.

8.3.2 Does the survey cast any further light on 'data' and 'justice'?

Questions around these cross-cutting themes were incorporated into the survey to gauge the prevalence of these issues in thinking amongst participants.

8.3.2.1 Data

Data were a theme that emerged through the analysis of the semi-structured interviews. Issues around data were explored in the survey from different viewpoints as a cross-cutting issue.

Context and design, Q4.5e), *the importance or otherwise of anticipating potential risks on infrastructure and data security at the early stages of a project,*

- Achieved a rating of 65.5%.
- In addition, 11 participants, (20%), voted for its increasing importance in later iterations.
- The difference between Pipebots and Stakeholders ratings has been noted (section 8.2.2) and could be explained by Stakeholders having more daily operational oversight into the wider issues affecting the sector (including risks) and so more alert to the potential issues.
- The Pipebots team may want to interrogate this further to ensure it is aligning its thinking and priorities with the sector.

Business case Q6.6f), *the importance or otherwise of data creation and management, giving due thought to how the project can use data to enhance our knowledge of existing systems including ecosystems:*

- achieved a rating of 83.6%.

Frameworks Q8.2b), *the need for wiser guidance on the use of and planning around data generation and use:*

- achieved a rating of 63.7%.

Future of Pipebots Q10, *whether there is a potential benefit in Pipebots and their sensors adapting to collect a wider range of environmental data.*

- Yes 69.1%;
- No 1.8%
- DNK 29.1%.

There was a lengthy list of ideas for future data collection in free text responses to be sent to the Pipebots leadership team.

Overall, this section suggests there would be support for strategies for data creation and management at an early stage, an issue the framework should be able to support.

8.3.2.2 Justice

Justice was a theme that emerged from the literature review although was less prevalent in the interviews. Justice themes were tackled in the survey with statements for ranking focussing on distribution, participation and responsible innovation. The results were mixed with key results summarised as follows:

From Q6.4 and Q6.5 as seen in Section 8.2.4, there was a greater emphasis on addressing the beneficiaries of a project as opposed to those that would suffer a detriment, (89.1% against

78.2%). Although the difference is small it was anticipated the results would be identical so any difference is noticeable. The 78.2% result may suggest a lesser emphasis on mitigation and balancing competing interests. The justice literature suggests that being equally aware of benefits and burdens is an advantage to a project team in better predicting areas of conflict as well as ensuring a 'just' approach to an intervention.

Q4 g) addressed the way waste and other detriments are viewed and whether they could be re-framed as resources in line with justice principles, urban metabolism and circular economy drivers. The question was influenced by the semi-structured interviews in how Phosphorus, Nitrogen or wastewater are perceived as well as the innovative projects that successfully solved problems through re-framing waste into a benefit. This question addresses justice issues on the use of resources and allocation of burdens. It is acknowledged that this is a difficult concept to explore in a single statement in a survey although 47.3% considered it important even at early TRL stages. This would increase to 63.7% in later TRL stages of a project.

There is a tension here between how things are viewed and how they could be re-framed, viewed and re-prioritised in the future. Despite the relatively low result, as a justice issue it will be included in the document to be put before the focus group to ascertain their views.

Q7.4 asked whether having RI and ethics codes of practice at its centre was a significant factor in the success of a project. This achieved a high rating. Although a positive response, this suggests approximately a third of participants are yet to be convinced of the merits of RI or ethics as an issue of substance that can improve the prospects of project success (Figure 8.10).



Questions over participatory justice arise from Q5 and the low networking priority ascribed to the public. The response suggests a detachment between the public, project design and solution generation. As discussed in 8.3.1 this may be a question of terminology. Rather than ‘networking’ with the public their role may be viewed as ‘public engagement’ with different connotations and purposes. Studies exist which flag the very different levels of public participant and engagement that can be deployed, from Arnstein’s (1969) well-known ladder of participation and beyond. There is a difference for example, between drawing in expertise through networking and communicating a message outwards through public engagement. There is a difference in who is considered an ‘expert’, what participation actually means and its goals.

This is a complex and nuanced area and a study on optimum levels and types of engagement with the public is outside the remit of this study. As a pragmatic solution for the framework, RI codes that include a public engagement strategy may provide assistance here. An RI code and strategy including public participation can be tailored to a particular project. The

framework's goal would be to prompt thinking in this area, rather than have prescriptive requirements. This encourages thinking and prompts around how and for what purpose the public are engaged. Ensuring a plan for public engagement is captured by an RI code may be the most practical way forward of ensuring participatory justice is achieved in situations outside planning or where a set legal process for engagement is not available.

Overall, the justice responses suggest there are areas where justice thinking could be more prevalent and embedded and supported by the framework. This leads to an issue over how the framework itself should be framed. On reflecting upon the data gathering experiences so far, calling the framework a 'governance' framework might not capture either the recipients' imagination nor the essence of what is actually being achieved. To this end the name for the governance framework was re-considered and the JUSTICE framework, JUST Interventions in Civil Engineering, provisionally settled upon instead. This emphasises increased justice thinking in project design and more readily captures what it is trying to achieve.

8.3.3 How can the survey responses be used to hone and adjust the framework?

To answer this question, reference is made to the cumulated impacts and themes that were summarised in Table 7.1

from Chapter 7. For ease of reference and to show how the survey hones and adjusts the framework, these impacts and themes have been updated, summarised and annotated in red.

Project, Context and Design

Perceived importance, or otherwise, of clear system boundaries; regulatory design parameters; internal teams and prevalence of silos; wide versus narrow problem-framing.

- Clarity on system boundaries, importance of regulation and reduction of the impacts of silos performed strongly and will remain in the framework.
- Free text comments suggest regulation should be pushed against where necessary and not automatically accepted.
- There were strong preferences between narrow or wide problem-framing highlighting different mindsets entering into these projects. How this translates into silos and solution framing could form the basis of further study in the future.

Networks

Perceived importance, or otherwise, of networks; who needs to be in the network and how are they engaged with and managed including existing suppliers; how access into the sector is achieved.

- Networks were important to projects with key stakeholders identified. Networking remains a key component of the framework.
- The weaker performance of the public and related categories could reflect that they are not viewed as stakeholders in project design. Pragmatically their involvement could be re-framed as public engagement and addressed as part of the RI section of the framework.

Business case

In supporting the business case for change the importance of forms of governance (e.g. regulation, policy,) relevant to the project.

- Regulation performed very strongly as a driver on a par with economic drivers, if not stronger. Wider policy and PR also featured. This suggests these are addressed when drafting and promoting a business case for change.

Strategy

Addressing the impacts of the regime in project planning; strategies for filling gaps in the network; awareness of contractual/procurement issues and their opportunities; addressing regime specific regulation and cycles in the project plan.

- Timing; the importance of the principles underpinning the framework will vary over time, for example AMP cycles. The framework will need to be applied on more than one occasion.
- Framework contracts; the relative low performance of this issue flags it is an issue at odds with the strong concerns raised in the interviews and will be taken forward to see how it is viewed by the focus group.

Cross Cutting Themes

To explore whether the lack of justice thinking exhibited is representative; the use and potential of data; perceptions of data benefits and uses; perceptions of ethics or RI codes and their potential.

- There was a slight difference in emphasis between beneficiaries/winners and potential losers, with the former given a slightly higher importance rating overall. Specific questions will remain in the framework.
- The circular economy, RI and some justice-related statements received a relatively low level of support. This also raises issues of the inclusion of justice principles and

the embedding rather than challenging the existing state of affairs if these issues are omitted; the framework is about prompting thought about issues that may be missed not solely reflecting the *status quo*, and therefore the current framework will be re-visited to include sections on challenge.

- Public participation. Again, and pragmatically, this may be better addressed as public engagement and part of the RI code for the project. The RI code should include a project specific rationale and plan for public engagement. This should be flagged in the accompanying notes to the framework.
- Perceptions of data benefits and uses
 - To support the findings, a question on data will remain in the framework looking at how it can enhance data knowledge and the business case for change.

Framework

How a framework might be perceived and potential hooks for acceptability; opportunities for challenge and how it avoids embedding the *status quo*, where necessary.

- In terms of how the framework is presented, emphasising networks and/or knowledge sharing may be helpful as both of these features performed very strongly in the survey.
- Some of the free text responses have highlighted an issue over the framework inadvertently embedding the *status quo* rather than challenging it. There is a difference between an awareness of regulation and being stifled by it, for example. The framework needs to be re-visited to ensure this distinction can be drawn.

- The framework will also be re-visited in terms of presentation to ensure coherent sections on learning and challenge are included.
- In line with the results so far, the 'governance framework' is to be re-named as JUSTICE (JUST Interventions for Civil Engineering), providing greater clarity on what it is intended to achieve.

8.4 LIMITATIONS AND SUMMARY

The primary goal of the survey was to give confidence that the findings of the semi-structured interviews were recognisable within the wider sector and to flag areas of conflict where further analysis may be required. The survey, by seeking views of a larger number of participants, was able to meet that goal.

In terms of the validity of the survey, there was a 22% response rate which was in line with expectations for an on-line survey (Zhang *et al.* 2017). A number of potential limitations of a low response rates were avoided by how the survey was framed. It was not designed to provide evidence of a consensus view across the sector, but to provide endorsement for the literature and interview findings within a wider pool of participants. This was achieved. The response rate was also in line with the current experience of the authors peers and sufficient for a data set that could be interrogated.

An additional potential limitation has also gradually gained more prominence as the data has been gathered across the interviews, within Pipebots and through the survey. That limitation is by asking participants for their views and experiences, there is a danger of embedding the *status quo* rather than bringing about new thinking or change. This issue has gained

importance through the data gathering stages as it increasingly appears that this is a sector which is driven (sometimes dogmatically) to follow the regime and regulatory requirements imposed upon it in the 'here and now'. To resolve this issue, careful consideration of how the survey data was to be analysed was necessary – both in terms of whether statements with low ratings were rejected and the extent the *status quo* is challenged.

In relation to how the data were analysed, statements that received a relatively low approval rating were not automatically disregarded. What was noticeable about some of those statements was their potential connection to wider issues particularly around justice. It has already been noted that justice themes are lacking in the sector but could be beneficial if included in project thinking more explicitly. With this in mind Section 8.3.3. considered a selection of lower ranking statements against principles of justice and rather than endorse their omission, the framework seeks to take them forward.

Conversely, even where there was a high approval rating, a more nuanced approach is indicated, one that differentiates between a need to acknowledge governance requirements as they are versus a need to challenge governance where it is a limiting constraint on desired innovation. On this latter issue, challenge and learning provisions to prompt reflecting are to be included in the framework.

The survey analysis has therefore had to be more subtle than a simple indicator of whether a threshold has been reached or not, although a majority view is considered a reasonable starting point. It takes what has been learnt so far in terms of justice principles (or a lack thereof) and what has been learnt about the sector (and working to rule), and draws that thinking into the analysis and so the framework.

As discussed, the survey did include some experimentation around how participants' views may change, with varying degrees of success. The questions addressing future iterations of the project appeared to work well and highlighted that whilst some statements may rank low in early TRL stages, their prominence may grow. This reinforces the point made by the MLP that governance impacts change over time. In relation to the backwards-looking questions, over how views had changed over time, due to the low response rates this experiment was not considered successful but does not impinge on the overall survey results. It also remains possible to compare Pipebots and non-Pipebots participant responses and for any significant differences between those groups to be noted.

In conclusion, an adjusted framework, included in Appendix 1, will be taken forward for testing before the focus group.

9 FOCUS GROUP

To recap, the framework has been adjusted to take on board the findings of the survey. The third step of the research methodology is to validate the adjusted framework. The method chosen is a focus group consisting of the type of individuals likely to engage with the framework in practice. These are the individuals the framework is aimed at and whose support would be needed to embed the framework as a tool for use within the sector.

This Chapter describes the framework presented to the focus group in more detail (9.1), the focus group results (9.2) and a discussion on validation and its limitations (9.3).

9.1 FOCUS GROUP FRAMEWORK

The latest version of the framework has been given the working title the Justice Framework–**JUST I**nterventions in **C**ivil **E**ngineering, and this was the version put to the focus group. The document is a single, two-sided document, with the framework questions on the front (shown in Figure 9) and with explanatory notes on the back (included in Appendix 1). The explanatory notes offer guidance and links to further support on issues such as RI and public engagement.

The twenty-two questions in the framework are taken from the literature and the data gathered so far. Together they integrate the issues flagged by academic theory alongside the governance issues, challenges and successes that project teams have encountered in practice. These are the questions a project team might want to address or ask itself to gain any advantages that a governance regime may offer (for example supportive policies to enhance a business case) or to avoid pitfalls (such as addressing common legal or regime challenges).

JUSTICE FRAMEWORK (JUST Interventions in Civil Engineering): A Touchpoint Framework for Project Teams vs 4

GOVERNANCE	CONTEXT AND DESIGN	NETWORK	STRATEGY	BUSINESS CASE	LEARNING & CHALLENGE
THE PROJECT TEAM AND RESOURCE	<p>1. What is the project about and what systems are affected?</p> <p>When answering this question consider the geographic, operational and administrative boundaries affected. Could the boundaries of the project be usefully expanded? Consider also Q13.</p>	<p>5. Does the project team have the expertise it requires to answer the framework questions?</p> <p>Consider your team and its wider contacts whose expertise it can draw upon. Beyond engineering is local, operational and governance knowledge, available?</p>	<p>9. If there are gaps in the expertise required to answer the framework questions how will you draw-in knowledge and expand your network?</p> <p>Consider answers to Q1, 5, 6, 7, 8 and 11.</p>	<p>13. What benefits does the project bring to people and planet? Is there scope for wider social and environmental benefits?</p> <p>Does the answer vary with your answer to Q1.</p>	<p>17. What lessons around boundaries and networks have been learnt? Did the system of interest change or the network expand during the course of the project? If so, when and why?</p> <p>18. When will the team revisit the framework? Could the framework itself be improved? Note, questions may become more important later in the project, new ideas may arise.</p>
	<p>2. What sector specific regulations impact on the design of the project? For potable water, are you alert to the design impacts of Reg 31?</p> <p>If the rules are vast, can your network advise you on the rules-in-use for your project.</p>	<p>6. Who are the regulators and authorities of interest to your project?</p> <p>Who is responsible for the system in the boundary areas affected by the project and are they in your network?</p>	<p>10. What sector specific issues or drivers need accounting for?</p> <p>Project teams in the past have raised AMP cycle and price reviews timescales, rules on contract procurement, as well as a desire for positive Public Relations.</p>	<p>14. Do the benefits from Q13 support an existing regulatory requirement? If not, what supports the business case for change?</p> <p>Could any of the wider benefits from Q13 align with a regulatory requirement? Can this be used to bolster the business case?</p>	<p>19. From Q2, do regulations need to be challenged? If so can the regulators advise you of the systems in place to support innovation?</p> <p>Note, if regulatory hurdles exist in England, could other jurisdictions be considered?</p>
	<p>3. Have common legal areas of concern been addressed?</p> <p>Is human or ecosystem health, safety and security impacted? Is there a plan to ensure data safety and security? Is the security and resilience of critical infrastructure maintained?</p>	<p>7. Considering other potential legal impacts and stakeholders - could there be an impact directly or indirectly (e.g. nuisance) on another's use of land or property?</p> <p>Can they be identified?</p>	<p>11. In considering any project specific risks (including Q3 and Q7), do you need specialist external advice?</p>	<p>15. What policies are there that support the projects goals? Are you aware of any new or pending policies that could be utilised?</p> <p>Can you link the Q13 benefits to a public policy or international goal such as an SDG, to support your case?</p> <p>Do new policies signal impending regulatory change and, if so, how does this fit with your project goals?</p>	<p>20. Are there benefits that policy does not recognise, but should? If so what are they? Is the lack of support a hindrance to Q4 or Q13?</p> <p>Can your project or business use this project to advocate for change?</p>
JUSTICE	<p>4. Is there scope for the project design to embrace 'circular economy' opportunities?</p> <p>E.g. to re-think 'waste' as a potential asset, re-consider the use of extracted nutrients, re-think flood water etc.</p>	<p>8. Is there a Responsible Innovation (RI) code (or company ethics code)? Do you need a plan to introduce one?</p> <p>I.e. Is there a code to support the balancing of risk, detriments and benefits and to plan stakeholder engagement.</p>	<p>12. Who or what may suffer a detriment as a result of the project (inc Q7)? Why is this group affected?</p> <p>If they are vulnerable or marginalised, how is the detriment justified? If there is no RI code, how will benefits, detriments and trade-offs be anticipated and balanced.</p>	<p>16. Who or what will benefit from the project? Why has this group been chosen to benefit over others/Q12?</p> <p>In answering Q12 and Q16 have future generations and the environment been included in the assessment?</p>	<p>21. Can the data generated by the project fill current data gaps (particularly improving knowledge around environmental status)?</p> <p>22. Standing back, do you feel this project delivered the best feasible result for people and planet? What has been learnt in this respect?</p>

Figure 9: Page 1 of the Justice Framework as presented to the Focus Group

This iteration of the framework has been re-designed and re-organised from earlier iterations into a matrix of questions set out in columns and rows. The rows address:

- The project team and resource (the context)
- The sector governance regime (including regulation and derived behaviours and values)
- Formal law and policy (the 'higher' legal framework and policies driving decisions)
- Justice

Row four, for example, addresses justice questions around the circular economy (Q4), Responsible Innovation (Q8), those that suffer a detriment as a result of the project (Q12), those that benefit from the project (Q16) and participatory justice and data to improve environmental status (Q21).

The columns are drawn from the earlier iterations of the framework, where answers could be categorised around impact themes. This was considered as helpful both in terms of organising the questions and in communicating the purpose and value of the questions. The categories that formed, and have since been adapted, are as follows:

- Context and Design
- Network
- Strategy
- Business case
- Learning and Challenge

Business case for change in column four, for example, addresses extending the scope of the project to capture wider benefits (Q13), identifying any alignment with existing regulation (Q14), identifying policies that can be drawn upon to support project goals (Q15) and clearly identifying project beneficiaries (Q16).

9.2 FOCUS GROUP RESULTS

The focus group took place in person over an afternoon with 4 participants taking part – a project engineer engaged in transformational projects, an engineer within the innovation team, a landscape engineer and a senior member of the climate and resilience strategy group. The session was recorded and transcribed. A summary of key issues was prepared from the transcript and circulated to the participants within a week of the session. The participants were asked for any objections to the summary to be raised within 14 days of receipt. No objections or comments were received. A copy of the summary of key issues is included in Appendix 7.

The framework appeared easy for participants to navigate and understand with no difficulties evident or expressed. As noted in Chapter 5 section 5, there were activity sessions set aside for participants to annotate their copy of the framework with green and pink markers. Green was used to highlight framework questions that the participant liked, did not routinely ask themselves or which they found thought-provoking. Pink was used to highlight questions the participant did not believe should concern them, they saw disadvantages in including or they would like to change. The results are also included in Appendix 7.

Drawing the session and the annotated frameworks together, an analytical framework was designed to review and present the content of the focus group session (Krueger and Casey, 2015). The results are shown in Table 9.1. Table 9.1 records the comments taken from the focus group against each question.

There was support or no adverse comment for 13 of the 22 questions. Of the remaining 9, there were comments or subtle differences in views between participants and these are shown in the table. The key points, alongside any changes made to the framework as a result of participants' comments, are summarised as follows:

- Q1 prompts reflection on the boundaries of the system and is a simple but fundamental question in understanding a project's ambitions and impacts. The importance of Q1 was noted by participants alongside how it might prompt needed reflection:

we are really good at asking the first part of the question [what is the project about?] but do not routinely do the second part [and what systems are affected?]

We are not very good at considering what the impact is on other parts of the business

- During the survey, lower importance was accorded to the statement around the circular economy. This was addressed in Q4. As a result of its mixed response so far, how the focus group would respond to Q4 was of interest. Q4 received direct and positive feedback from the focus group and will remain in the framework.

Table 9.1: Focus Group Comments, Overview

Question Number	Positive Feedback	Suggested Amendments	Negative Feedback or Queried	No Comment from any Participant
1	x			
2	x			
3	x			
4	x			
5	x			
6	x	Add more groups?		
7	x			
8	x	Exclude ethics and refer to Responsible Innovation only?	Don't all companies have ethical codes anyway? Is this needed?	
9	x	Adjust with reference to Q 11? Timing and expertise also important.		
10	x	Add ecological survey timescales?		
11			Overlap with Q9?	
12	x			
13	x			
14	x			
15	x			
16	x		Uncomfortableness about term 'benefitting from a project'	
17	x	Learning should be throughout not at the end of a project?	Need time and expertise to complete	
18		As Q17		
19	x		Add the word 'governance', not just a regulatory issue	
20	x			
21				x
22	x			

- A participant commenting upon Question Q6 (addressing authorities and networks) wanted to extend the categories of people included to expressly include other sectors such as energy and transport. Q6 was duly adapted as requested.
- There were mixed comments around Q8 and ethics. Although there was support, one participant felt that it was not necessary as companies already had ethics codes and the use of such codes would be a given, i.e. it was something already in place. However, participant comments from the semi-structured interviews casts doubt on this view and no amendment to the framework was made – although it remains the case that explanatory notes and links on this and RI issues are needed and the benefits made clear.
- One participant felt there was an overlap between Q9 (drawing in expertise from the network) and Q11 (seeking external advice). The questions had been drafted to distinguish between (free) network advice and paid for expertise drawn in on a one-off basis. They represent the fact that even in transdisciplinary studies with a range of people, formal expert advice, for example legal advice, might be required. The participant's comments highlight the similarity between the questions and how the subtle distinction may be unnecessary. In looking at ways of re-drafting these questions, a comment from a participant on networks and outsourcing of expertise and risk provided inspiration. Q9 and Q11 were re-drafted to address external advice and outsourcing being a more meaningful way of looking at where projects are placed (internally, externally or hybrid) and how this changes the network and expertise to be drawn upon.
- Question 10 was adjusted to take into account not only the AMP and formal governance cycles but also the regulations around ecological surveys. This was an issue flagged by a participant with ecological surveys being time-sensitive, taking place over extended

periods or being season specific warranting specific mention in the framework. They were mandatory forms of socio-ecological governance and not being aware of these governance requirements early on could mean significant delays. This was a helpful insight and included in a re-drafted Q10.

- There were positive comments around justice questions. Question 12, justice and who suffers a detriment, for example:

a really powerful question

it is a really important question we should be asking ourselves, whether it is a business case or a strategy, so we don't get blinded by the benefit.

Q12 and Q16 are linked questions relating to detriments, benefits, and justice. There was one amendment suggested by a participant relating to Q16 which was not implemented, and that was on the use of the term beneficiaries. The participant expressed uncomfortableness about this terminology as it expressly acknowledges that some have received a benefit and others have not, and this was not considered good PR.

The uncomfortableness was understood, but the reason for the term remaining is that although uncomfortable, the reality is that this is the consequence of a project; it may impact on how the information is handled, but is not a reason for the question to be avoided. In addition, it allows a direct contrast to those identified as suffering a detriment at Q12 – a question considered by one participant as '*powerful*'.

- There was a discussion on Q13 (scope) and Q19 (challenging regulations) and how these impact on projects. On question 13 and wider societal and environmental benefits:

It comes back to regulations [and question 19], does the current regulatory environment allow us to use the other 5 capitals?

We are very good at understanding the cost but is the benefit set right?

Specifically on question 19 and challenging regulations, participants further commented:

I think this is key for engineers [in the context of Phosphorus removal] and hitting targets at all costs...if we did the whole value, the whole capital value and looked at all of the sustainable development goals and we looked at everything would we really think that...was the right solution for the place.

There is a steam train and once it is going it is hard to do a U-turn. It is like the Titanic and we are screaming into the wind.

This is supportive of the reason for the framework and the desire by participants to do more. As an aside, a participant suggested that Q19 should refer to both governance and regulation expressly. This suggestion has been incorporated.

- For Q17 and Q18, participants wanted it clear that learning should be throughout the project not just at the end. This is now written into the questions.

In terms of overall response to the framework it was very positive. In relation to justice questions for example, the focus group seemed emboldened by the questions to a degree not anticipated from the earlier data gathering stages. The desire to 'do the right thing' seemed powerful and the use of the matrix to bring that about was recognised. When talking about the framework and its use, there were the following comments:

it gets the person who doesn't really think about regulations to think about regulation, it gets the person who didn't know about circular economy to look at circular economy, just to question themselves.

my thought about all of this was, the framework asks should we be doing this differently, is there a way where we need to kind of stop and say like we are on the juggernaut? Stop. Is there just something completely different that we could be doing to deliver this project? Similar to my innovation head. Should we be doing a traditional solution or look at it another way.

And on its application:

I just think use this the earlier the better. Almost like an appendix to the business case format that we have.

In terms of the name of the framework, the participants advised that the term 'framework' had a particular meaning for those working in the sector relating to 'framework contracts' with contractors and could be confusing. An alternative term of 'matrix' was suggested and is adopted. What is key, the 'Just Interventions in Civil Engineering', remains, however in line with participants comments the Justice Framework is now entitled the **Justice Matrix**.

The framework was updated as a result of the focus group responses and the redrafted and 'final' matrix with mark-ups showing for ease of reference in Appendix 1.

9.3 VALIDATION AND LIMITATIONS

It is submitted that the focus group provides validation for the framework (now called the Justice Matrix). There was one focus group, but it was well-constituted in terms of participants

who were all relevant to the aims of the study and were also influential and experienced. The focus group itself took over 6 months to orchestrate. It could have been undertaken sooner, but there would have been compromise on the range of relevant participants across the business. The pool of personnel suitable for the study were in extremely high demand – all of whom had to be available at the same time. These are the individuals with current experience of transformational projects from across the business and who would be asked to complete the framework, should it be rolled out. Their backing would be required for the framework to be used more widely in the business, so it was pivotal that their comments were obtained.

The focus group suggests that there is value in the framework and those working in the sector would find use in it in line with its aims. It is accepted from earlier stages of the data gathering stages that this endorsement may not be universal and there may be resistance. As with any new system, time constraints in processing the questions may be raised and embedding it into systems would be required. However, there were no unusual or insurmountable barriers to implementation beyond any similar decision-making tool. Participants made their own suggestions, for example, around how the framework could be worked into a new capitals strategy being developed within the business or how it could be included in existing business case documents. Consistency between those completing the framework was also raised and a system of auditing and feedback was suggested.

In addition, the focus group is not feedback in isolation; it complements the earlier application of the framework to the Pipebots project. This is powerful as the Pipebots project is a project external to water companies. The focus group was internal to a water company (and also

entirely removed from Pipebots itself – with no cross-over participants). The framework has therefore been applied to projects or teams inside and outside a water sector company. It works, and has application, in these different spheres.

The focus group cannot be used to prove universal validation and acceptance of the framework by the sector, and that was not its aim. What it can say is the value of the framework was identified by people that work on the projects the framework is designed to support. In fact, a final validation is against the principles behind its drafting. That it should be challenged, adapted, improved and changed over time is written into its design (Q18).

10 DISCUSSION

This study provides project teams with a tool to engage with governance. This is needed because of the close connection between a new intervention, the governance regime around it and its prospects of success. In looking at interventions and governance together it seeks to support better decision-making and a no-regrets design policy, with governance opportunities grasped and potential hurdles negotiated early in the development process rather than when solutions are set or lock-in reached.

This Chapter looks back at the research aims, questions and hypothesis as set out in Chapter 2, and uses them to discuss the implications of the data and results behind the resulting framework. The data and results used to inform the framework can be viewed from two perspectives. The first is from the perspective of the projects the framework is intended to serve; how projects can use governance to make better decisions and improve the prospects of a successful implementation. The second perspective looks at the results the other way around, what does the governance regime need to do to make it easier for better decisions to be made and implemented; how can governance be better ‘engineered’ to encourage the implementation of just interventions that meet environmental and societal goals?

This Chapter discusses the research aims, questions and outcomes (10.1), then addresses the two perspectives in turn, firstly exploring matters from a project perspective (10.2) and then exploring matters from a governance perspective (10.3).

10.1 RESEARCH OUTCOMES

In achieving the research aim, a series of five research questions were asked. The first four questions form the basis of the framework itself. The fifth question addresses the wider implications of the study.

Research Aim: To create a governance framework to support the implementation of ‘just’ infrastructure interventions, focussing on transformational projects in the UK water and wastewater services sector (the ‘sector’).

The aim of the study was to create a governance framework to support the implementation of ‘just’ infrastructure interventions focussing on transformational projects in the sector. The governance framework created (albeit at the conclusion of this study entitled neither governance nor framework but the ‘Justice Matrix’), is such a tool to support engineering projects as they engage with governance. As part of the design process, justice considerations were notably absent from general discussion and this has been remedied by the inclusion of justice questions in the framework. The final framework is included in Appendix 1.

The framework and research aim was achieved by following the research questions in turn:

a) Drawing on a literature review and data gathered from the sector, what aspects of governance, or governance themes, appear relevant to a project team seeking to bring about transformational change?

Knowledge and new ways of looking at governance around infrastructure, ecosystems and society were reviewed. There was no single body of literature to draw upon and bodies of literature around justice, SES, STS and recent work around SETS, developed from different

disciplines and perspectives, were considered. From this and further work on Pipebots initial themes were identified, adapted and developed:

governance regime and regulation;

forms and tools of governance;

networks;

resource and boundaries;

technology and rules;

justice; and

iterative processes.

The themes represent the governance influences, issues and considerations of which a project team may need to be aware, relevant to transformational change. These themes were taken and used to form the basis of questions that were drafted for placing in the framework. The asking of questions in this way, as a prompt to decision-makers, was noted in the energy justice arena (e.g. Sovacool *et al.*, 2017).

These themes were enhanced by the collection of data from the sector. This firstly consisted of data from semi-structured interviews, which was consolidated and adapted by surveys to include the following additions:

the strength of the regulatory regime and unintended consequences;

assets and value; and

justice and data considerations (as cross-cutting themes).

It would have been possible to keep the framework as a list of questions. However, a potentially more interactive and engaging way of presenting and organising the questions materialised during experimentation in the Pipebots project. When looking at the answers to the early questions, the responses could be organised into impacts. Following iterative cycles of development the impacts were defined as:

Project Context and Design;

Networks;

Business Case;

Strategy;

Data and Justice; and

Framework and Challenge.

The framework was organised into a matrix interposing the impacts with forms of governance and the remaining themes. By thinking and organising the questions using impacts the framework seeks to highlight how governance may affect a project, thereby making the rationale for each question easier to understand.

b) Using a systematic literature review, how prevalent are themes of justice in literature addressing governance and water infrastructure in this jurisdiction?

The second question addresses the pervasiveness, or otherwise, of justice considerations. To test the author's anecdotal finding of a paucity of discussion around justice issues in the UK, a

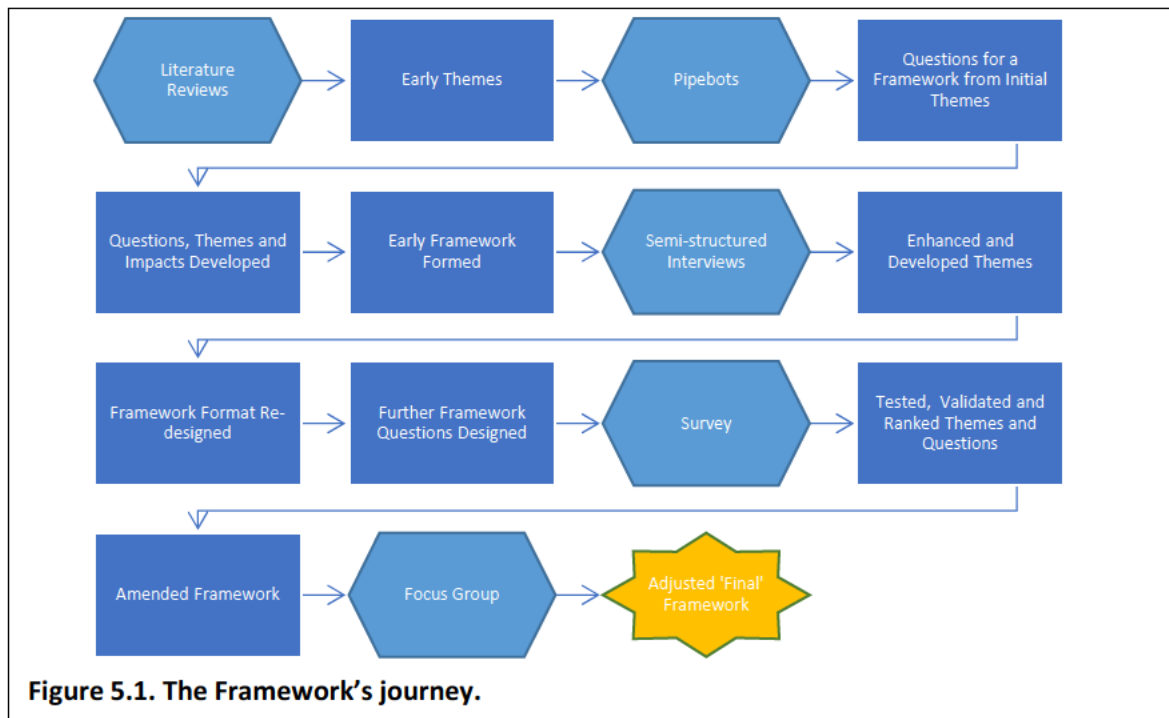
systematic literature review was undertaken. This confirmed the anecdotal finding that justice themes were far from prevalent in the jurisdiction. Although there was some evidence of justice-type considerations there was not a coherent or sophisticated dialogue; this was in contrast to other sectors around net zero and energy. The framework seeks to take this finding and start to remedy it. It operationalises justice principles using the environmental justice dimensions and uses them to form questions for the framework.

The results of the systematic literature review also add to the work seeking to expand upon the possibilities of water justice as a water governance paradigm, extending beyond the current sustainability agenda (e.g. Neal *et al.*, 2014).

c) Drawing together governance and justice themes, how might these themes be operationalised into a framework; what questions should a project team be prepared to address?

The framework took the governance and justice themes and operationalised them by designing questions in support of each theme. The questions act as guides and prompts for reflection. To aid communication about the value of governance the questions are organised around the impacts, in this way showing how they may fit into a project plan. The dimensions of justice are expressly included in questions around identifying benefits and detriments (distribution), in identifying affected parties together with RI and stakeholder engagement requirements (procedure and respect) and prompting for wider social and environmental benefits and the best feasible result for people and planet (capability).

Figure 5.1 from Chapter 5 is repeated to summarise the journey of development.



The framework questions and design went through many iterations and were reviewed after each stage of the research plan, before being tested directly in the focus group. The questions seek to embody the themes and the narratives drawn around them to represent the issues surrounding governance and transformational projects in the sector.

d) Through validation and testing via a focus group, what can we learn about how the proposed framework will be viewed and received, what barriers might it need to overcome?

The focus group results suggest that the framework could be understood, interpreted and answered by a project team. The focus group session was designed to be interactive with the framework being marked up by participants and discussed during the session. During the session, the framework appeared easy for participants to understand and navigate. Most significantly it was viewed and received as a helpful document with the focus group session being a very positive, energising and interactive one. To reiterate the quote earlier, as a participant put it,

it gets the person who doesn't really think about regulations to think about regulation, it gets the person who didn't know about circular economy to look at circular economy, just to question themselves.

As a tool designed to prompt thinking around the wider issues that surround a project, this was taken as a positive endorsement.

The barriers discussed did not appear to be any different to those applicable to any new process. It would need embedding into corporate processes with a review or audit process for uniformity of application, for example. To address this the focus group could see the document being incorporated into existing systems such as the business planning process.

However, experiences beyond the focus group suggest that there are likely to be factions who are not interested in the framework or what it represents, or to quote an interview participant go '*fish-eyed*'. This is not because of the drafting of the document itself (though if that is the case, feedback would be welcome from those that have engaged with the document), but more fundamentally because they disagree that it is part of their role as engineers. This is a challenge to transdisciplinary thinking although, in the author's experience, surmountable through understanding different points of view, dialogue and accounting for opposing views where possible (for example with timing and TRL stage considerations).

In addition to answering the research questions the study gave some insights into the differences between narrow and wide problem framing and preferences, as well as differing views on the role of RI and responsibility within science and engineering. This may be a fruitful area for further study as silos continue to be dismantled.

e) In answering these questions, what can we learn about how governance could be better ‘engineered’ to encourage the implementation of just interventions – interventions that meet the environmental and societal goals needed to address the challenges of the Anthropocene?

The study seeks to create a usable tool for project teams to have a practical and positive impact on transformational projects. The journey undertaken, synthesising practical research and applying theory, also leads to insights into engineering projects and governance in the sector and where improvements may be possible. These insights can be viewed from two perspectives, the project perspective (10.2) and the governance perspective (10.3).

10.2 PROJECTS AND THE FRAMEWORK/MATRIX

In looking at sector governance around project teams, one of the most striking points from the research data was the overwhelming strength of the regulatory regime in the UK. It follows that under the current regime, better ‘engineered’ governance requires regulation (the dominant form of governance) to meet the challenges of the Anthropocene. Regulatory compliance was the main driver for a project on a par with, if not exceeding, economic drivers. The regulatory drivers were seen throughout the research data, from the leakage reduction drivers spurring on the Pipebots project, drivers behind participants’ projects, direct quotes from the interviews placing regulation ‘*at the top of the pyramid*’, and as endorsed by the survey responses.

It follows that if a project can align with a regulatory driver then its prospects of success must be improved. Of course and conversely, transformational projects that do not have a regulatory driver and expect to be embraced because they save money or improve efficiency

may be unpleasantly surprised by the lack of interest. Similarly, projects that benefit ecosystems or include significant societal benefits but do not identify with a strong regulatory requirement may not be attractive and may not be taken up. The brutal reality is that unless there is a strong regulatory driver for a project, and money has to be spent on those areas, worthy projects may struggle to find traction within the sector. In practical terms, identifying governance drivers for a project and incorporating them into the articulation of the project and into its business plan would therefore be wise. In short, the need to be alert to governance issues is extraordinarily strong in the sector, stronger than anticipated for a regime described as 'market-based'.

This exposes a potential issue with a framework that bends projects towards a strong, existing governance regime – and that is where to do so could embed an unhelpful *status quo*. Indeed, the need to push against governance was an issue flagged by free-text comments in the survey. Complying with the regulatory regime as it stands is not always driving projects to solving the complex issues of the Anthropocene. There is a line between understanding a governance system and being limited by it, and this is of particular note where, as described in the STS literature, innovation may need to break down existing systems and structures and transition to new ones (Loorbach *et al.*, 2017). To address this the framework is not prescriptive and asks questions to prompt reflection. Those questions expressly include finding avenues to challenge where needed. This approach, of encouraging challenge, also seeks to tackle the passivity and work-to-rule seen on occasions throughout the study and linked to the strength of the regulatory regime. The starkest example concerned a change of regulatory approach based upon evidence that was thought to be fundamentally flawed with a ten-fold increase in costs (Chapter 7.4.1).

The framework also acknowledges the sheer complexity and volume of the rules that could apply – in itself a burden to innovators. To address this, the framework does not seek to replace lawyers, or indeed any other discipline, but to ask questions and draw-in knowledge from others and build capacity where that knowledge is lacking within the project team. The framework does not engineer governance as such, but uses the network structures around it to better navigate the system. It seeks guidance from the network on the key rules-in-use. The importance of networks in understanding governance was noted in the literature and, at least for some categories of stakeholder, was endorsed by the survey. The use of networks in the projects can go further than this. The use of networks discussed by participants was more than for information and dissemination. In looking at the successful projects around NBS and the circular economy, networks helped to bring about innovative projects across administrative and physical boundaries. It prompted new ways of looking at a collection of small problems in different regions into a single integrated solution for all of them. These projects show what is possible within the governance regime with wide problem-framing, expanding boundaries, vision and leadership.

That complexity, problem-framing and seeing multiple potential benefits is part of the systems thinking embraced by SES, STS and SETS. The question in the framework that seems the simplest, but is the most pivotal in this respect, is question one (Q1). Q1 addresses the scope of the project and its connection to other systems. This is itself connected to its sister question, Question 13, which asks if there is benefit in that remit being expanded. This is important for a project to define (and test) the physical, jurisdictional and administrative boundaries, amongst others. Are there benefits to expanding the remit of the project to include other sectors, water sources and water companies? As well as the literature, the importance of this

was stressed by participants discussing mission creep. Q1 and the desire for better scoping at an early stage was also picked up and expressly endorsed by the focus group. In this way the framework can trigger thinking to include wider societal and environmental benefits and multi-benefits schemes, where appropriate.

Wider problem-framing and the incorporation of issues outside the immediate technical challenges are at the heart of the framework. In embracing the breadth of scope it naturally challenges silos and narrow problem-framing by integrating governance issues directly into science and engineering projects. It asks questions, not only outside the area of expertise, but also the area of interest, of some. There was a range of responses for example around the issue of RI and the bringing in of governance and accountability directly into the heart of a project. The rationale for RI around the long-term issues of public trust and 'do no harm', is known. At the same time, the role of niche experts could and should remain highly prized as should the ability of science to have room to explore. A solution is likely to be one of ensuring a combination of wide and narrow problem framing within a project team with each recognising the skills and benefits of the other. It also suggests respect and space is still provided for engineers and scientists to explore, albeit within the constraints of a suitable and fully explained RI code.

Whilst respect and working to resolve tensions should take place, at the end of the day a faction of the science and engineering community that does not see the need for codes such as RI within projects, risks deepening public mistrust. It can also be self-defeating. Levels of mistrust were seen in sections of society in relation to covid vaccines, for example, and whilst the causes of anti-vaccination sentiment are multitudinous and complex, the lack of trust in

science is said to play a part (Sturgis *et al.*, 2021). Similarly, whatever views are held over GM and the precautionary principle, it is certainly arguable that a healthy and informed debate has been muted by lack of trust (Boden *et al.*, 2017). That the consequences of these issues exist for nanotechnology, robotics and AI amongst others is already recognised (Boden *et al.*, 2017; Read *et al.*, 2016;). Applying this to Pipebots, it is not hard to envisage that any public concerns would be heightened by the introduction of these technologies into potable water and Critical National Infrastructure. Navigating governance for societal goals and RI appear to go hand in hand. As an aside, the role of the public in problem-framing and solution generation is a substantial area and fell outside the remit of the project, but questions around the role of the public are also flagged through the response to the survey on their (relative lack) of importance in network terms.

On justice principles beyond RI, the framework directly asks questions, side-by-side, to identify those chosen to benefit, those that do not and those that may suffer a detriment (Q12 and Q16). A focus group participant talked of their uncomfortableness around the wording of beneficiary – but that is the reality. Infrastructure decisions are decisions about resource distribution, and some will benefit and some will not. Justice questions are not about ironing out winners and losers, but being open about the inevitable trade-offs, ensuring those decisions are equitable and made with due and respectful processes. It should also be said that highlighting a lack of a justice narrative is not to say that water infrastructure in the UK is fundamentally unjust from a social point of view – it is saying we cannot say one way or the other if we do not ask these questions and openly answer them. It is submitted that doing so is a means of engineering better governance.

In balancing winners and losers there are environmental as well as social factors. A difficulty for the environment can be its lack of a voice; how it can represent itself in human designed systems and processes. The lack of 'voice' was described by participants in the interviews including an example of wastewater being discharged out of public view rather than necessarily in the best place environmentally. This is also an issue commented upon in the literature. In his report commissioned by the UK Treasury on the economics of biodiversity for example, Dasgupta (2021, p. 273) describes the importance of ecosystems to human prosperity and refers to nature being overlooked as '*silent and invisible*'. It is this invisibility that the issues around data collection may have the potential to start to uncloak. Looking at the interconnectivity of issues around data, governance, environmental justice and health suggests that filling data gaps could be a step towards providing that voice. Questions around data and environmental health are therefore expressly included as a means of a project team re-addressing the balance. It is an opportunity for a project team to reflect upon data, not just for operational and regulatory reasons, but as a means of continually expanding the data we obtain to monitor ecosystem health.

In short, from a project team's perspective, engineering governance requires networks to navigate and understand the governance system and push-back where the regulations force solutions in a direction that do not meet wider societal and environmental goals. It also accepts that responsibility for better outcomes is not just a responsibility of governance but, through data initiatives, embracing justice and RI principles, and fighting passivity, it is a responsibility of project teams themselves.

10.3 ENGINEERING GOVERNANCE FOR THE ANTHROPOCENE

Near the beginning of this study, in Chapter 3, the UK water governance regime was described – as is commonly accepted – as market-based. This research journey has prompted the author to re-visit that description. The water governance regime is certainly privatised, but to describe the system as market-based does not satisfactorily or accurately describe the nature of the regime. It is not a regime steered by market-forces with tempering by regulation. It is a regulated regime with some tempering by the market. It is regulation that, predominantly, drives projects in the sector, not the market.

The question arises as to whether this re-think and re-framing of the governance regime matters. It is suggested that it does. It matters because this framing can help understand some of the problems and issues the sector is encountering and leads to literature on how those problems may be alleviated. As noted, it is also important for projects. Business cases based solely around economics, for example, may not be as attractive as may be presumed. Understanding the reality of the governance regime can help shape how a project needs to present itself and the levers, through policy or regulatory alignment, it has available to it to press.

The dominance of regulation may not have always been pre-eminent, although the exact tipping point is not discernible. It is clear from the initial stages of privatisation that governance concentrated on economic regulation, specifically to keep costs to consumers within reasonable parameters. Although keeping costs down for current consumers is still said to dominate (Ofwat, 2020), the goals of policy at least have expanded into far wider social and environmental goals (Centre for Competition Policy, n.d.). However, looking at the projects

discussed by participants, there appears to be a problem in achieving those wider social and environmental aspirations. From the interviews it appears that projects with additional benefits to society and the environment, are possible but only credited if they can be woven into the economic governance controls and fit a regulatory driver.

As discussed by the participant looking at a catchment based farming project, this means that wider benefits become nice-to-have but unnecessary add-ons rather than clearly desired goals in their own right. Examples of this were also seen in discussions on nutrient removal and wastewater management. There was evidence of regulation pushing projects towards single, discrete benefit projects through narrowly-framed regulatory requirements. The interviews suggest links between narrowly-defined regulatory parameters, narrow data requirements and collection and narrow regulatory goals and targets. It is worth re-stating the comment from an experienced and knowledgeable participant from a government agency in this respect,

They [regulators] need to be certain about delivering something that has literally no ecological benefit as opposed to be uncertain about delivering something that has a high benefit potentially.

This highlights the risk and enforcement issues inherent in something new, particularly where it tackles complexity. However, despite the perceived risks, to have a regime that remains narrowly framed is contrary to policies around sustainable resource management and catchment-based approaches, approaches that embrace a holistic view and systems-based approaches. Conversely, it also shows how governance could improve. The argument runs that wider parameters with ecosystem health targets should result in a more comprehensive data

collection and understanding around ecosystem health. If regulation is a driver, as appears to be the case, framing regulation in this way should drive projects into a more holistic direction. This may help address the apparent disconnect between sustainability policies above and narrow and fixed granular rules on the ground.

There were other examples of the regulatory regime presenting rigid barriers for innovation. On occasions, there was a disjunct between law and regulation at the granular level and policy goals at a higher level. An example is the existing complexity around Regulation 31, potable water and the Pipebots project, and the lack of clear avenues to challenge procedures under the advisory notes for Regulation 31 (Water Supply (Water Quality) Regulations, 2016; DWI, 2017; Appendix 8). These procedures represent the compliance process for a component being added to the potable water supply in England. They represent a major hurdle for a complex, autonomous, multi-component robot seeking to comply with rules designed for chemical dosing and pipework. These procedures do not appear to take into account the push for innovation to tackle leakage and the transformative initiatives this might prompt.

There are governance solutions out there to balance innovation, safety and compliance. It is not necessarily wholesale change that is required. Distinctions in the rules and processes could be drawn between incremental and transformational projects, with new systems in place solely where innovative projects and systemic change is required, designed in consultation with stakeholders in the sector (Tait *et al.*, 2017). This maintains a degree of *status quo*, yet provides alternative processes for innovative products. Examples of more flexible processes in special cases already exist, such as a move from a single application process at the end of development, to a staged or work-in-progress model using regulatory

gateways for input during design and development (with examples discussed in Dunovic, 2010). Even regulatory processes that are designed to provide the most stringent safeguards for trust and public health can adapt. This was seen in the recent pandemic vaccine approval using the rolling review process (UK Gov, 2020). Other examples include the use of regulatory sandboxes²¹, in use by the UK's Financial Conduct Authority (Financial Conduct Authority, 2021) and in the energy sector by 'Ofgem', the energy regulator for Great Britain (Ofgem, n.d.). In this way innovative ideas can be trialled, with suitable risk assessments and safeguards in place, yet with some leeway for governance breaches to allow innovation to develop. This is being explored by Ofwat (Ofwat, 2019) although at the time of writing it is not clear the extent this is in tandem with the Environment Agency or DWI.

As well as the solutions selected, participants raised issues over projects that were considered worthy but were not selected. Issues around the asset base, for example, raise concerns over short-term governance priorities and what is valued. Participants discussed how the asset base was treated and its relatively low priority in terms of spending. At the time of writing, concerns over leakage and water quality linked to the state, maintenance and growing capacity needs of the infrastructure system are highly topical with increasing public concerns expressed over water body quality (OEP, 2022; Harvey, 2021; Laville, 2021). Participants offered insights into how these issues are perceived from within project teams themselves – and in fact these are concerns they share. There was no denial of investment needs in this

²¹ A 'regulatory sandbox' is described by the Financial Conduct Authority as, '*a 'safe space' in which businesses can test innovative products, services, business models and delivery mechanisms without immediately incurring all the normal regulatory consequences of engaging in the activity in question*' Financial Conduct Authority (2015) *Regulatory Sandbox*, London, England: FCA.

area from the participants; in fact their concern and frustration was expressed. To re-iterate the quote of from one participant,

And if you look at the replacement cost of all of our sewers, it's hundreds of billions of pounds. But everybody hopes that they won't be sitting holding the parcel when the music stops, and they'll pass it on to the next person.

The concerns from participants addressed their perspective of the low priority the asset base was given in the Ofwat/Water company/AMP cycle negotiations. It was not possible in this study to unpick detailed funding agreements between Ofwat and the water companies that credit or disallow these type of investments and the issue falls beyond the remit of a single study. Whatever the cause, the regulators themselves are facing an investigation by the newly formed Office for Environmental Protection (OEP) into the adequacy of their enforcement operations around combined sewer overflows (CSOs; OEP, 2022). The UK's National Infrastructure Commission (NIC) also includes governance and regulation as a key component of their review of surface water flooding, including sewerage overflows, (NIC, 2022). This is not just a water company issue.

When the regulatory regime is so strong, it is not surprising that the regulators themselves come under scrutiny. This could itself be exhibited as an example of a successful, accountable governance system. There are mechanisms for the system itself to be reviewed and held to account. The outcome of the investigations will materialise at the proper time, but in the interim the suggestion from the interviews is that more investment in the asset base is required to support the resilience and sustainability agendas. The issue for justice, sustainability and regulators is the extent to which low costs and lack of investment to benefit

today's consumers leads to funding gaps and detriments for future generations to tackle *'when the music stops'*.

There is a deeper issue with the strength of the regulatory regime. The trend to date has been for incremental increases in governance controls and regulation (Centre for Competition Policy, n.d.). This adds to its complexity. Complexity and systems thinking tells us that absolute control of a complex adaptive system is a pipedream and there will be unpredictable emergent features. A body of literature within SES explores regimes that are instead centred around adaptive governance as an alternative to existing environmental governance regimes. What adaptive governance teaches is that rather than tightening rules, governance of a complex adaptive system should seek to flex, learn, adapt and be agile in the face of change.

Whilst a governance system that adapts and changes with the system it is seeking to govern appears a sensible avenue to investigate, a tension becomes apparent when human and environmental safety is so paramount. The governance system in question here covers life-essential water resources requiring clear and enforceable rules for public and environmental health, safety and security. The law's strength is considered to be in its enforceability, certainty and rigidity. Indeed, for investment purposes the regulatory stability and certainty is considered necessary to attract investors; essential in a privatised system (Dept for Business Innovation and Skills, 2011). Formal law and regulation can provide the enforceable safety requirements, security and trust in the system needed. However, formal law, as a strict and rigid tool of governance, may appear in direct conflict with adaptive governance principles and even a barrier in its preference for stability over flexibility (Cosens *et al.*, 2020).

The literature does not yet provide a resolution to this tension. There is a gap when it comes to resolving the place of law in an adaptive governance system, although suggestions exist (Cosens *et al.*, 2017; DeCaro *et al.*, 2017). Potential answers are contained within framings of the law which consider it as setting enforced boundaries, but within those boundaries there is free space for more flexible forms of governance to operate within (Cosens *et al.*, 2020). Other studies make suggestions over the drafting of the rules to include elements of learning and reflection, for example, ‘iterativity’ (Hill Clarvis *et al.*, 2014) or planned periods of reflection termed ‘legal-sunsets’ (DeCaro *et al.*, 2017).

Building on these ideas, reform for re-engineering governance could include a re-drafting of regulation to allow for iterative cycles or ‘legal sunsets’, as planned periods of review. There are some review mechanisms for governance already in place. A specific water sector example is seen in water safety parameters reviewed every 5 years to take into account ‘*scientific and technical progress*’ (Article 11, Council of the European Union, 1998). Embracing triple loop learning, however, the review should be beyond extending lists of controlled parameters and should also address underlying principles behind why the rules are there and what they are trying to achieve. In the NBS and nutrient extraction examples it could include whether good ecosystem health has been achieved as opposed to the ‘*bean counting*’ approach of a single level of nutrient reduction with the possibility of that having no meaningful benefit overall. It should have built in review periods to ask if the regulations are working. To use the comments made by a participant in relation to the framework and applying this to the governance regime.

...should we be doing this differently, is there a way where we need to kind of stop and say like we are on the juggernaut? Stop. Is there just something completely different that we could be doing to deliver this project?

The participant here nails the essence of reflection and learning.

Overall, the governance regime has shown an ability to temper the market but its strong directive force has its limitations in bringing about desired change when it is narrowly drawn. It also shows the importance not just of policy change but for a consequential review of the granular rules that remain on the ground, otherwise policy aspirations can be extinguished by inertia within the rest of the governance regime. Re-engineering the governance system could consider wider data collection parameters and associated regulation, reflection periods and in-built triple loop learning to allow formal law to adapt to the complex adaptive system it is seeking to govern. In this way governance can be more agile alongside the system it is governing.

11 CONCLUSIONS

The result of this research is a framework, finally entitled the Justice Matrix, that will support project teams in navigating the governance systems around engineering projects with a view to improving their prospects of success. No one discipline holds all of the answers in striving for a just and sustainable future (McPhearson *et al.*, 2021), but a tool to support the integration of multidisciplinary thinking into technical teams was lacking. The Justice Matrix is designed to work in that space. Viewing the sector with a governance lens asks project teams to look beyond the immediacy of their projects into the wider implications of their work. The framework helps to facilitate that thinking and is a step forwards in the drive to encapsulate the wider goals of society, integrate knowledge and thinking from different disciplines and away from business-as-usual complacency.

Through the design of the framework, the primary purpose of the research has been met, but the research journey uncovered so much more about the sector by seeing it through the eyes of those working within it. The wealth of insights they generously shared, particularly from the interviews, are laid out and discussed in detail Chapter 10. The research shows the disjunct that can occur between policy aspiration and existing systems, where governance can lead a sector and hone market-forces but, if not drafted with adaptive principles in mind, can create outcomes that are neither sustainable nor just.

There are two broad issues to reiterate at the conclusion of this project, both representing flaws in how the sector is discussed or viewed. The first is the place of the market as a sector driver and the second is the absence of justice-thinking in decision-making.

Addressing the market-based issue first, of course the sector in England is privatised. What this research shows, however, is that market forces are not the main driver behind projects. The predominant driver behind projects was the need for regulatory compliance. This research provides evidence that governance can shape markets and behaviours. Economic drivers were present but regulatory drivers were overwhelmingly dominant. This insight should impact on strategies and business cases for innovators as well as help re-assess the essence of the regime and where problems might lie. Looking at problems solely in terms of market forces will not help resolve its issues or necessarily mean projects are taken on.

The aspirations of the governance regime through policies and international agendas has progressed from simply financial regulation. The reality of the governance regime, however, does not meet those aspirations, or at least there were many instances where it fell seriously short.

There is recognition at policy level of the social and environmental impacts of the sector and the need for those impacts to be more widely addressed. However, there is a strict legal framework and regulatory regime at odds with this. Whilst the regulatory regime provides security and enforceability, there is evidence of hurdles to innovation and wider problem framing limiting the potential for social and environmental benefits. This can be viewed in a similar way to physical infrastructure. Whilst physical infrastructure can cause inertia, lock-in and a preference for the *status quo*, so can legal and regulatory frameworks that are inflexible or out-of-date.

Further, there is a suggestion that problems go deeper than an embedding of the *status quo* to the potential for harm, for example:

- The preference for limited projects with narrow goals aligned with narrowly-drafted regulation at the expense of projects with greater social and environmental benefits. The nutrient projects led by regulatory requirements, for example, were said by participants to do more harm than good.
- The example of lack of challenge mechanisms within regulation and the consequent failure to question a 10-fold increase in project costs based on research suspected to be fundamentally flawed. This is directly opposite to a result where market forces dominate.
- Evidence of a preference for limited data sets and parameters for regulation leaving gaps in our knowledge of the environment, potentially flawed project choices and 'greenwashing' with the environment 'unheard' in procedural justice terms.

These insights were not from media exposés or public campaigns, but from within the sector itself. The lesson from this study is that this sector is better viewed as regulatory with some market influence rather than market-based tempered with regulation and treated accordingly. Knowing this means that the problems are better understood and solutions designed. Assuming that the sector in England is to remain privatised (as raised in Chapter 3, a change would result in a wholesale change in governance and networks at all levels), there remains things that can be done about the regulatory issues. It is possible to have the security and enforceability of law with flexibility using the principles discussed in this project around justice, adaptive governance and triple loop learning. It is also possible through careful redrafting to have regulation that reverses the data gap issue and encourages a wider range of environmental parameters to be collected. These solutions only come to light when the true nature of the regime as 'regulatory dominant' is accepted.

The second issue is that of justice. The literature review provides evidence of some justice-thinking in the sector, but not in a coherent way and some way behind the concept of sustainability. Justice-thinking has much to offer in the journey to sustainability, as clearly recognised in the international agendas around net zero. It is not a transition that is sought, but a 'just' transition. Justice thinking can provide the checks and balances needed when making choices about distribution and representation. This research suggests that justice should be the next 'nudge' along in the development of a water governance paradigm, growing from the sustainability agendas and guiding us through the difficult choices that increasing water stress will bring. This research provides evidence of its omission and helps support calls for this omission to be remedied.

Taking these ideas forward also highlights four areas for further study.

The essence of this study is believing in a need to tackle infrastructure issues differently and a move away from silos, whether they are administrative, physical boundaries or disciplinary. The first area for further study flows from the issue of disciplinary silos. A move towards transdisciplinarity requires an embracing of knowledge and ways of thinking outside of one's own skill set. This prompts different questions to be asked, a change in problem-framing and/or solution generation. There are calls for the breaking down of disciplinary silos to address the complex issues of the Anthropocene and this study joins with them (McPhearson *et al.*, 2021; Jensen, 2020; Chester and Allenby, 2019) – to an extent. During the study two broad mindsets were noted, one preferring narrow problem framing and the other embracing wider challenges. Through the study, as discussions took place with different individuals, it was apparent that both mindsets are extremely valuable and necessary. It appears likely that

teams require both for the creation of solutions that work, with a clear picture of the overriding (and necessary) drive for wider problem-framing whilst not losing sight of the need for focussed specialists. An exploration of the mindsets and their connection to problem-framing and the response to RI, and how both views can be embraced, could be explored and developed further. It would entail tackling the reluctance seen in areas around the role of RI and attitudes to the role of the general public in solution generation.

The second area for further study is the sustainability of a governance regime based so heavily upon command and control, regulatory governance. The governance system has shown its power and potential to control markets, but it could do better. The current regulatory system has grown in complexity over time as the nature of water and its interconnectivity with most other systems is recognised, along with the consequent desire to control its emergent features. The current trajectory appears to be more and tighter regulation. If the regime is to remain as privatised and external controls are required, then the extent to which increasing regulatory control can continue is questionable and, in any event, undesirable for innovation.

It is timely for these issues to be tackled as regulation is already undergoing a substantial review. A review is underway as the post-Brexit UK reconsiders its laws emanating from its time within the EU, from which much of water regulation emanates (see UK Gov, 2022). A further review is also underway in the EU in relation to some of its key environmental Directives, notably a revised Urban Wastewater Treatment Directive (European Commission, 2022). Although at present the content of the new Directive is still subject to review and debate it appears to be continuing along the trajectory of even tighter regulatory control over individual parameters (European Commission, 2022). There are opportunities now, not just to

look at what rules are in place but, as a participant put it, '*stop the steam train*' and undertake a triple-loop learning exercise with adaptive governance principles in mind. The literature review suggests adaptive governance provides potential answers to the quandary of increasing regulatory control, but further study is required to provide practical insights into how the strength of the law can be maintained yet drafted to flex with a complex adaptive system. It is timely for that to take place. Integrating reflection periods and building in triple-loop learning could assist by ensuring that granular rules in force align with new overarching and higher-level policy goals.

The third area for further study is to explore the potential of justice as a water governance paradigm by extending beyond the principles of sustainability. The literature review notes that sustainability is a well-established concept in water infrastructure and governance literature and achieving sustainability may, ironically, be mistakenly viewed as fundamentally 'good'. There is already useful overlap between the concepts of justice and sustainability, and sustainability could be the platform from which justice thinking nudges water governance forwards. The extent to which justice principles can be built into governance mechanisms, and project plans more explicitly, should continue to be explored.

This leads to the fourth area of study, that of data as a lever to improve the 'visibility' of nature, allowing it to be better plugged into governance systems. It could add to calls to explore representation and proxies as a voice for ecosystems in procedural justice terms (Pieraccini, 2019; Schlosberg, 2007). A wider range of data sets has the potential to provide a more holistic view of the state of an ecosystem and so monitoring of change over time. By looking at the connectivity between the themes from the interviews, data issues were a common thread

with potential connections between narrow problem framing (for example Nitrogen levels), narrowly-framed regulation, narrow parameters measured and narrowly-framed solutions. This is at odds with the desire for holistic water governance. The extent to which re-drafted regulation and new forms of data can be used to reverse this problem framing and lead to wider benefits could be explored. This may also address another barrier noted in the interviews, that of the remit of water companies. An expansion of the remit for more holistic governance, allowing for wider environmental good, could also be explored and the implications and trade-offs assessed.

In conclusion, the issues drawn from the study and the areas for further investigation show the connectivity between governance and projects in the sector. Governance has shown its potential to shape markets in the area under study through regulatory problem framing and by implementing the goals of the jurisdiction. It is submitted that the hypothesis of this study is therefore proven, at least in part. That governance shapes projects in the sector is overwhelmingly shown by the rationale for the projects chosen (and not chosen) and their connection to regulatory drivers. This supports the need for project teams to be alive to governance issues that will impact so heavily upon their success. The application of the framework could in fact be a useful tool to trial in other jurisdictions as a 'compare and contrast' to the strong UK regulatory results.

The second part of the hypothesis, that projects shape governance, is weaker. Nonetheless there was evidence of projects bringing about governance changes such as in water trading with new funding and contractual arrangements between water companies being derived and attempts being made (albeit unsuccessful in this instance) around catchment-based

approaches. It is submitted that on reflection the framing of the hypothesis was incorrect. It is not that projects do shape governance, but that they should shape governance. Comments to this effect were noted in the survey, in pushing back on governance, alongside the need to address the work-to-rule mentality seen on occasions. Mechanisms for learning from the hurdles project teams face should help engineer governance, making it easier for innovative solutions yet allowing the law to do its job and protecting what it needs to. The 'challenge' questions in the framework are designed to take the sector a step forward in progressing this element of the hypothesis.

This together with the integration of justice thinking should take us closer to the just and successful transformational changes we need.

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13 LIST OF APPENDICES

Appendix 1: Frameworks

- A. The Final Framework (the Justice Matrix)
- B. Early iterations of the Framework
 - Early iteration of Framework (Pipebots)
 - Second Iteration trialling Poster Format
 - Iteration Post Interviews and before Survey
- C. The Framework post-Focus Group (showing mark-up)

Appendix 2: Literature Review for Justice Principles

Copy of Article: Justice in (English) Water Infrastructure: A Systematic Review

Appendix 3: Literature Review Table for Project Team Frameworks

Results of Literature Review for Frameworks

Appendix 4: Ethics documents

- Ethics Application Part 1
- Ethics Approval Part 1 email exchanges
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- Ethics Approval Part 2 email exchanges
- Interview Consent Form and Participation Sheet (Interviews)
- Interview Consent Form and Participation Sheet (Focus Group)

Appendix 5: Interview Transcripts and Anonymised List of Projects

- List of Projects
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Appendix 6: Survey Results and Tables

- Bar Charts (from JISC Software)
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- Drinking Water Briefing Note
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APPENDIX 1: FRAMEWORKS

A. The Final Framework (the Justice Matrix)

B. Early iterations of the Framework

- **Early iteration of Framework (Pipebots)**
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C. The Framework post-Focus Group (showing mark-up)

JUSTICE MATRIX(JUST Interventions in Civil Engineering): A Touchpoint Matrix for Project Teams FINAL FRAMEWORK

GOVERNANCE	CONTEXT AND DESIGN	NETWORK	STRATEGY	BUSINESS CASE	LEARNING & CHALLENGE
THE PROJECT TEAM AND RESOURCE	1. What is the project about and what systems are affected? When answering this question consider the geographic, operational and administrative boundaries affected. Could the boundaries of the project be usefully expanded? Consider also Q13.	5. Does the project team have the expertise it requires to answer the matrix s? Consider your core team and its wider contacts whose expertise it can draw upon. Beyond engineering is local, operational and governance knowledge, available? How and when will you engage with them during the project.	9. If there are gaps in the expertise required to answer the matrix how will you draw-in knowledge and expand your network? Do you need external advice? Consider answers to Q1,5,6,7,8 and 11.	13. What benefits does the project bring to people and planet? Is there scope for wider social and environmental benefits? Does the answer vary with your answer to Q1.	17. How and when will you review the matrix, system boundaries and network with the team? How will you embed learning points into the project? 18. When will the team revisit the matrix, can this be scheduled into the project plan? Could the matrix itself be improved?
THE GOVERNANCE REGIME AND REGULATION	2. What sector specific regulations impact on the design of the project? For potable water, are you alert to the design impacts of Reg 31? If the rules are vast, can your network advise you on the rules-in-use for your project.	6. Who are the regulators, companies, agencies and authorities of interest to your project? Who is responsible for the system in the boundary areas affected by the project and are they in your network? Is there an opportunity to work with other utilities?	10. What sector specific issues or drivers need accounting for? Project teams in the past have raised AMP cycle and price reviews timescales, rules on contract procurement, as well as a desire for positive Public Relations Are there seasonal or ecological regulatory requirements e.g. wildlife surveys that need to be accounted for.	14. Do the benefits from Q13 support an existing regulatory requirement? If not, what supports the business case for change? Could any of the wider benefits from Q13 align with a regulatory requirement? Can this be used to bolster the business case?	19. From Q2, do regulations and governance need to be challenged? If so can the regulators advise you of the systems in place to support innovation? Note, if regulatory hurdles exist in England, could other jurisdictions be considered?
FORMAL LAW AND POLICY	3. Have common legal areas of concern been addressed? s human or ecosystem health, safety and security impacted? Is there a plan to ensure data safety and security? Is the security and resilience of critical national infrastructure (CNI) maintained? Have you referred this to your CNI team?	7. Considering other potential legal impacts and stakeholders - could there be an impact directly or indirectly (e.g. nuisance) on another's use of land or property? Can they be identified?	11 In relation to risks (including Q3 and Q7), resources and strategy - is this a project that should be kept in-house or should an external partner be engaged?	15. What policies are there that support the projects goals? Are you aware of any new or pending policies or trends that could be utilised? Can you link the Q13 benefits to a public policy or international goal such as an SDG, to support your case? Do new policies signal impending regulatory change and, if so, how does this fit with your goals?	20. Are there benefits that policy does not recognise, but should? If so what are they? Is the lack of support a hindrance to Q4 or Q13? Can your project or business use this project to advocate for change?
JUSTICE	4. Is there scope for the project design to embrace 'circular economy' opportunities? E.g. to re-think 'waste' as a potential asset, re-consider the use of extracted nutrients, re-think flood water etc.	8. Is there a Responsible Innovation (RI) code?)? Do you need a plan to introduce one? I.e. is there a code to support the balancing of risk, detriments and benefits and to plan stakeholder engagement.	12. Who or what may suffer a detriment as a result of the project (inc Q7)? Why is this group affected? If they are vulnerable or marginalised, how is the detriment justified? If there is no RI code, how will benefits, detriments and trade-offs be anticipated and balanced.	16. Who or what will benefit from the project? Why has this group been chosen to benefit over others/Q12? In answering Q12 and Q16 have future generations and the environment been included in the assessment? Are we clear and have we communicated not just what we are doing but WHY?	21. Can the data generated by the project fill current data gaps (particularly improving knowledge around environmental status)? 22. Standing back, do you feel this project will deliver the best feasible result for people and planet? What can be done in this respect? Are there lessons to learn?

Explanatory Notes

This matrix is drawn from the governance experiences of project teams in the sector and the principles of ‘just’ interventions. It is not designed to be prescriptive or constricting. It is designed to ask questions of a project team to challenge thinking and prompt reflection on issues relating to justice and governance to enrich project outcomes. It is for each company using the document to decide how it can be embedded into their systems.

Notes on the Matrix:

The responses can be organised into project outcomes (following the questions in vertical columns):

- **Context and Design** (the description of the project, its aims, and systems affected),
- **Network** (identifying internal and external support and stakeholders – and potential gaps to be filled),
- **Strategy** (responses that require action or feed into the delivery plan),
- **Business Case** (the case for change, the governance drivers behind the project and why change is needed), and
- **Learning and Challenge** (what are the governance hurdles to be challenged, what can be learnt from using the matrix to pass on to the next team, how can the matrix itself be improved).

Alternatively, the responses can be organised into governance themes (following the questions in horizontal rows):

- **Project Team and Resource** (the team, the system of interest and the aims of the project),
- **The Governance Regime and Regulation** (the formal or informal rules particular to the sector that impact on the project),
- **Formal Law and Policy** (recognising areas that are commonly heavily governed)
- **Justice** (focussing on distributive justice (the equitable distribution of benefits and detriments), and participatory justice and respect (ensuring there is a system for identifying and engaging with affected stakeholders)).

Q1,4 and 13 address the ‘System of interest’. Can ‘mission’ or ‘scope creep’ be avoided by more timely consideration of resource systems and connectivity? Are boundaries between systems affected by the project fully understood? Can opportunities to bring further social and environmental benefits be grasped from the start?¹

Q2 ‘rules-in-use’ – In a heavily regulated sector, not all of the rules are enforced or applicable. Which of the many formal and informal rules are relevant and prioritised in practice? Can you draw in the expertise of your network to guide you? Regulations will change over time and between jurisdictions. At the time of writing, strict provisions for England are contained in ‘Reg 31’².

Q3 and 11. Whilst legal issues will vary between projects, common areas are flagged. Where flags occur, and knowledge within the team or contacts cannot be drawn upon, external advice may be indicated.

Q5-8 address the ‘Network’, namely the project team and its internal expertise, the external contacts the team can draw upon and other affected stakeholders. The network can be drawn upon for information and to understand values and potential conflicts. Understanding affected stakeholders and an engagement strategy forms part of the Responsible Innovation codes in Q8 and 12.

Q8 and 12, Responsible Innovation (RI) can help form the ethical foundations for a project. In the absence of an ethical code of practice already within the business it is recommended that an RI code is adopted to include a public engagement strategy, where indicated³.

Q9. Tools for considering the network range from a simple review of the contact list to more specialist network analysis for controversial or complex projects⁴.

Q10. This flags governance issues project teams have flagged as impacting on project outcomes. AMP refers to Asset Management Plan. Positive PR acknowledges the political nature of the water regime and regulated customer satisfaction requirements.

Q13-16. These questions look for rules and policies the project can align with and use to support social and environmental benefits, where appropriate. The SDGs in Q15 refers to the Sustainable Development Goals⁵.

Q17-22. These questions seek to activate and galvanise a challenge to the status quo where that is required.

Q18 It is suggested that a first consideration of the matrix is undertaken at the early stages of the project. Not all of the questions will be relevant at this stage. Its subsequent application, record and review can be built into the ongoing project plan. This is also a provision for the matrix itself to develop and suggestions for refinement are positively encouraged.

¹ Further material on expanding the benefits of infrastructure projects can be found at <https://www.icevirtuallibrary.com/doi/10.1680/jcien.17.00031>.

² <https://www.legislation.gov.uk/uksi/2016/614/regulation/31/made>

³ As a starting point, the UKRI link is attached <https://www.ukri.org/about-us/policies-standards-and-data/good-research-resource-hub/responsible-innovation/>

⁴ For the latter, the UK Gov guide is attached as a starting point

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/491572/socnet_howto.pdf

⁵ <https://sdgs.un.org/goals> Link to the SDGs

Draft Governance Framework

Theme	Governance Questions	Consequences: Project Framing and Flexing	Consequences: Governance Framing and Flexing	Notes	Link here to Project Requirements
Intervention	How does the project impact geographically? What is the status of the water or infrastructure resource the intervention is designed to assist? Are there the societal groups impacted by the intervention not connected to geographical location?	N/a	Na/	SES and feedback from context	Requirements!
Constitution	From the above, what principles of justice* does the project align with, if any? (*distributive, procedural, recognition, capabilities - needs a guide).	Helps frame the case for change if required	Helps understand opposing arguments.	Academic support derives from justice and critiques of SES literature although not applied in this context	
	Does the project have a code of ethics or is Responsible Innovation (RI) otherwise embedded?	Suggests need for code of ethics or embedded RI principles within Project's internal governance (which in turn may/should influence the final design or its framing).		Academic support for this derives from STS principles. Possibilities include British Standard, IEEE or new responsible innovations codes	
Policy	What are the key benefits of the project. For each is there an associated public policy? <i>Intended benefits as per Liveable cities?</i>	Supports business case. Requires input on 'use cases'	Are there other key benefits not supported by policy? If so does this suggest a wider need for change?	Potential links to Liveable Cities Academic support for policy alignment seen in SES and STS. Also seen in literature on justice. Again not directly applied in this context	
	Are there any policies that may influence how the project should be developed and delivered?	(not just what is built but how it is built)	(do those policies unnecessarily inhibit innovation)	As above plus sustainability literature and focus not just on outcomes but how the project is delivered (e.g. full carbon counting)	
Impact of the Project on General Law (England)	Does the project have the potential to impact on human health, safety and security?	Does the team have the resources it needs to answer these questions?	Does the law fit with the wider policies of the day or is a need for reform flagged?	Law - sub-categories as per English Law and derived from my experience (noting would be different for example in a legal system with dual religious oversight), promotes transdisciplinary working. NB English law	
	Does the project have the potential to impact on another's property or require planning?				
	Does the project have the potential to impact the environment*? (consider projects interface with water, land, air and ecosystems)				
Governance Regime	Has the type of governance regime for the sector of interest been identified?	(Informs nature of network and regulations to be considered)	So 'governance' not 'government'. Multiple stakeholders, multiple tools of governance.	From work on government to governance. This model based on water industry in England.	
	Does the stakeholder or contact list for the project include links to potential users and regulators?	If not suggest network needs to be expanded	Query if the project brings about changes to who may be a potential relevant stakeholder?	Derives from work on importance of networks in systems (note 'wider society' contacts dealt with in Constitution and Values and Norms)	
Sector Specific Regulation	Does the Project help its target users (or their customers) meet their primary statutory duties?	To align with the business case in due course	Can the potential users in the network identify regulations or practices that hinder benefits? Are the controlling activities inhibitors for the project in the view of users?	There is literature that looks at tools of governance e.g. economic regulation, self regulation, formal rules. This is designed to look at context specific outcomes. May need to work on specific questions linked to tools chosen.	
	What mechanisms do the Regulators use for controlling the activities of the target users (or their customers) and how will the Project help them comply? (consider formal regs, economic drivers, information and education campaigns, voluntary arrangements)	To align with the business case in due course			
Value and norms	What mechanisms are in place to understand and engage with the societal values and norms that may impact on the Project?	RI provides some mechanisms for this. Until adverse behaviours identified cannot determine which package of governance tools should be considered. Also need to identify extent those behaviours are endorsed by the current regulatory package - (<i>potential work needed on how to communicate their identification and strategies to deal</i>).		STS and RI	

Governance Framework:

Matters for Consideration by the Project Team

The Intervention

- 1 Briefly describe the proposed infrastructure intervention (the project) **Context and Narrative**
- 2 Who is in the project team? **As well as engineering expertise can local, resource, operational and governance knowledge be drawn upon?** **Network**

The Resource

- 3 Describe the water/wastewater system (system) affected including any natural, geographic and administrative boundaries. **Context and Narrative**
- 4 Are you clear on the system boundaries and its interconnectivity with other relevant systems? **Context and Narrative**
- 5 Are there opportunities to re-frame any 'burdens' into assets e.g. flood water, removed nutrients, 'waste'? **Strategy-Context and Narrative**

The Regime

- 6 Who is responsible for the system in the boundary areas affected by the project? If responsibility is split how will multiple stakeholders be managed? **Network**
- 7 Who are the key regulators of interest for your project? Do you know how to access them, if required? **Network**
- 8 Is the project novel? Are you aware of regulatory mechanisms in place to support novelty/ innovation? **Strategy**
- 9 What cycles or timescales does the regime operate under - e.g. price reviews, regulatory reviews? **How may that affect the people in your network?** How will you account for these cycles in your project plan? **Strategy**

Challenge

- 33 Standing back, do you feel this project delivers the best feasible result for people and planet? **Business case**
- 34 If not, what legal, regulatory or policy drivers could be put in place to support you, can you lobby for change, escalate these issues or draw on your network to improve future projects? **Strategy**

Policy

- 10 What are the intended benefits of the project? **Other than technical goals are there wider social and/or environmental benefits?** **Business case**
- 11 Can you link the above benefits to a public policy or international goals such as SDGs? Are there benefits that policy does not recognise? If so what are they? **Business case.**

Law (Legal Landscape Impacts)

- 12 Could the project **risk** human or ecosystem, health, safety and security (positively or negatively)? How will this be understood, managed and communicated **Design requirements**
- 13 Could the project impact directly or indirectly (e.g. nuisance) on another's use of land or property? How will this be addressed? Who needs to be involved? **Network**
- 14 Is data collected and communicated? Is this safe and secure? Have protocols for the handling of data been identified and put in place? **Design requirements**
- 15 Does the project's impact on the security and resilience of critical infrastructure need to be considered? If relevant, how will this be addressed? **Design requirements**

Regulation (Regime Impacts)

- 16 Does the project support a regulatory requirement? **If not, what supports the business case for change?** **Business case**
- 17 Do the current regulations impact on the design of the project? **For potable water projects are you alert to Reg 31*?** **Business-case Design requirements**
- 18 If the rules are complex can your network advise you of the 'rules-in-use'? **Strategy Network**
- 19 Are you alert to any issues regarding contract/ procurement **and existing suppliers** that need to be addressed? **Strategy**
- 20 If regulatory hurdles exist should other jurisdictions be considered? **Strategy**

Justice (Niche)

- 21 Have you identified/embedded a responsible innovation (RI)* code including an AREA* assessment **Strategy**
- 22 If a code is still being considered do you need buy-in from the project team? **Strategy**

Justice (Application)

- 23 Who or what will benefit from the project? Why has this group been chosen to benefit? **Business case**
- 24 Who or what may suffer a detriment? Why is this group affected? **Does the RI code address communication and mitigation strategies?** **Strategy**
- 25 Where there are detriments, does your strategy include preparing for a delayed or late response from the public /NGOs? **Strategy**
- 26 In answering Q23/24 have future generations and the environment been considered? **Business case**
- 27 If there is no RI code, how will benefits, detriments and trade-offs be anticipated, balanced and discussed? **Business case**
- 28 How will the data generated by your project be used? Can it enhance our knowledge of the environment? **Business case**

Network

- 29 Who is in your stakeholder or contact list (plus see answers to Q2,6,7,13,23 and 24). Does this include operations, R&D and engineering contacts? **Network**
- 30 Are all potential stakeholder groups represented / do gaps need to be filled? **Strategy**
- 31 How do you plan to engage and respect your network/ stakeholders to understand values that may impact on the project? Does your RI code address this? **Network**
- 32 If any of these framework questions cannot be answered **can you draw on the expertise of your network?** If not how can you expand your network? **Network/Strategy**

Review

- 35 How / to whom, will you communicate the answers to this framework? **Network**
- 36 How can this framework be improved?
- 37 When do you plan to revisit and review the answers? **Strategy**

Governance Framework:

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The Regime

- 6 Who is responsible for the system in the boundary areas affected by the project? If responsibility is split how will multiple stakeholders be managed? **Network**
- 7 Who are the key regulators of interest for your project? Do you know how to access them, if required? **Network**
- 8 Is the project novel? Are you aware of regulatory mechanisms in place to support novelty/ innovation? **Strategy**
- 9 What cycles or timescales does the regime operate under - e.g. price reviews, regulatory reviews? How may that affect the people in your network? How will you account for these cycles in your project plan? **Strategy**

Policy

- 10 What are the intended benefits of the project? Other than technical goals are there wider social and/or environmental benefits? **Business case**
- 11 Can you link the above benefits to a public policy or international goals such as SDGs? Are there benefits that policy does not recognise? If so what are they? **Business case.**

Law (Legal Landscape Impacts)

- 12 Could the project risk human or ecosystem, health, safety and security (positively or negatively)? How will this be understood, managed and communicated **Design requirements**
- 13 Could the project impact directly or indirectly (e.g. nuisance) on another's use of land or property? How will this be addressed? Who needs to be involved? **Network**
- 14 Is data collected and communicated? Is this safe and secure? Have protocols for the handling of data been identified and put in place? **Design requirements**
- 15 Does the project's impact on the security and resilience of critical infrastructure need to be considered? If relevant, how will this be addressed? **Design requirements**

Regulation (Regime Impacts)

- 16 Does the project support a regulatory requirement? If not, what supports the business case for change? **Business case**
- 17 Do the current regulations impact on the design of the project? For potable water projects are you alert to Reg 31*? **Design requirements**
- 18 If the rules are complex can your network advise you of the 'rules-in-use'? **Network**
- 19 Are you alert to any issues regarding contract/ procurement and existing suppliers that need to be addressed? **Strategy**
- 20 If regulatory hurdles exist should other jurisdictions be considered? **Strategy**

Justice (Niche)

- 21 Have you identified/embedded a responsible innovation (RI)* code including an AREA* assessment **Strategy**
- 22 If a code is still being considered do you need buy-in from the project team? **Strategy**

Justice (Application)

- 23 Who or what will benefit from the project? Why has this group been chosen to benefit? **Business case**
- 24 Who or what may suffer a detriment? Why is this group affected? Does the RI code address communication and mitigation strategies? **Strategy**
- 25 Where there are detriments, does your strategy include preparing for a delayed or late response from the public /NGOs? **Strategy**
- 26 In answering Q23/24 have future generations and the environment been considered? **Business case**
- 27 If there is no RI code, how will benefits, detriments and trade-offs be anticipated, balanced and discussed? **Business case**
- 28 How will the data generated by your project be used? Can it enhance our knowledge of the environment? **Business case**

Network

- 29 Who is in your stakeholder or contact list (plus see answers to Q2,6,7,13,23 and 24). Does this include operations, R&D and engineering contacts? **Network**
- 30 Are all potential stakeholder groups represented / do gaps need to be filled? **Strategy**
- 31 How do you plan to engage and respect your network/ stakeholders to understand values that may impact on the project? Does your RI code address this? **Network**
- 32 If any of these framework questions cannot be answered can you draw on the expertise of your network? If not how can you expand your network? **Network/Strategy**

Challenge

- 33 Standing back, do you feel this project delivers the best feasible result for people and planet? **Business case**
- 34 If not, what legal, regulatory or policy drivers could be put in place to support you, can you lobby for change, escalate these issues or draw on your network to improve future projects? **Strategy**

Review

- 35 How / to whom, will you communicate the answers to this framework? **Network**
- 36 How can this framework be improved?
- 37 When do you plan to revisit and review the answers? **Strategy**

JUSTICE ~~MATRIX~~FRAMEWORK (JUST Interventions in Civil Engineering): A Touchpoint ~~Matrix Framework~~ for Project Teams vs POST FOCUS GROUP.4

GOVERNANCE	CONTEXT AND DESIGN	NETWORK	STRATEGY	BUSINESS CASE	LEARNING & CHALLENGE
THE PROJECT TEAM AND RESOURCE	1. What is the project about <u>and what systems are affected?</u> When answering this question consider the geographic, operational and administrative boundaries affected. Could the boundaries of the project be usefully expanded? Consider also Q13.	5. Does the project team have the expertise it requires to answer the frameworkmatrix questions? Consider your <u>core</u> team and its wider contacts whose expertise it can draw upon. Beyond engineering is local, operational and governance knowledge, available? <u>How and when will you engage with them during the project.</u>	9. If there are gaps in the expertise required to answer the frameworkmatrix questions-how will you draw-in knowledge and expand your network? <u>Do you need external advice?</u> Consider answers to Q1,5,6,7,8 and 11.	13. What benefits does the project bring to people and planet? Is there scope for wider social and environmental benefits? Does the answer vary with your answer to Q1.	17. <u>What lessons around boundaries and networks have been learnt?</u> <u>Did the system of interest change or the network expand during the course of the project? If so, when and why?</u> <u>How and when will you review the matrix, system boundaries and network with the team? How will you embed learning points into the project?</u> 18. When will the team revisit the frameworkmatrix , can this be scheduled into the project plan? Could the frameworkmatrix itself be improved?
	2. What sector specific regulations impact on the design of the project? For potable water, are you alert to the design impacts of Reg 31? If the rules are vast, can your network advise you on the rules-in-use for your project.	6. Who are the regulators, <u>companies, agencies</u> and authorities of interest to your project? Who is responsible for the system in the boundary areas affected by the project and are they in your network? <u>Is there an opportunity to work with other utilities?</u>	10. What sector specific issues or drivers need accounting for? Project teams in the past have raised AMP cycle and price reviews timescales, rules on contract procurement, as well as a desire for positive Public Relations. <u>Are there seasonal or ecological regulatory requirements e.g. wildlife surveys that need to be accounted for.</u>	14. Do the benefits from Q13 support an existing regulatory requirement? If not, what supports the business case for change? Could any of the wider benefits from Q13 align with a regulatory requirement? Can this be used to bolster the business case?	19. From Q2, do regulations <u>and governance</u> need to be challenged? If so can the regulators advise you of the systems in place to support innovation? Note, if regulatory hurdles exist in England, could other jurisdictions be considered?
FORMAL LAW AND POLICY	3. Have common legal areas of concern been addressed? <u>Is human or ecosystem health, safety and security impacted? Is there a plan to ensure data safety and security?</u> Is the security and resilience of critical <u>national</u> infrastructure (<u>CNI</u>) maintained? <u>Have you referred this to your CNI team?</u>	7. Considering other potential legal impacts and stakeholders - could there be an impact directly or indirectly (e.g. nuisance) on another's use of land or property? Can they be identified?	11. <u>In considering any project-specific risks (including Q3 and Q7), do you need specialist external advice?</u> <u>In relation to risks (including Q3 and Q7), resources and strategy -is this a project that should be kept in-house or should an external partner be engaged?</u>	15. What policies are there that support the projects goals? Are you aware of any new or pending policies <u>or trends</u> that could be utilised? Can you link the Q13 benefits to a public policy or international goal such as an SDG, to support your case? Do new policies signal impending regulatory change and, if so, how does this fit with your goals?	20. Are there benefits that policy does not recognise, but should? If so what are they? Is the lack of support a hindrance to Q4 or Q13? Can your project or business use this project to advocate for change?
JUSTICE	4. Is there scope for the project design to embrace 'circular economy' opportunities? E.g. to re-think waste as a potential asset, re-consider the use of extracted nutrients, re-think flood water etc.	8. Is there a Responsible Innovation (RI) code? <u>(or company ethics code)?</u> Do you need a plan to introduce one? I.e. is there a code to support the balancing of risk, detriments and benefits and to plan stakeholder engagement.	12. Who or what may suffer a detriment as a result of the project (inc Q7)? Why is this group affected? If they are vulnerable or marginalised, how is the detriment justified? If there is no RI code, how will benefits, detriments and trade-offs be anticipated and balanced.	16. Who or what will benefit from the project? Why has this group been chosen to benefit over others/Q12? In answering Q12 and Q16 have future generations and the environment been included in the assessment? <u>Are we clear and have we communicated not just what we are doing but WHY?</u>	21. Can the data generated by the project fill current data gaps (particularly improving knowledge around environmental status)? 22. Standing back, do you feel this project <u>will</u> deliver the best feasible result for people and planet? What <u>can be done has been learnt</u> in this respect? <u>Are there lessons to learn?</u>

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JUSTICE ~~MATRIX~~FRAMEWORK (JUST Interventions in Civil Engineering): A Touchpoint ~~Matrix~~Framework for Project Teams vs ~~POST FOCUS GROUP~~-4

Explanatory Notes

This ~~framework~~matrix is drawn from the governance experiences of project teams in the sector and the principles of just interventions. It is not designed to be prescriptive or constricting. It is designed to ask questions of a project team to challenge thinking and prompt reflection on issues relating to justice and governance to enrich project outcomes. It is for each company using the document to decide how it can be embedded into their systems.

Notes on the ~~Matrix~~framework:

The responses can be organised into project outcomes (following the questions in vertical columns):

- Context and Design (the description of the project, its aims, and systems affected),
- Network (identifying internal and external support and stakeholders – and potential gaps to be filled),
- Strategy (responses that require action or feed into the delivery plan),
- Business Case (the case for change, the governance drivers behind the project and why change is needed), and
- Learning and Challenge (what are the governance hurdles to be challenged, what can be learnt from using the ~~matrix~~framework to pass on to the next team, how can the ~~matrix~~framework itself be improved).

Alternatively, the responses can be organised into governance themes (following the questions in horizontal rows):

- Project Team and Resource (the team, the system of interest and the aims of the project),
- The Governance Regime and Regulation (the formal or informal rules particular to the sector that impact on the project),
- Formal Law and Policy (recognising areas that are commonly heavily governed)
- Justice (focussing on distributive justice (the equitable distribution of benefits and detriments), and participatory justice and respect (ensuring there is a system for identifying and engaging with affected stakeholders).

Q1,4 and 13 address the System of interest. Can mission or scope creep be avoided by more timely consideration of resource systems and connectivity? Are boundaries between systems affected by the project fully understood? Can opportunities to bring further social and environmental benefits be grasped from the start?¹

Q2 rules-in-use – In a heavily regulated sector, not all of the rules are enforced or applicable. Which of the many formal and informal rules are relevant and prioritised in practice? Can you draw in the expertise of your network to guide you? Regulations will change over time and between jurisdictions. At the time of writing, strict provisions for England are contained in Reg 31.²

Q3 and 11. Whilst legal issues will vary between projects, common areas are flagged. Where flags occur, and knowledge within the team or contacts cannot be drawn upon, external advice may be indicated.

Q5-8 address the Network, namely the project team and its internal expertise, the external contacts the team can draw upon and other affected stakeholders. The network can be drawn upon for information and to understand values and potential conflicts. Understanding affected stakeholders and an engagement strategy forms part of the Responsible Innovation codes in Q8 and 12.

Q8 and 12, Responsible Innovation (RI) can help form the ethical foundations for a project. In the absence of an ethical code of practice already within the business it is recommended that an RI code is adopted to include a public engagement strategy, where indicated.³

Q9. Tools for considering the network range from a simple review of the contact list to more specialist network analysis for controversial or complex projects.⁴

Q10. This flags governance issues project teams have flagged as impacting on project outcomes. AMP refers to Asset Management Plan. Positive PR acknowledges the political nature of the water regime and regulated customer satisfaction requirements.

Q13-16. These questions look for rules and policies the project can align with and use to support social and environmental benefits, where appropriate. The SDGs in Q15 refers to the Sustainable Development Goals.⁵

Q17-22. These questions seek to activate and galvanise a challenge to the status quo where that is required.

Q18 It is suggested that a first consideration of the ~~matrix~~framework is undertaken at the early stages of the project. Not all of the questions will be relevant at this stage. Its subsequent application, record and review can be built into the ongoing project plan. This is also a provision for the ~~matrix~~framework itself to develop and suggestions for refinement are positively encouraged.

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¹ Further material on expanding the benefits of infrastructure projects can be found at <https://www.icevirtuallibrary.com/doi/10.1680/jcien.17.00031>.

² <https://www.legislation.gov.uk/uksi/2016/614/regulation/31/made>

³ As a starting point, the UKRI link is attached <https://www.ukri.org/about-us/policies-standards-and-data/good-research-resource-hub/responsible-innovation/>

⁴ For the latter, the UK Gov guide is attached as a starting point

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/491572/socnet_howto.pdf

⁵ <https://sdgs.un.org/goals> Link to the SDGs

APPENDIX 2: LITERATURE REVIEW FOR JUSTICE PRINCIPLES

Copy of Article: Justice in (English) Water Infrastructure: A Systematic Review

Article

Justice in (English) Water Infrastructure: A Systematic Review

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Abstract: This paper reports on a systematic review of the literature around governance and water infrastructure in England to analyse data on the application, or absence, of justice themes. It finds that, unlike in other sectors, justice thinking is far from embedded in the water sector here and whilst there are signs of a discussion there is a lack of sophistication and coherence around the debate. More positively, the research suggests that the concept of justice can be used as a tool or framework to help air and address these complex issues and in doing so is an advance on the concept of sustainability. By exploring the issues in this way, the study reveals a wealth of opportunities to use justice-thinking to improve infrastructure decision making. It is suggested a justice approach is the next step as our thinking matures beyond sustainability, improving the decisions we make for people and planet.

Keywords: justice; water; infrastructure; wastewater; governance; sustainability; systematic literature review

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1. Introduction

Water is a precious, life essential resource that, in England, a country often maligned for its wet weather, is often taken for granted. However, as a nation it is not immune from the crisis confronting the rest of the planet, notably because the context changes greatly from south to north, and east to west. Indeed, the National Infrastructure Commission stated “The risk of households having their supplies rationed because there is not enough water is significant. Large and densely populated parts of England have lower annual rainfall than Sydney and Mexico City” [1]. Added to this geographical disparity, England is facing changing weather patterns, leading to climate-induced water shortages and irreversible damage to its ecosystems as a combination of climate change, population growth and unsustainable practices [2].

Interventions into our water infrastructure are needed if we are to address the environmental and social issues of the water crisis [1]. However, in doing so, we are making choices about how the benefits and the consequences of those interventions are going to be distributed. Areas that bear the brunt of disruptive infrastructure construction for example, may not be the same areas that that reap the benefits of its implementation; societal and environmental impacts or the opportunities afforded by the intervention may not be felt uniformly. The cost of infrastructure also needs to be assessed both financially and more broadly to include how in providing for humans now we impact on future generations or how we may devastate non-human life. In addressing these issues we are making choices about ‘winners and losers’ [3,4]. If water is essential for life then how we deal with its distribution through our infrastructure, how we govern our resources and address these tensions is a question of whether we have acted justly [4].

In the energy field at least, it is accepted that the ‘transition’ to sustainability should be just even if discussion in this area appears limited to economic impacts of the move to net zero carbon [5–8]. This is driven, at least in part, by the urgent need to move away from fossil fuels to greener forms of energy. Academic discourse on justice in the energy literature appears to be establishing itself [3,5–7], but it is emerging in other sectors such as transport as well [8,9]. The authors of this paper are not alone in noting its relative absence in infrastructure in the water sector, particularly in developed economies such as in England [10,11]. This leads to what appears to be a gap in discussions on infrastructure and governance in the water sector here; whether justice considerations are evident in how infrastructure interventions are framed and planned.

To fill this gap, this research asks, as we strive to adapt to the water crisis: is justice present in thinking around how we govern our water resources and infrastructure; and are justice themes evident in how we are seeking to ‘upgrade’ our water and wastewater infrastructure in response to our water needs? In an attempt to answer these questions the current authors undertook a systematic review of the literature around governance and water infrastructure in England to analyse evidence on the application, or absence, of justice themes. The systematic literature review process as outlined by Yigitcanlar et al. was adopted [12]. A systematic literature review makes clear the parameters used to search the literature ensuring openness, replicability and reducing the opportunities for bias. It is the ideal methodology to identify texts or search for terms and concepts within those texts. It allows the hypothesis, that justice thinking is mostly absent from those texts, to be clearly tested and any limitations in the research methods adopted to be clearly identifiable.

This study is set out as follows:

1. Prior to commencing the systematic literature review what is meant by ‘justice’ needs to be explored and clearly set out. This study therefore starts by defining what is meant by ‘justice’ and explores themes around the concept. From those themes a framework of justice is created.
2. The study then sets out the methodology for the systematic literature review and provides an overview of the data collected;

3. This is followed by a more detailed discussion and analysis of the findings. The justice framework and themes is used to inform the analysis. This section includes a discussion on the limitations of the research methods deployed; and
4. The conclusion seeks to answer the research questions and suggest further areas of research.

2. Key Concept: Justice

In considering justice it is first beneficial to understand the governance regime in England to provide context. There are many ways in which water supply and infrastructure can be owned and governed—for example, a commons approach as discussed in the theories of social-ecological systems such as explored by Ostrom [13,14], municipal or state holding, market-based, or a hybrid scheme—and each regime has its advocates and detractors (for comparative case studies see [15,16]). It is argued below that each regime has its own impact on the application of justice.

Water governance in England is perhaps infamous for its privatisation, implemented at least in part to raise revenue for its ageing, under-funded infrastructure [17]. As regional water companies were set up to manage local monopolies of water and wastewater services, a series of institutional, regulatory and other governance mechanisms were initiated, and have since developed, to balance the need for water companies to make profit with affordability for their customers. A system of government, quasi-government, corporate and civil organisations are now involved in its management, epitomising the wider move from top-down government to ‘governance’ [18]. The implications of this fundamental change of regime, its impact on state and non-state actors, the view of water as a commodity and ‘citizens as consumers’ continue to be scrutinised [18–21]. As discussed later, it provides a context into which justice concepts are placed or where the regime and justice may be said to conflict.

In defining and applying concepts of justice, reliance here is placed on Schlosberg’s widely cited work on environmental justice [22]. The reason for selection of this work is its comprehensive review of justice themes relevant to the tensions in governance of natural resources, such as water, and its interface with humanity [23–25]. It is a work that, through its breaking down of the concept of justice, enables it to be understood and applied to different contexts. The association with the concept of ‘just sustainability’ is also significant [26,27], the addition of the word ‘just’ expressly accepting in some way that sustainability alone is not ‘enough’. The discussion draws on bodies of work around justice to include different forms of justice—distributive, procedural, recognition (or respect), and ‘capacities’ (or capabilities), all of which can interconnect [22].

1. Distributive justice is credited to the work of Rawls and justice as fairness [28], and addresses how resources, benefits and detriments are allocated amongst us. It accepts that there will always be ‘winners and losers’, but justice provides a mechanism for that to be as equitable and fair as possible. Where there is a distribution that is unequal, for example, that inequality should be to the benefit of the most disadvantaged [29]. It can be construed wider. A recent example is the ‘polluter pays’ principle, those who pollute being held responsible for the consequences.
2. Procedural justice demands there should be access to justice and procedural fairness: it asks who participates, who decides and how a conflict is resolved, and is an important form of justice alongside distribution [30]. There have been moves to embed principles of access to information, public participation in decision-making and access to justice, particularly in the environmental arena as enshrined in agreements such as the Aarhus Convention [31] and mandated in the EU Water Framework Directive [32].

Procedural justice is all the more important when considering the model of governance and the multiplicity of bodies, rules and regulations that can apply in complex systems such as water infrastructure in England. A just governance system needs a process

that allows multiple view-points to access it, to have the information they need and to have a forum to be listened to. Such a system can cut through the multiplicity of rules and players, inherent in ‘governance not government’, and allow the views of stakeholders to be aired, balanced and addressed [33].

3. **Recognition and respect** define procedural justice further to ensure that all voices are heard and respected in that process. Without recognition and respect there is no true voice, and it cannot be shown that a distribution or process is fair. In the absence of recognition, the processes lead to maldistribution [22]. This can be considered further when applying Arnstein’s ladder of citizen participation [34] on the even more complex question of whether a process gives a true voice; whether there is tokenism or true engagement and empowerment.

The connection between recognition and infrastructure is noted in the struggle for equality in the US, with disadvantaged groups feeling targeted for the siting of undesirable development, (for examples see [25]). A study in the UK also flags issues of social peripheralisation, or lack of political capital, and the risk of infrastructure planners being attracted to those areas for interventions, noting,

‘projects tend to run smoother where there is a background of undemocratic processes and low levels of activism’

([35] (p.4); see also [6])

‘Smoother’ presumably meaning to some ‘implemented without troublesome objection’ or the absence of so-called ‘NIMBYs’ (*Not In My Back Yard*). Justice in recognition is connected to the absence of distributive justice in the allocation of benefits and detriments. A decision based on siting of an intervention—not where it is best, but on the path of least (human) resistance—would be at odds with this view of justice.

4. Capacities, or capabilities, is credited to separate works of Sen [36,37] and Nussbaum [38,39]. It encapsulates the three previous approaches but goes further in not simply seeking some form of fair dispute resolution. It has positive aims to improve the lives of living things. Its essence is that for justice, an individual must be enabled to have access to assets they need not just to survive, but to thrive. It can include the equitable distribution among us to achieve this, and how we participate and engage with due process and respect for those needs to be articulated and heard. It then goes further by addressing quality of life and well-being, by setting minimum standards that need to be achieved [22]. (For an example of the application of capability justice in infrastructure in practice, see [8]).

The capabilities approach, achieving well-being, sits well with the concept of ‘liveability’ and further helps express the need for distributive and procedural justice in achieving that goal, i.e., how resources are distributed fairly so one’s well-being is not at the unfair expense of another [40]. In terms of planetary well-being, academics such as Nussbaum and Holland extend the capabilities approach to living things more generally, justice being the equitable distribution, procedural recognition and fairness to achieve that required for a living thing to flourish, to fully function as itself as far as possible [39,41]. This view extends the question of ‘who’ should have a voice, from a limited human perspective into non-human systems of ecosystems and environmental well-being in its own right.

The justice issues extend to how we represent the interests of future generations, how the needs of future generations are spoken for and represented now—in fact this has been described as the key tension of our age [42]. Attesting to the currency of this debate, at the time of writing a Bill addressing some of these issues is making its way through the House of Lords [43]. Consideration of our future impacts in this way arguably joins the concepts of sustainability and justice together. Further, the authors of this paper argue that justice takes us beyond the concept of sustainability. Sustainability accepts there are three pillars

—social, economic and environmental. Justice provides mechanisms for those often competing interests to be aired, judged and addressed. In addressing these questions, justice is more than a policy or law, although justice may be embodied in those instruments. Justice becomes part of our overarching Constitution [29] (p. 225), the driver for equity and fairness in our governance regime and a fundamental approach to how interests (current and future, human and non-human) are balanced.

It is these themes and articulation of justice that is taken forward into the study as shown in Figure 1. These themes form the basis of a framework.



Figure 1. Framework: Themes of Justice in Water Infrastructure.

3. Materials and Methods

A systematic literature review was undertaken to identify and evaluate the extent that justice considerations were evident in literature on governance of water infrastructure in England. The aim was to focus on interventions in infrastructure systems, both what is being talked of and what has been implemented. The study therefore included grey literature addressing practical infrastructure issues on the ground through to literature addressing water governance at a purely academic or conceptual level.

The following search terms were identified:

- Water OR blue OR sew* (to allow for sewage, sewerage);
- Infrastructure OR intervention OR construction;
- Governance;
- UK OR “United Kingdom” OR Britain OR England.

Although the jurisdiction of interest was England, Britain and the UK were included in search terms. This was because despite the ongoing process of devolution, the UK still shares common elements of governance and articles of potential relevance to England could otherwise be excluded. Documents that reference the UK generally were included even if they did not include an express reference to England alone. Terms such as justice, equity, equitable and equality were included as a trial. This gave extremely low return rates, too small for a review. ‘Rights’ gave slightly more returns, although again too low, and mostly because of the use of the word in other contexts including ‘copyright’.

Three databases were used—Web of Science, ProQuest and Compendex (Engineering Village)—with a view to ensuring multiple disciplines were fairly covered. A review process in line with that proposed by Yigitcanlar et al. [12] was adopted. The application of that process in detail was as follows:

- The above search terms were applied to an ‘abstract, title or subject’ search firstly to the Compendex database giving 365 returns.
- The results were filtered using controlled terms relating to infrastructure, governance and water. This gave 72 returns. A test of a selection of excluded documents was undertaken to ensure the filters applied did not exclude legitimate documents.
- The duplicate filter then removed 11 documents, leaving 61.
- The abstracts were previewed to check consistency with the aim and scope of the study. Documents rejected included additional duplicates not filtered out previously,

and documents that did not relate to England or where water or sewerage was not the predominant issue. Documents were excluded which could not be located online.

- Documents were not excluded on language or document type, i.e., grey literature was included.
- In total 28 documents were taken forward for a full review.

As an aside, a filter of ‘justice, equity* OR equality’ in the abstracts of the 61 documents referred to above resulted in no returns. ‘Rights’ resulted in 7.

The same process was applied to the Web of Science and then the ProQuest databases, producing initial search returns of 42 and 78, respectively. The filtering process resulted in 32 and 23 results to take forward.

The documents from the three databases were cumulated in Endnote software and duplicates removed. This resulted in 57 articles. These articles were reviewed in full. Some articles included reference to more than one jurisdiction. These were included as long as there was specific discussion on issues in England, for example comparisons between England and Australia or Europe. Similarly documents that had a specific discussion on water but also other sector interventions were included. Documents covering infrastructure generally without a specific focus on the water sector in England were excluded.

Of the 57 documents identified, 36 were found to match the criteria. These are exhibited in Table 1.

Table 1. Categorisation of References to Justice in the literature.

Category	Description	Number	Identity
A	Contains express reference to ‘justice’	3	Brown et al., 2010; Strang, 2016; Thaler and Priest, 2014. [44–46]
B	Is not included in A above, but does contain express references to ‘equity’, ‘equality’ and/or ‘rights’	8	Collins, 2012; Goytia et al., 2016; Guy and Marvin, 1996; Liang, Deller and Hviid, 2019; Molyneux-Hodgson and Balmer, 2014; Perrotti, Hyde and Otero Peña, 2020; Speight, 2015; Wells, 2019. [47–54]
C	Is not included in A or B above, but does contain references to justice themes	8	Broich, 2007; Frijns et al., 2016; Holt and Baker, 2014; Melville-Shreeve et al., 2018; Murrant et al., 2017; Piper, 2014; Roberts, 2007; Sharp, Macrorie and Turner, 2015. [55–62]
D	Is not included in A to C above, but does reference ‘sustainability’	13	Bar-Isaac and Walker, 2018; Brown, Ashley and Farrelly, 2011; Browne, Jack and Hitchings, 2019; Charlesworth, Warwick and Lashford, 2016; Goodwin et al., 2019; Gunasekara et al., 2018; Heptonstall, 2010; Rodda, 2009; Spiller et al., 2012; Ward et al., 2012; Ward and Butler, 2016; Way et al., 2010; Willis, Scarpa and Acutt, 2005. [63–74]
E	Is not included in A–D above	4	Bankoff, 2013; Millington, 2014; Tresidder and White, 2018; Williams, 2008. [75–78]

4. Results

The 36 articles were read and compared, with the following classes identified. 36 documents were reviewed:

- 28 peer reviewed journal articles
- 5 journal articles, not peer reviewed
- 1 chapter in a book
- 1 lecture (video)
- 1 thesis

Date ranges:

- 1 from 1996
- 1 from 2005
- 7 between 2006 to 2010
- 11 from 2011 to 2015
- 16 from 2016 to 2020

Governance issues could be broken down as follows:

- 4 Policy
- 10 Law and regulation (excluding economic regulation)
- 4 Economic regulation only
- 8 Sector Regime including networks
- 1 Norms, values and behaviours
- 9 Multiple forms of the above

Infrastructure interventions included physical and non-physical interventions. There were 25 Physical interventions:

- 9 Water Re-Use/Rain Water Harvesting and Sustainable Drainage Systems (SuDS)
- 2 hydropower schemes
- 2 sewerage and wastewater treatment
- 2 urban blue landscaping
- 5 freshwater pipe network including reservoirs and abstraction, metering and retrofitting
- 4 flooding interventions including Natural Flood Management
- 1 synthetic biology

The 11 remaining, non-physical interventions included work around policy, finance and economics, regulation and planning and development.

Additional data recorded included the discipline of the author(s) where discernible, any nexus (e.g., energy, food, transport) and academic school of thought if any (e.g., socio-technical systems, socio-ecological systems, commons, transition management). No immediate trends were apparent other than the diverse range of interests and thinking.

The documents were reviewed for references and engagement with justice issues. Due to the relatively low number of documents this was capable of being undertaken by hand. Of the 36 documents only three contained an express reference to justice. These were defined as Category A. Due to the low returns, express references to equity, rights and equality were also searched for and identified. These were defined as Category B. As well as express references, themes around the justice principles of distribution, procedure, respect and capabilities were also highlighted, even though express references to the key terms themselves were absent. These were defined as Category C.

This left some 17 documents without a categorisation. However, during the review process the prevalence of the term 'sustainability' was noted. The documents were re-reviewed to note the use of this term and also 'resilience'. In comparison to the three documents that contained an express reference to justice there were 27 documents that referenced sustainability and 14 for resilience. The 17 uncategorised documents were re-considered: 13 referred to sustainability and were defined as Category D, while the small balance of 4 documents that remained were defined as Category E. The articles and categories are summarised in Table 1.

The categories of most interest are those where justice is referred to either directly (A) or implicitly (B and C). The possible use of sustainability in lieu of justice was then considered through a review of all of the texts including those in Categories D and E.

5. Analysis

The focus of the analysis is on how the concept of justice is seen and used in the texts (or indeed its absence). These are found in Categories A, B and C. The analysis centres on how justice is dealt with in the Category A documents before ascertaining whether any additional themes can be gleaned from Categories B and C. In looking at themes the content of the texts is discussed and the framework containing themes (of distributive justice, procedural justice, respect and recognition and capability justice) is applied.

5.1. Category A

The three documents in Category A exemplify the diverse fields and interests in this field despite all three being grounded in issues of water, governance and infrastructure in

England. Although all three refer directly to justice, justice is not the core theme in any of them, rather it is an issue that pervades the topics of interest to varying degrees.

Strang discusses the connection between water and power, in particular how it is mediated through the provision of infrastructure [45]. It addresses these issues through a historical narrative and in the context of the current market-based governance model chosen in the UK (as well as comparing this with experiences in Australia). It argues that a market-based regime, particularly where the corporate ‘owners’ of the infrastructure are international, can be detached from the communities they serve and may or may not choose to act in their best interests. With the separation of control of water infrastructure, the article raises governance questions over the role of the State (or lack of) and issues of legitimacy and accountability over the governing of a natural resource when left in the hands of a detached corporate body. This leads to the tension between market-led regimes and the social justice and ‘water rights’ movement—the fundamental difference in how water is viewed as a ‘common good’ versus the market-led view of water as a commodity. The article addresses how the market-led governance ‘regime’ is not simply a context or background for decision-making around water but more than this, it shapes roles, behaviours and attitudes to water more directly.

The link with justice is evident in discussions on the drive for sustainability and its encouragement of bottom-up, community participation; participation having the potential to address issues of legitimacy and accountability that could otherwise be lacking in this regime. It argues that problems arise when some groups are excluded from due process or where only the stronger voices are heard. In this way it is arguable whether the author is articulating a connection between sustainability and participatory justice, and particularly how important participatory justice becomes in this model. However, it is the tension between human and ecosystems that are aired most directly. The conflict and tensions with the needs of ecosystem health with the immediate needs of humanity is; in distributive justice terms, humanity taking the benefits of an intervention and the ecosystem bearing the burden. The connection between justice and sustainability is discernible in the powerful closing paragraph concerning the failure to balance of the needs of ecosystems and humans:

“And humans do not hold all of the cards. In the end, the environment itself, impartially and inexorably, will continue to respond to human expressions of agency and power through water: if these are unsustainable they will, quite simply, cease to be sustained”

[45] (p.318)

In looking at water as power through its control and distribution, that power appears to rest with humans but ultimately we will not have the final say. The human right to water has its natural limit when resources disappear for good.

Strang therefore addresses justice directly, but justice themes are also evident more diffusely through the work in issues of access to the governance system (participation) and the allocation of benefits and burdens (distribution), be those human-to-human or human-to-ecosystem [45]. It also highlights the importance of the governance regime in shaping roles and attitudes to water and infrastructure, and so where tensions with justice may arise.

Justice considerations in the paper by Brown et al. are more narrowly drawn [44]. The article discusses the results of engagement with the water services community through questionnaires and workshops with a view to ascertaining their research needs. The results are a series of questions that, it is argued, need to be addressed to deal with the current and anticipated challenges in the sector. The results are clearly aligned with the three pillars of sustainability since the questions cover a range of issues on economic, social and environmental topics, although there is a weighting towards environmental

concerns. This is evident in the number of questions around how to value ecosystem services and balancing competing interests. The questions around balancing the interests of ecosystems could be construed as aligning with concepts of distributive justice.

There are 21 questions in the section dealing expressly with water infrastructure although none of the questions in that section expressly refer to justice. The majority of the questions are technical questions focussed on optimising efficiencies in the system. Although perhaps not the intention of the study, it is possible to draw on justice themes in considering and answering the questions raised. For example:

46. *What would we do with sewage and water supply networks if we started afresh (and considered all factors such as changing climate, population and policy); is current technology up to the job?*

47. *What would a modern water/wastewater treatment plant look like if we could start afresh?*

48. *How do we develop and implement low energy water and wastewater treatment processes?*

50. *Is local treatment more sustainable than a fully sewer system?*

53. *What is the best solution to water supply over periods longer than the next 30 years, and what are the potential barriers to success? (citation)*

[44]

The questions could be read narrowly as seeking purely technical input (*are we doing it right?*), or more broadly asking if we could start again how can we aim higher and make the system more just (*are we doing the right thing?*)? In the technical context within which these questions were aired it appears more likely that the narrow construction was intended. If so these questions will fail to address how we move to a 'just transition' and will represent a missed opportunity. It is submitted that if justice themes are applied they could help shape research or provide a framework of values to help answer them.

The Brown et al. text uses the term 'social justice'. It is not defined but appears mostly limited to questions of water debt; for example:

78. *How can 'can't pay' water debtors be differentiated from 'won't pay' debtors, and what pricing structures and measures are best able to deliver water justice and cost recovery?*

[44]

It is not clear what is meant by 'water justice', but the reference to payment and debtors implies affordability. This suggests the application of justice in narrow economic terms: justice demanding equity in terms of ability to pay for an essential service. As the participants were working within a market-led regime, in which users are customers, this is perhaps understandable as a reflection of the regime they are operating in. The market-led regime influencing how water and infrastructure is viewed has already been aired in the Strang article [45]. This narrow view leaves fundamental questions unaddressed; for example, over equality of provision and services, whether vulnerable or marginalised groups are going to feel the impact of water stress more acutely, and whether the benefits of infrastructure for well-being are available equitably.

Leading on from the application of justice in economic terms, the third text in Category A, Thaler and Priest, addresses the Partnership Funding Scheme for flooding infrastructure [46]. There is an anomaly in the article in that it does not actually lay out the key features of the scheme as the authors see it. Nevertheless, it is reasonably well known to be a provision for the funding for flood relief schemes, purportedly designed to encourage bottom-up participation in flood relief schemes, and in turn obtain buy-in locally for locally sensitive and sustainable interventions.

Justice and equity themes are noted in two connected areas in this text. Firstly, it raises questions over how the multiple levels of the governance regime operate in reality.

This is an inherent issue in a governance regime with a more diffuse use of state and non-state actors than in a traditional, linear top-down government. With responsibility being moved down the hierarchy and closer to the communities, the question arises as to whether that comes with the power and funding to manage the risks: does the availability of funds and allocation of risk and responsibility align? This is stated to be an issue for the governance regime and how it shapes distributive and procedural justice concerns.

The second concerns the issue of community participation and whether this scheme provides the democratic legitimacy anticipated. As already noted in relation to Strang [45], participation can bring procedural fairness, but only if those contributing are truly representative and not limited to certain education, profession and class backgrounds. The concern is those with higher social and political capital are more likely to benefit from these types of opportunities, leaving other groups behind. Legitimacy can be linked to participation, but the participation must be just. The article again raises issues of procedural justice and justice through respect and recognition.

In summary Category A texts raise justice issues to varying degrees. Applying the justice framework (distribution, procedural, respect and recognition, and capability) the texts in this category raise the following points:

In terms of distributive justice there is evidence of discussion on how we distribute benefits and impacts between both human-to-human and human-to-ecosystem. This is seen in at least two of the texts albeit to varying degrees. There is also a discussion on how the market based regime, the regime used in England, may lead the debate towards narrowly drawn economic considerations of price and affordability—such debates are important but there is more to distribution of water and infrastructure services than price.

Participatory justice, Recognition and Respect are evident in discussions on the extent to which there is true participation in processes and whether the system is tipped in favour of the socially and politically advantaged. This arises in discussion on the governance regime itself. It is not necessarily that a market-based system is unjust per se, but it shapes the view of water, behaviour and power relations between levels of governance and in turn raises questions of democratic accountability, true representation and fairness.

Capability justice and discussions on how infrastructure can enhance capabilities appears to be missing from Category A texts. In considering the research aims of this study what also appears missing is:

- A clear articulation within the texts of what justice (or indeed equity, equality or rights) means in this sector.
- An articulation of the relationship between sustainability and justice.

5.2. Categories B and C

The discussion turns to the documents in Category B (no use of the term 'justice' but contains express references to 'equity', 'equality' or 'rights') and Category C (no express reference to the terms 'justice', 'equity', 'equality' or 'rights' but justice themes are clearly articulated and discussed).

Similar themes to Category A are evident in the 8 Category B and 8 Category C documents. Although the themes are present the use of terms such as equity are rarely defined. In Category B for example, phrases of 'rights', 'equity' and 'equality' are used interchangeably.

The articles in categories B and C, raise similar issues over 'true' participation, respect and recognition and the disproportionate power of some lobbying or demographic groups [47,54]. Considerations of social justice in economic terms are seen in the article on water-metering [50], while pricing and discussions on the impacts of a market regime are also evident [49,51,53]. There is further articulation of effects of the change in regime from top-down 'government' to bottom-up 'governance', and the extent to which power/responsibility aligns with the availability of funds in practice [47,49].

In addressing water rights, a Category B article argues in defence of the market structure, commenting that the shaping of the debate around pricing in the water sector is confused [53]. The argument runs that it is not water pricing that is the problem, but poverty generally that needs to be addressed. The argument continues that shopkeepers and landlords are not tasked with reducing prices and improving affordability, so why is the water sector treated differently? The counter-argument, of course, is that water cannot be substituted for another ‘commodity’ [79] and most grocery stores and landlords are not operating in a monopoly. Nonetheless the article does address some of the benefits of a market approach and provides some balance to the debate.

However, the way arguments are framed around water rights and cost highlight a deeper problem—the narrowing of the debate to economic concerns and price. Justice is not just about affordability. This narrowness may be a consequence of the framing of the debate in ‘rights’ terms. The idea of ‘water rights’, as seen in Strang [45], is said to have evolved from campaigns against neo-liberalism in economics and the privatisation and commoditisation of water [79]. This may explain the leaning to economic considerations in how the debates are constructed as that is the basis upon which they were initially triggered. There are further potential problems. The human right to water and sanitation is enshrined in a UN resolution [80]. Nevertheless, a rights-based approach is not universally accepted as the best way forward—issues of enforceability, as with any international obligation of this nature, prevail but further, a rights-based approach is perceived by some to prioritise anthropocentric concerns and the entitlements of the individual [79,81]—the ‘me’ culture [47]. This limits the debate and does not embrace the complex nature of water, human and ecosystem concerns.

Justice and rights are not synonymous concepts and there are opportunities to learn from these criticisms. The justice themes as articulated here arguably address the critics of a rights-based approach as they lean outwards from individual concerns to communities, and non-human groups to wider impacts and principles, and most significantly contain an inherent acceptance of the inevitability of conflict (i.e., whose rights take precedence?) and the need for that to be addressed and resolved fairly. This scope is arguably beyond that achieved in the limited, albeit important, discussion on the right to water and its cost.

In addition to the augmentation of arguments already raised, further issues become apparent in Category B and C texts:

- Distributional issues specifically around the and ownership regime and its fitness for purpose;
- Capability Justice.

The Wells thesis articulates how the distribution of benefits and burdens around land ownership may not fit with current societal needs [54]. The thesis addresses these issues around natural flood management (NFM), an example of a more holistic, sustainable and land-sensitive approach to flood management, either as an alternative or supplement to hard infrastructure interventions. Exploring the issues flags the changing requirements of landowners, from farmers producing food (and an income), to stewards storing water for the benefit of others. As stewards they would not be producing an income nor necessarily benefiting their own land. Issues are raised in providing this public good over the responsibility for building and maintaining NFM interventions along with liabilities and risks. The experiences articulated in the thesis mirrored the first author’s own experience observing a flood forum meeting, where a farmer stood up and reminded the attendees that his role was actually to produce food.

Land, riparian and water laws have developed in English law over hundreds of years and not along a clear or linear path. There remain tensions between the common good, public goods and private rights, and the thesis serves to provide a recent example of where this impinges on sustainability. In articulating the benefits and burdens of NFM on communities, it also serves to flag questions of distributional justice. Those flags in turn ask

questions of governance such as compensation for land use, the role of existing public bodies and subsidies. Since the thesis was drafted, the new post-Brexit Agricultural governance and subsidy regime has progressed. The extent to which governance issues are now resolved as viewed through a justice lens exceeds the remit of this study, albeit it would be worthy of review (for an overview see [82]).

Capability justice in terms of infrastructure for well-being and equality is mentioned but only in passing in the Collins lecture [47]. Applying a justice lens, however, leads this study to ask capability questions of two developments referred to in the texts—these two texts discuss two separate unconnected developments that involve urban, blue infrastructure designed for multiple purposes including well-being [52,68]. The developments in question are situated in relatively affluent areas in the South East [52] and Oxfordshire [68]. The benefits to well-being of blue infrastructure interventions are increasingly understood, with the Oxfordshire development in particular yielding a positive impact on house prices and health and well-being. The location of the developments in relatively affluent areas does not mean that they are inherently unjust. However, without justice issues of enhancement of capabilities for all being aired, neither can it be said they are just. Are we confident these types of intervention that go beyond immediate function and enhance a local area are available to everyone? Is the divide between affluent and poor areas becoming wider? On the evidence from texts and discussions available for analysis it is not possible to say. A justice lens would demand that those issues are aired and highlights the potential benefits of a justice thinking to infrastructure decision making.

5.3. Sustainability

The final issue to be addressed in analysing the 36 selected texts is whether sustainability is used in lieu of justice. The term ‘sustainability’ appears widely embedded into water infrastructure discourse, as indicated by its reference in 27 of the 36 articles under consideration (in stark contrast with only three explicit references to justice). It was not to be expected that all 36 articles would refer to justice or sustainability, nor should they have done. The authors of the various texts came from diverse fields with varying interests and with different focusses for their work. What is notable in this study is the contrast between sustainability and justice in terms of the prevalence of the use of those terms. What it does suggest is that despite the range of texts, value-laden concepts such as sustainability, which ask questions on the wider impacts of an intervention beyond its technical success, can become part of the narrative even in technical arenas. In that respect, sustainability as a term and a concept is a success.

There remains a suspicion that sustainability could have become something viewed as so fundamentally ‘good’ that the fact that an intervention is sustainable is tantamount to it being right, equitable and just. Although this could reasonably be inferred, and advanced as a hypothesis, because of the way that the topic is now dealt with, drawing a firm conclusion from the texts was not possible. Sustainability was rarely defined in the texts and often used only in passing. Finding conceptual links through the literature was even more difficult. In Category A texts where justice at least was expressed, justice and sustainability were treated very differently. In the Strang article [45] the terms relate to separate, albeit linked, concepts, with an absence of justice leading to a loss of sustainability for example. Brown et al. [44] deal with justice more narrowly, arguably as an adjunct to sustainability as the more important driver. In Thaler and Priest [46], sustainability is not relevant to the issues they raise and is not mentioned at all. As a result of the lack of apparent consistency further research into justice and sustainability together should be considered.

6. Discussion

6.1. Issues Highlighted

Drawing the discussions together a depiction of the issues highlighted is shown in Figure 2. This highlights the broad range and richness of issues that arise when viewing the literature with a justice lens. It provides a framework for asking questions of an intervention and its wider values and implications beyond sustainability. It asks questions of what we want when we look to the future. The issues highlighted in Figure 2 could be used as set of themes to be addressed when infrastructure changes are planned or implemented.

Despite the issues elicited, however, in the past 10 years, only three of the texts articulate any issues around justice expressly and arguably only one does so to any significant degree. That is not to say justice type issues are entirely absent from the texts. There are concerns over inequalities, equity and rights as threads within the literature. The difficulty is that they are not articulated or applied in a coherent or consistent way. Even the terms themselves are used differently and/or interchangeably. There does not appear to be a consistent articulation of ‘justice’, ‘equity’ or ‘rights’. This arguably illustrates the lack of sophistication of justice narratives in this arena rather than a lack of need for justice as a concept.

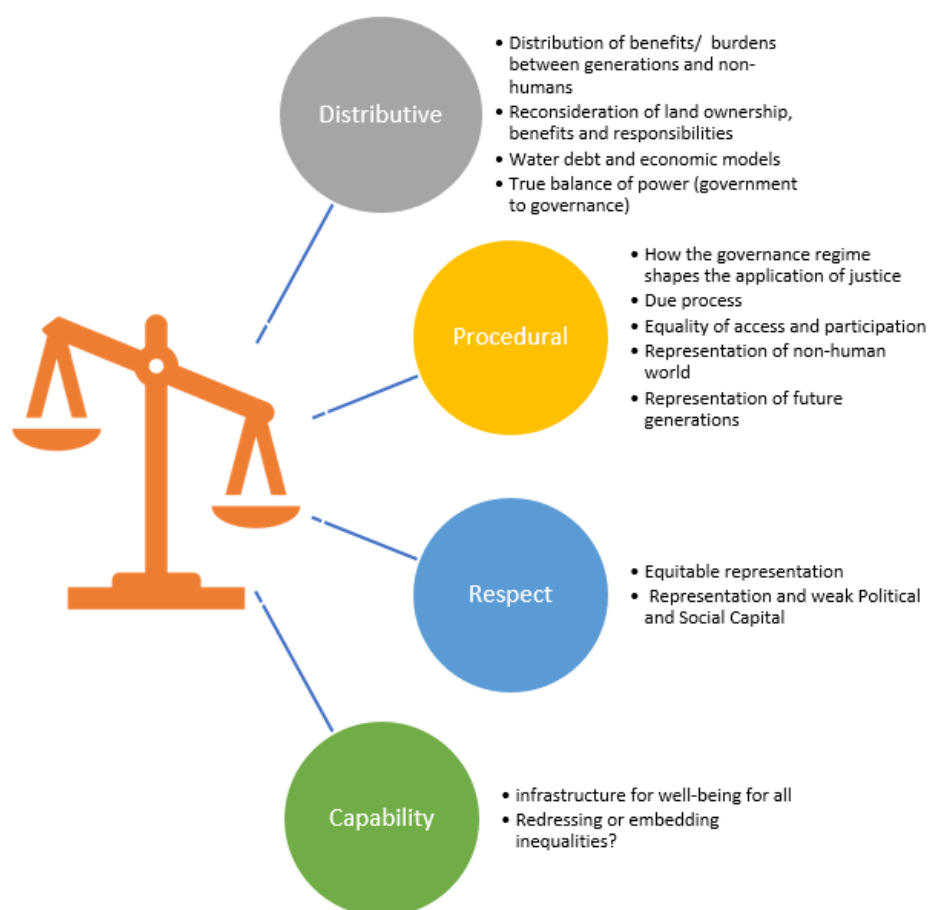


Figure 2. Justice Issues as determined by the review.

Progress towards embedding ‘sustainability’ into the narratives around water infrastructure in England has been considerably more successful. Of the wide-ranging articles identified by the systematic review the overwhelming majority acknowledged the application of sustainability. There is some way to go before the same can be said of justice. The predominance of the concept of sustainability suggests it may be viewed as the ultimate goal to be achieved? Whilst sustainability must be a goal, it is submitted that it is not a determination on its own of what is ‘just’.

To articulate this further, reference is made to the article by Ashley et al. [83] for its depiction of the different aims of urban designers in cities and how those aims have evolved. Although showcasing urban design generally rather than infrastructure, it shows a progression of drivers relevant to water services over time from simple supply of water to the addition and development of sewage systems driven by public health concerns, to progress into water conservation and eventually up to resilience and sustainability. In this depiction sustainability is the highest goal. Drawing on Maslow's hierarchy of needs, it could be construed as a depiction of increasing aims once immediate needs are satisfied and the progression to more complex requirements [84].

To develop that thinking further, the authors of this study ask whether there should be one step further in that hierarchy suggested by Ashley et al. [83], i.e., beyond 'sustainability', the wider view of justice should be added to the top of that list. To highlight the point, the hierarchy suggested by Ashley et al. [83,85] is adapted and depicted in Figure 3 with 'Water Justice' added. This then depicts the progression beyond sustainability and further into what we want for our water infrastructure into the future.

Endorsement for this approach can perhaps already be seen in operation in the 'just transition' agenda referred to above. It also presents an opportunity. Justice is not in competition with sustainability, it is its natural progression and can be used to address conflicts in balancing competing interests and needs. It can utilise the groundwork already laid by the sustainability agenda to move us up to higher level goals.

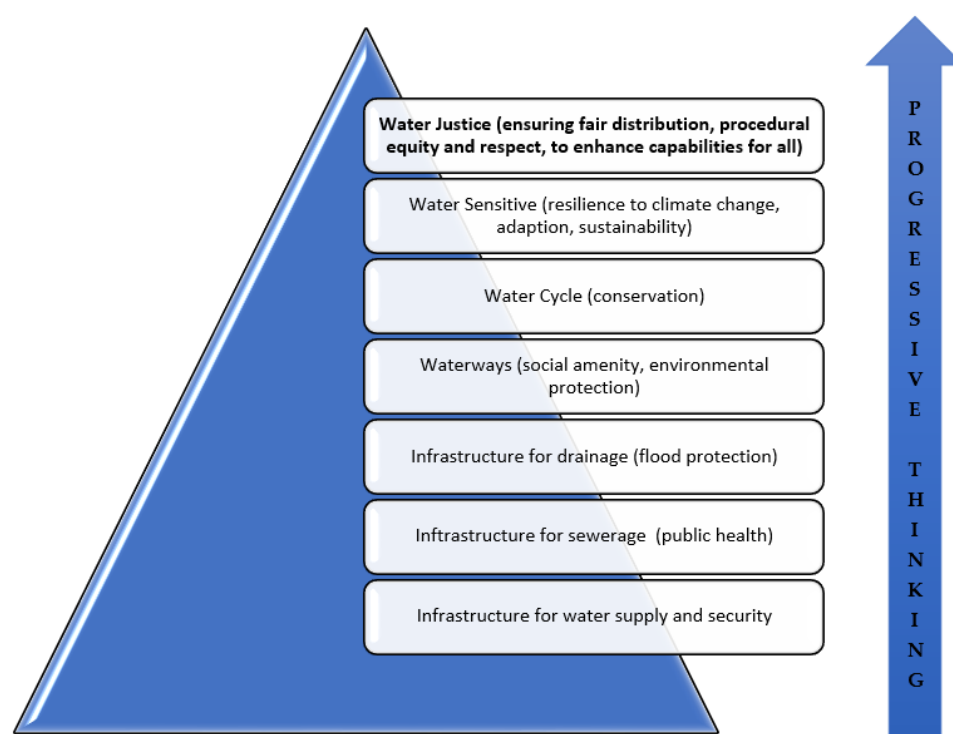


Figure 3. Water Justice as a higher paradigm. Adapted from [83] citing [85].

6.2. Limitations and Further Research

As with any systematic literature review, it is limited by the parameters chosen. In choosing those parameters it is then necessary to be clear about what the selected texts can show. The study is deliberately aimed at infrastructure to see what is happening in discussions around interventions 'on the ground', rather than solely at a conceptual level. The interest lies in what discussions there have been, if any, and how they have been encapsulated in the interventions that have been taken forward. It does not seek to include all water justice texts, although the lack of literature in this field generally, particularly in developed countries, has already been noted ([10,11]. The limit to England may exclude

other texts, but what is particular about the English system is its renowned system of privatisation. The link articulated between privatisation and the rise of the water rights movement may suggest it is more likely to prompt rights or justice arguments than not.

What also becomes clear is how the governance regime may frame justice arguments, making it essential that when considering water justice the full governance context is understood—and the dangers of drawing conclusions in one jurisdiction and applying it to another made clear.

Although the systematic review process should be objective, whether a document contained an implicit reference to justice, equity, rights or equality is unavoidably a matter of judgment. There is a risk of confirmation bias. To reduce the risk, the analytical review process paid attention to the articulation of the justice themes that were to be applied using a recognised and well-respected discussion on justice [25]. These themes were made clear in the framework.

There are three areas where it is suggested future research may be aimed. The first relates to the connection between water rights and justice—to explore the limitations of each concept, why water rights do not have a higher profile (certainly in England) and how the rise of energy justice may perhaps be adapted and utilised to fill the gap. The second is the relationship between sustainability and justice, notably how they can be utilised together. With sustainability already seemingly established, such research should study how justice can ride along with those narratives and move forward to enhance the debate. The third acknowledges that the study, for reasons given, is based in a single jurisdiction, England. Expanding the application of the justice framework to texts in other developed economies and low income countries is also suggested as research in this area is extended.

7. Conclusions

The case was made in the opening paragraphs of this paper for the need for justice in how we think of and improve our water infrastructure in England. With this in mind, the question asked was whether justice is embedded in current thinking. That only three texts out of 36 referred directly to justice (in comparison to 27 out of 36 that referred to sustainability) suggests the answer is ‘no’.

However, although justice thinking is not obviously referred to, it is still present. This study suggests a lack of sophistication in the justice debate, whether articulated as justice, equity, equality or rights, but not its absence. The multiple, disparate strands of thinking around justice-type themes evident in the texts may suggest we are inherently sensitive to potential injustices and that it does not need to feature explicitly—after all, it is a concept that is far older than sustainability and it is argued that the concept of sustainability should mature into one that permeates and influences thinking without explicit mention: it should become the accepted norm.

Nevertheless, there is encouragement that justice could resurface explicitly as a strong element of future arguments: in the same way that the concept of sustainability, which asks questions on the wider impacts of an intervention beyond its technical success, now routinely appears in discussions, it shows that the concept of justice can become part of the narrative even in technical arenas. Now that the issue of social justice is pervading many policy discourses and appearing in government priorities (e.g., the UK Government’s current commitment to ‘levelling up’), the opportunity exists to raise its importance when considering options and ensure, rather than tacitly assume, that it is embedded in practice. Crucially, the research has established a need to distinguish between the concepts of sustainability and justice—consideration and alignment with the former does not imply that the latter issue is addressed—and a solution is proposed: justice should be raised above the equally compelling needs for sustainability and resilience in a hierarchy of needs.

It is argued that as a species we have an innate sense of justice beyond a sense of injustice merely to ourselves [86]. Further, the wealth of issues raised and the underlining

of gaps in our thinking suggest there is value in justice being more fully articulated and deployed in this context. If successful it is hoped we will be judged by future generations and the natural world more favourably.

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**APPENDIX 3:LITERATURE REVIEW TABLE FOR PROJECT TEAM
FRAMEWORKS**

Results of Literature Review for Frameworks

Appendix 3

Review

On top of immersion in the literature, a formal literature review using the Web of Science database was used to check for any less well-known sources. A search was undertaken on abstract using “governance” and “infrastructure” as search terms alongside “framework(s)” or “tool(s)”. This elicited 1134 responses. A category filter was used to exclude categories such as meteorology and imaging science and focus on civil engineering, environmental sciences and studies, urban studies or law. Those not readily accessible and not open source were excluded as these may not be accessible to a project team. This resulted in 142 responses. As anticipated the range of subject matters and focusses of attention was considerable. An initial filter through titles not relevant to the project goals left 75 documents where abstracts were considered – many of which were already known to the author. The abstract review identified 2 responses of potential direct interest, one of which had already been identified by the author. Neither was considered to cover the issues required.

The list is attached.

Authors	Article Title	Publication Year
Drummond, P	Assessing City Governance for Low-Carbon Mobility in London	2021
Greiving, S; Fleischhauer, M; Leon, CD; Schodl, L; Wachinger, G; Miralles, IKQ; Larrain, BP	Participatory Assessment of Multi Risks in Urban Regions-The Case of Critical Infrastructures in Metropolitan Lima	2021
Pot, WD	The governance challenge of implementing long-term sustainability objectives with present-day investment decisions	2021
Iacovidou, E; Hahladakis, JN; Purnell, P	A systems thinking approach to understanding the challenges of achieving the circular economy	2021
Roelich, K; Litman-Roventa, N	Public perceptions of networked infrastructure	2020
Rogers, BC; Dunn, G; Hammer, K; Novalia, W; de Haan, FJ; Brown, RR; Brown, L; Lloyd, S; Urich, C; Wong, THF; Chesterfield, C	Water Sensitive Cities Index: A diagnostic tool to assess water sensitivity and guide management actions	2020
Franco-Torres, M; Rogers, BC; Harder, R	Articulating the new urban water paradigm	2021
Bonsu, NO	Towards a circular and low-carbon economy: Insights from the transitioning to electric vehicles and net zero economy	2020
Wilfong, M; Pavao-Zuckerman, M	Rethinking Stormwater: Analysis Using the Hydrosocial Cycle	2020
Houballah, M; Cordonnier, T; Mathias, JD	Which infrastructures for which forest function? Analyzing multifunctionality through the social-ecological system framework	2020

Savini, F; Giezen, M	Responsibility as a field: The circular economy of water, waste, and energy	2020
Dushkova, D; Haase, D	Not Simply Green: Nature-Based Solutions as a Concept and Practical Approach for Sustainability Studies and Planning Agendas in Cities	2020
Lomba-Fernandez, C; Labaka, L; Hernantes, J	Urban Critical Infrastructure's Governance Framework for Climate Resilient Cities	2020
Munkhsuld, E; Ochir, A; Koop, S; van Leeuwen, K; Batbold, T	Application of the City Blueprint Approach in Landlocked Asian Countries: A Case Study of Ulaanbaatar, Mongolia	2020
Kuller, M; Bach, PM; Roberts, S; Browne, D; Deletic, A	A planning-support tool for spatial suitability assessment of green urban stormwater infrastructure	2019
Aggarwal, RM; Haglund, L	Advancing Water Sustainability in Megacities: Comparative Study of SAo Paulo and Delhi Using a Social-Ecological System Framework	2019
Guerbois, C; Brady, U; de Swardt, AG; Fabricius, C	Nurturing ecosystem-based adaptations in South Africa's Garden Route: a common pool resource governance perspective	2019
Ahmed, S; Meenar, M; Alam, A	Designing a Blue-Green Infrastructure (BGI) Network: Toward Water-Sensitive Urban Growth Planning in Dhaka, Bangladesh	2019
Yan, JY; Jaw, SW; Soon, KH; Wieser, A; Schrotter, G	Towards an Underground Utilities 3D Data Model for Land Administration	2019
Cho, G; Cromptvoets, J	The INSPIRE directive: some observations on the legal framework and implementation	2019
Cassotta, S; Sidortsov, R	Sustainable cybersecurity? Rethinking approaches to protecting energy infrastructure in the European High North	2019
Truelove, Y	Rethinking water insecurity, inequality and infrastructure through an embodied urban political ecology	2019
Gulson, KN; Sellar, S	Emerging data infrastructures and the new topologies of education policy	2019
Kanai, JM; Schindler, S	Peri-urban promises of connectivity: Linking project-led polycentrism to the infrastructure scramble	2019
Huber, A	Hydropower in the Himalayan Hazardscape: Strategic Ignorance and the Production of Unequal Risk	2019
Ali, M; Geng, Y; Robins, D; Cooper, D; Roberts, W; Vogtlander, J	Improvement of waste management practices in a fast expanding sub-megacity in Pakistan, on the basis of qualitative and quantitative indicators	2019

Bernstein, MJ; Mancha-Cisneros, MD; Tyson, M; Brady, U; Rubinos, CA; Shin, HC; Vallury, S; Smith-Heisters, S; Ratajczyk, E	Mapping Ostrom's common-pool resource systems coding handbook to the coupled infrastructure systems framework to enable comparative research	2019
Munyasya, BM; Chileshe, N	Towards Sustainable Infrastructure Development: Drivers, Barriers, Strategies, and Coping Mechanisms	2018
Sturiale, L; Scuderi, A	The Evaluation of Green Investments in Urban Areas: A Proposal of an eco-social-green Model of the City	2018
van Ginkel, KCH; Hoekstra, AY; Buurman, J; Hogeboom, RJ	Urban Water Security Dashboard: Systems Approach to Characterizing the Water Security of Cities	2018
Elmqvist, T; Siri, J; Andersson, E; Anderson, P; Bai, XM; Das, PK; Gatere, T; Gonzalez, A; Goodness, J; Handel, SN; Torok, EH; Kavonic, J; Kronenberg, J; Lindgren, E; Maddox, D; Maher, R; Mbow, C; McPhearson, T; Mulligan, J; Nordenson, G; Spires, M; Stenkula, U; Takeuchi, K; Vogel, C	Urban tinkering	2018
BenDor, TK; Shandas, V; Miles, B; Belt, K; Olander, L	Ecosystem services and US stormwater planning: An approach for improving urban stormwater decisions	2018
Zhou, TX; Tan, R; Sedlin, T	Planning Modes for Major Transportation Infrastructure Projects (MTIPs): Comparing China and Germany	2018
Cosens, B; McKinney, M; Paisley, R; Wolf, AT	Reconciliation of development and ecosystems: the ecology of governance in the International Columbia River Basin	2018
Warbroek, B; Hoppe, T; Coenen, F; Bressers, H	The Role of Intermediaries in Supporting Local Low-Carbon Energy Initiatives	2018
Kim, H; Son, J; Lee, S; Koop, S; van Leeuwen, K; Choi, YJ; Park, J	Assessing Urban Water Management Sustainability of a Megacity: Case Study of Seoul, South Korea	2018
Henriksen, LF; Ponte, S	Public orchestration, social networks, and transnational environmental governance: Lessons from the aviation industry	2018
Kurapati, S; Kourounioti, I; Lukosch, H; Tavasszy, L; Verbraeck, A	Fostering Sustainable Transportation Operations through Corridor Management: A Simulation Gaming Approach	2018
Bakker, S; Guillen, MD; Nanthachatchavankul, P; Zuidgeest, M; Pardo, C; van Maarseveen, M	Hot or not? The role of cycling in ASEAN megacities: Case studies of Bangkok and Manila	2018

Feingold, D; Koop, S; van Leeuwen, K	The City Blueprint Approach: Urban Water Management and Governance in Cities in the U.S	2018
Partelow, S; Senff, P; Buhari, N; Schluter, A	Operationalizing the social-ecological systems framework in pond aquaculture	2018
Swapan, MSH; Zaman, AU; Ahsan, T; Ahmed, F	Transforming Urban Dichotomies and Challenges of South Asian Megacities: Rethinking Sustainable Growth of Dhaka, Bangladesh	2017
Teferi, ZA; Newman, P	Slum Regeneration and Sustainability: Applying the Extended Metabolism Model and the SDGs	2017
Duchin, F	Resources for Sustainable Economic Development: A Framework for Evaluating Infrastructure System Alternatives	2017
Fusaro, L; Marando, F; Sebastiani, A; Capotorti, G; Blasi, C; Copiz, R; Congedo, L; Munafo, M; Ciancarella, L; Manes, F	Mapping and Assessment of PM10 and O-3 Removal by Woody Vegetation at Urban and Regional Level	2017
McLeod, C; Nerlich, B; Mohr, A	Working with bacteria and putting bacteria to work: The biopolitics of synthetic biology for energy in the United Kingdom	2017
Barraque, B; Isnard, L; Souriau, J	European urban water crisis: the management dimension	2017
Emmanuel-Yusuf, D; Morse, S; Leach, M	Resilience and Livelihoods in Supply Chains (RELISC): An Analytical Framework for the Development and Resilience of the UK Wood Fuel Sector	2017
Blackmore, C; van Bommel, S; de Bruin, A; de Vries, J; Westberg, L; Powell, N; Foster, N; Collins, K; Roggero, PP; Seddaiu, G	Learning for Transformation of Water Governance: Reflections on Design from the Climate Change Adaptation and Water Governance (CADWAGO) Project	2016
Ward, S; Butler, D	Rainwater Harvesting and Social Networks: Visualising Interactions for Niche Governance, Resilience and Sustainability	2016
Lovell, K; Nightingale, P	Business models in rail infrastructure: explaining innovation	2016
Rouillard, J; Vidaurre, R; Brouwer, S; Damman, S; Ponce, AA; Gerner, NV; Riegels, N; Termes, M	Governance Regime Factors Conducive to Innovation Uptake in Urban Water Management: Experiences from Europe	2016
Siciliano, G; Urban, F; Tan-Mullins, M; Pichdara, L; Kim, S	The Political Ecology of Chinese Large Dams in Cambodia: Implications, Challenges and Lessons Learnt from the Kamchay Dam	2016

Stuiver, M; Soma, K; Koundouri, P; van den Burg, S; Gerritsen, A; Harkamp, T; Dalsgaard, N; Zagonari, F; Guanche, R; Schouten, JJ; Hommes, S; Giannouli, A; Soderqvist, T; Rosen, L; Garcao, R; Norrman, J; Rockmann, C; de Bel, M; Zanuttigh, B; Petersen, O; Mohlenberg, F	The Governance of Multi-Use Platforms at Sea for Energy Production and Aquaculture: Challenges for Policy Makers in European Seas	2016
Flynn, CD; Davidson, CI	Adapting the social-ecological system framework for urban stormwater management: the case of green infrastructure adoption	2016
Kremer, P; Hamstead, Z; Haase, D; McPhearson, T; Frantzeskaki, N; Andersson, E; Kabisch, N; Larondelle, N; Rall, EL; Voigt, A; Baro, F; Bertram, C; Gomez-Baggethun, E; Hansen, R; Kaczorowska, A; Kain, JH; Kronenberg, J; Langemeyer, J; Pauleit, S; Rehdanz, K; Schewenius, M; van Ham, C; Wurster, D; Elmqvist, T	Key insights for the future of urban ecosystem services research	2016
Peirson, W; Davey, E; Jones, A; Hadwen, W; Bishop, K; Beger, M; Capon, S; Fairweather, P; Creese, B; Smith, TF; Gray, L; Tomlinson, R	Opportunistic management of estuaries under climate change: A new adaptive decision-making framework and its practical application	2015
Koop, SHA; van Leeuwen, CJ	Application of the Improved City Blueprint Framework in 45 Municipalities and Regions	2015
de Silva, M; Paris, R	Delivering Crossrail, UK: a holistic approach to sustainability	2015
Bowd, R; Quinn, NW; Kotze, DC	Toward an analytical framework for understanding complex social-ecological systems when conducting environmental impact assessments in South Africa	2015
van der Brugge, R; Roosjen, R	An institutional and socio-cultural perspective on the adaptation pathways approach	2015
Minang, PA; Van Noordwijk, M; Duguma, LA; Alemagi, D; Do, TH; Bernard, F; Agung, P; Robiglio, V; Catacutan, D; Suyanto, S; Armas, A; Aguad, CS; Feudjio, M; Galudra, G; Maryani, R; White, D; Widayati, A; Kahurani, E; Namirembe, S; Leimona, B	REDD+ Readiness progress across countries: time for reconsideration	2014
Dowling, R; McGuirk, P; Bulkeley, H	Retrofitting cities: Local governance in Sydney, Australia	2014
Andersson, E; Barthel, S; Borgstrom, S; Colding, J; Elmqvist, T; Folke, C; Gren, A	Reconnecting Cities to the Biosphere: Stewardship of Green Infrastructure and Urban Ecosystem Services	2014

Chong, J	Climate-readiness, competition and sustainability: an analysis of the legal and regulatory frameworks for providing water services in Sydney	2014
Herrfahrdt-Pahle, E	Applying the Concept of Fit to Water Governance Reforms in South Africa	2014
Williams, A; Goodwin, M; Cloke, P	Neoliberalism, Big Society, and progressive localism	2014
Nilsson, M; Lucas, P; Yoshida, T	Towards an Integrated Framework for SDGs: Ultimate and Enabling Goals for the Case of Energy	2013
Porse, EC	Stormwater Governance and Future Cities	2013
Broto, VC; Bulkeley, H	A survey of urban climate change experiments in 100 cities	2013
Ghosh, S; Amaya, L; Skibniewski, MJ	Identifying Areas of Knowledge Governance For Successful Projects	2012
van Vliet, BJM; Spaargaren, G; Oosterveer, P	Sanitation under challenge: contributions from the social sciences	2011
Fudge, S; Peters, M	Motivating carbon reduction in the UK: the role of local government as an agent of social change	2009
Kauark-Leite, L; Vincon-Leite, B; Deroubaix, JF; Loireau, A; Silveira, D; Haddad, E	Projeto Vida no Vale: universal access to water and sanitation in the North East of Minas Gerais (Brazil)	2008
Schweik, C; Evans, T; Grove, JM	Open source and open content: a framework for global collaboration in social-ecological research	2005

This was repeated on 5th May 2022. Adding in a reference to 'project', left 33 additional items which were checked.

A monthly alert was set up to check for new items.

APPENDIX 4: ETHICS DOCUMENTS

- **Ethics Application Part 1**
- **Ethics Approval Part 1 email exchanges**
- **Ethics Application Part 2**
- **Ethics Approval Part 2 email exchanges**
- **Interview Participation Sheet (Interviews)**
- **Interview Participation Sheet (Focus Group)**

UNIVERSITY OF BIRMINGHAM

Application for Ethics Review Form

Guidance Notes:

What is the purpose of this form?

This form should be completed to seek ethics review for research projects to be undertaken by University of Birmingham staff, PGR students or visiting/emeritus researchers who will be carrying out research which will be attributed to the University.

Who should complete it?

For a staff project – the lead researcher/Principal Investigator on the project.

For a PGR student project – the student's academic supervisor, in discussion with the student.

Students undertaking undergraduate projects and taught postgraduate (PGT) students should refer to their Department/School for advice

When should it be completed?

After you have completed the University's online ethics self-assessment form (SAF), **IF** the SAF indicates that ethics review is required. You should apply in good time to ensure that you receive a favourable ethics opinion prior to the commencement of the project and it is recommended that you allow at least 60 working days for the ethics process to be completed.

How should it be submitted?

An electronic version of the completed form should be submitted to the Research Ethics Officer, at the following email address: aer-ethics@contacts.bham.ac.uk.

What should be included with it?

Copies of any relevant supporting information and participant documentation, research tools (e.g. interview topic guides, questionnaires, etc) and where appropriate a health & safety risk assessment for the project (see section 10 of this form for further information about risk assessments).

What should applicants read before submitting this form?

Before submitting, you should ensure that you have read and understood the following information and guidance and that you have taken it into account when completing your application:

- The information and guidance provided on the University's ethics webpages (<https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Ethical-Review-of-Research.aspx>)
- The University's Code of Practice for Research (<https://www.birmingham.ac.uk/Documents/university/legal/research.pdf>)
- The guidance on Data Protection for researchers provided by the University's Legal Services team at <https://intranet.birmingham.ac.uk/legal-services/What-we-do/Data-Protection/resources.aspx>.

Section 1: Basic Project Details

Project Title: PhD Project Title – Governance Frameworks for Utility Engineering Systems Interventions (previous SAF ref ERN_20-1831)

Is this project a:

University of Birmingham Staff Research project ☐

University of Birmingham Postgraduate Research (PGR) Student project ☒

Other (Please specify below) ☐

[Click or tap here to enter text.](#)

Details of the Principal Investigator or Lead Supervisor (for PGR student projects):

Title: Doctor

First name: Dexter

Last name: Hunt [Click or tap here to enter text.](#)

Position held: Lecturer

School/Department Engineering

Telephone:

Email address:

Details of any Co-Investigators or Co-Supervisors (for PGR student projects):

Title: Professor

First name: Chris

Last name: Rogers

Position held: Professor

School/Department Engineering

Telephone:

Email address:

Details of the student for PGR student projects:

Title: Mrs

First name: Elisabeth

Last name: Shrimpton

Course of study: PhD

Email address:

Project start and end dates:

Estimated start date of project: 01/10/2019

Estimated end date of project: 01/10/2022

Funding:

Sources of funding: EPSRC and United Utilities

Section 2: Summary of Project

Describe the purpose, background rationale for the proposed project, as well as the hypotheses/research questions to be examined and expected outcomes. This description should be in everyday language that is free from jargon - please explain any technical terms or discipline-specific phrases. Please do not provide extensive academic background material or references.

This project explores the relationship between governance and new engineering interventions focussing on water and wastewater infrastructure. The aim is to generate a tool to guide a project team working on these Interventions through the complexities of governance. In doing so it will improve the prospects of those Interventions being successfully and justly implemented and embedded.

In terms of a research hypothesis: *There is no decision-making framework that helps a multi-disciplinary project team understand and engage with the complexities of the water resource governance system into which an intervention needs to function*

There is no single academic theory to draw upon in drafting such a framework. Disparate theories from different perspectives need to be unravelled and married with practical experiences to form a framework that is intelligible and useful to a multi-disciplinary team.

This framework is essential as the success of an engineered intervention in the real-world is highly dependent on how it interacts with governance and there are opportunities to influence that interaction before and during implementation.

Section 3: Conduct and location of Project

Conduct of project

Please give a description of the research methodology that will be used. If more than one methodology or phase will be involved, please separate these out clearly and refer to them consistently throughout the rest of this form.

There are two stages to the methodology although they are both concerned with the same issues and themes and will involve the same or similar participants. Part A relates to data gathering on experts in water and wastewater on their experiences of governance interacting with their projects to expand/challenge the themes anticipated from the literature review. The data gathering in Part A will be qualitative data through semi-structured interviews. From this a preliminary tool/framework for use by a project team will be formulated. Interviews will be face to face or on-line.

Part B will consist of interviews or workshops with experts to validate the preliminary tool/framework envisioned after Part A. It will involve discussions and feedback on the preliminary framework. The data gathered will again be qualitative.

Geographic location of project

State the geographic locations where the project and all associated fieldwork will be carried out. If the project will involve travel to areas which may be considered unsafe, either in the UK or overseas, please ensure that the risks of this (or any other non-trivial health and safety risks associated with the research) are addressed by a documented health and safety risk assessment, as described in section 10 of this form.

Interviews and data collection will take place in England and/or on-line. No field work is anticipated.

Section 4: Research Participants and Recruitment

Does the project involve human participants?

Note: 'Participation' includes both active participation (such as when participants take part in an interview) and cases where participants take part in the study without their knowledge and consent at the time (for example, in crowd behaviour research).

Yes ☒

No ☐

If you have answered NO please go on to Section 8 of this form. If you have answered YES please complete the rest of this section and then continue on to section 5.

Who will the participants be?

1. For Part A the semi-structured interviews – 8-12 participants over age 21 chosen for expertise in engineering in water and wastewater services sector. It is anticipated the interviews will take place in England or on-line.

A document containing the question guide is attached.

2. For Part B - the validation interviews. After Part A, a framework will be drafted. This will then need to be validated by discussions with experts – the same categories of participants will be used for the validation exercise. It is anticipated that these will be via 1-1 interviews and will consist of a discussion on the framework emanating from Part A.
(Note it is possible that workshops rather than 1-1 interviews will be possible at Part B. Much depends on the position with the pandemic. If workshops become feasible then a separate/revised application for ethics review will be submitted seeking approval for workshops. At this stage approval is sought on the basis that Part B will be limited to 1-1 interviews).

How will the participants be recruited?

Please state clearly how the participants will be identified, approached and recruited. Include any relationship between the investigator(s) and participant(s) (e.g. instructor-student). Please ensure that you attach a copy of any poster(s), advertisement(s) or letter(s) to be used for recruitment.

The criteria for selection will be an engineering practitioner or academic with experience in water and wastewater infrastructure projects. Participants will be identified via Supervisor contacts within water companies in England and Wales and/or academics working in a University setting with established interests in this field. It is possible that one participant, already known to the PhD researcher, may be asked to participate. The participant works for the ICRC as a water engineer and was a fellow student on her Masters degree. Since that time professional contact via LinkedIn has been maintained.

Participants will be contacted by email, LinkedIn or by telephone.

Section 5: Consent

What process will be used to obtain consent?

Describe the process that the investigator(s) will be using to obtain valid consent. If consent is not to be obtained explain why. If the participants are under the age of 16 it would usually be necessary to obtain parental consent and the process for this should be described in full, including whether parental consent will be opt-in or opt-out.

A participant information sheet and consent form will be sent by email in advance. This participant information sheet and the consent form will also be referred to and noted at the start of the each interview with time taken for any potential questions to be addressed. At the start of each interview, each participant will be asked to confirm their consent.

Please be aware that if the project involves over 16s who lack capacity to consent, separate approval will be required from the Health Research Authority (HRA) in line with the Mental Capacity Act.

Please attach a copy of the Participant Information Sheet (if applicable), the Consent Form (if applicable), the content of any telephone script (if applicable) and any other material that will be used in the consent process.

Note: Guidance from Legal Services on wording relating to the Data Protection Act 2018 can be accessed at <https://intranet.birmingham.ac.uk/legal-services/What-we-do/Data-Protection/resources.aspx>.

Use of deception?

Will the participants be deceived in any way about the purpose of the study?

Yes ☐
No ☒

If yes, please describe the nature and extent of the deception involved. Include how and when the deception will be revealed, and the nature of any explanation/debrief will be provided to the participants after the study has taken place.

Click or tap here to enter text.

Section 6: Participant compensation, withdrawal and feedback to participants

What, if any, feedback will be provided to participants?

Explain any feedback/ information that will be provided to the participants after participation in the research (e.g. a more complete description of the purpose of the research, or access to the results of the research).

Participants will be able to see the results of the research once finalised, upon request.

What arrangements will be in place for participant withdrawal?

Describe how the participants will be informed of their right to withdraw from the project, explain any consequences for the participant of withdrawing from the study and indicate what will be done with the participant's data if they withdraw.

The Participant Information Sheet and the Consent Form will clearly state the right of the participant to refuse participation or withdraw from the project.

Please confirm the specific date/timescale to be used as the deadline for participant withdrawal and ensure that this is consistently stated across all participant documentation. This is considered preferable to allowing participants to 'withdraw at any time' as presumably there will be a point beyond which it will not

be possible to remove their data from the study (e.g. because analysis has started, the findings have been published, etc).

Participants are free to withdraw during the research without any negative consequences by simply notifying the decision to the researcher during the interview or within 14 calendar days after the interview has taken place. If a participant decides to withdraw, all the data collected during interview, including audio and video record will be deleted.

What arrangements will be in place for participant compensation?

Will participants receive compensation for participation?

Yes ☐

No ☒

If yes, please provide further information about the nature and value of any compensation and clarify whether it will be financial or non-financial.

Click or tap here to enter text.

If participants choose to withdraw, how will you deal with compensation?

Click or tap here to enter text.

Section 7: Confidentiality/anonymity

Will the identity of the participants be known to the researcher?

Will participants be truly anonymous (i.e. their identity will not be known to the researcher)?

Yes ☐

No ☒

In what format will data be stored?

Will participants' data be stored in identifiable format, or will it be anonymised or pseudo-anonymised (i.e. an assigned ID code or number will be used instead of the participant's name and a key will be kept allowing the researcher to identify a participant's data)?

Personal, video and audio data for each participant will be given an ID code unique to each participant. The audio and video data are only to be used for transcribing the content of the interviews. All data will be treated as confidential and stored securely. In reporting the findings all the data will be anonymised.

Will participants' data be treated as confidential?

Will participants' data be treated as confidential (i.e. they will not be identified in any outputs from the study and their identity will not be disclosed to any third party)?

Yes ☒

No ☐

If you have answered no to the question above, meaning that participants' data will not be treated as confidential (i.e. their data and/or identities may be revealed in the research outputs or otherwise to third parties), please provide further information and justification for this:

Click or tap here to enter text.

Section 8: Storage, access and disposal of data

How and where will the data (both paper and electronic) be stored, what arrangements will be in place to keep it secure and who will have access to it?

Please note that for long-term storage, data should usually be held on a secure University of Birmingham IT system, for example BEAR (see <https://intranet.birmingham.ac.uk/it/teams/infrastructure/research/bear/index.aspx>).

The video/ audio data from the interviews will be stored on the Researcher's password-secured laptop and transcribed for analysis.

Only the researcher and the Supervisors will have access to the data collected. According to University policy, on the submission of the thesis or a publication, data created will need to be transferred to the UoB Research Data Archive (RDA), to be stored as read-only, furthermore it must be stored 10 years after last point of access, so after 10 years without being consulted it will be deleted.

Data retention and disposal

The University usually requires data to be held for a minimum of 10 years to allow for verification. Will you retain your data for at least 10 years?

Yes ☒

No ☐

If data will be held for less than 10 years, please provide further justification:

Click or tap here to enter text.

What arrangements will be in place for the secure disposal of data?

As set out above to be deleted in line with UoB's procedures.

Section 9: Other approvals required

Are you aware of any other national or local approvals required to carry out this research?

E.g. clearance from the Disclosure and Barring Service (DBS), Local Authority approval for work involving Social Care, local ethics/governance approvals if the work will be carried out overseas, or approval from NOMS or HMPPS for work involving police or prisons? If so, please provide further details:

No

For projects involving NHS staff, is approval from the Health Research Authority (HRA) needed in addition to University ethics approval?

If your project will involve NHS staff, please go to the HRA decision tool at <http://www.hra-decisiontools.org.uk/research/> to establish whether the NHS would consider your project to be research, thus requiring HRA approval in addition to University ethics approval. Is HRA approval required?

Yes ☐

No ☐

Please include a print out of the HRA decision tool outcome with your application.

Section 10: Risks and benefits/significance

Benefits/significance of the research

Outline the potential significance and/or benefits of the research

As well as providing a usable tool this study will add to current thinking by introducing the concept of justice thinking to the use of interventions in this sector. Incorporating justice the framework will be a usable practical framework to allow, if not encourage, project teams to engage with the governance sphere surrounding their project and to look beyond their own immediate technical discipline.

Risks of the research

*Outline any potential risks (including risks to research staff, research participants, other individuals not involved in the research, the environment and/or society and the measures that will be taken to minimise any risks and the procedures to be adopted in the event of mishap.) **Please ensure that you include any risks relating to overseas travel and working in overseas locations as part of the study, particularly if the work will involve travel to/working in areas considered unsafe and/or subject to travel warnings from the Foreign and Commonwealth Office (see <https://www.gov.uk/foreign-travel-advice>). Please also be aware that the University insurer, UMAL, offers access to RiskMonitor Traveller, a service which provides 24/7/365 security advice for all travellers and you are advised to make use of this service (see <https://umal.co.uk/travel/pre-travel-advice/>).***

The outlining of the risks in this section does not circumvent the need to carry out and document a detailed Health and Safety risk assessment where appropriate – see below.

There are no serious risks involved for neither participants nor the researcher for interviews that are undertaken virtually via zoom. Should interviews be undertaken in person Interviews they will take place on reputable business premises or offices within hours of work. If face to face the interviews will take place in compliance with Covid-19 guidelines applicable at the time and location of the interview. The Interviewer will have a phone in case of emergency, and will inform appropriate people (e.g. supervisor(s)) about the details of where she will be, time of arrival and time of leaving.

University Health & Safety (H&S) risk assessment

For projects of more than minimal H&S risk it is essential that a H&S risk assessment is carried out and signed off in accordance with the process in place within your School/College and you must provide a copy of this with your application. The risk may be non-trivial because of travel to, or working in, a potentially unsafe location, or because of the nature of research that will be carried out there. It could also involve (irrespective of location) H&S risks to research participants, or other individuals not involved directly in the research. Further information about the risk assessment process for research can be found at

<https://intranet.birmingham.ac.uk/hr/wellbeing/worksafe/policy/Research-Risk-Assessment-and-Mitigation-Plans-RAMPs.aspx>.

Please note that travel to (or through) 'FCO Red zones' requires approval by the University's Research Travel Approval Panel, and will only be approved in exceptional circumstances where sufficient mitigation of risk can be demonstrated.

Section 11: Any other issues

Does the research raise any ethical issues not dealt with elsewhere in this form?

If yes, please provide further information:

No

Do you wish to provide any other information about this research not already provided, or to seek the opinion of the Ethics Committee on any particular issue?

If yes, please provide further information:

A question guide for the semi-structured interviews is attached

Section 12: Peer review

Has your project received scientific peer review?

Yes ☐

No ☒

If yes, please provide further details about the source of the review (e.g. independent peer review as part of the funding process or peer review from supervisors for PGR student projects):

Click or tap here to enter text.

Section 13: Nominate an expert reviewer

For certain types of project, including those of an interventional nature or those involving significant risks, it may be helpful (and you may be asked) to nominate an expert reviewer for your project. If you anticipate that this may apply to your work and you would like to nominate an expert reviewer at this stage, please provide details below.

Title: Click or tap here to enter text.

First name: Click or tap here to enter text.

Last name: Click or tap here to enter text.

Email address: Click or tap here to enter text.

Phone number: Click or tap here to enter text.

Brief explanation of reasons for nominating and/or nominee's suitability:

Click or tap here to enter text.

Section 14: Document checklist

Please check that the following documents, where applicable, are attached to your application:

Recruitment advertisement ☐
Participant information sheet ☒
Consent form ☒
Questionnaire ☐
Interview/focus group topic guide ☒

Please proof-read study documentation and ensure that it is appropriate for the intended audience before submission.

Section 15: Applicant declaration

Please read the statements below and tick the boxes to indicate your agreement:

I submit this application on the basis that the information it contains is confidential and will be used by the University of Birmingham for the purposes of ethical review and monitoring of the research project described herein, and to satisfy reporting requirements to regulatory bodies. The information will not be used for any other purpose without my prior consent. ☒

The information in this form together with any accompanying information is complete and correct to the best of my knowledge and belief and I take full responsibility for it. ☒

I undertake to abide by University Code of Practice for Research (<https://www.birmingham.ac.uk/Documents/university/legal/research.pdf>) alongside any other relevant professional bodies' codes of conduct and/or ethical guidelines. ☒

I will report any changes affecting the ethical aspects of the project to the University of Birmingham Research Ethics Officer. ☒

I will report any adverse or unforeseen events which occur to the relevant Ethics Committee via the University of Birmingham Research Ethics Officer. ☒

Please now save your completed form and email a copy to the Research Ethics Officer, at aer-ethics@contacts.bham.ac.uk. As noted above, please do not submit a paper copy.

ETHICS APPROVAL (EMAILS)

Elisabeth Shrimpton (PhD Dept of Civil Eng FT)

Reply

Fri 04/06, 15:22

Samantha Waldron (Research Support Services)

Sent Items

Thanks for dealing with this so promptly

Regards

From: Samantha Waldron (Research Support Services)
Sent: 04 June 2021 15:21
To: Elisabeth Shrimpton (PhD Dept of Civil Eng FT)
Cc: Dexter Hunt (Civil Engineering)
Subject: RE: Application for Ethical Review ERN_20-1831

Dear Lis,

Thank you for confirming how the snowballing will work. Based on the information provided I'm pleased to confirm this is approved under your existing application ERN_20-1831.

I hope the project goes well.

Best wishes
Sam

Ms Sam Waldron (she/her)
Research Ethics Officer
Research Support Group
C Block Dome (room 137)
Aston Webb Building
University of Birmingham
Edgbaston B15 2TT
Tel: [REDACTED]
Email: [REDACTED]

Please remember to submit a new [Self-Assessment Form](#) for each new project. Click [Ethical Review Process](#) for further details regarding the University's Ethical Review process.

Click [Research Governance](#) for further details regarding the University's Research Governance and Clinical Trials Insurance processes, or email researchgovernance@contacts.bham.ac.uk with any queries

Notice of Confidentiality:

The contents of this email may be privileged and are confidential. It may not be disclosed to or used by anyone other than the addressee, nor copied in any way. If received in error please notify the sender and then delete it from your system. Should you communicate with me by email, you consent to the University of Birmingham monitoring and reading any such correspondence.

From: Elisabeth Shrimpton (PhD Dept of Civil Eng FT) <[REDACTED]>
Sent: 04 June 2021 14:47
To: Samantha Waldron (Research Support Services) [REDACTED]
Cc: Dexter Hunt (Civil Engineering) [REDACTED]
Subject: Re: Application for Ethical Review ERN_20-1831

Thanks Sam,

I envisage that the snowballing will work as follows:

- a) an existing participant will pass my details on to a potential new participant and that new participant will get in touch with me if they are interested
- b) an existing participant will obtain consent to pass the new participant's details to me and I will contact the new participant direct
- c) a name of a potential new participant will be passed to me and their contact details will be openly available for example through their work/organisation website or linkedin.

I am not anticipating (or seeking) any personal or home email addresses or contact details. I am contacting people in relation to their work activities via their work organisations.

I hope this is in order.

Kind regards

Lis Shrimpton

From: Samantha Waldron (Research Support Services)
Sent: 04 June 2021 11:03
To: Elisabeth Shrimpton (PhD Dept of Civil Eng FT)
Cc: Dexter Hunt (Civil Engineering)
Subject: RE: Application for Ethical Review ERN_20-1831

Dear Elisabeth,

Because the changes are small, we are willing to review them as a note to file under your existing ethics.

One query has been raised in relation to this:

In terms of the snowballing recruitment method, please note the potential participants will either need to give consent to have their contact details passed on to you or, you will need to ask the existing participants to pass on the recruitment message on your behalf. In other words, you

shouldn't obtain contact information without consent (unless the contact details are already in the public domain).

Please can you confirm how the snowballing recruitment will work within this study?

I look forward to your response,
Best wishes
Sam

From: Elisabeth Shrimpton (PhD Dept of Civil Eng FT) [REDACTED]
Sent: 03 June 2021 15:10
To: Samantha Waldron (Research Support Services) [REDACTED]
Cc: Dexter Hunt (Civil Engineering) [REDACTED]
Subject: Fw: Application for Ethical Review ERN_20-1831

Dear Sam,

I refer to the ethical review approval below. The research is now underway. There are two matters I would like your advice on, if possible. None of these queries make any substantial amendment to the project. The aims, objectives and research approach remain exactly as before.

The issues are:

1. Recruitment of participants; and
2. Slight adjustment to the semi-structured interview questions.

1. Recruitment

It was originally envisaged that participants would be recruited using supervisor contacts. It seems unlikely that we will get as many participants through this method as we had hoped. I would like therefore to approach potential participants using two methods. The first is snowballing, to email contacts of existing contacts. A proposed email is attached. The second relates to a water industry project I am involved in via UoB called Pipebots. Pipebots has a monthly newsletter which is sent out to water industry contacts. I have permission from the project organisers to place an 'advert' or notice in the newsletter. Proposed wording is also attached.

The type, age, experience of the participants remains the same. It is only the recruitment process that needs expanding. Is this in order? Is there anything else I need to submit or information required?

2. Interview Questions

The ethical review application included a list of topics/themes and potential question areas I anticipated asking (making it clear I anticipated some flexibility being required). The topics, themes and question areas remain the same but there are some additional questions I would like to ask. These are more around opening up the conversation rather than expanding on topics or themes but I wanted to check no further approval is required. The questions are:

- a) talk me through a water/waste water project you have been involved with that has been successful/unsuccessful/interesting (with a sub-question on how success or otherwise is defined)
- b) If you could change the governance system what changes would you make?
- c) how have the projects you have been involved in supported 'levelling-up', if at all?

Again could you let me know whether any additional approval is required.

Kind regards

Lis Shrimpton

From: Samantha Waldron (Research Support Services)
Sent: 21 January 2021 11:29
To: Dexter Hunt (Civil Engineering)
Cc: Elisabeth Shrimpton (PhD Dept of Civil Eng FT)
Subject: Application for Ethical Review ERN_20-1831

Dear Dr Hunt,

Re: "Governance Frameworks for Utility Engineering Systems Interventions"
Application for Ethical Review ERN_20-1831

Thank you for your application for ethical review for the above project, which has now been reviewed by the Science, Technology, Engineering and Mathematics Ethical Review Committee.

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for your project, subject to your adherence to the following conditions:

- If any face-to-face interviews are conducted prior to the pandemic ending, please ensure you have a health and safety risk assessment approved in line with your local school/college procedures.

For clarification, as long as the conditions above are met and the details of the proposed work do not change, your project has ethics approval and no further action is necessary.

I would like to remind you that any substantive changes to the nature of the study as described in the Application for Ethical Review, and/or any adverse events occurring during the study should be

promptly brought to the Committee's attention by the Principal Investigator and may necessitate further ethical review.

Please also ensure that the relevant requirements within the University's Code of Practice for Research and the information and guidance provided on the University's ethics webpages (available at <https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Links-and-Resources.aspx>) are adhered to and referred to in any future applications for ethical review. It is now a requirement on the revised application form (<https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Ethical-Review-Forms.aspx>) to confirm that this guidance has been consulted and is understood, and that it has been taken into account when completing your application for ethical review.

If you require a hard copy of this correspondence, please let me know.

Kind regards,

Ms Sam Waldron

Research Ethics Officer
Research Support Group
C Block Dome (room 137)
Aston Webb Building
University of Birmingham
Edgbaston B15 2TT

Tel:

Email:

Please remember to submit a new [Self-Assessment Form](#) for each new project. Click [Ethical Review Process](#) for further details regarding the University's Ethical Review process.

UNIVERSITY OF BIRMINGHAM

Application for Ethics Review Form

Guidance Notes:

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This form should be completed to seek ethics review for research projects to be undertaken by University of Birmingham staff, PGR students or visiting/emeritus researchers who will be carrying out research which will be attributed to the University.

Who should complete it?

For a staff project – the lead researcher/Principal Investigator on the project.

For a PGR student project – the student's academic supervisor, in discussion with the student.

Students undertaking undergraduate projects and taught postgraduate (PGT) students should refer to their Department/School for advice

When should it be completed?

After you have completed the University's online ethics self-assessment form (SAF), **IF** the SAF indicates that ethics review is required. You should apply in good time to ensure that you receive a favourable ethics opinion prior to the commencement of the project and it is recommended that you allow at least 60 working days for the ethics process to be completed.

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What should be included with it?

Copies of any relevant supporting information and participant documentation, research tools (e.g. interview topic guides, questionnaires, etc) and where appropriate a health & safety risk assessment for the project (see section 10 of this form for further information about risk assessments).

What should applicants read before submitting this form?

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- The University's Code of Practice for Research (<https://www.birmingham.ac.uk/Documents/university/legal/research.pdf>)
- The guidance on Data Protection for researchers provided by the University's Legal Services team at <https://intranet.birmingham.ac.uk/legal-services/What-we-do/Data-Protection/resources.aspx>.

Section 1: Basic Project Details

Project Title: PhD Project Title – Governance Frameworks for Utility Engineering Systems Interventions (previous SAF ref ERN_20-1831)

Is this project a:

University of Birmingham Staff Research project ☐

University of Birmingham Postgraduate Research (PGR) Student project ☒

Other (Please specify below) ☐

[Click or tap here to enter text.](#)

Details of the Principal Investigator or Lead Supervisor (for PGR student projects):

Title: Doctor

First name: Dexter

Last name: Hunt [Click or tap here to enter text.](#)

Position held: Lecturer

School/Department Engineering

Telephone:

Email address:

Details of any Co-Investigators or Co-Supervisors (for PGR student projects):

Title: Professor

First name: Chris

Last name: Rogers

Position held: Professor

School/Department Engineering

Telephone:

Email address:

Details of the student for PGR student projects:

Title: Mrs

First name: Elisabeth

Last name: Shrimpton

Course of study: PhD

Email address:

Project start and end dates:

Estimated start date of project: 01/10/2019

Estimated end date of project: 01/10/2022

Funding:

Sources of funding: EPSRC and United Utilities

Section 2: Summary of Project

Describe the purpose, background rationale for the proposed project, as well as the hypotheses/research questions to be examined and expected outcomes. This description should be in everyday language that is free from jargon - please explain any technical terms or discipline-specific phrases. Please do not provide extensive academic background material or references.

This project explores the relationship between governance and new engineering interventions focussing on water and wastewater infrastructure. The aim is to generate a tool to guide a project team working on these Interventions through the complexities of governance. In doing so it will improve the prospects of those Interventions being successfully and justly implemented and embedded.

In terms of a research hypothesis: *There is no decision-making framework that helps a multi-disciplinary project team understand and engage with the complexities of the water resource governance system into which an intervention needs to function*

There is no single academic theory to draw upon in drafting such a framework. Disparate theories from different perspectives need to be unravelled and married with practical experiences to form a framework that is intelligible and useful to a multi-disciplinary team.

This framework is essential as the success of an engineered intervention in the real-world is highly dependent on how it interacts with governance and there are opportunities to influence that interaction before and during implementation.

Section 3: Conduct and location of Project

Conduct of project

Please give a description of the research methodology that will be used. If more than one methodology or phase will be involved, please separate these out clearly and refer to them consistently throughout the rest of this form.

As per the previous ethics application, there are two stages to the methodology although they are both concerned with the same issues and themes. Stage 1 has taken place having already received ethical approval. Stage 1 was concerned with gathering data via semi-structured interviews and has now taken place. This has resulted in a governance framework. This framework now needs to be validated in Stage 2 of the methodology. This application is to seek approval for stage 2 of the project.

Although a stage 2 proposal was set out in the earlier ethics document it was left open for this to be adjusted and updated as the research progress and as the covid pandemic developed.

Stage 2 itself has two parts.

1. Stage 2 will consist of a **questionnaire** to members and contacts of the Pipebots project, an EPSRC funded project of which UoB is a participant.
2. In addition stage 2 will consist of a **workshop or focus group** with engineers and contacts of United Utilities. This is hoped to be face-face and if so all current Government guidelines will be adopted. Subject to logistics it may be this has to take place on line or via semi-structured interviews.

Geographic location of project

State the geographic locations where the project and all associated fieldwork will be carried out. If the project will involve travel to areas which may be considered unsafe, either in the UK or overseas, please ensure that the risks of this (or any other non-trivial health and safety risks associated with the research) are addressed by a documented health and safety risk assessment, as described in section 10 of this form.

Interviews and data collection will take place in England and/or on-line. No field work is anticipated.

Section 4: Research Participants and Recruitment

Does the project involve human participants?

Note: 'Participation' includes both active participation (such as when participants take part in an interview) and cases where participants take part in the study without their knowledge and consent at the time (for example, in crowd behaviour research).

Yes ☒
No ☐

If you have answered NO please go on to Section 8 of this form. If you have answered YES please complete the rest of this section and then continue on to section 5.

Who will the participants be?

1. For the **questionnaire**, the questionnaire will be sent to the members of the Pipebots project (some 52 scientists and engineers) and their wider contact list of some 270 people all of whom either signed up as interested parties to the Pipebots website or being added to the list following a positive answer to a direct request. These consist of parties interested in the development of innovation in water and wastewater infrastructure acting in their professional capacity.

The draft questionnaire is attached.

2. For **focus group or workshop** (interviews by default)– the draft governance framework will be discussed with the engineers and other professionals working for United Utilities, the innovation team within United Utilities and/ or members of external innovating companies they have been working with to seek change in the sector. All participants will be acting in their professional capacity.

The governance framework will form the basis of a discussion as to its use, potential benefits and areas for improvement. A copy of the framework is attached. It is possible questions from the above questionnaire will also be adapted and used.

How will the participants be recruited?

Please state clearly how the participants will be identified, approached and recruited. Include any relationship between the investigator(s) and participant(s) (e.g. instructor-student). Please ensure that you attach a copy of any poster(s), advertisement(s) or letter(s) to be used for recruitment.

1. For the questionnaire. Participants have been selected using Pipebots as a case study. They are individuals who are connected to the project and/ or are interested in innovation in the sector.

Only those that have signed up to Pipebots information and contact lists are included. The contact list is a pre-existing list. Permission to use the list has been granted by the project organiser.

2. For the focus group, United Utilities are sponsors of the PhD and the contact there will ask potential participants to engage with the project. The participants will be drawn from their pool of innovators, engineers, project managers and external providers/innovators – all engaged in their professional as opposed to personal capacity. It will be made clear that co-operation is entirely voluntary.

Section 5: Consent

What process will be used to obtain consent?

Describe the process that the investigator(s) will be using to obtain valid consent. If consent is not to be obtained explain why. If the participants are under the age of 16 it would usually be necessary to obtain parental consent and the process for this should be described in full, including whether parental consent will be opt-in or opt-out.

1. For questionnaire, consent will be assumed if the questionnaire is answered. The opening paragraph of the questionnaire itself also confirms that participation is voluntary.
2. For the focus groups, as with the semi-structured interviews, the pre-existing participant information sheet and consent form will be sent in advance and noted at the start of any session with opportunities for any questions to be raised.

Please be aware that if the project involves over 16s who lack capacity to consent, separate approval will be required from the Health Research Authority (HRA) in line with the Mental Capacity Act.

Please attach a copy of the Participant Information Sheet (if applicable), the Consent Form (if applicable), the content of any telephone script (if applicable) and any other material that will be used in the consent process.

Note: Guidance from Legal Services on wording relating to the Data Protection Act 2018 can be accessed at <https://intranet.birmingham.ac.uk/legal-services/What-we-do/Data-Protection/resources.aspx>.

Use of deception?

Will the participants be deceived in any way about the purpose of the study?

Yes ☐

No ☒

If yes, please describe the nature and extent of the deception involved. Include how and when the deception will be revealed, and the nature of any explanation/debrief will be provided to the participants after the study has taken place.

Click or tap here to enter text.

Section 6: Participant compensation, withdrawal and feedback to participants

What, if any, feedback will be provided to participants?

Explain any feedback/ information that will be provided to the participants after participation in the research (e.g. a more complete description of the purpose of the research, or access to the results of the research).

Participants will be able to see anonymised results of the research once finalised, upon request.

What arrangements will be in place for participant withdrawal?

Describe how the participants will be informed of their right to withdraw from the project, explain any consequences for the participant of withdrawing from the study and indicate what will be done with the participant's data if they withdraw.

Questionnaire - There will be an opportunity for questionnaire data to be withdrawn up to a closing date and this will be explained in the opening section of the questionnaire. If withdrawn the data from that participant will be deleted.

Focus group - The Participant Information Sheet and the Consent Form will clearly set out the rights of the participant to refuse participation or withdraw from the project up to 14 days after the focus group has taken place.

In addition after the focus group has taken place a summary of the key points will be sent to participants for agreement. There will be an opportunity for them to amend and adjust that document up to 14 days after receipt.

Please confirm the specific date/timescale to be used as the deadline for participant withdrawal and ensure that this is consistently stated across all participant documentation. This is considered preferable to allowing participants to 'withdraw at any time' as presumably there will be a point beyond which it will not be possible to remove their data from the study (e.g. because analysis has started, the findings have been published, etc).

The questionnaire participants will be able to withdraw up to the date the survey closes. Subject to when the survey is launched this is likely to be 4-6 weeks after the survey is launched.

For the focus groups, participants are free to withdraw during the research without any negative consequences by simply notifying the decision to the researcher during the interview/focus group or within 14 days thereafter. If a participant decides to withdraw all the data collected during the focus group pertaining to their direct contribution will be omitted from the study. Participants of the focus group will also be sent a summary of the key issues arising from the session to ensure participants are comfortable with the contents.

What arrangements will be in place for participant compensation?

Will participants receive compensation for participation?

Yes ☐

No ☒

If yes, please provide further information about the nature and value of any compensation and clarify whether it will be financial or non-financial.

Click or tap here to enter text.

If participants choose to withdraw, how will you deal with compensation?

Click or tap here to enter text.

Section 7: Confidentiality/anonymity

Will the identity of the participants be known to the researcher?

Will participants be truly anonymous (i.e. their identity will not be known to the researcher)?

Yes ☐

No ☒

In what format will data be stored?

Will participants' data be stored in identifiable format, or will it be anonymised or pseudo-anonymised (i.e. an assigned ID code or number will be used instead of the participant's name and a key will be kept allowing the researcher to identify a participant's data)?

The questionnaire software is sent to participants using their email address. However the software will provide the participants with an identification code. It is the code that will be carried forward to identify participants.

For the focus groups personal, video and audio data for each participant will be given an ID code unique to each participant. The audio and video data are only to be used for transcribing the content of the group/ interviews. All data will be treated as confidential and stored securely. In reporting the findings all the data will be anonymised.

Will participants' data be treated as confidential?

Will participants' data be treated as confidential (i.e. they will not be identified in any outputs from the study and their identity will not be disclosed to any third party)?

Yes ☒

No ☐

If you have answered no to the question above, meaning that participants' data will not be treated as confidential (i.e. their data and/or identities may be revealed in the research outputs or otherwise to third parties), please provide further information and justification for this:

Click or tap here to enter text.

Section 8: Storage, access and disposal of data

How and where will the data (both paper and electronic) be stored, what arrangements will be in place to keep it secure and who will have access to it?

Please note that for long-term storage, data should usually be held on a secure University of Birmingham IT system, for example BEAR (see <https://intranet.birmingham.ac.uk/it/teams/infrastructure/research/bear/index.aspx>).

Data will be stored on the Researcher's password-secured laptop and transcribed for analysis.

Only the researcher and the Supervisors will have access to the data collected. According to University policy, on the submission of the thesis or a publication, data created will need to be transferred to the UoB Research Data Archive (RDA), to be stored as read-only, furthermore it must be stored 10 years after last point of access, so after 10 years without being consulted it will be deleted.

Data retention and disposal

The University usually requires data to be held for a minimum of 10 years to allow for verification. Will you retain your data for at least 10 years?

Yes ☒

No ☐

If data will be held for less than 10 years, please provide further justification:

Click or tap here to enter text.

What arrangements will be in place for the secure disposal of data?

As set out above to be deleted in line with UoB's procedures.

Section 9: Other approvals required

Are you aware of any other national or local approvals required to carry out this research?

E.g. clearance from the Disclosure and Barring Service (DBS), Local Authority approval for work involving Social Care, local ethics/governance approvals if the work will be carried out overseas, or approval from NOMS or HMPPS for work involving police or prisons? If so, please provide further details:

No

For projects involving NHS staff, is approval from the Health Research Authority (HRA) needed in addition to University ethics approval?

If your project will involve NHS staff, please go to the HRA decision tool at <http://www.hra-decisiontools.org.uk/research/> to establish whether the NHS would consider your project to be research, thus requiring HRA approval in addition to University ethics approval. Is HRA approval required?

Yes ☐

No ☐

Please include a print out of the HRA decision tool outcome with your application.

Section 10: Risks and benefits/significance

Benefits/significance of the research

Outline the potential significance and/or benefits of the research

As well as providing a usable tool this study will add to current thinking by introducing the concept of justice thinking to the use of interventions in this sector. Incorporating justice the framework will be a usable practical framework to allow, if not encourage, project teams to engage with the governance sphere surrounding their project and to look beyond their own immediate technical discipline.

Risks of the research

*Outline any potential risks (including risks to research staff, research participants, other individuals not involved in the research, the environment and/or society and the measures that will be taken to minimise any risks and the procedures to be adopted in the event of mishap.) **Please ensure that you include any risks relating to overseas travel and working in overseas locations as part of the study, particularly if the work will involve travel to/working in areas considered unsafe and/or subject to travel warnings from the Foreign and Commonwealth Office (see <https://www.gov.uk/foreign-travel-advice>). Please also be aware that the University insurer, UMAL, offers access to RiskMonitor Traveller, a service which provides***

24/7/365 security advice for all travellers and you are advised to make use of this service (see <https://umal.co.uk/travel/pre-travel-advice/>).

The outlining of the risks in this section does not circumvent the need to carry out and document a detailed Health and Safety risk assessment where appropriate – see below.

There are no serious risks involved for neither participants nor the researcher for interviews that are undertaken virtually via zoom. Should interviews be undertaken in person they will take place on reputable business premises or offices within hours of work. If face to face the interviews will take place in compliance with Covid-19 guidelines applicable at the time and location of the interview. The Interviewer will have a phone in case of emergency, and will inform appropriate people (e.g. supervisor(s)) about the details of where she will be, time of arrival and time of leaving.

University Health & Safety (H&S) risk assessment

For projects of more than minimal H&S risk it is essential that a H&S risk assessment is carried out and signed off in accordance with the process in place within your School/College and you must provide a copy of this with your application. The risk may be non-trivial because of travel to, or working in, a potentially unsafe location, or because of the nature of research that will be carried out there. It could also involve (irrespective of location) H&S risks to research participants, or other individuals not involved directly in the research. Further information about the risk assessment process for research can be found at <https://intranet.birmingham.ac.uk/hr/wellbeing/worksafe/policy/Research-Risk-Assessment-and-Mitigation-Plans-RAMPs.aspx>.

Please note that travel to (or through) 'FCO Red zones' requires approval by the University's Research Travel Approval Panel, and will only be approved in exceptional circumstances where sufficient mitigation of risk can be demonstrated.

Section 11: Any other issues

Does the research raise any ethical issues not dealt with elsewhere in this form?

If yes, please provide further information:

No

Do you wish to provide any other information about this research not already provided, or to seek the opinion of the Ethics Committee on any particular issue?

If yes, please provide further information:

The draft framework which will form the basis of the discussion with focus group participants is attached.

Section 12: Peer review

Has your project received scientific peer review?

Yes ☐

No ☒

If yes, please provide further details about the source of the review (e.g. independent peer review as part of the funding process or peer review from supervisors for PGR student projects):

Click or tap here to enter text.

Section 13: Nominate an expert reviewer

For certain types of project, including those of an interventional nature or those involving significant risks, it may be helpful (and you may be asked) to nominate an expert reviewer for your project. If you anticipate that this may apply to your work and you would like to nominate an expert reviewer at this stage, please provide details below.

Title: Click or tap here to enter text.

First name: Click or tap here to enter text.

Last name: Click or tap here to enter text.

Email address: Click or tap here to enter text.

Phone number: Click or tap here to enter text.

Brief explanation of reasons for nominating and/or nominee's suitability:

Click or tap here to enter text.

Section 14: Document checklist

Please check that the following documents, where applicable, are attached to your application:

Recruitment advertisement ☐

Participant information sheet ☒

Consent form ☒

Questionnaire ☒

Interview/focus group topic guide ☒

Please proof-read study documentation and ensure that it is appropriate for the intended audience before submission.

Section 15: Applicant declaration

Please read the statements below and tick the boxes to indicate your agreement:

I submit this application on the basis that the information it contains is confidential and will be used by the University of Birmingham for the purposes of ethical review and monitoring of the research project described herein, and to satisfy reporting requirements to regulatory bodies. The information will not be used for any other purpose without my prior consent. ☒

The information in this form together with any accompanying information is complete and correct to the best of my knowledge and belief and I take full responsibility for it. ☒

I undertake to abide by University Code of Practice for Research (<https://www.birmingham.ac.uk/Documents/university/legal/research.pdf>) alongside any other relevant professional bodies' codes of conduct and/or ethical guidelines. ☒

I will report any changes affecting the ethical aspects of the project to the University of Birmingham Research Ethics Officer. ☒

I will report any adverse or unforeseen events which occur to the relevant Ethics Committee via the University of Birmingham Research Ethics Officer. ☒

Please now save your completed form and email a copy to the Research Ethics Officer, at aer-ethics@contacts.bham.ac.uk. As noted above, please do not submit a paper copy.

ETHICAL REVIEW – EMAIL TRAIL

Samantha Waldron (Research Support Services)

Reply

Wed 15/12/2021, 12:17

Dexter Hunt (Civil Engineering);

Christopher Rogers (Civil Engineering);

Elisabeth Shrimpton (PhD Dept of Civil Eng FT)

Action Items

Dear Dr Dexter Hunt,

**Re: “Governance Frameworks for Utility Engineering Systems Interventions”
Application for Ethical Review ERN_20-1831A**

Thank you for the above application for amendment, which was reviewed by the Science, Technology, Engineering and Mathematics Ethical Review Committee.

On behalf of the Committee, I can confirm that this amendment now has full ethical approval.

I would like to remind you that any substantive changes to the nature of the study as now amended, and/or any adverse events occurring during the study should be promptly brought to the Committee’s attention by the Principal Investigator and may necessitate further ethical review. A revised amendment application form is now available at <https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Ethical-Review-Forms.aspx> . Please ensure this form is submitted for any further amendments.

Please also ensure that the relevant requirements within the University’s Code of Practice for Research and the information and guidance provided on the University’s ethics webpages (available at <https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Links-and-Resources.aspx>) are adhered to and referred to in any future applications for ethical review. It is now a requirement on the revised application form (<https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Ethical-Review-Forms.aspx>) to confirm that this guidance has been consulted and is understood, and that it has been taken into account when completing your application for ethical review.

Please be aware that whilst Health and Safety (H&S) issues may be considered during the ethical review process, you are still required to follow the University’s guidance on H&S and to ensure that H&S risk assessments have been carried out as appropriate. For further information about this, please contact your School H&S representative or the University’s H&S Unit at healthandsafety@contacts.bham.ac.uk.

If you require a hard copy of this correspondence, please let me know.

Kind regards,

Ms Sam Waldron (she/her)

Research Ethics Officer

Research Support Group

University of Birmingham

Email: [REDACTED]

Video/phone: If you would like to arrange a Teams/Zoom/telephone call, please email me and I will get in touch with you as soon as possible.

Postal address: Ms Sam Waldron, Finance Office, University of Birmingham, c/o Room 106 Aston Webb, B Block, Edgbaston, Birmingham, B15 2TT.

Dear Sam,

I attach an updated participant sheet marked version 2.

The changes are as follows (mirroring the numbering in your email):

1. there is now a new section on page 2 of the participant sheet which says

Focus Group Participation

For participants involved in focus groups, participants should keep each other's identities and contributions confidential outside of the session.

2. I have removed the mobile telephone number, participants can only contact me by my UoB email address.

I hope this is in order but please do come back to me if there is anything further to update.

Kind regards

Lis Shrimpton

From: Samantha Waldron (Research Support Services)

Sent: 15 December 2021 10:19

To: Dexter Hunt (Civil Engineering)

Cc: Christopher Rogers (Civil Engineering); Elisabeth Shrimpton (PhD Dept of Civil Eng FT)

Subject: Application for Ethical Review ERN_20-1831A

Dear Dr Dexter Hunt,

Re: "Governance Frameworks for Utility Engineering Systems Interventions"

Application for Ethical Review ERN_20-1831A

Thank you for your application for ethical review for the above project, which has now been considered by the Science, Technology, Engineering and Mathematics Ethical Review Committee.

The Committee has requested further information and amendments in relation to the following issues, to enable it to reach a decision on your application:

1. In the participant information sheet please state that focus group participants should keep each other's identities and contributions confidential outside the session.
2. Please can you confirm the contact number given is a work/project specific number? A personal number should be avoided.

I look forward to your response to the points above. When responding, please highlight any changes made to the study documentation and/or provide a separate document/email detailing how each of the Committee's points have been addressed.

Please confirm receipt by return email.

Kind regards,

Ms Sam Waldron (she/her)

Research Ethics Officer

Research Support Group

University of Birmingham

Email: [REDACTED]

Video/phone: If you would like to arrange a Teams/Zoom/telephone call, please email me and I will get in touch with you as soon as possible.

Postal address: Ms Sam Waldron, Finance Office, University of Birmingham, c/o Room 106 Aston Webb, B Block, Edgbaston, Birmingham, B15 2TT.

Web: <https://intranet.birmingham.ac.uk/finance/RSS/Research-Support-Group/Research-Ethics/index.aspx>

Click [Research Governance](#) for further details regarding the University's Research Governance and Clinical Trials Insurance processes, or email researchgovernance@contacts.bham.ac.uk with any queries relating to research governance.

Notice of Confidentiality:

The contents of this email may be privileged and are confidential. It may not be disclosed to or used by anyone other than the addressee, nor copied in any way. If received in error please notify the sender and then delete it from your system. Should you communicate with me by email, you consent to the University of Birmingham monitoring and reading any such correspondence.

Dear Research Ethics Officer,

The ethics team have previously approved the first stage of the research plan for research project title and reference, **PhD Project Title – Governance Frameworks for Utility Engineering Systems Interventions (previous SAF ref ERN_20-1831.**

Approval is now sought for stage 2 of the research plan.

I attach the following:

1. Application for ethics review - proforma
2. draft questionnaire (which will use JISC online surveys software)
3. participation and consent form
4. topics for focus group/interviews.

It is hoped the questionnaire can be circulated early in the new year, subject to your approval. The follow-op focus group is to take place early Spring.

Kind regards

Elisabeth Shrimpton (she/her)

Post Graduate Research
School of Engineering
University of Birmingham



UNIVERSITY OF
BIRMINGHAM

Dear Sir/Madam,

This is an invitation to take part in a research project, being conducted in the University of Birmingham as part of a PhD study. The invitation is to take part in a focus group or interview, either in person or on-line, to discuss infrastructure projects particularly in the water and wastewater sector.

The research project seeks the views of experts in the field of water and wastewater infrastructure on how governance has impacted on projects they have engaged with in this sector. It seeks expert insights on how issues such as policy, law, informal rules and networks have impacted on a project, negatively and positively, and how those insights can be used to help those engaged in future projects.

The practical impacts of governance on projects is a neglected field of study and this research project seeks to address that gap. The aim is to support project teams in engaging more effectively with the formal and informal rules and relationships that impact on their project. In turn, governance problems can be designed out or strategies put in place earlier to challenge governance itself. The information gained will be used as a practical tool for those, such as yourself, engaged in this Sector. In doing so it will support the infrastructure projects we need for the social, environmental and economic prosperity of this country and others.

Before agreeing to take part, you might want to know more about what this study involves. More information is set out below. Please take your time to read this carefully. If any part is not clear or you feel that you need more information, please get in contact.

If you feel able to take part I would be grateful if you could contact me on 07377546943 or eas983@student.bham.ac.uk and I will set up a mutually convenient time for the interview. If you have any colleagues or know of any other experts in this field that may be able to assist this project please do not hesitate in passing my contact details to them and if they are interested they can contact me to discuss further.

I thank you in anticipation of your assistance.

Yours faithfully,

Elisabeth Shrimpton
PhD Researcher
University of Birmingham

Participant Information

Target Audience

The information required at this stage of the project are insights and expertise from those already working on infrastructure interventions, particularly in the water and wastewater services sector.

Voluntary Participation

Participation occurs on a voluntary basis. In addition, you can withdraw at any time during the survey (if applicable) or within 14 days after completion of the interview/ focus group by contacting the researcher, without clarifying any reason. The collected data will be considered not valid and discarded.

Results of the Study

The results will be published in a PhD thesis and can be presented in academic or professional journals or at conferences.

Confidentiality of the Study

The data you provide will be stored in digital format in secured data storage facilities located on the Edgbaston campus of the University of Birmingham, and can only be accessed by the researcher and the supervisors. **Personally identifiable information will never be published.** Contact details will only be stored if you provide them. Your data will be treated in compliance with Data Protection Act 2018.

Next Steps

If you agree to participate the researcher will be in touch to arrange a mutually convenient time for the interview/focus group to take place. This will either be in person or via Zoom (or similar package). It is anticipated the interview will take 60-90 minutes. The interview will be recorded so the content can be transcribed, any audio/video will not be used in the thesis itself.

Contact Details

Elisabeth Shrimpton




Department of Civil Engineering, School of Engineering,
Birmingham, B15 2TT, UK

Dr Dexter Hunt



Prof Chris Rogers



If you are concerned about how this research is being conducted, you can contact the 'Science, Technology, Engineering and Mathematics Ethical Review Committee', University of Birmingham, Birmingham, B15 2TT, aer-ethics@contacts.bham.ac.uk



UNIVERSITY OF
BIRMINGHAM

Dear Potential Participant,

This is an invitation to take part in a research project, being conducted in the University of Birmingham as part of a PhD study. The invitation is to take part in a focus group to discuss infrastructure projects in the water and wastewater sector.

The research project seeks your views as someone engaged in the field of water and wastewater infrastructure on how governance has impacted on the projects they have engaged with. It seeks your insights on how issues such as policy, law, informal rules and networks have impacted on a project, negatively and positively, and looks at how those insights can be used to help those engaged in future projects. You do not need to have an in depth knowledge of governance and no advance work is required.

The reason this project is taking place is because the practical impacts of governance on projects is a neglected field of study and this research project seeks to address that gap. The aim is to support project teams in understanding the formal and informal rules and relationships that impact on their project. In turn, these problems can be designed out or strategies put in place earlier to challenge governance itself. The information gained will be used as a practical tool for those, such as yourself, engaged in this Sector. In doing so it will support the infrastructure projects we need for the social, environmental and economic prosperity of this country and others.

Before agreeing to take part, you might want to know more about what this study involves. More information is set out below. Please take your time to read this carefully. If any part is not clear or you feel that you need more information, please get in contact.

If you feel able to take part I would be grateful if you could contact me on [REDACTED] and I will set up a mutually convenient time for the interview. If you have any colleagues or know of any other experts in this field that may be able to assist this project please do not hesitate in passing my contact details to them and if they are interested they can contact me to discuss further.

I thank you in anticipation of your assistance.

Yours faithfully,

Elisabeth Shrimpton
PhD Researcher
University of Birmingham [REDACTED]

Participant Information

Target Audience

The information required at this stage of the project are insights and expertise from those already working on infrastructure interventions, particularly in the water and wastewater services sector.

Voluntary Participation

Participation occurs on a voluntary basis. In addition, you can withdraw up to 14 days after completion of the interview/ focus group by contacting the researcher, without clarifying any reason. The collected data will be considered not valid and discarded.

Focus Group Participation

For participants involved in focus groups, participants should keep each other's identities and contributions confidential outside of the session.

Results of the Study

The results will be published in a PhD thesis and can be presented in academic or professional journals or at conferences.

Confidentiality of the Study

The data you provide will be stored in digital format in secured data storage facilities located on the Edgbaston campus of the University of Birmingham, and can only be accessed by the researcher and the supervisors. **Personally identifiable information will never be published.** Contact details will only be stored if you provide them. Your data will be treated in compliance with Data Protection Act 2018.

Next Steps

If you agree to participate the researcher will be in touch to arrange a mutually convenient time for the interview/focus group to take place. This will either be in person or via Zoom (or similar package). It is anticipated the interview will take 60-90 minutes. The interview will be recorded so the content can be transcribed, any audio/video will not be used in the thesis itself.

Contact Details


Elisabeth Shrimpton




Department of Civil Engineering, School of Engineering,
Birmingham, B15 2TT, UK

Dr Dexter Hunt





Prof Chris Rogers



If you are concerned about how this research is being conducted, you can contact the 'Science, Technology, Engineering and Mathematics Ethical Review Committee', University of Birmingham, Birmingham, B15 2TT, aer-ethics@contacts.bham.ac.uk

APPENDIX 5: INTERVIEW TRANSCRIPTS AND ANONYMISED LIST OF PROJECTS

- **List of Projects**
- **Anonymised Interview Transcripts x 18**

Appendix 5 - Project List (Interviews)

Entity	Role (as described)	Participant's Choice of Project(s)
Water only Company	Projects and innovation, leakage and systems,	Drastic and wholesale move to innovative IT system change around trenchwork. Instigated by local authority, regulatory demand.
Water only Company	Projects, economics and finance, regulatory	New reservoir to be built to service a different water company. Water transfers.
Government Agency	Environmental adviser	Nutrient removal from well-known water body, improved wastewater management using NBS. Use of wastewater.
Government Agency	Environmental adviser	Phosphorus reduction methods and approaches, catchment approaches and beyond
Water and wastewater utility	Innovations Project Manager	Development of the 'sentient catchment' (amongst others)
Water and wastewater utility	Innovations Projects manager	Multiple. Trials for asset condition monitoring, flood and leak alarms
Water and wastewater utility	Rehabilitation Manager, engineering, trenchless technology	Multiple projects focussed on trenchless technology
Water and wastewater utility	Project Engineering Manager (bio)	New systems to protect particular species and biodiversity more widely
Infrastructure service provider	Operational Improvements Manager	Fibreoptic technology in pipes for water leakage detection and asset management
Water and wastewater utility	Area Stakeholder manager (bio)	Storm overflow projects, one very large scale
Innovation Consultancy	Wastewater catchment manager	Multiple innovations around data gathering and use
Water and wastewater utility	Lead Project Manager (Operational Transition)	Brand new potable water infrastructure network
Water and wastewater utility	Project manager (Civ eng)	Phosphorus removal using latest non chemical technologies
Water and wastewater utility	Natural Capital Strategy and Planning Manager	Phosphorus removal, multiple benefit schemes
Innovating Company	National Water Industry Account Manager	Sensing; Probes for measuring microbial activity amongst others
Innovating Company	Management Acoustic Sensing	Acoustic sensing for sewers
Water and wastewater utility	Wastewater project manager	Phosphorus removal from wastewater, new versus old technologies
Innovation Consultancy	Principal Consultant, Tech and innovation	Multiple, wide scale transformative projects

Appendix 5

Anonymised Interview Transcripts x 18

(Available on request)

APPENDIX 6: SURVEY RESULTS AND TABLES

- **Bar Charts (from JISC Software)**
- **Prepared Tables of Data (Q4-8)**

Pipebots Survey Jan 2022

Showing 55 of 55 responses

Showing **all** responses

Showing **all** questions

Response rate: 20%

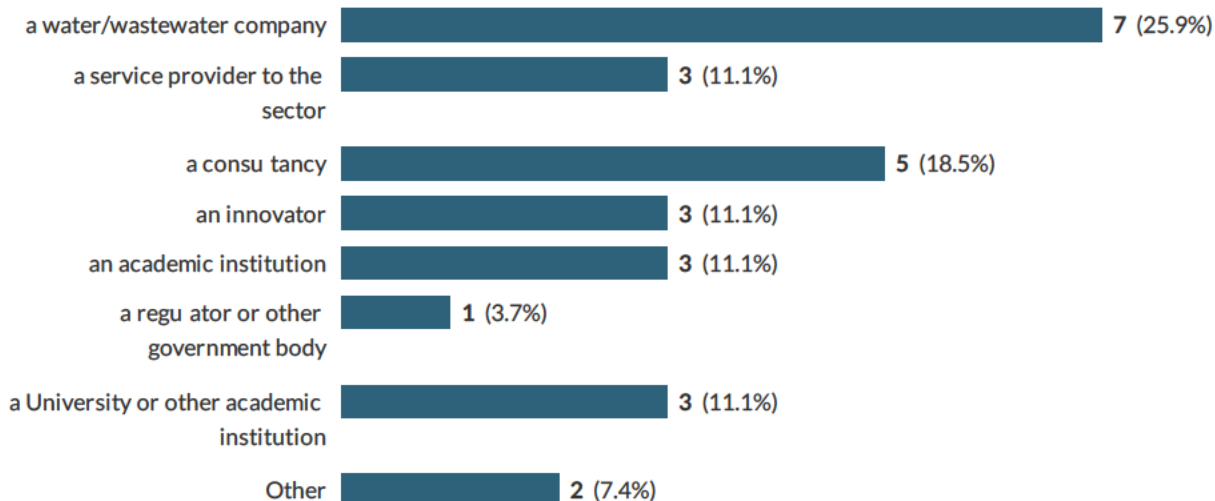
1 Q1. Are you a member of a Pipebots Technical Theme (Themes 2-8)?



1.a If yes, how long have you worked on the Pipebots project?



1.b If you are not a member of a Pipebots Technical Theme which type of institution do you work for (choose one)?

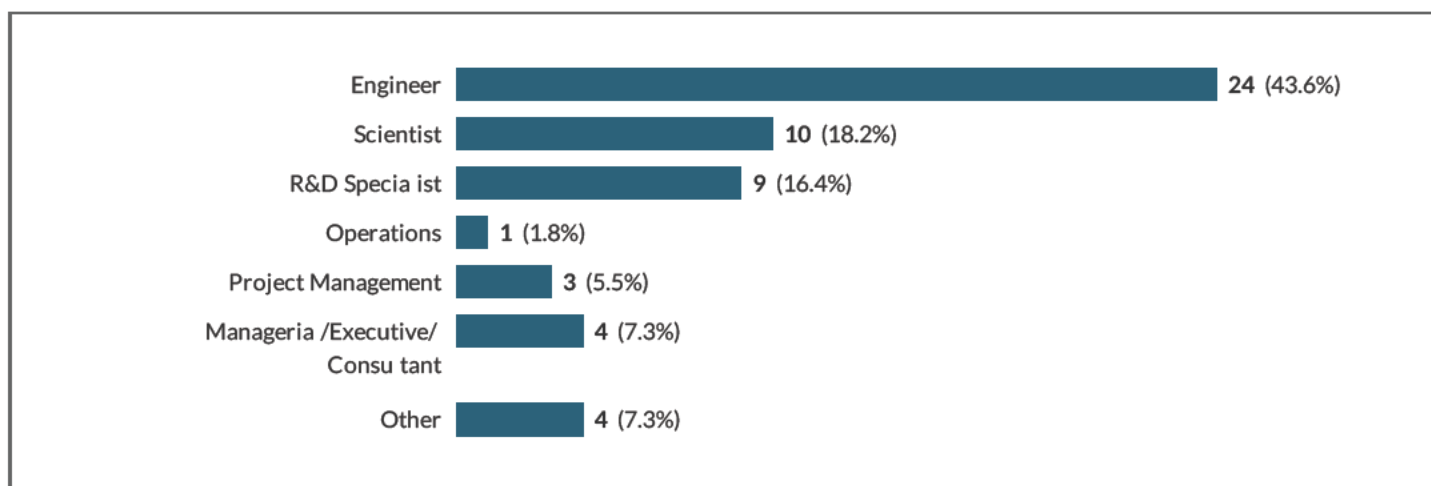


Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

1.b.i If you selected Other, please specify:

Showing all 2 responses	
Manufacturer of leak detection and monitoring equipment	831911-831902-88067095
Telecoms operator with some similar challenges to those of the water sector.	831911-831902-89112322

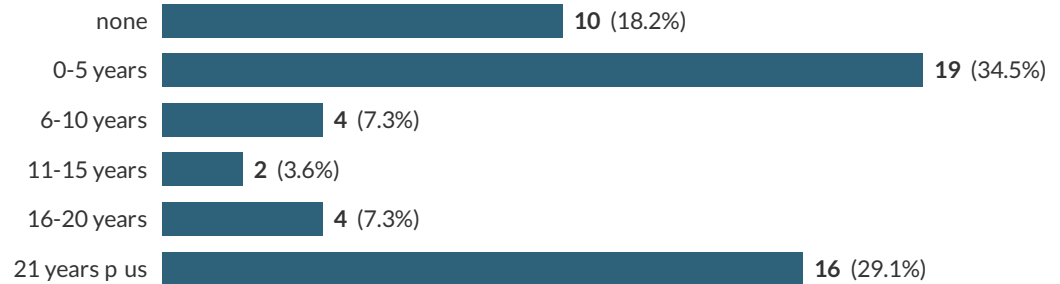
2 Q2. What term best describes your professional role or academic discipline (many of us are multi-talented, please choose the one that you feel describes you best (tick one))?



2.a If you selected Other, please specify:

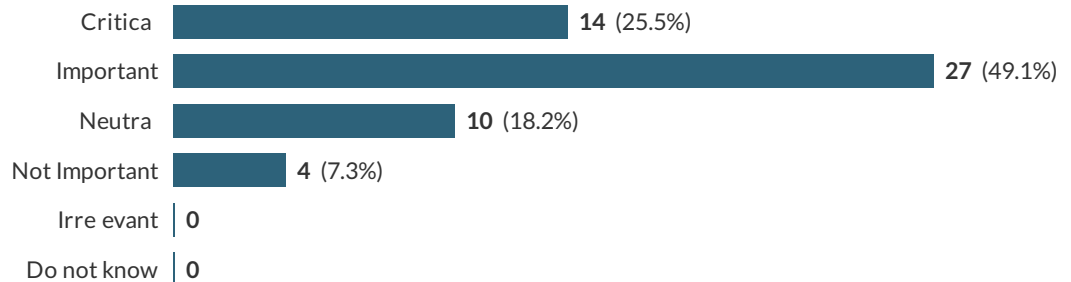
Showing all 4 responses	
Product Manager	831911-831902-88067095
Innovation Programme Developer	831911-831902-88699061
Innovation team	831911-831902-88705585
PhD student	831911-831902-88718587

3 Q3. How many years have you worked in or with the water and wastewater sector (the sector)?



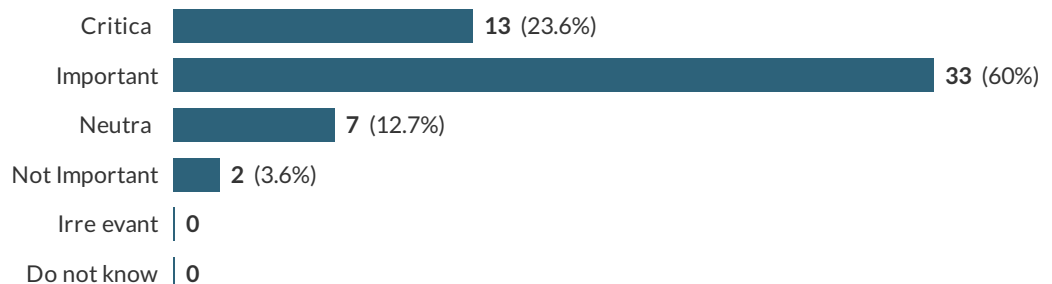
4 Q4. In your view, how important is it for project teams to focus upon the following during the early* stages of the project? (*for these purposes, early can be considered up to and including validating proof of concept)

4.1 a. Narrow and focussed problem framing e.g. achieving a particular technical requirement or goal



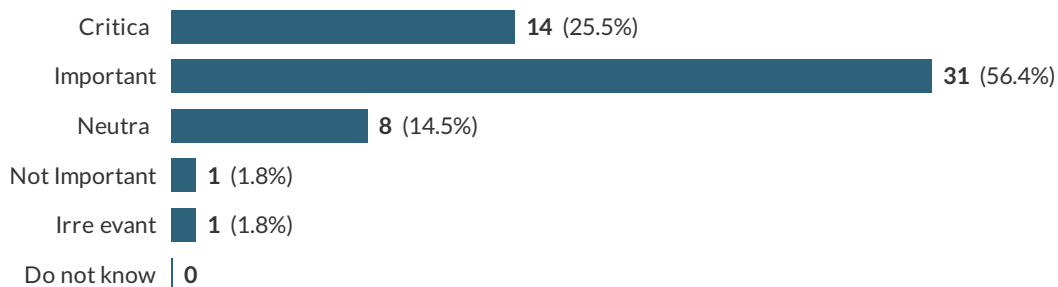
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

4.2 b. Wide and contextual problem framing e.g. early thinking about the wider potential for economic, social and environmental benefits



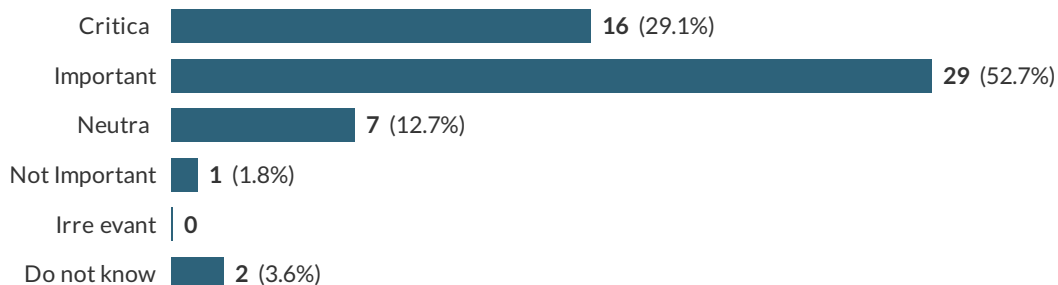
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

4.3 c. Defining clearly, and setting out the boundaries of, the system of interest (e.g. the water body or infrastructure system affected) and its interconnectivity with other systems



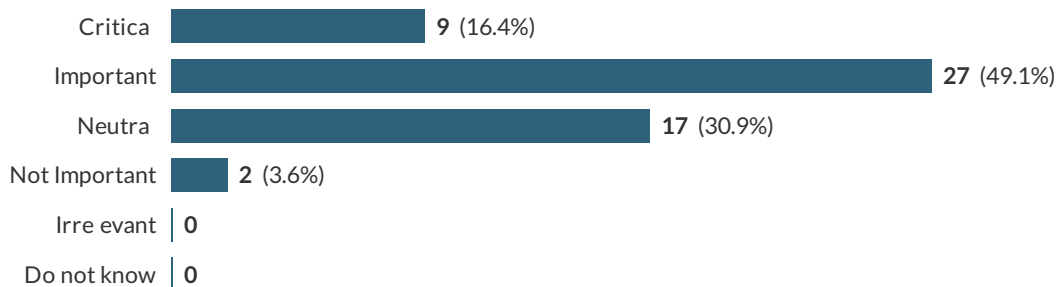
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

4.4 d. Reducing the potential for working in 'silos' - including any failure to communicate or account for the needs of other teams or disciplines, technical and non-technical



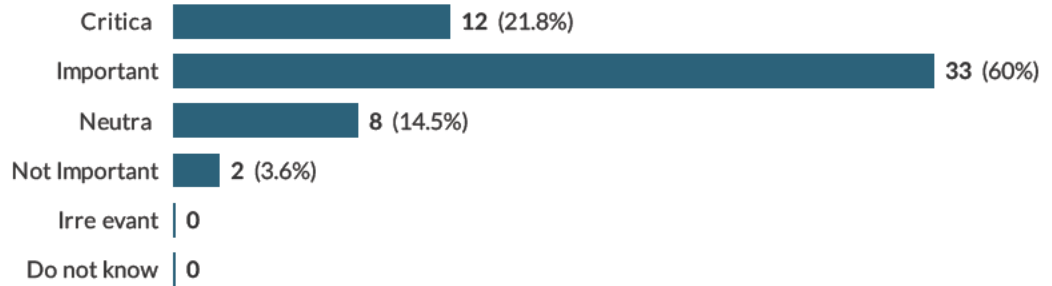
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

4.5 e. Anticipating the potentials risks of the project on infrastructure security and data security



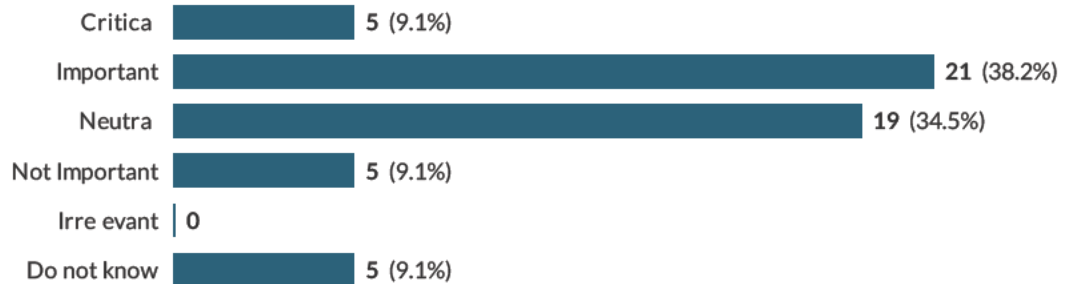
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

4.6 f. Ensuring the technical teams are aware of potential regulatory challenges, sector rules and norms



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

4.7 g. Considering opportunities early on to re-frame any 'burdens' into assets e.g. flood water, removed nutrients, 'waste', circular economy?



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

4.a Would the importance of any of your answers above increase if you were considering later iterations or stages of development of the project (i.e. post-proof of concept)?



4.a.i If yes please specify which of the statements (labelled a to g), would increase in importance

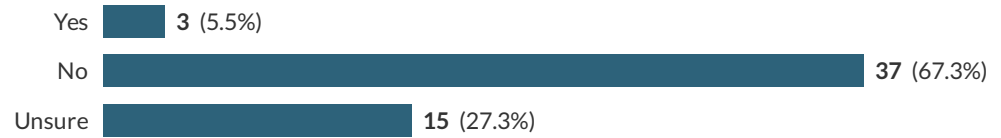
Showing all 30 responses

e

831911-831902-88067095

Following stages of development would afford proofs of concepts to demonstrate their meaningfulness both from scientific and industrial perspectives.	831911-831902-88066915
e,f	831911-831902-88067549
A	831911-831902-88067827
c., g. (this question is not clear as to its definition of burdens)	831911-831902-88071573
a & f	831911-831902-88075075
a	831911-831902-88084126
a-g	831911-831902-88087800
b,e,f	831911-831902-88146880
a, b, e, f	831911-831902-88404676
d e f g	831911-831902-88699057
a	831911-831902-88701393
c, f	831911-831902-88701629
f. Ensuring the technical teams are aware of potential regulatory challenges, sector rules and norms	831911-831902-88702138
Narrowing the focus and technical goals as research progresses.	831911-831902-88718587
a,e,f,g	831911-831902-88764849
b	831911-831902-88802350
b,c,d	831911-831902-89111150
Some impact on all statements, but primarily e and f.	831911-831902-89112322
g	831911-831902-89111587
a,d,f	831911-831902-89114657
a,f	831911-831902-89119888
a,b,c,e,f,g.	831911-831902-89123849
All of them.	831911-831902-89137876
f)	831911-831902-89144296
F	831911-831902-89474833
a	831911-831902-89475184
All	831911-831902-89477195
b in particular to be more precise on cost benefit, but at the moment, enabling the tech is the fundamental requirement.	831911-831902-89475467
a and e	831911-831902-89496863

4.a.ii Casting your mind back to before your involvement with the project, have your views on the statements in Q4 changed?



4.a.ii.a If yes, has your view of the importance of these statements increased, decreased or stayed the same?

a.ii.a.1 a. Narrow and focussed problem framing e.g. focussing on achieving a technical requirement or goal



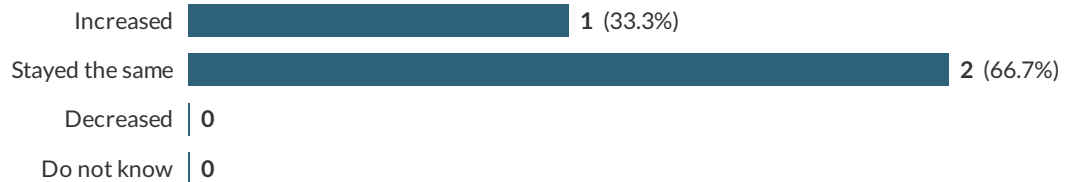
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

a.ii.a.2 b. Wide and contextual problem framing e.g. early thinking about the wider potential for economic, social and environmental benefits



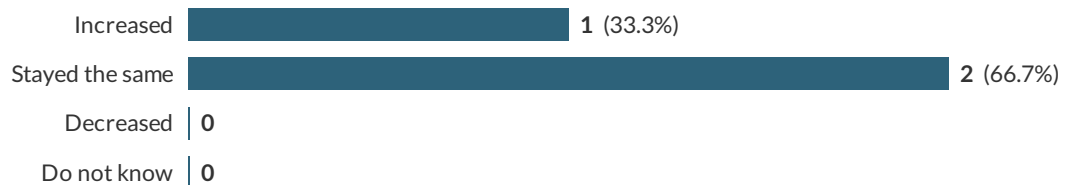
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

a.ii.a.3 c. Defining clearly, and setting out the boundaries of, the system of interest (e.g. the water body or infrastructure system affected) and their interconnectivity with other systems



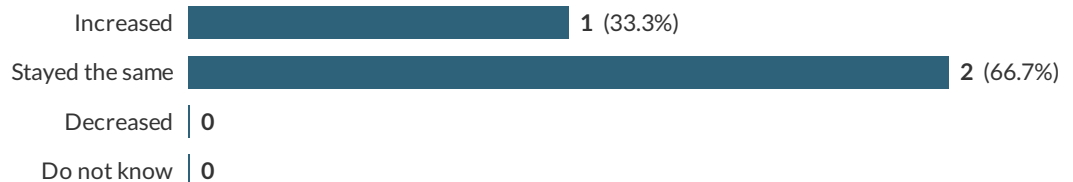
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- a.ii.a.4 d. Reducing the potential for working in 'silos' - including any failure to communicate or account for the needs of other teams or disciplines, technical and non-technical



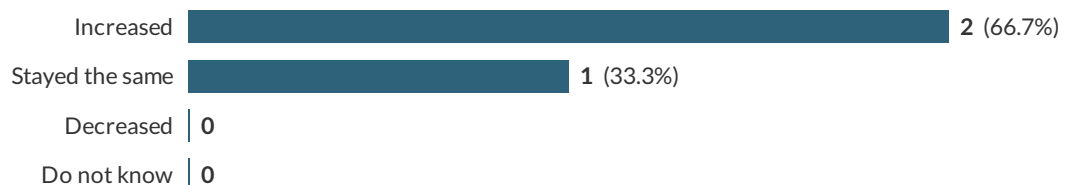
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- a.ii.a.5 e. Anticipating the potentials risks of the project on infrastructure security and data security



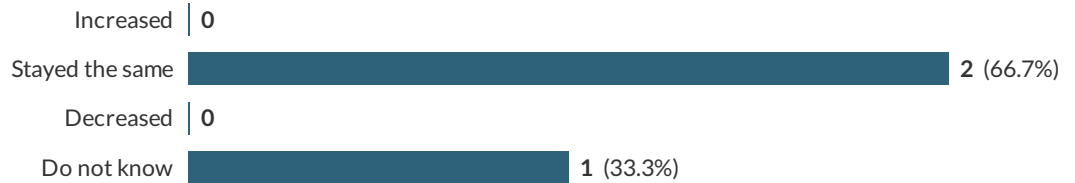
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- a.ii.a.6 f. Ensuring the technical teams are aware of potential regulatory challenges, sector rules and norms



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- a.ii.a.7 g. Considering opportunities early on to re-frame any 'burdens' into assets e.g. flood water, removed nutrients, 'waste', circular economy?



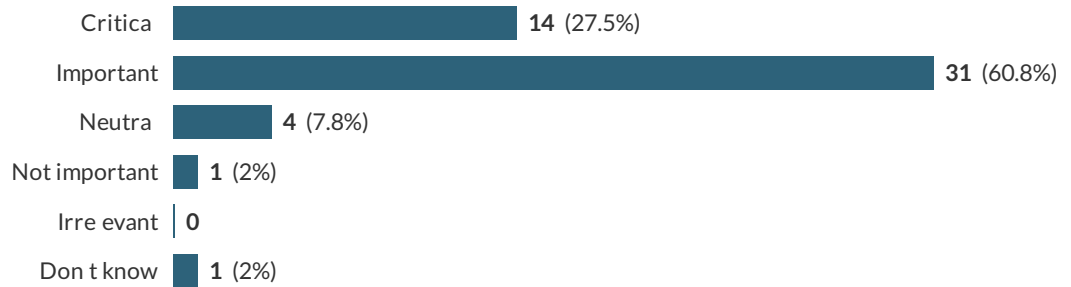
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 4.a.iii If you wish to add comments please feel free to do so here (optional)

Showing all 10 responses	
Prior to my involvement in the project, I did not have views on the project...this question is confusing...	831911-831902-88071573
Projects go through phases. It is common to explore everything and then narrow down to one or two solutions.	831911-831902-88084126
In the past I have always talked blithely about the need to identify stakeholders and their requirements without really appreciating how difficult it is to do. I now see wide and contextual problem framing as the essential bedrock for a successful project; but, of course, there is often limited time and money to do that. It really needs doing by the client (or some sort of guiding mind) before time and resource limited contracts are let.	831911-831902-88132997
For me, the importance of these areas would not necessarily change but the degree of confidence or detail in how to address these aspects may alter.	831911-831902-88429895
it is key to identify the clear desired outcomes first, and then allow innovators and free thinking to come up with the solutions that can deliver those outcomes	831911-831902-88698995
Statements e and f become critical to the definition and delivery of any sort of field trial.	831911-831902-89112322
I think it's worth considering a scope or problem statement that has different levels of requirements (e.g. essential, desirable, nice to have, must not have). This helps avoid focusing too narrowly on a few criteria and missing the bigger picture, but conversely it also ensures a project isn't overburdened by setting too many 'equal' requirements at the outset that might not all be achievable.	831911-831902-89111068
I struggled a bit with the question in terms of knowing at what level the concept is proven / what the concept is. Pipebots has a very broad remit, the end goal would be pervasive robot swarms surveying clean water and sewer pipes. Presumably a proof of concept would have to just focus on a much smaller element of this?	831911-831902-89123849
Also, for the first two point I put neutral, as the importance depends on the type and size of the project, e.g. is it a narrower industry focussed shorter timeframe project, or a much larger more blue skies research project, you can't really give the same importance of the first two bullet points for 'any kind' project	831911-831902-89137876
I have long held these views, but Pipebots has reinforced their importance / criticality	831911-831902-89496863

5 Q5 How important is it for Pipebots to actively engage in developing its network with the following categories of people?

5.1 Regulators



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

5.2 Operational teams within water/waste water companies



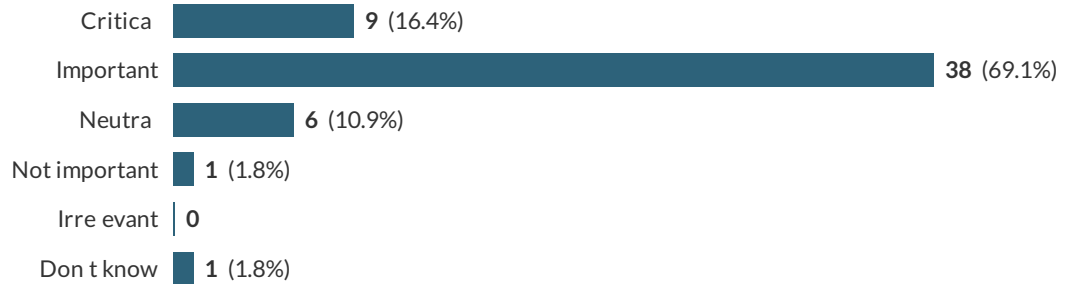
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

5.3 R&D / Innovation teams within water/waste water companies



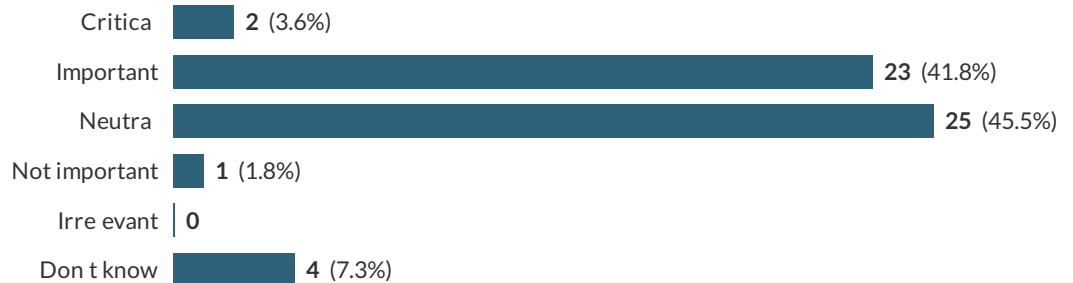
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

5.4 Existing service suppliers to the sector



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

5.5 eNGOs (environmental Non-Government Organisations)



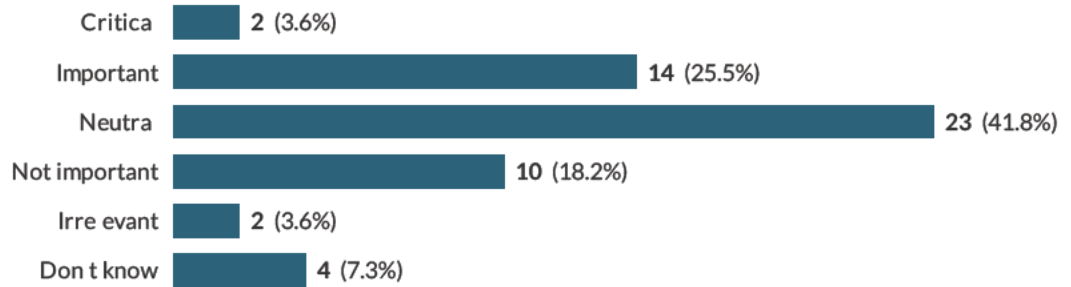
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

5.6 General Public



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

5.7 Consumer groups

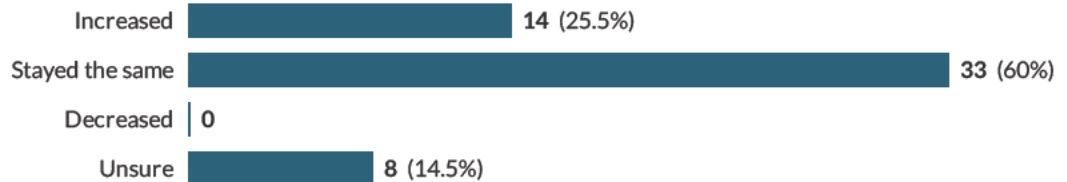


Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

5.a Would you add any other category to Q5 as critical or important, if so who would you add?

Showing all 12 responses	
professional associations in the water/wastewater fields	831911-831902-88071573
That senior person in an organisation responsible for strategic thinking, who has the authority to take a punt on something that is high risk in the sense that it isn't clear what the outcome is, but it looks promising.	831911-831902-88132997
Local authorities, councils	831911-831902-88429895
R&D companies in specific fields, such as sensors	831911-831902-88701393
The media Funders i.e. EPSRC	831911-831902-88702138
no	831911-831902-89111150
Possibly councils - they manage the whole wayleave process for streetworks.	831911-831902-89112322
It needs to be a two way communication especially if dealing with a potential competitor	831911-831902-89113825
Possibly highway authorities? Possibly asset management/strategy teams within water/waste water companies?	831911-831902-89111068
Potential manufacturers of Pipebots.	831911-831902-89123849
Consultancies, who often specify these things on behalf of others listed above	831911-831902-89144296
Infrastructure designers (consultants), senior management of water companies	831911-831902-89496863

5.b Casting your mind back to before your involvement with the project, have your views on the importance of a network increased, decreased or stayed the same?

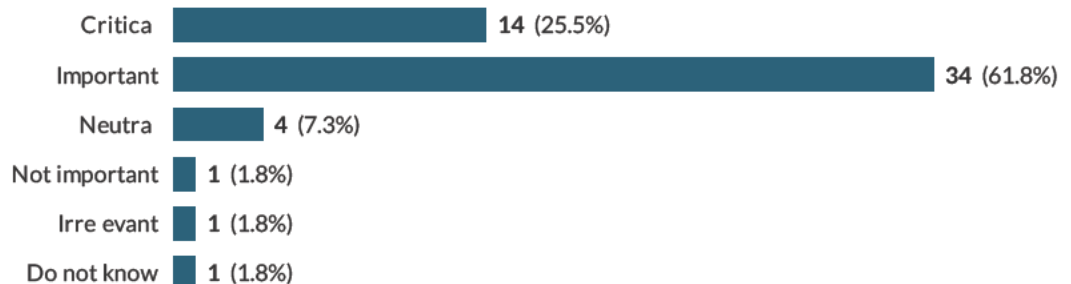


5.c If you wish to make an additional comment please feel free to do so here

Showing all 3 responses	
Building a network with a shared goal is vital for success, but it doesn't seem to be something that can be done by following a systematic process. Application of soft skills is a necessary factor in success, but not sufficient. Building and maintaining a successful team is fiendishly difficult - think football at the highest level.	831911-831902-88132997
It's not easy to say to what extent the Pipebots team needs to have all of these relationships itself, rather than replying on a smaller pool of engaged water company contacts who can facilitate communication with the extended stakeholder community.	831911-831902-89111068
I don't know what eNGOs are? Does it mean things like the Rivers Trust or Surfers against sewage? I'm trying to think whether important to involve such organisations, unsure	831911-831902-89137876

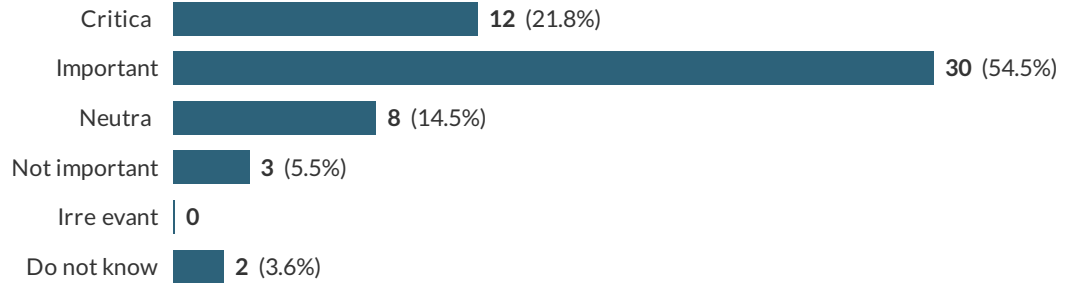
6 Q6 In setting out the foundations or business case for change in this sector, how important are the following issues?

6.1 a. Setting out the regulatory requirements the project is designed to support



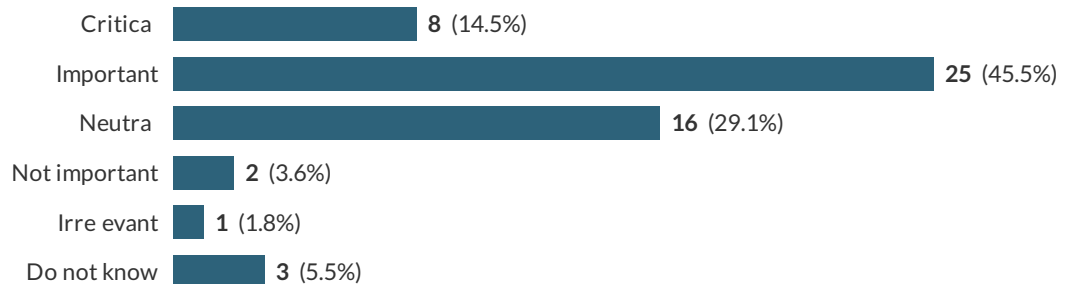
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

6.2 b. Linking the project to environmental and/or social policy or international goals such as the



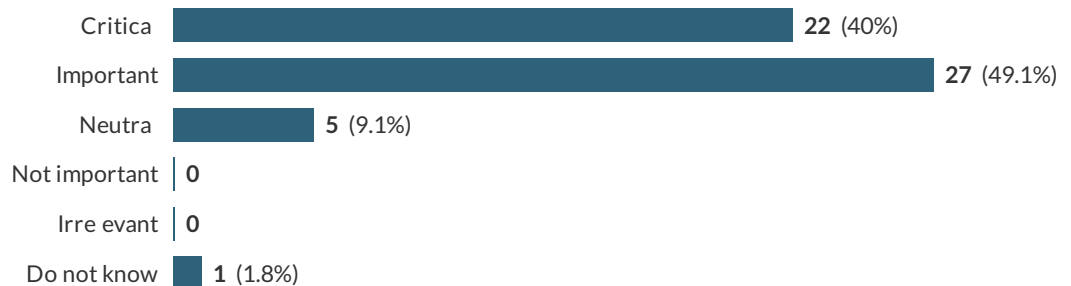
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

6.3 c. Ensuring any potential for positive PR (public relations) is explained and captured and any adverse PR potential is addressed



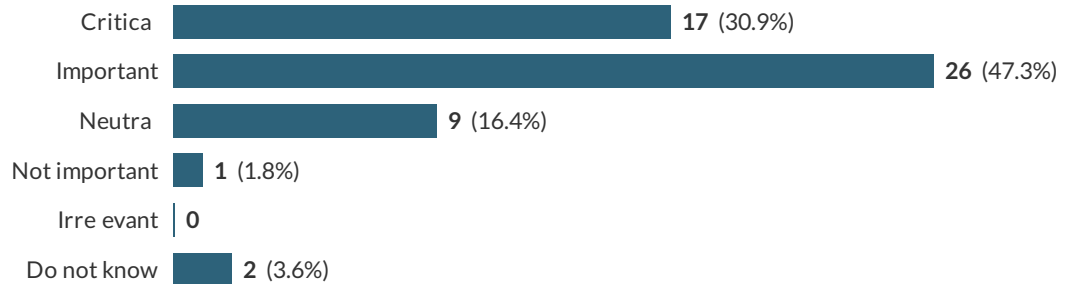
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

6.4 d. Being clear on who or what will benefit from the project (and why they have been chosen as beneficiaries)



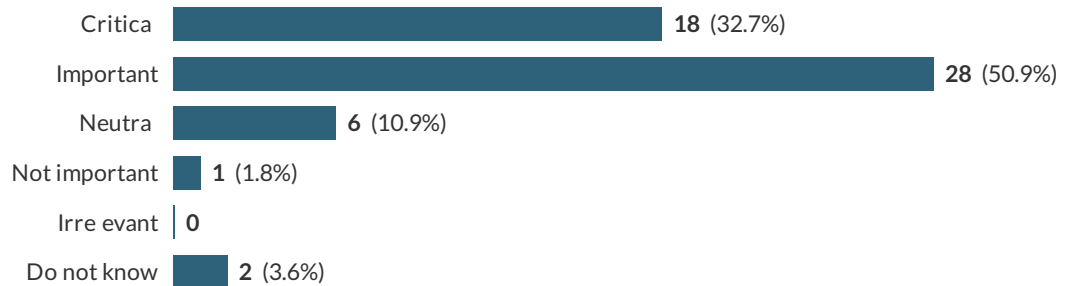
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

6.5 e. Being clear on who or what will suffer any detriment as a result of the project or its implementation and why, including strategies for mitigation



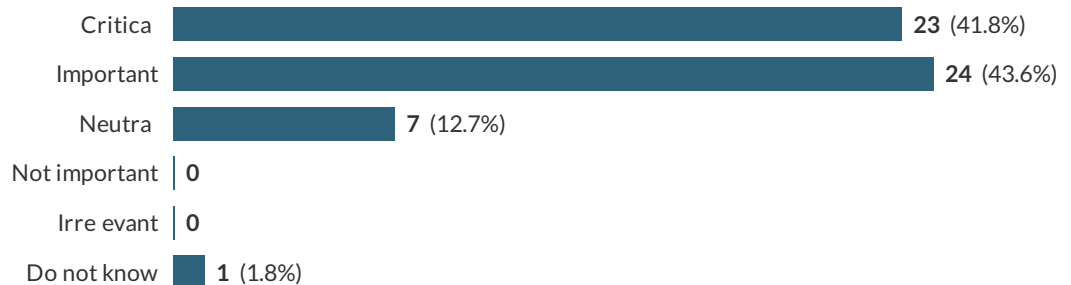
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

6.6 f. Data creation and management; giving due thought to how the project can use data to enhance our knowledge of existing systems including ecosystems



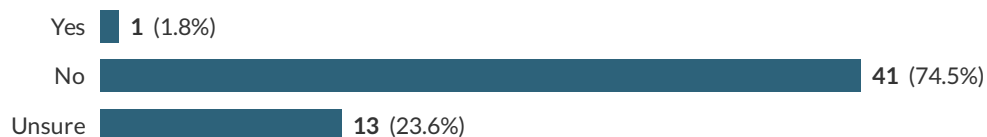
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

6.7 g. Economic efficiency, reduced whole life cost compared to existing system



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

6.a Casting your mind back to before your involvement with the project started, have your views on the statements in Q6 changed?



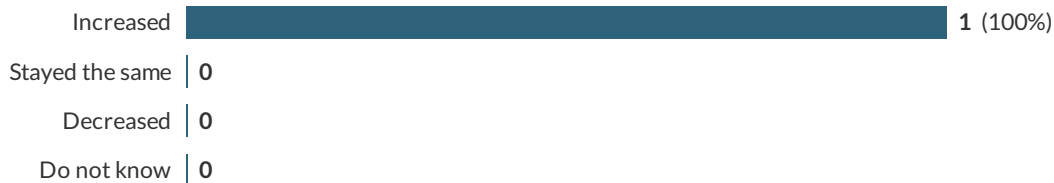
6.a.i If yes, have your views on the importance of these statements increased, decreased or stayed the same?

6.a.i.1 a. Setting out the regulatory requirements the project is designed to support



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

6.a.i.2 b. Linking the project to environmental and/or social policy or international goals such as the Sustainable Development Goals, net zero, climate change adaption or levelling up agendas



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

6.a.i.3 c. Ensuring any potential for positive PR (public relations) is explained and captured and any adverse PR potential is addressed



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 6.a.i.4 d. Being clear on who or what will benefit from the project (and why they have been chosen as beneficiaries)



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 6.a.i.5 e. Being clear on who or what will suffer any detriment as a result of the project or its implementation and why, including strategies for mitigation



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 6.a.i.6 f. Data creation and management; giving due thought to how the project will use data to enhance our knowledge of existing systems including ecosystems



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

6.a.i.7 g. Economic efficiency, reduced whole life cost compared to existing system



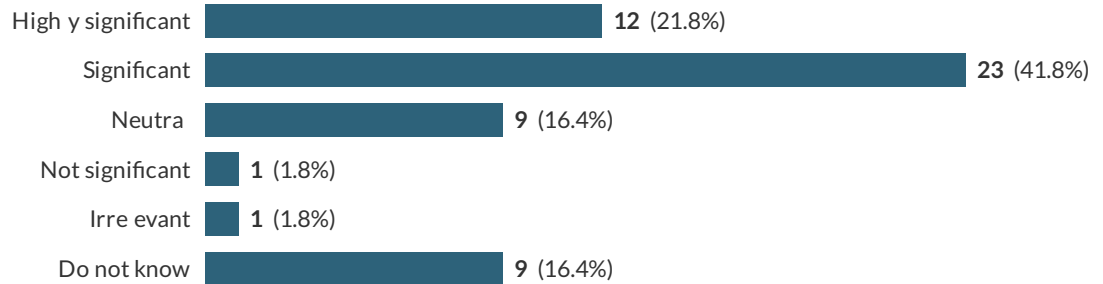
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

6.b If you wish to add a comment please feel free to do so here (optional)

Showing all 5 responses	
I knew nothing about water pipes before working on this project.	831911-831902-88084126
A strong business model setting out value generation and capture is foundation for the business case; however, it is necessary to be aware who ultimately will have the power to make decisions; what they regard as valuable will take precedence over other value generation issues. Power is real even though it might be regarded as a dirty word when viewed in the context of justice	831911-831902-88132997
pipebots must challenge and redefine the current regulatory framework, not be constrained by it	831911-831902-88239235
I have very little opinion on the business case of this project.	831911-831902-88718587
Regarding regulatory requirements, these are almost certain to change with time. The business case needs to be flexible enough to account for such change and ideally incorporate changes that are thought likely to happen.	831911-831902-89123849

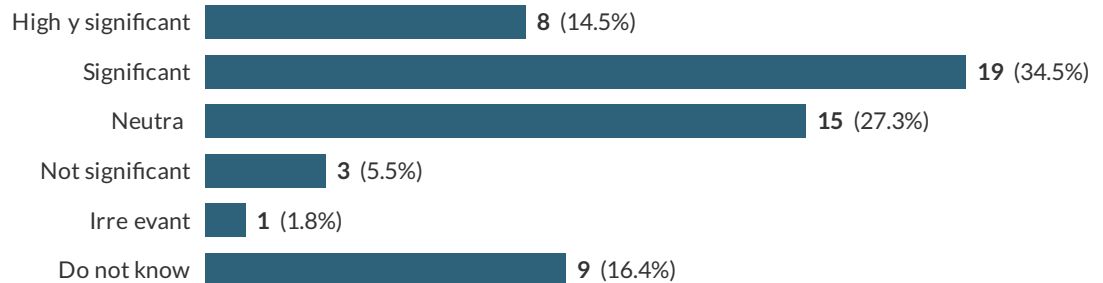
7 Q7 When working in this sector, how significant are the following factors generally to the success or otherwise of a project?

7.1 a. understanding the impact of AMP (asset management plan) reviews and cycle times



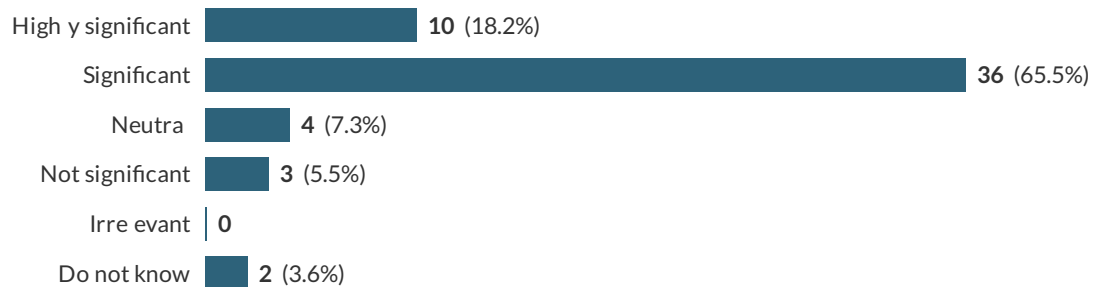
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

7.2 b. being alive to pre-existing framework contracts and/or procurement with other suppliers



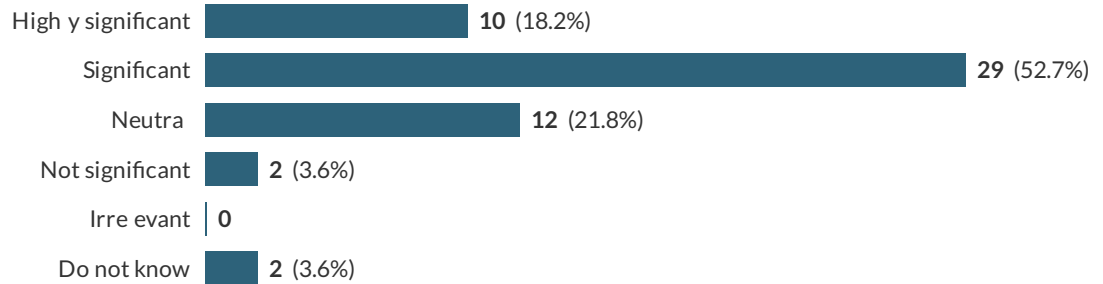
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

7.3 c. identifying supportive regulators or regulatory mechanisms including those for supporting novelty/ innovation in the sector



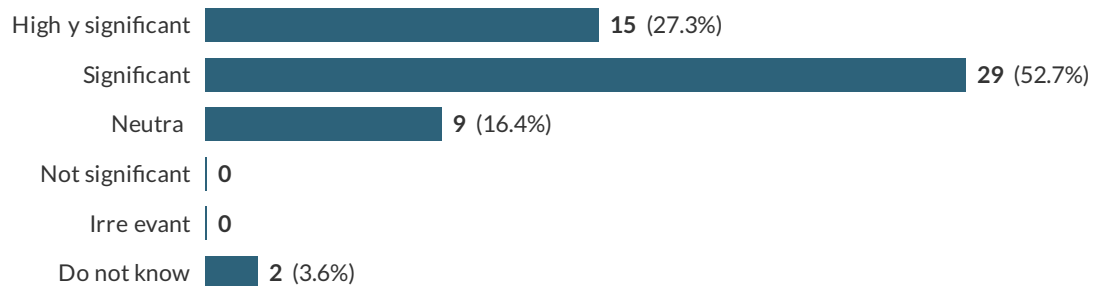
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

7.4 d. having ethical guidelines and/or a responsible innovation code of practice at its centre



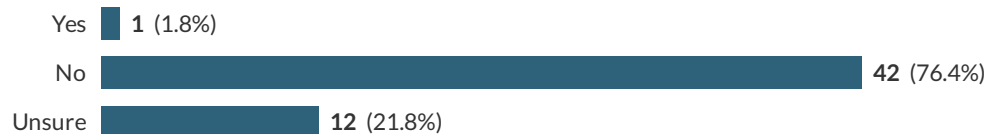
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

7.5 e. addressing and improving the project's network of supportive contacts or champions with knowledge of how the sector really works



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

7.a Casting your mind back to before your involvement with the project started, have your views on the statements in Q7 changed ?



7.a.i If yes, have your views on the importance of those statements increased, decreased or stayed the same?

7.a.i.1 a. understanding the impact of AMP (asset management plan) reviews and cycle times



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

7.a.i.2 b. being alive to pre-existing framework contracts and/or procurement with other suppliers



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

7.a.i.3 c. identifying supportive regulators or regulatory mechanisms including those for supporting novelty/ innovation in the sector



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

7.a.i.4 d. having ethical guidelines and/or a responsible innovation code of practice at its centre



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

represent that all this question's respondents chose that option)

- 7.a.i.5 e. addressing and improving the project's network of supportive contacts or champions with knowledge of how the sector really works



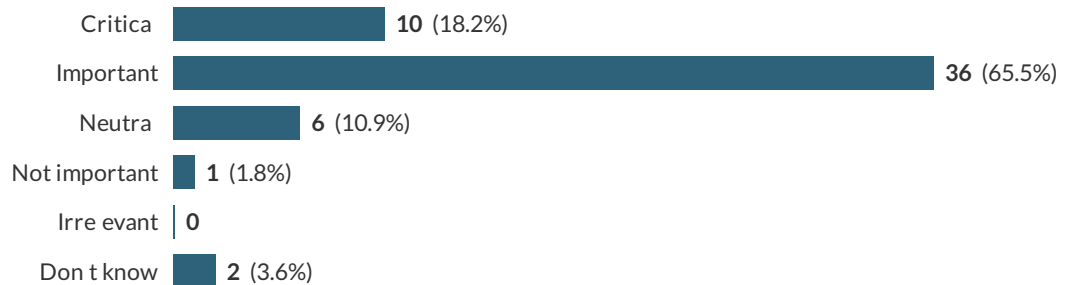
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 7.b If you wish to add a comment please feel free to do so here (optional)

Showing all 7 responses	
Didn't know what AMP meant!	831911-831902-88084126
Identifying the opportunity for change is key: e.g. this equipment is worn out and needs replacing; why don't we try this new technology. This is completely different from 'we should apply this new technology because it will deliver environmental benefits, even though the existing infrastructure has another 10 years life left in it.	831911-831902-88132997
pipebots can and should help break out of the horrors of the AMP cycle, it must not be constrained by it	831911-831902-88239235
It might be covered in a later question, but having a clear strategy to get from technology development to commercial implementation has tended to be a shortcoming of projects led by academia.	831911-831902-89111068
Responses to this would differ depending on expected timescales - e.g. some technologies might be ready for use immediately, others will take years of development to reach maturity. Pipebots potentially has elements of both. I've tried to answer for something in the middle. Aspects such as AMPs and frameworks would be critical for something close to market - maybe a sensor that could be used on an existing CCTV platform, but largely irrelevant for something that might be 15 or 20 years away from widespread deployment - e.g. robot swarms permanently in a network.	831911-831902-89123849
I don't understand what is meant by factor b...	831911-831902-89137876
If I were given 'important' and 'critical' as options, then all would ultimately be listed as critical, but some (b, c and e) might start out as important.	831911-831902-89496863

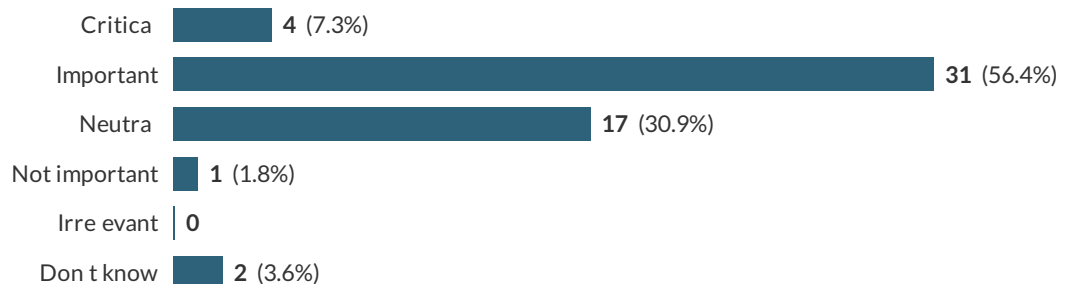
- 8 Q8 In your view, how beneficial, if at all, would the following be in improving current and future

- 8.1 a. A framework that could be used at the end of a project to share and preserve knowledge and experiences for future projects



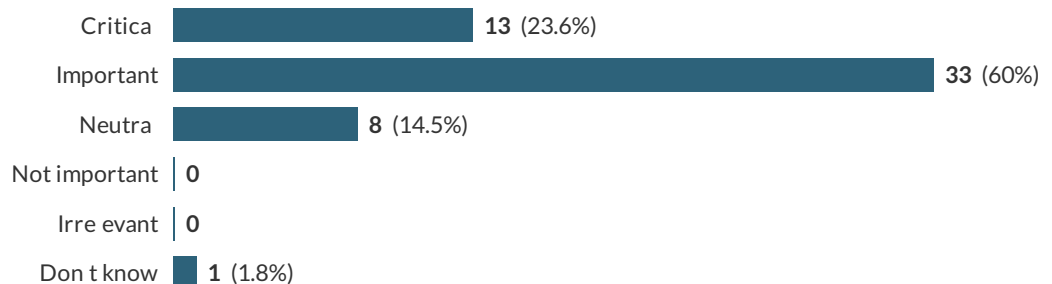
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 8.2 b. Wiser guidance on the use of, and planning around, data generation and use



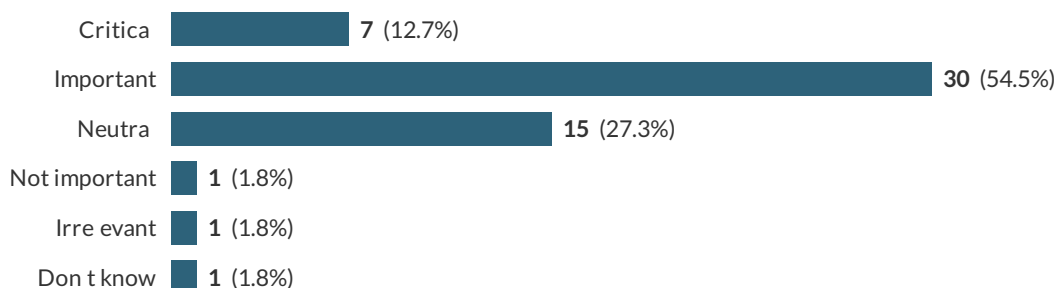
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 8.3 c. A framework to be used during the life of a project to draw in knowledge and requirements across teams



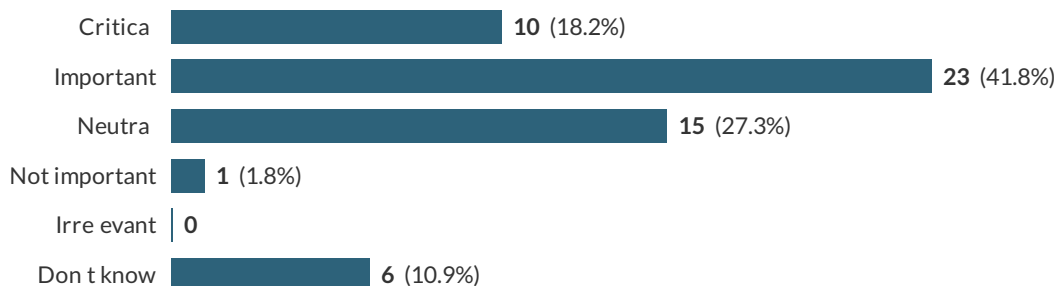
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 8.4 d. A tool for technical teams to have access to, to draw in relevant regulatory rules, policies and behaviours that may impact the project



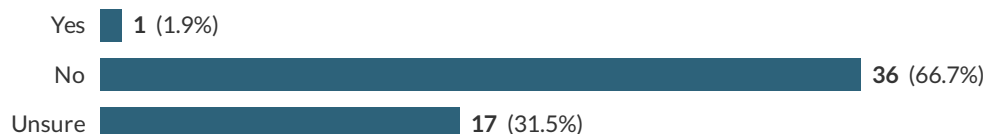
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 8.5 e. Identifying and engaging with review, advocacy and lobbying opportunities to challenge the status quo.



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 8.a Casting your mind back to before your involvement with the project started, have your views on the statements in Q8 changed?



- 8.a.i If yes, please note whether your view on the importance of the statements (labelled a to e) have

increased, decreased or stayed the same.

- 8.a.i.1 a. A framework that could be used at the end of a project to share and preserve knowledge and experiences for future projects



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 8.a.i.2 b. Wiser guidance on the use of, and planning around, data generation and use



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 8.a.i.3 c. A framework to be used during the life of a project to draw in knowledge and requirements across teams



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

- 8.a.i.4 d. A tool for technical teams to have access to, to draw in relevant regulatory rules, policies and behaviours that may impact the project



Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

8.a.i.5 e. Identifying and engaging with review, advocacy and lobbying opportunities to challenge the status quo



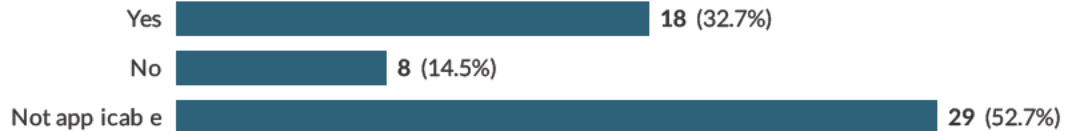
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

8.b If you wish to add a comment please feel free to do so here (optional)

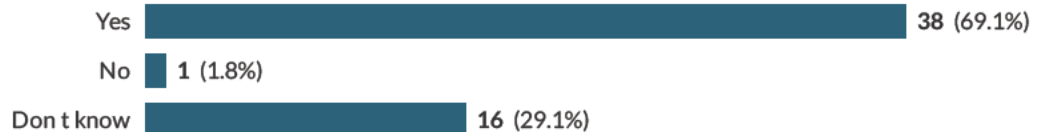
Showing all 6 responses	
a. and d. are interesting and people have tried to do this before, but I've never seen it work for all sorts of reasons: e.g. people leave the project before the end and take knowledge with them; real knowledge needs context and I've never seen anyone capture context in a database	831911-831902-88132997
pipebots can and should change regulation, not be constrained by it	831911-831902-88239235
Maybe not so much the importance of these tools and guidance existing (in some cases they do), but ensuring that they are used and embedded.	831911-831902-88429895
I'm a bit unclear what Q8 is driving at.	831911-831902-89111068
For row a., not sure what kind of framework I should envision here, the term 'framework' could mean so many things. I would say, a clearly written final report of a project (with exec summary, and more detailed appendices, both in a document as well as a digital legacy on a website/repository that doesn't disappear) is crucial	831911-831902-89137876
Again, Pipebots has reinforced my views	831911-831902-89496863

9 If you answered 'don't know' to any part of questions 2-8, could you draw on the expertise of

others in your team or business to address the question fully if you needed to?



10 In the future, do you think there is potential benefit in Pipebots and their sensors adapting to collect a wider range of environmental data?



10.a If so, what do you have in mind?

Showing all 29 responses	
A combination of air quality, temperature, radiation and other environmental data combined with economical data.	831911-831902-88066915
Water quality, gases in sewers. Pipebots will need new types of sensors to achieve this however.	831911-831902-88067549
I envision that the Pipebots platform could adapt to new, emerging sensors that have not yet been realized.	831911-831902-88071573
hydraulic data, control of placement of water quality parameters	831911-831902-88075075
Conditions, and also chemical/biological sampling, e.g. COVID...	831911-831902-88087800
I don't really have anything in mind, it's just that I wouldn't rule out a successful Pipebots project prompting developments in other areas	831911-831902-88132997
data from beyond the pipe, wider UG environment	831911-831902-88239235
generally more data support better and more sophisticated decision and response	831911-831902-88404676
Improving environmental data collection, accuracy and granularity is important for targeting and monitoring environmental improvements. Doing this with Pipebots in an environmental setting rather than a constrained asset setting is likely to be difficult from practicality, data management and perception perspectives.	831911-831902-88429895
Temperature, chemical and biological hazards	831911-831902-88700146
Contaminant Information	831911-831902-88699061

Water quality and waste water safety	831911-831902-88701393
Diseases in the water system	831911-831902-88702138
Nothing specifically but while the robot is crawling or swimming it might as well pick up everything it can provided it doesn't add significant cost	831911-831902-88705585
Range of environments where access is challenging (unstable buildings, airducts, rubble, etc)	831911-831902-88764849
Polution	831911-831902-88767648
Data that would enable better digital twin development and characterisation of the deployed context, e.g. traffic data (vibration etc.), land drainage data, tree root proximity etc..	831911-831902-89112322
Pollutants, contaminants - measuring water quality	831911-831902-89111587
Mine rescue	831911-831902-89113825
I don't know what data is currently in scope for collection by Pipebots devices, but there are undoubtedly always opportunities for collecting more data, subject to technical and financial constraints.	831911-831902-89111068
The Sensors can also be used for other applications, such as defect detection in oil&gas pipelines	831911-831902-89111345
It's difficult to answer because I don't think that there is a definitive list of what Pipebots will collect, but assuming it is general data on asset condition; additional data would be on hydraulics (flow, velocity depth/pressure), water quality (chemical and biological), temperature, etc.	831911-831902-89123849
Surface water quality data	831911-831902-89137876
monitor water quality, asset conditions	831911-831902-89471861
Gas and oil sector	831911-831902-89474833
analysis of a wide range of toxic pollutants	831911-831902-89475184
Spaces inaccessible to humans (other than pipes)	831911-831902-89480909
pollutant loads, level of ingress	831911-831902-89475467
contextual data (temperature and change in the ground beyond the pipe wall: density, voidage, degree of saturation). Pollutants and other chemical / biological signatures within the pipeline	831911-831902-89496863

10.b If you answered yes, to your knowledge do your ideas align with any public policy or regulatory requirement (or future likely requirement), if so what?

Showing all 15 responses	
No, just that, as a foundational principle, Pipebots should be adaptable to new sensor technologies, to the extent practicable.	831911-831902-88071573
impact assessment and regulation of storm overflow discharges and WFD (or its UK successor)	831911-831902-88075075
No, they don't	831911-831902-88132997
again must be beyond current regulation - its all too driven by short term views. Link this to SDGS etc	831911-831902-88239235
Environment Act 2021	831911-831902-88429895
Unknown	831911-831902-88764849
Better understanding and data relating to underground assets in general, e.g. National Underground Asset Register, National Digital Twin.	831911-831902-89112322
I think this aligns with future policy on ensuring water quality	831911-831902-89111587
I cannot think of any regulations being out there because the regulators do not know that this technology might be possible in Mine Rescue.	831911-831902-89113825
Discharges to the environment - pre or post treatment; managing water pressure and quality.	831911-831902-89123849
Yes, UK & EU regulatory requirements to improve surface water quality. Upcoming UK policy to mitigate harm from Combined Sewer Overflows.	831911-831902-89137876
Not sure	831911-831902-89474833
no	831911-831902-89475184
yes to address discharges to the environment	831911-831902-89475467
Not sure, but sewer monitoring could be use to detect drug use, drug farms, disease, malpractices concerning wastewater behaviour	831911-831902-89496863

11 Token

Showing all 55 responses	
28ae2d30f22240b7bdd938046fc007f9	831911-831902-88067095
ef8aa06008b64db3843e9695ae60aa63	831911-831902-88066915
aad47dc006d947d693d2f7bd32c2644b	831911-831902-88067549
1b2335333c3c401db9a195e293940db5	831911-831902-88066912
6c52be13be29408bafa50beb3db808d0	831911-831902-88067827
a9d0411439284e63a7cab9811f044e65	831911-831902-88068918
62e7b24c043742e48e1081d599d5730f	831911-831902-88071573
385f612e4b974bf6a4e60d77652665b3	831911-831902-88075075

Extracted Data - Survey Tables

Question 4

Statement	% Marked as critical or important	% Marked as critical	No. who would increase statements importance in later iterations	% who would increase importance in later iterations
a. Narrow and focussed problem framing	74.6	25.5	16	29.1
b. Wide and contextual problem framing	83.6	23.6	10	18.2
c. Defining and setting out the boundaries of the systems of interest	81.9	25.5	8	14.5
d. Reducing the potential for working in 'silos'	81.8	29.1	7	12.7
e. Anticipating the potentials risks of the project on infrastructure/ data security	65.5	16.4	12	21.8
f. Ensuring the technical teams are aware of potential regulatory challenges, sector rules and norms	81.8	21.8	17	30.9
g. Considering opportunities early on to re-frame any 'burdens' into assets ...	47.3	9.1	9	16.4

Question 5

Category	% Marked as critical or important	% Marked as critical	No. marked as critical	Mean Rank (including DNK)	Mean Rank (excluding DNK)	Mean Rank (Pipebots, including DNK)	Mean Rank (Stakeholders, including DNK)
Regulators	88.3	27.5	14	1.92	1.84	1.96	1.88
Ops Teams	92.8	47.3	26	1.65	1.57	1.68	1.63
R&D/Innovation	90.9	47.3	26	1.69	1.61	1.71	1.67
Service Suppliers	85.5	16.4	9	2.05	1.98	2.07	2.04
eNGOs	45.4	3.6	2	2.75	2.49	2.89	2.59
General Public	32.7	3.6	2	3.04	2.98	2.82	3.26
Consumer groups	29.1	3.6	2	3.15	2.92	3.07	3.22

Question 6

Statement	% marked as critical or important	% marked as critical	No. marked as critical	Mean Rank (with DNK)	Mean Rank (exc DNK)	Pipebots (mean rank with DNK)	Stakeholders (mean rank with DNK)
a) Setting out the regulatory requirements the project is designed to support	87.3	25.5	14	1.98	1.91	2.07	1.89
b) Linking the project to environmental and/or social policy or international goals (inc SDGs)	76.4	21.8	12	2.18	2.04	2.21	2.15
c) Ensuring any potential for positive PR (public relations) is explained and captured and any adverse PR potential is addressed	60	14.5	8	2.49	2.29	2.46	2.52
d) Being clear on who or what will benefit from the project (and why they have been chosen as beneficiaries)	89.1	40	22	1.76	1.69	1.93	1.59
e) Being clear on who or what will suffer any detriment as a result of the project or its implementation	78.2	30.9	17	2.04	1.89	2.04	2.04
f) Data creation and management; how the project can use data to enhance our knowledge of existing systems inc. ecosystems	83.6	32.7	18	1.96	1.81	2.04	1.89
g) Economic efficiency, reduced whole life cost compared to existing system	85.5	41.8	23	1.78	1.7	2.04	1.52

Question 7

Statement	% Marked as Highly Significant or Significant	% Marked as Highly Significant	% Marked as DNK	No. marked as critical	Mean rank (inc DNK)	Mean rank (exc DNK)	Pipebots (inc DNK)	Stakeholders
a. understanding the impact of AMP (asset management plan) reviews and cycle times	63.6	21.8	16.4	12	2.69	2.04	3	2.37
b. being alive to pre-existing framework contracts and/or procurement with other suppliers	49	14.5	16.4	8	2.95	2.35	3.32	2.56
c. identifying supportive regulators or regulatory mechanisms including those for supporting novelty/ innovation in the sector	83.7	18.2	3.6	10	2.15	2	2.25	2.04
d. having ethical guidelines and/or a responsible innovation code of practice at its centre	70.9	18.2	3.6	10	2.25	2.11	2.29	2.22
e. addressing and improving the project's network of supportive contacts or champions with knowledge of how the sector really works	80	27.3	3.6	15	2.04	1.89	2.21	1.85

Question 8

Statement	% marked as critical or important	No. marked as critical	Mean rank (inc DNK)	Mean rank (exc DNK)	Pipebots (inc DNK)	Stakeholders (inc DNK)
a. A framework that could be used at the end of a project to share and preserve knowledge and experiences for future projects	83.7	10	2.11	1.76	2.18	2.04
b. Wiser guidance on the use of, and planning around, data generation and use	63.7	4	2.42	2.28	2.46	2.37
c. A framework to be used during the life of a project to draw in knowledge and requirements across teams	83.6	13	1.98	1.91	1.79	2.19
d. A tool for technical teams to have access to, to draw in relevant regulatory rules, policies and behaviours that may impact the project	67.2	7	2.31	2.24	2.14	2.48
e. Identifying and engaging with review, advocacy and lobbying opportunities to challenge the status quo.	60	10	2.56	2.14	2.64	2.48

APPENDIX 7: FOCUS GROUP PLAN, TRANSCRIPT AND SUMMARY

- **Plan of Session**
- **Frameworks Annotated by Participants x 4**
- **Summary of Session**

United Utilities Focus Group – May 2022

A Framework for Governance and Infrastructure Interventions for the Water and Wastewater Sector

Plan for the Session (Vs2)

Time	Section	Description
0-15	Welcome and Introduction to the Framework	PowerPoint to cover ethics, the format for the session and to introduce the research and the framework.
15-20	Question to open the session	What is your name, practice area and how did you become involved in today's session?
20-30	Review of the Framework	Space for participants to read the framework or re-fresh their memory on its contents.
30-35	Activity 1	Looking at the framework could you highlight questions that: <ul style="list-style-type: none">- You like;- You do not routinely ask yourself; and/or- You found thought-provoking.
35-45	Plenary Session 1	Share and discuss results of Activity 1
45-50	Activity 2	Looking at the framework could you highlight questions that: <ul style="list-style-type: none">- You do not believe should concern you;- You see disadvantages in including; and/or- Would like to change.
50-60	Plenary Session 2	Share and discuss results of Activity 2
60-70	Plenary Session 3	When might the framework be used?
70-80	Plenary Session 4	What barriers might the framework face?
80-90mins	Summary and Wrap-up	Have we missed anything? Summary and next steps

GOVERNANCE	CONTEXT AND DESIGN	NETWORK	STRATEGY	BUSINESS CASE	LEARNING & CHALLENGE
THE PROJECT TEAM AND RESOURCE	<p>1. What is the project about and what systems are affected?</p> <p>When answering this question consider the geographic, operational and administrative boundaries affected. Could the boundaries of the project be usefully expanded? Consider also Q13.</p> <p><i>Not routine</i></p>	<p>5. Does the project team have the expertise it requires to answer the framework questions?</p> <p>Consider your team and its wider contacts whose expertise it can draw upon. Beyond engineering is local, operational and governance knowledge, available?</p>	<p>9. If there are gaps in the expertise required to answer the framework questions how will you draw-in knowledge and expand your network?</p> <p>Consider answers to Q1, 5, 6, 7, 8 and 11.</p>	<p>13. What benefits does the project bring to people and planet? Is there scope for wider social and environmental benefits?</p> <p>Does the answer vary with your answer to Q1.</p> <p><i>new capital should help this.</i></p>	<p>17. What lessons around boundaries and networks have been learnt? Did the system of interest change or the network expand during the course of the project? If so, when and why?</p> <p>18. When will the team revisit the framework? Could the framework itself be improved?</p> <p>Note, questions may become more important later in the project, new ideas may arise.</p>
THE GOVERNANCE REGIME AND REGULATION	<p>2. What sector specific regulations impact on the design of the project? For potable water, are you alert to the design impacts of Reg 31?</p> <p>If the rules are vast, can your network advise you on the rules-in-use for your project.</p>	<p>6. Who are the regulators and authorities of interest to your project?</p> <p>Who is responsible for the system in the boundary areas affected by the project and are they in your network?</p>	<p>10. What sector specific issues or drivers need accounting for?</p> <p>Project teams in the past have raised AMP cycle and price reviews timescales, rules on contract procurement, as well as a desire for positive Public Relations.</p>	<p>14. Do the benefits from Q13 support an existing regulatory requirement? If not, what supports the business case for change?</p> <p>Could any of the wider benefits from Q13 align with a regulatory requirement? Can this be used to bolster the business case?</p>	<p>19. From Q2, do regulations need to be challenged? If so can the regulators advise you of the systems in place to support innovation?</p> <p>Note, if regulatory hurdles exist in England, could other jurisdictions be considered?</p>
FORMAL LAW AND POLICY	<p>3. Have common legal areas of concern been addressed?</p> <p>Is human or ecosystem health, safety and security impacted? Is there a plan to ensure data safety and security? Is the security and resilience of critical infrastructure maintained?</p>	<p>7. Considering other potential legal impacts and stakeholders - could there be an impact directly or indirectly (e.g. nuisance) on another's use of land or property?</p> <p>Can they be identified?</p>	<p>11. In considering any project specific risks (including Q3 and Q7), do you need specialist external advice?</p> <p><i>yes</i> <i>net impact?</i> <i>water included</i></p>	<p>15. What policies are there that support the projects goals? Are you aware of any new or pending policies that could be utilised?</p> <p>Can you link the Q13 benefits to a public policy or international goal such as an SDG, to support your case?</p> <p>Do new policies signal impending regulatory change and, if so, how does this fit with your project goals?</p>	<p>20. Are there benefits that policy does not recognise, but should? If so what are they? Is the lack of support a hindrance to Q4 or Q13?</p> <p>Can your project or business use this project to advocate for change?</p>
JUSTICE	<p>4. Is there scope for the project design to embrace 'circular economy' opportunities?</p> <p>E.g. to re-think 'waste' as a potential asset, re-consider the use of extracted nutrients, re-think flood water etc.</p>	<p>8. Is there a Responsible Innovation (RI) code (or company ethics code)? Do you need a plan to introduce one?</p> <p>I.e. is there a code to support the balancing of risk, detriments and benefits and to plan stakeholder engagement.</p>	<p>12. Who or what may suffer a detriment as a result of the project (inc Q7)? Why is this group affected?</p> <p>If they are vulnerable or marginalised, how is the detriment justified? If there is no RI code, how will benefits, detriments and trade-offs be anticipated and balanced.</p>	<p>16. Who or what will benefit from the project? Why has this group been chosen to benefit over others/Q12?</p> <p>In answering Q12 and Q16 have future generations and the environment been included in the assessment?</p>	<p>21. Can the data generated by the project fill current data gaps (particularly improving knowledge around environmental status)?</p> <p>22. Standing back, do you feel this project delivered the best feasible result for people and planet? What has been learnt in this respect?</p>

why we're doing it.

MANRES/HARP did this well

*up service → how much scope
probably don't know to be creative
enough. do we have.*

JUSTICE FRAMEWORK (JUST Interventions in Civil Engineering): A Touchpoint Framework for Project Teams vs 4

GOVERNANCE	CONTEXT AND DESIGN	NETWORK	STRATEGY	BUSINESS CASE	LEARNING & CHALLENGE
THE PROJECT TEAM AND RESOURCE	<p>1. What is the project about and what systems are affected?</p> <p>When answering this question consider the geographic, operational and administrative boundaries affected. Could the boundaries of the project be usefully expanded? Consider also Q13.</p>	<p>5. Does the project team have the expertise it requires to answer the framework questions?</p> <p>Consider your team and its wider contacts whose expertise it can draw upon. Beyond engineering is local, operational and governance knowledge, available?</p>	<p>9. If there are gaps in the expertise required to answer the framework questions how will you draw-in knowledge and expand your network?</p> <p>Consider answers to Q1,5,6,7,8 and 11.</p>	<p>13. What benefits does the project bring to people and planet? Is there scope for wider social and environmental benefits?</p> <p>Does the answer vary with your answer to Q1.</p>	<p>17. What lessons around boundaries and networks have been learnt?</p> <p>Did the system of interest change or the network expand during the course of the project? If so, when and why?</p> <p>18. When will the team revisit the framework? Could the framework itself be improved?</p> <p>Note, questions may become more important later in the project, new ideas may arise.</p>
THE GOVERNANCE REGIME AND REGULATION	<p>2. What sector specific regulations impact on the design of the project? For potable water, are you alert to the design impacts of Reg 31?</p> <p>If the rules are vast, can your network advise you on the rules-in-use for your project.</p>	<p>6. Who are the regulators and authorities of interest to your project?</p> <p>Who is responsible for the system in the boundary areas affected by the project and are they in your network?</p>	<p>10. What sector specific issues or drivers need accounting for?</p> <p>Project teams in the past have raised AMP cycle and price reviews timescales, rules on contract procurement, as well as a desire for positive Public Relations.</p>	<p>14. Do the benefits from Q13 support an existing regulatory requirement? If not, what supports the business case for change?</p> <p>Could any of the wider benefits from Q13 align with a regulatory requirement? Can this be used to bolster the business case?</p>	<p>19. From Q2, do regulations need to be challenged? If so can the regulators advise you of the systems in place to support innovation?</p> <p>Note, if regulatory hurdles exist in England, could other jurisdictions be considered?</p>
FORMAL LAW AND POLICY	<p>3. Have common legal areas of concern been addressed?</p> <p>Is human or ecosystem health, safety and security impacted?</p> <p>Is there a plan to ensure data safety and security?</p> <p>Is the security and resilience of critical infrastructure maintained?</p>	<p>7. Considering other potential legal impacts and stakeholders - could there be an impact directly or indirectly (e.g. nuisance) on another's use of land or property?</p> <p>Can they be identified?</p>	<p>11. In considering any project specific risks (including Q3 and Q7), do you need specialist external advice?</p> <p>Same as Q7.</p>	<p>15. What policies are there that support the projects goals? Are you aware of any new or pending policies that could be utilised?</p> <p>Can you link the Q13 benefits to a public policy or international goal such as an SDG, to support your case?</p> <p>Do new policies signal impending regulatory change and, if so, how does this fit with your project goals?</p>	<p>20. Are there benefits that policy does not recognise, but should? If so what are they? Is the lack of support a hindrance to Q4 or Q13?</p> <p>Can your project or business use this project to advocate for change?</p>
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FOCUS GROUP 27TH MAY 2022

Summary Document

Preliminaries

Each participant had been provided with electronic copies of the framework, a plan for the session and the participation and consent forms in advance.

The session opened with a presentation about the project so far, participation, consent and ethics as well as an introduction to the afternoon.

Hard copies of the framework, the plan for the session and participation and consent forms were also presented to participants at the beginning of the session, with green and pink highlighter pens for activities 1 and 2.

There was space for questions and answers at the beginning of the session.

Informed agreement and consent to participate in the research and the session was obtained from all participants present.

Participants had read the framework in advance of the session to a greater or lesser extent (there was no requirement to have done so) and time in the programme had been set aside for participants to read/re-read or refresh their memories on its content.

The afternoon followed the plan of the session with two activities leading to 4 plenary sessions with questions to address in each.

Activity 1 and Plenary Session 1

Participants were asked to use the green highlighter pen to circle questions on the framework they liked, did not routinely ask themselves and/or they found thought-provoking. After doing so there was a plenary session to discuss the results.

During the plenary session, the following points we made:

- Question 1 [*project scope*] was circled by all participants and prompted a wider discussion. Quotes and comments included:

‘we are really good at asking the first part of the question [what is the project about] but do not routinely do the second part [and what systems are affected]’

‘The entities between the business, who is responsible for what, who can do what and what is affected can be difficult’.

'We are quite defined'.

'We are not very good at considering what the impact is on other parts of the business'

- Examples of 'scope creep' within projects were noted and that the framework may help with this.
 - There was a recognition of the existence of some unhelpful silos in how the business and projects were set up.
 - There was a desire expressed for earlier engagement on decision-making and more holistic scoping at a start of a project with a view that if the business did so they would be able to push and improve upon the strategy further.
- Question 19 [*challenging regulations*] was expressly raised by a participant as one they had starred. This prompted a wider discussion and quotes:

'I think this is key for engineers [in the context of phosphorus removal] and hitting targets at all costs...if we did the whole value, the whole capital value and looked at all of the sustainable development goals and we looked at everything would we really think that... was the right solution for the place'.

'There is a steam train and once it is going it is hard to do a U-turn. It is like the titanic and we are screaming into the wind'.

- There was a point made that in terms of the regulations, it may not be the regulations that are at fault but the risk appetite by the company – how close to the limit of a permit they wanted to go, for example.
 - In response another commented upon the zero tolerance policy, the rating system and the external drivers behind that policy.
 - On discussing any amendments to Q19 overall, it was agreed it could helpfully refer to 'governance' as well as 'regulations' to capture this.
- Questions 13 [*looking for scope for wider societal and environmental benefits*] and Question 14 [*the link between Question 13, governance and the business case for change*] was expressly raised by a participant. Comments include:

'Natural capital and our new ODI is worth highlighting here'.

'I think we need to look at the other capitals, things other than purely money and the question helps with that and I like it'

'It comes back to regulations [and question 19], does the current regulatory environment allow us to use the other 5 capitals?'

'We are very good at understanding the cost but is the benefit set right'

- It was felt Questions 13 and 14 could support the capitals approach.
- Another noted the difficulties drawing down on the ODI unless there was a clear water quality improvement providing an example of a footpath being put into a scheme as the right thing to do but hard to justify.
- On direct questioning, it was not felt that Question 13 needed any amendment.
- Questions on the sheets also highlighted in green by at least one participant were:
 - Question 2
 - Question 3
 - Question 4
 - Question 5
 - Question 6* *with some qualification by one or more participants later*
 - Question 7
 - Question 8 * *with some qualification by one or more participants later*
 - Question 9 * *with some qualification by one or more participants later*
 - Question 10 * *with some qualification by one or more participants later*
 - Question 12* *with some qualification by one or more participants later*
 - Question 15
 - Question 20
 - Question 22
- Questions 1, 4 and 13 were highlighted green by all four participants. There was also endorsement for Question 12 by all participants later.

Activity 2 and Plenary Session 2

Participants were asked to use the pink highlighter pen to circle questions on the framework they did not believe should concern them, they saw disadvantages in including and/or would like to change. After doing so there was a plenary session to discuss the results.

The following points we made:

- A participant felt Questions 9 [*expanding the network to answer the framework*] and Questions 11 [*drawing in external expertise around specific risks*] seemed similar and wondered if they were both needed.
- A participant liked Question 16 [*who benefits*] but was uncomfortable with the wording *who or what will benefit*:
 - This participant said the business would frame this as 'disadvantaged people being levelled-up' rather than anyone 'benefitting'. The wording could be reconsidered to address this.

- There was a discussion on prejudices and bias and how, particularly around planning, disadvantages can become embedded for a number of complex reasons.
 - The general consensus was it was a good question with further comments approving Question 12 [*who suffers a detriment*] as the ‘opposite’ part of the equation to Question 16. In particular:
 - Question 12 was considered to be a ‘*really powerful question*’ and another noted ‘*it is a really important question we should be asking ourselves, whether it is a business case or a strategy, so we don’t get blinded by the benefit*’.
 - Some participants saw Questions 12 and 16 linking into Question 13 and capitals.
 - A participant felt part of what was missing in this area was around explaining why a project was taking place, commenting ‘*we are really good at explaining what it is we are doing but not why*’, with examples being discussed.
- A participant raised an issue with the final column [*learning and challenge*] and timing. There was a discussion on how learning should be incorporated during the life of the project not left at the end (where it was more likely to be overlooked).
 - A participant thought it was wrong perhaps to raise as pink, but wanted to discuss the ethics code [*question 8*] as it was felt everyone should have one and he would like to think there was not a need to call it out.
 - There was a discussion on whether ethics codes were known about and their scope (for example concentrating instead on procurement or financial regulation and payments).
 - Another participant felt that Question 8 was a good question.
 - On Question 6 [*regulators and authorities*] a participant raised a request for more categories of people being included. This was in the context of a highways case and how different groups, companies and agencies had to interact and work together.
 - On Question 10 [*sector specific issues*] and discussing time and timings more generally, a participant commented upon the ecological surveys that needed to be done and how sensitive they were to the time of the year and the impact that could have if a suitable time was missed (leading to project delays).
 - Other than the above, Question 14 [*identifying regulatory support*] was the only other question with a pink circle (one participant) and was not directly raised.

Question 3

Participants were asked, when might the framework be used?

The following points and suggestions were made:

- A participant could see it being used by project engineers on day one *'to see what it is I need to sort out'*
- Another commented on the gap between strategy and engineering and how it could be useful tool to bridge that gap. There was general agreement on this with a discussion and examples.
- There was agreement that the framework would need to be looked at more than once during the life of a project and would be a useful tool to come back to.
- The framework would need to address time and project cycles and be part of that process; it would need embedding by a business into its processes.

Question 4

Participants were asked, what barriers might the framework encounter?

The following points were made:

- It wasn't just the time to do it but the order - chronology being important.
- It was felt that the word 'framework' might be a barrier, it was felt that in the company the term 'framework' was connected to getting contractors on board etc. It was suggested the word 'framework' be replaced.
- Some nuances in opinion over consistency were noted:
 - One participant commented that there were potential issues with consistency in how the framework may be answered, with different personalities and approaches and how it might be helpful to have a document to sit behind the framework.
 - Another participant felt the framework could drive consistency *'it gets the person who doesn't really think about regulations to think about regulation, it gets the person who didn't know about circular economy to look at circular economy, just to question themselves'*.
 - Its potential as a prompt was agreed upon.
- In terms of embedding the framework a number of points were made:
 - A participant felt that it wasn't just about getting the right expertise it was also about whether there was the right expertise to complete the framework and felt the framework was not for one person but for a core team.
 - Another participant felt there may still be a need to go to someone outside the core team for an informed answer in some instances.
 - A suggestion was that projects were audited to see how they had completed the framework. [Name] was suggested who could look at this with his *'capitals approach head'*.
 - Other suggestions were that there was a panel review quarterly on certain projects, or linked to AMPs or batches of PR24 to see how the framework had been answered and used.

- One participant commented that from their personal point of view, they wanted to be part of projects where the framework questions had been answered, they wanted to know that the issues were being looked at and to know their work formed part of that but they did not want to fill in the document themselves.
- A participant made that comment that the Critical National Infrastructure and security requirements [Question 3] would not be information within their knowledge but was glad the question was there. There may be need for a tickbox to say 'have you referred this to the [appropriate person]'

Anything we have missed? Final thoughts?

In concluding the session, final thoughts and comments were gathered.

- There was a discussion on projects work streams and those that run in a sequential/linear manner and those that run with work streams in tandem.
 - The consensus view was that both could have their place depending upon the project. In projects with tandem work streams they could work if they started together and then diverged at a point when everyone knew what they were doing and could go off and do their part.
 - A comment was made that the point of divergence was an important decision that needed to be documented.
- A participant noted that partnerships were not noted in the framework and wondered if there could be a section on the framework which asked if they should be doing the project in-house or if a project partner should be doing the work.
- Another commented on the framework generally, *'my thought about all of this was, the framework asks should we be doing this differently, is there a way where we need to kind of stop and say like we are on the juggernaut. Stop. Is there just something completely different that we could be doing to deliver this project. Similar to my innovation head. Should we be doing a traditional solution or look at it another way'.*
- The view from the participants was that the framework had value with a comment, *'I just think use this the earlier the better. Almost like an appendix to the business case format that we have'.*
- Another commented that it would be helpful as a checklist to make sure you think if every bit every time.
- The value in the framework was noted.

Concluding Comments, Wrap-up and Thanks.

End

APPENDIX 8: PIPEBOTS DOCUMENTS

- **Drinking Water Briefing Note**
- **Regulation 31 Webinar (slides)**

Drinking Water Regulations

Introduction

This briefing note considers The Water Supply (Water Quality) Regulations 2016 (SI2016/614)¹, referred to as the 'Drinking Water Regulations' or 'Regulations' and how they may apply to Pipebots in England^{NB}. It sets out the letter of the regulation and associated guidance with a view to seeking informed input from the themes to gauge the practical impact of the Regulations on Pipebots. The documents referred to are attached at the end of this briefing with Regulation 4 and 31 also set out in full in the appendix.

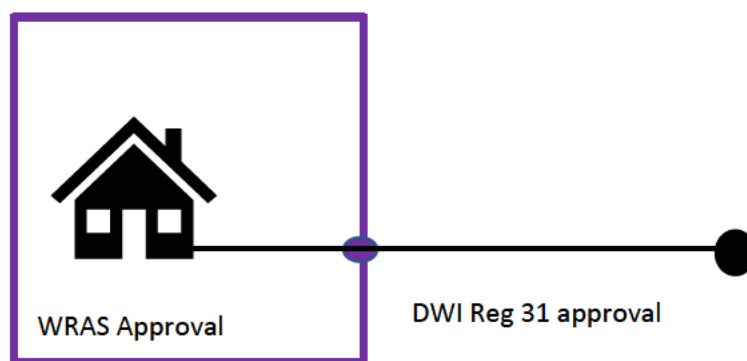
Executive Summary

- On a strict interpretation of Regulation 31, Pipebots will be prohibited from being introduced into the public mains water supply unless they fall within one of the limited exceptions.
- Of the potential exceptions, two appear most likely to be applicable:
 - Firstly following successful testing under the full Regulation 31 DWI approval process. As a complex product, if and how a Pipebot would fit within the DWI testing process is not clear on the information available.
 - Secondly to come within the small surface area to contact ratio exception under Regulation 31(4)(b). To fall under this exception a product needs to fall either within:
 - the exemplar list; or
 - fall within the parameter of the surface area formula.In either case the product must be risk assessed and compliance with certain tests within BS6920 is recommended.
- The route Pipebots should take requires input from all themes and is subject to the materials they wish to use and how flexible those wishes are.
- Irrespective of the above there remain obligations in relation to maintaining the 'wholesomeness' of the water supply as well as providing assurances to prospective purchasers (and their customers) that the product is safe.
- The rules are also opaque and practical experience of how they are likely to be applied in practice is essential.

^{NB}There are similar provisions relating to Wales and Northern Ireland. There is a different legislative regime in Scotland.

Preamble

This note assumes that Pipebots are intended to be used in the public water supply system up to the point of delivery to premises and will therefore require approval from the Drinking Water Inspectorate (DWI). If Pipebots are going to be used within the premises' boundary WRAS approval is needed. A product may require both WRAS and DWI approval if it is used in both domains.



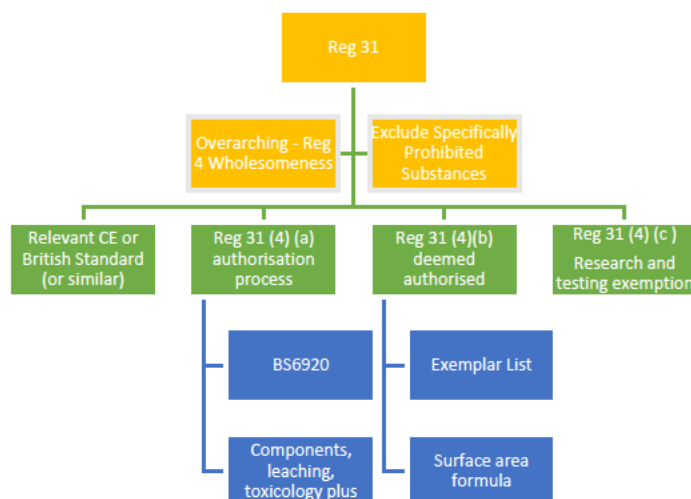
The Regulations

The Regulations form part of a governance regime that controls the quality of drinking water in England⁸. In it responsibilities are allocated to water undertakers and testing regimes outlined. The core, overarching responsibility is found in regulation 4. Under regulation 4, drinking water supplied for domestic or food production purposes must be 'wholesome'. To be wholesome drinking water should not contain any substance that on its own or with another substance would constitute a 'potential danger to human health'⁸. This is clearly a widely drawn requirement. In addition there are lists of substances and micro-organisms that drinking water can and cannot contain in order to be classified as 'wholesome'. These are listed in schedule 1².

As well as this widely-drawn, overarching requirement, the Regulations set out additional requirements. These include controls that look specifically at substances and products introduced into the public main drinking water supply. These controls are set out in Regulation 31⁸. Regulation 31(1) expressly prohibits the introduction of 'any substance or product' into drinking water save for a series of limited exceptions.

From this reading, it appears that a Pipebot will be a product introduced into the public mains water supply (*there is no definition of the word 'product' in the Regulations so it is taken as the usual legal definition from other Acts*). As such it is covered by Regulation 31 and so prima facie prohibited - unless one of the exceptions applies. The exceptions are listed in the diagram below.

One set of exceptions deals with the product having an appropriate CE, British Standard or similar accreditation for use in the water supply. These exceptions do not appear to be applicable here (but will need to be looked into further). If those requirements are not met then subsection (4) may apply.



Regulation 31(4)

There are three alternative options within subsection (4):

- Under (4)(a) the Secretary of State can approve a product or substance with conditions attached (the approval process being delegated from the Secretary of State to the DWI). Approval is sought via a thorough application and testing process undertaken at approved DWI testing sites. Once approved a product or material is added to an approved list³. The list of approved products and substances is updated at least annually.

From preliminary discussions with Theme 3 the current Pipebot materials do not fall within the current approved product list³ nor on the approved materials list⁶. In due course it may be possible for the Pipebot to be made at least in part from a substance or coating on the list of substances already approved. Even so and subject to further input from the themes it does not seem likely that the Pipebot will fall entirely within the current pre-approved list - and so to fall within this exception Pipebots would have to go through the approval process itself (set out below).

- Under (4)(b) there are certain products and substances which are automatically deemed unlikely to adversely affect water quality and where formal approval under (a) is not required. These include 'mobile sensors'. On reading of the guidance note this appears to be a real possibility for Pipebots. These are discussed in more detail below.
- Under (4)(c) there is a time limited easing of some restrictions for testing and research purposes albeit with conditions attached. This section may be helpful to explore further for testing purposes but appears unlikely to assist in full deployment in the system.

(4)(a) and (b) are therefore potentially applicable. The easiest route for Pipebots will fall under (b) so that provision is addressed first.

Subsection (b)

Examples of what falls under (b) are not set out in the Regulations themselves but are provided within advice sheets from the DWI. The advice sheet of relevance here is advice sheet 8.⁷

Advice sheet 8 applies when:

- a) The product offers only a small surface area contact ratio with the water; and
- b) The material which the product is made, despite the small surface area contact with the water, does not give rise to unintended odour/flavour to the water and does not support the growth of microbial organisms.

When products meet these criteria they are permitted to be used under Reg 31(4)(b). Further guidance on what this means in practice is given. There are two options to meet this exemption:

1. to fall within a category of products on the 'exemplar list'; or alternatively
2. to fall within the parameters of the surface area calculation

Turning to the 'exemplar list'. Of relevance to Pipebots are exemplars listed as 'CCTV cameras and associated fittings; in situ sensors and probes; mobile and temporary sensors; radio frequency identification devices (RFID) fastened onto the surfaces of products to be immersed in water'. Pipebots would appear to be a mobile sensor and may be able to take advantage of this provision. *(This may be the approach taken by such as 'smartball' although this is not clear from their websites).* Unfortunately, there is no further detail or guidance to be sure. There are no specific products mentioned just broad categories.

If not on the exemplar list it is still possible to fall within advice sheet 8 if the product or substance has a small surface area in contact with the water. There is a formula to follow although the examples only show how this has been applied to pipes, valves and vessels. The formula is as follows:

$$c = \frac{st}{v} \text{ sec. cm}^{-1}$$

Where:

s = surface area in contact with water in cm²

v = static volume of water in contact with surface in cm³

t = worst case estimate of the time the water is in contact with the surface in seconds

For multiple uses in one system this becomes:

$$C = \sum_n c_i$$

or

$$C = \sum_n \frac{s_i t_i}{v_i}$$

Where:

C = contact risk score

c_i = contact ratio of the ith use

s_i = s calculated for the ith use

v_i = v calculated for the ith use

t_i = t calculated for the ith use

n = the total number of uses

To comply C should be less than 100. If a score is less than 100 then regulation 31(4)(b) is a possibility.

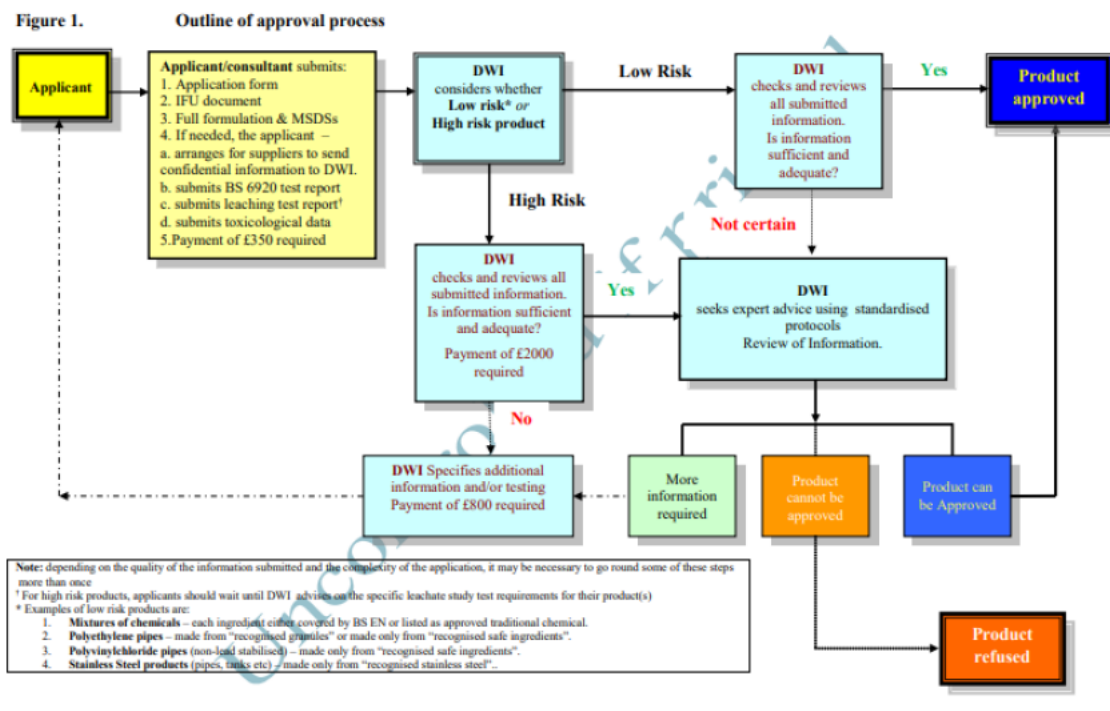
If Pipebots falls within Reg 31(4)(b) it does not mean a Pipebot can be deployed without any further action. There are still some substances that are banned (as per schedule 1² referred to above). The

water supplier still has to satisfy itself that the use of the product is not likely to adversely affect the quality of drinking water. The water still has to be wholesome. However, rather than the full Reg 31 approval process governed by DWI, it falls within the risk assessment procedures for the water supplier concerned. There are recommendations. For example, the DWI recommends for non-metallic products the requirements of BS6920 are complied with for flavour, odour and microbial growth where possible (metallic testing being more limited)⁷. Whether this would be sufficient for prospective purchasers falls outside the remit of this briefing.



Subsection (a), full approval

If Pipebots do not comply with (b) then a full regulation 31 approval is required. The application process is set out in Advice Sheet 1⁵. It requires full disclosure of formulation and ingredients including all water contact components and material safety data sheets, an Instructions for Use (IFU) document, BS6920 results or WRAS listing. Testing may also include additional leaching and toxicology tests.



In considering how this applies to Pipebots one can refer to the list of products or materials that have already been approved (as stated above this is published at least annually³) to look for similar products or examples⁶. Having reviewed the list and referred this to Theme 3 there are no similar products or materials with approval. In fact there are no categories similar to Pipebots in the approved list.

Looking deeper, a potential anomaly surfaces. There appears to be a discrepancy in relation to the drafting of Regulation 31. As drafted Regulation 31 expressly prohibits the introduction of **‘any substance or product’** into drinking water. However the associated guidance note states the process to get Reg 31 authorisation applies to **‘chemicals and construction products’** which appears to be more limited - a Pipebot would seem to be a product but not a construction product (*aside: a definition of ‘construction product’ for these purposes can be found following citations from the EU Directive*).

An obvious thought is that it may be the authorisation process is designed to consider the constituent materials rather than the entity as a whole and authorisation applies to those constituent parts. In exploring this further, advice sheets list the type of products and materials that can be approved:

- Treatment chemicals: Flocculants and coagulants, disinfectants, not covered by BS EN (products for use in building water systems cannot be considered).
- Treatment process products: Adsorbents, ion exchange resins, membranes, onsite chlorine generators, filter media, vessels and containers, electro dialysis water treatment units, pressure vessels, products used for the physical treatment of water.
- Pipes and associated components including coatings: Polyethylene (PE) (including barrier and laminated), polyvinylchloride (PVC), acrylonitrile-butadiene-styrene copolymer (ABS), polyethylene terephthalate (PET), glass reinforced plastic (GRP), stainless steel, and lined metallic pipes.
- Site applied and in-situ coatings: coatings based on epoxy or polyurethane resins.
- Repair materials
- Water retaining structures
- Covers and linings
- Underdrains
- Products for emergency use with public water supplies

Again, there is nothing clearly applicable to Pipebots. If and how this approval process applies to Pipebots is therefore unclear.

On reading the original EU Directive (98/83/EC of 1998)⁹ (which the Regulations seek to implement into English law) this apparent discrepancy may have arisen because of the difference in emphasis between the EU Directive and the Regulations. Of course, this may be a hypothetical or semantic gap that is a non-issue in practice but alternatively there is a suspicion that the authorisation process may not have been designed for products as complicated as a robot.

Further guidance is limited save the sheet says that for novel or complex issues a meeting with the DWI may be required.

Concluding Points

Guidance on these processes requires specialist input. Whilst some information can be gleaned from the regulations, how they apply to Pipebots will rest with how the guidance is applied in practice. This is not something that is published. The stakes appear high. At a minimum, the Pipebot will need to pass BS6920 if possible and fall within Reg 31(4)(b), at worst Pipebots may be unable to give purchasers the official assurances over safety they will need. Early liaison with DWI is indicated.

EAS – Post Graduate Researcher, Faculty of Engineering

Last updated 8TH October 2020

Documents

1. Reg 31 section of the DWI website:
<http://www.dwi.gov.uk/drinking-water-products/index.htm>
2. Drinking water standards including microbiological and chemical parameters as per schedule 1:
<http://www.dwi.gov.uk/consumers/advice-leaflets/standards.pdf>
3. Current list of approved products (updated at least annually):
<http://www.dwi.gov.uk/drinking-water-products/approved-products/soslistcurrent.pdf>
4. DWI list of advice sheets:
<http://www.dwi.gov.uk/drinking-water-products/advice-and-approval/index.htm>
5. Advice sheet 1 provides an overview of the regulation process:
<http://www.dwi.gov.uk/drinking-water-products/advice-and-approval/Advicesheet1.pdf>
6. Advice sheet 5 deals with approval of products made from recognised grades of materials. Where these are included in a product there is a reduced requirement to set out full details and specifications, (note if it is a small surface area coating it may also fall within Advice sheet 8)
<http://www.dwi.gov.uk/drinking-water-products/advice-and-approval/Advicesheet5.pdf>
7. Advice sheet 8 deals with exemplar products and the small surface area exemption
<http://www.dwi.gov.uk/drinking-water-products/advice-and-approval/Advicesheet8.pdf>
8. The Drinking Water Regulations in full:
<https://www.legislation.gov.uk/ukxi/2016/614/contents/made>
9. EU Directive (98/83/EC of 1998), incorporating any amendments (see Art 10)
<https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1998:330:0032:0054:EN:PDF>

Appendix 1

Regulation 4 and 31

REGULATION 4

Wholesomeness

4.—(1) Water supplied to premises [F1that is intended for human consumption including]—

(a)for such domestic purposes as consist in or include, cooking, drinking, food preparation or washing, or

(b)for food production purposes,

is, subject to paragraphs (4) and (5), to be regarded as wholesome for the purposes of Chapter 3, as it applies to the supply of water for those purposes, if the requirements of paragraph (2) are satisfied.

(2) The requirements of this paragraph are—

(a)that the water does not contain—

(i)any micro-organism (other than a parameter listed in Schedule 1) or parasite, or

(ii)any substance (other than a parameter listed in Schedule 1),

at a concentration or value which would constitute a potential danger to human health;

(b)that the water does not contain any substance (whether or not a parameter) at a concentration or value which, in conjunction with any other substance it contains (whether or not a parameter) would constitute a potential danger to human health;

(c)that the water does not contain concentrations or values of the parameters listed in Tables A and B in Schedule 1 in excess of or, as the case may be, less than, the prescribed concentrations or values;

(d)that the water satisfies the formula “[nitrate]/50 + [nitrite]/3 ≤ 1”, where the square brackets signify the concentrations in mg/l for nitrate (NO₃) and nitrite (NO₂).

(3) The point at which the requirements of paragraph (2), insofar as they relate to the parameters set out in Part I of Table A and in Table B in Schedule 1, are to be complied with is—

(a)in the case of water supplied from a tanker, the point at which the water emerges from the tanker;

(b)in the case of water supplied in bottles or containers, the point at which the water first emerges from any bottle or container collected from a local distribution point;

(c)in the case of water used in a food production undertaking, the point at which it is used in the undertaking;

(d)in any other case, the consumer's tap.

(4) Water supplied for regulation 4(1) purposes must not be regarded as wholesome for the purposes of Chapter 3 if, on transfer from a treatment works for supply for those purposes—

(a)it contains a concentration of the coliform bacteria or E. coli parameter (items 1 and 2 in Part II of Table A in Schedule 1) in excess of the prescribed concentrations,

(b)it contains a concentration of nitrite in excess of 0.1mgNO₂/l.

(5) Subject to paragraph (6), water supplied for regulation 4(1) purposes is not to be regarded as wholesome for the purposes of Chapter 3 if, on transfer from a service reservoir for supply for those purposes, it contains a concentration of the coliform bacteria or E. coli parameter in excess of the prescribed concentrations.

(6) Water transferred from a service reservoir for supply for regulation 4(1) purposes is to be regarded as unwholesome if more than 5% of samples taken in a year exceed the prescribed concentration for the coliform bacteria parameter.

REGULATION 31

Application and introduction of substances and products

31.—(1) Subject to paragraph (2), a water undertaker or [F1wholesale licensee] must not apply any substance or product to, or introduce any substance or product into, water which is to be supplied for regulation 4(1) purposes, unless one of the requirements of paragraph (4) is satisfied.

(2) A substance or product which, at the time of its application or introduction—

(a)bears an appropriate CE marking in accordance with the Construction Products Regulation, or

(b)conforms to an appropriate British Standard or some other appropriate standard of an EEA state or Turkey which provides an equivalent level of protection and performance, may be applied or introduced, notwithstanding that none of the requirements of paragraph (4) is satisfied.

(3) Paragraph (2) applies only if such an application or introduction complies with—

(a)such conditions of use restricting the dosing concentration as are for the time being in force in relation to such substances and products pursuant to a determination of the Secretary of State by an instrument in writing;

(b)such other requirements, within the meaning of the Technical Standards Directive, in relation to such substances and products, as have been communicated to the European Commission in the form of a draft technical regulation in accordance with Article 8 of that Directive, and whose adoption by a member State has also been communicated to the European Commission.

(4) The requirements of this paragraph are that—

(a)the Secretary of State has for the time being approved the application or introduction of that substance or product and it is applied or introduced in accordance with any conditions attaching to that approval;

(b)the Secretary of State is satisfied that the application or introduction of the substance or product either alone or in combination with any other substance or product in the water is unlikely to adversely affect the quality of the water supplied;

(c)the substance or product is to be applied or introduced solely for the purposes of testing or research, and the water undertaker or [F1wholesale licensee] has given to the Secretary of State not less than 3 months' notice in writing of its intention so to apply or introduce the substance or product.

(5) An application for an approval mentioned in paragraph 4(a) may be made by any person.

(6) If the Secretary of State decides to issue an approval under paragraph 4(a), the Secretary of State may include in the approval such conditions as the Secretary of State considers appropriate and, in accordance with paragraph (10), may at any time revoke or vary any approval that the Secretary of State has previously given.

(7) Where substances or products are applied or introduced in any case in which the requirement mentioned in paragraph 4(c) is satisfied, their application or introduction must be discontinued within 12 months of the date on which they were first applied or introduced or, if the Secretary of State by notice given in writing to the water undertaker or [F1wholesale licensee] so directs, within such other period (whether longer or shorter) as may be specified in the notice.

(8) The Secretary of State may, by notice given in writing to any water undertaker or [F1wholesale licensee], prohibit it from applying to, or introducing into, water intended to be supplied for regulation 4(1) purposes any substance or product which the water undertaker or licensee would otherwise be authorised to apply or introduce by virtue of—

(a)paragraphs (1) and (4)(b) or (c), or

(b)paragraph (2).

(9) A prohibition under paragraph (8) may be without limitation as to time or for such period as is specified in the notice.

(10) Subject to paragraph (11), the Secretary of State may—

(a)revoke by an instrument in writing any approval given by him under paragraph 4(a);

(b)vary any such approval by an instrument in writing by including conditions or varying existing conditions;

(c)give any such notice as is mentioned in paragraph (8).

(11) Unless the Secretary of State is satisfied that it is necessary to do so in the interests of public health without notice, the Secretary of State must not act under paragraph (10) without giving all such persons as are, in the Secretary of State's opinion, likely to be affected by the revocation or variation of the approval or by the giving of the notice, at least 6 months' notice in writing.

(12) Notwithstanding paragraph (11), the Secretary of State must give immediate notice to all persons likely to be affected by the revocation or variation of an instrument mentioned in paragraph (10)(a) or (b).

(13) At least once in each year the Secretary of State must issue a list of all the substances and products, with particulars of the action taken, in relation to which—

(a)an approval under paragraph 4(a) has been granted or refused;

(b)such an approval has been revoked or varied;

(c)a notice has been given under paragraph (8).

(14) The Secretary of State may—

(a)by notice served on the person who makes an application for approval under paragraph 4(a), require the person to pay the Secretary of State a charge which reflects the administrative expenses incurred or likely to be incurred by the Secretary of State in connection with the application;

(b)in determining the amount of any such charge, adopt such methods and principles for its calculation as appear to the Secretary of State to be appropriate.

(15) In this regulation—

(a) “the Construction Products Regulation” means Regulation (EU) No 305/2011 of the European Parliament and of the Council laying down harmonised conditions for the marketing of construction products [F2](#);

(b) “the Technical Standards Directive” means Directive (EU) 2015/1535 of the European Parliament and of the Council laying down a procedure for the provision of information in the field of technical regulations and of rules on Information Society services [F3](#).

(16) On the coming into force of these Regulations—

(a) an approval given under regulation 31(4)(a) of the 2000 Regulations which had effect immediately before the coming into force of these Regulations is taken to be a notice given under paragraph (4)(a) of this regulation;

(b) a notice given under regulation 31(7) or (8) of the 2000 Regulations which had effect immediately before the coming into force of these Regulations is taken to be a notice given under paragraph (7) or (8) respectively of this regulation.

DRINKING WATER

REGULATION



INTRODUCTION

We will be talking about:

The Water Supply (Water Quality) Regulations 2016
(Aka the Drinking Water Regs)

Industry Perspective

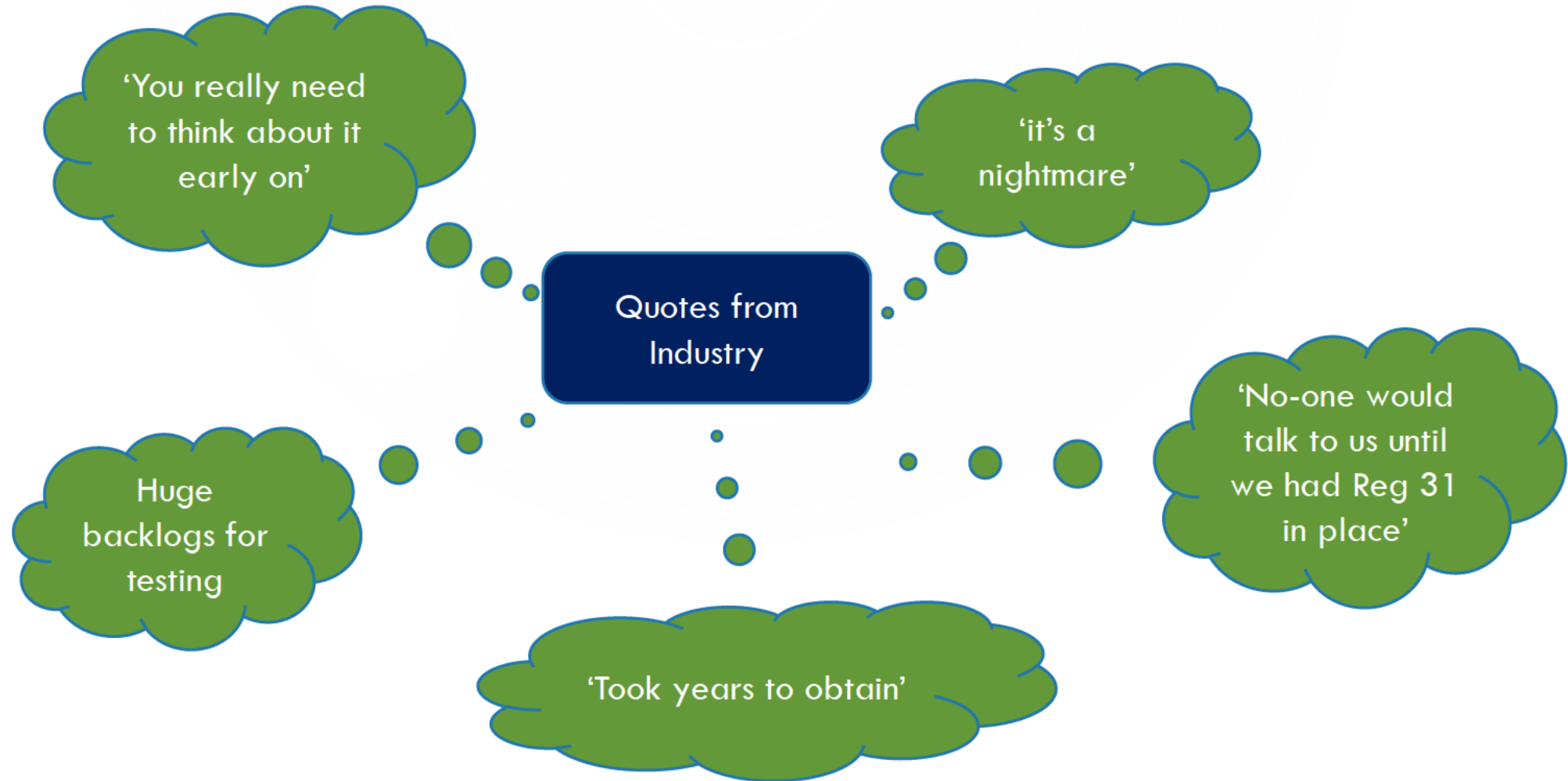
Why relevant (even though current focus is on
wastewater!)

Impact on the project and design

The action steps to consider...



INDUSTRY PERSPECTIVE ON REG 31



WE ARE FOCUSING ON WASTEWATER – WHY ARE WE DISCUSSING THIS?

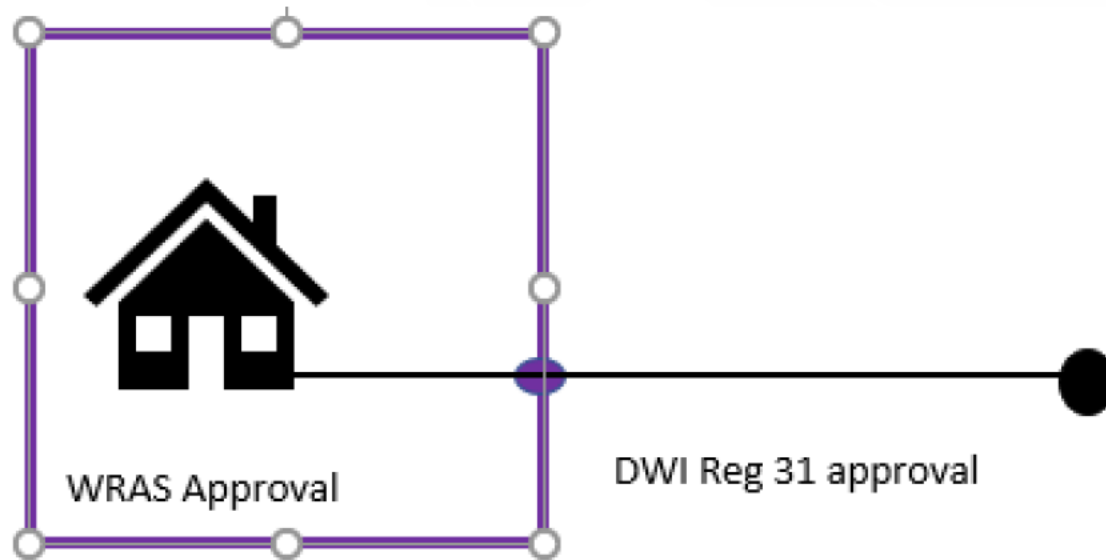
Theme 7 and governance (two levels):

- Level 1: the law as it stands (reference)
- Level 2: the law as it 'should' be (academic research)
- Plus: feedback on theme 7 discussion with the DWI

Practicalities:

- A requirement if/as/when we re-focus on water (from wastewater)
- Takes time and planning to overcome (years not months)
- Is surmountable if take note of the above!
- Ongoing and growing concerns around water contamination...and Trust
- Responsible research and innovation

THE DRINKING WATER REGULATIONS



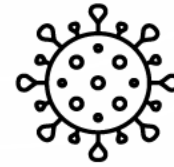
- Jurisdiction
 - Derived from EU (but application across Europe can differ)
 - These regulations specific to England (but similar across devolved states)
 - Apply up to delivery to property
- Purpose
 - Drinking water quality
 - Law – criminal sanctions
 - Safety and public confidence

KEY PROVISIONS: REGULATION 4

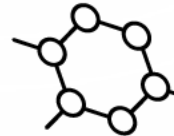
About the water itself - Water supplied for domestic or food production purposes must be 'wholesome'

To be 'wholesome' – no substance a potential danger to human health

Strict and wide safety margins (*schedule 1*)



MICRO-ORGANISMS



CHEMICALS



METALS (E.G. LEAD, COPPER)



IMPACT ON LOOK AND TASTE

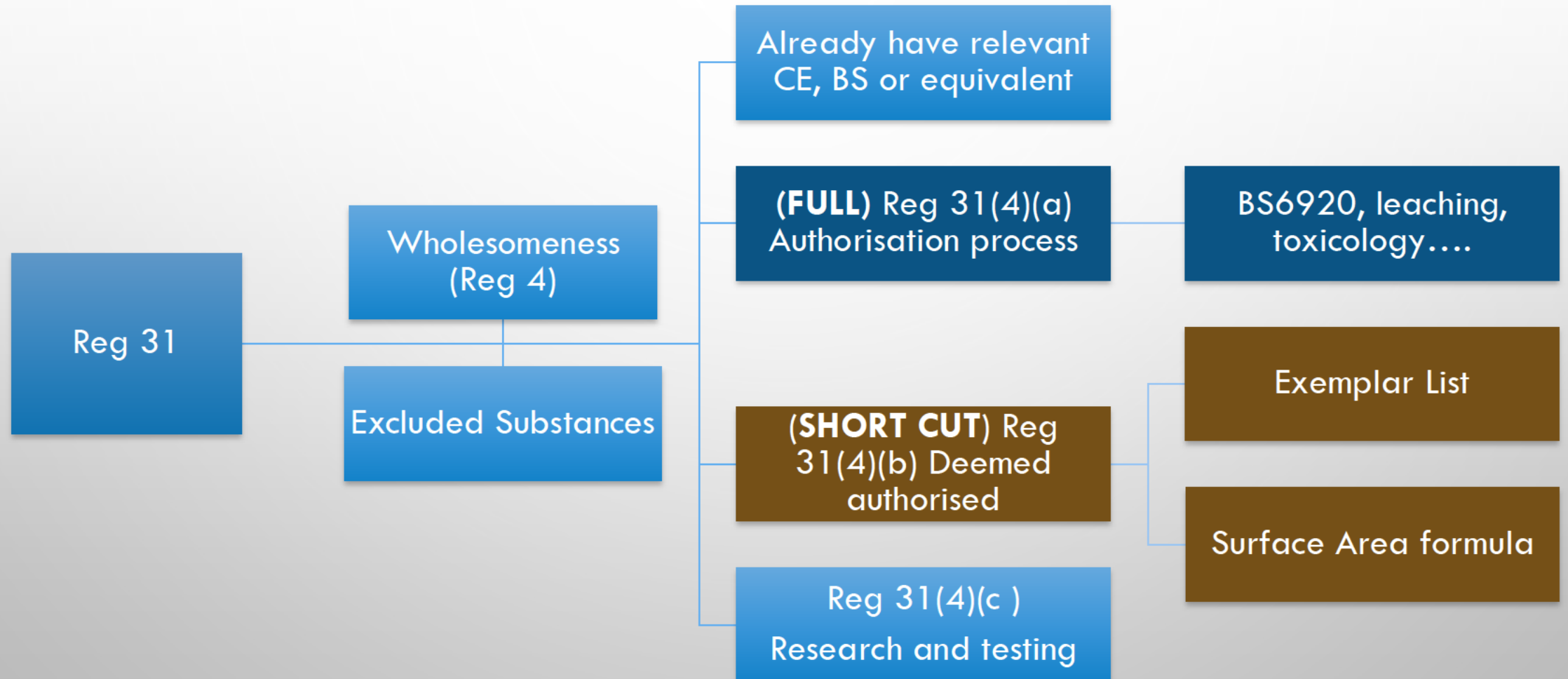
KEY PROVISIONS: REGULATION 31

DEALS WITH THE INTRODUCTION OF SUBSTANCES INTO THE WATER SUPPLY

31(1) EXPRESSLY PROHIBITS THE INTRODUCTION OF **'ANY SUBSTANCE OR PRODUCT'** INTO DRINKING WATER ...

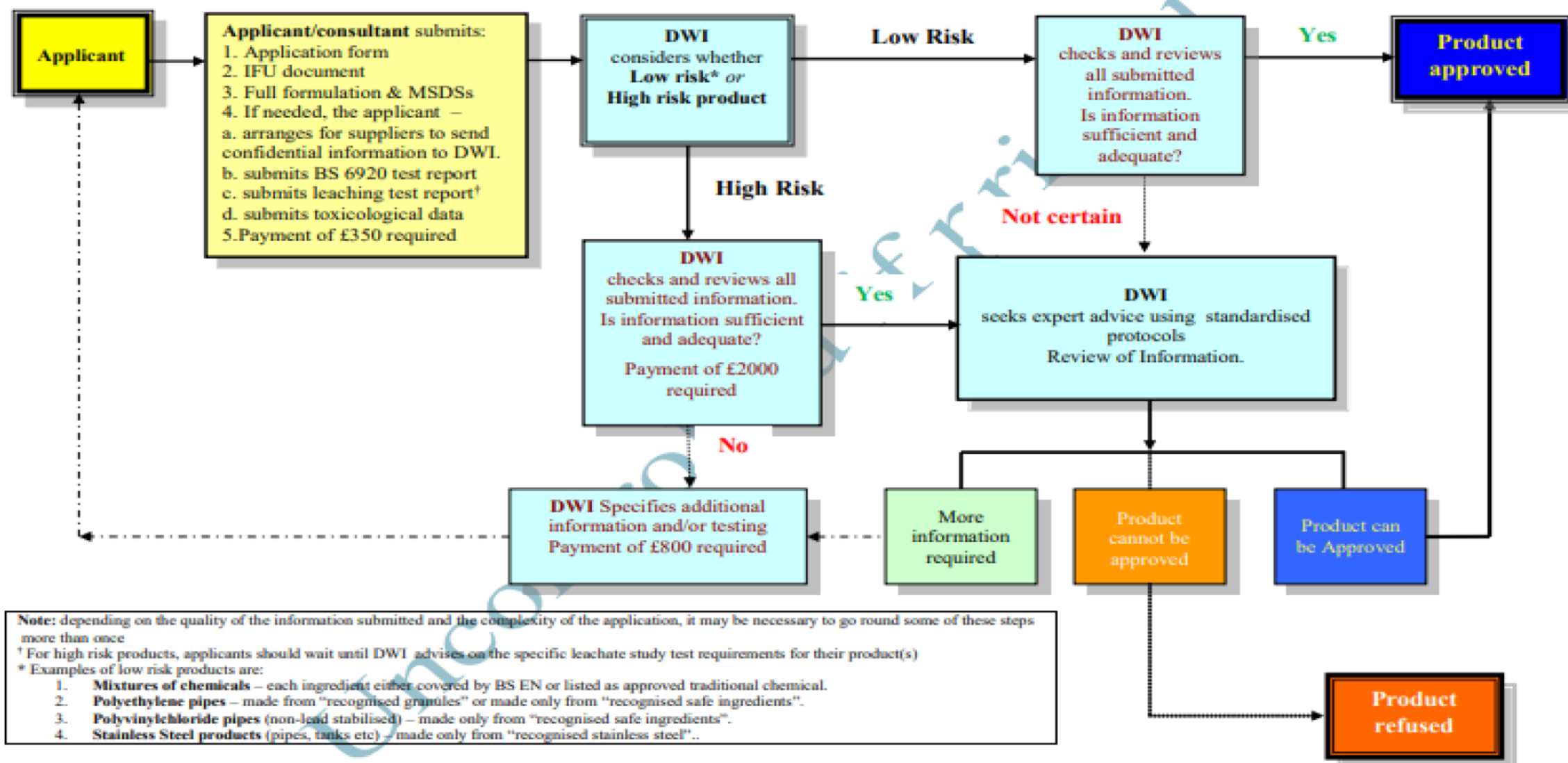
... SAVE FOR A SERIES OF LIMITED EXCEPTIONS ...

EXCEPTIONS ...



FULL APPROVAL (REG 31(4)(A))

Figure 1. Outline of approval process



REGULATION 31(4)(A) CONTINUED...

Challenges:

- Full disclosure of formulation and ingredients
- Material safety data sheets
- Instructions for use (IFU) - **operational considerations!!**
- BS6920 (or WRAS)
- Additional leaching and toxicology tests
- Publication of approved products and materials
- Designed for '**chemical and construction products**'

(more info Advice sheets 1 (and 5))



REGULATION 31(4)(B) – ADVICE SHEET 8

Advice sheet 8 applies when:

- a) The product offers only a **small surface area contact ratio with the water**; and
- b) The material which the product is made ... **does not give rise to unintended odour/flavour to the water and does not support the growth of microbial organisms.**

There are two options to meet this exemption:

- 1. To fall within a category of products on the '**exemplar list**'; or alternatively
- 2. To fall within the parameters of the surface area **calculation**

(Remember: reg 4 still applies, still need to be safe, BS6920 recommended)

EXEMPLAR LIST

EXAMPLES INCLUDE:

- CCTV cameras and associated fittings
- In situ sensors and probes
- Mobile and temporary sensors
- Radio frequency identification devices fastened onto products



SMALL SURFACE AREA/ WATER CONTACT RATIO

$$c = \frac{st}{v} \text{ sec. cm}^{-1}$$

Where:

s = surface area in contact with water in cm^2

v = static volume of water in contact with surface in cm^3

t = worst case estimate of the time the water is in contact with the surface in seconds

For multiple uses in one system this becomes:

$$C = \sum_n c_i$$

or

$$C = \sum_n \frac{s_i t_i}{v_i}$$

Where:

C = contact risk score

c_i = contact ratio of the i^{th} use

s_i = s calculated for the i^{th} use

v_i = v calculated for the i^{th} use

t_i = t calculated for the i^{th} use

n = the total number of uses

C LESS THAN 100

REG 31 SUMMARY

Theory:

- Reg 31(a) – full approval
- Reg 31(b) – abridged: size, components, exemplar.

Practice:

- Can reg 31 ‘cope’ with Pipebots? Depends on specification and intended use..
- Reg 31 is not the end: trust, how can we ‘show’ Pipebots are safe (will customers be satisfied)?

OVERVIEW OF REGULATORY ISSUES

- Regulation is out of date. Meant to be reviewed every 4/5 years but hasn't been.
- England perceived as a 'hard' jurisdiction. Regulatory barriers to innovation in this jurisdiction harder than with other regimes abroad.
- On positive side we have engaged with the DWI and they are interested and willing to liaise. Welcome presentations to expand their knowledge (and our network) (plus new regulatory one stop shop)
- Other options...



OTHER OPTIONS?



REGULATORY
SANDBOXES



FORUM SHOPPING?

CONCLUDING POINTS

- If considering application of Pipebots in potable water at some point *suggest* reg 31 is not an issue to side-line
- If decide to progress:
 - Practical application of guidance (continued liaison with DWI); and/or
 - Consider alternative jurisdictions?
- Theme 7 – continued academic work on what the regulatory regime ‘should’ look like to maintain safety but allow for transformative change

LINKS (CAUTION: CONTENTS UPDATED REGULARLY)

REG 31 SECTION OF THE DWI WEBSITE: [HTTP://WWW.DWI.GOV.UK/DRINKING-WATER-PRODUCTS/INDEX.HTM](http://www.dwi.gov.uk/drinking-water-products/index.htm)

DRINKING WATER STANDARDS INCLUDING MICROBIOLOGICAL AND CHEMICAL PARAMETERS AS PER SCHEDULE 1:
[HTTP://WWW.DWI.GOV.UK/CONSUMERS/ADVICE-LEAFLETS/STANDARDS.PDF](http://www.dwi.gov.uk/consumers/advice-leaflets/standards.pdf)

CURRENT LIST OF APPROVED PRODUCTS (UPDATED AT LEAST ANNUALLY): [HTTP://WWW.DWI.GOV.UK/DRINKING-WATER-PRODUCTS/APPROVED-PRODUCTS/SOSLISTCURRENT.PDF](http://www.dwi.gov.uk/drinking-water-products/approved-products/soslistcurrent.pdf)

DWI LIST OF ADVICE SHEETS: [HTTP://WWW.DWI.GOV.UK/DRINKING-WATER-PRODUCTS/ADVICE-AND-APPROVAL/INDEX.HTM](http://www.dwi.gov.uk/drinking-water-products/advice-and-approval/index.htm)

ADVICE SHEET 1 PROVIDES AN OVERVIEW OF THE REGULATION PROCESS: [HTTP://WWW.DWI.GOV.UK/DRINKING-WATER-PRODUCTS/ADVICE-AND-APPROVAL/ADVICESHEET1.PDF](http://www.dwi.gov.uk/drinking-water-products/advice-and-approval/advisesheet1.pdf)

ADVICE SHEET 5 DEALS WITH APPROVAL OF PRODUCTS MADE FROM RECOGNISED GRADES OF MATERIALS. WHERE THESE ARE INCLUDED IN A PRODUCT THERE IS A REDUCED REQUIREMENT TO SET OUT FULL DETAILS AND SPECIFICATIONS, (NOTE IF IT IS A SMALL SURFACE AREA COATING IT MAY ALSO FALL WITHIN ADVICE SHEET 8)
[HTTP://WWW.DWI.GOV.UK/DRINKING-WATER-PRODUCTS/ADVICE-AND-APPROVAL/ADVICESHEET5.PDF](http://www.dwi.gov.uk/drinking-water-products/advice-and-approval/advisesheet5.pdf)

ADVICE SHEET 8 DEALS WITH EXEMPLAR PRODUCTS AND THE SMALL SURFACE AREA EXEMPTION:
[HTTP://WWW.DWI.GOV.UK/DRINKING-WATER-PRODUCTS/ADVICE-AND-APPROVAL/ADVICESHEET8.PDF](http://www.dwi.gov.uk/drinking-water-products/advice-and-approval/advisesheet8.pdf)

THE DRINKING WATER REGULATIONS IN FULL:
[HTTPS://WWW.LEGISLATION.GOV.UK/UKSI/2016/614/CONTENTS/MADE](https://www.legislation.gov.uk/ukSI/2016/614/contents/made)

Governance and Infrastructure in the Water Sector: Towards Successful and Just Interventions

By

Elisabeth Anne Shrimpton

A thesis submitted to the University of Birmingham for the degree of

DOCTOR OF PHILOSOPHY

Volume 2 of 2

Department of Civil Engineering

School of Engineering

University of Birmingham

December 2022

APPENDIX 5: INTERVIEW TRANSCRIPTS AND ANONYMISED LIST OF PROJECTS

- **List of Projects (see Volume 1)**
- **Anonymised Interview Transcripts x 18**

29th June 2021 Word Transcript (anonymised) for A.1.

Opening pleasantries not recorded. Confirmed with the participant that he was happy with the participant sheet and had no questions. He also pressed the confirmation button on zoom to confirm he was happy for the meeting to be video recorded.

00:00:00.659 --> 00:00:01.260

E.S.: Recording and there you go. It just means I can then listen rather than try and make notes. It is more accurate. You've said you're happy with what we're doing and the participation sheet.

00:00:15.389

A.1.: Yes I have read everything. I supervise lots of students when working in the innovation team to PhD level, so I know, I have a lot of empathy for people doing what you're doing. It is difficult getting people to engage and so on, and also I've got two sons both doing their Masters at the moment and I know how difficult is to get people's approval, also things like ethics / ethical considerations how complex it is and so many things to think about.

00:01:16.410 --> 00:01:19.620

E.S.: yeah it's quite right

00:01:19.980 --> 00:01:24.480

A.1.: interesting but yeah absolutely so yes, I'll try to support however I can

00:01:25.080

E.S.: that's appreciated, so this project is designed to be supportive, it's not meant to be controversial. I'm designing a framework or tool for project team people to use to engage with governance around interventions in water and wastewater infrastructure. So I'm partway through a framework I've actually designed, something which is quite substantially based on the academic work that's already been done. This part of the project, still in relatively early stages, is gaining actual practical insights from people that actually been involved in projects, so I can start to glean more, not just from an academic point of view, but much more from an on the ground point of view and experiences about what hurdles, there are, how they've been overcome and also some of the more subtle things. So I don't ask for example, is what you think about governance? Governance means so many different things to different people.

So often people start just by talking to me about either their favourite project, the most recent project, a successful project, just literally talk to me about it and through that some of the themes start to come out. Then there's also some questions that I need to get covered off as we go. I mean you've got such a vast array of experience [] there's a 50% of people go for project and just talk about that, 50% talk about their experiences and what they want to talk about, and then we go from there.

00:03:02.220

A.1.: Well, I mean I can talk about projects I've been involved with and how they've been operated, what's helped us, you know, steer through those muddy waters of projects/ project management. With [] Water, who I've worked for 30 something years, we've gone through, had, a very interesting journey of that. So when I joined the company, they were a local authority...comprised of what was formerly a number of independent water authorities that were local. They were water boards and stuff. And the year I joined, it was the year that the water authority privatised and became a water

company. And I think with that the intent was to sort of do things better, stream-line and so on which meant review all the policies all the procedures, the company strategy and so on, so I was privy to it in some small ways and involvement in how the business moved forward in how we manage ourselves in terms of policies procedures and so on, and you know how we governed ourselves. Do you want to ask questions as we go on?

00:04:03.570 --> 00:04:12.960

E.S.: Of the most interesting thing is, when people talk, because I say I've got all the academic theory and I pull things out of what people say so I'll but in when I need to.

00:04:13.110

A.1.: yeah yeah so we were a set of independent, if you like, former authorities, local authorities, brought together as one and the first few years I worked for the company as a water company everybody treated everybody from different areas as independent, so always x is within their territory or [] territory or Northern territory and it was tribal and I think after a couple years people realize that there were different standards and approaches being applied in different local offices... when it got kind of divisive because people putting their scoring things for funding the "oh, we got we got a nine out of 10 we deserve funding" we scored it seven for us, we can't have the funding this year "hang on well yeah it was subjectively scored by some people locally and they gave themselves a nine!". There were no unit universal standards for.

00:05:09.600 --> 00:05:11.130

E.S.: Like a game?

00:05:12.630

A.1.: We and then suddenly it became a game, "they're giving themselves nine, and we would have scored it seven, we will give us nine and a half" and it became transparent that the standards policies and procedures were not common across the board and have a way of addressing that. And so the company sort of decided we'll have to centralize. People will not make local decisions any longer, it will be central and was hundred percent and we started building our policies and strategies and so on and so forth centrally. Well that's interesting, so it depends, who've you got and what their opinions are and how they value the people asked, all sorts of things.

So when there was several machinations that we went through about how we look at this over a number of years, obviously. But in the meantime, what we're busily doing is trying to play catch up with them proper, private companies in enterprise. Where they had a true commercial outlook, because you've got the old brigade in the water companies who were there for the common good they're probably former public servants and still have that mindset. I was kind of lucky because I joined us as a relatively young guy at the time with know I was a blank a blank canvas others were "this is how you do it" "that's always the way we have done it". And those people you know eventually got chucked out of the bath with the bathwater. As an organisation we said, hang on that's not we can't do that anymore that's not appropriate any longer.

And then, some of us, saw the people like our regulators, as the enemy - that the regulators impose conditions and constraints on us and ... our job if we choose to accept it is to circumnavigate those and do it by devious means and not doing what we are told. So I think I think we had a succession of leadership teams, directors and so on, who recognize the value in sort of making sure that we worked with collaborative collaboratively with our regulators - appreciate that the government standards regulated stands that were being set with for the common good. They conflict slightly and obviously occasionally with the opportunity for company gain in terms of it costing us more to do this, we have to change, that it's no longer good enough, we got to spend money. Yeah those things

there, and obviously the awareness was well if we talk nicely with our regulators and people who have interest vested interest in our activities, then we'll get by with them and will set rules and approaches which help us meet our objectives, whilst doing it in the most economic fashion, the most efficient way.

Yeah so we're trying to tick as many boxes in the best way. But to get people up to speed and in that in that area that line of thinking and the younger people I think generally that were picked upon, I was in my 30s at the time, but they decided it would be best to educate us, into which is quite nice actually because I was picked on as a person who might have the capacity to a little bit further study had a few brain cells left in those days and my memory storage memory wasn't completely full as it is now got more, more room for anything. But then I had a bit left, and they said would you like to do an MBA. And mean a bunch of others across the business, who were forming graduates and someone's it would you what would you like to study the art of them learning about behavioural the organization behaviours and

00:08:38.340 --> 00:08:38.820

wow.

A.1.: what makes it work. Well, I think at this hour, I thought not really! A lot of time going out to the bars at night and things. I think I do want to learn anything about organizing? But my managing director at the time brought a few of us into the office as engineers and said I've got some questions for you guys, because you think you know it all, we were a bunch of young, ladies and gentlemen, engineers, we were learning the trade, do you know about the design and construction for our business?

I think at the appointed time, I was about 29 or 30 or whatever, and they said to them just a question, you said you guys engineers do important things for our business - where do you think you fit in our organization? just thinking about roles and duties activities and then relative importance where do you think you're fit? and we said, well, we were kind of obviously pivotal to our business. We designed the systems infrastructure process that the business have to use us so therefore we are really, really important. And he said would it surprise you, if I said you're the least important people in the business. I thought what are you talking about?

00:09:47.550 --> 00:09:47.940

E.S.: yeah

00:09:48.060

A.1.: we design the infrastructure.

"Well" he said "when I say that he said we're a business that comprises operators who do the daily chores they go and fix this do this, men that operate everything, we've got a customer service department, legal department, finance department your resources department and engineers and some scientists. So you guys, are the most expendable of all. We need everybody else to do the job. They're required day in, day out, you know. Regardless. And you guys you do a task we can outsource you tomorrow, your jobs would be sent to India or something Indian designer works, no problem, don't need you anymore, you have zero value to us as a business".

I think that we're important.

He said "I'm just I'm playing devil's advocate, I just point out to you once you think your very important, you just told me, you were you're very clever you know how everything works you designed it - you are, and you did - but you can be outsourced so easily somebody with your similar knowledge can be brought straight in - those other people that have the understanding of the customers' requirements and specifically in that particular area. Some of them didn't come back in

tomorrow, the guy and lady that work that patch for 10/20 years, that can't be replaced tomorrow, the people have a rapport with the customers, customer services they cannot be replaced tomorrow. But you design engineers you are 10 a penny”.

I was thinking this isn't good news.

Another further question, he said, in terms of how the business operates okay we've established you're not important now. Wouldn't it be nice to make yourself important How are you going to do that? And, basically, he said because you guys are clever engineers, you know about the business, how are we funded as a business, how are we funded?

Why is he asking stupid questions of, ladies and gentlemen, engineers?

And then, he said, to give me an answer somebody and somebody said well the customer pays rates that's how it works, he said okay so customer pays rates and they come along when they're required to pay the rates that put a bag of money on the table and you grab your share do that's that works. Well, no, no, it doesn't know obviously, somebody pays us from your central locale and we get it done...?

“So what role does the regulator play in all this?” I thought, well, I don't know. Why is the regulator there even. They regulate they said that you should be able to set some rules...yeah yeah that's right they set rules about performance standards and things like that. And he said, is there anyone heard of something called the licence to operate?”

So he says regulator gives us up a licence to operate in the last 25 years and he said they offer it up to an incumbent...the licence ...relates to the water utility duties at a point of time, so right provided you do all these things in this list the licence and tick the box and say he will sign it off, we will allow you to you know remain incumbent for a period of 25 years provided you don't fail against that remit...How we convince them we are achieving and any way: that's to do with a periodic review the asset management plan cycle every five years, he said, but there's also something called the June returns, at times, every year, they doing a simplified assessment of our performance against set criteria, key performance indicators, they call the Director General requirements. And they're listed yeah 1 to 9 for the needs of clean water delivery and bursts and leaks and floodings and pollutions and blah blah blah customer service, etc.

He said “so obviously we are governed by sets of rules and regulations, not set by us but nationally by government via regulator and you guys didn't know any of that”.

00:13:30.090 --> 00:13:34.980

E.S.: One of the things I am pulling out of this, and tell me if I am getting this wrong (I am also conscious about what you told me earlier about the behavioural scientist) is the importance of understanding other jobs, it being multidisciplinary?

00:13:58.320

A.1.: Will I mean but in terms of what I've just mentioned it is kind of more to do with the functions and tasks within the organization.

00:14:04.410 --> 00:14:05.670

E.S.: and understanding the bigger picture

00:14:05.760

A.1.: The bigger picture, because, as we all do certain things, I think I mean I was, I was informed quite early on in my career, I guess. You think you're clever, you're not. You think you know what we're doing in the business you don't. And you need to find out if you want to go places and get on in the business finance a bit more, because you have you were all key players, all of us, we are, but I mean, I think, I think that we weren't quite as bright as that guy. He was a tree hugger kind of guy, ECO warrior of his time, but he was very and he realized, he was encouraging and people who are relatively speaking quite arrogant me and other colleagues like we're engineers we're clever.

00:14:43.950

A.1.: ... And he did say to people like me and others that you need to go spend time in the different department, not being engineer all your life, that's not great. Then, what he was trying to advocate was that if you gain a better understanding you become multi-disciplinary you appreciate what other people doing how they work, what their needs are you will be a better player in the in the in within the organization and if you recognize that you're good at it you'll go places you'll be able to have more say and help with strategy and it'll be more effective, because you know what your are talking about not from a single perspective. So that I mean talking about rules requirements and governance. I mean, I mean me like others I hate it when you're told this is what you have to say, you have to do it there, the rules follow them don't challenge them follow them. I was thinking, as I am an awkward person, sometimes I think well if the rules, there is there to be not break bent or broken but, but sometimes challenging for if you don't think the sensible.

00:15:40.620 --> 00:15:48.030

E.S.: Especially if you're innovating if you're trying to break down the existing system and create a new one, then restrictions can be extremely difficult.

00:15:48.630

A.1.: I joined innovation as I was somebody who was a nuisance and I was one of those people that think, we always know there's a better way of doing something, and I think I was challenged at one point, you arethinking there's a better way, why didn't go and join that bunch of people and...stop being a nuisance to us because we've got...I mean, I think, interestingly as a set of people engineers, particularly maybe scientists too are quite rigorous and follow a line of like working within the framework and that's what I do I'm in this box here, this is me like being in hierarchy in that position and that job in that I tell him he she tells them I'm told by her she's my boss it's all like that, and you think you're.

00:16:28.680

E.S.: you are trained like that, your research is like that?

00:16:31.860

A.1.: think so and then, and they like it, it is comfort and, for me it was too because if you if you if you. I wasn't a lateral thinker at all really, but my boss, you know challenged us and start saying think for yourself think out the box that's, the only way we'll move on, you start thinking for yourself and the system work and work with us don't think you know everything. You don't get other people in most of them work with them develop synergies from working with them across the board, etc.

But the rules and the rules and the working position in our business they've changed so much and so often. In recent times, especially. To keep up with them, and you know trends outside of our business across wider industry across the world so I mean, I mean we've come in terms of things like governance, we were, as I mentioned, and a unified authority for a period of time we decided we were lots of fragmented bits and pieces that all came together under government act in 1989 the

water act which, which is at 1989 whatever which privatised use now what became an entity of water company, and then we worked as a single entity - well on paper we did. The mindsets of people within the organization didn't.

00:17:40.560 --> 00:17:41.820

E.S.: Still it takes a while doesn't it

00:17:42.360

A.1.: 10 15 20 years until they retired and go, before they changed the mindset. There were rivalries with other people in different or don't like that the division ...

00:17:51.480 --> 00:17:59.940

E.S.: people say that about the Environment Agency now actually you know they were several different entities that have been merged,

00:18:01.650

A.1.: I did an MBA and projects under a wonderful lady supervisor, who said that you know everything that happens because of people. Change is inevitable obviously and it's a constant. But said the thing is, engineers like things but not people. And she said they are pretty poor, or she recognized in her career profession because she is a professor at Lincoln university and then went on to other places, but she said, people are pretty poor, engineers are pretty poor at taking into account people things...They're not so bad at environmental thing because they can quantify and qualify but with people I just do things and have that be a blinkered mindset and sufficient. But the most value comes from working with people and people as teams, especially.. I'm guilty as charged again is, engineers and scientists like to work alone because they know what to think, it's all happening in their head. They don't need other people conflicting with what their thoughts ideas are as a challenge and they know they are right, why would they say such a thing that they might not be right, so they work in isolation booths, but you know, occasionally, they get it right and the brilliant and more occasionally than not right and so you've seen the dragons den with some of the crazy inventions and things that are because they have no commercial nouse whatsoever. They've no clue about money law finance marketing publicity people you know colours shapes they just this is a thing that does that and everybody should buy it tomorrow million of them.

00:19:31.860

E.S.: are you into networks as well I'm just picking up from we're talking. Networks internally and externally.

00:19:38.460 --> 00:19:39.210

A.1.: Absolutely so.

00:19:39.510 --> 00:19:47.550

E.S.: you talk about in terms of building a network, but it sounds like that's quite was inbuilt into your at quite an early stage in operation side?

00:19:47.970 --> 00:19:49.440

A.1.: I think, mainly through failure.

00:19:50.670 --> 00:19:50.910

E.S.: yeah?

00:19:51.150

A.1.: Learning from failure. It's when you don't talk to somebody. And you build something, and I've been there, I designed this I built this hotel. Well, yes yeah good try, may be you should have put this in, or think about that, if you come to me, to me, I will ask you to do that first..

00:20:04.950 --> 00:20:10.080

E.S.: Recent project?

00:20:11.160

A.1.: No years ago years I tried to make all my mistakes early on. Even the big ones till later the bigger and bigger mistakes, but I mean the assumption assertion, I think the biggest mistake anybody could ever make is thinking they know enough, to know everything and, obviously, the more you know, the more you know you don't know I mean yeah.

00:20:26.400 --> 00:20:27.780

E.S.: It does makes absolute sense.

00:20:28.980

A.1.: And, especially when you think you've got something in you. I am mentoring, a young lady at the moment who is doing a Master's in environmental science, but focusing on micro plastics and she has a background in geography degree, a second degree in geography she's a completely out of her depth in the science and so I don't know. "Don't be afraid that you don't know stuff and just make assumptions and solutions, but state them, and if anybody says you got that wrong you say I did, but you didn't help advise me to inform me, but I did ask the questions is. Then yeah, challenge everything in terms in this in this interim knowledge as well.

00:21:07.410 --> 00:21:08.430

E.S.: healthy attitude

00:21:08.550 --> 00:21:18.960

A.1.: Yes, I think it really helps... for instance, ...as a young person growing up and getting clever I did chemistry...I'm not sure of your...

00:21:18.960 --> 00:21:20.910

E.S.: Taking chemistry first year and I did law, so now civil engineering so I've gone through everything.

00:21:27.240

A.1.: In detail o level and a level I was terrible chemistry (discusses orbits not transcribed) *but anyway de de., De de level the next level and then so but I remember being taught that chemistry was telling him that I got taught about electron theory and electrons going around and neutron yeah, yeah and I said that they told me that these electrons was around them, these and neutrons and protons in what they called K I M and shells these little orbits around the and so, yeah I was very impressed with facts I knew this stuff I don't know why they were K I M and N shells was told that I believed it I said when I went to started my a level course they said that. What we learned about electron theory turnover chemistry was incorrect what they actually do is all bit in what they call SPD NF orbitals which are more complex, they don't go around life threatening and move around the earth, and he doesn't know that's ridiculous we just told it simplified is actually an SPD NF orbitals. Okay, so I honest and they simplified and lied to me now Taylor and learning about SPD enough orbitals I thought that's good. And then went and did some further study in physics and they said well you know when you did the chemistry is a level, and you learned about SPD NF orbitals well that's not true there's cloud electron theory.*

00:22:33.300 --> 00:22:35.130

E.S.: And quantum theory after that...

00:22:39.900

A.1.: different stages, I thought where in the tree of every area of learning have I gotten to and who is still lying to me about. Believe about is this and what's going to come next and I realized at that point hang on everything's I mean obviously Einstein knocked Newton's theories challenging honest, I think, just a minute there's better and but you just don't know yet for thought so I'm somewhere along those lines everywhere everything I know I know something about but probably not throwing something, and probably somebody else could disprove what I understand.

00:23:13.350 --> 00:23:14.160

E.S.: ongoing processes, learning. When you emailed me and you were setting out and you said that and you're very driven to be efficient, efficient you said business efficiencies business case type things and also ecosystem services - it didn't mention sort of social side? No reason why you should necessarily. It's not a criticism but I was thinking whether you are doing anything about social levelling up?

00:23:49.560

A.1.: That that that kind of I mean that's just that's a weak area for me I'm an engineer at heart. And people things I like telling people stuff. But I've been told by not by have learned to accept that people know more than I do about many of the things and I know about a niche area and that's good. But some in terms of our business week for many years, I mean I work in innovation, one of the challenges we've had in innovation has been to communicate better across the business, across boundaries, and try, and where we can, to get rid of the boundaries, to some degree by integrating their workforces together and where there's opportunities or synergies to work better see if we can bring one deployment into another department and vice versa. Yeah those links form. It's always, I mean we've tried that over 20/25 years I've been working, that needs to get that built up and strengthen but it seems one of those, it's one of those, barriers that is always present, is an omnipresent thing, like people, naturally fall back to 'what I do this and take that' perspective, you do that and we've got to remember to link in and share that and it happens continuously.

And this is where governance is useful because procedures are in place for many projects and schemes, I mean, for instance, our engineering construction and have something called the strategic direction commercial alliance, who do our engineering designs for our capital needs and they have very detailed and refined processes which lay out exactly what you need to do to progress, a project from one stage next from needs to delivery and commissioning and so on your way through to is cradle to grave obviously to decommissioning and getting rid of, and so on to the whole thing, later on, they have plans for everything and within those quite complex and detailed approaches, they have specified and what they call gateways were to pass remote gateway to the gateway stage 12345, where you sort of have them meet up with people from different departments once a need has been established to identify what are the specifics of that need who needs to be engaged and involved with it, what marriage and benefits and challenges will it break all those... has been developed over years.

I mean a lot of this thinking has been evolved over many years and the companies, I've been lucky, I did my MBA at a time when we're trying to do quite interesting changing things. We were adopting TQM total quality management going back in about 1995 98, something like that, we were Japanese you know quality control processes keys and circles all that sort of thing, where we tried to establish a methodology, whereby we would ensure we whatever we did was done to a standard the quality

and then was left until we didn't make mistake,s so get it right first time, ethos and that that was brought a myriad of interesting things and we did things like and use the balanced scorecard and then, if you're familiar with a couple of blokes from Harvard University said well everything that a company does should not be measured in terms of financial success, that is, that is inappropriate way to do things that's things, as measured by how much money, did we make this simple that's not. It doesn't take into account anything like that the social value of work or are the impact on the environment, said you've got to have a set of measures which pertain to the activity, you know, in a holistic sense of wider sense so yeah it's in things like if you're going to make chocolate bars, for you know kids in the area. You know where are the materials, going to be taken from how sustainable, if you can have the end you've got lots of carbon footprint of doing so, how will it affect people in Africa, whether the cocoa beans are taken, and will it affect their livelihood, you sustain. Millions of questions pertaining to think not money, and this is the one thing you must not do at all when you use what they call this balanced scorecard to assess any activity is putting a pound sterling pence line as soon as you do that everybody will get won't forget all the others, the other 30 things the pounds and pence is the one that we are interested in as we are a commercial entities there is always someone who will say that we're about the yeah making profit that's what.

00:27:52.230 --> 00:28:03.060

E.S.: what is it going to cost me, so very interesting but..

00:28:03.360

A.1.: when you're looking at options and alternatives, yes, it has to be considered from it before you get to the stage of rolling out all the alternatives consider everything but the pounds shilling and pence. Then when you've got a handful of viable propositions look at the pounds and pence then. Last of all. And that'll get you to some way, it needs to be.

But I think our company took that approach on in looking at how we should operate the business in terms of our workforce, who should do what will get the most benefit to our customers, the environment. How can we get the most synergies from the teams configurations and we kind of moved away from the compartmentalised at the time we have a central control function tried to move away from a single control function managing all and we develop some sort of interesting tweaks and twists on that because at a point in time, and it was thought that we weren't behaving well commercially we weren't acting as a commercial entity and they said, we need to get into a situation where we identify our core competencies and skills and the things we must do as a business and then try and separate out those other things where we don't really need them, other people could be brought, in it's a it's a nice to have want to have certain set of people and activities and therefore we developed what they called the three ball model which is quite interesting and the three balls in this three ball model were the owner of that company could have privately owned by investment companies and so on, and then the other two balls were the operators and the third ball was the support functions. I was put into the support function ball, because I was an engineer doing design and everything else at the time, we were told it to the two balls that are absolutely one's going to exist forever the owner they do is they know what they want. And the second bullet she's a very important bullet, has a slightly less of all though it's the operator they're going to be required operates without the third ball they're the ones that might if you're juggling balls they're the ones are going to get dropped. If a ball has to be dropped is the third ball sports services. And that was like, yeah again it's not like oh heck moments in your life when you talk about three but they don't give you that insight, but he was really between lines and talk it's clever people in the business they think, this is what the third balls about. Then set of people business units that could be replaced by others will drop completely they think do we need operational scientists do we need them?

00:30:24.780

E.S.: Is there a responsible innovation code or a code of ethics at all within the business ?

00:30:31.590

A.1.: yeah that's an interesting one, I mean, yes, yes, we do but I think that's evolved organically, and we have all sorts of written documents nowadays. I mean we've adopted gosh I mean I don't know we get some typically we get memorandum pushed around so many times and we have a massive list of corporate policies and procedures and ethics is part of it, obviously, and I mean a lot of it over the last number of years is related to the inclusion - how we treat other people modern slavery, obviously.

00:31:01.560 --> 00:31:02.310

E.S.: internally, in time, yes, oh yeah.

00:31:06.540 --> 00:31:08.190

A.1.: it's a corporate think as I'm as aware for my room. We are a strategic direction statements and corporate literature is not shy of advertising what we do as.

00:31:19.920 --> 00:31:20.490

E.S.: I can look on the website but because a business has documents on the website doesn't mean they are used or that anybody has ever heard of them.

00:31:30.330 --> 00:31:37.020

A.1.: yeah yeah I go to our corporate website, from time to time to see what they were saying to the public and I didn't know we're doing that. But then you go back through your emails and you realise, you were briefed you just forgotten about it. So people ask do you have an inclusion policy and I say I don't think so and then I look and yes we did with a big thing it was announced two years ago and you were there and yeah forgot about that.

00:31:58.230 --> 00:32:06.270

E.S.: I'm also interested in outside governance, so how the legal and regulatory regime. How you you interact with that and so the framework that and designing is around the hurdles that people encounter because it bleeds and it's hard to differentiate.

00:32:20.100 --> 00:32:27.840

A.1.: I can only give you a perspective, which is mine, obviously, and because I have not been involved with that as a specific function. One thing that happened with me, is for a period of some three or four years I was I worked in the asset management department and was subject to regulation or this which is the my interface with are regulated with through audit of the work that we've done in our specific areas of knowledge, but so that was quite interesting but its done in a very formal when it has to be they need to follow a script and ask you to share various things against it and have you met certain standards, how do you do these things you do know this obviously was sharing understanding information and so on, that whatever you say is going to be here's the evidence against you. By comparison, but in terms of in terms of forming our business, we have with our business, we have them regulatory release on the pumps in offices yeah we have them, for instance department of environmental regulation. And we have regulation managers whose job it is to talk about like your regular trespass relating to elements of things are regulated on. I have frequent discussion with people called lash our head of environmental regulation for things like river water quality soon network operation processes and systems on water recycling side that kind of thing. She hosts meetings visits talked about major schemes, and I think one of the things we do

as a business is because we don't think any business likes to be dictated what they're going to do when they go to do it.

We don't like having things spelled out to us as we're not doing well enough. What we tried to do is be insightful and aware of where we're not performing as well as we could be performing because of feedback from customers or other evidence and we try to hold meaningful dialogue about things where we have things which is consents that are only narrowly met and we were just squeaking in and just doing enough we're conscious that rather than, say okay well that's okay let's put that under the carpet that's fine, knowing that we might have a failure later. We have dialogue, we actively instigate dialogues with a regulator. We say we know we have issues that the issues I mean to be fair and reasonable the issues are not of our making in fact might be that we have a lot more customers connected to a system was never designed to take as many customers as we have, because the local planning authority said, this is a green belt area that cannot be used as things like the A 14 corridor around Cambridge spring to mind. Well done, that we thought were all sorts of we got works performed satisfaction awesome know that can be 5000 houses built in next 10 years. What we can take that 5000 houses that works for capacity already knew we had to start dialogue with our legacy if this happens, and then the developers have a right to connect to our system that's illegal right to and we have to accept the flows. And it's going to have an adverse impact in the works that works already capacity. You have where you are aware of that, how can we work together to sort of mitigate and manage that additional input, because it could lead to failures. Only because we've got more flow, we never intended not our fault, we, and I think that positive dialogue where you address issues before the rise is always really well received. A governance, you know in our businesses is hinged around being open and frank with our regulators, where it not causes us to be prosecuted, not showing things we should do.

00:35:44.310 --> 00:35:47.700

E.S.: they are not your friend, they are not your enemy but not your friend

322

00:35:48.630 --> 00:35:49.020

A.1.: they police, what we do and how we do it, but they are human beings with the empathy within the souls. And I think the impression I've gained of these from our business and our business leaders is that it's far better to offer up issues and concerns before they become serious and get a joint resolve rather than it's a sort of put it under the carpet hope it doesn't happen when it goes wrong people then say to you, did you know about this before and you get a little bit, but we didn't bother raising it because yeah we thought would be okay

ES: You explained about and that you can involve a lot of innovation projects, I think.

DS Yeah have innovation 15 years.

00:36:35.520 --> 00:36:43.590

E.S.: is there one in particular working on at the moment, or one that's particularly been what you consider successful or.

00:36:43.890 --> 00:36:45.420

A.1.: all model successful yeah.

00:36:45.510 --> 00:36:46.050

E.S.: One and we'll chat about that.

00:36:48.600 --> 00:36:54.450

A.1.: I don't know I mean which one to go for it because there's quite a few other interesting that can completely boring, and all the.

00:36:55.530 --> 00:37:01.230

E.S.: way to kind of bring about some sort of with more transformational change than an incremental nudge maybe.

00:37:01.530 --> 00:37:06.780

A.1.: The grandest of all, I suppose, if you like, is something which should, which is entitled sentient catchment. And, and I mean, as the name suggests, and sentient catchment, the idea is if we could make it possible that the system itself is self aware, it's a bit scary, it's a bit like Big Brother or IRobot all that kind of thing. Yeah in essence it's not at all sinister or scary but the premise is that our networks are quite dumb, I mean they I mean because, you'll understand obviously, that some things like sewer networks operate mainly under gravity and liquid flows.

I mean there are things that you can do in terms of looking at some the systems we operate manage and maintain, which interface with the wider environment and humans and animal life and organisms and so that were responsible for, but we do not have significant enough knowledge of what they do and how they work to be able to control much properly given a bunch of stuff that's happening around us. And one of those things that's happening around us is climate change and there are whole variety of things happening to our system, not due to our activities, and you know changing rainfall patterns and temperatures, one of them. Things like increase in hard paved area from growth and development, another situation of our assets, because of age, wear and tear a third thing. There are a whole bunch of stuff happening and we've got strong managing content with that and based on all we have to go on, is knowing where things are and how they generally performed based on historic experience.

00:38:32.280 --> 00:38:32.640

E.S.: yeah.

00:38:32.760

A.1.: I mean the premise of the sentient catchment I've been working on is what if we as guardians of the environment and try to as best we possibly could gain a better awareness of changing conditions in terms of things like weather we already know about things like an additional flows from trends and growth that's monitored and managed. But if we if we get a handle on sorts of understanding well how does rainfall that is projected to occur differently going to affect us. And what are we going to affect I mean, given that we try the majority of time to keep the flows within our system. Treat the flows process the flows and then let them back into the environment in a manner, where they wouldn't cause any adverse harm to the ecosystems and so on. And that that's the sentiment but not the truth of it, because things happen to work processes that aren't satisfactory given different changes in temperature and volumes and flow that equipment is designed to work, ideally under specific conditions. If the conditions change outside those parameters they're not going to do what they're supposed to be doing, supposed to do what will, how would you know?

I mean the only way you would know be if you put sensors in the system and the means of having a feedback loop, if you like. I did a masters of clever means smart clever idea masters years ago you tell people. They must isn't some systems thinking any way to get a better understanding how things work and what to do about it, but simply learn on that because clever people me told me, it may be

lied to me I don't know but principles of cybernetics the feedback systems, I mean it's about everything that you do has a has a reaction or response of some sort depending what it is and also something called them Ashby's laws of requisite variety which I don't like saying to people because it's about complexity and it's a thing that is little heard operative some chat many years ago, said well, if you're trying to solve a problem, one of the failings of people is they try to solve a problem within an inappropriate solution by which he meant if you've got a complex problem, you probably require a complex solution because, as many things to consider. And if it's a simple problem yeah it probably a new cause a simple solution, but what people tend to do is, because we're people, is for a simple problem somebody will come up with a very complex solution well that in itself gives rise to further issues. And the other thing is something that's very complex somebody will come up with a very simple all you have to do is this, it yeah that's not going to do is let's think about it, and the trick is to identify all the components of the problem, so identifies complexity and then, once you've done that you can sort of better understand what is needed to remedy that situation where something that's equally an appropriately complex to suit. But don't get it wrong either way, though, and I think that's exactly in a nutshell, what water companies do with their systems. Like we don't know enough about what the heck's going on controls and affects what we do, and therefore how mediate manage and control and adapt to changing environment and climate and then and that's evidenced by the fact, for many, many years I'm I worked on sewer networks to upgrade for additional flows or we're having floodings and build some extra storage in and the pushing flows about differently in the sewer network and providing capacity here, there and wherever - without at that point in time, go back 30 years 25 years, fully understanding the implication on the wider environment. If you're changing the flow regime to a network to cater for something that wasn't there before that the history and the wealth of knowledge and understanding, you had before about how the system operates under variety conditions has all now gone because you've changed at all. It's a bit like say to people if you're talking about particular things like overflows from sewer networks, which requires pressure relief, if you like, to prevent properties from getting flooded. Yeah when you run out of capacity needs to network and it's a bit like a hole in the bucket if you're filling the bucket to certain rate and there's one hole in the bucket it's at the moment, provided the fill rate of the book it doesn't exceed the escape rate from the hole you've got in the bucket, then you never can have a flow from the top of the book it's always in come out the whole. yeah miss if more goes into the top and the whole bottom stays the same as at some point that is liquid rising is going to overspill and who knows where's that will go

00:42:49.830 --> 00:42:54.180

E.S.: Do you have a solution for this or is at the solution choosing stage?

00:42:54.480

A.1.: yeah that that one. I mean I've got lots of I mean did this is where the multidisciplinary approach comes in, I mean there's nothing to do with governance really as opposed but I suppose it could be. It is basically who to talk to, when to talk to them all that stuff but basically, if you want to build a catchment that is sentient, I mean this is where I deviated from my background knowledge of civil engineering, where you look at pipes and hydraulic flows. I had to work with over the years, I wanted to work with people with knowledge of disciplines like an electrical engineers mechanical engineers, because they know how the mechanical equipment works and operates and control it. But more interestingly, because of the modern technologies that are available in the world, things like and wireless technologies and computing and analytics platforms I've been working with computer engineers and radio and communications experts who are able to support your past signals from point A to Point B to do things like remote management and control so you can catch me to talk about that really hinged about on hinged upon they're putting sensors in in our systems, the eyes and ears if you'd like to see what's going on - and then we can use that understanding based on a representation of the hydraulics and how that system performs under various flow

conditions to dictate whether or not, things are happening as you would expect them to happen and to modify the understanding of the network if that's not the case. And thereafter, when you get things like and wet weather events which we detect from I built a weather radar platform some clever like that no I didn't I got talked to some nice people very clever and help me do that on my behalf and that we are working with Environment Agency and the Met office and other people and built a weather platform which gives us forward notification of wet weather which and the rain likely for any given area of land and we look at the rain is falling on a contributing area, which is a catchment and say okay we're for predicting this amount of rain in the catchment over a period of time the laws of hydraulics to dictate what might what might be entering what point in network and therefore try to understand how that might equate to flow and capacity and performance, the system, and then, when we detect that something might be happening, that is not going to be good news for us, we can decide to take action. If we see this rainfall event coming that we don't think we'd be able to manage will call out the tankers for starters, but before that will do things like him and drain the system down by entering all pumping stations existing that catchment so this capacity available when the rainfall enters.

00:45:20.160 --> 00:45:20.430

E.S.: yeah.

00:45:20.520

A.1.: Other things like that also, and I mean it's levels of complexity in detail talked about [] most directly variety blah. But basically, if you have a system and you're trying to prevent certain bad things were happening, you're aware of bad things that could happen, usually their escape points from sewers and combined sewer overflows. I don't know see what network experts I'm sure that's like your bag, but that's my bag, but anyway, we have things like combines the river flows which allow flow out to prevent properties from flooding now under certain conditions and where sediments of nasty things are built into it, because of low flow and warm weather. Yeah these nasty things can be pushed out of those overflows by the volume of water that enters in a rainfall event. And what you don't want is nasty things leaving your system at point locations where the river is very sensitive, it may be a low flow or wherever it might have a higher amenity value it might be supporting fisheries or whatever, but you don't want those nasty toxins going in job lot at that place so what would you do about it, I mean it wouldn't previous maybe have known that was happening even but now we have monitors in place which was rising we know it's a it's a first foul draft, which is occurring, we can operate something like a containment, though, which prevents that single over from operating as a fixed period of time to prevent the most contaminated substance entering into that environment.

00:46:37.770 --> 00:46:54.930

E.S.: what do you think is going to be the main legal regulatory hurdles to you getting this sensor projects off the ground.

00:46:56.370 --> 00:47:02.790

A.1.: Everything that's the way at the moment, and it seems to be heading is that it's driven by public opinion. The consensus from the public, we work towards as a business nowadays and ensuring that our customers and the public are satisfied with what we do, I mean you probably you know about the SIM scores, and so on. I mean we are engaged and measured by how we're perceived by our customers and their yeah and if they say well [] Water are dreadful do a terrible job or we are unhappy with them, we can see evidence of the pollution in the rivers, and it's from those then we failed.

00:47:34.170 --> 00:47:36.540

E.S.: How would you get public opinion on your side.

00:47:36.750 --> 00:47:40.320

A.1.: We I'm not the guy that does this a lady that does this, but obviously, great effort is being made by business to engage with the customer and the public and to educate, if you like in the issues and concerns and considerations. A we know, I know, from my experience working with folks like that, because things I do impinge on the environment which there after has effects on the public, who may make comments etc so we've had interesting discussions about how do we manage this. And we tend to look at places which are obviously sensitive to that, and I mean it's not a great thing to say, but if you've got a choice of discharging into place, which is in plain public view and any pollutant load and one which is not and people seldom go and never need notice it, which would you choose to do? Its' obvious isn't it.

00:48:26.430 --> 00:48:28.230

E.S.: does that depend on if it was ecosystem.

428

00:48:28.860 --> 00:48:32.220

A.1.: yeah okay, the problem with the ecosystem, is it can't talk for itself kind of now so yeah people will see things in place oh I got my basement flooded.

430

00:48:38.580 --> 00:48:47.310

E.S. so how does the ecosystem speak? how does the ecosystem make itself heard.

431

00:48:47.580

A.1.: it's an interesting thing, but I mean over the years I've worked very closely with and they've been guided by documents I've been governed in what I do led by documentation which has been formulated by the Environment Agency, under the guise of UKWRC so that water industry bodies that have been set up with the sole specific purpose to make sure that what we do is the most efficient effectively in terms of being sustainable and protecting enhancing improving environment and talking to the customers, that currently those documents have led us. And, and I mean it, I mean the Environment Agency and Ofwat are our policing authorities. And they are there to protect the public good and help the public and protect the environment, etc, etc duties are to do those things so when they introduce things I'm I've worked with something called the UPM many times over, urban pollution management plan your it's a document you may have heard of but anyway, that that gives a set of procedures, governance again, it explains exactly what you should be doing and how you should be doing it, but it's not prescriptive it's not a it's not a mandatory. It is recommended and the thing is what I found obvious I was actually one that I was the first person you get to use that document in 1994, that was interesting, but since we were commended for adopting that approached by a regulator now I mean mentioned before we have a good relations with a regulator and we tried to foster those and but obviously adopting the standards that they've suggested that are built into a document got as a pat on the back.

443

00:50:22.230 --> 00:50:22.650

E.S.: yeah.

00:50:22.770

A.1.: Oh, you told us we.

00:50:23.820 --> 00:50:31.200

E.S.: And to an extent your sensors are giving you that feedback anyway aren't they? I suppose the sensors will start to give you a sense it's a communication tool in a way isn't it that data.

00:50:40.620

A.1.: But with sensors the sensors have to be set up and configured against certain standards, I mean we want to know what is the threshold at which we need to take action or be made aware. And one of the concerns I've had over the years is a whatever schemes I've been involved with them because I'm innovation, I can do all sorts of crazy things and hopefully gainful and beneficial for our business, if you're concerned about things like the quality of the water and receiving waters rivers and so on and the regulators are very keen on maintaining the state of the regulated environment and are very much concerned about maintaining quality or improving quality - for a water company, we need to be first off aware well, we were not guardians of the waterways. We affect them and we try to work within standards, the standards of being set by regulators and to have an awareness of the body of water and it's ecological status is very important and we're only told that by our regulator. And, and I have found over the years that our regulator is hand tied by the fact that they are cash strapped they have little money to do all the necessary observations and analysis for all the river water reaches that exist in the whole of the UK too be able to give us a definitive answer this is what we need, this is what I felt because, obviously, for various reasons, water quality deteriorates or improves and it varies and we don't understand the water company enough about that and it's not our job to do that, but what I found is that if you can work with the Environment Agency to gauge it and understanding of the standards to which they aspire to maintain or to improve and then you can say well actually we monitor what's going on from a sentinel catchment thing I can understand the impact. And I found that in terms of the talks about sending catching thing I can evolve a system with others in our business to manage and control our system as optimally as you as you wish, but I have to do that in context of what's happening in the receiving worse than the river and I don't know about that that's not our area of expertise. So linking the understanding held by the Environment Agency about the river water and environmental aspects to what we know and do is something that's an imperative if you want to get the balance right. If you want to optimise.

00:52:49.500

E.S.: There was something a few people have said to about environment that leads in quite nicely, they say that when they're trying to innovate they're trying to bring about some change the changes that are easier for them to bring in are the ones which are have a degree of certainty and so, because it's easy to see where the cash is being spent, and the result is linear. They Environment agency finds that easier than nature based solutions or things like that have you found that?

00:53:21.750

A.1.: Well we've got one quite good example of how uncertainty still exists, despite us complying with regulatory requirements. In 2012 the Bathing Waters Act was introduced and I don't know if you know much about that again, but basically the government and Ofwat there was required for water companies to comply with the bathing water at that said that they under circumstances where there were bathing waters and the water companies who may be discharging through overflows into receiving waters that thereafter affected the bathing waters needed to have a system in place that was able to analyse assess an estimate the likely risk to be this based on the presence potential of e-coli and meningococcal to certain levels thresholds and was a big ask. So in 2012 we all have to jump to and start devising systems to recognize when our overflows operating and whether or not the discharged from the overflows was likely to affect the downstream bathing waters to a degree, which would potentially exceed the threshold of e-coli, which would there after potentially cause people tummy upsets and so on. That's massively complex, because we didn't have any monitors on

our overflows at the time well not all of them at least. So we had to setup monitors of overflows to know when they were discharging do calculations, based on hydraulics model, on what was leaving the system when they did operate, we have to calculate things like the time of travel from the point of discharge the bathing monitor itself take into account the river flow and tidal action and other things, and then come up with a definitive answer to whether we should notify the customer, whether it's safe to bathe or not.

ES Wow.

D.S And one case in point was I don't know if you know [] but [] has an eight bathing waters effective variously by 57 different discrete combined sewer overflows. And I had to do the calculations for our business to work out which of those bathing waters might be affected when, and whether we should notify the appropriate authority including the Environment Agency and the local authorities to notify bathers to bathe or not bathe. It's a big thing because, obviously, if you put a red flag up telling bathers that have gone to Great Yarmouth or [] with the kids to paddle and say don't go in the water, because the water company CSO's are operating – imagine the great press we as a water company would get. We've told them not to bathe because we're putting sewage into the water at the moment. So don't go in the water please.

Obviously we tried, as best as we possibly could to be as accurate as we possibly could be but my great concern was, how we would be viewed? And if our system was audited and as it has been, and we knew it would be, is it seen to be being conservative and safe and saying oh don't go in the water, it might be unsafe then put yourself at risk of criticism of what we're what terrible water company, and so, if we did the other thing and not tell people as often as we perhaps should because it looks better to us like ahh we don't have any problems, and then they find out actually know what we took samples and they were, they were operating and we are the bad guys then.

So it's a fine line to tread and sort of that certainty / uncertainty thing there and the Environment Agency weren't able to help with that, in fact, they did quite the opposite, not intentionally, but so what they did because it's their job to do so is take samples. At bathing waters. When it had been raining and they would rush out at certain locations which are lots of bathers and wants to be clear that people were potentially going to be safe and take a sample and say hah you passed or your failed and then, when we the sample came back clear. They say well there wasn't enough e-coli and you'd be using red flag don't go, and that's daft you are totally upsetting your customers and they should have been allowed in the water.

I had to counter that logic, well you take a bucket load of water from the sea. There's lots of metre cubes of water in the sea. You take one bucket load that is like 1,000,000th of a million per cent of the sea and it's point in time, because they..

00:57:27.990 --> 00:57:31.110

E.S.: I suppose that is the point really, that to them is certainty? They have got their bucket?

00:57:31.650

A.1.: Because they have their bucket

00:57:38.580

E.S.: I suppose .. it's not about the actual result? The reality it's about what they can prove with the resources available?

00:57:50.820

A.1.: Absolutely that. It says the law is of the requisite variety nonsense again, as I mentioned before, because there's so many factors to consider one of them, which is quite interesting and entertaining happened at [], there is a pier at [], you may or may not know. And you know. This lady called [deleted] [role deleted] she's very bright lady she's a PhD in something. She is very clever. And she and I had meaningful discourse about the issues at []. She said I think there's an issue at [], they went out there and sampled a while back and we failed.

And I said oh well, okay fair enough. And she said can you go back to the system that I built with some others and have a look at it and tell me what went on the day of the failure. And I said yes. She said I've got a specific time the samples was taken. There was no specific time it was taken and I want to now what was happening with our system. I went back into it and I found out all the information for []. This is what went on, and I said the time of sample they took it around the pier area, was this time. Our CSOs operated about three minutes before that and it's all it's all atomic clock stamped it's all these guarantee times, we were all working to the BST thing. So we're absolutely certain about the times, these things operate.

And she said yes yeah it failed says, I had a word with them. She said she had a theory, she said that the e-coli that was counted in their sample that was exceeding the threshold was taken at the pier, 100 metres away, they took a sample there as well, that was clear is fine. And that's nearer the overflow but they say it's our overflow that did the damage.

And I said well ok some interesting information. The time of travel for our overflow once it operated for the sewage to get to the Pier it would have had to travel at 300 miles an hour. In the water to get there. So it's impossible. It's absolutely couldn't have happened, I can show them that and with these if the stamp timestamps were wrong then, then that will help something else, but no they were right. And she said look my theory is pigeons and sea gulls. And when it rains what the pigeons are see will leave as little presents get washed off and they contain e-coli. And the concentration of e-coli was so high, but it lasted for such a short period of time it looked like the washings off of the pier landing in the water. And then sampling that and 100 metres away was clear, she that's exactly she says it is the pigeons and sea gulls I'm blaming this. But they are having none of it. Is a no it's your overflow.

I said well okay, then our sewage was traveling at 300 miles an hour that's how it works. That is the certainty / uncertainty principle where we... and then the complexity of knowing enough information about what ... to this day [] tells me that the pigeons and seagulls theorem it does not hold well with the Environment Agency. Yes they recognise that e-coli is contained in what they do, but they still think it's human e-coli but they can't recreate that and, by the way, but this is with this, we need to look at our overflows more carefully and manage them better.

01:00:53.700

A.1.: we got a telling off on that occasion. I said that is a nonsense, because it absolutely definitely wasn't us. And anybody reasonable will say no, it wasn't but they had already done the sample and we had failed it apparently.

01:01:04.530

E.S.: But yeah you know yeah I get a lot of those sort of comments actually. Your sentient scheme doesn't sound like you're going to rub up against any particular legal or regulatory hurdles as, as you said, it's public opinion really, it's not a legal/ regulatory. Have you got problems getting buy in or anything like that?

01:01:24.210 --> 01:01:26.130

A.1.: No, no, money is always an issue.

01:01:29.250

A.1.: It gives us better data control and management opportunities for our systems, and I think that's where we're headed anyway. But extract extra value out of it. We're particularly looking at the value from engaging with society on a wider scale because, obviously, if we engage with the public and make them aware what what's going on in your networks, they have greater empathy for what you do if you keep them informed rather than land it on them. And so what I think there was social value that is a construct we are considering as well. I know that that's something that the government is now enacting and it says its trying to engage with society...

01:02:08.700

E.S.: yeah not just the ones that shout the loudest but everybody ?

01:02:13.140

A.1.: How to inform people. And I think in terms of what we do in general []'s approach and is art of our governance procedures now is for any capital schemes and four major business decisions on changing our practice not an operational duties and so it's - engage with the public - and so it's those affected by what we might do, get their involvement and make sure that they have a say and that say is fairly reflected or reasonably reflected in what we do as an outcome.

01:02:39.960 --> 01:02:40.380

E.S.: Sorry.

01:02:41.130

A.1.: I say what we didn't want to do is make anybody feel disengaged. Its been landed on you, bad luck, because that gets you enemies not friends.

01:02:49.650

E.S.: yeah it does it get people's backs up. This very difficult question for you, you may not have had any then - but if or when you've had objections to big proposals big projects is there generally a theme as to where they're coming from and why?

01:03:06.930

A.1.: Yes there are a set of conscientious objectors. They are generally certainly informed and educated people. I don't like them at all.

01:03:14.610

E.S.: (laugh) should be banned and asked to move to another area.

01:03:19.230

A.1.: But yeah but no (laugh), I mean typically objections are often people who do know about how systems operate at least roughly. And, those are even better informed, have worked in the industry, and so on, and a very scary people because there's no wool to be pulled over their eyes to know what goes on how it works and they can cut through all nonsense, not that we would ever give them nonsense, but going on but when you say you could do this, well you could do but a better solution would be build it elsewhere and add capacity here. And the answers are appropriate answers, they're just not affordable answers and that's the issue, because obviously as a regulated company in terms of as an engineer like I said before, I don't understand how its funded, what the regulator's got to do with anything. Well obviously the regulator approves our spends so when we say we want to spend money on this, that and the other, we have a finite amount of money which has come from

the ratepayer in our coffers to spend and it has to be approved by regulator, so when we usually say to our customers, well, we would like to do this, but we don't have money to do so. And they say we know you're making 300 million profit. Yes we are but that's nothing to do with the regulated spend, which has been approved, through a capital programme, through the asset management plan which is you know approved or set by regulators. That money is spent in a privatised way the most useful meaningful place to be spent in that order. If there is spare cash which there isn't, we have to go for further approval. It's.. I still struggle with that myself in that it is our regulators that we have to get approval from to spend money. We can spend money on additional things and try and curry some further favour from regulators having done so, but you get very little on that. If you've improved it you get better, but obviously our owners, business owners, don't want to spend any more money than they have to on

01:05:21.090

E.S.: I promised I wouldn't go over time and I have. I have so many things I want to ask you and [] if you don't mind I'll come back another time.

01:05:29.490

A.1.: Absolutely

575

01:05:30.720 --> 01:05:37.320

E.S.: Rather than rushing, as I say, I've tried to be respectful of people's time. Just one thing I wanted to ask you, quickly, just thinking of governance, both internal and external, how that impacts on the business, if you could have one thing that you could change, if there's something you could change that would make you get something really good through more easily what sorts of things would you be thinking of?

01:06:05.880 --> 01:06:09.660

A.1.: The things I'll say it will be completely inappropriate from a business to say it but I will say it anyway.. innovation is hand tied and confounded sometimes, by your governance procedures, sometimes you have to...to get where you need to go, you cannot, if you tried to travel by the prescribed path it'll take you to the wrong place, if that makes sense. For instance, these are things we have things like procurement procedures, we must follow. We must, there's no deviation. But we must follow them. And I find that when our strategic sourcing team say ahh you want to work with this company and they're not on our list of approved vendors, you can't. But they've got the knowledge, they are a one person outfit. They cannot afford to register as a private company. Sorry they are the rules. No. You could employ them as a water employee. No I can't, how am I going to do that. Ahh well, maybe they'll do it for free. Oh that's right they like working for nothing.

01:07:16.530 --> 01:07:17.850

E.S.: you are the third person to say that to me.

01:07:18.240 --> 01:07:24.840

A.1.: Oh, for goodness sakes, I mean that hampers does innovation, it really does, and the other one which I know absolutely know I shouldn't say, but it will - health and safety - or you can't do that because these are.

59701:07:28.860 --> 01:07:31.860

E.S.: you probably can I used to do, health and safety work as a lawyer and sometimes its more fear than reality

01:07:35.100

A.1.: I mean the health and safety is above all and, and I would never suggest we anything against health and safety, but, we shouldn't say but, - and I have seen small companies not able to progress, because they cannot afford to go through the purchase of the equipment is not available to them. And I must admit it, because I'm innovation, I have a budget money other parts of our business don't, I've been able to facilitate things such as provision of gas monitors for when they are working in enclosed in a confined spaces. I can provide that for them. It can cost two or three thousand pounds.

01:08:12.930 --> 01:08:13.860

E.S.: Right

01:08:14.040

A.1.: the company can't afford to buy one of those for Fred and one Joe or whoever, then you know we can't do that work for you because we don't have the equipment.

01:08:22.470 --> 01:08:22.800

E.S.: yeah.

01:08:22.950

A.1.: it's prohibitive, and that stops you know development. And also things like fabrication of equipment, we said we must go here and look at that and you can't procure your supplies from a supplier from China, because it has to come from EU, because of the requirements that think it will they can't afford to now they don't know where to get it from any way then it's prohibitive but

01:08:45.660 --> 01:08:50.760

E.S.: the procurement. Is it regulatory, formal regulation? Or is it internal or is it a mix of both?

01:08:50.910 --> 01:08:53.190

A.1.: I think it's a blend.

01:08:53.850 --> 01:08:55.410

E.S.: yeah I need to look at those at some point.

01:08:55.620 --> 01:09:11.250

A.1.: Most notably, the Overseas Journal of European Union where which requires for any contracts or any work exceeding a certain value it's a legal requirement we must advertise the opportunity to carry out that work or supply that service or products across the EU, but we're not in the EU anymore. I think I think. Well, but I wish we were but we are not. But our supply chain department say that doesn't matter about that those are still laws in place you.

01:09:30.060

E.S.: yes they are carrying on.

01:09:32.490 --> 01:09:46.440

A.1.: It's just the fact that you have to then consider people from France, Germany, Spain, anywhere else that may want to. It doesn't happen that often because they are not interested in working with us a lot. But again it's the small contractors and suppliers in this country that have to comply with all the regulations to be able to submit a tender at least. And that's prohibitive, and they oh well, we can't do.

01:10:02.550 --> 01:10:04.470

E.S.: When you're starting up its really hard.

01:10:04.860

A.1.: you have to get on certain databases, get certificates and they say well, we can't do it then we will just have to back away and say sorry no.

01:10:12.210

E.S.: One more question ...En-able? you've got an offshoot company .. it's quite it's really nice idea I think you are putting financial service funding more niche based solutions, I've forgotten the name

01:10:45.570 --> 01:10:47.400

A.1.: we've got a few offshoots like that. Didn't know whether to touch on that or not. When I did my MBA I did a and finally a thesis on lending waters global ventures of interest in the global marketplace

01:11:02.640 --> 01:11:04.020

E.S.: En-trade.

01:11:04.260

A.1.: Okay.

Well when I did my MBA I did a final year thesis on [] water ventures in the global market place. Round about 1998 to 2000 [] decided that we could become a global brand. Really really. Well, I thought that was an exciting opportunity coincided with my final year of my MBA as a three part time course I thought, all other projects on now do a thesis on that. [] waters ventures in the global market. And I came up with 114 points that needed to be taking consideration or for operating around the world, which II indicated that this wonderful venture we had embarked on, it was getting things like build and operate contracts and design and build things for overseas markets, mainly Australasia and then we went to places like and then we worked in Finland, Denmark, I think a bit we worked in Poland Czechoslovakia at the time, and then we were in sorts of places Argentina was all sorts of places all over the place, but generally places where people don't like the English or British.

01:12:05.430 --> 01:12:06.450

E.S.: Right that's quite a long list

01:12:07.560

A.1.:I thought to myself well that's interesting and also in places in water sector places like Brazil and Panama places where the French and the Germans have a very good footing already. I did a study around the economics of it, as well as geopolitical factors. I actually presented my work to the director in charge of the [] Water international and nearly finished up with the sack. Which is great isn't it.

01:12:35.910 --> 01:12:38.460

E.S.: you painted a picture of somebody ducking and diving through their career which is obviously not the case!

651

01:12:41.310 --> 01:12:47.310

A.1.: Well I shouldn't give you his name but it was [] and they called him crazy horse. And he was educated in the school of life because his degree from the school of life. I should have seen the

warning signs were there, I should have known this fast than flighty director lots of blustering and coms of stuff and he was the director of frankly more for international and he was very interested in my project, and he wanted to read it, and I gave him a sort of a synopsis of just finished it. And he said fantastic this isn't going to be as he's going to be yeah there's the story of the success in the making of it and I thought were not quiet he points at all the foibles issues that concerns the worries, he went through it, he didn't read he read the synopsis and any flicks and back patient looks like on that stuff and then he said I didn't realize we employed idiots. And I thought that would be me then. I was an idiot showing him it. Because he was director of this this venture not and I indicated, there are so many challenges so many barriers success was unlikely. You really believe that you really believe successes and like anyway, five years later, was totally vindicated when we failed so I felt so good about that (laugh). I was the one that goes yay we failed.

01:14:02.910 --> 01:14:04.530

E.S.: In 30,000 words, but yeah (laugh)

01:14:05.580

A.1.: I mean, but things like and relations with local people. I mean things like I had very clever Professor [] lady progressive, brilliant and she said I'm really interested in this she said, are [] Water going to consider rebranding. I said I'll ask the question and the man in charge. And they said why would we do that, we are [] Water, and she said [] is very English isn't it. And apply it to a former French colonial territory. You think and in England [] water English not going to go down very well maybe use aqua or something. Of course the locals like it didn't go down, but I got feedback from people went out there and worked on projects that the locals were not friendly. And Government Officials less so.

01:14:59.790 --> 01:15:02.700

E.S.: government officials can place barriers in the way.

01:15:03.060

A.1.: And then, on top of that, obviously, things like in terms of clearing at trade in different countries, I mean it's near of interest to me, I did some. Participation action research engage different people from across the business with different experience so....

[personal to participant, not transcribed]

01:18:32.250

E.S.: And you mentioned the small business products. I'd be quite interested to talk to them if they would talk to me about looking at from the other perspective and trying to get in and trying to break into to get these products off the ground. Is there anyone it doesn't give me an answer now, but if there's anyone that you think you might be interesting perspective. That might be interesting to talk about.

01:19:04.710

A.1.: I get them all the time, I mean, I mean the interesting thing about what we do is when we get so it's a bit like dragons den we get circumspect enquires about things all the time.

01:19:12.120

E.S.: yeah just wondering, if my framework can actually help them that would be great.

01:19:21.720

A.1.: in terms of barriers into our world we invented something called the Water Innovation Network (WIN) and effectively what that is a portal for ideas, thoughts and services products, etc to our business. And so, if people have an idea about ooh I've invented a widget that will help your whatever showers, water supply, treatment anything. And we encourage people to submit an active idea in a formal way, by a one page, this is how it works, this is how it will benefit your company. Goes to people in this system steering group, but then look at the opportunity and give a valid answer to the people.

But the reason that was done is because we hosted a number of events going back 10 or 12 years where we encourage people with interest in anything to do with water company to come forward and air your concerns that was issues and we found is we thought you're going to get lots of people saying complain about the quality or the taste of water or that that really keeps getting polluted, we got some of those not many, but I think about 80 or 90% of the attendees of these open events talk to your water company, were people would products to pedal us. I saw a bloke in a pump or pumping station or went to your local offices and they didn't want to know, and this is really valuable, you could say this widget will save you money on this that and the other or whatever it was and you guys sent me away what you're thinking about this is brilliant. Well that is their perspective perspective. It's a bit like dragons den but there wasn't a dragon's den. It was just like 6500 employees at the time or whatever is now and they just found haphazardly one of the and said what about this as if they were the right people to talk to, and then they got blind response from somebody walking with an [] Water jacket on do you want to buy this widget it deals with chlorine and he says I don't know what you are talking about mate.

01:21:24.660

A.1.: there was no there was no there's, no, no procedure, no place, but now there's there is governance around that who goes where who gets informed of what so it's controlled and managed much better. So we have been guilty opportunities for us do better. And then that that's working very well, but thing, but the small business that you work with currently I have done over the years, with lots of small outfits ladies, gentlemen, good ideas, who formerly couldn't get into our business because they talked to the wrong people got sent away numerous times - finally, broke in by getting referred to the innovation department ultimately and thank God for the innovation department who are prepared to look at it.

And big biggest barrier of all to some of the clever ideas and missing from our procedures, was the opportunity to collaborate and stimulate the development of very good ideas, because people like the ingenious folk that come up with things generally have limited funds and an even if they do have some funds and could do something they've got often poor fabrication skills and ability and absolutely zero commercial nous.

They often do something clever, I'm taking this to a big company like Siemens Electrical to show them, and we say have you got IPR on that, have you copyright and patented it, no. We say are you sure you want to show it to them, because it can plagiarised, borrowed, copied, whatever you like. And then they say yeah but only I know how to build each and I say don't be too sure they can do all sorts. And then we try to help them, but not we're not interested in terms of our general approach, we do not, we have a unwritten policy we don't try to plagiarise anybody's ideas or thoughts, we support them on the basis we don't want to go down that route and also we don't take IPR. We talk about it in procurement teams. My former head of department had this philosophy that if you start taking people's IPR and benefiting from it, it gets known and people know that [] Water are a don't go to company for sharing ideas.

01:23:37.470

E.S.: ok yeah benefit for a short time win

DS: the company will help you develop and partially funded and sharing maybe the success of your involvement in something and benefit from its use, then that's great, but if it's stealing our ideas and take the credit, no thanks. We know water companies that have done things over those other lines and it doesn't go well for them really. It's an interesting perspective.

01:24:03.900

E.S.: I'm embarrassed I've taken so long day interesting to listen to. And it's been really helpful so I'm very grateful.

01:24:12.750 --> 01:24:17.670

A.1.: Well if I can help again. It's nice to talk to academic and intelligent people do get to talk to.

01:24:18.150 --> 01:24:19.350

E.S.: You may get that later in the day!!

01:24:21.090 --> 01:24:22.410

A.1.: To help you with a PhD and so.

01:24:22.470 --> 01:24:28.950

E.S.: So I'm really grateful really kind of you and but very appreciative but I'll let you get back to your day

01:24:31.320 --> 01:24:32.520

E.S.: But take care, thank you.

769

01:24:32.670 --> 01:24:33.570

A.1.: Take care. Thank you, bye.

B.2. 3rd June 2021 10am

Initial chat and pleasantries not transcribed.

Ensured that participation sheet was discussed and agreed. Pressed agreement to video record and proceed on zoom.

00:00:05.549

ES: So this is my PhD project, which is on the subtle impacts of governance on water and wastewater infrastructure projects and I'm gathering people's experiences at this stage to take the project beyond just an academic reading into what people are finding, what their experiences are, and just gather some sort of deeper intel, if you like, on what it's like.

00:00:39.00

ES: We've had a chat very informally and I wouldn't use any of that information, but the idea is this sort of recorded interviews are just a way that I can use the data in the thesis, and so we have to go through an ethical procedure, I have to tell you how I'm going to use the data which is anonymized. You won't be identified, either directly or indirectly, [] won't be identified and it's just really as an intel gathering information exercise and the purpose isn't a hatchet job on anybody. The purpose is to be helpful. And so this isn't one of those controversial projects, it's actually quite straightforward.

00:01:25.050

ES: So I've got a few questions and really. At this stage of the project, it's very much about just listening to what people's experiences are rather than me doing too much key question digging.

00:01:38.790

ES: So I wondered if we could talk about, to start off with, a project that you have been involved with, that you think is particularly good, particularly bad, or particularly interesting, or something that just comes to mind, just to get the ball rolling on projects that you've been involved with something in particular.

00:02:02.280

B.2.: So one of the quite exciting projects at the moment is dealing with wastewater going to []. Very seriously impacted by eutrophication both from agriculture and wastewater and such that the whole ecosystem has switched from an eel grass salt marsh natured ecosystem in the past century to one that is increasingly natured by an algal base ecosystem.

00:02:43.980

B.2.: There needs to be a massive reduction in nutrients going into [], particularly from farming but also from the wastewater industry and [] is the major, most significant part of the waste water industry by a long way.

00:02:59.370

B.2.: And the most significant works is [] Stream Works which discharges directly into an embankment within [] so that's particularly badly affected because there's very little mixing of the water there.

00:03:09.720

B.2.: And what you do with that wastewater: in the past or currently it's treated to the requirements of the Urban Wastewater Treatment Directive, but that is nowhere near good enough to improve the water quality in that part of []. So the options are to improve the treatment even further, which is costly, particularly for nitrogen, and has a big carbon footprint.

00:03:35.250

B.2.: And you also need to remove phosphorus. So you can do that, which involves additional capital infrastructure and quite high running costs. In fact, I think [] Water say Poole Stream Treatment Works is their highest cost treatment works that they've got because they're removing nitrogen and that will obviously increase if they have to go through a lower standard.

00:04:01.830

B.2.: At the same time, they've got emerging issues coming forward: micro plastics, so for example being very good at dealing with those, chemicals, pharmaceuticals, and what's very much in the public eye, storm overflows.

00:04:16.410

B.2.: All of those things are coming down the road, and although probably when it first established way back in the last century, it was on the edge of the town, now it's within the town and it's got very little capacity to expand. So there are massive constraints on the site in terms of putting in new treatment, as well as it being one that's grown by proxy over the last 80 odd years maybe. More and more treatment has been added so it's not very efficient.

00:04:45.870

B.2.: So that's the problem. The easiest thing would be just to chuck it out to sea. But there are environmental issues, a lot of the near case is designated for its marine wildlife and habitats, so you need to get beyond that. There's no point just putting it out off the [] beaches, because that's just not going to be acceptable to the politicians, particularly economies based on the beaches and tourism so you've got to go a long, long way out to sea. You've got the construction costs and a consultant said that basically, the only way you're going to deal with this is a bore tunnel. You can't bore it underneath the conurbation very easily because you need a 35 metres wide shaft a bit like the Thames Tideway Project, so the only way is to basically start somewhere else, on the other Purbeck, bore the shaft there and bore back to Poole Treatment Works and then bore out to sea.

00:05:49.470

B.2.: The cost of that initially 525-550 million. Yes, enormous. So that's where it was a little while ago and that's what the processes that are set up lead to, those two options. But there was a third option that didn't really sit comfortably within the various processes that are set up by the water industry and Environment Agency, and that was to transfer it inland which seems a bit ironic, to the River [A], which is not far away. Which would open up the possibility for a new treatment works constructed there, more modern treatment works.

00:06:34.410

B.2.: That in itself creates problems, because it obviously puts a lot of nutrients into the River [A], but there is a game changer in that the water company that abstracts from the River [A] further downstream has identified that it needs more water in the future, and the only place at the

moment, you can get that water is from the River [B], which is a SAC¹, and we've said that would breach environmental standards of that especially as a special conservation river. And it is probably already being breached by the amount of abstraction at low flows.

00:07:14.760

B.2.: With climate change, they're going to need more water and here you have a large sewage treatment works with a guaranteed supply of water. And so, if you can transfer that water to the [A] and then abstract it further down the [A], because the [A] does something quite funny, it actually runs parallel to the coast for quite some distance before discharging to the site. So basically, it will transport the water across behind [] to this other water company.

00:07:47.670

B.2.: And it ticks quite a number of boxes. One, it gives the water company a better supply of water. It allows it to abstract more water from the [a] rather than the [B] so it can reduce the pressure on the [B]. It would also mean that at the moment, the water company, this is [], which is now part of [] (just to explain the setup, that was two small private companies in the distant past which then joined together to form [], which then went through various buyouts and ended up in [].

00:08:26.520

B.2.: But effectively, the infrastructure of [] is very much similar to the original founding water companies and you've got [] abstracting from the River [B] and supplying the East side of the [] conurbation. And then you've got [] abstracting from the [A] and two chalk streams, and supplying the West side of [] from its treatment works. And there is not a lot of resilience to move water from one place to the other, so if you reduce abstraction from the River [B], that treatment works has got no way of getting alternative water from anywhere.

00:09:14.130

B.2.: But with this scheme potentially, if we can get through all the processes, you'd build a new abstraction pipeline from the [A] to the water treatment works on the [B], and therefore, you can basically use both, and it allows you to reduce the pressure on the [B]. The other coccyx is the [A] is also suffering from low flows in parts of its reach because of over abstraction, and therefore, this would increase the flows.

00:09:37.980

B.2.: The downside is, is what you're going to do about all the nutrients and other things that are in that wastewater, even if it goes through processing. One of the big things we're looking at is the [A] Valley is identified for a regional park for public access.

00:09:54.300

B.2.: The floodplain is being dried out, basically, but it's low-grade agricultural land, so can we put this water through a really big wetland system to polish it off, as is done in the States. So it doesn't actually go straight into the [A], it goes through this wetland first and then, if you like, the vision would be that the water actually coming out of that wetland at the end of the day, would be better than the water that's already in the [A] at the moment.

00:10:25.050

¹ Special Area of Conservation

B.2.: Obviously the land ownership is an issue. We've got the National Trust homeland down there, which looks promising, but a lot of it's a scheduled ancient monument which becomes a bit of an annoyance. That archaeology just happens to be exactly where the wetland might be best suited so we're going to have to look somewhere else. The other aspect is that there is a scheme through development that new development must offset the recreational pressures that go on to the [] Heathlands through building more houses, which means you've got provide more public open space.

00:11:05.130

B.2.: And the [A] Valley running behind the conurbation is an ideal place to have large open space, but most of it's inaccessible; it's in private ownership. So there is also the possibility of bringing in developer contributions to open up this land with a wetland, which doesn't necessarily need to be a reboot from one end to the other, it could be a series of streams and lagoons and meres and things like that, with dry land, so you can have a very big project here that ticks lots of boxes.

00:11:38.280

B.2.: It takes that major wastewater source out of [], it adds to the flow in the River [A], which is suffering from low flows during dry weather, it provides a guaranteed supply of abstracted water right down the bottom of the [A], it links the two parts of the water company together so they've got more resilience in terms of where they take their water from, and potentially it provides a large wetland with public access, close to a conurbation, thereby potentially reducing the amount of visits that happens on the Dorset Heaths and causing disturbance to breeding ground nesting birds.

00:12:17.370

B.2.: So that's a big project. Going through all the processes for the two water companies that are involved here, [] Water and [] Water, they're getting through their process and the process that Ofwat require, getting it through the agency statutory processes, a scheme that basically, if under current statutory process through the Water Investment Environment Program, everything sort of is very much is a one hit wonder, so you basically say improve the sewage works with this amount, that treatment, that result.

00:12:55.770

B.2.: It's not very good at seeing a big picture, multi-benefit scheme that involves lots of elements and more than one company, and involves not only wastewater, but water resources. The process isn't designed to deal with something like that. It'll examine each little element on its own, and does it stack up without looking necessarily at the big picture. Now, the Environment Agency and water companies recognise that WINEP, Water industry Process Water Industry Environment Plan is very tunnel-visioned, it doesn't look at these big ideas.

00:13:34.200

B.2.: And this is one that I put forward as basically testing a new process, though they actually provide, doesn't see all the benefits: the benefits to water resources, the benefits from water quality, the benefits for relieving recreational pressure on the heathlands. And the benefits to climate change and reducing abstraction from chalk streams by reusing wastewater.

00:14:02.550

ES: So it came from you, did it, []?

00:14:04.350

B.2.: Well, I can't claim 100%. All they said that this is very soundly put together. I identified that transferring the wastewater to the [A] was probably the most likely one that was doable without having further environmental impacts. Then some completely unrelated piece of work on the River [B] and the amount of abstraction going on there with the water company. Because recently on the [B] the water company was proposing to transfer more water from the River [B] across to Southern Water, which has a dire water shortage because the abstraction curtailments on the Test and the Itchen. And then I and my colleague started looking around closely and said hang on a minute; the River [B] SAC has exactly the same, if not more designated features than the River Itchen SAC, and the abstraction there is being pulled back to protect those features when the River [B] has the same features and there is no constraint on the licences on reducing abstraction at low flows.

00:15:17.220

B.2.: And that doesn't make sense. Because that abstraction license on the [B] were looked at some 10 plus years ago, whereas the ones on the Itchen have only just been reviewed and gone through a legal process which was tallied and found okay. So when Southwest Water looked at it and suddenly, their consultant said yes there's an issue here, we certainly can't abstract more water and we may actually be over-abtracting in relationship to the wildlife needs at SAC already.

00:15:48.180

B.2.: So it was that, then you started to link up if you if you need more water to supply [] with and you needed to get it to the [B] treatment works, and you had this waste water stream in Poole, you can then start to see that actually, these two can go together. And it wasn't just me that made the link, some people in a water companies made the link as well.

00:16:15.090

B.2.: So it's very much now being led by the water companies as a possibility, but we're sort of bringing in this idea of a wetland and looking out for the planning authorities and their needs to provide mitigation land for new development for public open space. So it's basically [], they're sitting in and seeing all the different... we've got these contacts between the water companies, the Environment Agency, the planning authorities, the designated sites and what they need, tying in all that knowledge and bringing it together and bringing the people together and putting in ideas. So it's really being led by the water companies and does it stack up financially?

00:16:55.830

ES: Why are the water companies interested in this option?

00:17:09.330

B.2.: I think, well, one is, [] Water can see what's going to happen in terms of increasing need for treatment at [] stream Treatment Works, and that is going to be costly. And the idea of spending 450 million pounds putting this out to sea it's just nonsense probably. And I think politically it's not going to get past the political test, with [] BCP Council, in terms of the potential economic impact if the water companies discharged more sewage down the pipeline for whatever reason.

00:17:52.320

B.2.: The impacts on [] beaches in the media if they found out that there was raw sewage going off the beaches, which has been enormous, so they'd probably say that the risk is just too big and.

00:18:09.030

ES: So the alternatives aren't financially viable?

00:18:13.560

B.2.: I think this is it. The alternatives... it's what is the best one. So [] Water can see that there's a need for more treatment and it's going to be expensive, and they ultimately are... they've got pressure coming from three directions: they've got pressure from the regulator in terms of meeting constraints, they've got public reaction and what's going on in terms of water quality, which may not be the biggest issue, still mobile flows, in terms of pollution, but it's very high in the public interest.

00:18:56.640

B.2.: _____ There's a change in attitude now, I think as well on that, so that they're very sensitive to the public reaction towards them. And then they're also responsible to their shareholders. [] Water happen to have a foreign shareholder, another company based in Malaysia. So you've got this dilemma between potentially rising costs and expectations and bringing in income to the shareholder.

00:19:29.850

B.2.: And so they're always looking at what is the least cost solution that meets those three on that on that side. And then for the water company, it's got to abstract, but it's likely to have a rising water demand with climate change and population growth, but also a reducing water availability in the environment and because of climate change and stronger regulation in terms of protecting chalk rivers.

00:20:04.440

B.2.: So it needs to look at where it's going to get this water, and you are often talking about planning in horizons of 20 plus years. I mean, if this scheme gets to go ahead, we are talking about a 20 years sort of scheme because of all the pipe work and potentially land works and land acquisition and so on.

00:20:30.210

B.2.: So all the water companies have got quite a strong driver. What clearly is not possible is just business as usual, because business as usual means that the river state is polluted and there is a rising expectation of that is just not on. And [] Water: where are they going to get additional water from other than taking it out of highly protected chalk river?

00:20:51.090

B.2.: So the question is, why are you doing that, why aren't you getting it from somewhere else? And yet you've potentially got all this wastewater that's not being reused. There's a public perception about reusing wastewater, but by putting it through a wetland and then send it around 5, 6, 7 miles of river before it's abstracted again is no different to what happens on the Thames, where it's discharged and re-abstracted three or four times possibly before it goes into the sea.

00:21:19.200

B.2.: So those are the main drivers, I think, that stack up. Next, looking each individual part and finding out how it will be financed, and whether it can get through the regulatory processes both from the Environment Agency and OFWAT, who basically regulate finances of the water companies.

00:21:37.980

ES: You're really turning wastewater into an asset, aren't you?

00:21:41.490

B.2.: Yeah, you're turning wastewater into an asset here, which should tick the boxes, but OFWAT is very sensitive to government guidance and things, and certainly the prevailing government attitude in the past has been keeping water bills as low as possible as people don't have an alternative. That's slightly changed as there are now social tariffs for those that find it more difficult to pay their water bills. But it's not like you can go to a different supermarket and buy something much cheaper. You can't, you've got to get it from that water company.

00:22:19.050

B.2.: So there is this dilemma, there's always this dilemma in the water company between keeping the bills down, and the government will set through OFWAT how much they need to bring bills down by, and at the same time they're trying to make a return to their shareholder, so they've got that pressure. And then you've got the environmental improvements which costs money. And it's on balancing all those together that the water company needs to come to a decision. At [], we're in a position to try and make sure what is required for the natural environment is in is in that frame with ... advice on the other aspects.

00:23:01.320

ES: You've touched on this already, but what do you think the biggest hurdles for this project are? It doesn't sound like it's a technical problem.

00:23:11.820

B.2.: No technical. The biggest hurdle is probably going to be land ownership and acquiring land in the [A] Valley. I suspect another hurdle will be with the Environment Agency in that there is going to be a balance of impact on the River [A] and relieving impact on the River [B]. So the River [B] is in a better state now than the River [A] but it's not where it should be, especially as a special area of conservation, so there's going to be that tension within the agency of achieving the objectives of the SAC, which it already meets its WFD objectives, and potentially not meeting the WFD objectives of the [A].

00:24:04.890

ES: And also the enormity of it, the cross jurisdiction.

00:24:10.890

B.2.: yes, yes I mean we're talking here of two water companies, two planning authorities, the Environment Agency, OFWAT, and [], and then public pressure groups. There are a lot of benefits there, but a lot of public authorities that will have a regulatory say. But I still think the biggest struggle is the land ownership in the [A] Valley. Will we have the land to do this. So that to me is likely to be the biggest single hurdle.

00:24:55.230

B.2.: That might be something that needs to be released through the Development Mitigation Scheme, because some of that land, though not necessarily in the right place, is owned by the estates that want to develop some extensions, for example. So you just see then it widens out even further.

00:25:15.900 --> 00:25:23.880

B.2.: You haven't got a lot of flexibility where you can potentially put a new sewage works or at least partial sewage works if you retain some of the treatment capacity at Poole. So you've not got a lot of flexibility there, and the wetland's got to be somewhere close to it before it discharges to the River [A], so looking at the valley, there's only about three or four parcels of land that are potentially usable. Because it has ironically, a restoration scheme that's been drafted for that area, but no money to implement it. So there's another link going on there with the river restoration scheme.

00:26:01.620

ES: But the water companies are driving this now they've got the idea.

00:26:06.270

B.2.: Yes, they're driving it because they can see that there are these pressures coming down the road, and government has basically given directions to the water companies to improve their resilience on climate change, particularly on the water supply side, because that's what really concerns government. They don't want another 1976 situation of stand pipes in the streets.

00:26:38.940

B.2.: Yes, so you can see that that is just not going to go down with them. But then, conversely, there is this thing that most water companies now claim as a good thing, that there would be no water restrictions, even during dry weather. So all the water companies have been peddling shall we say putting to the public, one of their performance commitments, is that there aren't any hose pipe bans and things like that, which sounds great if you're a person on the street, but that comes at an environmental cost.

00:27:18.600

B.2.: I think that's going to be the next thing: public expectations. Probably with climate change, you're going to have to change. It can't be an expectation that you can have as much water as you like whenever you like, regardless of what the situation is in the environment. Now, how that shifts- because there is a public expectation and there's a performance agreement from many water companies that advertise quite openly that there have been no hosepipe bans for the last 10 years or whatever.

00:27:49.020

B.2.: And how you gain that shift in public perception... but you can't have as much water as you want whenever you want, particularly during severe droughts. That's going to be a tricky one. And that's probably going to come to some way of changing also with metering. Another metering becomes smart- at the moment some of the water companies have very low levels of metering. They've been looking at smart tariffs, where you pay by the amount of water that's available in the environment; so as the water gets scarce, the cost goes up. There might be a base price and then above that you pay more. So you work out how much an individual or individual property need on average consumption, which might be 100 litres per person and that comes at a base price, and if you want more than that, you have to pay a hell of a lot more. I think the question was asked why should somebody that's got a young baby and washing their baby be paying the same price as somebody that's filling a swimming pool of water during that period of dry weather.

00:28:56.010

B.2.: That's a difficult one to answer, why the price should be the same. So I think there are going to be some changes there in the distance. When they're going to come in I don't know. At the moment, all the companies in southern England are struggling to find where they're going to find the water with climate change over the next several decades, because, as I mentioned, building new water supplies and the treatment of them is a multiyear investment. You just can't suddenly switch them on. So they are planning 20, 30 years ahead.

00:29:42.990

B.2.: And what they're seeing is that the what the '76 drought, and there have been a few other droughts, those are going to become much more common. And there will be droughts that are even worse as we go through this century.

00:30:00.060

ES: With social issues, where the local governments try and look after their local populations and the social side of water, how is the environment represented? How are the ecological interests balanced? You said here we can't just abstract what we want forever; there are impacts on the environment. How do we balance that better between social and environmental?

00:30:44.070

B.2.: All the regulators have multiple duties, though obviously at [], one would be primarily for the natural environment as with the Environment Agency. But there's also an economic... and there's always caveats within the legislation if there's reason for overriding public interest, or of the social needs that they override environmental part.

00:31:12.780

B.2.: And balancing that can be a tricky one. People might argue the balance has gone too far towards the economic interests or it's gone too far towards the environmental interests. And companies are always in this dilemma. It's often finding a solution about that. I mean, one of the things was about water pricing... Often water prices were low on the basis of those least able to pay. And that meant the environment suffered because there wasn't the money there for the investment, or not as much as they could be.

00:31:45.690

B.2.: The water companies are very focused on the international markets and borrowing's pretty cheap at the moment and has been for quite some time. But it basically kept down the amount to spend water companies could do on improving their assets or replacing their assets. _____ So companies have been very good at replacing water pipes because there's targets set by OFWAT on leakage.

00:32:17.520

B.2.: There is nothing like that on sewage infrastructure. And so many pipes don't get replaced until they're just fail basically. And I did see recently a report that, at the current rate of replacements, sewage pipes are expected to last something like five to 600 years, which is just a nonsense. But it's hundreds of years, because the rate of replacement is so low because the money hasn't been there; it's hidden. And yet, these are leaking all over the place. And various science reports show that, in some areas, particularly older urban areas, where we've got raised nitrogen levels in the groundwater, you see these hotspots under the cities. And it's not from agriculture; that's from leaking sewage pipes and urban drainage.

00:33:02.340

B.2.: There's a study done, must be over 10 years ago around Southampton, that showed this hotspot of nitrates sitting underneath Southampton. So there is this issue about investment in replacing infrastructure. And it is quite a tricky one because, if you're investing in infrastructure, you're not making as much profit as you could be, and some companies, notably Thames in the recent past, exploited that by running their infrastructure, their pumping systems on their sewage works until they failed and they'd polluted the River Thames and then replacing them. And they were basically caught out by whistle-blowers. It was a company that was not directed to replace the pumps all the time but to wait until they failed.

00:33:45.540

B.2.: And that caused enormous pollution incidents on the Thames, and they got fined multi-millions of pounds. But that was clearly something to try and increase the profit margin of the company by not replacing it until it failed. So you do have this, and that was very open because it was going down the river; you can see it going in the river. But when it's sewage pipes underground that are leaking like crazy, that's more difficult. The converse of that is, the more sewage that leaks out the pipes, the more water gets into it when there's a lot of rainfall through high ground water levels. That then goes to the sewage works, and the sewage works can't cope because there's too much water. A lot of it comes from groundwater or rainwater. And therefore you got storm water discharges which the public equally don't want.

00:34:38.190

B.2.: So you see, there's almost within there a check and balance. If you're not dealing with your sewage infrastructure, then you've got a bigger problem at your sewage works. And the public don't want sewage works overflowing into rivers, which now people have pretty good resorts to swim in or recreate on, but the advice is don't do it because quality is not good enough. And marrying all those up is going to be a difficult one, but primarily, and this is where we've got an advantage now that advances is with what companies having to introduce these social tariffs... It means that those in society at least able to pay their bills have a much better ability to pay a lower bill, and you're not basically forcing it down.

00:35:21.780

ES: So you're safeguarding the most vulnerable and making the others who can afford it pay more so you can get what you need.

00:35:30.060

B.2.: That's where the water companies are working with citizens' advice, social services, the local authorities. So all these things start to come together to play that play that out. But you've still got the situation where some companies have very, very low bills and, therefore, if they are to invest more, it reflects quite highly on the percentage increase. Like in Portsmouth the water bill is on average about 100 pounds, which is... most of the others are nearly 200. If you're going to invest more there, you're going to get a big hike in percentage increase and that doesn't go down well with the public.

00:36:16.530

B.2.: And part of the water industry has to be aware, through its customer committees, how it shows to OFWAT how it is taking the customer wishes into account. It can't take them into account all the

time. But it has to show, in terms of what it's doing and it's investments, that it is meeting customer expectations.

00:36:44.010

ES: In your personal dealings with the water companies, do you feel that they want to do the right thing?

00:36:55.170

B.2.: Well, they say they want to do the right thing. Or I think it rather depends on where you are talking in the water company. Doing the right thing is high if you're dealing with their environmental services as you might expect, and it can be pretty high with their engineering sections. When you get into the director level, particularly the finance director, doing the right thing for them is slightly different to what doing the right thing might be in the environment section of the water company. This is only a suspicion, but they are much more looking at the financial structure of the company, the return to their shareholder. That's their priority of doing the right thing.

00:37:52.050

B.2.: We had an incident about six years ago to illustrate this, where a whole range of sea improvement schemes were approved through the normal process within Environment Agency and became statutory drivers for the water company in their draft business plan. And then the water company publish that, and then it got the directions from OFWAT as to what was the allowable in terms of price rises or cuts in the water bills.

00:38:25.110

B.2.: And I got a visit as did the EA, from a quite senior member in the water company saying we can't afford to do this; we're going to cut all this out because we can't meet bills, even though they are regulatory schemes. And that had come from, I understood, the chief executive and finance director. That was the decision that was taken somewhere in that area. And that was a problem for [] because the water company was basically saying we are not going to do what regulators told us to do, because another part of government has told us we've got to keep bills down to this level and we can't afford it.

00:39:11.100

B.2.: There was a stand off for quite some time about that. But the water company's not just relying on its bills. The Environment Agency stood its ground and said no, you've got to do these. These are regulatory improvements required for the environment. And they've gone through the process and the water company backed down. It did cut out some of the ones which were discretionary. But those which had a regulatory driver, either because it affected a NES or European site, or were framework directed, were done.

00:39:42.390

B.2.: And presumably, it had to borrow more money on the private markets, I don't know whether he did that, but it did say it cut down its return to its shareholder to afford that. And similarly, I've seen that elsewhere. Portsmouth Water had targets to meet leakage and they were failing. And there was more and more concern from the regulators that they were failing. And essentially, OFWAT basically told them, in no uncertain times, you've got to meet your leakage target. And miraculously, millions of pounds came from nowhere and the return to the shareholder was reduced. The company took the hit on its profit margin.

00:40:25.890

B.2.: But it takes that sort of pressure. So you do have these competing actions within the water company. And that's why you also get the politics around water, about whether there should be private companies, whether there should be public interest companies, not for profit companies or not. So there's a lot of politics going on here.

00:40:49.140

B.2.: I go back far enough to know that when water companies were privatized way back in the 1970s, the government was in no fit state to finance the scale of investment. It happened for that reason, but now... it's similar to railways; should they be a public good or not. So you've got these pressures. And I would say this there's a fair bit of greenwash within the water companies. They'll say how much of their SSSI land they are managing well, achieving the targets for SSSI land.

00:41:30.900

B.2.: But they don't say, actually that's a few hundred, but in terms of the amount of pollution we're causing in rivers that are designated sites and coastal waters, that's thousands hectares where the water companies directly impact on the condition of those sites.

00:41:48.600

ES: When you first started talking about this project, you said that the setup pushed forward two options that were quite limited. What was it about the that setup that forced those limited options? It doesn't seem from what you said that there was anything about dealing with the source of the problem; they seem very end of pipe solutions.

00:42:16.260

B.2.: Very much the setup was aimed at the solution: how do we deal with this, we've got a problem here. But it isn't looking at these other problems or opportunities all around that geographical area. Is there something that can provide multiple benefits on multiple solutions. So the process was not as it currently stands in the last asset management plans for WINEPS. So you have a water industry environment program, which is a statutory program that's determined by the Environment Agency which the water company must do.

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B.2.: Once it's approved, it comes out of the asset management plan for the company, which is a statutory driver. And then it's got the voluntary things that it does as well, which is performance commitments. If it has targets, OFWAT may agree to a performance payment if it meets those targets, and so on. The Winep was very much end of pipe results, so you had a single problem and the sewage works and how do you deal with that sewage works.

00:43:28.410 --> 00:43:45.360

B.2.: So it has moved a little bit from putting in a piece of hard for treatment to wetland, but there's still an issue that the way the regulatory setup is, wetlands aren't same as a piece of machinery or dosing with chemicals that gives you almost any expected result. Different things in different seasons and different years, and currently the regulatory system doesn't easily allow that flexibility. It says, you have to meet this level.

00:43:57.930

B.2.: There is slightly different setups in other countries, and I think it's something that water companies and the Environment Agency are struggling with at the moment that's on regulation. We've got a number that you must meet as an average. If you're doing these natural solutions, you can't guarantee that. So that is an issue still being looked at.

00:44:23.250

B.2.: So it's: that river is failing on its ammonia target, it's due to that sewage works, what are you going to do with that sewage works, sorting that out. We've been slowly moving away. Some of the ammonia is actually coming from livestock farming; can the water company help the livestock farmers, rather than putting in hard infrastructure. So it's starting to break down that that single focus problem and solution into a broader look at the environment. And that's the problem; where is the problem coming from and how can sectors work together to solve the problem?

00:45:02.460

B.2.: There's also the danger in that, can the rich polluters be allowed to pollute? Can the rich polluters pay to pollute by providing funding into those polluters that are less able to deal with their own pollution? You can almost say that offsetting, which is what the term is, if one polluter basically carries on polluting but reduces a polluter from another sector. You're basically paying to pollute because you're in a richer position.

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B.2.: So that's a tricky one. Or should each polluter be required to basically consume it sounds smoke? So there are these other issues that come into the forum now when you start to look at these wider issues. Particularly where we've been looking at it in [], where the water company would find it always got to remove _____ because there is no other alternative, some of the other sewage works... nitrogen going into the harbour comes from multiple sources. So as far as ecology is concerned, it doesn't matter where it comes from. In terms of the cost of dealing with it, it matters quite a lot.

00:46:17.670

B.2.: Should the water company pay farmers to pollute less because it's cheaper for the water company to do that or not? What should the water company to do with its own pollution? So the way that they're going at the moment, which the Environment Agency is pushing forward, is that the water company can pay farmers to reduce pollution, but only the pollution beyond which the farmers need to do themselves anyway. Which is sort of levelled the playing field somewhat, because water companies have suddenly realized that it's not such a cheap easy option.

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B.2.: Water companies been paying, for example, for farmers to put cover crops in which absorb nitrogen during the winter which otherwise would leach out. That's something that's pretty low cost and farmers could probably absorb that cost themselves. What the water companies are saying now is that farmers should be doing it anyway. You've got to go beyond that to something else that they wouldn't necessarily be doing to reduce their own pollution, going beyond what they call fair share, what the farmers need to do to achieve their fair share. And suddenly that starts to make the more expensive works at the sewage works seem a little bit less expensive relative to what you would need to do on the farmland, which you might have to basically change the farming system. So it's not just paying for cover crops; you may just not be able to have that as intensive arable farming.

00:47:51.780

B.2.: _____ crops every two or three years on the farm, which is what some farmers do because they find that low outputs still make an economic business.

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ES: Do you think the Agriculture Act will help?

00:48:12.480

B.2.: No. Everybody's speculating about what's going to happen. there are too many fringes for us to ever hold a discussion on that in terms of trade deals; Australia's in the news at the moment, farming... We've got the single farm payment disappearing over the next five to seven years, I think it's something like that, and that's worth, depending on who you listen to, between £21 and 27,000 on average to each farm.

00:48:38.370

B.2.: There is big agribusiness that stands to lose a lot of its _____, you just think of all the big toys that farmers have bought over the years, based on that £3 billion per year, the EU subsidy that was provided, paid for initially, by the government of course. So there is going to be changes in agriculture, just what happens I don't know. My speculation: I think we'll see it going in two ways. I think we'll see intensification or more productivity in some farms and we'll see extensification and diversification on others.

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B.2.: It may well go both ways. It's going to be an interesting time. Regulation is probably going to be quite important as to where there's going to be 10s of thousands of individual decisions made by farmers as to which way they go. But some are making that. We're seeing that with the biggest estates that are turning into bigger estates, they're looking at what the future holds over the next several decades. Some are talking about diversification into partial rewilding schemes and they're seeing the money that's available for recreation.

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B.2.: So I think we might end up going that way. At the same time, government's pumping more and more money into carbon capture, woodland planting, peat land restoration. So there's lots of competing pressures here. _____ And the farmer also just wants to make a living. _____ And at the same time, there's still expectation of basic foods being relatively cheap in terms of your overall bills.

00:50:21.900

B.2.: So it's almost reversed, as I understand it; the amount of the household bill that was spent on food in the 60s was the largest proportion of the lot. Now it's the rentals that's become the largest rental and mortgage. So there's been a shift in terms of what the average household budget is spent on. Food is now relatively minor from what it was in the past. So there is the argument; the cheap food is being paid for by environmental degradation.

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B.2.: That's huge. And then you've got the counter argument that we've got a good regulatory system, it's a relative productive country in terms of its soil types and its climate. If you extensify here, does that just not push the cheap food production into areas where there's going to be more

damage to the environment, into South America and places like that. You can see more deforestation caused by soya products and beef production to feed the European market.

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B.2.: But it's a really difficult one. Fundamentally, the aspiration that you can have meat on the table every meal every day and it's cheap it's probably going to have to change eventually. That's the really big one.

00:52:14.310

ES: Someone said to me once that infrastructure projects, water infrastructure projects, tend to get done in rich areas not poor, so I'm just conscious of []. I don't think there's a richer area in the country, there certainly didn't used to be. Do you think there's any truth in that?

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B.2.: Well, I think there is some truth in that. Recent studies from America show where waste tips are located. A very high proportion are in the most disadvantaged communities. Now I'm not saying that we have the same planning systems here as they have in America. But there is a degree that I think you could say that that occurs. But at the same time you look at where the pressure has come from for, conversely, let's say bathing beaches, which has been in the old industrial area on the Wharf, so I don't think it holds true all the time. But there is an element of truth in there, but those areas that are socially deprived tend not to feature highly in terms of where money is spent to improve the environment.

00:53:51.990

ES: Someone said to me, I can't remember who it was, that people focus on chalk streams because that's where rich people live. I'm paraphrasing.

00:53:59.040

B.2.: Certainly a lot of rich people live where there are chalk streams.

00:54:00.720

ES: They could perhaps tend to have a higher profile than perhaps other river systems that could be more worthy. And I don't know if there's any truth in that or not

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B.2.: There are other systems that are perhaps as worthy but they tend to be in the uplands where not many people live. I think that's just a geographic accident. There are chalk streams that are in pretty deprived areas. I mean you've got Wandsworth in London, which is terribly impacted. But then again it does have a restoration scheme, so money is being spent on those areas. But you can see the fact that there is a high degree of truth in that. You can see that the pressure to bring down the abstraction on the Test and Itchen was substantially driven by the pressure coming from the Salmon and Trout Fishery Organisations founded in the more wealthy part of society. That's not say that there are people less wealthy that also...

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B.2.: But you can certainly see that that is where the pressure that comes in is. Certainly in the old industrial areas, the increases in water quality there have been largely driven by the offshoring and manufacturing, which has gone, not by pressure to sort out the pollution. Then replaced by cheaper

manufacturing, particularly in Asia. So I think there is a degree of truth there, but there may be some levelling up with the Internet, people able to use social media. So I won't say it's a universal norm; there are exceptions.

00:55:47.850

ES: Another question I had, another difficult one. I asked people at the end of the interview if there's one thing they could change about the governance system, whatever it may be that they're involved with. What changes would you make? You can have more than one. If you could bring about this project that you're talking about. It can be impossible, but what would it be?

00:56:23.430

B.2.: Actually, this might be a bit obscure. I would want to reduce the sheer amount of bureaucracy that happens, not only in the public service but the water industry, because it takes up so much of saps the resources when people want to achieve things. The one thing I would change probably is management structures in organizations, because the more you end up being top heavy, the more bureaucracy you see. That's my personal view.

00:57:02.490

B.2.: There is so much potential that's being held back at the front lines because of dealing with the sheer scale of the bureaucracy that goes on. The processes that have been dreamt up now are just colossal. I just look at the water industry investment process. When I started, AMP3, AMP4. It was relatively simple guidance, you could digest it relatively easily, it would sit in a small pile on your desk. With computerization, which is part of it, it would be almost to the ceiling if I tried to print it off, the guidance that's been produced. And there's sometimes guidance on the guidance. So you've got this issue of these increasing bureaucratic processes that sometimes stifle innovation. And it might be over precautionary, I don't know, but it just pervades everything.

00:58:01.980

ES: You've got many targets you can't reach all of them. You have to choose which target you hit.

00:58:08.580

B.2.: Computerisation is limitless in what it allows. So whereas previously, it was limited by what you could actually physically do on paper, now basically the brakes are off. Sometimes people say we need more resources, we need more people, and I look at it and looking back 40 years, and I'm saying well actually, we've got more people now and we're achieving less. What we're doing, it's vastly more processy stuff.

00:58:41.040

ES: What drives that process of bureaucracy, what's pushing that way? Do you think it's computerisation?

00:58:50.640

B.2.: Computerisation allows it. It may be that the way organizations are structured, the way they pay that, basically, if you want to get on and you want a higher income, you have to go up the management chain. Maybe managers or those that are in senior positions need to have something to show they've delivered. And if you deliver a process and you are meeting the process, it's something like that. There's an interesting one recently about conditional SSSIs. So we had a small group in the office and we just went out and we knew that each one of us had a responsible site. We

knew we had to do them every six years and we just did them. Maybe some people failed, but that was a management issue.

00:59:34.650

B.2.: And now we need to get basically a senior person to draw up a strategy for monitoring sites and a plan of which sites are going to be monitored and a bidding system from all the people as to which ones they are going to monitor. We created a whole process that didn't exist before, because people had a responsibility of going out and making sure those sites they were responsible for were assessed every six years.

01:00:06

ES: How do you overcome the bureaucracy?

01:00:06.780

B.2.: I just ignore it sometimes.

01:00:18.480

B.2.: It was really simple and it's now been computerized. The complaints coming in from the staff, where it's been sold as something simple and accessible, and they say no, no it's just going to take up more and more time. It allows people further up the organization to do more and more analysis on when people are taking leave. Why is it necessary, with a computer system everybody struggles with? So there is this problem that we've got. We've got a lot of people basically pushed downward by bureaucracy. And it is taking that away, or working your way around it sometimes.

01:00:54.750

ES: Is it who you know, as well? If you've got good relationships?

01:01:01.200

B.2.: Relationships can help build those, but there are some things... But I also think it's the public service. I've talked to people I've known for a long while in the water companies, and they've got exactly the same overwhelming bureaucracy coming from above, filling in forms and justifying virtually everything that they do. And does that make it more cost efficient? Maybe there needs to be a bit more risk-taking. And allowing the people the flexibility to make mistakes, not necessarily the really big ones, but lots of small ones. Rather than basically having everything in a process. I just don't think it's resource efficient.

ES – gone over time, you've got bureaucracy to attend to.

B.2.: more importantly a coffee break

(tie up chat)

C.3. Interview Transcript 13th May 2021

Preliminary chat and opening pleasantries not transcribed.

Taken through participation sheet and confirmed no questions.

ES:so just should be recording on zoom as well.

ES: So, and this is about governance on the water and wastewater projects and the more subtle impact on projects. So I'm talking to people at the stage just about their experiences I'm not asking them to help me find problems. It's more a case of just talking I want it to be incredibly practical piece of research that's actually based on people's experiences so it's. for me just learning about what it's like and talking to me about some of the experiences that they've had.

ES: So some people find it easy to talk about one project and some people, like to talk generically is there a particular project where it's been massively successful or lots of issues or something that comes to mind, we think that that might be nice one just to chat through or.

C.3. - -: Yes, so so one probably is is probably remote working okay so that's probably the easiest one and the beauty of that one is because actually a number of projects involved in there.

ES: Okay yeah.

C.3. - -: all of which were kind of like first time development type stuff and things like that.

C.3. - -: yeah so so that's probably the easiest one to talk about remote working.

ES: Okay so that's what water infrastructure related?

C.3. - -: yeah so effectively, this is about where we're sending out our crews that were originally it was for when we're sending out our crews to do our work. yeah and how you've managed that work being passed through and coming back into your offices.

ES: Okay yeah. So talk me through what the situation was and what you wanted to move to.

C.3. - -: So it was it was actually an extremely tight one in terms of time scale so effectively what happened there was what you got to dig up a road yeah, you have to put in more currently you have to put in a permit but that wasn't the case previously. So some years ago what happened is the councils were allowed the option to move over to a permitting scheme, and the two largest Councils in our area, Sutton and Surrey, both announced roughly around the same time that they were moving over to this permitting scheme. Now at that stage, we had a number, we had a few other small councils or small areas that were part of our thing that we're doing permitting and we knew that the overheads

of doing permitting, were particularly onerous and it was one area, particularly was about providing data on what you were doing. And you had to get back to their offices, the next morning by 10 o'clock which sites and jobs, you were on, what was closed down, everything needed to be done by 10 o'clock the next morning.

C.3. - -: at the time we were on a very paper based system, okay, in terms of information coming back from the crews because there wasn't this requirement to get it in by that time. And I remember the team managing this, the manager turning around and just saying well that's it, we might as well just start writing blank cheques to the councils because there's no way that we can do this.

C.3. - -: And in terms of the time scales, it was literally months that we had to come up with a solution. Well, now I've been at the company here for 20/25 years now, and I knew that the people who try previously to roll out remote working solutions in - water, so this was some years ago, just you know.

C.3. - -: yeah people in the past had tried to roll out remote solutions, the big issue that we've always had is that we're only one office, we have Redhill, we are quite a small water company. Everybody starts in the morning at our offices and comes back in the afternoon. Therefore, there was always an argument every time you talked about remote working is well, to be honest, why do we need it because everybody comes here and everybody starts here and everybody comes back, its easy just hang onto every bit of paper. And it's really hard to justify cost benefit any other way.

C.3. - -: Now, suddenly you've got this you know they call it the big hairy audacious goal, yes, suddenly you got this thing rolling over that says there's no do nothing option, yeah, you're going to end up with huge great fines unless you suddenly come up with a solution on how to do this.

ES: yeah.

C.3. - -: And that's that was a real thing, and, and I've often looked back on that and said actually that's where a lot of innovation occurs, it is where there's no other option.

ES: yeah yeah.

C.3. - -: you've to be able to deal with that, so how we dealt with that was, for this is effectively I ran out and started talking around into interest trying to find you know what solutions were out there, and how you could do this. At the time almost everybody was using Panasonic tough books, they were quite rugged systems and things like that and identified at the time that potentially we could use phones, which was quite hard, because the iPad was quite new at that stage, and this was seen as quite a different thing.

ES: My links dropped out. Gone dead

[video frozen, link drops out at circa 9mins 30 seconds through to 10mins 51 seconds.]

ES: Should I turn my video off, and likewise that might help.

C.3. - -: might help so actually i've dropped off my corporate network as well, so hopefully that won't happen again because that's good.

C.3. - -: yeah so so effectively I started looking around for solutions, one of the big issues that we had then was the a lot of the systems were based around laptops and things like that which we're going to be really hard in terms of training up the crews. Okay, these were people that were not used to using any kind of remote working solution at the time, so you're either going to be bringing in something like that we started looking at the kind of the windows handheld systems and things like that. A lot of those were starting to be deprecated and that was quite an issue as well, and finally we I've been pushed by managers saying why can't we just use phones or something like that, and so I ended up actually talking with Google.

C.3. - -: I had a previous relationship with them in terms of stuff and they came and said well actually, we've got this new solution called Google Maps Coordinate which we're looking at which is effectively it's like Google maps but it's got forms bolted on, and it may be useful, you know it's one of the kind of applications we've been looking at maybe useful for this.

C.3. - -: yeah so looked at that and I started playing around with it and going actually you know there's there's some stuff that we can do here, so I wrote, I mean basically actually an excel spreadsheet at the beginning, worked out and I'm a coder as well, so I worked at have to do the code and we were able to start passing bits of information back and forth. And literally it took us probably from from that - we can pass information - to actually getting a system up and running - probably took us three weeks, which is a phenomenal time scale to be working and I kind of use that as an example, is because there were so many, there was such a big goal that you had to hit. There was no do nothing option, we were going to run into huge fines, otherwise, and it was how we manage that process of getting this thing up and running so quickly.

C.3. - -: Talking with, you know the Councils, and confirming exactly how they wanted to receive the information, so it was a real piece of work, to try and get everything sorted and together and in order and to get that out, but we actually did it and we actually went live I think three days before the councils turned on their permitting system and it certainly saved as a hodge load of cash. Now, one of the other bits with that is that when I actually went to see the senior management team, I said look, you know we've got a great solution here that we think we can do it with this. And you know, don't

get me wrong, they were they were overjoyed to hear that, but the instant question was what's the cost? Yes, okay, so the interesting bit here is I look I did it cost based analysis, obviously I said well you know, every time we send out the crews were sending them out with paper plans you know, we send them out with gas maps, electric perhaps everything else, like that, and these photocopies. Do you know how many how much we're spending just producing colour photocopies every year to send out with a group is this much. Using the system, I can actually pass those through electronically as pdfs and actually easier to use on a tablet you can just zoom in and zoom out yeah.

ES: yeah.

C.3. - -: very easily, and in fact we paid for the system merely by the reduction in printing costs.

ES: wow okay.

C.3. - -: yeah that was that was great, but then the other real constraints on that was then we now had to train the crews as well. Yeah so, we then had a that was a huge thing in terms of meeting with the crews and talking it through with them as well, and we engage with them very early on in the process that they've been doing some of the trials with us and things like that. And it was a big step for them, because previously nobody knew where they were to some degree, they go out and they work for the day and then they bring back their job sheet at the end of the day. Part of this was actually for the first time it would actually be saying right you've checked in and out of jobs and things like that, so it was a big issue that we had to bring HR in talk it through with them and and sat down and and go through the training. And there were some tricky questions from the goal is therefore about I feel I'm being tracked and things like this and how we dealt with all of that as well.

C.3. - -: So there was quite a cultural shift within the company as well. And you know, and I would actually say to the group so, we feel like you're being were being tracked all the time, so I would simply take my part of my neck and go look every time I go through the door in the office I checked in and out, you know. They know exactly where I am in the office why is it different for you guys. But it is that whole bit of how you deal with that side as well, and those kind of discussions that you have with people that are going to be affected by bringing in these solutions.

C.3. - -: One good bit was that because we weren't passing through customer data, we didn't have to worry so much about that side, and in fact the system kind of developed over the years, we did start to bring that in so we had to go through more governance on that, and in fact ended up changing provider and things like that, but at that stage it was very, it was pretty much location just go here and dig up the road.

C.3. - -: So that sets out the background. I imagine that generates questions and also maybe you know what you want to discuss based upon that.

ES: it's really just listen to what you've got to say I mean you've picked out the fact that governance is about informal practices and as well as sort of the legal and regulatory. Did you think that the project was a success from from what you've said and how do you define that success from it, but it being cheaper practices now and..?

C.3. - -: So, for us, the big saving there well.. Okay, so there are numbers, so let's start off, so firstly was cost absolutely there's no doubt that that saved just considerable amounts in terms of fines. We monitored it very carefully, so we can understand, and in fact what happened is that we were then held up by the Council as being the model for good practice. So we were the ones that were dragged into meetings with other contractors and and utilities and gone, look - water are able to do this, why aren't you guys able to do it, and then they'll come over and go how exactly have you managed to do that?

C.3. - -: Yes, so yes, so certainly there was there was financial, reputational is another really interesting one as well, because we did this project, because it worked so well, our reputation amongst the councils was really good, because we were the people that have managed to provide this solution, have managed to be the ones that were coming back going yep we can provide you with the information you need by 10 o'clock the next day. And we had you know, we had a very strong reputation in the Council so reputationally it was really good for us as well.

C.3. - -: The other thing I think is is what that does within a company is when you have a good project like that it opens the door. So, because we've looked you know because we had the success of this, there was an instant question that came back for the management was okay so that worked, where else could we roll this out to you then start to look at other teams that previously, you said there's no point in doing remote working with them, and suddenly it opened the doors for them having remote working as well, and now I mean you know, obviously I love with any company it's rolled out pretty much across the entire company and we wouldn't dream of working without it. But at that stage is a really big step for the company and really made this kind of okay you know this is game changing stuff we start with a small number of crews, and it was only 8 crews that we started with, and then you know it ends up, it is rolled out across your entire field force are all using remote working, but it started from that point.

ES: You said that the informal practices is seems to be where you rubbed up against the most issue doesn't sound like it's the technical that the science was there, it was choosing the science and implementing it, is that fair?

C.3. - -: There's two bits there, firstly, is the kind of the background solutions OK, so the the technical bit of getting that solution up and running, and it was something very new. At the time they just started using what's called an application programming interface it's a new way of talking. I'm getting devices to talk to one another, it was very new. And there was quite technical, burden of working out how we were going to do that yeah how we're going to want to sell it and, as I said, fortunately, I had some background in programming, so I was able to sit down and work that through, but that was quite a technical bit in terms of how we manage that and working out how to do that process, and that was because you're on a tight timescales as well, it was kind of like okay, it was very much forget forget the the waterfall it was very, very agile yeah. You know, in terms of right build something test it, yes, that works right, build test and just keep iterating through until you get to that solution. So on the technical side there was one side of it that was very technical that require quite a bit of work and input, but was done very much as an agile scheme at a time when we had no concept of agile, we didn't know what agile was, yeah we just iterated fast and then secondly was you're right the bit about the crews and and that comes because there's a simple mantra that I've had when I've worked with with my staff is whatever I do should make life easier for them. And this is what I said is look, you know if we're going to bring in this solution, it should make life easier for the staff. And that's how I sold it to them when we were kind of meeting with them and yeah there was this bit about over your tracking me and things like that was going okay but at the moment how long do you spend filling out all the forms of the bits of paper and everything else, like that yeah. Yeah we don't like doing it. Right all you need to do is when you turn up on site you press this button it checks you in on the job. And when you, when you come back from site it's here you do that, you know, at the end of the day, you will be driving past your house to all the way back to the office to drop your paperwork in then to go back home, I said that changes or you can simply do is press the button, it will send all that information back you don't have that requirement to do all these kind of things as well. And you know you suddenly start to end up with those kind of situations where they actually start to see the benefit behind it.

ES: yeah

C.3. - -: You know it's not this project but, but when I first started working in the industry I was, we had a slight issue, and this will show you the age of it, he typing pool had a number of staff off sick and therefore they weren't getting letters out okay. And I was working in developer services at the time, and my boss said look, can you come up with a way of doing standard letters for us so I wrote

something in word and it's quite simple, but he did it and we did about 10 standard letters for sending out to developers as part of the development.

C.3. - -: So I rolled this out across the department that's probably about five or six people that were going to be using this. And it got us out the immediate hole with the typing pool and got the letters going out the door. But when I rolled it out everybody said to me, you won't get Peter to use this system. Now I knew Peter he is one of the engineers there and I said okay what's going on with that and they said, Peter doesn't like computers. He doesn't use them at all doesn't like that he hand writes everything, he's not going to be using a computer. I said that's fine he can carry on doing that doesn't matter he can still use the typing pool we have just taken the strain off the system. About two weeks after I rolled this all out Peter came and sat down on my desk he said i've got a bone to pick with you, I said what's up he said you haven't installed that on my computer. I was told you don't want it on your computer. He said you're right I didn't, but I do want it now. Right absolutely but can I ask why. He said, because all the other engineers are getting their job done in half the time it takes me to do it, and then they get out and go on site, which is what we were always meant to be doing a doing all the site work, which is what we all prefer. He said, I want to be like them.

C.3. - -: And that that's where this came from. If you're going to bring something in yeah make it easier for the staff to do it shouldn't be that that huge onerous overhead. And that means engaging very, very early on, with the staff and getting them involved in the process.

ES: So you recognize that the staff working practices was a significant issue that needed to be addressed, you recognise that from your previous experiences and knowing your teams

C.3. - -: yeah so we knew we knew that, firstly, it was going to be a barrier and a blocker that they will be concerned about this. But at the same time we needed to make it attractive to them as well as the benefits to them. So what you do is we worked quite hard to make the interface as simple as possible. So when we did the training, and what was going on at the same time, Google we're also working at the same time putting out new versions of this app it was that new. And we were we were the first utility in the world to get this up and running, okay. So Google were coming up to us going what give us feedback we just changed this, how does that work for you. So we had one wonderful moment where the crews were saying, would it be great if if we could just do this and they described a feature or functionality that they wanted. Yeah they said it'd be really great if you could just do this yeah I phoned up Google and said all right, you know latest feedback from the guys is this would be brilliant if you can do that, they said we've literally just pushing out the next version now that's got that on yeah. Yeah the next morning I strolled down to the crews, and said remember that feature, we talked about yesterday they went yeah I sort of got Google to do it on and there it's on there now so update

your tablet and it will be there and I mean the great bit that they were actually feeling they were involved in the process, that their suggestions we've been taken on.

C.3. - -: yeah hey I'm working with Google. We had a new member of staff come and work for us. She's still working with us, to this day yeah husband was one of our crews yeah. He worked for a contractor and she applied to come and work for us, when I interviewed I said, why do you want to come, she said. because my husband has been showing me the app that you guys have got it when it's just so good it's so good, I want to come and work a few people because that's the kind of company, I want to work for. That's really good, when you get that kind of feedback for doing the day to day work. They're going it's really good because you're listening to us yeah. Yeah you are taking all of our ideas on and actually using them.

E S: I can't remember if you said you did or didn't have an IT background.

C.3. - -: So i'm a mechanical engineer by training but I'm also a qualified programmer as well. Okay, that kind of really helped so I wrote over the years, I wrote a large number of the systems that we use at -. Again it's almost always been based on that first experience that I had where I said okay let's make it easier so sorry Elisabeth you're getting a kind of complete brain dump.

ES: A brain dumps are fantastic.

C.3. - -: So one of the departments, I worked in when I came to - yeah so it's I told you, I was in developer services at another company, and when I came to -, I went through a number of different areas, but then ended up switching out of developer services and and when I say sort sort out, it was one of the things that company tended to do because of my background and kind of coding and things like that. They would ask me to look after a department, on the basis that I would go in, look at the current procedures and water working and then kind of bringing new solutions and things like that.

C.3. - -: So when I came into developer services they were using again very paper based system, so they had what they called the Chinese wall, because it was this huge great filing cabinet block yeah that run halfway down the office. Yeah all the files for every site and so people would go if they phoned up and said I'm calling about this site, you had to go find the file, and hopefully there'll be all the paperwork on there, and almost every day you'd hear somebody shouting out across the partitions, has anybody got the file for such and such and saw it on their desk because I got a guy on the phone, and things like that it was really quite difficult to manage, so we wrote a system, that we kind of manage all of the developer services side yeah one of the things I did on that was I bought in a document management solution. Which again we kind of customised ourselves because we wanted it to be really useful and easy for the staff to use. So they said, this is what we wanted to do yeah. So we

did that, and then we went through an exercise getting some students and we scanned everything and put it onto this system. So now we've suddenly ended up with a system that manages everything, it does the quotations for the staff. Yeah and there's documents all on one system. So again we have one old boy who worked for us and he'd actually provided quite a bit of insight into how it worked. He was famously the person that didn't like computers and things like that. We got a new director. He was someone within the company who had been moved sideways, and he came in and he started working with us. And I actually asked him to go around and meet the staff, so I said look, you know or introduce you to them all. So he starts going around the staff and, finally, he comes to this guy. And this director is somewhat old school as well, and then he turns to this guy and says, Richard, Rick its nice to see you again I haven't worked with you for years, he said I see [] has brought in all this modern stuff he says, I imagine you're probably missing the the old paperwork aren't you? So this guy, bless his cotton socks turns around and says I don't miss it at all. He said I can find everything. He said when a developer phones up everything's on my fingertips, I know exactly what's going on, he says I'm not chasing people all the time.

C.3. - -: And again, it comes back to this bit. You engage with the staff, and you know, I think there's this bit that we talked about you know agile development these days, and that kind of iterative process as been really important. So do that well and work closely with a team it's fantastic, and in fact we transformed over about two or three years we transformed how those teams worked.

C.3. - -: Because they just kept, once they got the mood for it, they will be coming out going [] can you make it do this, can you add this function, can you add that in and we just kept iterating all the time. Yeah it was really, really powerful.

ES: I suppose if you're and you're an IT background, but you're not you're you can speak the same language with your mechanical engineering that must be, a help as well, so you can engage with people and not not getting too much IT jargon.

C.3. - -: There is that as well. And then you kind of you understand how the problems work so. We often find with programmers are there yeah there is that disconnect of kind of like actually understanding the real world application of what they're trying to do, whereas because I tend to actually be managing department and doing the coding of that stage, you got a very good understanding of what you're trying to solve. But I think for me it's the iterative, is the iterative loop of going back and saying I've done this, does that make it better. Does it make it easier?

C.3. - -: And when we did the training with the guys that was one of the things I said to them is we were talking, you know, that people were saying, how on earth are you going to roll out mobile

working for the crews? Okay, because, how can I put this nicely, there was a perception that these guys weren't very IT literate. Okay, so yeah and I actually called them out the senior management and I said I said I think you'll find that they're really good at it. I said, if I bought out, I was a conference with someone, just to give you an indication, I said, if I get that, because what i've said, is in the world today yeah ITt knowledge has completely flipped on its head, so. 10/15 years ago your CEO would have a good working knowledge of excel or something like that it would have come up through the company and things like that, so we understand the excel and things like that and probably knows quite a bit more about how these things work and the guy that digs up the road. Now flip in in the other direction in terms of how we use systems. So if I got a brand new android phone okay, fresh out the box and put it on the table and I called in one of my works crews these young lads you know go out digging up the roads okay, so 20 year old guy who digs up the road and I bought in my CEO and asked them both to set up that phone. I will put my money on the guy on the 20 year old be able to do it quicker and slicker and easier.

ES: um yeah

C.3.-- it's absolutely transformed and it's recognizing those kind of things as well, and so, by using phones we actually found. It went really well because got very quickly engaged with it. And then we did some we did some clever stuff so they actually said we want some other apps on it. So after we allowed we said okay we're allowing you some other Apps on there. So the tablets suddenly that we've given them these tablets suddenly it wasn't just for work it wasn't just a horrible thing, giving them work. Yeah we put some other Apps on the copy and things like that, but then we put on like somebody might suggest and I went you know what unlike that we're going to put it on again slightly showing the age of this project, but it was angry birds. So, so we put on angry birds and and I can remember taking it into the IT manager he looked at it and, just went, seriously and I went yeah and I said, the reason why I want it on there is this, I said when you first got a computer did you play solitaire on it anyway, everybody played solitaire back in the day yeah. Yeah well that did is he taught you is really clever for Microsoft it taught you how to click have to drag and drop how to Double Click it taught you all those techniques in a game that you could then use excel and word and all the other packages. It was a very clever way of doing it. Yeah angry birds is this generation' Solitaire. Put it on their tablets, play it and end up having a little league table on who had the highest scores and how far they were. It meant the guys that weren't used to using a phone or a tablet, and there were people like, that actually could go on, have a little play and they get used to all of the skills of using a tablet by playing games and.

ES: take away this scariness for want of a better expression as well. It sounds like to some extent the regulatory system pushed a lot of these projects because they are market based, perhaps because there are you know the the privatization of water sector has its critics doesn't it?

C.3. --: yeah.

ES: But it sounds like in these sorts of situations where you're putting cost pressure on a business, it has to respond in a positive way. I can see this as an example of that, would that be a fair as-sment?

C.3. - -: I think that's a very fair as-sment, I think, a lot of the innovation not all of the the innovation I've seen, but a lot of the innovation I've seen has been due to cost or, or is either cost concerns or service concerns. Okay. It's providing that service to customers yeah or we're dropping the cost of our provision or making sure we don't get fined and things like that. And that's a huge huge driver. And yeah you know I came into the industry, a few years after the privatization had happened, and yet some of the stories I heard of of how things were. I thought I'd actually yeah I am a believer in the privatization because yeah ilve seen the benefits in terms of driving our efficiency and taking it forward. And it's interesting you know that's still so I still have that same model today i'm going to talk with the guy so one of the things i'm working on at the moment is repair technologies so I'm doing an awful lot of work on how we can innovate repairing pipes quicker. Okay. And the driver behind that is twofold it's cost and it's public service. So, if I can, if I can do an installation quicker there's two benefits number one is I don't spend so much time on it yeah. I can do a smaller hole, there is not so much to reinstate, and so my costs are lower brilliant, but the other big big bit behind it, is that my customers won't be off for so long, so one of the things I'm looking at is there's two types of technologies two ways, you can repair a pipe okay. Yeah one is called clamp and the other is cut out okay. So clamp is effectively as it sounds, something that goes around the pipe yeah and just seals, the leak. A cut out literally you take two cuts and then you join the pipe. You know you piece it through and join, put back together. Yeah, when we're doing a cutout is you've got to take the supply off to do it. So, every time I do a cut out I've got customers without water. Yeah if I do a clamp I can keep positive pressure the entire time yeah. So I don't have anything going into the pipe yeah, which is great so there's all this danger of contamination and at the same time, I can keep my customers, supplied as well. So there's huge benefits and I am happy.

C.3. - -: So that's one of the areas I'm looking at in terms of how I do it, and the first thing I did on that was I talked with a crews and sat down and said look, you know the clamps are better we talked about that and I said okay, what are the kinds of technologies, we need to be looking out for and so we've now started sourcing those. Some of those are off the shelf technologies that we've come across and we go right okay, we start to bring those in. And some are ones that we're developing from scratch,

where i'm being approached by developers going, you know we've got one of these would that be of use to you again yeah that's pretty similar to what we're trying to do here, but it would need to be this and needs to do that. Right away the first people I talked about it with as the crews because they're the guys that actually use it and understand the issues and problems.

ES: yeah well, I'm involved in Pipebots.

C.3. - -: So, and that was there, we go of course.

ES: that's it is for the future an innovation, we are getting there.

C.3. - -: Again and again, to me, I think, so that was really interesting, so I attended the pipe bots and actually now part of the. I'm not gonna say steering group, that's probably the wrong phrase but I'm certainly part of the group that is kind of feeding into it from the water companies. Yeah and part of the reason for that is because, when I attended the conference, we were sitting down talking through, and I can remember asking a question I said okay, how are you guys planning on dealing with the water transients? And they said what is the water transience. And its okay so and it's that bit of going okay here's the practical bits that you need to think about yeah.

ES: yeah, very much so.

C.3. - -: so start to base it upon the real world situations that we're aware of.

ES: yeah that's absolutely pivotal to Pipebots, drawing in so many different disciplines and outside into guiding how that project moves.

ES: you've mentioned bringing in and looking at new technology and new innovations, if you like. Some other people I've spoken to say there are actually some hurdles when they're trying to bring in something sensible sometimes from a regime point of view that it's gotta wait for I don't know the regime cycle, the PR cycle and that sort of thing.

C.3. - -: yeah there's there are a number so let's go through, firstly, money is a constraint okay and let's be, to be frank about it, we have a budget that we've set for five years that says this is how we're going to spend our money. Okay, now there are innovations, where you can come in and go okay we're going to be able to do this, you know and such like, it will save money now obviously those ones that's great that's fantastic, but some of them you've got to spend a good amount of money in order to start realizing that return. And that within a regulatory recycle can be really hard so you know you're in a situation where you go okay I've got to spend I make 200 K OK, I will spend 200 K in this regulator recycle, the return from that will be in the next regulatory cycle, when we start to get this information about when we start to use it, but hang on we didn't budget for that 200k in this regulatory cycle yeah.

It's not part of our return and stuff like so there's that side of it and so money is always a kind of starting point of can we afford to actually do this now. Having said that one of the big advantages we have now got is the innovation funding, that's coming through because that's you know really designed to get around that problem. I can apply for Innovation Funding. I put a small amount of funding myself, there's a huge return on that, and that will certainly help.

C.3. - -: So, money is a is a constraint, and certainly the regulatory cycle, but I think my gut reaction is the innovation cycle will massively help that.

C.3. - -: yeah I was gonna say the other one is procurement is framework contracts. And so you end up in situations where we you know we've got a framework with the supplier yeah and it's therefore really hard to bring in. And that has always been seen across the industry as one of their concerns on framework contracts. And I've spoken to no end of supplier companies who have got an innovative solution who have been told that, when they go an apply I'm sorry we've already got a framework contract for PRB. Okay yeah but I've got this really innovative PRB. I'm sorry but we got a framework contract we're buying our PRBs from this supplier come back in four years time.

ES: Right okay.

C.3. - -: So that is a that is certainly a problem. Now we have ones where we're going okay. And certainly I discussed with procurement on mine and I've been in situations where I go yeah we do have a supplier for this particular type of device, however, the device that they're supplying us with isn't capable of dealing with this particular situation.

ES: Okay, so you're differentiating

34mins 8 seconds

C.3. - -: I am able to kind of, I won't say get it get it in on the side, but but we don't like doing that because we prefer to have one contract that covers everything.

ES: yeah.

C.3. - -: So it is quite a tricky one is is that side of saying okay we've got certain supply we've got certain supplies and framework contracts.

C.3. - -: yeah the other big one one within the water industry, is the not invented here syndrome okay. So here we go this is, this is the famous quote on it, which which somebody said at the conference and I kind of picked up on it, because it's such a great one but it's the water industry has more pilots than Gatwick, more trials than the old bailey. That sadly is extremely true. What happens is that a supplier will come to a company and they say I've got this brand new solution system coming so that's

great we'll do a trial with you. Okay, so they do a trial and it works and it's good and everything like that, and then they go and they say right okay fantastic. They go to the next company the neighbouring water company go yeah we've done it we've done a really successful trial and they're rolling it out across their company area. And, and the next company goes that's really good yeah I think what we'll do is we'll do a trial with you know. No, we've already done trials and it works well yeah we don't quite believe their trials because we've not seen the results yeah we've only got the fact we are rolling it out. And also our water quality is slightly different or how how what type of mains we got a slightly different, for whatever reason, all situation is different, and therefore we do another trial with you and so supply chain, end up doing trial after trial after trial, all the way around.

ES: Okay there's a bit of silo.

C.3. - -: it's not even that it's it's, because it didn't come through our company yeah we don't trust a another water company. In terms of what they found. One of things I specialise in is leakage. I am the programme lead in leakage. My job is to co-ordinate the research there. Two years ago, I asked all of the water companies to share their learning okay,, and I said look we're all faced with this 15% open leakage yeah how are you going to innovate to achieve that. Because if it was a 5% job everybody would have just said I'll take on a few more staff. But 15 is so challenging that every single was companies looking at innovative solutions on how they're going to get there.

C.3. - -: We could all just reinvent the wheel, we could all just keep trying and doing it ourselves, and every new supplier comes through the door, but I said what I'd like to do is actually, let's share what we're working on, so that everybody knows. Amazingly they did. So I've got all of the companies in England, Scotland and Wales share what they're working on, not every single project, some of it is NDA stuff but they shared 328 projects. Okay.

C.3. - -: yeah I'll put the link actually for that, so you can you can download the actual the spreadsheet that came out from this yeah. Yeah before you having a look, because it will just show you the kind of you know what's going on there. But what that allowed me to do, and one of the questions I asked if I tell, you what I'm going to do is just gonna pop this up i'll share the link and i'm just going to put the excel spreadsheet up on my screen, which is fine I'm allowed to share this, because this is the publicly available one anyway. Ok so that is the link for it.

C.3. - -: yeah I just open up excel, and the reason I want to do this is because we just talking about this kind of, not built here, syndrome ok. And, and how we manage that, and one of the questions I asked them to do was not just list the projects yeah and here we go share my screen now. (shared screen). Right so hopefully you have an excel spreadsheet okay.

C.3. - -: Yes, though there's an overall notes, this is my research program that goes on there right So these are the projects, so this is every single company yeah. And you can see company names what they're working on okay, and what are the bits they also told me which I you can't see on the general one, which is what you're seeing here but there's a there's another copy that goes to the water companies only that shows willingness to share. And for each individual project, I would like to know whether you're willing to share your findings. And you can see company names what they're working on Okay, and what are the bits they also told me which I you can't see on the general one, which is what you're seeing here but there's a there's another copy that goes to the water companies only and the results we got back was this. So what that saying is that for more than 50% of projects companies were willing to share either all of their project data or selected project data. And that means that I could then take something that the Anglian are working on and instead of just finding out, yeah we did it and it worked and we're rolling it out across our area I can actually find out where they tried it on what type of main's they were using what, what what size DMA they were using. All of the data behind it, to understand how they got there, how they got it working in their area, so that we can then start to look at how I can get that working within my area.

ES: I think I know the answer this question but it's not my opinion that matters it's yours what what's behind the drive for the leakage reduction. Why are you bothering?

C.3. - -: So so environmental concerns.

C.3. - -: yeah okay so, and the reason I say that is because for years the water companies have been operating at a certain level of leakage okay or driving their way down to that. But my own company has had the same level of leakage for 20 years probably okay, and the reason for that is because we were operating at or close to or what's called a sustainable economic level of leakage. That means, and the way I always described this as you go, is is is how you try to explain to people so good, on your supply pipe feeding into your house let's say for an example of leak still there. Okay, so let's start upon there, and you know he's picked up on the meter and they say yeah you got leak upon your your supply here, which you need to get repaired and it's probably worth you know, giving the age, do you got your supply pipe and replace the entire pipe. Okay you go okay well how much is that going to cost me that's probably going to be a about 400 pounds of least. Okay well how much is the leak costing me about a tenner tenner year. Yeah now instantly you're doing that okay what's the value of water that I'm losing against the cost it's going to be for me to do that, and what most people actually doing that kind of situation if they go, you know what i'll leave it until it gets worse yeah. An eventually what you do is you go there's some equation that says how much water, am I losing the value of that water against the cost of actually intervening. That's the sustainable economic level of leakage and

you do it, just as we do for a supply. You run that across your entire network, so we, and a lot of other companies have been actually operating at that level where, our regulator and us we've gone through the figures and said here you are operating where it's most cost beneficial for the customer, meaning the customers not paying to drive down leakage further where there's less value in terms of finding it.

C.3. - -: yeah well that's gone out the window is because of climate change. Okay, and effectively the government turn around and said that was fine for back then, but it's no longer acceptable, we have London is the 8th most likely capital city to run out of water.

ES: worse than Mexico City isn't it.

C.3. - -: Yeah, okay there's no do nothing option here, we need to be driving down leakage below any kind of economics it's not about that anymore it's about sustainability yeah. Yeah so we've got to drive down leakage and so effectively what they did is they looked at one of the water companies and said look, we know you did a lot of work trying to get it down in your area over the last five years how well, did you do, and they said, well, we got down to 15%, we dropped it by 15%. They went okay, is there any reason why the others can't do that. And they went out to us, and there was, I guess, a lot of humming and haaing, but eventually everybody signed up and went yeah okay let's let's let set ourselves a big hairy audacious goal. And we're going to drop by 15% and that will be hard and will drive an awful lot of innovation, the reason for that is there's a lot of comparison and people will say oh you look at Japan or you look at Taiwan and places like that, where they have very, very low levels of leakage, but the way they did it is predominantly through mains replacement. They change their entire network. So Tokyo redid their entire network from the 60s they're actually relayed every single pipe. We're not able to do that.

ES: No, we don't know where they are for a start.

C.3. - -: No, and you know, I know, everybody picked up on Thames and says oh yeah their leakage is terrible. We're talking about a city here that was bombed in the blitz. Yeah where at the time they were just trying to throw anything in the ground to try keep the water flowing. And you kind of get it when you start to think like that, but um yeah so effectively we're in a situation where we just go yeah we do have to do this, we got to drive it down and we can't do by major placement so we've got to come up with really innovative ways of driving our leakage down, that we haven't been tried elsewhere in the world. So I predicted a couple of years back, when this first started coming through, and I said, you know 20/30 years ago. The leakage industry in the UK was the kind of pride of the world, everybody came to the UK to learn how to do leakage. Everybody else, then overtook us,

because we were sitting at the same level, and there was no driver to push it down. Now we've got this 15% reduction you've now got you know 19 water companies across the UK who are all innovating to drive down leakage. What's going to be fascinating is seeing over this AMP period, who manages it and how they manage it, and my prediction is that, that will be a template and the rest of the world will start coming back to the UK and okay that's a really interesting experiment you guys have done, we want to know who succeeded and why they succeeded and what innovations, they brought in to be able to do that.

ES: Okay [] when you talk about your company you've mentioned a couple of times they're small company in comparison to some of the others. It sounds a way of describing it you see that as an advantage.

C.3. - -: Yes, and no. Yeah there's always the answer on things like that.

C.3. - -: there's some really big advantage and being a small company are typically agility okay. You have a fall flat management structure, so you know, probably from the guy that digs up the road, and I use that as an example, was the kind of life at the lowest of the low into the employee but they're probably the most manually. You know, takes up the road to the CEO is probably only about six levels.

ES: Okay yeah.

C.3. - -: it's very flat structure, when you have a small company. You know my CEO just walks down to see me. Yes, he's not kind of like you know I book an appointment and if I want to get a meeting, together with my you know. Let's say we're bringing in something new and one of the departments I've got to speak to is my regulations okay, the water regulation side, that's me just strolling along the corridor and sitting down with them and saying right, this is what I'm planning on doing what do you think. Some of the larger companies, you know if you look at what that's going to take them six months of arranging a meeting. Okay. The big advantages agility with small company you've got flat structure which the flat structure also means quick decision making, as well it's very you don't have to have loads of those layers of management to get decisions made.

C.3. - -: yeah so that helps us. The big issue is funding. We simply don't have the funding for some of the bigger projects. So, I know that as a company, we are very attractive to a lot of supply chain for those initial trials, just to see whether something works, because we can be very agile with them in the way that we work. They give us something and very quickly we can say yes, this works or no it doesn't we can give them very quick access to the works crews to the guys out on site to say yeah this is really good or not.

C.3. - -: yeah we struggle is that scalability. Then taking that out and start to kind of roll that out further and starting to fund larger trials because that's where we. That's you know they tend to go look, we could we can do this, but it will be a half million to build some prototypes were like that's a real showstopper for us because we simply don't have that kind of funding. As I said earlier, my hope is that the Ofwat innovation fund will kind of start to fill in on that and allow the smaller companies, to be far more agile and also to have access to the funding that allows them to develop.

ES: Okay, and we've got about 10 minutes left. I've got two or three specific questions, I want to cover with people generally and one of them is what your views are on water trading. In particular, you mentioned, London and we've got to move water from the north to water to the south. Are you engaged with any of those sorts of projects.

C.3. - -: We are doing some water trading at -, and I know that some of the other water companies are doing exactly the same as well.

ES: What barriers do you see.

C.3. - -: In terms the company's viewpoint, I don't know. Okay personally I'd agree with it, I think we, although we are regional monopolies, we work together in in concert okay I'm, you know, one of the things I've seen within the water companies that I really admire it for is its ability to be able to talk to one another and share on learning and insight. And typically when I talked to other industries other utilities yeah it's that kind of level of sharing is very rare because you know your intellectual knowledge and things like that is seen as being one of your assets that you need to protect from other people.

ES: Why is that do you think in the water sector.

C.3. - -: I think it's because there's there's still that slight legacy of we are doing a public service. You know we see ourselves as public servants we're not what you know I'm an employee of a of a company that is you know here to make money at the end of the day, but actually on the ground, all of us think like public servants, all of this thing that our job is to provide water for customers yeah. : And I will be honest even even that that attitude permeates through the entire company everybody is here, thinking about we want to keep our customers supplied with water. And therefore, when you're talking with our water companies that have got the same zeitgeist, they kind of got that same feeling that they want to do that as well, and so I think there is this sharing of you know fine you are my, to some degree competitor, but you got customers, just like us, and none of us wants people without water. It's not a good thing it's not a good thing for the industry, always want to help out and so there's a lot of mutual aid there's a lot of sharing of understanding, so that we move forward together.

ES: So there is a value given to water beyond money?

C.3. - -: Oh completely and I think you know when when you look at how this staff work here. They will push everything in order to keep customer supply water. Yeah you know it's that kind of when a burst is happening at three o'clock in the morning and things like that people will be you know I don't care I'm rolling out of bed I'm going into the office. What because it's your job you're not on shift yeah I know but, we want to, we want to serve, we want to do it. I think you know, one of the biggest issues that we have within the company and in all the time I've been here, as we did last year treatment works, and it was [] works it was in the newspapers and it was effectively flooding. We had a river that had not been seen for 20 years suddenly resurface as a result of high groundwater. And it was running down the valley, and it was going to flood out this works, and if it did, that we would lose 50,000 customers. And I can remember speaking to some of the managers and I was involved in the incident room, so we were running this I mean this was a long term thing we will running that incident run properly for about a month. With rainwater events coming in, and we how we were managing it. And what was remarkable to see is how everybody pulled together and how everybody worked together, and the reason for that is because we wanted to keep customer supplied and it is such a huge driver within our industry.

ES: Is wastewater seen as valuable in any way similar.

C.3. - -: Yes, so mine's a water only company, so we don't do wastewater but the same attitude that I have in terms of you know, keeping water supplied to customers, I know, sits exactly with our wastewater companies as well yeah so the big water and sewage companies. Is that they got exactly the same thing or trying to avoid customers being flooded out. And that is the bit you just don't want to do so. I had. We had flooded customers, we did there's a small village here called Blindly Heath. And it has a trunk many runs down through the high street and it burst. And it's a big trunk main is quite high pressure and it flooded out a number of properties. Okay, and our Operations Director at the time went and met with them individually, he apologised profusely we arranged for everything to be done. Okay, and then 18 months later it burst again. And, in some ca-, literally months after that everything had been restored in their hou- and put right, and this again our Ops director went down and met with them, he apologised profusely. They said what you're going to do, and he said we're going to move the pipe. And it cost us millions, it cost us millions, but we moved we rerouted that pipe around that village yeah because he never wanted to have to go in and meet with customers again and say I'm really sorry that we flooded you out.

ES: yeah yeah well. Just a couple of last question, it is a difficult one and.

ES: We talk generally about the regulations and the regime which is market based but heavily regulated this might be too difficult or obtuse a question to answer, but is there one thing you think would be really nice if that changed if the law of supporters more in this way or.

C.3. - -: Yeah there is. I'm quite happy to set this out as I have actually set this out to our regulators. So there are certain areas where our regulator says look, you know, this is what we want you to do. This is how we are pushing you in this direction okay, - and yet not seeing a longer term view. That there's better solutions and a good example of that is interruptions to supply so regulators, has taken the view that three hours is the cutoff point and it says, basically, if a customer is often more than three hours there's a penalty to the company okay, which I get I understand. The issue that we've got is our mains replacement programs so I've told you earlier, we were talking about the fact that they're not giving us sufficient funding to replace all of our pipe.

ES: yeah.

C.3. - -: So what are the areas I'm looking at it going okay, how can we rehabilitate pipe so rather than you've got to cast iron main it's got good life still left in it, but there's parts of it that are bursting, how can we could slow something now right yeah. Yeah a structural liner. You put that in place and it would use, you know 50% of the strength of that pipe, as well that's going to extend the life of this asset for another 60/70 years. Yeah great solution used in America, all the time. Big issue. The time taken to slide that pipe in and cure it is six hours. Instantly every water company in the UK, as soon as the supplier says it's a six cure time the phone goes down.

ES: Okay yeah.

C.3. - -: Now that's not because the water company go that's a poor engineering decision. And even I'd be interested to know customer perception if I said to a customer here's an option we can either have you turned off for three hours every couple of years, when that pipe bursts, or we could do a proper job yeah. Yeah put the liner in it, it will be six hours, but you won't be interrupted again for another 20 or 30 years. My guess is the customer would say actually do a proper job.

ES: yeah okay yeah.

C.3. - -: The regulator is pushing us and saying no it's three hours and that's it there's no allowances for actually if you're doing something to improve the network, that you're allowed to have some longer time in there, But actually the customer benefits in the longer term. And that's one of the kind of areas that I really do look at and just go that's where the regulator needs to think again is these kind of longer term benefits. Where as a customer we think about that kind of thing yes okay, I can

either do this again and again and again, but actually if I spend a little extra time it will be fine and that will mean doing it less often.

ES: yeah.

C.3. - -: Customer must do that all the time about things around their property and things like that.

ES: yeah.

C.3. - -: I'd like to be able to do that, I think, in some ca-, about our water.

ES: Why do you think they are like that?

C.3. - -: Because they're very much driven by customers and talking to customers and saying what do you want? I think a time is maybe they don't think of the longer term questions that you would ask customer, so the customer says when they say customers, how long do you want to be out of water for, the customers will say three hours okay, we think that's about fair and right. Should they actually be asking a longer kind of engineering questions that go okay, but if we were able to do this would that make a difference. It's the engineering side they tend not to do.

C.3. - -: They are economists. Again, but also these days they're not just economist they're very, very good at the kind of listening to customers bit and they push themselves into that area. But they sometimes don't think in the kind of engineering terms.

ES: yeah yeah see.

ES: I've reached my hour [] . don't want to impose post upon your time and massively grateful for, is there anything else you want to add on.

C.3. - -: Yes I've got a hard stop as well because I've got a meeting I'm going to go into.

ES: Just let me pass on my massive gratitude that brain dump it's been fantastic.

ES: Keep strumming

C.3. - -: Yes and you.

ES: I'll drop you an email and let you go to get into the meeting. And I'll drop you an email with some you know what happens next and what not bit later down the line, and the line but I'll let you go I know you've got to go to the next meeting.

C.3. - -: Thanks very much.

ES: Take care. 1 hour 2 mins 4 seconds

Aug 2021. Interview with D.4.

We had spoken at length previously about the water sector and some of the work he was doing and he was familiar with the project.

We still discussed the consent and participation sheet and that he was happy with this interview being recorded.

00:02:04.260

E.S.: So is there a particular project that you want to start with, that we can start chatting about.

00:02:14.520 --> 00:02:21.360

D.4.: Yeah I guess a couple probably spring to mind, maybe if we start with the work we're doing in the [P] at the moment might be a good one. It's a well-established project that's struggled a bit recently, I suppose, and so we've been doing work up there for a long time, so we had the initial operating techniques agreement at [C], which was signed a good few years ago now, and delivered catchment offset interventions in [C], which were then offset against the requirement through delivering the treatment works. Was delivered successfully, getting the right benefit out the catchment interventions and the treatment work stuff, all working fine, which was great, and the types of interventions we delivered were all worked up in detail, using RB209 to estimate what was going to be delivered and was reasonably I guess a relaxed agreement in terms of what was being done. We then scaled that up in terms of the whole [P] for the next stage, so we did this similar sorts of modelling activity to arrive at the amount of load we needed to deliver through low production, based on the relaxation of the permit at the four other sites within the [P] catchment, calculated what that was, we then applied a safety factor to that, which was 50%, which would come down from the hundred percent we'd used on the original [C], one which was great, but still gave us a significantly larger target to try and meet.

Rather than doing the RB209 modelling that we've done from previous one, the EA had asked us to use farm scoper, so a tool developed by ADAS to understand what to do, but there was not a lot of guidance as to what interventions were ok, what one ones weren't etc, etc, so we went off and we did some work with, or we tendered out for a partner to work with us, [FM] was successful in that. Went and identified through their farms where they believe there was opportunity to deliver investment which would improve the performance of those farms to meet the offset requirements we've got. However, we then proposed what we were looking to deliver through that route, and then the EA issued some new guidance associated with farming rules for water, that drastically reduced the scope for what we were able to do, took a lot of things off the table and there wasn't a huge amount of clarity as to exactly what it was, and how we should be going about doing what we were doing. That's now basically the position we're still in where there's an ongoing debate as to what is reasonable for water companies to pay for and claim the benefit of, and what it is that farmers should be delivering on their own. And there's a lot of challenges around, I guess interpretation of regulation and how it all links together. So, there's a view within the EA that they're expressing, how did the guy word it, it was pretty much, the regulation says farms should lose no nutrients, therefore anything you're talking about is covered in regulation, was how he said it, I believe. And so we pushed back quite hard on that one and he backed off a little bit, but he made that point twice, so it wasn't kind of an accident, what he said.

And, but, but what were there is a challenge is, there's this view that I think infrastructure improvement is more aligned to what you can deliver, so talking about improving slurry storage, those sorts of things. However, a lot of the benefit that comes out of driving the improved slurry storage is associated to the improvements it allows you to make operationally. So it allows you to spread in better times and all of those sorts of things so. The crux of the argument we're having at the moment is, we're saying we should be able to claim the value from slurry store and also the operational improvements that that slurry store allows you to make, because the farms wouldn't been able to achieve that if they weren't doing it. The EA's position is essentially, but the operations should be perfect, regardless of whether the infrastructure is there, or not. While the regulation specifically guiding slurry stores is the Sappho regs, which says, four months, unless you're in an NBZ. If the farm needs to have 10 months in all the order to be able to spread at the right times, etc, then they have to have 10 months, even though the regulation doesn't really state that. We're at an impasse at the moment as to how we represent the benefit that farm is gaining from our investment. And we're able to really drive the value from that. Because essentially the modelling we originally did suggested the interventions we were going to do was going to take out about 130 kilos of phosphorus per year. We remodelled it based on what the EA's stipulation was, and it was somewhere in the mid 30s and so you lost two thirds, a bit over, of your value. Which obviously has a significant impact on affordability and whether you want to go down that route and go back to just doing direct investment at treatment works potentially or, even worse, it pushes things to be non-cost beneficial, so we don't do anything.

00:08:40.470

E.S.: My understanding from what I've spoken to you before, just so I can get this accurate, is you are looking at phosphorus reduction in the catchment area. I'm paraphrasing, just so I've got this right [], jump in whenever I get it wrong. Rather than just looking at end of pipe solutions, you're looking at where phosphorus can be taken out at source and funding farming, because that's a major source of pollution, to do things better, so you haven't got to worry as much about end of pipe. You're looking at source. You're then wanting to account for the money that you've paid for this investment, rather than end of pipe, into the farmers and given credit for the phosphorus reduction that that produces. Is that right?

00:09:39.480

D.4.: Pretty much spot on.

00:09:42.240

E.S.: I don't like to assume and skip a basic question than get something wrong. So originally this was OK and approved and now it's not, is that right?

00:09:54.510

D.4.: Well, I mean, I guess, so the EA's position would be that the principle is still valid, you can still do it, however, they are very restrictive on what can be delivered and how you go about doing it, and that restriction makes it in practice a lot harder to do, bordering on the impossible. So the reason they're doing it, it makes sense from a theoretical point of view, is that what they're basically saying is there is an amount that [X] is supposed to remove from the catchment. There is also an amount that agriculture is supposed to remove from the catchment. So if [X] remove the bit that agriculture is meant to do anyway, agriculture can't deliver that and then overall you don't get the total load reduction that you need, so again in principle, it makes sense. But there are a variety of

challenges, one being there's not really a significant amount of regulatory enforcement at the moment, which means that there's no real mechanism to get the agricultural reductions delivered through any other mechanism, and that therefore means that you could make almost the assumption that most of the farms we're going to might not be fully compliant.

And that, then, has a challenge, because what you're basically saying is, somebody has to pay a chunk of money to get that first bit done before you can start claiming benefit. Now that either makes it very expensive for us and you'd argue not really an ethical way to be spending [X] customers' money. Or we're going to the farmers with an offer that says, if you spend 50 grand, we will give you 50 grand to get further. They're thinking about that, well Okay, I could spend that 50 grand but realistically, the EA do a regulator inspection about once every 210 years, so I'm pretty unlikely to get caught, why would I want to do that? And that therefore becomes a bit of a challenge. Now they've got some things, like you've just heard them obviously expanding the scope of CSF, and therefore potentially they are starting to move in that direction and I think they've just, I've not seen it, but I'd heard that they've appointed some more regulatory enforcement officers focused on agriculture, so actually they maybe are starting to do some of the right things in that area. It's still not really up to the scale that we need it to be. And then the other element that I think they're going to really struggle with, is this argument that the expectation of their operational performance is not aligned to the regulation that governs the infrastructure that they need to have. So it's this element that, if you're not in an NBZ, your slurry storage requirement is entirely governed by Sappho. That says four months storage. If after four months it is absolutely bucketing it down with rain and all of your fields are sodden, what do you do as a farmer? You can make the argument that operationally you're still not allowed to spread on that land in line with farming rules for water, but it's got to go somewhere. That's what happens, I guess a case of how they're intending on enforcing that regulation, because we're offering an option to allow that increase in slurry storage to allow that better actual operation and management on the land. But if we can't capture the benefit that that better operation and management has, then it becomes an extremely expensive investment, one that we realistically would not ever make.

00:13:45.600

E.S.: Going back to basics as well, and again I'm going to ask questions, I want to understand the real answer, not what I think the answer should be, why are you interested, or why are bothered about phosphorus? What's driving that, what's behind it?

00:14:02.850

D.4.: Water framework directive, essentially. So the Water Framework Directive obviously has requirements on in-river phosphorus concentrations. And we're a significant element of that, as is agriculture, and they're probably the main two elements, so we therefore have obligation to reduce our phosphorus discharge where it's cost beneficial to do so, to allow those water bodies to meet good ecological status. However, we obviously want to do that in the most cost-effective way, so, in some instances it's more cost effective to do it that way, but in other instances, it may be that actually there's no cost beneficial option through on treatment intervention work, intervention alone. And actually, the way to make those schemes cost beneficial is to deliver within the catchment, because obviously the Water Framework Directive has the cost benefit assessment element to it. So you look at urban wastewater treatment works directive, there's no cost benefit assessment. If the directive's identified, you need to do it, you have to do it, regardless of how expensive it is. Whereas with WFD, you do a cost benefit assessment and actually if it's not

beneficial, if it's so expensive it's not cost beneficial to do it, then you don't have to deliver that activity.

00:15:16.740

E.S.: When you're looking at benefits in terms of that cost benefit analysis, how, why do you allow to take on board benefits? How remote, if you like, is that benefit? Can it be enhancing social structures, improving farming, or is it quite narrow in how that benefit is defined?

00:15:42.780

D.4.: I've not been too close to doing those cost benefit analysis for these schemes, this all happened five years ago, basically, before I was involved, but I believe there's quite a defined way as to how you assess the benefit associated to it, which is quite aligned into the water quality drivers that takes into account some things around the recreational improvement that you get from the water body and all those sorts of things. So you've got the N webs through the EA assessment and how you're improving different things align with that, and then that gives an assessment for what that benefit is. I don't think it fully takes into account the broader environmental and social benefit that's associated with it. That being said, the EA can suddenly every now and again, when one comes back as non cost beneficial, find a load of other random benefits that never existed previously. Certainly, when we pushed for a broader approach to environmental value and social value to be considered in what's being delivered, then that's never been really viable, so it's quite focused on, the view is you absolutely must deliver water quality benefit, not environmental benefit, and if you can then maximize other environmental, social benefits through that and then great, but that's all an additional thing. There's no real view of taking a broader picture of the environment in the round.

So, if, for example, we could demonstrate that we could meet a water quality benefit but the way we do it would be by causing a significant carbon footprint, increasing flood risk, whatever, then you just do it, that's the position. Even if you have an option that maybe didn't quite hit that water quality benefit but actually delivered a far improved carbon perspective, it aligned to other benefits. There's not a lot of flexibility in how that's approached, and that's to an extent that the EA's hands are tied a little bit. From a regulatory position that's the way the regulation is set up. However, when we were in one of our [P] discussions, one of the EA's regulatory people words were, we're in a strange situation where the regulation doesn't really drive the best environmental outcome. But that wasn't said in a way of, that's a massive problem and needs to be sorted out, it was said in a way of, and therefore we just have to deliver the regulatory obligation. Which doesn't help us and, if you look at say, the WINEP methodology that they've just published a month or so ago, the very first bit is very much clearly about, this was supposed to be a real joined up way of working, that was to improve and bring in other benefit, etc, etc. But the very initial statements going through it were, you must deliver water quality benefit and anything else you can deliver on top of that is preferable if you can do it. But the water quality first, and then worry about all the other stuff as an add on, rather than really thinking about the whole big picture of how you drive proper environmental gain, societal gain and all of those other things.

00:19:29.040

E.S.: So you're trying to do something a bit different in how you're approaching it and you're being hampered back into almost like an end of pipe, clear solution?

00:19:45.330

D.4.: On the [P], we're so far down the road we have to find a way to make it work, so we will make it work, however, my concern is, if I was looking at one of these and how we might go into that in the future, I'm of the view it is so hard and so unlikely to identify sufficient offset opportunities, you just end up wasting a huge amount of money looking for something that you're realistically never going to find. It may be easier because part of the problem at the [P] was there was no defined way of doing it at the start, so we went and did it our way. And we just spent the last six months with basically the EA going no, we don't really like that, but not giving us any guidance on what they want us to do. So I think now we're starting to get to a point, partially through the work we're doing in the [P], but also partially through some of the guidance the national EA are doing. Where we're a lot clearer on what the rules of engagement are and, whilst I might not agree with what they're doing. But at least, that means going into these at the beginning, I know whether there's an opportunity or not, whereas previously it felt like it was an opportunity, but when we said, this is what it is, they will go no no, that's not good enough. So that improved clarity at least helps us really understand what the opportunity is at the outset. And therefore making informed decision as to whether it's worth investing the time to go down that route.

00:21:10.260

E.S.: Okay, so it makes it easier to understand what's going to be approved, but doesn't necessarily improve the overall health of the catchment?

00:21:18.990

D.4.: Yeah absolutely. I think we will be putting some fairly robust feedback in on the Winep methodology to say it fundamentally hasn't really delivered what we believe the whole point of it was. What it's really done is documented what happened five years ago.

00:21:35.820

E.S.: Okay, and why are they, they're taking the stance because that's their interpretation of the regulations. Is it also because it's easier to enforce their way and monitor than it would be in a more diffuse...?

00:21:52.380

D.4.: Definitely nervousness with some of the local teams around how they actually can really monitor these effectively. And monitoring is a big challenge because it adds huge cost if you're doing enormous amounts of catchment monitoring that just doesn't really exist in any other way at the moment. I guess it's hard to really argue it. I might have a view that would be along the lines of, I think that the EA have thought this is very difficult for a while, and wonder whether some of the blockers that are coming up are aligned to their thought process on that. However, I mean nationally, they made the right overall noises as to this is the direction they want to go in, but I would say that some of the actual action that they then take seems to not necessarily be aligned to that publicly stated ambition. And I think there is certainly, whilst the national teams are making noises, although maybe not backing up with action, the local teams are certainly more concerned around one of the first things you will tend to get when you go down this route, where this is going to be really hard to regulate, how would we set up that. But I don't think there's necessarily a lot of guidance on that element of it, I think is very much left to the local teams to figure out how they want to go about it, and maybe that's something that National could be more helpful on, say actually, this should happen.

And part of that challenge is the fact that EA monitoring, like fair enough, their monitoring budgets have been slashed so therefore their monitoring has been slashed. Certainly there is not a lot of data out there. And not a lot of standard monitoring, and that therefore makes it quite difficult to manage what's happening within the catchment and really understanding that picture. Like the catchment monitoring cooperative that's gone in as an OFWAT innovation fund proposal could be really helpful in that, because it can just establish that ongoing monitoring is just a general thing that's happening. And then you can tap into it, whereas like in [C], actually part of our operating techniques agreement is us doing a huge amount of monitoring, which is extremely expensive. And it still just about pays for itself at the moment, but in reality, there's gonna come a point where these things are going to break the back of the project in that you're kinda spending 75% of your money in monitoring what you've actually delivered and it just pushes the cost up so much.

00:24:39.900

E.S.: And you mentioned that you're going to push back hard on the Winep. Why are you doing that?

00:24:47.490

D.4.: Well it's gone out to consultation, essentially, so the process that's happened so far is they had the working group on the methodology which we put in. We had a representative directly from [X], but also we had someone seconded in from the Rivers Trust, who was also one of the representatives from the NGO sector. So, it wasn't me that was in those sessions, but it was Sarah who I work for. And her view is that the methodology that they have eventually published is not in line with what they were trying to achieve. And was a bit of almost like a waste of time going through that whole working process, because all they've really done it is written, there's never been a methodology before so Winep's happened but it's never really had a defined methodology. The view is it's almost, all ever really done is written down the process that happened last time. And everybody approached it slightly differently, so we did it in a more engaged way than quite a lot of the other water companies did so, possibly for some of the water companies, it is quite a step forward. For us it's actually just basically what we were doing anyway and hasn't really addressed any of those challenges. So I think we will want to feed back on the fact that actually, we feel like the original work that was being done on that was being done from a far higher aspiration than has eventually been realised. And we want to reflect that in our feedback that that needs to change.

00:26:24.630

E.S.: Wouldn't it be easier, being devil's advocate, for [X] just to go back to treatment?

00:26:31.680

D.4.: Quite possibly, however that's not in the publicly stated ambition of EA and particularly OFWAT, so part of our challenge is OFWAT is very adamant they want to see more nature based solutions, more partnership delivery and all of those kinds of elements, so if we went back to OFWAT with a price review submission that was just us delivering on treatment works on our own, we would not really be meeting that and we would not be delivering the best value for our customers. So whilst it may be easier, it doesn't necessarily meet what the actual obligations on us are to deliver the best value for customers. Including our core functions as a water company, but also where we can go over and above that, and deliver enhanced service to environment and society and all of those things. And to an extent, it would be easier, but not really deliver what we should be trying to deliver but, equally, it would then become very hard for us anyway at the back end, because actually

when we submitted a price review submission, OFWAT would probably not be overly keen on what came through.

00:27:38.400

E.S.: OK, so the OFWAT policies and other drivers and are more effective, perhaps, in pushing a more ecosystem or social perspective.

00:27:49.860

D.4.: Well, I think there are certainly challenges from an OFWAT point of view, in the sense that they are, equally, making public statements around wanting to go down these routes, but not necessarily backing those up in their action, so we obviously had our recent green recovery submission that went into OFWAT. We had an element of nature-based solutions, partnership delivery and an element of concrete, traditional, managed by [X], and the original draft determination with came back, basically said all of the traditional stuff, yep, no problem go for it, all of the catchment stuff, no there's not enough evidence, therefore replying attempts then budget cut. Now to put that into context, one of the traditional projects, we provided a document that was about 40 odd pages, as the evidence, and that was yep, good enough. And that was for about 50 million pound investment, for the natural solutions was about 15 million pound investment and we submitted documentary evidence over 110 pages, so we put in a huge amount, and it was deemed not to be sufficient compared to far less for far more money. And so we push back hard on that in the draft determination, and in fairness, OFWAT then went back off on that for their final determination, gave us the full allocation for the green recovery element when we submitted another 10 pages of evidence. However, what they said was along the lines of, we're prepared to let you have this for a green recovery point of view, however, we still don't think it met the evidence threshold of customer benefit and we would expect to see far more for PR 24. And I think our economic rent team basically went back to say, we really don't feel there's much more that we can do in this space. If you don't believe this is sufficient evidence, then we think that pushes us down the direction of moving away from nature-based solutions. Now I don't know where that's ended up in reality through that and how that's progressing, but, but there is that challenge in the approach OFWAT taking. And almost judging everything by the standard of what has historically been delivered through grey infrastructure and not adapting that to be reflective of the going through nature based options and partnership delivery which has greater uncertainties, but potentially greater benefits and greater efficiencies. But there's to be had there, you can't just expect the full same level of data and probability.

00:30:32.190

E.S.: Certainly until you do it, and then you inform the next project, don't you, to an extent. They are more diffuse benefits often, aren't they.

00:30:41.880

D.4.: Yeah absolutely.

00:30:43.350

E.S.: I mean end of the pipe is relatively easy to monitor in comparison to those sorts of things.

00:30:51.120

D.4.: I think that was all part of that concern is around the actual realisation of the benefits. A lot of it is based on modelled benefit essentially. So if you look at like natural capital ODI, for example, the

way we demonstrate the natural capital we've delivered is all based on what the model predicts will happen. So there's nothing to really then demonstrate that that actually is realised, so if we're claiming recreational value based on 300 visitors a day or whatever. There's nothing to actually check that you do get those visitors, it's just the model says that's what you're going to get the start and therefore you claim it. So they are looking at how they can develop a more industry-wide natural capital focused ODI for AMP8, and I think will as part of that, have a thought around how you actually demonstrate actual benefit delivered, rather than just theoretical benefit delivered.

00:31:45.990

E.S.: Presumably it's a risk for [X], with nature-based solutions in that you also don't have complete clarity on what will actually be achieved at the end?

00:31:57.690

D.4.: Yeah absolutely, there's certainly an element of risk that we need to manage in terms of the core regulatory obligations and meeting those permits. I mean the EA have actually on this, with things like treatment wetlands, been reasonably progressive. I mean I might have liked them to go further, but they have actually done setting up ways to do three year trials, etc, which gives us a bit of flexibility. So essentially we're not subject to a regulatory enforcement proceedings for that first three years while we get those nature-based solutions up and running. We still do take the risk, however, that if we go down that route, and after three years it's not meeting what it needs to do, we have to then invest in additional activity, so potentially spending two chunks of money to deliver the same benefit, which obviously from an OFWAT point of view isn't a very good position to be in. However, it is a way of helping to share that risk a little bit in fairness.

00:33:04.320

E.S.: A bit of a sandbox to try to get it right.
It sounds like it's quite hard to do anything new or novel.

00:33:11.460

D.4.: Yeah, absolutely true. The water industry is generally quite risk-averse in terms of that, and our regulators are even more risk averse than we are, and so there are a lot of challenges with how we can really push some of these new technologies, but I mean that's just part of it, isn't it.

00:33:38.580

E.S.: That's water. A fundamental for life, you can understand it to an extent. You've explained some of the policies, OFWAT, EA< what's the current agency legal statutory duties, and sort of top down, if you like, pressures. Do you get much, or do you have to respond much, for want of a better expression, bottom up? I think when we were talking about the bathing, wild swimming communities, angling communities, and all those sorts of social pressures, if you like. Do you have much of that in the [P] catchment, or perhaps other projects? Is that that an influencer?

00:34:20.760

D.4.: And I mean yeah, absolutely. You get Rivers Trusts etc that might be pushing the particular outcomes and trying to drive where we should be investing. We've not had a big push on inland bathing wild swimming etc within our area.

00:34:51.270 --> 00:34:51.780

E.S.: Too cold up North.

00:34:52.890

D.4.: Well Yorkshire had quite a lot of pressure. I don't think it's necessarily been focused on them so much as being more focused on pushing regulatory activity. So there's a lot of concerted effort on basically getting one of their inland water bodies classed as a bathing water, and that will then have that impact on how Yorkshire need to manage inflows into it etc, etc. But it's not necessarily been focused direct at them, however, you do certainly get you know local action groups that are really interested. Particularly flooding is a big one, and therefore you end up often with a conflict between flood delivery and water quality delivery. I mean, and that happens within the EA as well. We have had examples where the flooding element of the EA has told us to do something very specific and you must do this. And the water quality element of the EA said, if you do that, we will prosecute you for an environmental breach. It's like one of you talk to the other and decide what you want to happen.

00:36:02.280

E.S.: What was that about?

00:36:04.920

D.4.: I'm not involved in the specific detail of it, but I believe it was to do with kind of, effectively, reservoir compensation flows. And basically there's a move towards wanting to utilise reservoirs for flood risk management, so we're quite reluctant to do that based on a number of factors. One, you're potentially opening yourself up to quite a lot of liability when you start talking about flooding, but equally obviously they're there for a reason. And if you potentially reduce reservoir levels, assuming that you're going to get significant rainfall and that rainfall doesn't materialise, potentially you're putting yourself in quite a difficult position in terms of water. But I think in certain circumstances there may be opportunities and we're working with them to do it, but then equally that effectively involves changing compensation flows through the reservoir to manage that, and that then comes into water quality debate and environmental debate. And there's not necessarily great alignment between the two sides of the EA and how they manage that.

00:37:09.630

E.S.: Okay, and people said to me before, the EA is labelled as one institution but actually it's a collection of multiple institutions merged over the years and they could be quite different animals.

00:37:24.960

D.4.: Absolutely, that is definitely true.

00:37:27.210

E.S.: In terms of the relationship with regulators, how would you describe that?

00:37:34.860

D.4.: I think generally at the moment we're in a pretty positive position, I suppose, a lot more positive than some others. I think, certainly with OFWAT we've obviously come off the back of fast track for the last price review, I think we're quite well regarded in a lot of the areas that they're focused on around things like innovation was a key theme, for the last one, which we did very well on. Themes they are looking at this one around partnership, nature-based solutions, which we are quite a well-regarded company for, so they're quite keen to engage with us around how those things take forward, which is great. And with the EA I think we've been forced our company for three of the

last four years, so our core environmental performance is generally pretty good. And I think nationally, they recognise a lot of our innovative ideas around how we can drive better environmental performance. I think some of the feedback we have, we're obviously part of Natural Course, which is collaboration between us and the EA amongst others. Again, through natural course, I know that the EA guy there said, I don't quite get why all I hear are positive things from the national teams and negative things from the local teams. So I think sometimes it's a bit of a disconnect in terms of that and I think we probably make their local teams lives quite difficult because we're trying to do different things and push back a lot more than other companies perhaps do. But generally speaking I'd say actually our regulatory relations are pretty positive. Albeit there are some significant areas where we disagree, but yeah in a general position I think we're alright.

00:39:20.010

E.S.: And it sounds like is there, if we're looking at the Environment Agency, there are ideals at the top and sort of functional things that have to get done at the lower ranks. Is that where this positive and negative thing might be coming from?

00:39:38.820

D.4.: I guess all organisations have it, but I think EA have it particularly strongly, is the messages don't, or approaches don't necessarily filter down from top to bottom effectively. So quite often, strategically, the national EA and the top people see which way they want things to go in. However, it doesn't necessarily then filter down into how decisions are then made by the people on the ground and they don't necessarily give them the.... I think they give them actually quite a lot of autonomy to make decisions, but against a very strict regulatory position, and therefore they're not really comfortable to move away from that. Whereas there is strategic thought being had, but they don't necessarily have the support there to move in that direction to align to it, and that join up isn't always great. I think it's particularly also challenging because the EA is almost 15 separate bodies, in the sense you got 14 areas and the national EA. Well, I think that is actually one of the areas anyway. But therefore actually that cascade of the flow of information between all of those and getting a consistent approach across all of them is quite challenging.

306

00:41:02.310

E.S.: In terms of the code of ethics when you're designing or reaching a solution, is there a specific sort of ethical guide or anything that [X] utilise when they're thinking about what to do?

00:41:44.250

D.4.: I mean, provisionally we're driven by needing to demonstrate efficiency in our activities to OFWAT and essentially on to our customer base, so initially our position is driven by demonstrating we're delivering whole life cost. The best whole life cost solution, so achieving our core objectives through for the lowest cost in the long run, essentially. We're just starting to develop our multi capitals framework, so we have done in the past in some limited examples, incorporated natural capital assessment into the activity that we're doing, and that is starting to become a lot more commonplace to try and look at how we can deliver greater value through natural capital, and potentially that may result in slightly higher expenditure, but the whole life cost value is better. Although there's limited, but we are starting to do that, and then we're also starting to work out what our approach to a multi capital assessment will be. I guess your traditional whole life cost is based on your manufactured and your financial capital basically. We've started to think about natural capital, and we have some examples of where natural capital and the value that comes from

that has influenced what we have delivered on the ground and also some examples where we have spent more money to achieve greater natural capital value where we can justify that. But now also the Multi capitals framework will then start to bring in social, human and intellectual capital as well. Social probably fairly soon, because I think that's a little bit more advanced, I think, human and intellectual is still probably a little bit out there in terms of really understanding that. And so we're looking at then how we can try and make value based decisions rather than purely cost based decisions, but equally, one of the things OFWAT have also been very clear on is water companies should only be paying for benefits delivered that are core to what water companies should be doing. Particularly with natural capital, quite often a lot of the value is driven out of recreation and there's an argument that says well we're not there to provide recreational space. We do that in some spaces, but it's not our core function so actually, should you be spending customers' money delivering recreational value or should you just be spending customers' money to deliver the core elements of water company activity? I guess the OFWAT belief is very much the, well actually that's where partnership comes in, so you get partners to pay for those bits that are above and beyond. But I think the reality is quite a lot of the time, whilst the value can be calculated, society isn't necessarily set up to pay for it in that way. So actually water companies are quite well placed to potentially deliver that broader societal value, but at the moment, the structure isn't there to allow us to do it, to be the people that do that.

00:44:58.920

E.S.: Why do [X] want to do that? (I think it's brilliant, by the way, from a personal point of view). Why do [X] want to do it?

00:45:15.240

D.4.: So I think our initial interest in driving down these routes was very much on the basis of where there might be opportunities to drive cost savings, and there are examples where delivering through these ways are the cheapest option and therefore wanting to do that is clear from that route. But you've also got regulatory framework that states it wants to see that broad value being delivered. It wants to see partnership working, it wants to see nature based solutions which can achieve those multiple things, so all of that's quite important into it, but then equally there's a fundamental point around things like ecosystem resilience and changing the way that we deliver can help us to deliver in a way that will achieve more resilient ecosystems and society across multiple benefits, aligning into things like climate change, and all of those types of challenges. Which is positive and more sustainable in the long term. A lot of the value that you get out of delivering those things does come from other, and more broader, social element. And therefore considering that value in our decision making process feels like the right thing to do to make sure we're making decisions on the benefit of society as a whole, and that's why we're interested in it. I often talk about actually, the reality of the situation is it doesn't really matter, this is probably my view rather than [X]'s view, who pays for it, because it all ends up being the same person who pays for it at the end of the day, anyway, whether you call that person a customer, whether you call that person a voter, whether you call that person a constituent, whether you call that person a taxpayer. Actually, it's ending up on the same person and you could argue that taxation would be the fairest way to distribute that cost if it's something that should be done, but obviously you then start to get into a load of political debate. But actually taking that broader view of what is the most efficient way to deliver the best value from a societal point of view is the best thing to do, and if it's deemed that a water company is the right person to deliver that because that they're well placed to do it and efficient, and that's a great thing. If it's deemed the local authority is the right person to deliver it because that comes through taxation and is more transparent, or whatever, then that's a great thing, or if it's deemed that actually you want

private industry to do it then because they can do it more efficiently, then equally that's a great thing, but actually having that joined up approach to that whole societal value across all of the different things from natural, society, human etc and taking those decisions has got to be the best overall outcome at the lowest sustainable cost from a country point of view.

00:48:20.430

E.S.: It's a very deeply holistic view which aligned with all the resilience and sustainability thinking and those climate change pressures, I can see that. And I've gone over time, I said I'd only take 45 minutes. This sort of question I tend to ask at the end, and that is, if you could change one thing about this, rules, regulation, regime, governance, that would make your life easier, or would be able to achieve what you want to achieve more easily and quickly, what would it be?

00:49:02.880

D.4.: I think, for me it would be an ability to assess the holistic value that you were delivering rather than being tied into a pure water quality element. Because I think that has really strong implications for then being able to align with what other organisations are doing more effectively and drive better overall outcomes. I mean the [P] is really strong case in point, that we're investing a huge amount of money in taking phosphorus out of the water course for a river that pretty much every five years, floods the entire of [C.] city centre. And you know if you're a resident of [C.], are you bothered about the fact that there is phosphorus in the water, or are you bothered about the fact that the water is in your front room? And we could be using our investment, yes to meet some of that water quality objective, but to support the delivery of far more sustainable catchment in a resilient way that addresses a lot of those challenges, and we are, to an extent, in that we are partnering with Cumbria County Council to deliver interventions that will have a natural flow management benefit, which is what they're interested in paying for, and phosphorus benefit, which is what we're interested in paying for, so looking for those joined up activities, but actually we've got to be very clear that fundamentally we're paying for that phosphorus and the phosphorus has to be delivered, and therefore we can't maximize the flooding benefit if it's going to reduce our phosphorus benefit. And actually in some cases that might not be the right decision to be taking, and equally then balancing things like climate mitigation and balancing the amount of carbon that the solution has against that benefit, all of those decisions that would be really good to be able to incorporate. Whereas at the moment, we're very tied into well, the first thing you think about is that water quality objective in that very specific place. If you can deliver all the stuff on top of that thing, great. In reality, you know once you've met your core regulatory objective, it's very difficult for us to justify spending additional money to do additional things. So you need to have more flexible approach to allow that joined up working.

00:51:30.510

E.S.: Right I can see that. So anything you want to ask me before I let you get on with your day job?

00:51:43.140

D.4.: Not in particular.

[general discussion not transcribed]

00:54:44.520

D.4.: Just actually on the back of what you just said, there was one point that possibly might be relevant. Defra had a workshop, the other day, talking about how you can drive more effective

public-private financing approaches. And one of the bits of feedback that I've put into that was around this polluter pays principle. And how the farming rules water challenge we discussed at the beginning has come about in this belief that we're signed up to the polluter pays principle which is great, but fundamentally you end up with a debate between, there's the polluter pays principal or you could have a beneficiary pays model, so essentially you could argue that an element of us paying for farmers to take out pollution on that land is essentially a beneficiary pays model, however it's also tied into the polluter pays principle in the fact that we're obligated to take out some of our own pollution and we're just choosing to do it in a different location. And effectively the alignment between those two is quite a challenge, because actually you can see there are cases where beneficiaries would want to engage in those sorts of activities, however you can't really do so because we're signed up to the fundamental principle of polluter pays. And one of the challenges with that I see is how the regulation is driven to essentially turn polluters into beneficiaries as well.

So there shouldn't really be a significant difference between the two models, because if you have the right regulatory approach, then polluters become beneficiaries anyway, because they are obliged to do it. Whereas, potentially, you have a bit of a challenge at the moment where the regulation doesn't necessarily put the onus on those organisations to actually meet their polluter pays principle. But equally we're not keen on other people doing it because it goes against the polluter principle, and therefore how we meet that is quite an important challenge to drive people to then participate in catchment markets and those sorts of things to really create that multi organizational approach. Sometimes it feels like when we're trying to create a catchment market it very much hinges on whether we've got an interest there, and it feels like we will invest a load of time setting it all up, and as soon as we can achieve what we want to, nobody else is interested and it will probably die.

00:57:06.180

E.S.: There's something I did with [] on public money for public goods. So it flowed from farming and it was this similar sort of argument really, that the farmers are supposed to be doing stuff and if you start paying them to do stuff that helps their farm, like the ecosystem services actually benefits the rest of the farm, you're actually subsidizing a market. You're subsidising a farm when it should be things that they're doing anyway. So how do you subsidise the farm in a way that gives a public good, rather than simply benefits a farming market private activity.

00:57:56.010

D.4.: But, equally, I think it's really important to recognise that actually there are a lot of public goods that farmers deliver the market for. So actually it's more about saying okay, you might do a particular thing, and it has a benefit to your core farming activity, but it also has all of these other benefits as well. And it's fair to therefore make those a saleable commodity, rather than just expect farmers to basically invest in things that aren't necessarily something they necessarily do but it's having this huge other benefit, so creating the right market conditions to truly incentivise. Because one of the challenges is always, farmers see their sole priority is to deliver food, some are really efficient environmentally and really interested, but a lot are, actually my job is to deliver food as efficiently and as productively possible. But that is fundamentally out of the fact that the market conditions that exist are there to target them delivering food, that is the saleable commodity they have, so if you make it viable for them to deliver flood risk reduction and that be a saleable commodity for them, then that's going to influence the way that they're using their land and doing it in that best one. And creating those market conditions is really important tool, because you can essentially then tweak the remuneration that is available for whatever is the relevant ecosystem

services you're trying to deliver in those specific locations, and therefore drive people to be taking those actions themselves, rather than having to do that through central action. But all of that is very challenging to set up.

00:59:33.720

E.S.: I totally agree with you. I think there's fantastic things that can be achieved. I think there's just peculiarities or particularities about how it's phrased. Making it clear that it's for those additional benefits, and what we were doing was transferring all those benefits and that philosophy to try and apply it to fishing, fisheries. And so that's coming out, hopefully in a few weeks, getting published. But it's that sort of same thing isn't it, it's what people should perhaps be doing. But they're still having to run a business, it's still a market activity. So how do you incentivise that exactly? I think we're on the same page.

01:00:13.260

D.4.: I think it also links into the additionality principle, which is one of the things that winds me up more than anything around this output focus, around people really worrying about someone getting paid twice for delivering the same output. Whereas actually that's completely irrelevant concept, what you should be thinking about is they are delivering outcomes, and if they are paying being paid for all of the different outcomes that they are delivering, then that is absolutely fine. Because what that enables is it forces people to look for the outputs that will deliver the greatest range of benefit and the most outcomes because that's what they get the best payments for. And also once that establishes itself, the market conditions will drive down the individual cost for those outcomes anyway. And therefore actually it will find the right price point in terms of driving that efficiency, but it will be a far more efficient way to do it, rather than worrying constantly about the fact that somebody might be planting trees for carbon and selling a biodiversity outcome as well.

01:01:20.160

E.S.: Pragmatism should always prevail, we should have a pragmatism principle, shouldn't we?

[end of interview chat- not transcribed]

E.5.— 29th July 2021

Opening pleasantries and chat not transcribed.

Confirmed in order to be recorded and that had seen the consent and participation sheet and was happy with participating. Recording started on zoom.

00:00:02.909

E.S.: So thank you for participating. I don't know how much [K] has told you or how much you know already but I'm part of the pipe bots project and also doing a PhD on the governance issues around how and why and some technologies get adopted and some don't. Particularly water and wastewater sectors, so anything that affects infrastructure and going beyond some of the obvious things like the PR cycles and all that sort of regime and looking at it in more detail. So I'm interviewing quite a lot of people- government agencies, water board companies, innovators- about what they're finding. I know [K] thought that you would be really helpful and insightful in your in your field which I understand is trenchless technology and aligns perfectly with what pipe bots is trying to do.

I have got some questions I need to ask, but people often just start by just talking about a particular project that they're working on. So in terms of the trenchless technology, is there anything in particular that you're excited about or worried about or any particular project is going on, that might be of interest at the moment?

00:01:26.640

E.S.: I've been in the business now for 43 years and I all my life's been in trenchless technology and half of it's been in drill and blast tunnelling big tunnels, and then I came over into the trenchless team in 2004 to set it up for [] Water. And I immediately found that people, contractors, were being bringing me products they thought I wanted, and I said to them, look, I don't want any of those products, why don't you ask me what my problems are and help me solve them. And they said no, no, we don't do that, so immediately from setting the team up in 2004 I said, you move out the way, I will go worldwide and find out what I want, and then, if you buy the plant, you can work for me. And subsequently I set my own team up in 2013 so that became less important for them to participate in my interventions- we did it ourselves. So we were the people with the need, and we were the best people to find out what the solutions were, if you wanted to be proactive, which I am. I'm a bit of an anorak. So [] Water is very open minded and allowed me to travel around the world looking for products. And that short circuited so many learning curves by talking to other water companies, so I soon found that the best water company in the world for innovation was Sydney Water. And then I felt that we were probably, after by seven or eight years, in the top five worldwide in innovation. I think only Vassar Berlin, those two companies, were better than us.

So, then, we advised in Hong Kong Water and the Singapore PUB, and we brought about a whole set of tools that answered our own needs and we're still doing that today.

So what particular one has brought advantages to us in the last five years? Most of what we do is cured in place pipeline CIPP, which you've probably heard of. So we do around about 15 million pounds worth of that a year. For your information under PR 19 we reported to OFWAT that our lining interventions were 75% cheaper than open cut, so if we're doing 15 million a year that represents around 60 million pounds worth of work if it's done by open cut. In addition to that, the other benefits, for your knowledge, are that we have used the O'Sullivan North American Society of Trenchless Technology NASTT carbon calculator, and our lining interventions are 95% less carbon

than open cut. Our pipe bursting is 85% less carbon than open cut. Over those 15 million pounds, on average, every year, we would not be removing 170,000 tons of excavator material from trench to a tip. Therefore we don't bring in 170,000 tons of bedding from the cliffs of the beautiful Mendips where I live. And that represents 30,000 lorries that don't incur on our customers' rates, which I think is an incredible fact. Is this the sort of thing you're interested in?

00:05:22.290

E.S.: It's perfect. I think, how you explain it, I can ask a lot of questions about amp periods and things like that, but it's how people express the benefits that's really interesting. It's going to seem like a stupid question, but it's how you answer it and what you think's important, why are [] Water interested in trenchless technology? What is it in particular, they wanted you to do it, they've enabled you, what is it that's behind that?

00:06:08.250

E.S.: "[*name of book*]." And it's written by []. The [] family own [], one of the biggest [] in [] and they own [] Water. So obviously from this book in 2007 they've been instrumental and saying we must do something about carbon reduction. In addition to that, we have an outstanding CEO. His name is [], one of the longest ones in the British water industry. I think he's been in charge, since, I don't know, 1985 or something. He says customer is king. You really do get that feeling when you walk around and talk to people who work for [], the 2500 employees or whatever, and all the framework contractors who work for us. We're all aligned to giving the best service we can, that is why we're consistently number one in OFWAT's table for customer care. And so its customers, the fact we want them to breathe, see environment, look at all of the wonderful things we do around reed beds and modelling nature, so that we don't impact heavily. And it goes on to other things like health and safety. I know that we've had this terrible accident last year. But, overall, the health and safety at [] is incredible. And we have an acronym we use in the construction division which I'm part of, SQTC: safety, quality, time and cost in that order, that's what's important to us. So quality's important. When you look at the fact that they were doing very little trenchless until I turned up and they had the foresight to ask me to set up the team and they just let me go and do what I wanted to do, it's just shown amazing benefits to our customers and it's reduced the cost as I've told you, the whole thing just works for us. What I would say, and I don't know whether it's true but I'm told it all the time, we are the only dedicated _____ rehabilitation team in the British water industry, the only dedicated. All of our QA and QC is important. So let me give you an indication that cured in place pipelines are a thermo set material, so you cure them either with heat or light and they catalyse. How many thermo set structural building materials are there on a building site? Well, I can think of one: concrete. So, would you put up a concrete beam without taking some cubes and crushing them to make sure you had the right consistency of USC strengthen? No of course you wouldn't, so why wouldn't you test your linings to make sure they're strong enough for the 50 or 80 years longevity that you want? Because if you don't test them, after the loss of the patent in 1997, it became a bit of a black art and the water industry really lost their way on what they should be doing on QA QC and so we've been educating the other water companies and most of them do it now. But they must take samples for corporate governance and for a record of their short-term Fletcher modulus. Those are the things that drive us.

00:10:09.060

E.S.: So that's a very unusual answer. That is brilliant, but you know in fairness, when you read the press, you know the water industry press, [] Water everywhere on the innovation front. And you see the dynamism in what you're doing and it's very infectious. In terms of the drivers then, they don't

seem to be legal or regulatory or OFWAT driven. They seem to come from inside the company itself and in its leadership. Is that a fair assessment?

00:10:56.850

E.5.: I've never thought of it in that way, but that is true, I think. We didn't wait to be told what to do, we just did it and it just aligned with what OFWAT wanted.

00:11:10.350

E.S.: That's what's different, I think, to some of the other answers I've had.

96

00:11:14.910

E.5.: In 2014, I asked IKT of Germany, sounds strange, the guy English guy working for me in the isthmus, to bring together the water companies so that we could all discuss and benchmark where we were. Till then I'd been trying to get them involved, and I think there was a bit of suspicion. Why is he coming and wanting to talk to us? So anyway, Ian did it and now all of the water companies, including Scotland, Northern Ireland and Irish water are in the mix and we meet once a month. And it's brought up quality, it's showing everybody how to do things at least cost, and that was an initiative that [] Water felt was valuable. We're not in competition really in terms of the quality of our products.

If I said to you what products that we produce have really changed our life? We were the first company to start looking at well, I think we were the first company, to start looking at defect recognition algorithms for using big data artificial intelligence to classify sewer defects under MFCC five WRC and develop document. We started in 2015 and we put it into our marketplace, it attracted 31 companies around the world who felt that they could help us produce an algorithm. And we got that 31 companies down to four. And I can't tell you who they are yet because we'll be launching that later in the year. But we're there. So if you like, our man in a van turns up on a road in Sheffield and he starts looking at the sewers as a camera goes down and every time he sees a defect, he has to type it in, and it takes a lot of time. All that's gone, the algorithm will do that, so instead of doing 500 meters that they will be doing 2500 meters a day. That means we are on the highway last time, and when you look at the carbon footprint, most of the carbon produced on civil works on the highway come from waiting traffic lights, not from the embedded carbon cradle to grave. So the algorithm's very important.

Then, when it comes to CIPP lining. When you design a lining and we designed them to the American standards, ASTM F1216, you get a thickness of lining. So give you an example, we recently did a 1200 millimetre diameter concrete tube. We were told that it had 20% deflection. You shouldn't be lining with CIPP over 10% deflection, because the bending moments in the lining that go up. I didn't believe that because a lot of these destinations are subjective, so I put in a laser and find that it was only 5% deformed, not 20. So if you calculate the thickness of the lining at 20% deformed, it would turn out to be 52 millimetres given those particular strength of lining. If you look at it at 5%, it's half that. So for the 200 meters or 1200 mil I would have spent an extra 18 tons, 18,000 kilograms of resin I didn't need to use if I took his subject of coding. You go and ask any of those other water companies if they would have done the same due diligence before they ordered it and I think you'd be surprised at the answer.

00:15:38.970

E.S.: I've getting a strong vibe of network being important to you understandably. You've mentioned other water companies and international and also input from your customers. How do the regulators

fit into that network, if at all. So your OFWATs, I'm thinking of the Environment Agency and OFWAT in particular or your drinking water inspectorate.

00:16:08.400

E.5.: Well, this is where I'm going to disappoint you. I have some excellent colleagues and all the water companies have people who look at the assets and analyse them, but out of the four w's I don't do what or why, I do, how and when. And sometimes I don't do when, I do how. So I don't really know what OFWAT would say, so you'd have to ask my colleagues.

00:16:40.710

E.S.: In terms of influencing your designs and direction and your teams, your relationships with them and your knowledge of them isn't something that influences your day to day work in an overt way that you're conscious of.

00:17:00.780

E.5.: No.

00:17:02.820

E.S.: Fair enough. In terms of the trenchless technologies and your digging up roads and the health and safety aspects, and you're trying to bring about something new in water- is it water and waste water?

00:17:21.390

E.5.: I do 95% waste, 5% supply.

00:17:26.130

E.S.: So a bit of both. What are the major legal hurdles that you have to overcome that spring to mind when you're looking at these sorts of tech?

00:17:38.550

E.5.: Well from the perspective of adopting new solutions, most people- is this a confidential conversation?

00:17:51.060

E.S.: I can use what you say, but I can't identify you and I wouldn't, I can't identify [] Water. And anything that may lead to you being identified, even indirectly, I obliterate. Anything that's commercially sensitive I wouldn't use but tell me, so I know.

00:18:17.070

E.5.: Whenever people invent things they tend to knock on water companies' doors first. We've just been very open to seeing everybody. Now sometimes you get the impression that some things didn't need inventing, which is a terrible way to release somebody and show you not interested, you wouldn't say that to them. But other times they explain what they've got and you say, well, I am interested in that, but for a different reason for what you've done it for or we just adopted it. That leads to non-disclosure agreements they're not always easy to deal with. So from the perspective of innovation, innovation is not difficult, you just have to have a passion and you just have to have a lot of knowledge. From a legal perspective of actually going and doing the renovation work, once we've chosen the system, of course please correct me if I'm wrong, but my mind goes back to the 1875

public health act, the 1933 public health act, 1991 Water Act, and guess what, all of them say that we can't serve a notice on network rail. So Network Rail we have lots of sewers under and they are or have been very difficult to deal with, to get their interest. Having said that, there has recently come about an individual who we met, I met on Mondays again, and he has said that network rail want to change their attitude 180 degrees, they want to participate, they want to listen, they want to know what problems we've got, that sort of thing. I said to him, you know, where were you 40 years ago when I started? He wasn't even born. But the point is that it is to do with Network Rail, it is to do with anything on beaches, with crown property. Because, Elisabeth, we cannot serve a notice on them. Normally we can serve a notice under the Water Act. We don't barge our way in, that's not the way [] works. If somebody objects to somewhere we want to do, a customer, then we sit down and talk to them and try and find other solutions. We do listen, but at the end of the day, public health comes first. They're the only legal type things that I find a problem with.

00:21:00.630

E.S.: When I'm looking at pipe bots, one of the issues was the regulations on what you can put in freshwater systems and obviously it was not designed for a robot. It's designed for pipes and certain types of materials which are authorized. Regulation 31. Have you encountered issues negotiating your way through Reg 31 or similar?

00:21:37.980

E.S.: I'm 95% waste and my company come to me all the time with "do you have a lining for a water main etc," and most of the time I have to say that we don't have they don't have products in the waste that transfer over because, if you look at the polyester in CIPP, they contain bisphenol A, which wouldn't get regulation 31. Other chemistries which have XO toxicology problems. So they don't naturally jump over and we wouldn't put them in and we're very, very careful about ever suggesting anything like that. Now there was a new type of liner that came out that we helped bring to the market. There's an organization called the international society of trenchless technology, the ISTT. We've won their innovation worldwide innovation prize twice, we did it for this product called aqua liner in 2009, Canada and unusually, it got regulation 31. So it's now being able to be used in drinking water applications. It's taken 10 years to get there. Good for them. Now I'm sure there are other products in the pipeline. I can't name them at the moment but definitely aqua liner has got it. And that's just the benefit of [], if we can promote those people to get reg 31.

00:23:23.460

E.S.: In terms of the policies, it seems again that it's not the OFWAT, the PR 24 flags that they're giving over environmental factors being even higher drivers in the next PR round, that's influencing, it seems to be again something that's within the company ethos as you're displaying from []. Or are other public policies or agendas driving []?

00:24:09.750

E.S.: I have to decline to answer that, []. I would only be giving you my own views and not objective.

E.S.: Top of the list is the fact that, I showed you that book, all these last few decades, [] have wanted to do the right thing in terms of carbon neutrality. So that is top of our list. Further down the line, then comes the cost, because if we can mend the sewers cheaper, we mend more sewers. We've got 35,000 kilometres of sewers. We adopted 17,000 in 2012 with private drainage. It probably won't surprise you that we've only ever seen 20% of that. Part of my team are reactive and go out and do emergencies as you'd imagine, and to give you a view, this is another statistic which

might help you, from setting up our no dig team in house, we've got five lining teams now. Since 2016 we've converted 35% of those reactive emergencies that would normally be dug into trenchless. The company have just invested another 2 million pounds, giving us more capabilities, and we expect to do in 18 months 50% of reactive work emergencies by trenchless means. Well, that's incredible for our customers.

00:26:11.790

E.S.: in terms of your staff, has there been a lot of changing in terms of how you move them from one type of work to trenchless? Was that an easy move?

00:26:24.480

E.5.: My team is split into two I have about 30 staff, of which I have 10 engineers. And the engineers tend to do the planned works, 10 million pounds. And each one of them I choose because they have a speciality. So I've got a Brazilian senior engineer, and she is an expert in info works and hydraulic conductivity analysis. I managed to get hold of a guy who was head of highways at Wiltshire Council for over 25 years. And now when we have disagreements with various authorities who run the hawk system, we can push by where we feel that it's unfair and we're very successful at that, because of his knowledge. And that's the right thing to do, we don't want to be bullied in any way. So each one of them has an expertise and then, what I do is I build them with a second expertise in the trenchless. So going back to 2004, I've set up a number of in-house half day courses on CIPP design, GRP pipe design, type one GRP pipe design, pipe bursting, DCTV. And I'm doing some others in the next 18 months before I retire. I'll make sure there's a suite of 10 courses, and the whole idea is that we get natural rotation, and sometimes we have lots of young engineers coming through. If you look at the UK STT 50% of the people who've won that are now on my team for young engineer of the year. That is because we invest in them. So they also go around the world to things like IFAT, the biggest show in the world in Munich every two years. And when the young engineers have been with me for four years, I then tell them they have to go because it's my view that they shouldn't be in one place too long. And so it's a bigger rotation of staff, but they go into the business, and we have increased our workload by probably 2 million pounds a year just because they've said to the bosses where they work, no, no, you don't have to do it that way, you can do trenchlessly, so I'm seeding people into the business.

00:29:15.510

E.S.: It's really impressive. That sounds like a very dynamic place to work.

00:29:19.980

E.5.: Well it's not unusual to save a few times a year a million here or a million there. And that's the biggest buzz when they come back and say, I did a job and it costs 10% of what they thought. It's wonderful.

00:29:38.790

E.S.: And one of the pressures that you're obviously under in terms of cash, and how you spend your money is very tightly regulated. And I'm interested in how the social and environmental conflicts, if any, arise, so in terms of keeping the cost down for the customer, versus bringing about investments, particularly for environmental improvement. Have you encountered anything like that, where you've got a lack of willingness to pay?

00:30:27.090

E.5.: I'm given the what and the why by our asset people. That forms, for example, a table of works, and you might get half a million pounds in realigning etc. It's incumbent upon me to scrutinize that and try to do it in the most efficient way. I then put my proposals into our networks management team, and they have to approve it or decline it. Because we have always taken the attitude that innovation and trenchless technology, it's very rare that they have any concerns at all, so I've never had projects turn down because they're too expensive because, as I said, we're already 75% cheaper than open cut.

00:31:26.280

E.5.: So you haven't got that issue. I don't know if you're aware of this, or you might not be the right person to ask, but is [] Water, as far as you're aware, doing anything on the latest sort of levelling up agendas. There's a big push at the moment in policy, in the world, about public entities or quasi-entities like water companies and things doing more to level up social inequality. So I've seen examples of improving blue and green infrastructure in certain areas within their catchments, for example. You might not be aware, but is [] Water doing anything like that that you're aware of?

00:32:22.230

E.5.: um I would imagine they are, but, as I say, I'm very blinkered. I mean the government had an initiative to give some young people who were on benefits, maybe had problems with the law or drugs recently. I'm not sure, it was called the kickstart process, and they have ensured that all of the departments have taken somebody on to give us an opportunity. So I see that social aspect. I see lots of environmental aspects. Of course, when it comes to social aspects, they are very accommodating when it comes to customers having economic difficulties, for example due to Covid and not pay the bills, that sort of thing. But otherwise I don't really see it.

00:33:24.810

E.5.: Nor should you, it was just a general question. In terms of the governance, if you like, so I'm talking here of the legal and regulatory sphere that surrounds you in your in your world. Is there anything in particular that you think I wish I could change that, that would make your life so much easier?

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E.5.: As I alluded to, there was only those legal aspects by those people that we can't serve notice upon.

00:34:05.310

E.5.: Do you have any issues with procurement, for example?

00:34:08.610 --> 00:34:12.270

E.5.: No. Procurement is really stringent in [], and corporate governance. I have a separate financial team. If I have any concerns whether I can do something, I ask for their advice, so I don't make my own policies as I go along. And we've got lots of those people to do with that, and when it comes to health and safety, we've got a compliance department, so I can go and ask colleagues there. [] do realize that you cannot be an expert in everything, and so they get me to focus on what I am an expert in, and my colleagues around me are there to support. But otherwise I don't have any problems.

00:34:58.980

E.S.: Have you ever had a situation where you wanted to use a supplier and you couldn't because there was an existing framework agreement in place or anything? You couldn't trial something or do something because of an existing arrangement?

00:35:16.470

E.S.: No, I mean all the time I go and find new suppliers and contractors, who have very specialist techniques, for example hydro demolition in small places using water cannons. And then I have to find three companies like that, and if I can't, if there's only one in the world that exists, then I have to make a declaration to that extent, and then they make a decision. I've never been refused, at the end of the day, they're pragmatic and the customer and the environment come first, and I think they just make a decision that we've done the due diligence as far as we can.

00:36:04.110

E.S.: Some people have said to me that, in the water and wastewater sector with new products, there are more trials than the Old Bailey, I think someone's quote was. More pilots than Heathrow. Is that something that you would say, yeah that rings a bell.

00:36:28.830

E.S.: I don't recognize that, in terms of what I do and I don't recognize that, in terms of what [] do as a whole over 40 years. I never got that impression. It comes back to the fact that I recognize what my need is. And therefore I go and find something and I quickly discount things which aren't going to work. I mean look, I'm that old that I've seen most of it before. As they say, the graveyard is full of indispensable people.

00:37:06.180

E.S.: I think pipe bots, from what I've seen are very, very keen and have been engaging with the water sector and whatnot and learning from those needs. Is there anything any advice you'd give to innovating companies to try and get your attention, or to get a good product out there? Any sort of top tips you would give? You said had all these people come to you over the years and say that's no good. What sort of advice would you give to the up and coming start-ups out there?

00:37:43.530

E.S.: Well, what we have often said to people is we've got a good brand name, got a lot of respect worldwide, just come and talk to us if you've got an idea before you invest too much money in it, you might like to come and explain what you're doing and will give you the benefit of what we think at an early stage. Because I don't like to see people waste a lot of time and I do see a lot in the other water companies through my contact group that we set up. And suddenly a certain person from water company disappears, they've gone off to do something completely different, and I do sometimes wonder... I can only speak from what I experience in my world of trenchless- are they rotating people so much that they don't really get anybody who has the expertise and in a particular field, in my field? So constantly you're finding people, you're explaining to people.... You know I can think of an example, I was sent to OFWAT in 2015 because a water company were told by their insurers, you haven't been in or seen that tunnel, five kilometres, long four meters in diameter, we understand it's a dangerous place, but you haven't seen it since the mid 1960s, and if you don't know what the condition is, we're not insuring it. So I was sent to the UK Water Offices where I met a number of people who I thought were going to be like-minded and it turned out that I was immediately the only one with any real experience. So I said look, what we want is a platform where

they are, they're in Australia and America, we want to bring them in, and we want to throw all of our needs, all the money in one pot and reduce the unit rate of bringing them in. We want to collaborate in the best interest of the industry to bring in these vehicles. And that's what we did, but I was shocked when we all introduce ourselves and half the people that never even been in a tunnel. I think that's the thing that shocked me, that sort of thing.

00:40:21.900

E.S.: Yes, rotation of skills. Someone else said to me that they had a brilliant project and it was disbanded at the end, and all the skills disappeared. That sounds like a similar sort of rotation skill set, retaining that.

00:40:43.590

E.S.: Yes, yes, I totally agree, I think they should choose some people, like what [] do, to become experts who are going to stay there. Look, I mean if I was 20 to 35 I would have been doing the same, I did I rotate myself, I did everything, but then I focused on a niche and that was important. And that helped me because, at times, water companies shared people, and if you've got a really valuable niche, they'll retain you. They're a business after all.

00:41:20.490

E.S.: If you are a niche is one of the dangers that you don't see the bigger picture?

00:41:26.160

E.S.: Yes, I don't see the bigger picture. You've seen it, I've admitted it.

00:41:32.400

E.S.: You haven't, you said you're a network man.

00:41:36.240

E.S.: I'm a network in what I do.

00:41:41.700

E.S.: You can have a niche in a network, can't you? If you're drawing in on other people.

00:41:46.890

E.S.: But everybody I talk to are people in my world. I admit that I find myself in management meetings about some subjects and I go all fish eyed because I'm a civil engineer, with a passion for what I do. I've constantly always done five hours of CPD a week all through my career. I've got a library of over 100,000 documents. That is just me. And when they say to me, [] you're going to retire in 18 months, can we have a discussion about what you're going to do for us after that I say well I'm not doing anything for you. Because if I did two days a week, I come back and do seven, that's just me and it's not fair on me. I network and I bring home solutions from my colleagues. I was seconded to Hong Kong and when I was out there, I saw how they dealt with silk traps, sand traps, and we've got a problem on the south coast, where we get a lot of sand in our sewers. And they were going to build this thing and I said no, no, you want to just put in the sand trap with load cells in the floor and connect the telemetry to our control room, so the load cells will tell you when the sand trap is getting close to filling in, and was 75% less in cost.

00:43:20.550

E.S.: You're drawing on other skills aren't you, you know what your limitations are, you've mentioned legal and whatnot.

00:43:27.390

E.5.: I do apologize. I don't feel I'm answering all your questions.

00:43:30.720

E.S.: You are. There's no wrong answer, no such thing. It's how you're interacting with the governance sphere. It's an awful word, governance. It's really interesting, it's quite different.

00:43:50.130

E.5.: When you encapsulate something that happened with K, I told him at the beginning, I wanted a robotic that could work out gross metal loss under pressure, going through working out diminishing wall thickness. Ultrasonic or magnetic flux, or something. And he said from an assignment, yeah we can do that. I spoke to our innovation manager [], and I said I want you to drive this, because these are your skills, about how we go about this, and he said well your fund's coming up. We decided that we had to get in with two other water companies, we went with the Thames and Welsh. And even Southern wanted to join when they heard about it, it was the right thing to do. And we did a lot of due diligence, we put it in for a quarter million pounds, we weren't asking for the big sum, and then OFWAT announced their results, and I was just staggered. Because I told you, one of the first things I did in 2015 was I went to look at the defect recognition algorithms to CCTV. Well that got a grant and yet in the rules, it said we're not going to entertain anything which is already being looked at on the market. The one big driver in my world is gross metal loss, it's something we just don't have. And so I was disappointed, I don't know why it happened, I don't know the expertise of the people who judged it at OFWAT. I'd be fascinated to know why they didn't think it was so important. You can go and buy these algorithms already for the last five years.

00:45:29.250

E.S.: So the expertise within the regulator, essentially.

00:45:34.410

E.5.: And I can't question that because I don't know what they do.

00:45:36.720

E.S.: It's only opinion, we can't say what's fact. Just say what you think and what your experiences are.

00:45:43.110

E.5.: Very disappointing.

00:45:45.300

E.S.: Do you have much to do with the Environment Agency? It doesn't sound like you do.

420

00:45:49.380 --> 00:45:50.220

E.5.: Well, actually, you know I told you about the lining thickness. So I invented a robot called the re-rounder. There wasn't one, to my knowledge, in the rest of the world, and I looked. It goes into a sewer and it re-rounds the pipe. And I plagiarised the idea of heart stents in aortas and we put that

on the robot and when it shrinks down... I can send you details if you want to see it. When it shrinks down it leaves the stent in, and then we line over it. We had a call last week, there was one of our pipes, a plastic pipe deformed under a dam down in Dorset. So immediately we just rushed down there with the re-rounder and just pop it back, I mean it costs a fraction of the money of digging up. When you're five metres deep, think about that. We can put it in for probably 1500 pounds, do the job 1500 pounds. To dig down on it on a dam crest, it's gonna cost you 20 grand.

00:46:59.130

E.S.: And what did the Environment Agency- you said the Environment Agency were involved with that.

00:47:04.740

E.S.: Well the Environment Agency, it's their dam. And they were worried because there are government targets for dates, so they were worried that we wouldn't be able to solve this problem quickly. There are certain organizations like the EA, if they're that concerned about it, what's important to them is important to us, so we were prepared to drop some other reactive works, it was prioritised, and we go out and do it for them.

00:47:35.220

E.S.: Is there anything else you think I might be interested in, in terms of the sort of governance hurdles and non-technical reasons, if you like, for innovation not being adopted. So just because something works doesn't mean it will be accepted or adopted. Is there anything else you can think of off top of your head before we close up?

00:47:58.650

E.S.: I don't really think so Elisabeth, I think you've got most of the things that fire me up. And I am passionate by them and I realise that I'm not going to see some of these things come to fruition. There's lots and lots of things I've got on the back burner that I won't do and I'll try and pass those on to my younger team and hopefully they'll take those forward. Innovation in the last two years has gone exponential around the world, there's just so much that we can do, such an exciting place to be. And play our part about the CO2 emissions, really.

00:48:43.560

E.S.: We've got to do something. I'm really grateful, I've gone over time. I'm conscious I need to get you back innovating while you... It's been really illuminating, really, really interesting and a really different perspective. I think it'd be lovely for you to hear all the other perspectives and you'd be really surprised, I think. I can't do that because it's confidential. But what I can do is, I'm doing a lot of interviews over the summer and then I've got two projects I've got to complete and then the PhD is the following year, so might not hear from me for a while, but it's not because I'm not doing anything or it's not being used, it's just that it takes a while. But I'm more than happy to, if you drop me your private email address in due course, I should be finished before you retire. But if not, then, then let me know and I'll send you an advance copy so you can see what's what. It's designed to be helpful. I'm designing a framework for innovating companies like pipe bots. Comments on "know your customer" and all that sort of thing are obvious but some of the networking things are really important and some of the hurdles that we're encountering in pipe bots are feeding into that. So I'll let you see it. Anything you wanted to ask me?

00:50:12.690

E.5.: I would say that if you want any case studies of innovation and the way we've gone around them in terms of the re-rounder or adopting and driving for CIPP pressure linings for rising mains, we've got a load, introducing calcium alumina cement as biogenic corrosion veneers to stop concrete corroding. We've done loads of it and it's all open.

00:50:41.970

E.S.: That might be, because I've got to find a project that's not been outsourced, that's within a water company, so if there's something like that they've done in house, that would be really interesting, so I might come back to you, if I may. I'm really grateful for your time. I'm conscious that I need to let you get back to your day job.

Chat and interview closed.

EAS

19th Aug 2021. Research interview with F.6.

Opening, pleasantries, start of interview not transcribed.

Agreed video record on zoom and agreement to proceed with no issue with participation sheet.

00:01:58.650

E.S.: What most people do is start talking to me about a project that they're running or something that's novel in their head and I'll pick out themes from that. In your case that might be too narrow a focus. I'm really looking at what barriers you've encountered when you're trying to get a new product or system embedded into the water sector.

00:02:25.110

F.6.: Maybe I can just talk and we can see. I've got lots of different projects and lots of things, so I suppose I've been doing, for the last probably nearly six years, I've been working with SMEs, small Scottish companies, through a scheme called HNWIS. Hydro National Water Innovation Service, which is a Scottish service funded by Scottish Government to support companies in Scotland who have got products or services, trying to set them up and get them into the water industry. Quite a lot of examples of where people have got barriers and challenges and things like that. And we're trying to solve those for them to. Maybe I could talk a little bit about some of that. I wonder where I start with that, I might bring up a few things on my screen just to prompt myself, let me just get it open. This will just help me rather than me ramble too much, it will just help prompt me with some of the discussion. As a consultant, you tend to work on so many different things, sometimes it's a bit of a challenge to be able to remember. This document might help me a bit. I won't share this because it's confidential but it's okay, it just helps me.

So quite a lot of the companies we've been supporting have the same sort of challenges, so the sort of challenges that they have is they've maybe got a good idea, and they are maybe very small and they're very passionate about what they have developed or the idea they've got. I'm telling you stuff that I'm sure you've already heard before, they struggle to engage with a water company or a potential end client.

Part of that is trying to find who is the right person within that end client to speak to. So they might be trying to get into United Utilities or Thames Water and it's virtually impenetrable, even if they go in by an innovation route, because they just get pushed back, and part of that is knowing the right person to talk to, because I think often if they find the right person to talk to, they will get listened to. Another part of it is that they don't often have, especially if they're coming from slightly outside of the water sector, they don't have the knowledge or the right language or understand the background. They're sometimes not speaking the right language or speaking in the right terms to articulate their solution, the problems that is going to solve, so they might say we've got something that's really great that we solve leakage. Actually, they don't really understand leakage and leakage is quite complicated and just because you've got something that seems to be really good that solve leakage in the oil or gas sector, doesn't at all mean that the water company is going to jump and suddenly say this is great. So trying to speak the right language and understand whether it's the problems or the way water companies are regulated on leakage or whatever you're talking about. Or even understand the sort of costs, how costs work, so water companies sometimes they'll pay a lot

of money for things and sometimes they won't, so that it's that sort of thing. I'm trying to work out where I'm going with this.

00:06:47.040

E.S.: There's an education piece with the people you're talking to, to get them to speak 'water'.

00:06:56.700

F.6.: Exactly, there's an education piece and trying to get them to understand some of that so that they can have a more intelligent conversation with someone as an end client. And I think that gets them a lot further if they can talk a bit more intelligently and understand the problems.

00:07:13.290

E.S.: I haven't come across a situation yet where someone's had a product and been successful off their own back. They've either had an existing relationship or they've gone through an intermediary with an existing relationship, and what you're saying about networks, if I'm understanding correctly.

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00:07:34.140 --> 00:07:45.960

F.6.: I think so, the fact that some water companies have got innovation teams or R&D teams and they have more formal routes for accepting ideas or they have innovation competitions, opens that up a bit more in that somebody can put an idea forward and make companies a bit more open to something completely new and completely different, but I still think sometimes, there are examples where people have got ideas they go through the innovation team and things just never happen at all. Actually sometimes the innovation team route seems the slowest possible route of all. It's much easier to go to somebody out in the business who has got the problem themselves, because if they see the solution in it and it ticks their boxes, they'll probably say yes straight away. And they will either do a trial or might even pay for something up front, whereas an innovation route can be very slow, and for small company which is desperately trying to go from grant funding to a revenue model, that bit of time is really critical, so the funding is the other bit that's a barrier.

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E.S.: I'll go back to funding..but are you talking more operational and R&D rather than innovation?

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F.6.: Yeah I think so. So there's an example of a company that we're working with on something completely different who has developed some tooling for looking at minimal excavation, so smaller holes in the road, reducing the size of the holes, and they've developed some technology and they developed it previously with an innovation team and it never really went anywhere. And through a link I had, they got introduced to someone operational in a different water company. And immediately, he said yeah we'll try it and we'll test it and if it works we'll buy some. That company's experienced two routes, they have experienced the innovation route, which never really went anywhere, petered out before it got anywhere, and then a separate window looks a lot more open to them, they can see the pound signs at the end, and they can see actually selling something. That engagement with the with the end customers or the end user is quite important, I think, and lots of companies run out of steam before they even get anywhere near any revenue.

00:10:16.080

E.S.: You talked about language. And, I suppose a phrase that comes up is problem framing. Is it just language or is it that their idea doesn't fit, although an excellent idea and may improve things, doesn't fit with the need of the water companies?

00:10:42.900

F.6.: So it's more it's more the broader isn't it, yeah it is that. Often, the lack of understanding, and I do see this quite a lot, is that somebody has got a solution that and, I'll go back to the leakage, they say I've got a solution that can solve leakage in subsea oil pipelines, and we put a PIG down the pipe in it does something clever and it's solves or detects the leaks and everything. But actually when they talk to a water company, the company will say well our pipelines aren't subsea, we don't put PIGs down the centre of our pipelines. Actually what we really want is something that can detect a leak from above ground to a certain accuracy, and actually understanding that problem. I sometimes see, you see some of the innovation calls and some of the stuff that's put out for the industry, setting out those problems, it's very broad, very high level in a way to try and capture everything, but that almost promotes people coming with their ideas that are really different. There's a lack of detail in actually trying to set out almost like a specification for what the real challenge is, so we need to detect this leak within 20 centimetres, 30 centimetres because we want to dig down on the pipe and actually be able to locate the pipe, that's our challenge. So for a specific challenge, rather than we just want to be able to reduce leakage by 70%, we're looking for leakage technologies and stuff.

12:39

I think some of the projects the industry is increasingly doing through organisations like WNC but also like AQUIR, the research collaboration, is lots of the projects are looking at what the technologies are and then also looking at maybe setting out a specification or doing a gap analysis between a specification and existing technologies, and then setting out what the gap is. So that sets a more, it's a much, much, much clearer scope for maybe what's needed for the industry, it's a much more structured way of doing it, rather than just going out wider, just saying that we've got this problem, it's much more. Does that make sense?

There is an example that we're doing with that, the one that's on my mind at the minute, is we've got this project, which is an AQUIR project looking at minimal excavation. It's looking at how does the industry move away from, and it's the water utility sector, move away from having people in digging holes in the road by hands, with machinery, in holes, which is not the way, really, we should be looking at an industry, how does it move from that to a more automated or health and safety-focused approach where maybe you don't have a person digging a hole in the road.

Actually you have a robot, we have a system that makes the hole and it's a smaller hole, there's less traffic, there's less carbon implications, it's more accurate, it's less disruption to the customer, etc, but how do you get away from an industry which employs lots of contractors and the contractors are set up, they work on digging so many holes a day or so many holes a year. They pay so many people to dig those holes, so actually that's a little bit of, I'm going off on a tangent, but that's one of the barriers is the supply chain is set up in a way that the sector has historically worked. Some of the contractors are changing, but there are others that don't really want to embrace new technology, because it's moving them away from a business model of so many holes, so many people. We can deliver that, we've got lots of trucks, lots of machinery. If somebody invents a super duper machine,

such as they are the gas sector, which comes along, it's like a robot, it digs a little hole in the ground, and it has somebody who's very, very much more technically computer literate rather than somebody, a big burly guy who digs a hole, that's a completely different business model for them. There's a bit of a reluctance to move to that and that's just one example.

00:15:48.570

E.S.: So they've got to be, these innovators, got to be sensitive to the operational impacts of what they're doing in a far wider way.

00:15:57.180

F.6.: Yeah I think so because if you did have some invention that maybe could say, well, we don't need to dig so many holes, or we don't need people to dig the holes, the water company might be really keen on it and they might say, this is really excellent, but actually the majority of the water companies have long standing or long running tier one contractor agreements. So actually you can't just bring in a new technology, actually, probably the person with that idea needs to talk to the contractors and actually the contract might say, well for the next five years we're working on this contract with [] so we're not actually interested in anything new for five years. Come back to us in five years time when we've got to show some innovation to the client and we might be interested. That's a bit of a negative way of looking at it, but there isn't always the incentive for the person who's already tied into that long term contract to do something really different. And that's, I am rambling a bit, but that's sometimes where the innovation team within a water company I think gets a little bit trapped in that they might bring in some good ideas within that team, and they're quite small teams and then actually, their challenge is trying to get the idea out of their team and into the business. Where actually the person who's out in the business, and if it's Thames Water it's a massive business, they're actually just wants to deliver their day job and actually some wacky idea from innovation might actually be the last thing they want, they're just interested in getting their contractors to complete their job on time. Some different way of doing things is sometimes considered as a hassle. That's a very negative way of looking at it.

00:17:53.910

E.S.: A lot of people in innovation teams have said something similar from a different perspective, that they try and bring in something new and they can't because there's an existing contract in place.

00:18:04.770

F.6.: Yes, Yes. They've tried, I've seen it from my side that they try, when they set up within these innovation teams, when they set up a new project, they'll try and bring in a representative of the wider business to support it, who says, I support this, I want to be part of this, so that you don't get the sort of almost the closed innovation box. And they finish the project and go look at this, business, we've got this exciting thing you haven't even heard about, but certainly we've solved all your problems.

Which I think was a problem before, which was a bit of an issue before, but trying to do that, but I think it's just, for some things, it's the contractual arrangements, and the business arrangements are very complicated. To change things is very, it takes time.

00:18:55.020

E.S.: Some people suggested to me that you can deliver, they're interested if it's got a statutory driver behind it, the water sector. If it's great in the innovator's view but doesn't necessarily match

the leakage.. target or something like that, it's good for the water sector, in their view, they just can't get it, because there's not an investment in the business as a whole. It's very hard for them to pin down what that is. Is that ringing any bells or can you articulate something along those lines?

00:19:38.790

F.6.: I think that's yes, so I would say, is there a statutory or regulatory driver to do this. And that is often at the top of the pyramid in terms of a sort of a reason for somebody to do something, that's often the absolute top. If Southern Water get a massive fine like they have and then somebody's got something which certainly solves their CSO problems or something, often, that means they'll spend money straightaway, and that's really great. I think the challenge is often making the cost benefits, financial cost benefits stack up. It's back to somebody in a technology company with an idea or proposition approaching a water company, and because they don't necessarily understand how the company works, they struggle to try and produce a financial benefit of their tool, so that can get, and I've seen companies who really struggle to try and, they know that it does something good, but actually probably what the water company needs to say is, it saves this amount of time, this amount of resource or solves this problem. And trying to quantify that is quite difficult, and then you also see sometimes companies who have got, so there was an example of a company who produced an asset tag that went on to, as you laid a pipeline, you put every hundred metres this asset tag which you could come along later on with a reader and you could detect exactly where the pipeline was. The problem with that was that the benefits of being able to detect where the pipeline are and to not hit the pipeline are all very far in the future, when you need to go back to the asset, so trying to create a business model for a water company that you get that return on that investment was quite difficult. In terms of if a farmer or somebody or somebody from another utility company hit that pipeline, then the cost implications were quite large, and potentially if you've got to try and find it again and you've got to dig a lot of big holes, the cost implications are quite large. But that's probably in the future, so that company for example, produced quite a complicated business case / cost benefit model, which the water companies just found far too complicated to get their head around. It's a kind of a sliding scale between not being able to justify on a cost basis and being pushed back because we don't understand actually how we'd save any money on this, to somebody who's picked up every possible cost benefits that they could possibly achieve and put it in this really complicated spreadsheet and said here, water company, you can use this to calculate how our product's so good. I see both of those sometimes.

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E.S.: I've seen it, a little bit of that's ringing a bell, people talking about data and the lack of baseline data.

LC: Yes that is another really good example.

E.S.: You can't tell if there's been an improvement because there's no baseline data but there's no money to put in the baseline data infrastructure, which would be good for the industry. That sounds similar.

00:23:25.950

F.6.: The example I can think of for that is there was lots of, probably over 10 years ago, the concept of more advanced process control of wastewater treatment works was brought in. So traditionally there's very much less instrumentation on a wastewater treatment plant and an operator who really understands there plant, they've probably been on there for decades, and the concept of being able

to run our plant more like a factory, or at least have more monitoring and control of the plant. And there were various suppliers who came in and some of them have sold quite a lot of technology to companies to improve the process and save energy and carbon etc, but there was a real challenge that water companies didn't really understand the baseline conditions that they had in terms of how much energy where they actually using, how much chemicals are they actually using, so that when somebody did put in a more advanced control system, there wasn't an easy comparison between the before and the after, so it was lots of percentage savings quoted, 20% savings quoted and banded around the industry. And lots of people know kind of said, well, we don't believe that, the plant at the beginning was being run, for example, from the beginning was being run in a very poor way, it was a really run down plant.

There's the point that quite often with trials and evaluations, the water company might give you the difficult site to work on. So, some of these process control, the water company said well, this is our problem site, we're having all sorts of problems with this, if you can sort this one out that'll be great, so they give you the worst of the bunch and then you demonstrate at 20% saving. Actually, you probably could have got 10%, half of that through just a little bit of housekeeping and that then, I don't know where I'm going with this, sometimes creates a bit of, yeah not having the baseline data, you have some frustration, but it also maybe creates a bit of people not believing necessarily the benefits that can be achieved and the cost benefits of it, especially when then you get the sales team within some of these companies quoting really big numbers, and then there's a bit of a reluctance because, sorry I might be going off on lots of tangents. With that example there was a kind of a bit of an internal conflict in that you might have a treatment plant which has a little bit of instrumentation to monitor some key parameters and maybe the operational budget has been squeezed on that plant over years and years and years, and the instrumentation and the number of operators on the site has been reduced, and maybe it's not operating as well as it could do. And then, a team come in who are the energy efficiency or carbon saving team with a separate budget, and they say we've got this new technology, we want to put it on. And they come along and put the technology on and they immediately get some savings, and the people who are operating the plant or the ICA technicians are really put out because all they wanted was a fraction of that budget just to get the plants working.

So, there's an internal conflict. And, and sometimes you find that that it's the people bits of it, so that people are brought into it. And I think that's probably a wider point to make is, if you don't get the people on the ground brought into stuff, things like automatic control systems, when something does go wrong, they get switched off. In that case, people immediately thought, this was going to take my job away. So when it starts to go wrong, I'm just going to turn it off, I'm not interested, , but nobody's really brought me into this journey of how the industry needs to evolve. Because they could have been part of that, but actually it's just another part of the business coming in with a completely separate agenda, probably with good intentions, but the people who had been suffering for a long time weren't really involved, so that's a bit of a tangent.

00:28:18.030

E.S.: There's benefits not being realised. In terms of the products themselves or the systems themselves, you talked about the regulatory regime around the water sector and how that's very statutory driven. Are there any sort of legal hurdles that you're encountering during the design phase, so any sort of barriers to what can be utilised or what can be produced, anything even at the innovation stage itself?

00:29:02.760 --> 00:29:15.750

F.6.: So I think there is a big barrier, whether that comes in at that stage I don't know, there is this barrier and I don't know how many people have already raised this about the DWI regulations. Regulation 31. Has that been raised before?

00:29:20.940

E.S.: I'm working on Pipe Bots and Regulation 31 is...

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F.6.: So that's at the moment, there is, I think that there may be three test labs for getting stuff through regulation 31, so there is a backlog in terms of people getting technology through this regulation, which is required if you want to install equipment or use chemicals within the water treatment, water distribution system. That is a fundamental regulation to make sure that what you're putting in isn't going to cause any harm to people drinking the water. But it's suffering because there aren't the laboratories. There's two or three companies that I'm aware of at the moment and actually that you can look at the list of companies that have applications and the backlog, but there's a huge backlog of companies that have got a technology, they put an application in and they're waiting for the testing to happen in the laboratory, testing to check the materials that they're using don't present any contamination risk, and at that point, there is only limited stuff that they can do with the water company in terms of testing or evaluation. They definitely can't get to that high TRL level and have a manufactured product. That's definitely a current barrier which is, if you talk to anyone involved in putting stuff into water treatment and their new company, they'll probably raise that and be really frustrated about it, but it is definitely a problem.

00:31:11.550

E.S.: Is it, I mean it's a great regulation in lots of ways isn't it, I mean it's protecting us. But when I was looking at it myself, it was designed for pipes, not robots.

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F.6.: Yeah it's very true, there's a section on pipes and a section about treating processes, as soon as you put something that's really innovative and new it just falls out, regulation is always behind, but this doesn't fit very well. So there's people with very strong views who say it should be completely changed, there's people who say, well, we just need more just need more support around the process, there's a need for more labs definitely because that's a real issue with the backlog in the labs. And the problem is that, people who might have, maybe somebody developed a tepidity monitor for going in a water distribution system and they developed a really low cost system. And they don't know but somebody said that there's a need for this and, probably, they will develop something and then at some point, somebody will say, well, what about regulation 31, have you thought about this, and probably what they needed to do is think about it really early on, but they never heard it, so that's the challenge.

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E.S.: So engaging with regulation 31 early is a recommendation. Sometimes you get pushed back that you're stifling innovation before it's been born. There's a balance isn't there.

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F.6.: I think there is. What was the question you were asking about regulation holding back...?

00:33:16.080

E.S.: Like regulation 31. They're there for a reason but they're getting in the way. What I would like to be able to do is put forward proposals to make certain things safe but more flexible, for example, and whether there's anything that you've encountered.. that would be good if just that law or regulation or regime could just be changed in some way. Regulation 31 is the classic

00:33:44.400

F.6.: That's the biggest example.

00:33:48.450

E.S.: What I'm finding is people are so often living with these things, they don't think there is a hurdle anymore, it's just something that we have to do.

00:33:54.930

F.6.: Probably because it's from the regulator, people don't think that there maybe is in the future, something could be done to make it different, it's always seen as accepted. I think there's also a point that the industry invested a lot of money during maybe the 1980s, 90s, or maybe some of the early 2000s, in producing lots of industry standards. WISes, water industry specifications and standards, WRC wrote lots of these. At the time they were current and up to date, but a lot of them haven't been updated, so actually if you look at some of these, they actually don't reflect current technology and things like that, so that might be.

00:34:55

E.S.: So it becomes like a norm?

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F.6.: Whether it's stifling innovation is not necessarily, that's probably a bit harsh, but it's definitely not promoting innovation, so there might be something about... Actually, this probably isn't a true one but it's an example, that there's maybe a standard about using CCTV inside pipes or sewers, and it probably talks about like a really low resolution camera or something like that, it doesn't talk about high definition, doesn't talk about all the computing power that you can do at the minute, it will just give you the specification, anyone would look at it and think well that's definitely from the 1996 or something. That might have been cutting edge in 1996 but nowadays we provide something that does that. That's kind of almost set as the standard. Probably suppliers who are supplying well above that and being used, but it's almost the industry standards are not setting an ambitious benchmark. Does that make sense.

00:36:13.230

E.S.: Yes, it does. Are there industry standards or are they water company level?

00:36:18.750

F.6.: So water companies will have some of their own, but there are also these things called water industry specifications which only cover a certain amount of things, and they are managed by Water UK. Water UK as a trade organisation for the water companies manages some of these specifications, and they have working groups to update them. One example is there is a specification for spraying the inside of water mains with like an epoxy type lining material, and that I think has been updated, but maybe it was updated seven or eight years ago, maybe slightly longer ago, but it is definitely outdated in terms of some of the terminology it uses and some of the techniques. It is in

the process of being updated but there isn't always the, either you go down two routes with updating, either you get some water company people to do it in addition to their day job or you pay somebody to do it, and I don't think there's been the funding to pay people to update the specifications. It's been really slow, really, really slow.

00:37:41.370

E.S.: So understanding the system you've got to engage with if you're doing something new therefore becomes more difficult? [yes].

In terms of trying to move to have an innovation that has wider benefits. Some people talk to me about wanting to do more nature-based solutions but not being able to because, in their view, the wider benefits aren't valued. Is that something that you've encountered or is that just people that aren't understanding the statutory drivers?

00:38:37.140

F.6.: I think there is... It is slightly outside of what I know about very much, but I think water companies now have ways to quantify and capture the benefits of more wider environmental, or maybe something such as a change of land use, or something which prevents runoff, or something that improves the ecological status of another water body or working with a farmer. I think those sorts of things companies do now have a process where they can start to quantify that and look at the benefits if it. But I would probably say that people probably need to engage better with the right people within the company to understand that process really, but if you try, there is a process, I'm pretty sure there is a process. But if you're coming at it, saying I've got something that can solve this problem, it probably as a standalone by itself, you probably might feel, without understanding the process, you might feel very, very much that you're struggling to justify it. I think that area has got a lot more recognition in recent years. And I think if you approached, I would hold if you approached an innovation team, there would be support, because there are groups within water companies who do work on that sort of thing, so there should be the links within the organisation.

00:40:27.960

E.S.: You talked a bit about the regulations, the government/ regulators and that regime pressing down and creating this sometimes positive, so you know regulations to make our water secure, and sometimes in its inflexibility, causing issues. Is there anything you've seen from the bottom up, like the social drivers that have been used by innovators or not to say bandwagon, but they've used those sorts of drivers to try and influence the water company. Has there been any success with that?

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F.6.: It is an interesting question. So almost looking at the social behaviour or the sort of wider community.

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E.S.: Somebody said to me once that they weren't going to dump things in the sea in this way, not because they couldn't but because of the community reaction they would get from it, a simplified version of what they said. It was anything where those sorts of social drivers were supporting innovation.

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F.6.: Am I the right person to know about that, I don't know. I think they do. The public awareness and public perception definitely through the press and social media definitely does drive some of these large organisations, water companies, some of their behaviours and the trends and everything. Bathing waters and CSO spills is one of them isn't it. It's very much public awareness and the public are aware of these things that spill out sewage every so often.

00:42:34.620

E.S.: It has struck me how strong PR is as level of importance in water companies. Not that it shouldn't be. It's very, very high, it seems to me, on what they're saying.

00:42:49.230

F.6.: I think it is. I'm not sure if I've got any really good examples. I can think of almost like a counter example in where you might have a company who has got a technology that maybe can detect leaks in a pipe or something like that, and then they do a lot of promotion, PR, saying this technology will solve your leakage problems and everything. There's generally few examples, because generally they're targeting the water sector, but sometimes you see things where people pick up on this, the general public, and say why isn't Thames Water buying these in numbers, surely if they just bought enough of these we could solve all the leakage problems, so sometimes that relationship between the supply chain and the end user, people get frustrated, I think, because I think sometimes, it's back to this problem framing thing. Sometimes, the problem is seen from afar as very simplistic, it's just holes in the pipe. If you can detect where the holes, are you could just go and dig it up and replace it. Of course it's much more complicated than that.

00:44:14.040 --> 00:44:28.680

E.S.: And what about knowledge within the industry itself? Do you find when you're going to meetings that the people that you're talking to are firstly the same people you spoke to last month, and whether they understand what you're talking about?

00:44:40.590

F.6.: So I think there's definitely differences. Within some areas of the sector it's quite small communities in terms of expertise in certain areas, and it's the same people all the time. I think sometimes, just going back to where we started talking about these companies in Scotland who have got these ideas they're trying to take them into this sector. They're sometimes struggling to get the knowledge or engage with the right people, I suppose. I suppose, and quite often I'm encouraging them to attend events and things like that and conferences and workshops. Maybe I lost the thread of thought.

00:45:40.290

E.S.: It's been suggested to me that there's a high turnover in terms of staff.

00:45:50

F.6.: People and knowledge.

00:45:50.190

E.S.: Yeah, and in the water sector sometimes there's big project, it goes ahead and then everyone's disbanded and knowledge goes with it. People said that they go to a meeting, and some people there have never been in the sewer and don't understand it. Is that something you've experienced or is it just anecdotal from one or two people?

00:46:18.060

F.6.: Sometimes I feel that those views are almost exacerbated by people who have had sort of more first-hand experience of that. There's definitely a challenge in terms of the utility sort of sector and a lot of people who have got a lot of experience retiring and not being very good at doing that knowledge passing and that succession planning. That's the same, it's the same within WRC, it's been in the same within the utility companies. You get one person who's become the expert in a certain area and they've been at the company for 35 or 40 years and then they retire and if you're not careful, you haven't backfilled.

00:47:10.290

E.S.: That's the same with any industry, I suppose.

00:47:14.700

F.6.: The same as any industry. The counter to that was the industry was struggling to attract people when the industry wasn't really seen as exciting or dynamic or somewhere you wanted to go if you are really interested in really techie stuff or something like that compared with other sectors. It was always seen as like slightly less exciting. But I think the introduction and use of much more technology in the sector in the last 10 years has changed a little bit. But there is thing. I'm not sure, definitely a few years ago, there was lots of discussion about retaining the right people and keeping people within the sector and everything. I think it's probably still an issue, but whether it's any different from any other sector. I see people that I work with, most of them, they come into a consultancy and might work there for a few years, and if they don't stay on they might go work for a water company or the regulator, so generally they'll stay within the sector. And we just keep building up more experience. I think people move around a lot more than they used to.

00:48:41.580 --> 00:48:43.920

E.S.: It's probably people have more than one career now, don't they. I'm on at least my third. I've got some specific question that I need to box off. I'm conscious I want to finish on time because I could talk to you forever. I'm looking at responsible innovation codes and ethics around innovation. Have you encountered any anyone that's actually engaged with that in the stuff that you're helping people with at the moment?

00:49:16.440

F.6.: So what do you mean? I think I'm gonna say no, but maybe what do you mean?

00:49:22.950

E.S.: Well there's code of practice where people won't actually do something if it's unethical. Wherever they define themselves as ethical. So they won't do something if it's not carbon neutral, they won't do something if there's not social advantages to it, they won't do anything that would impact workforces or fourth industrial revolution, or whatever their mantra is. Or they have codes of how they engage with the public or anything like that. I'm just trying to gauge if there's any evidence of that taking place, not that it should or shouldn't, just whether it is in any of the companies that you're helping or people you're helping with their innovation?

00:50:12.090

F.6.: This is a really good question and it's something that I'm sure we'll see more of. I think a lot of the companies that I'm working with generally, they see the invite an environmental benefit in what

they are doing. And this sort of thing hasn't really come up at all. A lot of the companies are set up in the belief that they are doing the right thing, and this is a way of saving energy or carbon or less disruption to somebody or doing something in a better way. I suppose generally the area that we're working in is trying to make improvements and doing things for the better good, with an environmental slant on it. There must be examples of other sectors, we're not talking about some type of like coal mining or something like that, where we're seeing how we can improve a coal mining process to remove more coal or something like that, generally talking about how can we improve the quality of effluent discharge into the environment or how can we make water quality better, or less disruption to customers, traffic disruption. Generally it probably fits within that box, but I don't think people are generally talking about it in the way that you maybe said. And I think that's really interesting, I think that probably will come along more, and I know some people, maybe some individuals who are, maybe either through their chartership or through maybe the company, they will have some ethics they follow.

00:52:12.960

E.S.: Their morals. I've seen it a bit with the levelling up agendas. People saying that their projects will help inner cities more. We might see more of it, I suppose, as levelling up becomes a policy driver. I've got one or two more questions, I'd be quick. Is Scotland easier than England?

00:52:47.760

F.6.: To do innovation in? The difference is that there is this scheme process approach. Through like Hydro Nation Innovation Service, if you are a Scottish-based company, you can apply for a grant and get some support and there is probably more support in terms of water-related innovation in Scotland than there is in England or Wales, and it's actually focused and targeted. So you're not competing with some sort of Innovate UK competition where maybe you're competing against some of sexy type of industry, so I think there's a little bit more help available, but I think once you get beyond that help, you're no different from anyone else I think. Most of the companies will say, well we're in Scotland so we'll approach Scottish Water. Actually, Scottish Water is no different from all the other water companies and actually it's being bombarded by people who think they've got the best innovation since sliced bread. They can't possibly take on all of these. Quite often they say, well, you need to talk to other companies as well, so there's some help, but I don't think it's any easier, no. The success rate is still really, really low and frustrating. There's lots and lots of frustrated people out there who just see everything moving at glacial pace, I think, which is frustrating. And actually some of the companies that we've supported, we've worked with in the last two and a half years, 24 companies, some of them from other sectors, there was one who is working in the aviation sector, oil and gas. Actually quite a lot of the advice and guidance we give them is actually, these are the barriers, this is the sort of thing you can expect, these are the sort of timeframes you can expect, and actually quite often. The oil sector may have gone through a bit of a dip where prices have dropped and they're looking at what else they could do elsewhere, actually they think, oh God this water sector doesn't look quite as attractive any longer. Let's stick with what we're doing. That might seem really negative, but I think it's good to give people the facts.

00:55:29.760

E.S.: A very quick question on what you would change. It's a nice end question. What would change to make your life easier in the water and wastewater sector, (not life generally (laugh)? What would you change in terms of the regime to help your clients?

00:55:44.550

F.6.: This is the big one, isn't it really. I'm sure other people have said that, there is more collaboration, but there definitely needs to be more and more collaboration

E.S.: between?

F.6.: between...definitely the end users.

There is this recurring thing that we haven't got right in the industry, which is around acceptance, testing acceptance and trials of technology, so a company going to Severn Trent and having to do a trial and that going well and Severn Trent using the technology, but then they go to Thames and Thames say well, that's different with us, we need a trial. That's something that I think the industry, and that's probably something probably everyone mentions.

Maybe the industry needs to get better at setting out, this problem framing, problem statements making stuff as an industry better at setting out those challenges, because I'm sure there were lots and lots of people out there in other sectors who could have solutions to the problems of the water industry, but from outside it looks pretty impenetrable or it looks like, oh it's all just about leakage or just about pollution. And I think you could make it easier for people to come with their new ideas.

00:57:26.070 --> 00:57:29.580

E.S.: I'm conscious I've just run out of time and you've got another meeting to go to.

[not transcribed, discussed end of project etc]

00:58:42.780 --> 00:58:57.150

F.6.: It's probably picking up the themes and probably trying to say what would really make a difference, and I'm just thinking off the top of my head here, here and now, but what could the industry do that would actually make some difference. And there's probably something, there's quite a lot of different sort of trade associations for organisations. There's the UK Water Partnership, there's British Water, Future Water Association and they all have initiatives to try and solve some of these things, but they probably do sort of work slightly in isolation. And like lots of initiatives they run out of steam and things, so there's probably something around, if there are things that should change in the industry, what's the mechanism for changing that as a whole rather than lots of little pockets.

00:59:44.730 --> 00:59:46.710

E.S.: That's an interesting idea, yeah.

00:59:49.200

F.6.: Different individuals have different sort of loyalties to these different trade associations and those sorts of things. And some of them are membership and if you're not a member, you don't find out about anything, so quite a good document will go out, but if you if you're not a member, you never even hear about it.

[end of interview- not transcribed]

G.7 recording 3rd August 2021

Confirmed OK to video record on zoom.

00:00:01.350

E.S.: I sent a participation sheet, are you comfortable with all that and what we're doing and what the project's about? ...

LD: Yes I didn't spot anything, it was fine

ES: [background to project not transcribed]

00:01:40.950

G.7.: Yes, so. What it is, is we're looking at new ways to understand leak detection. And what we're doing is we're inserting pipes into water mains to try and split leaks up so that instead of using it in the normal ways that they use them with acoustic loggers where they'll say right, or from data meters where they'll say we know that we're losing X amount of water from this area, and turn out a few teams to go run around at different times to see if we can find out where they are. Hopefully we'll see it, we'll excavate there, but they won't know whether that's a very small leak that's come up and there's an enormous one that just hasn't grounded yet five metres away.

What this does is it splits the length of fibre that's within the existing water main, millions of different sensors, and that will be able to tell you exactly where the leaks are located, within a couple of metres along, that pipeline, so you've just got to then walk across the top and track where you are with the fibre in there, and that'll say you're right above it, dig down now, and it keeps the excavation as small as it needs to be. And so you're providing less disruption to the customers' network, anything like that. And you're also able to talk to the water owners and say, across this five kilometres you've got 20 leaks and your pipe works are very, very thin at this location here. Instead of going out there and just waiting for these leaks to go, we can start scheduling for mains replacements for that section because it's going to go within the next couple of years.

00:03:41.370

E.S.: Okay, so you're getting data not just on the leaks, but do you get anything on the quality of the pipework that's left in situ?

00:03:51.630

G.7.: Yes, so as soon as that fibre's in there, that will be anything from 12 up to 288 fibres. We only need one fibre to detect the leak, so the rest of those fibres can be used for anything the water company wants them to be. Whether it's pressure sensors, whether it's temperature clarity, all that sort of stuff. Or like you go down the route of selling these fibres off to telecom companies and providing fibre solutions to reach places where traditionally they wouldn't have been able to reach so easily.

G.7.: Yeah, it is brilliant technology, but it's been like six years since I first discovered the company and started working with them. And it's only really been in the last two years that we've started to take it forward to a lot more in the UK, because they've been working externally and found it's a lot

easier with technology and patents to get into rounds in say, the USA and Spain. Once you get to the UK, you've got to get a lot more testing done, and then the networks as well, the network owners, they want to see it proven themselves and have their own tests. Although they all want to be the first ones to do it, it takes a lot for them to make the first step and do it.

00:05:26.910

E.S.: Someone said to me that in the water industry, there are more pilots than Heathrow and more trials than the Old Bailey.

00:05:38.160

G.7.: I've not heard that before, but that sounds very much like it.

00:05:43.980

E.S.: That seems to be striking a chord with what you're telling me already.

00:05:47.460

G.7.: Oh definitely, yeah. So this has been with quite a few of the water companies. I'd say we've spoken to majority of them about it. But again there's only really [] Water that have started to put their hands in their pocket and invest in it a little bit more, and that's only because [] are also working with them and willing to support them with it.

00:06:15.510

E.S.: So I'll ask some idiot questions, and that's because I want to hear what you say, rather than what I think. I don't want to put words in people's mouths. So why are [X] doing this?

00:06:31.020

G.7.: It helps to link a lot of our areas of business together. It's work within utilities companies, for water companies, we've got a lot of water companies that we work for. It also starts to bridge the gap to telecom companies, which again, we've got a lot of those that we're working for. And it meets a lot of our strategies going forward in that we want to be part of frameworks, rather than dipping in and out of contracts, we want to be there for the long game. And bringing this technology to the table we see as being part of that because, again, a lot of water companies and telecoms companies are asking their suppliers to bring this to them.

00:07:12.960

E.S.: And why are they interested, do you think?

00:07:17.550

G.7.: There's a lot of money behind it really, isn't there, I mean you look how much is available in terms of the government investment into fibre broadband and roll out. Loads of money in there, and there's also data is the new gold. You're going to be wanting to know more about your network and being able to react to it a lot quicker than 24 hours, 48 hours down the line, once you get a call from your customers to say that they're offline. You want to be reacting prior to that so that you're getting negative impacts on your KPIs from OFWAT and OFGEN.

00:07:58.290

E.S.: So it's, I suppose, meeting the fibre broadband agendas and the efficiency.

00:08:04.590

G.7.: That and, yeah ODI objectives from OFWAT and OFCOM, so if it's leakage WISER or quality or anything like that, if we can react to it faster than the customer sees that, they're never going to get any complaints from the customer to say, I've got no pressure, I've got no water, or the water comes out looking a bit funny.

00:08:32.190

E.S.: I know from pipe bots that putting things in the water supply...

00:08:40.680

G.7.: It's a nightmare, isn't it. Which is completely understandable because everyone drinks it and you don't want to be poisoning anyone.

00:08:51.060

E.S.: And so what I found is obviously, the regulation 31 wasn't designed for robots.

G.7. No

ES: What sort of legal, regulatory hurdles and have you encountered?

00:09:07.650

G.7.: So we did a first legal review of the technology itself to make sure the patents were in place. We then did our own testing rig set up with the innovations company again, just so we can get it right. Partly it was to help them develop their solution as well. So prior to [X] getting involved, they weren't able to do a live insert without depressurising the main, which again works for other continents and countries around the world, because their systems, they can just cut off one area and go to another. But in the UK, because it's all connected, you start depressurise anything, because the age of the network as well, if you start depressurizing, there's a chance the mains could just collapse. Or you're risking stirring up the sediment at the bottom so you're causing water quality issues, and generally they just don't want anyone to depressurise the network unless they have to.

00:10:10.320

E.S.: So you did a legal review of what they'd already done.

00:10:13.500

G.7.: That's it, so we did our review of the company, the technology, and So prior to [X] getting involved, they weren't able to do a live insert without depressurising the main, which again works for other continents and countries around the world, because their systems, they can just cut off one area and go to another. But in the UK, because it's all connected, you start depressurise anything, because the age of the network as well, if you start depressurizing, there's a chance the mains could just collapse

00:11:01.950

E.S.: So you haven't got any moving parts and energy sources in there, I suppose.

00:11:07.500

G.7.: Not really, no, not with the fibre anyway. But it's tricky isn't it, it's all self-contained within the torch head, if you like, really. So I think if you were introducing robots, the more that you can contain within something that's already approved, so a lot of the external material is the same

material as the pipe work itself. That's what we're covering, anything that's on the inside bits, you've got an argument to say, well it's never going to come into contact with the water anyway because of this external housing.

00:11:53.010

E.S.: How easy was it to get through DWI approval?

00:11:57.150

G.7.: So, it took about a year, a year and a half, I think it was, probably something like that.

00:12:02.070

E.S.: That was even though it's approved in other jurisdictions?

00:12:05.250

G.7.: Yeah, same materials as it.

00:12:08.820

E.S.: Well you know we're glad to be really aren't we I suppose. And you said that even though it had DWI approval and you'd gone through reg 31, there was an additional regime that [] Water wanted you to go through. Could you tell me a little bit about that?

00:12:29.160

G.7.: So that was materials in contact, why did they do it. I'm not sure really, apart from they're very precious about their network as you would be, and I think they just wanted to go a little bit more, over and above what the DWI suggested. So they had their own lab tests, we had to send everything away for, I think it was 31 days and then three months. Just to see how it would react in the pipeline, if it was left in there or lost or anything like that, not that it would have been. But they wanted to test it for every circumstance.

00:13:12.750

E.S.: To do their own risk assessment.

00:13:13.890

G.7.: That's it, that's it. And I think, because the amount of money you're talking about for these instance if they occur to the water companies, it's an enormous hit on their bottom line at the end of the day. So if they can avoid any of those risks, they will do.

00:13:32.040

E.S.: Right okay, so were there any other legal or problem issues with getting this tech through, obviously the acute Reg 31, but anything else?

00:13:43.770

G.7.: Yeah, so we're having discussions around the contract side of it as well now with [] Water because there's a certain amount that [X] have invested in it, there's a certain amount the innovator's invested as well. And we want to make sure that all parties are covered. And because it's outside, or it actually links, a few of the existing contracts we've got there together. And, rather than going in and disrupting those, we've sort of had to pull it back and try and describe new contracts,

and we're working with them to create that. And that's also looking at the data side that's coming out the back of it as well as who owns that and who does what.

00:14:31.230

E.S.: A number of questions coming out of that. Is there much on data security? Have there been many questions and issues over that, yer?

00:14:40.260

G.7.: Yes, it's early days, but there are a lot of reviews that go through it, so for a few of the other technologies we've got, the amount of GDPRs and PRAs that I've had to go through. You go through the first hurdle, get it out to the site, and the legal team will get involved again and everything stops, waiting for a full review to take place. Which I know is more personal data, rather than data information coming out the back of it, but yeah it's, certainly hyped up an awful lot lately.

00:15:13.110

E.S.: Anything that can identify people, I suppose.

00:15:14.610

G.7.: That's it, yeah.

00:15:16.860

E.S.: And how about the infrastructure security, anything on that?

00:15:28.800

G.7.: (laughs) hmm yes, yes, it's difficult because a lot of these water companies haven't really had the investment to do full asset mapping of their networks, so they'll have a rough location that they'll send out as part of their maps, but you've seen them, they're just streamlines really. And when you go out to site it could well be that they've drawn it up in the footpath but it's actually in the middle of a four lane carriageway, you know, something like that. And so there's more to be done on that, but again that's the investment that's required a bit, because you look at the major infrastructure projects that have been successful with it, you know, crossrail, HS2, they've all had huge budgets to go into the design process at the beginning. So the mapping of these networks is enormous. And brilliant. You apply that to the water networks, where a lot of it is going to be going out to sites as quickly as possible, repairing leaks as quickly as possible, get back on to the next one. Do that, and you're constantly playing catch up with the red line drawings, just to say where it is. There's always a chance that information is going to be lost because it's just not going to be captured in time, or those people that know about the network leave the industry. And so, in terms of actually information security, it's hard to say, because it could be a whole lot better than what it is at the moment.

166

00:16:52.980 --> 00:17:04.320

G.7.: yeah once you get on to sites themselves, I've heard people saying some of them go out to certain sites, this isn't [] Water, this is other areas but I'm sure it applies to everyone, is that you'll go out to the pumping stations, it will be a really old operating system and the password for it will be written down next to it, or something like that. These are unmanned locations with huge assets and lots of potential if things go wrong. It's mad.

00:17:22.500

E.S.: Someone was telling me it's all Victorian infrastructure, plus World War Two, people just connecting pipes anywhere to keep the water going and it's just best guess really, completely understandably.

And you mentioned contracts as well, quite a few people have mentioned procurement and contracts and trying to get something new in when there's something established in place. Is that something that rings any bells with you?

00:17:53.850

G.7.: Yeah, I suppose it's been a little bit easier to bridge with somebody like [] Water because they see themselves as being the market leaders for the water industry. So if you do bring something new to the table, they see it as, right it's going to improve us and keep us at the front. Whereas if you're working with other water companies, it's more a bit like, right well this exists and we're still not the best now so we're just going to keep using what we can while it's available. We don't have to do any additional funding for testing or writing up any new contracts. It can be more difficult and more time consuming to outline the need with those sorts of companies. Rather than them being more receptive to it.

00:18:45.690

E.S.: So in some respects [C] have circumvented a bit of those problems by aligning with you. You've already got contracts in place.

00:18:55.800

G.7.: To an extent, yeah, but they originally came to us because they were trying to ingress into the water industry. They were approaching these water companies and telecom companies directly and they just didn't want to hear about it really. They said you're not coming on to our networks if you haven't got the right training or anything like that in place. We've got these contracts set up. Go speak to those guys and we'll bring you in that way. Which again is completely understandable. You don't want anyone mucking around with your networks.

00:19:27.060

E.S.: It's transferring the risk to [X].

00:19:30.270

G.7.: That's it as well, yeah.

00:19:37.470

E.S.: In terms of environmental impacts, has there been any sort of assessment on pros and cons of this process, the fibre optics?

00:19:48.390

G.7.: It's still early days, so we haven't had anything really materialised from it yet, other than saying, well, it should work out because, instead of digging the potential for dry holing, what you excavate on a potential leak location, get down there and find out that it's not actually leaking, you can eliminate that completely. You're also starting to plan in the works more once you start identifying where these individual leaks are. So you can start hitting locations in one phase, rather than going there, going back, going there, going back, so you essentially eliminate a lot of the transport carbon

emissions that way. But again it's still quite early days within the trial. Its still early in the trial to be measuring that fully and providing that, we've saved our company tons of carbon per year. It's something that we certainly wants to be looking at and seeing how we can improve it, because all these water companies have said, 2030 we're going to be zero emissions, zero waste. So, the more we can provide as a contractor to those companies to help them meet their targets, the better chance we've got retaining those contracts.

00:21:08.190

E.S.: And carbon is the big environmental driver, isn't it.

00:21:11.580

G.7.: that's it, yes, we recently released our own carbon framework for it and again that's 2035, I think it set ours as.

00:21:20.610

E.S.: And in terms of relationships then, you've mentioned water companies. Do you have much contact or liaison with regulators? Not that you should.

00:21:34.440

G.7.: Not really. Not a DWI or OFWAT or OFGEN or anyone like that. I'd say once you get higher up the company, we're involved in a lot of government contracts, so we've been involved in a few of the construction Covid papers that are going out and helping out a lot on those. But in terms of the actual water companies themselves, not that I'm aware of at this level.

00:22:07.320

E.S.: And in terms of the people in your team are working on this, what's sort of disciplines do they come from? What's your background? Are you engineers, are you project managers, are you a mix?

00:22:22.920

G.7.: So there's a lot of Civil Engineers in there. The CEO for [C] came from an IT background, originally.

00:22:34.890

E.S.: Has he been with you long?

00:22:37.530 4

G.7.: So we've been working with him for about six years, well I've known him for six years, working with him properly for about two and a half years or so. So long enough. Yes, but it's mainly been Civil Engineers I'd say that are working with it at this time.

00:22:58.260

E.S.: Has there been much contact, have you had to do much in terms of the public and PR or anything like that?

00:23:06.120

G.7.: It has been difficult, because a lot of it was under nondisclosure agreements to begin with. And also, we didn't want to release anything too early because of the people involved. We're trying to get something proven and our to market and ready to go, because we do see this as being

something that every water company will be interested in and we don't want to be offering them a half-baked solution. We want to be going out to market with the full design and operation ready to go. And so we have had to keep it quite brief, but the first one I think I sent to you was from January last year and we've just done our live trial out on sites two weeks ago, which we'll be releasing a video on shortly.

00:24:15.750

E.S.: You said that it was more difficult to get some things through in England than it was in, I think you said Spain and the US. Could you talk me through that a bit more?

00:24:29.700

G.7.: That was what I said, again it, I think it was just more that we're a bit more stringent in the UK and seem to be, you know, it could be a number of reasons. It could be because there's a lot more people per square mile than anywhere else really in those sort of areas. So if you do impact something, there's going to be a lot more people affected than anywhere else. And the network, I think, as well, in the UK is a lot older than those sort of places. And there's a lot more of it that we're using for a lot longer periods rather going out there and bypassing that or replacing the older ones. Leaving them there, we're having to reuse them and improve them, as they are in situ rather than removing them. So, again that's probably a combination of that that's meant these assets are crucial, and they were quite delicate at times.

00:25:32.730

E.S.: But what is it exactly that's making it more difficult? They're the reasons why it's difficult but who is it, what is it that's standing in the way, is that a regulator?

00:25:42.840

G.7.: I would say so, that was the original one that was kicking it off, so nobody would really talk to us properly about trial until we had that DWI approval in place. And even once that was done, you know you'd still getting the MICs, and I think there is a case in America as well, where they deal with it on a state by state basis, or even county by county rather than national.

00:26:12.540

E.S.: It's massively fragmented.

00:26:13.800

G.7.: That's it. So you could go to one State and they'll say no, but you could go to the State next door and they'll say yes. It's just meeting as many people as you can really and saying what you've got.

00:26:28.470

E.S.: Okay, path of least resistance as well.

00:26:30.690

G.7.: Yeah, that's it.

00:26:34.170

E.S.: If there was something that you would do differently, having been on the project a couple of years, did you say?

00:26:42.300

G.7.: Yeah I've been speaking to [C] for six years or so, just keeping in touch with them, seeing what they're up to and making sure they're still going really. And then the last two and a half years I've got picked up for my role, and that was to pretty much launch projects like this within the south and east region for [X], or Water North as it was then. And then just take it forwards.

00:27:12.960

E.S.: If you look back at what you did two and a half years ago...

00:27:21.270

G.7.: Was there anything I'd do different... It would have been brilliant to see in place a lot sooner. And you know, there were a few things there. It's difficult. How far is this going to go really?

00:27:44.190

E.S.: Anything you feel uncomfortable with don't say. Everything is anonymized, anything that could identify you, your customers or your company is removed. And so you can't be identified. I'm not out to cause any embarrassment.

00:28:08.430

G.7.: And will I be able to check it prior to it being published?

00:28:14.

E.S.: We don't normally send it out in advance of the thesis being submitted to the university, we don't normally circulate it in advance. So if you feel uncomfortable, limit what you say. I don't need to know anything controversial. The project is really designed to help. So we want to help the water sector, we want to help people like you get innovations through. Anything that you could flag, that would help me help, look at it that way.

00:28:52.440

G.7.: It's probably going to be easier if you've got a stable team involved with it all the way through.

00:29:01.830

E.S.: Everybody said that.

00:29:04.110

G.7.: And you've got executives and senior leaders that are bought into the projects early on and grasp the idea, understand it and want it to succeed as well.

00:29:17.520

E.S.: Leadership has been a massive thing throughout all these interviews that people have said. "Brilliant, my CEO has been in place for 25 years, or it's awful, my CEO has been in place for six months, and the knowledge gaps, the turnover of staff and things like that. That sounds similar to what you've seen in the industry more widely.

00:29:41.760

G.7.: I'd probably say timing as well, because a lot of these, you know we're working on five year cycles or four year cycles. So the first year is normally about scoping just what you've got, and the

water company has been a little bit cautious with it, second year they normally know what's happening, start spending a little bit more. And by year five, dependent on how frugal or how much money the companies have spent, they'll either be very short of pocket and be holding everything back and waiting for the next AMP cycle, or they'll be spending as much as they can to get it out the door as quickly as possible so that they can go back and ask for that amount again.

00:30:29.220

E.S.: You're outside this as a separate entity. How do you find out where they are?

LD: We're involved in a lot of the management meetings and leadership meetings with those companies, particularly on the alliances. We'll be involved at quite senior levels fairly early on. And we're able to have more of a say, of helping those water companies to invest more wisely and get the best bang for their buck coming back. That's quite helpful for it, and then that also feeds, our timing as well, so I'll say right that's got to go out the door immediately. Or they're saying you know, we're actually focusing on something else, rather than this innovation, right now, so let's hold it back a little bit longer. And so is quite fluid in how it works. But probably about every six months, not six months, maybe six weeks or so, we'll get a push from the leadership team just to say what's going on at the moment, so we've set up a project team that's mixed across the alliance from [] Water to set up this [C] system and their network. About every six weeks or so we'll get the leaders involved in that to try and push it forward a bit more and say what's going on, but again... Perhaps it could have moved faster if they were a bit more involved, but at the same time we're also waiting for them on a lot of the matters that are holding it up, so getting the contracts in place, for example, we can't really do an awful lot more until that's been sorted, because it costs money to innovate.

00:32:31.830

E.S.: In terms of generally, and the governance, the law, policies, statutes whatever, and what drives you mad, is there anything in particular that you think, if the regime could change, just in these ways, this way, that would make my life so much easier, what sort of things would you be thinking of wanting to change?

00:32:59.430

G.7.: I'll definitely want it to speed up. Six years on it. You see it and think, you know we could be helping out loads more countries, we could be going global with this now, rather than just still focusing on a region of the UK. How would I speed up though?

00:33:24.210

E.S.: What is it that's part of the slowness.

00:33:29.580

G.7.: It's probably getting innovation to be part of the day job and actually setting out a certain amount of time for it, rather than having it as an add on or as a means to meet an opportunity or counter a risk or something like that.

00:33:53.820

E.S.: Sometimes I get the impression that innovation's PR.

00:33:56.880

G.7.: Yeah a little bit isn't, it is very showy. I get what you're saying. Again, behind closed doors it's taken years and years to get a lot of things in place, and once it goes out, we say this is something we thought about last week and we've just done it for the benefit of our customers, well, you haven't really have we. It's a lot of margin improvements as well in that we've had to meet first. So it can be like that. I think the investment pots and the innovation fund that's been set up is the right way to approach it. When you hear a bit more about where that money came from in the first place, again it's all makes sense that it's come from water companies to invest back in the water companies but yeah, and that makes those guys more keen to get back what they've invested in in the first place. That's probably the right sort of approach for it. It would be nice to be more open with it, but can't really see that changing really anytime soon.

00:35:18.000

E.S.: What do you mean by that, be more open?

00:35:21.600

G.7.: There's always, you're investing in it, but it's got to benefit yourself in some way, you're not doing it for everyone. You've got to be first if you're going to be investing that amount of money, you're going to be first to market and you're going to be expecting 12 months of just you having the market, and then it opens up into everyone else. It makes commercial sense and you can't really go against, that can you.

00:35:54.210

E.S.: But yes, it's a commercial market. I interrupted you. You're talking about an innovation not just being a day job.

00:36:04.680

G.7.: Yeah it would be nice for it to be given some time, part of the nine to five really. So as well as going to all of these commercial update meetings and financial meetings and operational meetings, if you set up some time for it. I think that would help get more of a buy into it, rather than it being, okay we'll invest in us now, we'll set up a little bit of a pot for it, try and gather in as many ideas as they come in organically, but then, if we hit hard times, innovation is going to first one to go. We need to get on everything else, really, to get us through. So I think that you'd want to try and make it more of a stable income, I suppose. How you do that with something that's always changing, I don't know.

00:37:12.480 --> 00:37:13.890

E.S.: I see what you mean. Is it innovation for innovation's sake, in a way, that there's some benefit in having just a constant stream of thinking?

00:37:38.580

G.7.: That's what at the end of the day, that's what the shareholders want isn't it, they want a stable business to invest in. So if you can provide something that is stable but also improving the company as it goes, you're going to get a lot more buy in from your executives, because it helps meet what the shareholders set them to do. So rather than bringing in something that says, right we're going to take a hundred K out for an investment bond, for an investment pool, but you might not see the benefit from that for another five years. Equally it might come in next month. Shareholders are going to be a bit like well, that's hundred grand that could be in my pocket already, why take that out.

00:38:23.940

E.S.: Difficult sells. ...There's a lot on levelling up, particularly energy sector, but very little really in the water sector. I'm just exploring whether there are levelling up social investments that you're aware of that may not be obvious. Green or blue infrastructure projects and more Community based.

00:39:01.950

G.7.: Yeah so we've got a few in the pipeline to help utilize some of the land that these water companies are sitting on really. So, whether that be helping to rewild them or plant more trees, or just get more use out of them, whether that be solar plants or anything like that really, the more sustainable side of it. And we also do quite a bit of work jointly with [] Water, with the BITC, which is business in the Community to help develop the local area around there. And we've done a lot of work during the pandemic supporting the lowest of the community in terms of getting food to the vulnerable people that need it and providing laptops for the kids so they can go to school, those sort of things. It probably could be shouted about a bit more, but we're getting there slowly and there's a few things that was set up within [X] itself. There's a social impacts calculator that I think came out about two years ago, or so. And that basically analyses all of our contracts and says in the East of England, for every pound spent at [X], we've actually invested another 50 pounds into the Community in terms of the extra income from supporting local people and local jobs, using local materials, all that sort of stuff. The fact it's not really heard about says that we could be promoting it more.

00:40:44.100

E.S.: And fibre optics as well, I think you said at the start, it has the potential to reach communities that haven't been reached before. And that has massive levelling up. Is that something that's been on the radar as well, acknowledging that?

00:41:06.270

G.7.: Yeah so we've picked up a few big contracts with [], [] and [] recently, but again a lot of those are sitting around the central city locations. In terms of actually getting out to the local communities, it's looking at a few more of the individual telecoms well, not even companies but groups that have been set up for those little villages to get the telecoms to them. There's still funding available, but for the bigger ones, they're going to make more and be more efficient, providing houses with 50 customers, rather than one or two farms across 30 miles or so. It's something that the fibre networks could help out and make it more sustainable and efficient to do for them, because the water networks are already there, so they don't have to invest in any potholing or digging up the roads or fields or anything like that.

43100:42:12.090

E.S.: And they know it's going to go to communities, that's where the water is going.

00:42:15.780

G.7.: Exactly yeah, everyone's got water.

00:42:17.970

E.S.: They're all my standard questions. Anything that you want to add?

00:42:29.250

G.7.: I'm not sure really. Has it been helpful? ...

00:42:35.370

E.S.: Yes. This is very much the start, so I've done this academic exercise and I'm speaking to about 20 or so people. Government agencies, water companies, innovating companies, small ones big ones, intermediaries, if you like, like yourself. And you can see everything from both sides, as you seeing innovator, and then having a relationship with the water company, that's something that is really interesting that illuminates that. It has been brilliant, yeah really helpful.

00:43:06.330

G.7.: I would say that if you're sticking with water mains or water, wastewater, it seems to me that once you get past the initial hurdle of your DWI approval, and your approval with water companies to use their network, I think, once you're in, you're sorted, you're going to be able to do everything. That initial hurdle and risk is at the main, the first stage. If it's in a sewer it seems like there's going to be risks around every corner, because you could get issues of working in that explosive atmosphere or anything like that. You never know what you're going to come across, it could be massive fatbergs that you've got to cut through. So to design a robot that is able to deal with all of those and still be able to hang on, sounds impossible really.

00:44:07.260

E.S.: They actually want to concentrate on wastewater because they're bigger. The project I'm working on covers pipe bots but it's meant to be wider anyway to cover eventualities, but I think is tricky in sewers, just the terrain. Getting the sensors clean. They're a very keen on having swarms of them. And with the water there, they're going to live in the water.

[more general chat end of conversation pleasantries, not transcribed].

Interview with H.8. 25th May 2021

Opening chat and pleasantries not transcribed.

Checked participant happy with participation sheet and what was happening. No questions.
Confirmed ok for me to video record on zoom.

00:00:01.829

ES: So. Some people have found it easy to have a project in their mind and talk about that. Any projects around water and wastewater infrastructure. Some people want to talk more generically. If you've got a project in mind or particular successful project you think...

H.8.: I'm thinking is sort of in my mind is sort of like a generic picture really because, as you may recall I'm doing stuff with water companies around the conventional you know, nutrient stripping. I'm doing also doing quite a bit around nature based solutions, well trying to and yeah yeah we have got some success on that. And then I'm also heavily involved in water resource, strategic water resource planning as well. So trying to.. without knowing the questions you're going to come up with ..it's difficult to know which one to pick really.

ES: Okay, so if you talk just try and think about a successful project. That's nice to begin with, doing something where ..just to get the ball rolling. So if you think of a project around water or wastewater which you think you are proud of that that was a good project or that was successful.

H.8.: Okay. So I'll probably start off with then the WINEP, of the 2019 WINEP. Yeah so I was, I presented evidence to the environment agency and [-] water around the problems with nutrients on the [s] Levels and Moors, which has been quite topical recently. And you know I followed the the national guidance and WISER and the EA guidance and managed to secure a great deal of funding really for fair share reductions as sewage treatment works so yeah you know, in total we're talking about 55 million across the [s] Levels and Moors.

00:02:03.360

H.8.: So there are negative aspects to that which we can maybe come onto, but the positive thing is like you know you present your evidence, you need a solution and the and it sort of falls into place. And there's no disagreement there's yeah well really there weren't any disagreements about that.

00:02:23.670

ES: So its one of those situations where the planets aligned, and it was then of its moment, or was it something that, and you know, because often you hear about projects more likely to be cut back or not progress for economic reasons, rather than going through things successful was it something that was resonating with the policies of the day. Why do you think it was taken up without disagreement?

00:02:55.380

H.8.: I think you just simply because there was a national guidance from EA, not only but mostly from the EA, and [x], led by EA, but know it's the WISER, you've heard of WISER ? so it aligned with that.

00:03:16.560

H.8.: It also aligned with the sort of fair share principles that Environment Agency are very keen on, in terms of you know sector reductions. So it was just all by the book really there was nothing, nothing really innovative about it. And that's the downside. But it didn't, it didn't disrupt the agency's policies and process, so it fell into place.

00:03:43.500

ES: When you say successful. What do you mean by successful?

H.8.: Well, I think it well it's successful it's halving the phosphorus load to the [s] levels, to that was from waste from the wastewater industry. So that's a massive chunk.

00:03:57.660

ES: yeah.

00:04:00.810

H.8.: successful in terms of ecological, ecological success. Hmm well no not really, not at the moment because we need to do the same with others, other sectors, you know almost halving their load. So, if you think the concentrations of phosphorus, without even get started on nitrogen, phosphorus to stop the decline, you probably need to be somewhere between 50 to 100 micrograms per litre, and we're actually still at 200 300 400, after the phosphate stripping.

00:04:42.660

ES: OK, so why was this option taken up if it's not the best ecological solution. That's a million dollar question?

00:04:56.370

H.8.: yeah it is ,isn't it. I think there's a point from the start that you know you have to start somewhere with the problem of nutrients, there's so much been going in for so long and it's been I say neglected issue for a long time, certainly an issue that's been brushed under the carpet on some sites. So you have to start somewhere and and phosphorus removed from sewage treatment works is very effective and given the scale of the inputs it, it is a requirement somewhere along the line and the restoration of the site is clearly a requirement.

00:05:36.660

H.8.: the disappointment is that, even though you've done a lot spent all that money, you haven't really got a great deal of show for it in terms of you've got a different concentration in the in the in the [s] levels and moors and in the rivers. yeah you haven't got an ecological gain and no will you get any for a long time unless other sources are dealt with.

00:05:56.940

ES: other sources of phosphorus or other nutrients?

00:05:59.940

H.8.: Right I'd say phosphorus. But I mean nitrogen, we haven't even looked at Nitrogen, but I'm sure nitrogen will also need dealing with. Now, one thing we could have done is said right well we won't invest all of our energies and money in phosphorus stripping from sewage treatment works. We'll do some of that but we'll also do will do a lot more around you know nature based solutions so at least you get biodiversity benefit of whatever you're doing. As well as the nutrient reduction. The downside to that is that they are it's more uncertain generally in terms of the reduction you're going

to get. And it's also the unknown. So the Environment Agency like to know what they're going to get in their program to reduce nutrients and also the companies will be nervous about these new well, it may, it may change now because of a recent Ofwat change of heart, it seems, but you know, back then, they were very nervous that Ofwat what would want them to deliver this project and the Agency would want them to deliver the more innovative projects within times within the certain times scale and there was uncertainty around that all sorts of uncertainties, you know because it's breaking new ground.

00:07:19.050

ES: OK, so it's easy to bring about an incremental change than a big one, which a transformational change, I suppose.

00:07:28.560

H.8.: yeah I think I think that's going to be true across the board, because of the scale of the problems that we have, I think incremental changes are going to be the order of the day, not big ones. Yeah but you know we've had P stripping in what was was it, in the levels, there was a bit in PR 09 then there was more in PR 14 and now and PR 19. So the water industry are you know, are the ones that are making the making the incremental changes to just you know, to really quite significant scale. But nothing else is really nothing else is happening to other sources.

00:08:07.620

ES: Say farming?

00:08:09.510

H.8.: Farming predominantly yeah.

00:08:11.280

ES: yeah. Why do you think that is?

00:08:16.590

H.8.: crikey. They are not easy questions are they. I know the answer I just I just want

00:08:23.520

ES: I always have an opinion on things but it's what you think that matters.

00:08:28.980

H.8.: yeah yeah okay so um. It's a combination, I think it's a combination of, well it's politics isn't it and finance so, and, to some extent, maybe tradition. So if we just maybe we just pull apart, like what are the obstacles around changing agriculture. Obviously, the farmers profit margin is going to be key, how do you know, in the light of you know, current things that are going on at the moment around incentivizing, rewarding farming, how do they keep going you know, how are they going to respond to deal with that and intensification is one possibility, I think. And then there's also the scale of the incentive to make them do something, to incentivize them to do something different.

00:09:28.800

H.8.: It's not big it's not big enough either. And then on top of that there's you know the regulatory requirement, you know, are they all conforming to regs and diffuse water pollution regs? Probably not? And is anybody enforcing it? no, you know.

00:09:43.740

ES: it's very difficult to enforce I suppose.

00:09:47.310

H.8.: hmm well.

00:09:47.970

ES: is it traceable?

00:09:49.590

H.8.: I think I think it's a matter of interpretation of the legislation. When I looked at diffuse water pollution regs, I say well, it says here that you shouldn't do this you know, effectively, on a high risk site and that's high risk site and yet they are still doing it, yeah and so that's where the politics comes in, you know. So especially somewhere like the [s] levels, because hmm well I'm sure you know about the history of levels and the science and also in terms of farming and flooding and you know floods and all of that. I don't think the agent generally I don't think the Agency have got an appetite for upsetting farmers and for regulation, I think that's particularly acute on the [s] levels.

00:10:32.370

H.8.: And then they would say, that there's I mean we're actually having this discussion with them at the moment because all of the sites on the [s] levels are now being changed to unfavourable/ declining, as a result of nutrients. So we've taken that decision and we are talking to them at the moment about comms. And all you keep hearing again and again, is that we can't do anything different because we haven't got the resources. You know, we can't regulate. Because we haven't got enough people to find the necessary evidence, you know to collect the evidence to regulate, to make a case, you know we can't we can't challenge water management plans, because we haven't got the staff to engage you know.

00:11:09.570

ES: so they can't add teeth, so why bother?

00:11:12.390

H.8.: yeah.

00:11:14.520

ES: And sometimes it sounds like it's a very Science quantitative measurement that they're looking for in terms of when you put forward a proposal it's got to be, very science quantitatively..

H.8.: And Certain.

ES: So certain. Yeah is there scope. would it be better if there was more qualitative if there were more disciplines involved in deciding what successful would look like.

H.8.: Definitely

ES: Okay. Why do you think definitely?

00:12:03.900

H.8.: because you've already I think you've already said, the agency are there, so WINEP water quality stuff is run by water quality function in the Environment Agency and they'll have their processes in there, they know and their requirements and they will need a high degree of certainty that they will get the company will get down to that level of reduction.

00:12:24.510

H.8.: so whatever parameter now like like phosphorus and it will be like you need to be confident you're going to do it, so they need to be. It's really weird actually. They need to be certain about delivering something that has literally no ecological benefit as as opposed to be uncertain about delivering something that has a high benefit potentially.

00:12:51.060

H.8.: So, so the nature based solution, you know the hope I did manage to get a Nature Based Solution in WINEP around integrative constructed wetlands, to try and trial them to look at nutrient reductions as long sighted and multiple benefits and I had a huge job getting it into the onto the WINEP partly down to the EA who was sort of saying well it's not going to deliver these benefits across the whole catchment with any certainty. The company were also nervous, because it was like well where abouts or if we can have this wetland, landowners are they gonna play ball, what if it doesn't work, what are the EA going to do to us if we if it fails, you know. And that just shows the whole system hinges on the certainty of delivering a quantifiable reduction, even though you know even that amounts to sort of bean counting in my mind.

00:13:47.340

ES: yeah yeah. How much problem, for want of a better word is land ownership in that particular example? Did you never get as far as testing it or or view, do you rub up against land ownership issues?

00:14:04.980

H.8.: yeah I mean I think land ownership is in terms of delivery nature based solutions yes it's huge because I mean we are doing this with some some really innovative work actually within en-trade, you know, have you come across en-trade?

00:14:23.700

ES: No

00:14:24.810

H.8.: Alright, so environmental trade is a sister company of [-] Water. And they basically are brokers of ecosystem services. By effectively so project, I mean it's been going for a while, but it's really ramping up now. Yeah so they they basically put buyers and sellers, you know the link buyers and sellers of an ecosystem service so that could be, it could be phosphorus reduction, it could be carbon credits or natural food risk management.

00:14:58.590

H.8.: So you know entrade is developing really quite a well thought through scheme to do this. The actual finances in the middle, between the buyers and the sellers, is not it's not entirely clear at the moment they're still trying to work that through, but they are essentially providing a brokering audit trail monitoring system, and on top of that they're sort of underwriting the whole process. So if someone's buying a credit and they say yeah we can sort that for you, by putting you in touch with these sellers. If it transpires it that that isn't, that credit, it doesn't actually happen to the necessary degree, then they're saying we will underwrite that with [-] Water. So it's really quite a powerful system that's developing there. But going back to your question hmm, so if you are going to put wetlands in the catchment you know, in the catchment to mop up nutrients, you know to intercept nutrients. You can't just put them where someone's willing to play ball, you have to put them where you've got a source and a flow pathway between you know the source of the receptor. So instantly then you're going to kind of course the spots where you identify, this is, this is, this is a good place for a wetland. So one issue might be well it's like you know it the landowner going to be prepared to play ball or not. And then the other one is that if you're identifying all these real hotspots for interventions, you're going, there's a real risk they're going to put up the capital value of that that bit of land, you know so landowners might they this is a really important spot, we can inflate the prices.

00:16:51.000

ES: Do you see the Agriculture Act helping with the you know the payments for public payments for public goods type and there's a new terminology now isn't there? that the LM yeah.

00:17:04.080

H.8.: Yes ELM, I don't I don't know because I just don't know enough about what's actually being decided.

00:17:09.660

ES: It is only just coming out really, watch and wait may be.

00:17:12.840

H.8.: yeah so at the moment, as far as I'm concerned it's still being discussed within DEFRA. I mean I've got this gut feeling, but it may be very similar to what we've got already just in a different, in a different guise. In which case I wouldn't really help us that I don't think.

00:17:27.780

ES: Right, maybe sounds like a step in the right direction but let's see I suppose.

00:17:33.120

H.8.: yeah So in principle I mean, in principle, is it clearly is. I think there needs to be right balance between regulating farmers and incentivizing them, so if I you know if I come along and say right we should have a water protection zone around the levels on the steep slopes, no maize growing, that's it could be my bit of advice, which is technically sound. But if that farmers got all his will land on the edge of the [s] moors and can't grow maize, then you know what does he do then.

00:18:05.

H.8.: So I think there needs to be something , there needs to be appropriate balance between regulation and incentive.

00:18:14.070

ES: And, just a quick question on one aspect of what you talked about and that's phosphorus itself hmm is it seen as a bad or is it seen as an asset?

00:18:25.320

H.8.: yeah. Depends who you ask.

00:18:33.570

ES: In your experience how is it viewed?

00:18:35.850

H.8.: Oh, I see I see it's bad because, we have oodles of it everywhere, and you know we've got five times as much as we need in the in the Ramsar site. Hmm I think farmers a lot of farmers will see it as good because they probably think that they put more on they're going to get a better a better output yield.

00:18:54.840

H.8.: I think I think agriculture sees it as not a waste, but something that we need you know more of.

00:19:03.870

ES: Because of nutrients stripping is there an angle, for it being seen as an asset that could be taken away and reused, would that help at all.

00:19:13.950

H.8.: I think that's been discussed a lot over the years I've never actually heard about it actually happening in practice.

00:19:22.890

ES: Now you have to get a certain proportion of quality and.

00:19:28.530

H.8.: Hmm

00:19:29.100

ES: and going to have to utilize it.

00:19:37.230

H.8.: Just grab a glass of water, I will be back in a minute.

...

00:20:12.870

ES: You talked about water resource strategic planning. That's well not a hot potato but massively interesting. Could you talk to me a little bit about what you're doing, as far as you are able to?

00:20:26.340

H.8.: Did you used to be a lawyer, by any chance?

00:20:28.140

Yes. Both laugh. Solicitor. [not transcribed]

00:21:17.850

H.8.: Right. Yeah I can, I can tell.

00:21:23.670

ES: yeah. So interested you talk about Strategic planning. And suppose I'm interested in the extent that it brings about, environmental benefits, social levelling up even. Or just talk to me about what you are doing

00:21:54.870

H.8.: Have you heard about regional water resource management planning? Yes, okay right, so there are these regional groups that have been set up.

00:22:04.050

H.8.: and [x]'s on many of those groups. I'm on the [] water resources group, yeah and the agency have issued some quite exhaustive guidance on what the regional planning process should do, in terms of environmental need it covers it sort of takes every box really.

00:22:24.090

H.8.: But in practice when I'm having those discussions within those groups, with the Environmental Agency, with the water companies, I'm saying well you're not telling me how you're going to meet these needs, you know for the environment. So you seem to be selectively looking at some examples of environmental benefits around certain catchments but the requirement here is for you to deliver these you know, to have a plan to deliver them across the board, but you know you are not doing that. So I think one of the problems of the agencies guidance was that it literally ticked every box. You know, so it said, you must deliver these SSSI, Natura 2000 outcomes you, you must deliver WFD then there's net gain and by the way, you know, on and on and on and on. And when you've got thousands of water bodies like, in the southwest it's like also what gives and what doesn't give? And I say under given you know the protection that European sites have, you shouldn't be giving under those.

00:23:26.340

H.8.: They shouldn't you shouldn't be giving on those you should be protecting those and finding the water that's needed, to restore them. But that's getting lost, and I think, it is actually Southwest water, leading the process, they are keen on finding certain catchments where they can demonstrate environmental benefits. And they've been through some fairly well, I think a fairly weak process of identifying these project catchments or I say, well, what about these designated sites, that are an issue that are outside of those. It's like well we'll deal with those yeah we will deal with those but not just yet. So okay what's your plan. And oh well, we haven't you know we were working on it so. And I think the agency are part of that process.

00:24:24.570

H.8.: I think the Agency, a part of that process really in terms of protecting the water industry, understanding that the water industry have you know they they feel the pressure because can they supply enough water in the future, given the climate change, given this this this pressure to find more water for the environment. How does it stack up in, business, financially all of that is worrying the water companies. And I and the Agency is well it's blatantly not implementing it own guidance.

00:24:57.390

ES: You know, talking about weak processes and deciding which catchments they're going to look at and prioritize. What sense, do you have of the criteria that they're using to identify those?

00:25:10.530

H.8.: So I was involved in in a group to draw up the criteria with, and it was very lively discussions so. They I think they looked across so we looked across 10 criteria, which I guess we're sort of a broad abroad range. I can't remember all of them, but it was like you know presence of European sites that were that were favourable or unfavourable, because of water availability, same thing with SSSIs, same WFD flow status, benefits you know multiple benefits, potential carbon sequestration. You know we look, as you, you know you look across a wide range of criteria and you think, well it looks quite reasonable. Yeah but then the problem is, what do you do if you've decided not to go for a European site, you know restoration of the European side where there is a clear legal driver to do that and you're and you've just said ahh well, we we decided not to. Because, the stakeholders, said that we shouldn't bother you know, we shouldn't we shouldn't focus on that we should focus somewhere else. And that's gone through a scoring process, you know. They've gone through a scoring process to identify these catchments where they should invest their time demonstrating environmental improvements around water resources. They've asked stakeholders and they've come up with with like five catchments for the whole of the West Country.

00:26:37.680

ES: yeah we you talk about stakeholders you're talking about the water company's customer?.

00:26:43.290

H.8.: No, no, well. No, they will mainly NGOs stakeholders.

00:26:49.410

ES: Right okay.

00:26:50.790

H.8.: So you know it was like rivers trusts, wildlife well. It was a you know there were two workshops and some people just dropped out so you know what you started off with is not what you had on your second workshop. The nature conservation NGOs seem to drop out and you're left with sort of like the catchment partnerships and the fishing lobby really.

00:27:15.330

H.8.: I mean I just thought I just don't think it was very, a very robust process. What I would have done is what WRSE has done is a load of modelling shared with the water companies which looks at supply demand balance across all these catchments. And they've assigned flow targets to them and they've said, you know, based on that designation and they've looked at, climate change, going forward as well, so there'll be a whole range of sort of sub catchments where you've got supply demand projections. And what I would have done is gone across all of those and said right where are we failing terms of supply demand? Where have we got the legal must do's? And that would be my starting point, really.

00:28:03.150

H.8.: So I think I think it's a bit of a back to front sort of. I mean depends on your perspective about what's important and what's not I mean I'm obviously going to come at this by saying that the

designated sites are crucial, particularly European sites. So the danger is they will write the regional plan, and then there won't be anything that you know that will be that will set the scene for the next five years and there may not, they may not be anything in there around sorting out, you know, a sack river that's failing it's flow target. Then they say we're going to look at that and then it will be another five years before they look at the strategy and then I mean the solution for some of these problems over abstraction is huge. It is going to take you know years and years so I sort of, say, get on with it now, not not differ it for another five years.

00:28:52.230

ES: yeah too difficult column maybe?

00:28:55.710

H.8.: Probably. I should think what actually happens is it coincides with critical abstractions and it's going to cause them real problems if they deal with it.

00:29:05.040

H.8.: I mean having said that, I should be fair to [-] water who who are as part of his process have looked at the River [v] situation and there's a there's a significant low flow problem on that well we believe, on the on the [v] and [-] water in partnership with [/] water are doing a lot to look at a solution, you know which will be part of the regional plan.

00:29:29.760

H.8.: and that's great it's just that there are other sites where nothing's happening

00:29:35.760

ES: what's difference between the sites that get action in the ones that don't?

00:29:42.840

H.8.: The company probably. I mean I'll be honest with you the two sites that are both they're both unfavourable because of flows The Hampshire [v].

00:29:52.290

H.8.: And the River [c] in []

00:29:55.800

H.8.: Now the River [c] is in [] patch and the River [n is split between [-] and [/] water is owned by [.] water but [-] have got a big hand in what goes on there, and so, for the [v] there's a huge focus on looking at the sustainable solution to restore flows. On the [c] I'm not hearing anything. And I tell them, every single call we have, with them about about this, I tell them about this problem of the [c] and they just ignore me.

00:30:31.470

ES: Corporate social responsibility?

00:30:38.220

H.8.: There is a perception about the relative importance of advice in the Environment Agency and [x]. Okay, you know, because the Environment Agency or giving them comfort I think you'd say well yeah we we can deal with on the next regional planning around in five years time. I think they're

getting that message locally. Um so they they feel comforted I think that the EA are happy so so that's the way it's going to be.

00:31:05.580

H.8.: And there is a nationally available document I think on regional water resource planning which sets out involved, you know environmental destination.

00:31:15.540

ES: Interesting to see how it is actually working in practice.

00:31:18.060

H.8.: Well, I think it's written by somebody, a group in the Environment agency, that seem to have done the right thing in terms of environmental requirements, or all the ambition but it's it's so wide ranging there's no choices being made, you know I mean it says, you must do this, you must do this and you must do that. And you also do. You know and it's like well, I think we need to be a realism here what what what options, how we got what do we have to do. What could we do. I think the document to some extent, does that but, but certainly, the agency, who modelling this I don't think I've taken I don't think they've taken into account when they've assigned always targets and I were gonna we were going to restore or not they've been kind of be ambitious. This is a national modelling um and locally they're not doing it all, not following the guidance at all, but just sort of just cherry picking from it.

00:32:14.280

ES: it almost sounds like you, they, they need to have a weaker documents to be stronger?

00:32:22.560

H.8.: yeah more choice.

00:32:24.210

ES: But it will look weaker to an NGO or whatever it may be is that the problem?

00:32:29.850

H.8.: yeah I think it seems. I think it needs to be stronger in places around whether there is a clear legal requirement. And you know [x] will. Our view would, I think, is generally that if there's case law that says we should be doing this, to restore. The European side, we should be doing that you know that there's no debate about whether that's legally required or not, we would say it's a requirement it's apparently. I don't think the Agency are so worried about that I think they're more, they are worried about water framework directive, water bodies more generally. Okay, and they've got their own KPIs as well. Okay, and on top of that you've got function, the function, so you were worried about the water industry and protecting the water industry and being reasonable and being sustainable and you know. yeah, so I think it sort of goes to the heart of the Environment Agency really in terms of what's driving them what what you know what do they want to achieve what do they believe is, is a reasonable balance in terms of sustainability.

00:33:33.450

ES: it's not necessarily the strict law that's driving them it's simply potentially things like internal KPIs?

00:33:39.090

H.8.: yeah I think so yeah.

00:33:40.440

ES: Right when everything, so many options, what's your big job today. They're focusing on how they're going to be measured. And I see that's really interesting.

00:33:49.770

H.8.: And I really I really a massive one example of this, and moving away from the water industry, but is around so it flooded risk management vs restoration of wetlands, carbon sequestration on the [s] Levels and the call I have after this one is all about this. So if you're trying to reduce carbon in [s] carbon emissions, you would rewet the, the wetlands that are currently being drained.

00:34:21.360

H.8.: And they're being drained now largely because of farming, you know that's you know, arguably, not very profitable, not delivering much in terms of biodiversity really well you know they're still very good, large wetlands, it could be amazing but they compromised by the water level management. But the agencies, it seems, because the political concern is continuing to defend the status quo, you know get rid of the water. It's all about flood risk management and ensuring we've got enough water storage in floods, so that means you need it as dry as possible in the summer.

00:35:02.700

H.8.: So there's a real conflict there in terms of sustainability, based on you know one view around what the local community or local farmers want and the other one is around what science tells us is a sustainable way for.

00:35:20.370

ES: Someone said to me, well a couple of people have said to me that when they're looking at different solutions, and I think they're talking about. Well someone told me about a project they wanted to run in Liverpool. One in Liverpool and Chester, number one part one poor. And they said that they wanted to make improvements to the River river in Liverpool, and that they couldn't because it was already in such poor state. And they felt that funding was more likely to go to more affluent communities or where you could show more improvement or where there was more stakeholder interest. And someone else said to me something similar about chalk streams and the reason that they're prioritised is because that's where posh people live, I'm paraphrasing. Have you you come across anything like that, where you think that there is a selection based on how articulate the Community is ..?

00:36:35.160

H.8.: I mean we would never I don't think we'd ever prioritize based on who was shouting the loudest or who was providing the most sort of cognisant argument I don't think we would we would prioritize on that. It does coincide I think that where you have the best quality habitats, like chalk rivers, they probably are in a more affluent areas, and they have, and they have interests that are, you know, sectors that are very well to do, like I mean obviously, angling on the chalk rivers.

00:37:07.290

H.8.: And landowners around chalk rivers. So I think there is a grain of truth in that. I don't think it's that we're actively trying to provide for richer communities.

00:37:20.340

ES: yeah I don't think I don't think they were saying that. It was not aimed at [x] at all actually.

00:37:28.500

H.8.: I know the agency have a bit of a thing about this I know. And they feel that with WFD they need to improve everywhere and to improve rivers in inner cities, so people can enjoy them and all that. There is a conflict there I think if you haven't got enough resources to go around so do you say let's get everywhere sort of fairly mediocre, or do you say no, we need some places that are really good you know where you have got these wilded catchments you know. Will never get totally wild it was you know, but a much, much better quality and the land around it is better quality and the whole catchment is of better quality.

00:38:04.830

H.8.: You know and that's where I'm trying to go to, and I think I think [x] is as well, really, you know we're talking about wilding in focus areas and linking up.

00:38:16.050

ES: yes its easier to rewild in the country than in the city. I am in Coventry and they are trying to uncover the Sherbourne. yeah so you know.

00:38:32.760

H.8.: there's also the issue about will people notice in the cities as well you know. If you're going from WFD, phosphorus class poor or bad to poor poor to moderate when will they really notice and I.

00:38:45.120

ES: think that was one of the points Liverpool was making, same resources what difference, would it make. It would make an incremental difference, but what would be noticeable, whereas we could make a noticeable improvement. Difficult as you say the affluent areas tend to be more beautiful places anyway don't so a bit of a circular argument.

00:39:08.820

H.8.: I think what we'd say, aside from sort of water quality and the aquatic environment that we obviously believe that there should be more green spaces for people in you urban environments. People need to have somewhere that they can enjoy an experience you know. So they're closer to green environment, close to nature. And there's lots of things that can be done that hinge around you know sort of phosphate target going from poor to medium. Yeah and I think most people would probably benefit, and they would agree that if they've got like you know, a water park, or whatever you can have crappy water really from our point of view but, but you can still have an awful lot of nice green space and biodiversity.

00:39:55.320

ES: yeah i've got sort of a last question for you and, and it's very broad but thinking about the job that you do and your priorities at the moment what regime or regulatory change would you find the most helpful to support you in your work?

00:40:18.120

H.8.: is just a single one.

00:40:19.860

ES: Well, you can answer it anyway you like!

00:40:25.350

H.8.: I think I think definitely, with the periodic review process of water quality, I think, moving away from a process that is heavily, that heavily relies on quantifiable results that are certain and is based around phosphate class change across the board, I think. You know I think that's probably the wrong way to go, for the reasons we just talked about you know you may have you may well that that were lots of places that are mediocre and and nothing much really ecologically to show for it. Okay, if you in some places that you may need to continue with phosphate stripping you know to meet a legal requirement and there's, no doubt, that you know it can have a big impact on reducing phosphorus. And you might there might be some places where you do need to do that, but I think striking that balance between end of pipe solutions and sort of nature based solutions is a right way to go, because you're going to get improvements multiple improvements from nature based solution, so I mean land use change, restoration of how habitats function.

00:41:31.770

H.8.: It's never going to be an either or, but I just think a shift in the balance is required because at the moment that those sort of nature based solutions are really hard and we're really hard to get in the WINEP. I mean I think Ofwat have said they want to try and shift that it going forward into the next, into PR 24.

00:41:55.200

ES: How would you shift that balance? Through 24?

00:42:01.290

H.8.: I think. Yeah I think it's some extent, it says right, this is that you know, this is the traditional rulebook that we would have been issued from the EA nationally. All right, we've got that but now I've got another rule book which says we can you can let you know you've got a blank sheet of paper, these are the problems in this catchment that we need to deal with, how can we deal with that in in a way, which delivers the most benefits which also takes into account of the constraints of other things. So what's the point in rapidly reduce you know harden your phosphorus phosphate from industry. I'm sorry from the wastewater industry but if you're not making absolutely no reduction on your agricultural sources. There's no, you know it's not you're making a big incremental step. But in lots of cases you're not you know you're just ticking a box really. You're not getting to a level where you're going to see an ecological benefit at all.

00:42:59.100

ES: At all yeah.

00:43:00.660

H.8.: And now, there may be some sites where you would do that you know, there may be that if you can, if you went and you could push the wastewater company a little bit harder you could get down to that target and you would genuinely reach a high level of ecological status, ecological quality.

00:43:17.880

H.8.: And that's and that's different so you know you needs, you need context around individual sites, when you are making decisions.

00:43:26.190

ES: yeah and how do you get that how do you get that, how do you make that better getting those different and better contexts?

00:43:35.040

H.8.: We are not short of people who know these well, I mean depends on which catchment talking about, but you know [s] Levels, e [v], [] that you know we're not short of people that have have this information and they all sit around the table every you know every periodic review and then the rule book comes out the agency says, oh no you can't do that it says here

00:43:59.790

ES: How frustrating

00:44:05.910

H.8.: The other thing about process changes, I mean agricultural regulation, I mean it's not just about regulation it's also about incentive along the regulation, but, as we are currently going and the moment I think we're heading for lots and lots of wasted investment by the water industry because it, you know you just. Give give give an example, [s] Levels and Moors, you know we, we need to get down to about 50 to 100 micrograms per litre of phosphorus to have a chance of ecological improvement we're now at 300 yeah and that's and that's after 50 million pounds worth investment. Well, now I don't you know I don't want to say we shouldn't have done that, because you have to start somewhere, you know the other extreme, is that everybody sits around and say well there's no point in this because I say, is it a big job we will just not bother you know that's I mean it's everybody's been polluting philosophy decades and the problems massive conclusion would be we won't do anything. What I'm saying is that it just needs to be it needs to be thoughtful about how you go on that journey so, you get benefits along the way not just a chemical concentration reduction that actually has no ecological benefit.

ES Okay

H.8.: But it all hinges on dealing with other sources, particularly agriculture, you know, so I think I mean the water industry, they are going to say without a doubt, well hang on a minute we're not going to go and invest loads more money in phosphorus stripping if agriculture is doing diddly squat you know. That and that's where we are really and I think I mean companies like [-] Water will say yeah we will try and help you work, work to get a more sustainable and environmental I improvement through innovation but they need to be given the space to do it, you know. We always have regulatory red tape that says you haven't delivered your WINEP by you know by this date therefore you're going to be fined yeah something like that.

00:46:03.630

ES: yeah and, if I understand this right it's almost like you want to I'm not going to phrases this right, less scientific or wider range or soft, that is not the right word...?

00:46:18.900

H.8. yeah less I think I think it's around the indicators of success, I think.

00:46:26.730

H.8.: I mean we need we definitely need scientific targets for the chemistry that we're trying to get to. It is a question about the journey that you go on to get there. Yes the speed at which you go there, in terms of reductions of point sources, how you and how you look at it holistically and what the other benefits are from a more holistic reduction. Because I mean in the past, I know that you know my colleagues as well, we are not maybe I'm guilty of it as well, we say oh great if we do that we're going to have halve the concentration going in that's great isn't it when I'm left thinking now well you know we've had 10 years to try and deal with agriculture and we've got you know minimal reductions, yeah it just doesn't really I'm getting to a point now I think it's not there's no point just going on like this and we need now, we need to focus on agriculture, get that get reductions on that and we need maybe we need to try and get the water industry to help help them do that, and they are doing that some extent. But yeah and I think its case by case, catchment by catchment really depending on, taking into account, you know, the challenge, the size of the challenge, what the designations are, what what's happening with different sources, the benefits of doing things differently at certain speed, you know it's that's a really considered approach catchment by catchment.

00:47:47.550

ES: That was my last question but I have so many more. You will have to shut me up. I know you have to go in a minute.

00:47:52.800

H.8.: Yes I have to go in a minute.

00:47:54.570

ES: Know I'm going to let you do, be respectful of you time. I'm incredibly grateful that is so interesting. I'll drop you an email just to you've got a contact details again, and this is going to be this won't be complete for another year, at least.

00:48:08.370

H.8.: If you want to talk again, I mean less sort of in any context or not, maybe not well. Maybe not a really formal context, well not a press conference (laughs).

ES: And I've explained the ethics your it's anonymous completely. Not just anonymous in name but you can't identify anybody. And all that stuff, then I can use it in the thesis. Any informal discussions I wouldn't use anyway and so it's part of the UoB code as well. I'll let you go, not because want you to, but because you've got a meeting and I promised to be respectful of your time I'm incredibly grateful.

00:48:48.540

H.8.: you're very welcome it's interesting talking to you, makes me think on my feet.

00:48:56.550

ES: Are there you go, an hour with a lawyer, you need a cup of tea.

00:49:01.560

H.8.: Yes, okay, well, if I can be of any help just let me know.

00:49:04.710

ES: If you think you might be interested in participating that'd be helpful.

00:49:09.360

H.8.: If you can get in touch with [], enjoy that one. yeah okay.

00:49:21.120 --> 00:49:22.410

ES: Will do, okay, take care. bye.

I.9. Transcript 17th August 2021.

[opening, routine preliminaries not transcribed]

Discussed the participation sheet, explained that it was a formal interview for data for a PhD. Went through the data issues and protections. Explained that the data would be stored. Confirmed he was happy to proceed.

00:03:13.450

E.S.: All I actually need is for you to think of a project that you're currently working on or recently worked on and literally just tell me about it. And from that I've got some set questions I need to ask, but really it's just about understanding that project and what it's about and we go from there.

00:03:33.120

I.9.: From listening to what your questions are, I think the interesting bit is yes, about the projects we're working on, but there's also the projects we're not working on. It's really interesting because there's a large portion of what we're doing at the moment that is funded for reason of improving the water courses, improving the quality of effluent, but in terms of managing our asset base and making sure that we're managing our risk and the condition of our assets, there's challenges within that and there's probably some projects, some areas that do need funding, but the works never seem to quite get that funding because of the way it's allocated to us, the drive that we're measured on the regulations.

00:04:23.370

E.S.: That would be really interesting.

00:04:25.740

I.9.: But in terms of a project that I'm working on, so I work in waste delivery or waste capital delivery, all wastewater, and it's non-infra projects. So in [s] land, infrastructure projects are pipes and pump stations, everything that goes to the network, and non-infra projects are on-site treatment works, assets that treat the wastewater and then put it back into the environment. That's my world. So we're currently working in AMP seven and I'm delivering some of the earlier obligations in AMP 7 so I could actually go through a project. [i] Bank is one of the ones I have just completed actually. And so [i] Bank is a medium sized sewage works, I'd say for our patch, takes roughly around 3000 people I believe, population equivalent. And as part of the Water Framework Directive and National Environment Programme, bit of a mouthful, short to WFDNEP, it receives a new phosphorus effluent permit. So were it discharges to the river, we are now permitted on a lower level of phosphorus going into the river, and that is to reduce the amount of phosphorus in water courses, because that causes its own problems, adversely affecting wildlife and whatnot. So a lot of the Water Framework Directive NEP is reducing phosphorus, reducing ammonia, reducing iron that's going into the water course to improve the status and so on. On that project what we've gone and done is we've refurbished the chemical dosing and increased the size of it. So we dose ferric sulphate which is an iron product which fluctuates and settles out the phosphorus. And that's on the front end, and then on the back end we've put in a tertiary solid removal plant, which is like a very fine filter which filters out any of the solids that we've hopefully flocculated by adding the chemical.

And then that discharges into the river. Eventually it end up in the Avon. It's a tributary of the Avon, it may be the River [i], don't quote me. I probably should know that but I'm a chemist, not a geographer

[informal comment, not transcribed]

00:07:18.840

I.9.: That's that project really. It's around about 1.9 million total cost. And we deliver it through a tier one contractor who are WMH treatment, who are our tier one, they are one of our framework contractors.

00:07:40.230

E.S.: Am I right that you're doing it because you have to, it's a statutory reason?

00:07:44.880

I.9.: So we go to OFWAT with our plan of the water courses we aim to improve. And we say we're going to do these sites to improve these water courses, and this is how much it costs, and then they come back to us with that ODI points which is how we get that money back, effectively, one of the metrics of getting it back. So, yes we're doing that because we're getting a new permit and we couldn't reach that new permit with the existing assets that we have on site.

00:08:18.870

E.S.: Were there a number of options, possibilities to solve that phosphorus problem?

00:08:30.990

I.9.: Yes. Probably for this site not as many as many as you would do normally. For some sites, you can run into pages and pages and pages of options to do stuff, but this one was from a technical point of view anyway, it was quite obvious what you would do because the technology has been around for a while, we've done so many of these now. We know what we're doing, we've learned the lessons.

00:08:57.600 --> 00:09:02.850

E.S.: So why was this option the one that was picked if you had a selection of them, what was the criteria?

00:09:03.180

I.9.: Whole life costing. In this AMP now there are more considerations than there has been in the past. In the past is very much done on a TOTEX approach, so obviously your initial capital investment and your OPX going forward put into a formula to work out over a 25 year period or a lot of time as assets what's going to be the cheapest solution. But now, certainly in our future designs, we need to be targeting carbon and targeting REOC, which is it basically OPX going forward, so we need to be much more aware of the OPEX challenge the our operational colleagues do when we're picking assets. Certainly carbon is a new metric we're going to be measured on. So every site, every option now needs to be a 15% improvement on carbon. There's also bio diversity, as well, so we need to be improving by diversity on the site by 15% with any project that we do, so a lot of that's currently done by offsetting because we still need to build these structures, so we just need to offset them in different areas of the site.

00:10:24.990

E.S.: And, and this is a subjective question, but was the option chosen, do you think it was the best option?

00:10:36.120

I.9... Yes, I think it was.

00:10:43.380

I.9...: On whole life cost, yes, it was, and there are some things you can do, but from a risk point of view, say there's certain biological processes you could put in, or innovation processes you could look at, but in terms of surety of achieving the outcome that we set out to achieve, and doing it for the best whole life cost, yes, the option for the best one.

00:11:08.070

E.S.: A lot of people talk to me about phosphorus and nitrogen and that removal. Some of the comments are that, yes, we've achieved the goal of reducing phosphorus but we haven't improved the environment overall. There are other things that we could have done that would have had a wider more ecological benefit, but we couldn't, we weren't allowed, and this achieved everyone's goals, but it didn't help overall. Is that a view that rings a bell with you, or make you think what are you going on about or this is a good result this is a good ecological outcome.

00:11:53.940

I.9...: So I talked earlier about, to get the real answer that question, you need to be not looking at the projects we are doing the projects that not necessarily they're doing. So the way that the NEP works, or the way that sewage works really work, you get dilution of where it goes into the river. So if you discharge into a big water course you obviously get a lot of dilution, so the permits are more lax, and if you discharge into a smaller water course you then get a much tighter permit because the dilution is less in the water course it's going into. What you can end up with is really small sites that discharge into really small watercourses getting quite tight permits. Whereas you get quite big sites discharging big water courses that don't have necessarily much permit because the dilution. But what happens is, rightly or wrongly, what you do is when you get a P dosing scheme, a quality scheme like this, you tend to go around the site and fix the other bits that are broken while you're there. You tend to go well, I need this piece of kit to definitely work to meet my permit so I'll fix it. And the bigger sites that go into big water courses don't get a lot of that investment. So you tend to build up risk on those sites because they just don't see the same investments as some of the other sites.

00:13:31.230

E.S.: So the percentage improvement is too small.

00:13:38.250

I.9...: We're looking through a very narrow lens of P permits on sites where we put P permits in. I think there's other sites that don't have any permits, which discharge much higher amounts of this stuff, but because they're not permitted, it doesn't have its own focus potentially.

00:13:57.390

E.S.: There's two things coming from that. First is you mentioned there are innovations that you could have tried. Why weren't they tried? There might be fantastic reasons, but why weren't they tried, do you think?

00:14:14.250

I.9.: So in the last six AMP period we had a chequered history with innovation. I think the water industry, we've been doing the same thing for a long, long, long time, so the last real innovation that was like ground-breaking is the ASP process, and I think that's about 200 years old now. So essentially the job that we do about treating wastewater hasn't really changed, so the levels of innovation, you start working within the confines of what you can do in science. Thermodynamics says that, you can't destroy energy, you can't create energy.

So why did we not do it on this project is the specific question you're asking so, we had quite a tight timeframe to deliver in, so we have to deliver by December 2021, so in four months time. So compared against our normal projects, it was much faster, so the room for error in terms of going back round the loop of innovation didn't work, what else can we do, was non-existent. Risk. And the innovation isn't really knocking down the door in terms of cost at the moment, it's not really saying I'm much cheaper on an OPX or a CAPX basis, put me in. Like I said in, AMP six, we put in quite a lot of innovation technology such as granular sludge, Nereda plants, biomag plants. And we've really struggled with them to be honest, they've not really delivered on the promises that technology was supposed to. We know we need to innovate, but we've been a little bit burnt over the last sort of five or so years where we've put stuff in and it's not worked and then we'll have to go spend a lot of money, time and effort going and fixing that sort of thing. So it starts out looking a really good prospect, but sometimes I feel like sometimes we don't necessarily innovate for the right reasons. We innovate because that's all we can afford. It's not right project right option, it's this is the money we've got so this is what we have to do and we get driven down that road.

00:16:35.130

E.S.: You get driven on price, as well, don't you. Does that come down to what's considered wider benefits? So what would be allowed if you could calculate the benefits more widely rather than cost, some of these innovations might seem more cost effective if you see what I mean?

00:16:55.230

I.9.: I there needs to be a quantitative way of measuring carbon in terms of pounds and pence and emissions. Those sorts of things. At the moment it's very qualitative, it's very all we've reduced carbon by 20%. Okay, so what? It's kind of like, well how would you measure that on the bottom line, so I've saved 20% on carbon but I'm spending 30% more on chemicals. Does that stack up? Is that a better option for me as an asset owner or asset operator? And that's the main thing. I think the benefit of doing these schemes, improving the environment, is we get the outcome delivering incentives from OFWAT for doing them, so when we are measured on the improvements we make. That is a good system, but your capital plan is probably narrowed down to what we can do to get most back from those ODIs in terms of really looking at a lot of the risks that might exist. Especially this plan as well, so [s] have got fast track through OFWAT with our plan in PR 19 which is seen as a very ambitious plan, a very good plan. The regulators were like yes, crack on, get on with it, get started early. I think it was a very lean plan, and I think the scope to do lots of capital maintenance work and improving sites that are sort of not necessarily linked to ODIs is limited.

00:18:44.820

E.S.: Looking at the risk, you mentioned the risk side as well and you'd perhaps been burnt. If someone came to you with a new product that would be on the possible list for this [i] Bank project, what would you be looking for them to be delivering, beyond obviously the phosphorus reduction that you need. What would you be looking at them to present to you?

00:19:17.220

I.9.: In terms of benefits? They've got to either be cheaper, more energy efficient on either CAPX or OPX, or they've got to be a real carbon save. I think one of the things we're doing at the moment at a very small site is using algae. Algae's not been used at scale before. I think there's one in Southern Water that's commissioning like as we speak. But it's not commonly used. And it's probably a slightly more on CAPX but it's a pretty much carbon neutral process. The algae actually releases oxygen. And so that's the reason we've gone for it, because we need a more sustainable solution. Or something like wetland so, in turn, instead of putting like a very small treatment works in, we can actually do a nature-based solution where you can effectively pond, then you can leave for 25 years and then come back and recondition them.

00:20:22.830 --> 00:20:29.430

E.S.: Are you concerned with nature-based solutions over the certainty? Have you had issues with certainty with nature-based solutions?

00:20:30.510

I.9.: We're not a hundred percent sure about what the regulator will give us in terms of permits. I think one of our aims to push back was saying yes, we recognise that there's a big push to do this but you need to help us out a little bit with permitting, so we can do it, but we're not sure we can hit the really tight permits you want us to. So there's a trade off, you get slightly lesser quality effluent, but we're doing a nature-based solution, we're not putting carbon out, we're not use electricity, chemicals and all the other stuff. I mean I know they did it with Anglian and Anglian and kind of snuck it in, they kind of built it and then went, we've built it now, what do you want us to do with it?

00:21:18.330

E.S.: You can't really approve it until it's in action either really, can you, that's the nature of the beast.

00:21:22.470

I.9.: And it's a big investment, they need a lot of land, there's a lot of land, you need the right typography. And if you've got to align them it can get quite expensive, so it's quite a bespoke solution for a bespoke application. But yes, certainly if the regulator was willing to work with us, we could do more of them because instead of, so things like an ammonia permit, if we could do it as an average instead of like a pass-fail or whatever, if there's that flexibility there, we can do a bit more potentially.

00:22:00.810

E.S.: Do you have a relationship with the regulator? I presume it's EA you're talking about.

00:22:04.860

I.9.: Yes, the Environment Agency. So we have monthly meetings on projects. We have people that coordinate that, so you've got one point of contact, but we're talking very much on a monthly basis, around sort of flows, the amount of flows we need to be treating, permits, all that stuff. So we will

go to them with, a lot of it's flow, because you get the quality permits, if you take a slightly higher flow that goes up, there is a little bit of horse trading to go there and say, well, if we did this that gets that and then you get this, is that okay sort of thing. I think we've got good relationship with them, I think we've got a shared sort of understanding about what we're trying to achieve.

00:22:48.540

E.S.: Okay, and you mentioned and projects that haven't been done. I get the impression there might be a few that you're thinking I'd really like to have done that.

00:22:59.370

I.9...: I think there's a few that you walk around and think Jesus, you need to go and put some investment to this place. Because stuff just isn't working, but it seems like, at the moment, some sites are in the bracket of, unless something catastrophically fails, we can't go and we haven't really got the money to go fix it. We can't prioritise it against other sites. The sites that I can think of that you walk round, and with consecutive AMP periods we've pushed back because to fix everything we need to fix is unaffordable, and so doing a little bit actually won't have that much benefit. That's a tough one. And that's that capital maintenance, it's difficult to find because we're always measured on ODIs, measured on quality permits, improving rivers. Until you're in that point where you get catastrophic failure and you're really affecting the effluent quality going into the river, that's when you start going to the emergency pots of money.

00:24:04.080

E.S.: Are you talking capacity or leakage or just underperformance of assets?

00:24:10.710

I.9...: Some assets can get to a situation where they've been limped along, they're costing a lot on OPX to keep them running when really you need to go and put a new one in or a slightly different process in, because maybe they're running at sort of 130% and they're really starting to sweat those assets, as opposed to having nice comfortable operating ranges.

00:24:33.090

E.S.: So it's the regime, if you like, is pushing you towards certain statutory goals, rather than looking at the maintenance of the existing system?

00:24:47.010

I.9...: Yeah, a little bit, and it's the way we set up our plan. I mean I'm nowhere near close enough to the submissions on PR19 and PR24. I'm looking at those things, but we've very much targeted our spend on achieving ODI and achieving effluent quality permits. And the money we've set aside to do capital maintenance on some of this other stuff, every AMP seems to get eroded slightly, because as soon as your sort of capital spend on quality projects is exhausted, and you find some stuff that all this is going to be more expensive than we thought it was going to be, the pot it goes down on is the capital maintenance fund because it's not a regulatory requirement, so you start drawing down on that, and then the budget, the amount you have to go in there and fix stuff gets less and less and less.

00:25:39.960

E.S.: And on the project, the [i] Bank project, so we've talked about some of the possibilities of innovation, regulators and whatnot. Was there any public involvement in that project?

00:25:56.820

I.9.: No, not really. [i] Bank is pretty much in the middle, well it's in a village called Long Itchington, so we'd speak to the public about deliveries and delivery routes and HGV traffic through the area in terms of construction. In terms of liaising with the public about what we're doing on site, we tend to not do as much. We like to shout about the improvements we are making to the rivers, but in terms of we're going on to this site to do this construction work tends to be opening yourself up a little bit. I think if you tell people exactly where sewage works are and what you're doing to them they'll go oh, I can smell that now, when they wouldn't have even known they were there.

00:26:36.510

E.S.: So it wasn't really necessary on this one.

00:26:39.720

I.9.: No, there was very little public interface because there's no houses around there, there's no real interface with the public.

00:26:45.990

E.S.: Okay, is that always the case in the sort of work that you are doing?

00:26:50.220

I.9.: Not always, no. Some are in areas that are close to residents. So there'll be aspects like closing public footpaths during the construction or dealing with noise complaints from construction or operational noise complaints as well. Just that they can hear the site, running all the time. We've done some stuff on noise, smell complaints is one as well.

00:27:21.600

E.S.: Okay, so it's as and when it's necessary. Are there any other sort of projects where you think I really wish we could have done something, where perhaps it had a wider benefit then just the immediate statutory goal? Or is it more a case of wanting to improve the capital maintenance for a longer-term longevity?

00:27:56.460

I.9.: To be honest, I mean the goal for me personally always is to improve the quality of the effluents going into the river and make sure that the operational people that I'm handing the site over to have got a really good set of assets that they know how to operate, that will last them a long time, that will work and cause them as little hassle as possible. I think there's been sometimes where we've had to put some sticking plaster on sites and some workarounds and we get a really old site. The great solution if you had all the money in the world would be knocking it down and start again and build something completely new, bang on. But instead you'll put a bit of chemical dose in, you'll patch this process up and you'll add a bit of a sub stream that goes around this bit, and then the operator is stood there going, not quite sure how this works, but that's the nature of the beast so we don't have the money to go and knock everything down and start again. You improve your assets, you expand your assets, you sweat your assets to meet what you need to. As long as you're managing that process risk and that risk on the effluent, then yeah that's the right thing to do, because we everyone's water bill would be hundreds of thousands of pounds if we went round and built everything again.

00:29:14.520

E.S.: It's Victorian infrastructure in a lot of instances isn't it still.

00:29:17.160

I.9.: I mean I don't see the worst of it, I mean I'm sure the worst of it is on the network side, where they are dealing with Victorian sewers that are falling down. Infiltration is a massive one, so infiltration I think to fix, it's something we're never gonna fix. We have got assets, sewers that will leak groundwater into them, and you have to understand it, treat it and deal with it because we're not going to go and dig up 50 kilometres of sewer that's under five main roads. So we do what we can, we find new solutions we do innovative stuff and do our best, but and some of the stuff we do is treat the symptoms instead of the cause if that makes sense.

00:30:03.870

E.S.: Inevitably with something so vast. With the phosphorus, some people say they've tried, it might not be applicable on your site, fair share. So getting farmers to reduce it and working with them for a global outcome. Is that a factor on this one or on other ones that you've worked on?

00:30:32.220

I.9.: So we've got a team, a farm liaison team I think, I'm not sure. But their sole purpose is to go around, to work with farmers, to give them education on using different stuff, less phosphorus, less ammonia into the river course, I think there's even some grants as well to do some for some stuff around reduce. Because someone told me once that I think the biggest contributor of phosphorus into Minworth, I don't know how true this is, was run off from the M42 or something like that.

00:31:07.080

E.S.: I'm not surprised.

00:31:08.370

I.9.: And it's stuff that we're never going to be able to control. Working with farmers, that's a big piece of that puzzle, and the more we can prevent it instead of treating the symptom when the phosphorus ends up in the river.

00:31:25.620

E.S.: How do you get credit for that work, or is it just part of the whole education remit that you're naturally involved in?

00:31:33.150

I.9.: Essentially, when we reduce the amount of phosphorus coming in, there's less to treat so we can get better coming out. Or we spend less removing it so it's in our interest to reduce the amount coming in. One of the interesting ones is so on the back end we take phosphorus out, on the front end we put it in, because if you've got a lead pipes in your house, we actually dose ortho phosphoric acid to stop the release of lead into your drinking water. There's a big piece on changing lead pipes so we can reduce the amount of ortho phosphoric acid that we have to dose as well.

00:32:14.220

E.S.: Okay. Phosphorus generally then is seen as a burden. Is there anything you've come across where phosphorus could be extracted and reused in any way, or are we way beyond any of that at the moment? Can you put it back into the pipes to reuse it somehow?

00:32:36.090

I.9.: I mean, this is what we really need to start thinking about, because nutrient recycling is, before I joined the water industry I was in solid waste, and a lot of that thinking was about circular economy. And how did you generate revenue stream from waste. And I think that's where we are now, that's the next step for us, I think, things like ammonia stripping. So there is some technologies out there, looking at this, so we get lots of ammonia coming in as part of wastewater, that's what is, but that's a really useful product if you can extract it, purify it and get it and take it back. Now we do it with methane, so sludges are put into bio digesters and produce bio gas, which then goes back to the grid. So that's a great start, but I think resource recycling such as ammonia and phosphorus is the next step. I'm not sure the technology is out there at the moment. But it's got to be close. Phosphorus is so useful in so many applications in terms of fertilizer, in terms of all this other stuff that uses it, there has to be something, when it's useful it's valuable, when it's valuable someone will be looking at it.

00:34:00.420

E.S.: I suspect it will be speculative technology until it's tried with you guys, for a while, anyway, so it's got a long way to go from the sound of it even if there is nascent tech out there?

00:34:13.470

I.9.: I think ammonia isn't that far away, I think there's some small trial units that might be knocking about that we might have looked at before you. But large scale, I don't think is anything approaching market, the next couple of year.

00:34:26.130

E.S.: To make you any money. In terms of heat, have you done much on the possibility of heat from maybe the [i] Bank.

00:34:35.790

I.9.: So no, so they are too small, so the likes of Minworth or some of our really big sites, yes. We will have combined heat and power for those things that run, so Minworth is completely self-sufficient in terms of power and puts back to the grid as well, so yeah we will recover those sort of things. The heat they use from the engines heats the digesters.

00:35:00.510

E.S.: How about the heat more widely in the sewer network?

00:35:05.220

I.9.: So yeah I've heard of this, I've looked, I've sort of seen it, heat recovery, and I think the network's team have looked, are looking into it, I think there is some small scale trials with different heat from sewers. But yeah again that's probably networks, I don't really...

00:35:23.430

E.S.: That's fine. So it's more a case of if it chimes with carbon reduction targets, if it's providing an income stream, then there are things that will allow you to explore and look at.

I.9.: Exactly

ES: The workforce, that was it. I'm going through each individual category of people. Have you had situations where you wanted to try something new at a site and it just didn't work, perhaps because the workforce didn't like it or didn't adjust to it or it's just too much of a change?

00:36:11.070

I.9.: Yeah, all the time. The operational staff in a wastewater environment, operational environment, they tend to be quite set in their ways I suppose. It's very, very unionised sort of atmosphere, no one really wants to put heads above parapets. So in our department, we know there's a drive to innovate and as engineers you want to put some new stuff in. And there's bright sparks in operations, but I think they just want things to work, they know they work and it's going to cause them not much hassle, they're not going to be at 2am unblocking a pump. I think it's a generational thing. Our workforce in [s] is probably on the operational side, probably quite an aged, I don't know if that's appropriate to say but it's that age brackets that a lot of our operators are, the top end of the scale.

00:37:21.300

E.S.: They've been there a long time.

00:37:22.350

I.9.: Yeah exactly. So you know innovation tends to be more of a younger generation thing, in my experience, that's just speaking from my experience, the drive to innovate probably comes from youthful enthusiasm, that sort of thing. We've had technologies where you put them in and it's been a real battle to get operational staff to interface with it, to learn it, to understand how it works, not just to go, that's nothing to do with me over there, I don't want to know, I don't like it. But again in there there's always pockets of good practice and good people that want to learn, want to understand, want to see something new. I think they're always heavily beaten with a stick. If it doesn't work it's your fault.

00:38:15.570

E.S.: That's what I was going to get to really. Sometimes people are performing in relation to the parameters they're judged against.

00:38:22.530

I.9.: So if you're showing it to me going, you need to make it work, it's your responsibility, if it doesn't work I'm coming to you, I'm going to go, I want the most tried tested piece of kit that's been around for years, I know works, because I'm responsible for it. If I'm not involved from the start and have an understanding of the technology, and I trust it, I like it, I think it's gonna be great. And plus they didn't see any of the benefits, so the money saved on carbon saving, no one goes up to them to say great work, it's so much cheaper. They only get the bad end of the stick when it doesn't work.

00:38:58.920

E.S.: And they are literally the sharp end of the end of pipe solution, I think, I'm mixing two metaphors at least there that.

00:39:06.090

I.9.: Especially if it goes wrong, because what happens, it tends to happen if you put some innovation in and it kind of works but doesn't really work as well as you wanted it to, they have to

live with that asset for 25 years. That can't be fun to babysit assets through the, yeah they work, but not quite as well as we want it to.

00:39:25.800

E.S.: I'm quite interested in what innovators need to do to work with water companies, how they prepare their problem statements, if you like, how they engage with the staff. What could they do to help support you with that or make life easier when you're dealing with staff? Is it looking at the interface that they have with it, is it working with them? Is there anything that they can do?

00:39:55.710

I.9.: To be honest, I think they do an alright job. Water companies that I know I can speak to... We don't make it easy for them. Because we're large organisation that doesn't move very quickly, so when you've got a small sort of one or two man band, they're trying to get this kit in, they're desperate for the order but we're making them go jump through all these hoops, and all this governance, and all this process and it's like, you can almost see the sort of light in their eyes dying as you go through the process. I'm so sorry for you, but I can't make this machine move any faster. And we've had incidences well where you put your head in hands, because someone comes to you with a good idea, because they want to develop this idea with you. And then the commercial bods at [s] are going well, we want 50% of your idea, your IP. I'm not a hundred percent sure that's the right thing to do, because you really are stifling it by trying to make a few quid out of it. That doesn't feel right sometimes. So I feel like they do a good job, I think we need to do more to support that. I think the appetite is changing, I think, with some new people in the business that are very much, we need to do this, just do it, but they're still fighting against the governance of the, have you done this, are they solvent, what happens if it fails. And we're still in that slow mindset of having to get 50 people to sign it off before it can go into an order.

00:41:41.220

E.S.: People say it's a risk-averse culture?

00:41:46.050

I.9.: It is, and it's bred from the fact that we spend bill payers' money. So your water bill goes, I spend it on building capital assets, so I need to make sure that I'm using the best use of that money. So it's beyond reproach if anyone ever comes in challenging, what did you spend all this money on, you can say we have the best assets, we made the best use of it, we weren't frivolous with that money. But that's the trade off.

00:42:12.450

E.S.: I don't get a sense that I have with some other people that there is silos that are getting in the way, siloed thinking and departments. I'm not picking that up from what you're saying, or are there problems with departments doing their thing and another department doing their thing?

00:42:30.510

I.9.: Maybe that's a factor of the relationships that I have with our process engineers, our commercial, our design. Our delivery and design work very well together, because we used to be one department and we only recently split off, so we're still very, very much in the same headspace with that. Commercial are in the same directory as us as well, sometimes there's been a conflict there because they work to different masters. They target efficiency and affordability, sometimes at any cost, and we're sort of working more so we've got an eye on quality, time and delivering great

assets, as well as that commercial side, so sometimes there's something there. Innovation as well, I think it's an under-resourced department, as they are, there's really clever people, and then they are really principled in that is their goal is to get innovation in, to seek out new products, build it at scale and help us get those in. Sometimes you have to temper a bit of that enthusiasm, sometimes. I don't feel like we're particularly siloed - ops, maybe sometimes between us, but essentially we'll come up with a solution and then we'll have to sell it to the operators. The senior staff operations understand the challenge. Sometimes when you get down to the frontline operations is a bit more difficult. I wouldn't say the silos in the organisation are particularly difficult.

00:43:57.660

E.S.: So you've got your own network, you're making it work.

Do people have an overview of what's going on? When you're running your project, is it just you that has that oversight and everyone else sees little bits of it, or do people have a big picture about what's going on with these projects?

00:44:19.440

I.9.: I think people understand because all our projects are delivered under the Water Framework Directive, people understand what it is and what we're doing and what we're trying to achieve. I don't think it's a case of, I'm just delivering my project to do this, to reduce this phosphorus from here to here. I think they understand that, by doing my project at this part of the river, it effects this part of the river and then, if he does his project here it does that, then it affects that and it all adds up to a cumulative effect. And we get the benefit from that. I suppose, if you compare it to what they're doing on the clean water side, the network side, I've got no idea what they're doing. I'll be honest, I've got no idea. I used to have more of an idea because it used to be one team. I used to have a bit of insight into what they were doing. Then we split wastewater and water up, and now I haven't the foggiest what they're doing.

00:45:08.160

E.S.: And I've just ran over time. I was only supposed to take 45 minutes. Do you mind if I ask, it's so interesting. One of the questions I ask people at the end generally is, if they could change something to make their life (work-related) easier, what would you change? Easier or better.

00:45:35.910

I.9.: This is my job, so it's about spending the money and getting the most assets I can, reducing our risk profile as much as I can, with the least amount of money, where's the biggest band I can spend. If I want to spend a million pounds. I want way more than a million pounds worth of risk reduction if that makes sense, I want to get as much as I can, but what that leads to is there's never enough money to do all the things that I wish I could do. So sometimes there are difficult decisions to say, this is what I'd like to do, this is what I can afford to do, and this is what we're going to do. And I'd love to have more money to go and improve the asset base but that's probably just not gonna happen.

00:46:31.860

E.S.: What would it take to make that happen, other than more money, I mean? You're reducing phosphorus because you're told to.

00:46:41.130

I.9.: There are some sites I look at and go, this site works perfectly well, this is a lovely site, all stuff works. Effluent's quite good, but we're getting really tight permits and it doesn't feel right just putting chemical dosing and more assets on this site that seems to work very, very well. You go to some of the sites and you're like, this is a risky site, a lot of stuff is sort of near asset expiry. Because it's not got a P permit on it, I can't do anything here but fix stuff and make things better and reduce our risk profile because there's a probably a good sign over there that's got a P permit and I've got to go there.

00:47:26.760

E.S.: I'm looking at how governance can be supportive. So what could governance do to help you improve those sites? I mean we're talking about public opinion, Surfers Against Sewage... or is it well, if, like with phosphorus, if we had targets to have an asset maintenance regime. Is it something where actually governance could be in place that would actually lead to a goal you think that's great, I'm really pleased with that goal.

00:48:10.110

I.9.: It's really interesting because it's one of those things that's really difficult to put a quantitative measure on. How are you measuring my asset base quality. Is it the value of my assets, is it the condition of my assets, that's very subjective. You might see it one way, I might see it another way, so what constraints can you put on me as a company to go out there and improve some of these sites that need improvement. I think the phosphorus permit is a good vector of doing that because I'm improving the quality of what goes into the river. I think what I would do is instead of putting these very, very, very, very tight permits on sites, I put laxer permits on more of them. It might not work with the water quality model and stuff like that, because some very clever people that work out what's best for the river in that respect. I feel like we've been driven to this point where, on some sites we are getting 0.2 milligrams per litre or 0.16 milligrams per litre which is bordering on technically impossible with the current attack, current technology we have. But you've also got sites discharging five, six milligrams because they've got no permit. And I know it all depends on where the dilution it discharges into. I feel we'd get a better quality of assets if we gave both those sites one permit, something like that.

00:49:48.960

E.S.: So you think there could be some more flexibility in permitting that would allow you to actually improve the overall quality of your area.

00:49:57.900

I.9.: Yeah and I just don't feel like the direction of travel of going lower and lower and lower and lower is something that's going to be sustainable, because all it means is we're going to be dosing more iron, so more iron's gonna be produced, which has a massive carbon impact on the environment. And I think some of them are set as challenges like okay, here's a point two. To hit a point two you've got to go and innovate and find new technology, you can't just do it the same way you do it where you chuck loads of chemicals on it. At the moment that's kind of where we are. It's kind of like work with us, we're trying, because we don't want to spend a hundred thousand pounds on chemicals, we're trying to find other ways, but fundamentally the technology is not keeping up with us at the moment.

00:50:42.480

E.S.: Okay, I see that's really interesting []. Is there anything else you wanted to add? I've gone over time.

00:50:49.350

I.9...: No it's fine, I think, hopefully that's been useful to you.

00:50:53.250

E.S.: It was exactly what I wanted. Really it's just so much more interesting and insightful when you're talking to people, they're actually doing it, you can read and read and read and read and read. And it doesn't really come alive and doesn't really help you prioritise until you speak to people, so people like yourself are actually doing it. It also gets across how difficult the job is. Speaking to so many people, I'm speaking to you know, government bodies and the water companies' innovators and it's so complicated and such a behemoth of an industry, and so respect where respect's due.

00:51:33.180

I.9...: Just reflecting on that point, I think that, if I could speak to the people that are setting this sort of stuff up and giving us these new parameters, I get it's a challenge, you're challenging us to meet them in new ways and do better and innovate. But sometimes, think about what happens if the technology doesn't keep up. All we're going to be doing is chucking so much more iron and aluminium, chemicals at it, and is that what you wanted us to do? When you set out to give us this challenge, is this what you were expecting us to do, and, if not, let's review it, let's have another look.

00:52:17.730

E.S.: It too much of a target focus rather than a wider view focus? Is it so 0.6, 0.2?

00:52:26.040

I.9...: Yeah and I get that and that's what they want.

00:52:30.750

E.S.: That's quite narrow focus.

00:52:32.520

I.9...: If you're looking at phosphorus you want to get lower, lower, lower, lower, lower. But there's always a trade off. There's always going to be a trade off, so you can't tell us get lower P but don't dose more at a high end, don't spend more on OPX costs or whatever. It was interesting, at the start of this AMP we got a challenge saying you've got to hit all these new quality permits, but we want zero increase on OPX. And I genuinely sat in the room and almost chuckled to myself at the senior managers telling me this because I'm a chemist, I understand the laws of thermodynamics, and that is fundamentally impossible. You're asking to lower the amount... to take energy out, you need to add energy, you can't delete it. I don't know if the technology ever will exist, but it certainly doesn't exist at the moment. So what you're asking is fundamentally impossible.

[end of interview- not transcribed]

13th August 2021 J.1. Research Interview

Opening preliminaries not transcribed. Checked comfortable with participation sheet, no questions or concerns and happy to proceed.

00:01:07.110

E.S.: Is there anything in particular you're working on at the moment?

00:01:11.610

J.1.: So we can draw from my experience on my PhD work, which is where I was actually in the innovation team at [] Water, working in collaboration with a few different organisations to build a pipe facility that I then ran in the region. Or we can talk about the [C] technology that I'm working with at the moment. I'm working as a project manager to project manage this new technology across six different water companies in the UK, so whichever experience would be best.

1800:01:46.080

E.S.: The latter might be interesting, so the water sector has been brilliant in giving me their perspective. What's more difficult is the people one step outside that water company trying to make it work from that perspective, so that would be brilliant... So what's [C] about?

02:14.280

J.1.: [C] is a technology, it's a new way of working, a new parameter, something that we're not currently using in the UK for our regulations. It's able to calculate the microbial activity of a water body, so normally when microorganisms reproduce, they respire, and electrons that are produced go out and get released into the environment. But this device, the [C] technology, it captures those electrons and with that you're able to calculate the reproduction rates, the microbial activity of these micro-organisms. So it can go in any water body, and it can tell you what the micro-organisms are doing. So, for instance, if you've got a really good food source, like you're at a domestic wastewater plant and you've got lots of sewage coming in from people's houses, you'll see the micro-organisms eating all of this sewage and the rates of microbial activity will really increase because they're reproducing lots in an environment that they love. Equally if you're at a sewage treatment works and you get something toxic coming through like maybe some dyes from a plant, like an industrial factory that produces paper, making coloured paper, those dyes involved, you'd see all the microbial activity decreasing. So it's a bit of a new one for the industry because it's not something that they're regulated on, they've not got to look at the microbial activity in their water, it's not something they have to do, but at the moment, I'm particularly talking the wastewater treatment here because that's where most of my projects are, at the moment we monitor things like ammonia, dissolved oxygen, pH. And the reason why we monitor all those things is because they're precursors of microbial behaviours, it's just in the past we weren't able to directly monitor what the microorganisms themselves were doing and they're really important to break up that sewage. So instead we've been monitoring precursors, but with the [C] technology we're trying to say instead of or as well as monitoring those precursors, if you want to, we can directly monitor exactly what the micro organisms themselves are doing, so that's the [C] technology.

00:04:30.870

E.S.: And why is that a good thing?

00:04:33.300

J.1.: And so I'm working on two different, two main problem statements of different companies at the moment, depending on what their interests are.

So the first problem statement I am working on, is this idea of compliance, so the benefit of the [C], compared to other parameters like DO, dissolved oxygen and that kind of thing, is that this is more reactive. And so you've got the micro-organisms are reproducing more and because they're reproducing more, they're using more oxygen, and so it's on average about an hour quicker to monitor micro-organism activity than it is to monitor the DO. So it's more reactive. So that's the compliance piece, where the benefit comes in. The way they manage their treatment works can be dictated by the DO levels, that's normally how it is, it's called a dissolved oxygen feed forward system. But they can be using [C] to make it quicker, and make it more reactive, and reduce the oxygen that they're dosing, which makes it cheaper and more efficient. But the main reason for doing that is just to make sure that they're well within their limits and they're not being penalised, they're not taking in too many loads. So for instance, they can show, if you've got a [C] probe on the inlet, you can go back to the Environment Agency if they've had a fail yet and say, look it's not because of the way we've operated our plant, because look we've got one of these probes on the inlet and actually the stuff coming into the works it's killing off all these micro organisms and the micro-organisms are the ones that are doing the job for us to break up, so that's kind of like the compliance piece.

And the second project that some of the water companies are interested instead of the compliance piece is like energy optimisation. So we've got this real drive and industry them to get to net zero in our energy consumption. And in the piece we're working on, this is how like motion activated lights, when you're under, they're working, they're on and then, when you move away, they turned off, saving energy. It's a bit of a similar situation where, when we see low microbial at the treatment works, we can turn off bits of the plant to try and save energy. And so, specifically the process that I'm doing this with is the bath units, which is an aeration step. So we've got one of the probes on the front end of the bath units, one probe on the back end of the bath units, and there are six units in total. And then, when the microbial loads coming in are really low they can turn off two of those six units so only four are operational, saving there that energy costs of the two that are able to be switched off at that point.

00:07:17.250

E.S.: Okay, so why would a water company be interested in this or why would they buy it? Is it because of these efficiencies or what would drive them to take this technology, rather than something else or do nothing?

00:07:32.040

J.1.: And so, at the moment we've had quite a few people taking on this technology purely from the compliance piece. One of the main benefits of this probe compared to, especially on the drinking water side. My application I'm seeing is in wastewater because there's lots of benefits there, and the reason why there's so many benefits compared to similar technologies that work in the drinking water capacity is because it's zero maintenance as a device. It requires no calibration. It sometimes needs cleaning so we've got one over at United Utilities that's been in place two years now, and so, when I went to site last, I cleaned it. And cleaning means getting a bucket of sewage, putting it in the

bucket for an hour and then putting it back in place. And that's really, really different to some of the probes they've got at the moment, so things like a DO probe they'll need to be calibrated frequently. Really technical, some of them, some of the stuff that you've got to do to make sure they're still reporting true values. Some of them drift over time, they need cleaning because, especially at the inlet for sewage treatment works, as you can imagine, where the most dirty water is. And so lots and lots of sewage grows on them, but the whole point of the [C] device is because it's monitoring the microbial activity, it's been designed so that biology grows on it and the form of a biofilm so that growth on the probe is a good thing and it means that we're measuring that growth over time. With other probes that growth is stopping the signal going out and stopping it measuring what it should be measuring. That's one of the real benefits, I think, for the sewage side of things, it's just the fact that it's designed for the biology to grow, it doesn't need cleaning, it doesn't need that calibration.

00:09:23.880

E.S.: Yes, it's an easier tool to enable them to comply with governance, if you like, and to comply with the regime around them. [Definitely]. And also carbon neutral move drivers, policy drivers as well, pushing in that direction. It sounds so good, why isn't everybody having it now?

00:09:41.400

J.1.: And so I think, from my perspective, you probably heard from [] that they've got quite a few things go on around the world, big strategy kind of things. I'm the UK person, I'm the one here on the ground, doing the site visits, doing the installs, putting SIM cards in place, that kind of thing. And the main pushback that I've had so far with the project is people are saying, it's a really good probe, really reliable, the maintenance you've got that down to a tee, but they're kind of saying we don't know what to do with the data. They don't know how to integrate it into their control philosophies. Or on the compliance piece they're saying you know, at the end of the day it's not a parameter that's regulated. So they're not certain about those two things really, that's what I'm getting back.

00:10:53.100

E.S.: Is it quite a narrow vision, that we've just got to comply and that's the path of least resistance to some extent, rather than what's better for the system as a whole?

00:11:07.710

J.1.: Yeah, so it's just difficult, I think, to try and encourage them to think in this new way, to add this new parameter and just try it, but they seem quite keen to try something out, but after that initial three month period, or that six month period they're kind of like, we've had lots of interesting reports back, it's working, it's showing us interesting things. But we can't find the budget to implement it at other sites, so implement it in the longer term, because we're not sure what we can be doing with this or how it's going to help us steer clear of regulations.

I also find with the zero energy piece, it seems to be something that's spoken a lot about on a higher level, like from a strategy kind of level. But the guys on the ground, the operators, it's not something that's kind of filtered through to them yet. They're not interested, it's almost like these kind of projects, they can't find time for and they're not being very heavily involved with them because they've got more pressing matters like compliance that they want to be dealing with instead. I think until that strategy has reached the ground level and there's incentives and so on for people on the ground to be working on them, they're not going to have the same level of investment with this, as they would, for instance, with a new DO probe.

00:12:42.240

E.S.: Right so it's not a root and branch total revisit of carbon, it's just strategy not leaked down lower yet. Lots of people say to me that it's relatively easy to get a trial, but it's really difficult to move on from there. Is that your experience generally and why do you think that is?

00:13:06.120

J.1.: So yeah, both in this role and in my role when I was at [], that very, very strong reoccurring theme, really, and in that the innovation team within a company is always up for giving someone a go, doing a trial, they can find the budget to do all sorts of things. They really want to produce articles and shout and go to congress and shout about the really cool exciting things they're doing. But there's still very much this idea that operators, the guys on site, there's very much this feeling of, it's our site, it's absolutely fine, it's all okay. Why are you coming here, why are you messing around with the system that works, that we know, what is this thing, what is it doing on site? There's still pretty much that feeling, and so as part of my role at the moment I've been trying to take a little bit of that knowledge that I've got from being in the innovation team and kind of apply it to this role. So, like when I'm setting up site visits and things, I'm getting the people on site involved and I'm telling them exactly what this is and what it's doing and that kind of thing. And I want to have in future, I plan on going along to the team meetings, operator team meetings. I always bring doughnuts when I'm on site as well because I just want to tell them what it is that I'm doing on site, why I'm here, who I am, because it's really easy for them to feel so disengaged from the projects that are going on and, at the end of the day, the thing that makes something from a trial into full scale implementation it's those people, it's those people on the ground who are going to be keeping an eye on things and they've got to be doing it. It's that transfer from innovation to operation, which is so difficult to achieve.

00:14:53.610

E.S.: So, in your network, if you like, you're including people on the ground, as well as your knowledge of how the sector works generally. Are you speaking at different levels within water companies then from the sounds of it?

00:15:09.330

J.1.: Yeah definitely. I'm really interested in speaking on like an ops level. And just ringing up the guys on the site and being like, oh, is this happening on this day, is that happening another day. And it can be difficult when, for me as an individual, when I first go on site, it's really difficult to talk to those guys, because I am not the norm, and so just being a female and being on site. Quite often on the site I've been doing with this job actually, I'll be visiting a site, maybe with someone like [] or my manager or someone like that, we'll both be on site together. And the guys on site, the operatives, they'll be speaking to [], they'll be speaking to my manager and they're completely avoiding all eye contact, not looking at me in any way. They'll be asking questions to the other person but it's me who's answering those questions, but then, by the end of the site visit, they've kind of got that I'm the one who's going to be, I've got the tape measure, I'm measuring and I'm doing the walking and so, I'm the contact who's going to be talking with them about this. So that is a little barrier to begin with, and first impressions, really, really do matter, and that's something that you've got to overcome a little bit at the beginning. I'm doing a lot of the operator chats, keeping innovation in the loop. I would say I'm not very good at the high level strategy, so I do plan in future to go to a few more conferences and talk about the work we're doing, write a few articles on it and stuff like that.

But, at the moment it's [] doing a lot of that higher, higher level strategy, talking to like, I don't know, the big Jacobs of the world, and these other big companies and things. I've just got my head down and I'm talking to the people directly involved with my specific projects that I'm working on.

00:17:02.850

E.S.: So between you're all as many bases as possible. Do you have much contact with the regulators?

00:17:10.350

J.1.: And so, not in this role, no I don't. So at my previous role I was really interested to hear about what the DWI were doing, because my project was all about chemical-free water, so it was all about regulations and what would be possible with the future of water, but in this role, I have not, not in the slightest.

00:17:30.870

E.S.: What were they saying about the quality levels of water?

00:17:36.030

J.1.: In my previous, they were actually, so I initially thought that there might be some concerns there really. I think [] Water as a company are very, very risk averse and health and safety conscious, or even as a water company like [] I found are super super risk averse so they were really concerned that whenever I spoke about my PhD project, I was always saying, like in the next 50 years, or we're never going to be turning off your chemicals [] tomorrow or today. But I hosted like a DWI site visit around my pipework facilities and gave them my talk and showed them all around and so on. And they were really excited and they're really on board, and I was kind of thinking it's a bit sad that within the company, we were so worried about what they're going to say and very careful about the words that we're using and stuff. We're running this for waste, no one's getting this water. But actually the DWI was super on board and now this research, this blue skies thinking is a step in the right direction.

00:18:42.780

E.S.: Brilliant. Because you always hear the restrictions of water quality being so fixed and like this narrow vision that it's almost all encompassing, you can't actually sometimes make ecosystem benefits globally or wider because you've got to do this, one narrow thing, so it doesn't sound like it's necessarily coming from the DWI.

00:19:04.320

J.1.: No I'm not sure who it is coming from.

00:19:06.330

E.S.: Environment Agency I'm told. But there you go. One of the projects I'm working is pipe bots. Have you come across that?

00:19:24

J.1.: At []?

00:19:25.960

E.S.: Yeah, there's a group universities looking at putting different miniature robots into the water and wastewater supplies as sensors. They'll live there, so that's obviously a challenge for drinking water and sewage perspective. One of the things [] said was this technology and also [C], anything that new is incredibly difficult in England but less difficult in other jurisdictions. Is that something that you would agree with, or have experience of or could comment on?

00:20:04.560

J.1.: And so I think in my previous work, my PhD work when talking about chemical;-free water, I found that Welsh Water and Scottish Water were always really open to having that discussion. Especially Welsh in terms of lead and what they're planning to do with replacing all their lead in a really ambitious way. I just felt like they were a lot more on board with that kind of research, and I know, so my PhD was with University of [] and I'm in the same water distribution research group, so the same research group as like pipe bots, with Will. So yeah, and they found with [] they get so much, so many projects, I mean PhD students and so on, with Scottish Water. They're a really great company to work with, and their sites which are really great to visit, that complete innovation treatment works, and they've got all the different projects and in different areas, and so on. Just my experiences with them, how they've been really open to trying things and discussing it more, but I don't know. I've not worked with all of the English companies yet, so at the moment I'm working with We might be doing something with coming up. I'm doing some work with some paper mills actually because paper mill companies actually treat their own wastewater and they've been really up for this work.

00:21:49.920

E.S.: So why do you think that Scotland and Wales might be more open?

00:21:56.820

J.1.: And I'm not entirely sure why, and I think the different companies have really, really different innovation strategies, I mean I would assume it's because of the different ways of funding and so on, compared to in England. But all of the companies, they have really, really different innovation strategies. Yorkshire Water, I found they've not got a big innovation team and they're quite difficult to get into. It's almost like a special club that I'm not part of. Like a closed group and it's really difficult to have a conversation with those guys. I really [like so](#) Welsh and [] and some other companies have some plate things in place where anyone who has an idea for technology or something similar, and you can apply online.

00:22:50.520

E.S.: They set up an access portal or something haven't they, to allow things to come through...

00:22:59.670

J.1.: Yeah. So those kinds of things do make it a lot easier, but, equally, I think it makes it more difficult for small companies. My company that I work with this called [] Laboratories. And we've actually got 19 members of staff and in the company I'm the only water person, so I'm the only one who works in water. They mostly do brewery and do dairy, and what they do, as a company is, they basically sell and project manage projects with microbial technologies, so that's why they've added [C] into their portfolio that they offer in the UK. This is their first experimentation almost into water, but it's a really, really small company, so things like applying on an official website and having to put in almost like a job application, you know, having to put in loads of forms, loads of proof, loads of case studies and so on. It can be really difficult to find the time for that, even though it makes it

more accessible. It can be really difficult for me as an individual to dedicate the time for that, because you know, while I'm running all these other projects and things that's a lot of time dedicated. I feel like that's really good if you're a big innovation company and you've got lots of members of staff, and you can say right Gary, you get on that, get on Welsh and fill out that form. But with it just being me for the company, it can be quite difficult to justify the time on that, so I do feel like it narrows who can apply for that. Like the OFWAT innovation fund scheme, I don't have the capabilities to go for something like that. Lots of the companies have people who their full time job now is to chase up those applications and so on.

00:24:48.390

E.S.: So how did [] get the ins to the water companies, you have? You've got some of the big ones, some of the ones that are known for innovation, how did you gain their trust, if you like, and get in with them?

00:25:02.520

J.1.: So I only started in March of this year, so I have not been there when these projects first kicked off like a year ago, but what they've done is, so they met...so they had a technology PCOD, an online COD analyser and they're at a conference talking about PCOD. And they met some of the guys from [C], who have designed this technology and are based over in America. And they said, they just started having a discussion and so on, and the [C] guys had a project running with UU that they were struggling with because, being in America and the UK, it's just difficult to have that response time with the time difference and so on. And so [C] were working with [] and they brought him on as a consultant to pay on an hourly basis. But his role was all around Europe and he was focusing a lot on Amsterdam and wherever else, I don't really know. And they were just struggling with the UK market because there's so few companies but there's such a potential there. With [] if we've got our foot in the door with [], we could have like over 100 units, if we were to go at all of their sites. So off the back of that discussion, they had a few more discussions and they got a geographical UK exclusive contract to the technology, to project manage all the projects, sell all of the units for the UK and so that's how they got that that contract. But they found that having that many projects was really difficult so, then they wanted to recruit a dedicated water person, because [] also hired [remove name] as a consultant to try and help with getting the foot in the door.

00:27:12.360

E.S.: It sounds like some of the innovative companies talk about the costs, the health and safety, even. Not just the actual technical development per se, but the compliance and the risk and those development costs. But it sounds like you've got some development costs funding, if you like, or some development resource for the American outfit.

00:27:38.760

J.1.: So they supply the technology, and this year they've given us a little bit of a boost, like a marketing budget, you could almost say, on top of our normal marketing budget that we have for all of the different products that are sold at []. So it's a little bit, it's a few extra thousand pounds, but it's not like anything extra than that. It's really been down to us to get it out there, and so on. And so what happens quite a lot so, recently I got contacted by [] about starting a trial with them, and how that as an example has kicked off is they heard [name] who's CEO at [C] over in America, give a talk, so they contacted Patrick and said we'd be really interested in doing a project with this device. Patrick forwarded that email to me and said, [] will you follow that lead and talk to that person, so on. So I've contacted them back, and I said, I'll come in, do lunch and learn, I could do a site visit, if

you like, here's some brochures and stuff like that, just let me know and we can have a discussion. But previously I've reached out to a few people in the innovation team at Welsh and I've not heard back from one of them, one of them told me to apply for that online portfolio thing which we've already applied for in the past and it didn't go anywhere. It got allocated to someone who replied, we gave them all the information they asked for and they didn't respond, we chased them up and they didn't respond again so it kind of went to nowhere with that platform. I mean we'll see how this this new lead plays out. But yeah that's just as an example, how that one may or may not pick up.

00:29:35.910

E.S.: I suppose it can be timing as well, because it is just a bit of luck, maybe with what's floating boats at particular times and wastewater seems to be on the ascendancy in terms of priorities.

00:29:47.880

J.1.: And it's getting in touch with the right person as well, because so for me coming into this role, some of these projects are already off the ground and it's much easier to run one of these projects if I've been involved from the beginning, because having done my PhD, it is really important for me to have clear problem statements, clear research questions that we can then answer, and if they're doing like a three month trial, if they're doing a six month trial, I want to make sure that they've got a problem statement which is solvable within that six month trial. For instance, recently, I visited a paper mill down in Devon and he was saying that he was really, really interesting in seasonality, and how the different seasons impacted the micro-organisms within his plant and so on. And so I was talking with him, having this discussion, and I said how long is the trial that you guys have actually signed up for, and he was like six months, and I was like you can't assess seasonality in six months, you're either going to have to extend the trial to be longer or you're gonna have to find something different that you want to be focusing this trial on. So it's much easier having been involved from the beginning, and then you can really set those expectations, and I think some of our projects, the feedback that we've got is we don't really know what to do with this data. I think that's one of the reasons for that is not having these clear problem statements or things that we can answer from the beginning.

225

00:31:20.280 --> 00:31:22.080

E.S.: It sounds like these problem statements aren't 'just' technical questions, they sound very, governance or compliance... you've talked about the carbon neutrality and the compliance, it's solving an external question, am I getting that right?

00:31:51.450

J.1.: Yeah I think so. The whole reason why I'm in water is because I want to help improve water. I don't want to be part of the problem where you're just creating data for data's sake, I spend a lot of time running the data analysis on these projects, I'm writing reports, I'm speaking to these people about their sites. I'll be sending them an email and be like, hi just letting you know your primary settlement tank seems to be struggling today, is everything okay? And I want them to be able to do something with that data, I want them to take those next steps, I don't want to do this just for the sake of it, just for the LOLs. I really want it to mean something, so and I think those problem statements from a governance point of view, they are really important for justifying that research and finding that budget required to keep the project on long term or move to a different location,

that kind of thing. But, equally, from my point of view as someone outside of these water companies, I want it to mean something and help them out too.

00:32:54.930

E.S.: In terms of the environmental impacts of what you're doing, is there and any sorts of other ecosystem benefits to this project that you can align with?

00:33:06.840

J.1.: Yeah, so the piece that they want to be focusing on next is the catchment piece and bathing waters, I know that's an issue close to []'s heart because he swims a lot.

00:33:20.910

J.1.: And I do see a real value there, and especially with what's going on at the moment with a lot of times in the news with different companies polluting various water bodies, and that would tie in very nicely with the Environment Agency in their aims, I think. We've got a project which might kick off soon with the Glasgow smart canal system. And so, basically this microbial activity monitor, if you imagine it in a river or a canal or something similar. You would be able to detect when the microbial numbers are really, really increasing because they had a lot of food source being put in, which could be, for instance, raw sewage. So there's definitely an application now on the catchment side of things and it's something that we are working towards, but equally from my point of view, [C], the guys over in Canada, are really, really excited and they've got loads and loads of different ideas and so, for me, what I have to do as an individual, is narrow it down a bit, find our niche, find the place that we can do the work and where we're going to fit in. And so they do have loads and loads of ideas of what it's going to look like in the future, in 50 years, 100 years time, and so on. And I'm thinking, maybe the net zero piece, it's been difficult and it's a difficult sell for those reasons that I mentioned, with the operators and so on, so I am kind of thinking we should move and start to the compliance, into the catchment piece instead. It's difficult to get that first case study going. Once you've got that first case study, then you can use that as I say, look it's working here, why don't you guys give it a go, why don't we try it here and here. And I find as well, and this is something I find in my PhD work as well, that stuff happens abroad, in the UK it's nothing.

00:35:19.680

E.S.: We don't really like foreign water?

00:35:24.510

J.1.: Not applicable in the slightest. It can be quite difficult when [] is going to these meetings and he's like oh, in Singapore and you can just see the people switch off because they're like, we're not in Singapore, but if you say, oh [] are doing this, they're like oh. Our direct competitors, you know what I mean, we understand [] and we understand what they're doing but we don't understand what Singapore and so on are doing.

00:35:50.370

E.S.: You're talking about the bathing water. I know there are regulatory drivers for that, but there's also a lot of, I hate the expression bot[] up, social drivers. Would that form part of your strategy or your networking or has it in the past?

00:36:15.570

J.1.: And I think it's something that []'s quite interested in doing, especially because, I saw recently a piece on the news about another technology, Proteus, and about their bathing water application. The piece around you can't go swimming in the water, but this device will tell you that it's safe to go swimming in the water so you can go for your swim, that kind of piece. I can really see that working maybe in future, but for me personally I think it'll be difficult because I think that piece is best coming from the big water companies rather than us, no one knows who [] is, my own friends, they were like oh, you work at Queen's College London, I was like no. No one's heard of us, no one knows who we are, what we do, anything. What I'm trying to do at the moment is just raise awareness of as a brand, having a few adverts, talking at a few conferences that kind of thing, and just say to people hi, we're here, this is what we're doing. I think that would be a really good comms piece for the Scottish Waters, the [] Waters and so on, but equally I do know how strongly they don't like people swimming in the reservoirs and they prefer that people don't do that so I'm not sure if that's something that they would do.

00:37:39.480

E.S.: Again, thinking about the Surfers Against Sewage people and then the regulations push behaviour. So does PR and public opinion, and that seems to be the bathing, as the anglers did in the not so distant past. That seems to drive things forward as well, a little bit more difficult, I suspect.

00:38:06.180

J.1.: I'd be really interested in doing that for sure, it's just. I don't know, it's difficult because it's just me, you know what I mean, so it's not my skill set to do that kind of thing. At the moment all I'm doing is talking to the water companies and saying we're out there and we're doing this stuff. I'm not really sure how I would take the next step and do a public campaign or jump on the back of an existing campaign, or something like that.

00:38:32.040

E.S.: I completely get that. I've written a question down, I can't read my own writing. In terms of what would make your life easier from a regulation point of view. It's a heavily regulated sector that brings about all sorts of behaviours and problems. Is there anything that would, a single thing or some things, that might, that could change that would make your life easier? You're trying to bring about some brilliant change that makes these systems more carbon neutral, closer to that, and improves all these systems. What was it that you could change if you could that would get this sorted quicker..?

00:39:35.760

J.1.: So I think I've got two answers for this, so in my PhD work, something that I found was quite a barrier was the whole AMP system set up. I really quite struggled with that as a set up with my research that I was doing, because it was very blue skies, it was very this isn't something that's going to be happening next year or the year after in five years time. This isn't something that's we're doing today but we're doing it's for like 15 years or 50 years down the line. And so I felt like in that work, I was always, the very first thing at every steering meeting that I was having to do was really justify the research and the budget and the time that's spent on it to the water companies, to the stakeholders, just reminding them why it's important, why we're here, why we're doing the work. And I think it's something that the whole of the University of [] have to do quite a lot is just reminding them why we're here and why we're doing it, and just reassessing that problem again and again and again.

I do feel like it's because of the way that it's structured to prioritise these short term projects with short term wins. And it is a problem from within the company as well ,because you're reaching the end of the AMP cycle. And you're like, oh my God we've got this cash, what are we going to spend it on, and there's a case of right thing right time. We're suddenly investing lots of money into something that we wouldn't normally have thought about just because it's there, we can do the invoice and we can spend the money or we're going to lose it ready for the next AMP cycle. That's definitely something that I would see a lot, that rush to spend, spend, spend, just paying everything that we possibly could. It's just not a good way of doing things when we're then so money conscious and tight, the rest of the time. So, I wrote a bit about that in my thesis, but I think my examiners maybe cut a lot of it out because it's not directly relevant, and so I think just abolishing that system. I don't know what could be used instead, but for my PhD work yeah, if we wanted to focus on long term projects, something else needs to be in place instead.

For this current work, I'd really like it if the Environment Agency were more engaged, they wanted to do work themselves. I've worked with them a little bit in the past, so my Master's project was all about cryptosporidium, the protozoan parasite. And the work that I was doing with them was all about trying to stop farmyard animals going into a canal, so we were talking about putting fencing up. What I found working with the Environment Agency was they were happy to support things but they weren't happy to pay for things. And I think both of these things together are needed if you want to make a change and have a difference. So I think if the Environment Agency themselves were willing to put some money down on the project and give it a go and see if it does help in terms of the bathing water problem rather than trying to get water companies to pay for it, to monitor the water quality of the catchment. I think that's why, with the Glasgow project that we're doing about the catchment, that's why we're having some success there, because it's this external body, it's not the Environment Agency doing this work, it's not the water companies doing this work, it's the Glasgow smart canal system who are doing this work, so it's really interesting to see how that one goes. I'm not sure it will be able to roll out elsewhere, because it's a very unique setup up there. And, but yeah I think if the Environment Agency were happy to do some projects with us that would make this work a lot more interesting, and I think water companies would then be able to take advantage of the fact that they're using [C] and other applications. That would be good.

00:43:48.150

E.S.: I suppose another thing while you're talking, with pipe bots, for example. The regulations, regulations 31, you can't stick anything you like in the water supply, which is a good law generally. The rules are based on pipes, they're not based on any things more sophisticated than that, and I suppose the rules haven't adapted or changed and are quite inflexible. It sounds similar to your [C] in a way, if they could change to monitor what you'd like it to monitor for all those good reasons that would be a benefit. Not necessarily the Environment Agency, but maybe a more flexible adaptive regulation might support you more?

00:44:32.310

J.1.: Definitely, I mean in the UK we've got strict regulation, so I was doing this comparison piece for the chemical-free water work between World Health Organisation guidelines, the EU Water Directive and the UK regulations that we've got in place, and what I found was we're a lot stricter than a lot of other places. For instance, even in Germany they just had to make sure the drinking water was of a quality that was acceptable, microbiologically acceptable, I think it said, something like that. Whereas with us, we've got very clear definitions of what is acceptable, what is not acceptable, number of colourful forming units there should be or shouldn't be. It is colourful forming

units, it's heterotrophic plate counts, it's the old school reliable traditional methods of assessing if water quality is safe or not, whereas nowadays we've got flow cytometry, we can count individual numbers of cells and whether they are intact cells or non intact cells, but regulations are still like, grow this on a plate for 48 hours and see what happens. See what grows on the gel and then count it by eye, the number of colonies that you've got. I mean it works and it's reliable but a bit of a strange way of doing things.

And what I found as well doing my PhD work is a lot of the people, they didn't know what the regulations said, and so I had a lot of people giving me feedback, some of them quite rudely during conferences, and telling me that the UK guidelines require that chlorine is dosed as part of the water to process or as part of the network. A lot of them are saying that the barrier to making this change is the laws that are in place. But actually having read of all the regulations that are WHO, EU and UK based level, chlorine isn't required by law at all. Only when a bowser is used in emergency situations is the residual chlorine dose required. And I would say that to people and they wouldn't believe it. I spent the first six, eight months of my PhD work just going around telling people what the law said, because people didn't believe that that's what the law said. I think it's the regulations themselves being archaic, but also people's views on what the regulations say is clearly a bit skewed as well.

00:47:03.270

E.S.: [] and practice becoming almost like the law? And expectations. I suppose that a lot of the regulations have codes of practice, and so it gets more and more informal as you go down the chain. Which by its nature should be more flexible, but doesn't seem to get adapted either, in my far more limited experience of it.

In terms of AMP turnover, I'm going over so time I'll be quick. Some people have mentioned to me staff turnovers as well tends to follow AMP cycles and there's a knowledge gap or knowledge gets lost within that cycle as well. Is that something that you could comment on?

00:47:52.020

J.1.: It's not something I experienced when I was in innovation at [], and I was there for six years. So I did my Masters there for a year, maybe just about over a year, and then I spent a year in the water quality team as an assistant operational scientist. And then I went back, I was innovation researcher for a little while, and then I did my PhD with them, and so it was six years in total in innovation. And I didn't find that, but I did find that we had a really, really high turnover of staff. And so it was either, there's lots of young people coming in, staying a year, a year and a half and then leaving, or it was the same faces that have been there since before I was born, still there now, still there in many, many years to come, and so it's a real divide of people. The coming and going, though, was really, really intense and I'm not entirely sure why it is. I think it's really difficult for them with their portfolio of projects that they have, it's a lot of projects and all really quite intense, quite engaged, lots of discussions going on, and it's difficult as well, because you don't have the time to become an expert in a particular field, so you might be doing one project on algal growth and solar panels, you might be doing another project on something completely different like, I don't know hydrogen and cars. You're juggling lots of different plates but they're very different plates, and that makes it difficult, so I think that's why there's such a high turnover. I didn't really see it with the AMP cycles, though, that didn't seem to be a pattern, it was just the younger members of staff coming and going coming and going, and then the people who are there throughout.

00:49:42.690

E.S.: I suppose that knowledge changes as well if you've got a trial. You were talking about projects, if they're trialling and not implementing as much then that's going to feed that even more isn't it, that lack of retain knowledge.

[end of interview chat- not transcribed]

K.2. 2nd July 2021. 10am.

Introductory discussion and general loosening up chat. Confirmed ok with recording.
Confirmed ok with participation sheet and no concerns.

00:00:05.370 --> 00:00:16.379

E.S.: yeah and you are okay, with the participation sheet and what we talked about in terms of the ethics code that we adopt on these sorts of projects.

K.2. That's fine.

E.S. and designed to be helpful..., I know your time is very precious so and then try my best to stick to the 45 minutes.

People start in different ways, one is people to talk to me about their experiences in terms of trying to make a change in the sector, trying to bring about a new infrastructure intervention and where the laws or regulations or just system bucks against you, or where it supports you. Or people sometimes start by just talking to me about a pet project. One they just love or hate and we just talk about that just to open up with, and then I can draw themes from that at the end there's just a few specific questions I need to box off. So how do you feel most comfortable about proceeding ?

00:01:30.090

K.2...: I think, because I've written down a few kind of notes and you know I sort of worked in the department, R&D for about 25 years so over the years we've sort of tried several projects, and you know you find aspects of things get through some don't yet, but you know it's never smooth or perfect so probably sort of more from the lots of different angles and lots of different projects.

00:01:58.860

E.S.: Okay, ..

13

00:02:00.930 --> 00:02:07.080

K.2...: yeah and a lot of it is more probably internal things may be than external um yeah I mean, I guess, with the examples, you may be can sort of pull things out and want to see things I've not thought about it.

00:02:14.970 --> 00:02:21.750

E.S.: Well that's what I'm finding actually.... as people are talking we're finding more things that perhaps we could tackle. ..

00:02:46.980

K.2...: yeah so the first one was probably the biggest one I've ever done so far, which was super big projects and that was with multi utility companies. Yeah and you know we kicked it off with advertising on the [.]. It was a major projects, you know back then.

00:03:06.120

K.2...: yeah, and this was looking at developing an ultrasonic device sort of like inside the pipe, that'd be a free swimming unit inside a pipe to tell you about the condition. Particularly for us it's kind of big bursts of mains in [.] and massive risk associated to that. I picked it up at sort of at the end of the

project, when it was starting to overrun. And you know these things are very difficult, you know you you're developing something from scratch you don't know how you're going to get there and they had a really good team, technical team, on board. And you know, and that was very, very key to kind of get getting it done.

00:03:53.910

K.2..: But you know it had to be brought on track and sort of actually delivered, and so we had a prototype and then we took ownership of it and did some trials.

31

00:04:03.150 --> 00:04:08.610

E.S.: yeah so it was a project that you're working with an external supplier to begin with, and then you then brought in house is that.

32

00:04:09.900 --> 00:04:11.430

K.2..: we're still working with the external supplier, for all of the sort of technical design etc and we were kind of project managing it.

00:04:17.130

E.S.: Okay yeah.

00:04:18.840

E.S.: Like a collaboration.

00:04:22.560

K.2..: yeah, and this was quite a long time ago and I think we've over the years we've had different approaches so I'll give another example.

00:04:30.450 --> 00:04:40.920

K.2..: And so you know this was in house technical development and then, and you know, like I say with the prototype we did some trials ourselves and things like that, and this was for a you know, because it was a prototype you do something that is small a lot more manageable and containable, but what we wanted it to do really was something a lot bigger. Yeah, and so we embarked on go into designing the next stage and it just became too big for the business. The amount of investment that it would need and so that's sort of funding and support and sort of perhaps risk for the utility to invest that kind of money. And again I mean you know you mentioned it already about the AMP cycles.

00:05:22.110 --> 00:05:30.750

K.2..: You know the need for doing this, is that the investment needed to replace them is huge and so we need to prioritise it but prevent the burst from happening because it's a massive risk, you know in Central [..], well anywhere, but it's our biggest risk. And so you know it became too big and we had to sort of park it, where it was.

But I turned it around to taking a different approach, where we've built a test facility and that's now coming to completion and we're basically inviting people to come in and test their equipment on our facility, so you know, I suppose, we have moved the risk to the suppliers.

00:06:16.230

K.2.: But that would always be the way in that you know, it would be very difficult for us to get a commitment for a sort of a.. we definitely would do X amount of surveys.

00:06:28.320 --> 00:06:29.400

E.S.: yeah

00:06:29.640

K.2.: that order book is very hard to get for the suppliers.

:06:34.740 --> 00:06:49.020

E.S.: In terms of the finance side, on that original project, the do you think the the business would have funded it based on.. you've got a lack of certainty haven't you because it's new science.. was it the business that didn't want to invest because of that lack of certainty or was it the regulatory regime, if you like saying, we're not going to fund, allow you to spend that money.

00:07:03.900 --> 00:07:12.990

K.2.: it was a mixture of both it's both. Because, like you say you are developing your sort of investment plans and considering how much you want to put forward um and, yes, it was just felt that they you know wouldn't invest us that much.

0:07:21.720 --> 00:07:22.650

E.S.: yeah yeah ok

00:07:22.830

K.2.: And it's an ongoing, it's you know, still an ongoing issue in that particular area, you know, we're not funded enough and it's difficult to know how much have you got to do to get them to really, release that amount of money.

v00:07:41.820 --> 00:07:42.150

E.S.: yeah.

00:07:46.590 --> 00:07:55.710

K.2.: I mean at the moment, the replacement line, you know they are expected to last another 200 years. Its like, its going to happen at some point.

00:07:57.720 --> 00:08:01.080

E.S.: Someone was explaining to me once about [x] Water in particular and people talk about Victorian infrastructure, which you are classic.

00:08:05.070 --> 00:08:06.150

K.2.: yes that is exactly it

00:08:06.870 --> 00:08:08.820

E.S.: well worst and now they're explaining to me that it was also the Blitz and they were just lying pipes anywhere to keep the water flowing. You don't know where they are, people were not making maps. So those sorts of huge issues and one of the biggest most important cities in the world, well the finance side alone..

00:08:34.740

K.2.: yeah, the drainage side and the overflows and pollution is a massive issue at the minute. We've got lines over there, you know were created in wartime, and you sort of think well why is that pipe

connected to that pipe, that doesn't make any sense whatsoever because it's really high, but you know if you've had a bomb go off and you're just trying to stop people being flooded, you would.

00:08:52.500

E.S.: Absolutely yeah and you pick it up now in 2021.

00:08:58.920

K.2...: But you know, we have done work looking at sort of on maps and try and find where things were

00:09:05.430 --> 00:09:11.670

E.S.: Of course yeah just appreciative of the hard work that goes into these things that are so hidden.

00:09:12.630

E.S.: So with this new one, you were explaining, you're transferring the risk, in your words from the business to innovators but supporting them, is that it?

00:09:23.700 --> 00:09:36.180

K.2...: But it's still kind of like an unknown track and I'm actually quite nervous about it in that unless somebody can come with something that could do it for us, which I am doubtful of, then you know they are probably going to need some investment to do that and how do they do that without our support, to you know get it passed the legal people that would be able to do that.

00:10:03.000 --> 00:10:09.930

K.2...: You know all they would be looking at..to fund it, which you know we have to be careful really of what we are or aren't investing in. And I say this has changed over the years and we have to sort of really consider that you know it's bill payers money and that we shouldn't be developing people's products for them.

00:10:20.970 --> 00:10:24.540

K.2...: But at the same you know you know it's kind of then, then you end up with the suppliers coming yes it's fully developed its TRL whatever and you're like, you need some sort of real life applications to kind of like to get that status. You have to have that in the back of your mind when trying to evaluate what sort of project and the partners are and things like that.

00:10:48.690 --> 00:10:54.210

E.S.: yeah, and so I take it really it's the bigger entities that the bigger innovators, rather than the smaller ones that are more likely to get through?

103

00:11:03.780 --> 00:11:13.080

K.2...: I suppose on the on the whole, but I mean this experience with super pig really showed that you know, like I said, we had a really, really good technical team. But once you've disbanded that that's it all the knowledge and the ability had gone, and you know you can't sort of really go back and you know walk straight back into where you were so you would do a lot of sort of you know rework again and technically skilling up people again.

00:11:40.260 --> 00:11:43.560

E.S.: So superpig was the first project was it?

00:11:43.710

K.2.: yeah, that's just one where it's kind of is a good example because it's been through you know quite a few different stages in the sort of now looking at it from a different perspective.

00:11:56.910 --> 00:11:59.100

K.2.: yeah so that was quite a good example.

113

00:11:59.160 --> 00:12:13.560

K.2.: yeah and then another one, we had this blockage alarm so, the need had come from us in that you know, we had some customers that are you know, unfortunately sort of flooding really regularly and you know it was sort of we want to do something for the customer so okay, we might not be able to get there quick enough, but if they've got an alarm and they know that they may flood at least, you know, they can ring us, they're on a priority list, that we know it regular floods and we can kind of get there, but also but you know, they can move things out of the way, they can keep an eye on what's happening.

And you know it was sort of a time of change of technology, where you know this was sort of more we can't necessarily get it all plumbed into our bigger system and the only sort of ring locally into the house and things like that, but it was sort of seen as a customer focused project and we sort of did this in house development with a very small guy that's worked on us with development and things. But he is a bit of a sort of one man band in a workshop. And all of a sudden, we were kind can we have 100 of these please and you know, it was sort of we weren't ready for sort of the scaling up and when you do go to the sort of scaling up, and you know you then start to have problems creep in like sort of you know, not the manufacturing quality and various things.

00:13:45.300

K.2.: But we have been in the phases, where we've had sort of subsidiary companies so Terra Tara and you know we were international at one point, and that was in its way, a bit easier because we had them you could bring them in a lot earlier to let them know what you're doing, and sort of, say, you know we'll see looking at this, because it's something that we need as a business and things you can't do as sole supplier and the commercial stuff that that's now coming in, but at least, you could have those kind of conversations and we had somewhere for the products to kind of go to, but because we don't have any of that and with now we have lost that again but we're now going through a phase where things are starting to be discussed again whether they would be individual companies or not I don't know but they'll be ventures. So its like just the core business or whether there's any external ventures there have been and you know and that happens between AMPs.

14:53.550 --> 00:14:57.540

E.S.: I know this is a difficult question but you know the changing approaches is that company led through just experiences and natural cycles or is it the AMP process and the blurb that comes out in advance of that directing your thinking. Is it the regime or is it an internal issue that that's changing these approaches and vehicles?

K.2.: I feel they are you know high level executive decisions that are being made but like you're saying I mean, especially with this some AMPs we kind of knew we had to keep bills low again it is sort of other ways of generating income for our shareholders.

00:15:38.880 --> 00:15:39.720

E.S.: Okay yeah.

00:15:42.180 --> 00:15:47.190

E.S.: Is there much collaboration between water and wastewater companies?

00:15:47.790 --> 00:15:51.150

K.2...: yeah I'd say quite a lot. At the moment it's very open door

00:15:51.180 --> 00:15:52.350

E.S.: excellent okay

00:15:52.440 --> 00:15:59.610

K.2...: yeah, it goes through phases, you know, but I think at the moment there's great collaboration going on.

00:16:01.440 --> 00:16:04.920

E.S.: what's s behind that all of a sudden or is it or is it all of a sudden?

00:16:05.610

K.2...: Like I say it kind of comes and goes, but I think it's sort of you know it's the UKWIR links, it's some sort of you know, common things that we really got challenging to sort of like, and you know to meet as part of our kind of indicators and that that sort of joined us in forces together. And you know the ofwat innovation fund that that's just come out, you know we're having to get other partners to strengthen our bids to show we are industry wide and I think that's what it's meant today, and you know, and I think you know, like the stuff I've always been involved with up UKWIR and Cira and so have always had that sort of national feel but sometimes that's a lot more forthcoming and I guess there's probably more people working in that area, because those extra bids and things are there.

00:16:58.320

E.S.: yeah yeah that's great to hear isn't it.

00:17:02.250 --> 00:17:07.110

E.S.: was saying to me that and I can't remember what words were used.. but I along the lines that there are more trials in the water industry than the old Bailey or something on those lines...

165

00:17:17.760 --> 00:17:19.680

K.2...: (Laugh) that I see it as a massive problem. And again, you know, having been here a while I've seen trial after trial after trial on the same things and you like think well you know okay has anything changed, you know. I am conscious that it is a bit like a publicity thing and want to seem to be innovative and you know. But when you've got that kind of knowledge and you know people who haven't got that background, think what this is a fantastic idea and have all the enthusiasm but it's kind of like, yes, but it's been tried several times and must be reasons why. And if it hasn't changed why try it again and, and you know I get frustrated when I get say told from directorship you know you've got to have a look at this system, and if they say that then we have to kind of go through it and trial it again, and you know.

00:18:15.270 --> 00:18:17.820

E.S.: what's behind that, then what, what do you think's behind this trial...

00:18:18.420

K.2...: Is the kind of that you want to, you want to be seen externally innovative. But there's also a lot of companies out there that are trying to sell their equipment or their novel technique and make their money, so it really depends, where they kind of come in to feed into the business and if they've got the right persons ear or from the shareholders coming down or something. You know, pressure behind that to make it happen, and so we what we want to do is go more you know, what are our needs, what do we kind of like want rather be technology, lead and we have a front door.

00:19:05.550

E.S.: Okay yeah cart before the horse, so the opposite to cart before the horse, horse first

00:19:13.800

K.2...: Yeah, but it's easier said than done, because you are kind of like in this sort of race let's say trial.

00:19:25.470

E.S.: Someone said as well that if another water company trial something the mentality was..

00:19:33.510

K.2...: yeah we all have a go!

ES: the not done here mentality

00:19:39.030

K.2...: yeah I hate that. We shouldn't have to do that unless there's a valid reason you know, and there is, in some cases, you know our [...] network is got a lot of rivers so it's quite weak sewage so you need to trial something, you know meets that sewage works to meet those needs than that makes sense

00:20:02.910

K.2...: But you know, otherwise you shouldn't have to but it's kind of getting the assurance I said, I guess, so the quality of documentation that kind of like says that it's had the right testing, and so you can be.

00:20:15.870 --> 00:20:16.740

E.S.: yeah okay.

00:20:16.950 --> 00:20:21.090

K.2...: And t there's a lot of rumour mills and perhaps not a lot of stuff is being written up.

00:20:28.860 --> 00:20:42.330

K.2...: yeah so there's we're doing it again now there's a product called aqua pay for fixing leaks, and I think it's actually been trialled within [x] before but it wasn't a very extensive trial.

00:20:42.810

K.2...: Right so we are doing it again now. We are trialling something for fixing leaks and it's been trialled not within [x] before but its got a bad name yeah so but actually it just means that we perhaps haven't got those controls in place to measure why, perhaps it didn't work and then give feedback as to sort of like well they either need to change their product or that we need to just only apply it in certain situations.

00:21:03.870

E.S.: or honest data for change, maybe.

208

00:21:08.760

K.2...: yeah and you know other companies have used it and you know you get that sort of feedback across the industry and, unfortunately, I think that sometimes that can kill things off quite quickly people have a decision before giving it a fair chance really.

00:21:24.810

E.S.: probably too generic a question, but what stops something generally moving from trial to implementation is it a failed trial, or is it just...

212

00:21:38.910 --> 00:21:47.160

K.2...: So the way I look at it is that's why we're here. We want to fail them before they get rolled out safely.

00:21:48.090

K.2...: so okay yeah so rather than somebody sort of picking up in adopting it you know. So it varies that percentage, but you know you'd say 80% 90% of stuff I'd expect to fail.

00:22:02.940

E.S.: Well that's great, I suppose, because then you're not expecting you know, only to taking up the ones that like to successful you're being more risk taking? In what you are trialling?.

00:22:15.270

K.2...: yeah thanks that's the whole point it's not just all that sounds like a great idea let's I run run with it and you get all sorts of contractors trying lots of different things, and then you've got lots of things in your network that you don't know you've got to sort of, saying, well, no that's it evaluate let's see if it fits with our standards our processes and things like that.

222

00:22:41.040 --> 00:22:53.250

K.2...: But yeah we do get as well criticised that perhaps we're not as good as rolling out I think that's a little bit unfair sometimes because I think everywhere, has a bit of trouble with that. You know you mentioned earlier about someone thinking that they've had done a good project and then you look back at it and think it isn't. So that doorbell alarm for flooding projects and we're still monitoring the success of that because the prototypes still out there and it's still not embedded in the business properly. But it's you know we thought we'd put everything in place rolled it out and then some about five years on you're looking and kind of going on, hang on is the priority status come off... so the system changes and not getting the benefits that it was originally kind of put out for.

But there's another one as well, where we sort for detecting customer leaks, you know it's just bits that you can buy off the shelf. And we hit sort of problems with then that you couldn't buy the parts with our sort of approved suppliers and that was a massive hurdle. And then the process of kind of getting that the customer interaction was, and still is, a major hurdle.

00:23:57.600 --> 00:24:04.770

E.S.: Okay, could you talk to me about that in a bit more detail. It's a detection leak for sewage or water I didn't quite get catch.

00:24:04.860 --> 00:24:06.840
K.2...: on clean network.

00:24:06.960 --> 00:24:07.920
E.S.: clean networks.

00:24:08.340 --> 00:24:11.040
K.2...: It's a leak that's on the on the customer side. I mean it actually came in, we have the idea quite a while ago but with Covid. It's something that you can test out in the road to see the leak whether it's likely to be under the ground or in the person's property. You don't have to go in the property until you know until you know, and you can write them a letter to, so to say, we need you know we believe it's on your side, please can you check or we think it's in your supply pipe to your house. Can you check so that we can fix it and yeah so you know it is kind of it's it's flown because of covid is but it's sold it's kind of like a major hurdle with how we interact and deal with customers and how it works with our contractors so.

00:24:59.970
E.S.: So you can take both of those in turn, if I may, with the contractors and the customers, the procurement side, I think, is what you're talking about, could you just summarize that for me or just run through that for me.

00:25:12.660
K.2...: So because we have framework agreements with certain suppliers and get reviewed and there's massive process sort of behind it. And they come up with a certain meter that wasn't supplied through the framework. So you know it's it then becomes I mean it's very difficult for us to get this as a department for a test, but for getting you know a few hundred or thousand kind of like bought for the whole business was, you know, there was just that hurdle. Yeah and you know it just seemed to be a major a major blocker really where a couple of conversations, perhaps you know could have could have sorted that out.

00:25:58.320 --> 00:26:00.660
E.S.: And that's because of the framework contracts system.

00:26:00.720 --> 00:26:15.510
K.2...: yeah yeah and it's funny because I think, as a department we do like small stuff you sort of like see lots of inefficiencies with those big contracts, but it is because we are buying so much stuff at the big scale that you know, we must get efficiencies at that scale.

00:26:16.800
E.S.: Of course you've got to advertise haven't you and all that sort of thing, but that might change us to post brexit but, at the moment it's still very much..

00:26:27.630
K.2...: there will be a similar format I think it's just that it will be not be Europe wide.

00:26:31.530 --> 00:26:45.660
E.S.: you're spending so much money aren't you it's difficult. And then you mentioned in that that side of the regime, if you like, the procurement side, and you're not the first person to mention that at all, it seems.. everyone seems to understand why its there but it seems to be a blocker

00:26:47.430

RC Yeah, (laugh)

00:26:58.800

E.S.: And, but the other aspect you mentioned was the customer site. Could you just run me through that so I can get my head around that.

00:27:04.800

K.2.: yeah so it's really weird how sort of the customer side of our world...I suppose, there are different skills, rather than sort of majorly engineers and things like that and they you know there's a little bit of a bridge that needs to come between the two. And I think and it's a bit of a grey area that there is quite a lot of standard processes when we're having interaction with customers. A lot of sort of for more letters, etc, that that kind of have to be done and from where I sit and not sort of dealing with that every day.. and even, I think, from sort of frontline operations that they're not always necessarily that au fait with that process, and I think we've probably encountered quite a lot of change. You know, and there is formal letters...it's kind of I think there's so much change going on of like well you know, is it is, is an email, is a text, are they enough

00:28:10.980

E.S.: okay yeah.

00:28:12.690

K.2.: it's all a big can of worms, I think, at the minute.

00:28:16.050 --> 00:28:16.440

(chat)

00:28:38.610 --> 00:28:44.550

E.S.: you mentioned engineers need to bridge the gap, what did you mean by that?

00:28:46.050 --> 00:28:48.540

K.2.: So so like I said, the customers sort of, the kind of customer expectation, is quite different to the sort of engineering expertise and this is on the ground and and so um you know me having those two interfaces where you've got to be customer facing and being au fait with kind of like what officially needs to be done in each situation. So when you're introducing a new system, you know it's often the last thing that gets thought of. And it's been you know, seen as quite a blocker, because they are quite set procedures, and probably rightly so.

00:29:28.710 --> 00:29:29.040

E.S.: yeah.

00:29:29.880 --> 00:29:34.380

E.S.: Have you sort of customer negative feedback or objections to things like this, then.

00:29:37.290

K.2.: there's always a lot of nervousness, I think..and so I think most of our experience has been that you know we will do trials with customers, and so we will go through with them and explain what we're trying to do and.

00:29:52.050 --> 00:29:52.350

E.S.: yeah.

00:29:52.470

K.2.: You know and it's always been really receptive. I think our ability to do that is alright, but I think when you come into rolling things out because it's you know a lot more in this sort of treadmill and your contractors. You know so this flooding alarm, you know we're now doing something similar, but this is sort of like monitoring... we're looking at back gardens and where blockages occur and putting alarm sensors in there and you know we're having to use contractors and they you know we get photos send back and their garden is in a mess and it's kind of they shouldn't really do stuff like that.

00:30:40.740 --> 00:30:42.000

K.2.: But yeah some. I guess things like that always happen and it's just tightening up on those generally as a business I don't think yeah it's a barrier. If anything I think there's always this fear of you know you have to think through kind of like you know what am I aiming for, my where's my end goal, how many of these are we eventually going to use, or buy and things like that and what other sort of things need to be put in place to support that.

00:31:09.810 --> 00:31:13.590

E.S.: so you're talking about that the customer engagement earlier

00:31:14.970 --> 00:31:15.240

RCUE. yeah

298

00:31:17.370 --> 00:31:21.630

E.S.: How they're going to respond at the earlier stage, rather than at the implementation stage.

299

00:31:22.200 --> 00:31:30.180

K.2.: yeah, you know that is it. You know from the customer end, you know, they actually want us to be invisible, but they might also, they have experienced flooding or something like that you never want that to happen again, and so you might be a bit more receptive, but I don't think we know that granularity level of detail everybody's different. And you know and it's not an exact science is it and we have so many customers, how do you do that at a broader scale.

00:31:52.380

E.S.: obviously, [..], I think, someone said it was the 8th city most likely to run out of water. And how is the environmental agenda impacting you. Just from your perspective, what, what do you see most.

00:32:15.780

K.2.: it's quite strange, I mean in our department we've done a lot of work on and reuse and Marie in our team and quite a few people before her you know, probably international experts on reuse and things like that so we've done a lot of pilots, you know we were involved with the Olympic Park and things.

00:32:45.180

E.S.: are okay I've seen the studies on those yeah.

00:32:48.060

K.2.: So just trying to get this embedded as a solution.

00:33:06.090

E.S.: Right, well, I imagine there is a huge difference of opinion in the customer base around feelings towards it.

00:33:18.480

K.2...: yeah exactly.

321

00:33:20.610 --> 00:33:25.170

K.2...: yeah so you know, but then yeah it so so it's kind of like it's skills isn't it and it's kind of like you know, like I said there's sort of Marie that's left but Evers moved to a new job and their predecessor retired a long time ago, so. And it's keeping those skills in house for the right time, when things will be accepted.

00:33:47.010

E.S.: You don't feel it's good acceptable at the moment.

326

00:33:51.360

K.2...: I'm not up to date, to be fair, how much we're planning to do I know we've got a little bit in in the current AMP plan, but like I say I mean on the water side you know we've actually had this longer term water resources plan, it's only just come in on the waste side and the most of my experience is actually on the waste side so.

00:34:11.670

K.2...: yeah it's it's been a lot more short term on the waste side. You know I mean when I started at 10 we were looking at the Tidal tunnel and I'll be retired when its fully built. You know that's a massive infrastructure projects, and I think a lot of our pollution focus, of course, has been on there. I find the Environment Agencies position and with us very strange. You know I think they expect our sewers to be completely leak free. You know, and in reality, you know you've got groundwater, it will get in any tiny crack and you know, then, if it's on the ground, it starts coming in the manhole chamber through the manhole. You can't stop it, and you know, we are in that situation in the West part of our catchment. And Wessex and Southern and that we do talk to them as well and we are all suffering with similar problems, and I think their expectations are just way beyond what we can do.

Even I mean we trialled a treatment process unit and so to do high rate treatment on poor quality low b.o.d etc and we showed it to the Environment Agency to say you know we have this tool we will use it, where we can you know in places aswell , where it will stop sort of like traffic disruption with you know continuous kind of like lorries to move the water, while you are still inundated but, and you know they've never kind of actually signed or agreed that was the right response.

00:36:05.850

E.S.: They have a supportive innovation or just in their own bubble?

00:36:12.900 --> 00:36:27.000

K.2...: I'm not that close but that's the impression I get is that they're in their own bubble and I guess they are really under resourced, and they are really focussing on their prosecution end.

00:36:31.890

K.2...: And I've been I mean you know we've done quite a few things you know with the sort of [.] side of things in sustainable drainage, we've got quite good co-operation on and heat recovery and things like that.

00:36:46.620 --> 00:36:50.610

E.S.: So you've got such a massive city, but so many potential avenues

00:36:55.830 --> 00:36:56.520

E.S.: This is not to say that you should be doing it it's just an open question and are there any projects where you're looking at social levelling up - where there's a green or blue infrastructure component that's crept in or is the main focus if any of the projects that you're dealing with at the moment

00:37:17.160 --> 00:37:21.180

K.2.: Blue and green infrastructure is is sort of part of the overall plan. And I say I'm working with cira, so a lot of the work and guide frameworks and guidance that they develop but I say there is a core few people, and I think the you know they do that job because they love it and they want to do the right thing, but it's just a small core of a big business.

00:37:43.050 --> 00:37:47.490

E.S.: You have to forgive me, I don't know I don't know who cira are

00:37:47.610

K.2.: they are construction in research. They do a lot on sort of like what's guidance for sustainable drainage. And even though we take this approach, you know for stormwater management that you know we don't own those assets we just don't have the ability to be part of them, but we want them to help support when we do do a really big tunnel or whatever, because it there is a lack of space under [.] you just you know it's a massive in such an expensive thing dig up [.] And so you know we have partnerships, and I think we've got some money that we're releasing out to the council's now and it's it's kind of we've done many pilots, and this is sort of like just a be rolling out of our pilots I suppose to give some money to the council's to kind of say that do these more green infrastructure.

00:38:52.290 --> 00:38:53.040

E.S.: Okay yeah.

376

00:38:53.250 --> 00:38:58.620

K.2.: we have developed a planter, you know so that's all part of that that thing as well, so.

00:38:59.280 --> 00:39:06.690

E.S.: In terms of goes where those are located, are they, how do you choose which areas to give money where do you choose to put the blue or green infrastructure.

00:39:16.500

K.2.: So it's more driven by the surface water management plans so it's kind of where are we getting those surface water issues and internal flooding and our asset managers kind of you know, plot the common GIS and plot them all and kind of work all now.

00:39:34.350

E.S.: is it like scientific data, or is it is it any way influenced by the people on the ground shouting louder than areas.

384

00:39:41.670 --> 00:39:58.830

K.2.: I was gonna say it's key that you've got that engagement from the Council, especially with today's age, and I don't think that is equally blanketed across everywhere, so it is you know we have gone, you know, we would like to do this, we know where we were preferentially like it to be. You know not and actually with [...] mayor we develop this model to help communicate it out that you know we have problems here, but they originate from here, so we want this, you know so. It was good, it was a very high and people didn't like it because it wasn't that technical, but it was kind of just a good way to say these boroughs and areas, you know, this is, this is where we would like people to come from. We've got to do this solution here to benefit people down by the river.

00:40:28.740 --> 00:40:37.320

E.S.: Okay yeah so and it was it's the who engages with you ultimately can veer you off in the right or wrong direction?

00:40:37.710

K.2. E.S.: yeah yeah right yeah with let it out and it's kind of people are bidding for it and they are screening those bids. I haven't been involved that closely, but I think that is how it has worked.

00:40:50.070 --> 00:40:51.600

E.S.: In terms of them another general question in the team that you're operating within is it do you mind me asking what your background is your your background specialism.

00:41:01.350 --> 00:41:05.550

K.2.: yeah so so you know I did a degree in environmental science. I did my my university placement in the R and D department of [x].

00:41:14.820 --> 00:41:20.250

E.S.: it's a science background is that typical of the r&d department, do you have a mix of disciplines or as.

400

00:41:20.370 --> 00:41:26.910

K.2.: Well, and this is something so um yeah we happen oh definitely we've got a mix of disciplines, you know and you know I've got a physicist in my team about to retire and it's kind of that question of well do I need a pure physicist or do I need a more general project engineer, so my manager, I think, wants to have everybody as project managers bring in the technical skills. But I am quite quite favourable that we have actually some core technical skills. When we lost one of our and chemists you know you just don't have that person to go to.

00:42:07.920

E.S.: yeah so do some cross disciplinary. I'm a lawyer by background, previously chemistry now civil engineer. I am conscious we are close to time.

00:42:27.450 --> 00:42:28.920

K.2.: that's fine I'm nothing until 11.

00:42:30.630 --> 00:42:34.920

E.S.: I've got a more general question I ask most people at the end. In terms of your job and you're innovating you're trying to make changes big changes not just necessarily incremental ones big transformational change make things better. And I'm interested in the governance regime that either supports you or challenges that and if there's one or a few things that you could change that

would make your job easier, that would enable you to bring about those changes what sorts of things, would you be putting on your wish list.

00:43:08.610

K.2...: I mean from a day to day perspective, and you've probably had everyone say this, is the procurement. So the time and effort you have to put into just going through the procurement hoops just for just getting a trial done is quite hard. But then you know I think if you are rolling out something like saying it's quite transformational, then you just going to accept that that's something that has to happen at those later stages.

I think a lot of the problem as well, is that we, when we sort of sit as a team and we service the rest of the business, and we have to sort get within a company and we sit within digital at the moment and doesn't feel like home at all, but sometimes we're asset management and sometimes we're operations, and you know, but we hopefully provide efficiencies and that for the whole business. And that's quite unique because we kind of have that oversee of actually the whole business where most people support you know so surprising now they just sit in their little inner area and I find that strange.

00:44:24.630

K.2...: so but yeah, to make something kind of happen, you know, we need to engage with the asset planners to kind of like saying we're going to do this as a pilot, but if it does work, then we need to be able to sort of scale it up and how many treatments sites, would you put that on and all that kind of thing.

And it's probably just the change in leadership and the change in the differences of direction. This causes a big problem, so you might think I'm doing this now, but it's going to take you know 25 to 30 years to get there to where we feel safe to kind of hang this out but the focus or direction sometimes it's changed and come back again. It doesn't really matter, you have these nest eggs and kind of like say well when is the right time to let let them fly.

00:45:28.500

E.S.: I think we said you suggested to me before that that isn't just the external regime it's the power that be, at the top and their particular vision it's a mixture of both rather than one or the other necessarily?

00:45:44.790

K.2...: yeah I think so yeah yeah, and I mean particularly at [x], I mean our whole executive team has completely changed I think there's one person that's been here for longer than five years.

00:45:55.980

K.2...: so that that executive memory, is just is not there.

00:46:04.260

E.S.: you have to train them again!

00:46:07.200

K.2...: that's it, you have to put that effort into telling them. It's easy to get them but they are either hot or cold.

00:46:27.240

E.S.: You talk about customer engagement and getting customers on board, why are [x] Water bothered about what the customer thinks what has driven their need for customer positivity.

00:46:40.890 --> 00:46:47.970

K.2.: yeah I mean we have the MPS score, so we do have scores on what on what the you know, they think of us, and so.

00:46:50.670

E.S.: Okay, so it's the regulatory driver.

00:46:57.810 --> 00:46:58.080

RC.U.: yeah. yeah yeah, and I say yes, we use that or that publicity of the fantastic things we've done, more so than being hampered by sort of the smaller trials being negative. But maybe that's just luck at the moment. If we were rolling out something and it significantly upset a lot of customers, it would obviously fall back the other way and we're conscious of that, which is why we want to do the necessary steps and do an offline trial then field trial, you know.

And so this is it so, four or five years ago, there was sort of a very much fail fast attitude and it was kind of well you know go out and try as many things as you can,, you know, but it's kind of like, you do that sometimes and it can be a complete disaster, you know, you need to.. you're throwing away things that aren't valid. There is a lack of ideas out there, I think everyone's scrambling over the same ideas.

00:48:16.320 --> 00:48:18.840

E.S.: I'm part of Pipebots team and I've got a privileged position to be in a research environment where it's not cost, of course it's funded. But you can explore and examine in that space to explore that so science, the thing that's a sort of the social.. you've got customers need to...like any business, etc and I'm interested in how you balance that with environmental mean social, environmental, sides of things like I imagine, particularly in [.] , must be huge tension, how do you balance...

00:49:07.440

K.2.: we have customer surveys and of course they kind of focus on, you know hmm so it could be pollution flooding you know leakage, etc and yeah you know you kind of have to put a scale of what's most important to you, and you know I have seen the questionnaires before so they they're quite sensitive and they are run for that purpose, really to learn, where our priorities should be.

00:49:39.870 --> 00:49:44.880

E.S.: Okay, so it says society determining where the environmental impacts.

00:49:47.190 --> 00:49:49.800

K.2.: yeah you look at the answers and go well, how...I'm an informed customer and you sort of like think well if I wasn't why would I care about leakage, do you see what I mean?

00:50:03.810

E.S.: Absolutely yeah. Well there is an education piece without trying to be patronising. But we are getting more educated with climate change I suppose.

00:50:15.510 --> 00:50:16.440

K.2.: yeah yeah.

00:50:16.770 --> 00:50:20.250

E.S.: But do people make the connection between climate change and leakage I don't know.

00:50:20.610

K.2.: yeah they must do the surveys right but yeah you do sort of thing yeah the people that are partaking in surveys are they already educated people. They probably...they must try and get the mix but yeah I am quite often surprised. And yeah there is quite a lot of pressure, you know from pressure groups.

00:50:44.310 --> 00:50:45.030

E.S.: Okay yeah.

00:50:45.180

K.2.: Well, for you know, like the from the free swimmers and things like that at the moment. That's quite big pressure and something that's very difficult for us to resolve.

00:51:00.000 --> 00:51:11.280

E.S.: The sources of pollution are so vast aren't and variable and how can you know where it's coming from and when it's just incredible. In terms of this pressure groups and the free swimmers and people have talked to me about angling and things like that in their catchment areas and chalk streams and all this. I'm not sure how to phrase this but they tend to be from the posher end of communities.

K.2. Yeah

E.S Its very much what's on their door and what's affecting their world and is that an issue with driving resources towards the haves rather than the have nots at all?

00:51:48.300 --> 00:51:49.470

K.2.: Unfortunately, I think it does.

00:51:50.370 --> 00:51:50.910

E.S.: Right okay.

00:51:51.090 --> 00:51:56.220

K.2.: They do take up our time and push things up the priority list. And if anything I should imagine we we are..its difficult isn't it...but typically I think we are a little bit more balanced because we have the sort of [.] Mayor.

00:52:08.430 --> 00:52:09.660

E.S.: okay yeah.

00:52:09.900 --> 00:52:19.260

K.2.: They have to sort of look, you know a lot more broader and you know. And the massive drive on us is things like us is Transport for [.] We're not digging up roads and things like making sure, things are open for cyclists and amenity areas and things like that.

Yeah yeah I mean yeah I'd say yeah a lot, a lot of time and effort from public relations team definitely gets driven into those discussions and then questions across to us to then spend time on kind of well you know how do we answer this so what's our current stance and things like that.

500:52:53.400

E.S.: Am I okay it's interesting the [.] Mayor maybe bringing some more levelling then?

00:53:04.710

K.2...: I think, as well one of the things I love is fatbergs (laughs)

E.S you are the only person that has said that (laughs)

K.2. and it's kind of one of these things where it's kind of what you know, we want to do... You know, we do a lot of customer education and I'm involved in the wet wipes things and things like that, but controlling kind of like what restaurants practice and do, standing especially right now kind of like where they are. You know. Lots of restaurants, when I was younger I know exactly how they are. And it's very, very difficult but it's not...it's out of our control, and so you know, all we can do is go and sort of raise it sort of like to the government. And we get it back from MPs to say, well, they need a financial incentive.

00:53:57.510

K.2...: yeah you sort of feel like you are a bit stuck sometimes.

00:54:00.150 --> 00:54:03.630

E.S.: yeah there's similar problem in rural catchments in such as farming and talk about a financial incentive to do the right thing. I'm paraphrasing incorrectly but yeah.

I've gone over time [], I'm really embarrassed.

00:54:18.960 --> 00:54:19.920

K.2...: I could talk for ever. I've started off.

00:54:30.150

E.S.: you've got such a fascinating job makes it, you can make changes to make such a difference must be really, really positive at the end of your day. Anything anything you want to add or anything you want to ask or anything, you think or what you should have you should have asked me that so.

00:54:45.690

K.2...: I'm just looking to see if I've noted anything else really. Just perhaps that the capital process, you know, we've tried to perhaps go through things too big too quick or things that we perhaps don't think needs to be really piloted, the capital process would just see it as as far too risky.

00:55:07.530 --> 00:55:08.400

E.S.: Okay yeah.

00:55:09.240

K.2...: Unless, you know, there was one example where we were offering to give additional support... But I think we're getting a bit better at that now like say with this sort of front door process and sort of what levels is it at and making sure perhaps that innovation is a bit more acceptable right across the business and not just my world.

00:55:30.210

E.S.: Okay, so is that is that they want you to have a trial to confirm the data, to support what you're doing?

00:55:39.150

K.2...: No, I think it's just when you're weighing up kind of like the solutions and your risk it's kind of like yes, it might be that cheaper and better but there's a lot of unknowns and the risks .

00:56:00.090

E.S.: Okay but doing a trial would provide you with that certainty that would help it get it through?

560

00:56:05.400

K.2...: Maybe, but it shouldn't, that case is one where it's not, is it really that novel it's not really that.

00:56:15.990 --> 00:56:17.640

E.S.: I'm not saying they should, but that's what they're looking for?

56300:56:18.870 --> 00:56:22.950

K.2...: yeah yeah and even like I said with that we're offering to sort of like help with you know with the monitoring, of course, then that's an additional cost.

00:56:26.940 --> 00:56:27.660

E.S.: Okay yeah.

00:56:27.780

K.2...: you have to look passed your own budget into the bigger bigger picture.

00:56:32.400 --> 00:56:33.240

E.S.: Right okay.

569

00:56:33.510 --> 00:56:34.560

E.S.: Okay so maybe a lot of data requirements to confirm, reduce that improve certainty for something that seems quite obvious.

00:56:44.310 --> 00:56:44.730

RCU.: yeah.

00:56:46.980 --> 00:56:48.120

E.S.: that's a common theme as well.

00:56:50.700 --> 00:56:52.320

K.2...: yeah I think that that's it really. If you do have any questions just come back to me.

(closing discussion on next steps and the framework so far etc)

00:58:21.090

K.2...: it would be really interesting to see see what you come out with.

00:58:23.910 --> 00:58:29.070

E.S.: yeah and well share experiences from across the whole spectrum. I'll let you get back to your day.

00:58:31.590 --> 00:58:36.540

K.2...: there's an UKWIR project that looked at the barriers for implementation. Yeah and I don't know if you've seen that for anyone's provided that. And on the waste network side of stuff it is kind of the.. it's not the innovation it the barriers to implementation that stop these things and its lack of investment. I've said, for years, you know because I was, I was always in the waste networks team it's kind of you know, the clean Amt team and process and everything always came first and I was bottom of the pile and that's changing and things like that, but um yeah it's just with lack of investment on waste works for us yeah it's just as old as the clean.

00:59:18.900 --> 00:59:21.900

E.S.: yeah well, especially with Pipebots the issues we've had is putting a robot in clean water, because the DWI are going to love that obviously. The regulations aren't designed for robots in water, they're designed for pipes.

00:59:37.140 --> 00:59:38.010

RCU Exactly., exactly.

00:59:39.090 --> 00:59:41.310

E.S.: those sorts of issues,

00:59:42.660 --> 00:59:49.200

K.2...: everyone thinks you can just put it in wastewater and it's got its own set of rules

E.S yes with explosive potential as well.

00:59:57.000 --> 00:59:59.310

K.2...: (laugh) exactly, they have both got the same hurdles really

00:59:59.490 --> 01:00:02.070

E.S.: yeah yeah well let you get back to you to the rest of your day and your innovation but thanks, thank you for you time much appreciated won't be wasted.

01:00:11.550 --> 01:00:12.060

K.2...: (laugh) Thank you, best of luck.

18th August 2021. Transcript of interview with L.3.

Confirmed ok to record and had received and read the participation document I had sent through.
[opening general discussion not transcribed]

00:01:49.320

E.S.: .. I'm asking people to do is talk about an innovation or a project that they've been involved in, like [tech], and talk to me about it, and from that I pull out certain themes that I'm looking for. And there are certain system set questions at the end I go through, but it really just starts quite informally with you telling me about your innovation. And I have to pull out some questions from that. Are you comfortable with that?

00:02:20.550

L.3.: Absolutely yeah.

I did write a paper for the water ... project that are involved in. It was intended to be one of the white papers but I don't think it ever got published so I don't know whether you've come across it.

00:02:40.050

E.S.: No I haven't. Would you be comfortable sending that to me?

00:02:44.220

L.3.: Yeah sure, I think it might have been deemed slightly too abrasive. Yeah by all means. I'm happy to share my experiences, I mean we've just finished an Innovate UK funded project which was their fund, it's called the sustainable innovation fund, and it was set up to help companies survive Covid impacts and come out stronger the other side. It was a nine-month project, ended up being 10 in our case. And our aim was to produce our second-generation [tech], and it's been quite successful technically. The report only went in last week. And we've got a close out meeting next week so it's all very fresh at the moment, but I'm now looking for further funding so that we can move to commercialise what we discovered and invented. I'm just wondering, would you be interested in a copy of the report from that? I mean there is a section in it which is about commercialisation and the value proposition for the UK water company.

00:04:21.360

E.S.: Yeah anything like that would be gratefully received. Anything with such a practical/commercial edge to it would be really valuable, because you get a lot of academic material. Practitioner and academic merging like you're doing is really great so it'd be really helpful. I've read about [tech]s and obviously I worked with []. Could you explain to me what it is for the purposes of this study?

00:04:54.810 --> 00:04:58.200

L.3.: I am a civil engineer. And most of my working life has been working in wastewater network management and drainage, design of highway drains and all sorts of things like that. Sounds terribly dull but I enjoyed it. One of the projects that I was involved in and I'm going back now to 2002, something like that, was for one of the water companies to come up with an investment plan and funding requirement that they could put forward to OFWAT so they could achieve their required

outcomes in terms of collapses and blockages of sewers. And so I started doing that and had a box of videotapes, it was the video tape era, then. And I started off on it and it seemed to me that there was no way of coming up with a proper logical worked-through plan to say that your sewer system is in such and such a condition, deteriorating at such and such a rate. And here's what survey you should do so that you can find enough of these problems so that you can fix them and those fixes will give you the rate of deterioration that you need to achieve, couldn't be done in my view.

I was thinking, not in terms of that project, but just more broadly, what other sources of information could be accessed that would provide that data, and the only thing I could think of was acoustics. In my time of my career when I used to go surveying sewer systems, there was a well-known method for testing connectivity, to lift to cover and then bang the covers around it with a hammer, and if there was a connection you could very clearly hear the sound, so that said to me sound can travel through these pipes. You know, I don't know much about acoustics, but it seemed to me that if we could inject a known acoustic signal into a pipe and record what came out, then the different frequencies might be affected in different ways, and from that we could deduce some useful information. I went to two or three universities to see if there was some academic collaboration that could be done. Well, I got a tip off from a colleague and in the sewerage field to go to the University of Bradford and meet [] and [].

And so I did that, and from that, first of all, we tried a few things together, just to see if there was anything in it, we got a little bit of help from [*water co*], just to lay out some pipes that they had at a sewage works of theirs so that [] could take along some microphones and loudspeakers and we spent a day or two testing there. I'm just trying to remember the exact sequence of operations. I'm just wondering whether I approached a number of water companies to see whether there was any interest in collaborative learning, I think I did. The only interest I got was from [*other water co and other water co*] in fact, thinking back on it. And they provided 10,000 pounds into the project, which enabled me to be involved, you know and be paid to be involved. That's another story. [] compiled a grant application for EPSRC funding, which was successful. Has [] told you this history?

00:09:48.930

E.S.: No, no. I've gleaned bits of it, but it's the history as important to you anyway. That's what I'm trying to get hold of.

00:09:59.550

L.3.: Okay, my version of history. So that was successful and from that he was able to employ a doctoral student called []. And there was another researcher involved for a short period, but it was only a one aspect of what he was doing, so [] was the mainstays through the project. There was a second EPSRC grant. And then [] also won the (*award*) quite a prestigious thing, which brought some funding as well.

00:10:53.670

E.S.: Who were you working for? What sort of company, organisation was it?

00:10:58.890

L.3.: At that time I was working for a smallish specialist consultancy, who were into higher end asset management practices.

00:15.750 --> 00:11:19.470

E.S.: So why were you doing this, why were you pursuing this?

00:11:20.130

L.3.: Right well, a little bit of background to me. My basic practical experience in sewers came was 14 years with ... city council, mostly in their main drainage section, and that was from 1974 to 1988 or something like that. And at that time, a lot of the local authorities were acting as agents for the water companies, but when the water companies, they were water authorities, when they were set up, they started business in 1974, which was the year I graduated They took on the water supply side and water and wastewater treatment. But, for some reason to do with practicality, I think, lots of local authorities were taken on as agents for the water authorities to provide wastewater network management and that went on until 1990 ish when those agencies were eventually taken in house by the water companies, but I'd already left by that time. I left and went to successively two of the larger civil engineering consultants, which at that time were And, as they were. And in both of those, my room, it was to build up an in house wastewater networks business. Which I did, but in 1995 I decided to branch out on my own. And I spent five years building up my own small consultancy and got up to about 12 people, I think, but I then decided that I wouldn't really carry on doing that, so I sold that tos, went to work for them, didn't like it, left them and then went to the company ... Group, which is where I was when I was doing this work. So having had the idea, I spoke toand said look, I've got this idea.

If you fund me working on it, then we can share whatever we can get out of it, so that was why I was able to do it. So I had to fit it in with other things.

00:14:21.420

E.S.: But I suppose as well as that, you could see a practical need? But, also, that practical need seems to be underpinned by statutory requirements? In terms of surveying, identifying problems similar to what we've got now. So I can see a statutory driver behind this, am I getting that right?

00:14:50.820

L.3.: Absolutely, yes, it was to do with the five year investment planning cycles. The targets that were set for each of the water companies. And they always involved something to do with collapses and blockages and the flooding that those things cause. And the pollution as well, you know if you've got combined sewer overflows and you get a blockage or a collapse downstream of them, then you can get flooding of sewage into water courses or into the sea. It was a statutory obligation that I thought I could help them address.

00:15:30.030

E.S.: And you didn't go to water companies straight away, you went the academic route? Or did you do both?

00:15:39.810

L.3.: I got the academic partner. And then went to water companies, and that was when I got [] Water and [] Water on board.

00:15:49.020

E.S.: It was that way around.

00:15:54.060

L.3.: I did it that way around. Obviously I'm thinking this is quite a long time ago now, but I think it was that I wanted to have the technical confidence to say that there is something here, which [] gave me.

00:16:10.920

E.S.: You wanted to get it up to a certain TRL level before.

L.3.: A very early one, yeah. I didn't know about all that stuff then.

E.S.: We give the label to everything with an acronym now, don't we.

00:16:34.920

L.3.: Yes, so that was the academic thing. So [] got his PhD and carried on doing some work with K. But it was clear by then it needed to move from academia to commerce. And so, in about 2011 probably we started looking for some route to commercialisation. We looked at the possibility of one of the larger companies or several of the larger companies, in fact, that provide equipment for various sorts of sewers, various sorts of surveys, I should say, to take a licence for the intellectual property and take it on, and we talked to several of the biggest US companies in that respect. But we never quite got it over the line with them. It was then decided, it was mainly [] and the commercialisation person at Bradford who were working on this, although I was providing some information on sewer systems and sewer system regulation and all that stuff, what the business case might be.

And the commercialisation man was [] at that time, who I think is now at Leeds. I've had mixed experiences of people in that role, but he was good, and the person they've got there now is also good, []. And so we started looking for investment for a spinner company. And one of the things that [] and I did was to do a Dragons' Den thing somewhere in Leeds that was organised by the local chamber of commerce. And we didn't get any interest from the dragons that were there, but we were approached afterwards by somebody who said he was interested and thought he could access funding to do this, and that's what eventually happened, and that guy was I won't tell you his name to protect the innocent, or guilty in this case, anyway, he had contacts in an organisation called the ... which was eventually ..., and they access money from the European Investment Bank and channel it into start-up companies. They were persuaded that this was worth doing.

00:20:08.100

E.S.: What was driving that? Was it the money potential, were they environmentalists?.

.080 --> 00:20:24.750

L.3.: Both, I think. The money was primarily. I mean that they had to, I suppose show some return on the money that they were getting from the EIB. But they had various funds, and the one that we were put into was to the Northwest fund for energy and the environment so the environmental credentials were important, I think, from that respect.

00:20:40.890

E.S.: So, how did you, ... articulate the wider benefits of [tech]s? It's not just about putting sensing in the sewers, you've got these wider benefits and impacts. Did you have to set out what they were?

00:21:00.240

L.3.: Because that changes every time there's a different AMP period for the UK. And it's different in all the overseas countries. The UK water system is a bit of a freak really. I understand that there's

only one other country that's got a system that's like it, and that's Chile and they basically copied our system. But in the paper that I did for water 2050 as more of a survey of what's going on in different countries around the world, generally speaking, there's more direct control by one or other levels of government, you know, so in the US it's the US EPA regulates and each municipality provides the services. Whereas in other countries, the government, it has a more direct role in provision, it's very varied. Because that matters to us, not because Sewer Bar will do something different, but because the value proposition in each of those different countries is different.

00:22:22.320

E.S.: Is easy or difficult to get products like yours through in England? As opposed to other jurisdictions, you've mentioned you approached the US.

00:22:40.050

L.3.: Yes. Let me just make a note of what I can send you, so I'm going to send you a water 2050. The reason is I just thought of something else, and if I try and hold it in my mind I'll forget something. Before I forget my thread, continue on with the setting up of the companies and then this will flow, America will flow from that, because we hadn't at that point done anything outside of the UK. So we persuaded the Northwest fund that this was a viable investment and that meant doing projections of sales and costs and all of those things to build up a business plan. We had to, I'm just trying to remember who would have paid for this, we used an accountancy company to help us prepare the business plans with authentic account format something, and I think ... must have paid for that. By this time, incidentally, ...Group had been sold to, can't remember now. Andhad gone off to do other things, and his agreement with me to share this just fell away, so I was left to be able to take it forward from a commercial point of view without having to reference him.

So in late 2012 an investment agreement was signed, the company was set up in early 2013. And it had around about half a million pounds worth of investment, I think 650,000, something like that. And the business plan that was set out was that we would be able to make sales fairly early on. Part of what we had done during the securing of the investment, thefund wanted to, did a due diligence exercise on what we were saying. We got support from [] Water in that you know, for them to confirm their interest in the product, and [] Water were in fact the first customer that we had. However, in the benefit of hindsight, I don't think the business plan was good in as much that it predicated sales too early in the process. And the only way we could do that was to really transfer the academic equipment and software over to the company and make some more copies of it and sell them, and there were two or three probably serious shortcomings at that stage. There was the accuracy of the system, which needed more calibration data from real sewers to really pin it down. There was the software which was basically what [] had been using in his PhD, it was written in matlab it was not an interface that the actual users of the system found it easy to use, because they were sewer inspectors, by and large, you know they don't use computers in their day to day work or probably not at home either. So that became a problem.

00:27:17.320

And there was one other thing which I was going to say, robustness. And so again the sensor heads that we had manufactured was just a copy of what [] had been using. And whilst it had had some use it in real sewers and it does work in real sewers, when you put it in the hands of somebody that doesn't really want to be using it and doesn't take care of it, it would maybe get dipped in the sewage and it wasn't waterproof. That was the main drawback. So I think with hindsight, we should

have agreed with the investors that we would spend at least 12 months dealing with those issues. Because once we got into the making them selling them, supporting them, we were selling enough. But the problem was that every time we made a sale, there was a kickback coming as the users found didn't like it and it broke, and all that stuff. And after about five years, I think that really started to build up as a problem. There was no move made by the company to address those issues, and I have to take responsibility for that, because I was the director of technology at that time. I actually retired. So the company started to lose income. It came up with a system which, well, one of the problems... I'm sorry I'm dotting about a little bit here as things come to my mind, maybe unpick it with the video afterwards.

The business model that we set up initially was that we would sell units with the software and we would charge an optional yearly fee for maintenance and support, which very few companies actually took advantage of, they just thought they could buy them and go off and use them. A company like [] Water could really do everything it wanted to with six units, and we were selling them for about 15,000 pounds a pop, so you know that money doesn't keep a business running for very long. So the only way that would work as if we could either get them to buy more units or get more clients and more customers. And so we were looking at, you know we sold a similar number of units to Thames Water. And the other water companies, bearing in mind that [] Water in terms of follow the project through its development, other water companies were really wanting to buy one or two units and do tests with them and decide whether or not they were going to take the system up. And we were also looking at overseas markets. We spent some time in Australia and the States. And we sold limited numbers in those markets, but we were, I think, always hamstrung by that those three problems that I outlined to you which we never addressed. The problem with the sales model we sought to address, and the reason that the companies didn't need very many of these units was because you can do so much survey with them. A sewer survey won't take about five minutes to do with [tech], so one man in a van can go around and do a hundreds of surveys a day.

00:31:55.740

E.S.: Is that the big sell, the sell that stuck with the water companies? I've spoken to so many people who say to me the opposite of your experience in a way, they sometimes get a trial and there's no money for anything after a trial, and it's really difficult in the first place to get water companies involved, but you're actually getting some sales. Which is opposite to a lot of interviews. And your experiences are really different. What was it about the sell that struck a chord with the water sector, wastewater sector. Was it that ease of use?

00:32:41.730

L.3.: Speed of use, I would say. The default system for sewer survey is still CCTV. And there are various formats, physical formats of CCTV cameras, from for small diameter shortish pipes, just camera on the end of a flexible rod that can be wound up on a drum and pushed into the pipe. For bigger sewers, the camera will probably be mounted on a wheeled trolley which is can be driven through the sewer or pulled through the sewer. And there are quite elaborate systems, there's one called Panorama which uses a system, something like Google uses for Street View where they have a camera taking a number of pictures which can then be stitched together. Very clever. But at the moment, all of those systems really require somebody to look at the pictures and code up the defects that they see. There's standard ways of doing that, which enables each pipe to be scored based on the defects that are observed. And then those scores are added up and thresholds can be set by each company individually. It goes in grades from one to five, where one is perfect or nothing very much wrong at all, to five where it needs some immediate attention. The companies generally

try and band them between four and five, which are attention required in in the near future, or immediately, one and two, which are okay, and three, which is deteriorating but doesn't need anything doing at the moment.

And what we did with our system, we can't get anything like the detail that you can get from a CCTV survey, and you can see that if you think about the size of the data files that are recorded. A data file for a CCTV survey of a reasonable length sewer it can be 700 megabytes. It's basically a video. An acoustic survey for the same pipe would probably be only five megabytes. In the first iteration of [tech] we were only using sound up to the... When you send sound down a pipe it can vibrate in different modes, and the first mode, which is what we were using, is where you just get a plain wave of pressure going down the pipe and coming back. If it detects any change in cross sectional area, which is basically what [tech] does. But the wavelengths that we were using with too long to pick up any detail really, so what we would do with [tech] is, we would send the sound down the pipe, so we have a sensor that goes into a pipe, makes a noise.

You generally assign it so it'll sweep. And if there are any lateral connections, you know, pipes that join sewer where there's an increase in cross sectional area as the sound goes past that connection, or blockages or serious defects where there might be a reduction in cross sectional area, that will affect the sound. A reflection will be created by that change cross section. What we're doing is called pulse reflectometry. So yes, it is a well researched and developed method, but what we did was flight to sewers, which hadn't been done before. And if there's enough sound and it's possible for the sound to reach the far end of the pipe then they'll be a reflection from the point where the pipe joins the next man hole in the system. So, and we were looking for those reflection, so we sent and we receive at the same point, and then we still do that.

00:37:44.310

E.S.: I was interested how you got [] Water interested. You were saying it was better than what was out there already and is better than what's out there, but there are lots of technologies that are better than what exists in the moment that aren't taken up. What was it about you, you guys and [] Water, how did you get into [] Water? Did they already know you or trust you?

330

00:38:11.070 --> 00:38:14.520

L.3.: Well they followed and supported the project from its inception. So they were aware of it.

00:38:20.280

E.S.: How did you get them in the first place?

00:38:26.370

L.3.: Well, this goes back to 2002 or 2003 when we were seeking EPSRC funding. Those bids, I think, are strengthened by having industry support. Right, and so you know, I was in industry and I was supporting it, but I wasn't in position to make any financial contribution. So that stage, I went to probably all of the water companies, I can't remember now, you know it would have been a circular email.

00:39:05.250

E.S.: You knew who to contact?

00:39:07.290

L.3.: Yes, each of the companies have a research and development arm. They were already... Because [] Water has its headquarters in Bradford, there was already a relationship between [] Water and the University of [], which helped. But I got [] on board as well and that wasn't a prior relationship there. So I think it was the companies that felt that they had a problem with controlling the rates of blockages and flooding.

00:39:48.510

L.3.: Interestingly, as a side comment, [] still use acoustic survey. I would ask you probably not to put this into the report... *[not transcribed]*

00:40:28.560

E.S.: I was going to ask if there any legal hurdles, you touched on a few, in getting this innovation out to where it has. Were there any legal parameters to navigate in terms of its design and then later on in its implementation and acceptance?

Pipe Bots, for example, if you're putting it in freshwater, you probably know it as regulation 31 we had to navigate. Was there anything like that, regulatory hurdles?

00:41:03.120

L.3.: Not like that no. When you sell something to a water company, there's always a dance that goes on about whose terms of contract you're going to use, so we had to make it clear that [tech] isn't always right. I'd done some work with Thames for one particular size of pipe where we had sufficient CCTV and acoustic surveys done at the same time that showed that it was about 95% accurate with that data set, and we really need to do more of that because I don't think that's always the case. And we've generally had to do that, whenever we approach another company they always want to do a trial. Part of the trial has to do with accuracy. Having enough data to actually do it for the range of pipe sizes that we're interested in which, by the way, are a hundred millimetres two maybe 375 millimetres, so the smaller pipes. But they're the ones where most of the blockages occur, and most of the defects. So you know the companies were made aware that [tech] is not 100% accurate. And our liability was limited to providing them with equipment that would do a test and give them a result. What they then did with that result was up to them, we couldn't take any liability on for that.

00:42:54.570

E.S.: Did you get involved with the ...world of procurement?

00:42:57.480

L.3.: Procurement, yes we have. By the time acoustic sensing technology was in existence that tended to be done more by our MD, this chap ... than myself. It's always an issue. One hears tales about things that go on. It was never something that we tried to short circuit, we've always played a straight bat in that respect.

We were talking about business models, weren't we. So that was the direct sales business model. The idea was put forward by us that we could monetise the value of the data more by collecting the data and doing some analysis on it. And charging per metre, so every time a survey was done we'd get some, probably quite small, but amount of income from it, rather than just selling the unit and

saying goodbye to it. And that was successful with one of the companies for several years, and those were the best trading years that we had. But that then came to a rapid end when there was a change of personnel within the company and the person coming in didn't want to do acoustic surveys, he wanted to do CCTV. That was that, and that had a very big impact on us and we had to reduce the size of the company at that point to fit within our income. And at that point, I retired. And I've been back with it, so that was 2017, I think, and I came back into the company in 2020 last year at the invitation of the chairman to take out my old role as Director of Technology. With the view of trying to get some further investment into the company.

00:45:58.770

E.S.: Is that English-based or is that anywhere?

00:46:03.870

L.3.: If it was an investor, it could be anywhere. What actually happened...

00:46:09.990 --> 00:46:11.130

E.S.: Can it be used outside England? Not just where the investors are but product use outside of English jurisdiction?

00:46:27.690

L.3.: Yes. Although, by that time, adventures in the US and Australia had stagnated. As the US was concerned, we made an arrangement with one of the equipment suppliers on the west coast to become an agent for [tech]s, and I spent a couple of weeks over there doing demonstrations for what they thought were their best clients, City of Los Angeles, City of Sacramento. And they were they were all okay, but no sales came from those, and so that arrangement for a dealership didn't really go anywhere, and since then we haven't done very much in the States in terms of trying to push the product. One of the reasons for that is that there are differences in US sewers. We found at least in California, that the way they develop their land, or at least in the bits that we were in surveying, was that a development company would set out the roads and sewers and then sell off individual plots for people to build their houses on, so you go along the street and every house would be different. And every house would have its own connection to the sewer. So you tend to get a lot more connections than we might have in in the UK where tend to get networks of small diameter pipes coming together and then making a connection to the main sewer, so you get fewer connections to the main sewer. And those large number of connections were one of the problems that we needed to address technically and we have done in the innovate UK project that we've just finished.

00:48:35.250

E.S.: Were the drivers for interest in the product in the US different than the drivers for interest in England? Was it the same? What was pressing the interest, why were they interested in America?

00:48:50.550

L.3.: Well fundamentally the same in that all sewers, or sewers wherever they are in the world can block up, can collapse, and there's an awful lot of them. There's huge lengths of public sewer in any developed country. And typically, not many of them have ever been surveyed, and even if they are surveyed it will be maybe once or very infrequently. Things have changed over the 20 or so years I've been working on [tech]. I'll just try and describe those changes, at the time when we're starting off, the basic way that sewage systems were managed had been set up by WRC. And the principles were

basically followed by all of the English water companies. And that involved creating a strategic grading assessment for each length of sewer in terms of its importance in the network and the consequences if it failed. And the inevitable corollary of that was that the high value sewers were the ones fairly well down the network, where there was a lot of upstream catchment, so that if they failed there'd be a lot of flow coming out. And quite a lot of those sewers would be the oldest in the system, because they would have been the first pipes to be built, they might go back to the Victorian era. So they would be high strategic value.

And the collecting pipes in the housing estates upstream would be a low value, so the idea was that for the high value sewers, it was worth doing proactive survey and maintenance. And the low value sewers, they'd just fix them when they went wrong. That basic style of management worked from 1983 to 2010 probably. It turns out, of course, that most of the blockages, and quite a lot of collapses, occur on the small diameter sewers. A lot of those would have been built by developers initially and then put up for adoption or adopted automatically under the 1936 Public Health Act. And they wouldn't necessarily have been built to a very high standard or with materials that we would now consider to be satisfactory. So some water companies like Southern Water, for example, have a lot of sewers built out of pitch fibre, which is essentially if you think of paper soaked in tar and then wrapped around a mandril. It doesn't sound a sensible idea, does it, but that's what they did. And if they were cheap and the developers could get them adopted, well that was fine, it was then somebody else's problem, namely the water company. So, water companies got this very large asset base. It's already quite old, nobody really knows how long it's going to last. That was another piece of work I did, looking at the rates of deterioration of sewers.

00:53:07.980

E.S.: Some of the people I have spoken to in water companies tell me anonymously it's extraordinarily difficult to get funding for asset management. As opposed to say shiny new projects.

00:53:24.090

L.3.: That's true.

00:53:28.260

E.S.: That's a productive the regime, what they can get past OFWAT?

00:53:34.440

L.3.: Think of the railways, because we've sold units to Network Rail in the past. Railways have got a billion-pound project in HS2. But they don't spend money on maintaining the drains on the existing network and those drains are fundamental, not just for removing rainwater but they drain the earthworks and keep the earthwork stable. And that accident, I think it was last year up in Scotland where there was a landslide and a derailment and three fatalities, a sad but prime example of that. But yeah I would agree with that, it is true.

00:54:24.870

E.S.: Any thoughts on why that's the case?

00:54:30.840

L.3.: It's to do with OFWAT, essentially. And the privatisation of the water industry. When the water companies were set up, I think one of the drivers for it was everybody knew that a lot of investment was required to meet European directives for water quality, and that investment was required for

wastewater treatment works primarily. And that went on for, talking about five year investment cycles, it started in 1989, I would think at least the first three cycles were all about building new assets, and those assets add to the regulatory value of the assets that the water companies have got, which is good for them as well. If anything that existed was working at the time, well that was fine, we'll just leave it like that. And there's always been people saying well these assets aren't going to last forever, a stitch in time is worth nine and all of those sorts of things. And if you look at the replacement cost of all of our sewers, it's hundreds of billions of pounds. But everybody hopes that they won't be sitting holding the parcel when the music stops, and they'll pass it on to the next person.

00:56:15.360

E.S.: I'm conscious, [], I said an hour and I've only got three minutes left. It's such an interesting interview. I don't want to outstay my welcome. I'll try and be as quick as possible.

00:56:29.970

L.3.: As long as you're all right, I'm fine.

But having said that, more recently, OFWAT has changed his tune. There have been very distinct changes in its regulatory methods and what it's aiming to do. You could pick that up, I think, by looking on the OFWAT website and looking for the guidance that they give every five years and see how it's changing.

00:57:21.000

E.S.: Have you had much contact yourself with OFWAT, the Environment Agency, regulators?

00:57:34.170

L.3.: Not as clients, I have done one piece of work for OFWAT, but it was to do with evaluating the cost of draining a large development site. Not to do with the issue that we're talking about at the moment.

00:57:58.590

E.S.: Have you come across any tensions between OFWAT are trying to do and what the EA are doing?

00:58:07.110

L.3.: Well, I can't say I have. I can't tell if that's a leading question and I'm not picking up on it [*no, not at all*], but I can't think of anything.

00:58:21.660

E.S.: There's just a few issues need to box off. I haven't detected in the discussions on [tech] that there are any ethical issues, which is not the same as so many of the projects that people are talking to me about. Were there any ethical, so social, environmental impact issues with [tech] that I haven't picked up on?

00:58:43.860

L.3.: No, not at all, I mean one of the aspects of [tech] that we state if we're looking for funding or whatever, is because it addresses sewer blockages and collapses, and the flooding can follow from those, and because those factor tend to be more common in older, more intensively developed

catchments, people in those lower, less desirable areas can suffer more sewage flooding than their more affluent neighbours. And so [tech] is a way of trying to make it more socially just.

00:59:46.950

E.S.: Is that something you've explored and try to make plain?

00:59:50.250

L.3.: We did that in our most recent application to innovate UK because it was in response to one of the questions they were asking.

01:00:00.480

E.S.: About the levelling up agenda.

01:00:03.480

L.3.: Yeah. This issue of flooding and pollution from sewer blockages and collapses is now being paid more attention to by OFWAT. There is much less emphasis now on... most of the big investment in new works has already been done, or carries on to some extent, but they are looking at issues to do with the existing networks. We've always suffered on the sewers side because the water networks have had more investment in the past, and I think still do, and that's because a problem with the water pipe affects a large number of people, whereas problems with small sewers tends to only affect one or two. Even if it's draining more properties, it actually floods from the network at the lowest point upstream from the blockage. So any escaped my might only affect one or a small number of properties, but OFWAT are looking at this. In the last amp, the PR19, which set the scene for, I think it's amp seven now isn't it. I lose track of it, but the current AMP anyway started in 2020 started in April last year. And it runs through to March in 2025, so it's only about one and a half, just over one year into it at the moment. The thinking for PR 19 was that there would be funding for specific new build projects that were required, but there would be some common commitments that the water companies would have to respond to. I can send you something on this, if you would like me to. It might just be a reference to the OFWAT website, but I'll see what I can find, but there are a series of common commitments.

1:02:33.

And they cover the whole sweep of what the water companies do, so it'd be water supply, water networks, sewer networks, sewage treatment, but then also billing, customers in difficulty and everything. and there were a number of commitments that OFWAT required the water companies to make in terms of a minimum level of performance of their whatever it was, so sewer networks in my case. And those commitments would be incentivised with a cap and collar scheme. There would be a target set. If the water company was able to do better than that target, they would get some financial reward up to a certain level, which was the cap, and if they failed, they would have money docked down to the collar level, so that if things went horribly wrong they wouldn't lose huge amounts of money. I hesitated there because some of the penalties are really quite extreme. And if you add them up for all the water companies, just for the things that [tech] can address, it's over a billion pounds, I think, from memory, potential penalties. The real potential reward is smaller than that, generally speaking, the penalties are bigger than the reward. But there was also the opportunity for each of the companies to put in what they call bespoke commitment, so the companies themselves could come up with a target that they would like to meet, and they would commit to the same pain and gain arrangements. And, most of the companies accepted that. I mean

there were some appeals to the Competition Commission. I can't remember exactly what they were for now, but I don't think it has to do with these issues. And it's quite revealing to do an analysis of those targets and the penalties, because you see that some companies have really accepted quite onerous targets, but then potentially have a bigger budget for addressing them which might mean they can do more CCTV, whereas other companies are more constrained.

And I would see those as potential targets now for our new version [tech], so we can go back to. Because you know, having been in the market now for what, eight years, most people have had a go with it and there've been reservations and the sales have dropped off, so we need to be able to go back to the market and say look, we've got something new now and it works better and it's more robust. We're not ready to do that yet with the outcomes from the innovate UK project and I'm looking for further funding so that we can get to that stage at some point next year, but if we don't get that then we won't survive as a company frankly. But, having learned the lesson of not going to the market with a product that's not really ready. We don't want to make the same mistake twice, we had a customer advisory group as part of the innovate UK project. We had somebody from [] Water somebody, from [] il and somebody from [] who actually works very closely with []. Those are our three core customer bases covered there, and we got some advice from them in terms of not being premature, making sure the thing was properly calibrated, make sure it was robust and even to consider changing the name of the company, so that we can go back, and something fresh and different.

595

01:06:57.540 --> 01:07:02.520

E.S.: I had a couple of last questions if anything else comes to mind. At the start you were talking about your experiences in the industry and you noticing not only a problem, but a potential solution in the acoustics and the hitting of it to make that sound, and it triggered some thoughts about some things that people have said to me during these interviews, one of which was they've experienced problems with huge personnel changes. As a specific factor for the water and wastewater sector. And difficulty retaining people with expertise and knowledge. And I wondered if you'd had any experiences and could endorse what people have said, or maybe contrary experience, or if that even just chimes any bells with you at all? The value of having that knowledge and experience.

01:08:05.520

L.3.: Yeah, they are constantly changing. I think one of the things that helps us with [] Water and Thames was that actually the same people in the R and D department had been in post, the people that we were dealing with were a little bit down the R and D management tree, who were responsible for sewer network, so there'll be somebody at a higher level who was responsible for R and D in the company as a whole, and then it would be probably broken down into waste and clean and then broken down into networks and non-infrastructure, so they were like three tiers down. But even at that level in a lot of companies, those people change. And you really need some champion within the company, and ideally that champion needs to be not in the r&d department, but somebody responsible for the operations side of things, blockages. And, to some extent collapses, are usually funded out of the revenue budget and under the control of the operations department

01:09:33.030

E.S.: It's important for innovators to know that then. You knew that then, but somebody coming into the sector would need to be alert to and aware of those sorts of structures.

01:09:41.880

L.3.: Yes.

01:09:45.270 --> 01:09:48.960

E.S.: Have you noticed a difference, I mean all sectors have personnel changes. But people say to me it's far more significant in the water and wastewater sector.

01:10:01.800

L.3.: I haven't probably got the experience of other sectors to compare. To be honest, it's one of those facts of life that I've always had to deal with.

01:10:13.350

E.S.: I think put it down to the amp cycles and a lot of personnel needed in the middle and then, when projects tail off at the end, lots of layoffs. That's anecdotal.

01:10:30.390

L.3.: Well yeah, and I mean water companies have dealt with that by taking on these various tiers of contractors to do the grunt work so that this becomes the contractors' work to lay off the people.

01:10:50.580

E.S.: One last question, it's a very open one, if you could change something about the regime that you're operating in, and that would make your life in promoting and getting [tech] sorted easier, is there something that you would want to change that would help?

01:11:15.240

L.3.: I think you'll probably detect this when I when you read the water 2050 thing. And it's for the water companies and the staff to really value the assets that they've got, not just see them as a way of generating some income, this year, next year, but see them as a core part of what enables us to run our civilisations the way we do.

01:11:53.490

E.S.: Why don't they do that, do you think? It's obviously just an opinion, but why don't they do that?

01:12:03.210

L.3.: Well I'd have to say why don't they do it in my opinion, because if you ask them they'll probably say they do. I've spent my entire working life pretty much working in sewer systems and following my degree course, spending 14 years with a local government and working with people who built up some of the systems over the past number of years in their career, it was almost more of calling them a job. I had some treatment in hospital, a few years ago, only for something wrong with my hand and he was very, very nice consultant, and he was asking me what I did. And he said well really yes, what you do, public health, that's really our health system, and what we call the National Health Service is really the National Illness Service. Without the sewer systems, we couldn't have the cities that we have, but they're just so much taken for granted. And just seen as a source of generating income, rather than an immensely valuable capital asset that we need to know more about if we can, if we're to preserve that value, and it's the social value. If you look at sustainability and carbon, if you let asset just deteriorate beyond the point at which it can be effectively repaired, then you have to renew it and then you've got all the embedded carbon that goes on to do that, and not to

mention the disruption that it causes, which could potentially have been avoided just by being a bit more intelligent and caring. And I think, to carry on as I have done for so long, I don't think if I was just preaching this as a job I would have done it.

01:14:34.380

E.S.: A remarkable number of people refer to a sense of public service.

01:14:42.750

L.3.: Do they? That's interesting. Because I was going to extend that thought and so I'm not sure that the people that come into water companies and progress, are pulled out for progression through the system, necessarily have the public service ethos.

01:15:01.980

E.S.: I could never draw an academic conclusion because it's too small a pool. But it's certainly there.

01:15:11.880

L.3.: So I hope that's helped.

01:15:13.860

E.S.: Yes, it has []. I'm really grateful and it's been hugely interesting. I'm sorry I've gone over.

[end of interview chat- not transcribed]

M.4. interview 30th July 2021

Opened chat not transcribed.

Confirmed receipt of the participant sheet.

00:00:24.300

E.S.: ... I'm looking at the governance around new innovations in water infrastructure. So I'm in civil engineering and, but I think we all know that something can work, technically, but not necessarily get adopted for all sorts of other reasons beyond the normal technical. Big infrastructure projects can have hurdles that aren't technical so I'm looking at all those other issues, if you like, through a governance, legal, regulatory lens.

It's been suggested that you would be somebody that might be able to help me with that. So I sent a participation sheet, which explains the ethics and how we take care of you and it's confidential and all that. You're under no obligation, just because you're part of [X], so you can pull out and what not It's got all the details on there. But the idea is that I gather as much information as I can from people that actually work in the sector so I don't just produce some dusty academic nonsense, I produce something that's guided by the experiences of people on the ground, like you, running these projects.

So the purpose of today is about 45 minutes, really not a grilling, really relaxed. And just usually people start just by telling me about the project or something infrastructure-wise that they're working on. There are some set questions I have to ask at the end, but we can just start by you just talking me through what you're working on, for example, or something interesting or scary that's going on in your project.

[ok]

You're a projects engineering manager aren't you?

00:02:31.650

M.4.: Was it through [] you got my number? I did a presentation to him and his team a few months back on one of my projects. So you want to know about the sort of projects I work on. All the jobs I'm working on the moment are what we call working in managed service provider, so not major, major capital projects, 200, 300 million pound projects with our major kind of delivery partners. I'm on the smaller scale ones. They can be up to 5, 6 million pound projects. All those projects tend to go through cost teams, as our managed service provider leads all the- I'll say engineering, but not really. Have you seen all the project delivery system?

00:03:50.580

E.S.: It's more about if you're trying to bring about any sort of change, it doesn't really have to be landscape level, it can be any sort of change that you're trying to bring about. Some improvement, and the hurdles, we can talk about the hurdles that you're encountering on them.

00:04:11.490

M.4.: The job I did a presentation on for [] was a eels and elvers project, eels and elvers are a regulations driver at [.] water pumping station. And let me see, do you want me to go through the presentation with you?

00:04:30.690

E.S.: Can we do that separately, would that be okay? Just run me through what it's about and I'll ask some questions on it. I saw that in your calendar, you know you sent me your calendar. I was going to ask you about that because I saw the eels thing you had to come up in our meetings about it so that will be something that's current, obviously.

00:05:02.850

M.4.: regulatory drivers. The pumping station doesn't comply with the 2015 Eels Regulation. As we abstract water from Lake [..], the pumping stations got too deep abstraction intakes in the lake, and abstract into this big pumping station. And the water goes through to an inlet screens, big bands screens about 14 metres tall, about 3 and a half, 4 metres in diameter. And we can abstract about 200 meg from there, send it up to []...for treatment and then from []atch Gate it goes down into the aqueducts to go down and feed [M[.

The ... Pumping Station, I think they've got 12 or 15 millimetre apertures on the screens and that just means that any of the little elvers you can't see because they're that small, even small fish or fry, when we're abstracting, they just get taken through the inlet screens and sent up and pumped away. When you go to [..], you do see fish in the intake at [..]. [..] can be fed from ..reservoir, it gets most of its water from [...] Reservoir, it gravitates from the reservoir into [] Works. When we take water from [.] it costs money because you're pumping 200 megs over a massive hill into a service reservoir on top of a hill, so it's quite expensive. For every meg we pump it's a meg less coming out of [...] reservoir.

In the past, I think we always tended to prioritise the cheapest water. Now we're a lot more, water resources, I think. In the past 10 years I've seen a lot of dry weather situations and drought, very low levels in the reservoirs. We aren't getting the rainfall we used to get all year round. We're having to keep the reservoirs full. So we're trying to protect the reservoirs as much as we can, so these pumping stations are critical to keeping [...] Reservoir topped up.

7mins 37 secs

The big change around the [.] project was when it originally came through, before my time, probably five or six years ago, they agreed a solution that went in the MEP, which was to put some strobe lights in the intake so any fish or eels or anything that got into the intake tunnel, the strobe lights would be flashing around and that would scare the fish away. That was kind of, at the time, a recognised solution to these sorts of issues. It had company business plan value attached to it. So way before my time on the projects, that was tendered, that solution was agreed with the EA. As the tendered returns came in, the EA changed the requirements of the job and said strobe lights are no longer an effective deterrent for eels and fish. We want you to go away and do a full eels and elvers Regulation Assessment of the pumping station. So that's what we had to go and do, we had to go back and do a full assessment. I don't know if you know about the Eels and Elvers assessments, the EA have a hierarchy of options from the top one to the least favourite one, and so you really have to go through that hierarchy to prove, well we can't do your number one because this reason, we can't do number two because of this reason.

Number One solution is trying to exclude the fish from the pumping station, so it's kind of on the intake in the lake. The number one solution would be, you've got to put 2 millimetre screens, so we're going from a 12 millimetre screen to 2 millimetre screens. So the ideal would be 2 millimetre screens on the intake on the lake bed, and so, basically, preventing any eels or elvers getting into the pumping station.

To keep things clean, you put an air burst system in or a back wash system in to continually keep those screens clean. And we've got that sort of system on other sites in [x], air bursts, and it keeps the screens clean. But the issue at [.] is the intakes are really deep, one intake is 30 metres deep, the other one's about 50, and also at [.] you've got a lot of boats, even big boats for the tourists or little sailing boats and lots of wild swimmers down there. And if the system's going off randomly, there was a big concern that you've got a boat going over it and you've got an air burst system coming up. That was a big health and safety concern, that was number one. Number two was when you've got these air burst systems and these screens and they're 30 metres deep, you can't just drop- normally you'd have a screen break and mechanical FSE comes along to fix it. But of course you can't do that with a screen that's 30 metres under water. You need a specialist diving team to go in there to do maintenance or ongoing servicing or break down of anything with a screen. It wouldn't be something you could organise tomorrow, it would be weeks and weeks of trying to get any maintenance work done.

That maintenance issue, compounded with the health and safety issue of the air burst system for swimmers discounted the intake option the EA would have preferred. And the EA understood that, they were quite happy when we were going through the reasons why we hadn't chosen that option. So we had discounted all of the intake options and there's various other different types of screening you can put on the intake. And we went through all of them with the EA and we said, we can't do these, mostly because of the maintenance issues, trying to get specialist team down there. You fall back to your inner pumping station solution, which is looking at the band screen. So you're allowing the fish to get into the pumping station but now our solution is replacing the band screens in the pumping station with two new band screens with two millimetre-

00:12:20.520

E.S.: Did you just say bounce screens? I can't quite hear that. Band screens, okay.

00:12:32.790

M.4.: Band screens. Do you know what band screens are?

00:12:35.580

E.S.: No, but I can get the drift.

00:12:39.270

M.4.: Just a big, massive screen, 14 metres high and 4 metres wide. They've got metal plates on them with 2 millimetre holes in it, and they continually rotate and the water pours through the band screens. Typically what you'd normally get in a sewage treatment works. At the treatment works you'd have them on differential heads across the screen so when it lines up, a screen will rotate. And you are creating a new clean pressed bit of screen and it will turn again.

The fish screens, band screens, they have these buckets on and so every four or five panels, you have a bucket, it's a big bucket, across the screen, and the screens rotate continuously so as we

abstract, the flow of the water draws the fish into the screen. The fish get caught in these buckets and the buckets lift the fish out, dump them over the top like a flume which takes them back out. It's like a helter skelter. At the moment, there is a fish return system in there, but the pumping station was built in 1978 or something like that, and the system that's in there is quite manual, and so there are pipelines back to the lake from the pumping station. So we are putting these new screens in, new fish collection, automated fish collection systems in to send the fish back down into the lake. And so the biggest thing there if you want to talk about change was, it was requirements driving change from the Environment Agency, which obviously delayed the job. So as well as having an Eels and Elvers driver, we also have what we call an abstraction exemption, which basically said that, if we weren't complying with the Eels and Elvers regulations, the Environment Agency could revoke our abstraction licence.

00:15:14.820

E.S.: Okay, serious stuff then.

00:15:18.420 --> 00:15:22.980

M.4.: Yeah, quite a big chunk of water there. I think the original date was March 2020 for our regulatory target date, and that was set when it was the strobe light solution. And we were trying to hit that, but the EA changed the requirements, I think it was February 19 (can't quite remember date)

00:16:02.220

E.S.: Don't worry, it's all recent.

00:16:07.410

M.4.: We had basically 15 months to do this. I picked it up in the June time in '19. 12 months or something like that to do the assessment and then agree the solution, do the tender documentation and get it out to tender, and build it. Very, very, very, very tight dates. It must have been 18, it couldn't have been 19, we couldn't have done that in 6 months. And they screens were made on a 36 week leading time, specially made in Germany and shipped over. And the were screens on a massive leading time as well.

00:16:52.440

E.S.: This is very much driven by having to do it, it's a regulatory requirement that's forcing you down this road. Can ask some stupid questions? In your view, do the strobe lights work? Would they have worked?

00:17:13

M.4.: I've never seen them and never installed any before.

00:17:21.660

E.S.: Presumably they weren't just installed because the EA said it was acceptable, I presume that someone had checked to see if they worked.

00:17:29.130

M.4.: Well it was a national accepted solution. Now what I've heard on the grapevine is that another water company or another area where EA had installed these themselves the strobe lights were

installed backwards, so instead of flashing down there, they flashed the other way. And a lot of EA decisions are based on maybe a flawed project.

00:18:00.870

E.S.: I did some work in marine and they were starting to use strobe lights to keep the fish away from the new infrastructure they're putting in the sea. But who knows?

00:18:15.210

M.4.: We've got like air diffusers, an air bubble blanket that keeps fish away and I'm sure we have strobe lights on them as well. We used them in the past, but if EA aren't accepting them, there's nothing you can do. It was quite a surprise; you've gone for maybe a 200, 300, 400 thousand pound project to a 3 million pound project so it's increased the cost tenfold to the job.

00:18:57.570

E.S.: What do you think of the list of options? Are they helpful in that they guide you and stop you going down dead ends, or are they hampers to innovation?

00:19:13.440

M.4.: I think it's good to have a starting point that you know the EA are going to accept. On a normal kind of water or sewage type job you don't involve the EA in the option selection. You need to comply with a discharge consent into a river, so you're designing solutions around that and as long as you get the discharge at the end, that's it. In these kinds of jobs you've got to have the EA bought into the solution and so signed up to it. So, having options that you know that they'll sign off and sign up to in order of preference as well, at least one of these has got to work.

00:20:10.410

E.S.: It's like being a policeman, if you know what your speed limit is, you know if you're under it you're alright.

00:20:18.870

M.4.: It enables you to investigate a number of solutions, and you can find one that's better for us. You can steer on them down that way. It might not be their preferred solution because their preferred solution is going to be a million pounds. But you can kind of steer things around to the solution you want as well, as long as you're meeting the regulations. So yeah it is useful, having the solutions there.

And [x] have picked up some good experience and knowledge in the area, but doing this Eels and Elvers assessment we tend to use a specialist in a company called APEN, an environmental and engineering company that specialises in that type of work. They know the regulations inside out, and they also know the type of things that will satisfy the EA and how to put things forward and explain things so we can get our argument across in the best way to the Environment Agency. We're good at pumping stations and we're good at water, we're good at wastewater, that's our core business. This is a little bit core but it's not a specialist area for us so having that, for me as the project manager, having those expertise to call on is useful as well. Help interpret the regulations and help with them to speak to the Environment Agency.

00:22:00.570

E.S.: So then, I don't know if it applies to this job or other jobs; sometimes if you have prescriptive regulations, it can be helpful to the person because they know what they've got to do, but sometimes it doesn't always give the best solution of what you're trying to achieve. You're trying to protect the eels aren't you? It's not really about complying with regulations, it's about helping the eels, and sometimes that can get lost in these lists of prescriptions. Is that something that could apply here or was applied in other cases, whether it's been so prescriptive that it's lost sight of what's actually trying to be achieved?

00:22:44.700 --> 00:22:47.400

M.4.: I've got other Eels and Elvers regulations jobs as well and especially the senior management levels, certainly people above me, lose sight of the job. Why can't we just do that, but doing that doesn't comply with the regulations, doesn't help the fish. Some of our engineers get focused on the engineering and don't always see. And I think that's why a lot of these jobs get given to me because I'm not an engineer, I'm the project manager. I am a biologist. I use a lot of third party liaison. In AMP 4 and AMP 5, I am continually speaking with the Environment Agency, Natural England, planning authority, landowners. I think I understand how those other third party issues can impact on a project. I've got Civil Engineers and mechanical engineers to do the engineering, but they do that for me and I do that. But sometimes when you speak to them, they don't see that bigger picture, they just focus on their little bit.

00:24:18.660

E.S.: Would it help you if they did see the bigger picture?

00:24:21.660

M.4.: I think sometimes, yeah. But they get stuck in their own little vision and sometimes you need to get them to look a little bit further. But that's the nature of what they do, that's why they're specialists in their area. Sometimes they just don't see the links between things and how that can impact on other things because they haven't got the experience. Or if you're a civil engineer, you might not want to know about fish and river bank erosions or whatever. "Just go and buy some land." It isn't quite as easy as just going to buy some land, is it? You've got to go to the landowner, negotiate, make a deal, get planning permission, speak to the customers if you're going through their front garden with the JCB. It isn't always as easy as just go and do that, is it? There's a much bigger picture. You can't work there because there's a watercourse, you can't work there because there's a fishery and you can arrange it in September, you've got bats and they're building up there so you can't work between September and February, all that bigger picture. Sometimes the guys don't always see that, you've got to bring the right people in to lay out that bigger picture for them.

00:25:43.800

E.S.: In this particular job, what was the relationship like with the EA? Was it constructive dialogue, or was it very policeman-policed?

00:25:53.220

M.4.: Very good, very open. The particular guy on the [...] job, I never dealt with before, but we're working two jobs concurrently, one at Ullswater as well with the same driver, and the EA guy was doing it on the Ullswater project. I knew him very well from other projects I'd done, and we had joint meetings, and so I think that helped that I'd already had a relationship with this other guy, the opposite number in the area, that trust there. But now I'm dealing with just the [...] guy and I don't speak to him for months and months. I emailed him last week and said, well we're starting on site

and taking a screen out, we're starting to put a new screen in. Let us know when you're free at the end of August and we'll go for a site visit and go for a walk around. It never really felt like he was a policeman telling us what to do. We go in and we'd run a presentation for him to take him through all the options, why we'd gone down this option, disadvantages, and broadly he'd except what we'd say or put some challenges in and we couldn't answer them so then we'd go away and answer them. He was always accepting what we've said, he'd ask us to go and investigate, we hadn't thought about this, this was a new type of screen, go away and look at that. So I went away and looked at that type of screen and tell him he couldn't do it for these reasons, and it was like, okay. Ultimately, as long as we're compliant with the regulations, he can't really...

00:27:42.690

E.S.: It's a trust thing. They can make life easier or more difficult, and it sounds like they're working with you, which is great.

00:27:49.470

M.4.: I think generally with the Environment Agency, all of the jobs I've been on with them and what I hear about from guys at work, they have a really good working relationship with them, working together. That doesn't seem to be a big issue, I don't think, yet.

00:28:09.600

E.S.: You talked about your network little bit and that you drew on some outside expertise to fill in gaps and you've got a relationship of sorts with the EA. Were there any environmental NGOs or customers involved in this project? Have they had any input? I'm not saying they should have done, but is it one where you've had other people involved?

00:28:49.980

M.4.: Not that I can think of. The EA is our main stakeholder. You've got the internal stakeholder within [X] and it's a fine balancing act with our production planning people who oversee how the water resources are managed within [X], who agree the pumping station out for a set period of time, and we've also got liaison with the aqueducts people, because they manage the large diameter mains between the pumping station and the water treatment works. You've got to liaise with the water treatment works manager, because you're limiting his supplies. All those internal relationships you've got to manage all at once.

I suppose outside of [x], where we were looking at the various different options and we were talking about the air burst system, you've got big boat operators on Lake [.] and they've got a management committee, I can't remember what they're called, but obviously we went to speak to them and we've got our area stakeholder manager, I think, within [X], they're regional. And so we went to see them and said this is what we're thinking about doing and we don't want to do it for these reasons, we need to also get a bit more ammunition to convince the EA. We don't want to do this air burst system. So our stakeholder manager went up to all the stakeholders in the area, and presented this to them. So we did go and see them. And they backed us by saying we don't want this to happen, air burst system, that sort of stuff.

The site's next to a high school so we've been to speak to the high school about deliveries, construction traffic. The site compound is on a stable. It's a big stable, opposite the entrance to the pumping station, and they have 40 or 50 horses stabled there. So we're going in there and taking a big chunk of their field out of the compound, so it's going and liaising with those guys. And you've

got noise, you've got traffic moving more than normal with young horses there, so you're managing relationships with the local community there as well. I've had much more customer stakeholder involvement on other jobs, Keswick town centre, for example, that was massive stakeholder management and managing police, fire, flooding, everything. It was nothing like that. But you've got to lay the foundations so when you turn up to do something, it's not a surprise.

00:32:00.720

E.S.: They don't feel like it's been dumped on them.

00:32:05.460

M.4.: What I always think is if people are informed, it's not a surprise that things are happening and why we're doing it, people are quite tolerant of traffic movements and things like that. It's if you just start and they don't know, they act hacked off, don't they? That customer liaison, so everyone knows what's going on, and they know who to ring if there's a problem, if they've got my number project coordinator's, third party liaison's number.

00:32:40.170

E.S.: So you're not invisible to them.

00:32:41.760

M.4.: That's quite important to me, knowing that we're responsible and they can give us a phone, so we can deal with any problems.

00:32:52.140

E.S.: In terms of the projects driven by regulation, in terms of delivering the solution, you've alluded to some legal issues already, have you come across legal problems, if you like, in executing a solution?

00:33:09.480

M.4.: Well from a regulatory date point of view, obviously we've got back to the Environment Agency and told them that we couldn't hit the original date they gave us. That was down to them changing the requirements. So changing the solutions of the project, and they took a bit of time, but they've accepted that and we now have a new regulatory date of December this year, so we've got to comply with the Eels and Elvers regulations. Our abstraction exemption is extended to the 31st of December. From that point of view, it's been alright.

Challenges we've had...yeah... So, like I said we've got this new fairly new MSP delivery group within [x] and so all our projects go through []. But these type of screens we're using, we have a framework supplier, so we can only really go to that framework, and that had a massive lead in time to get them made and shipped. The framework supplier has been on site five or six times and measured up. And I agreed the screens directly with the supplier last summer. It was going to be a 26, 28 week time from placing the order to install and commission.

So we placed the order last August time and the screens arrived at the site two weeks ago, so instead of being a 26, 28 week wait between in order to install and commission, from the 1st of August, it's been probably a 47, 48 week from placing the order to the screens being delivered to the site. That's been a massive challenge. They're 500,000 pound screens, so it's not like they're cheap. It felt like been let down a little bit by our favoured supplier. And they were very difficult to deal

with and in the tendering phase. So [...] used our framework supplier to install the screens. I placed an order for the screens, [...] have ended with the same company to install the screens. They were very difficult in the tender period and pulling the cost together. They didn't really seem that engaged or enthusiastic to deliver, everything's a drag, you've got to drag them and push them to deliver. We're having to pull them a little. That's a challenge.

00:36:17.070

E.S.: Virtually everyone I've spoken to has independently mentioned procurement and framework contracts as one of their biggest problems.

00:36:32.010

M.4.: It doesn't help that we've got these new contracts in place that have only been in place for 18 months, two years with this MSP contract. It's a new contract and no one's really thought about how it's supposed to work, and [...] aren't geared up or resourced up to help deliver. You've got ex-[X] guys being TUPED over into [...], which probably sours relationships a bit because they didn't want to go. So there have been some issues, and [...] are pushing as well, but from the actual contractors doing the work, there didn't seem to be any energy out of them to do what they need to do.

00:37:13.710

E.S.: They've got no competition, have they, I suppose.

00:37:19.110

M.4.: Exactly. In AMP4 and AMP5, I was on all the major CAT delivery stuff and we had all these Pen Gain contracts, and so the contractor had a drive to deliver quicker and cheaper and faster because it got them a gain share, in the tech target price. Like a carrot. So if the target price is set at 2 million pound, but if you can deliver it for 1.8 million pound, we share the 200 grand each, so there's a bit of a carrot to deliver. So what are the consequences of not delivering on time, it liquidates damages in the contracts. It's not worth shouting about. There's no real drive for them to push to deliver. That's only a personal opinion.

00:38:09.090

E.S.: It's personal opinions I was after. It's your experiences, you've worked in it.

General questions. You might not be able to answer so these don't worry. Are you doing any projects or worked on anything with other utility providers, energy, transport or any infrastructure providers? If you encountered any difficulty in doing so if you have?

00:38:40.650

M.4.: Well I've only worked at [x] for 20 odd years, something like that. Within [X] I've delivered projects having to get new power supplies put in, new transformers put in, working with highways, working with the Environment Agency to help them to deliver flood defence projects. I've not done anything with rail. I've done local highway sort of stuff having to put things in highways and reservicing and diversions that sort of stuff, and we've done gas diversions. A lot of time generally, apart from the initial contacts that we might make internally as [X] engineering, the delivery of all sort of things usually are handed over to our contractors. So we might help them along a little but and make those contacts and things, but the delivery of them and the onsite management of them will be done by our contractors.

00:39:58.650

E.S.: This is another very random question and, again, you might not be able to answer this but, are you aware of [X] doing anything on social levelling up or blue infrastructure projects, anything like that? Renovating, focusing on rundown sections of communities, or green enhancement, anything like that?

00:40:26.400

M.4.: I know we do, but it's not something I'm working on.

00:40:30.120

E.S.: Don't worry.

00:40:32.010

M.4.: That's the sort of things we deliver a lot of the time. As part of projects in the past, I used to work with your parish council, the local groups to try and deliver with the community as part of a much larger project. With parks and playgrounds and community footpaths and work with schools. I've done a lot of stuff like that with my [X] project manager's hat on in AMP 4 and AMP 5. There seemed to be a lot more money around to do that sort of stuff. As a project level funding, it doesn't seem to be that there anymore. We've taken a step back from that pro-faced project delivery because we're going into design and build contracts, so we're generally just doing project requirements to contractors. They're developing a lot of the detail. Previously we were doing a lot of detail ourselves so you can see how you could help and fit in things. Because it's now much smaller value things I'm not sure what the bigger projects, the 200 million pound projects where there's funding available in them to do any of that stuff to be honest.

00:42:17.520

E.S.: One of the things I'm looking at as well is, I think you mentioned one of the projects where you involved with parish councils and lots of stakeholders and Keswick. How you listen to everybody, not just the loudest, has that ever been an issue any of the projects that you've encountered?

00:42:43.800

M.4.: Oh yes. You always get it.

00:42:45.990 --> 00:42:47.010

E.S.: And how you've dealt with that, if you've been able to.

00:42:51.600

M.4.: You're always gonna get the one person in the community group or in the various groups or parish councils or club defence group or whoever wants their voice heard. It's almost finding the balance isn't it, between all the stakeholders, and everyone's got a voice, and find that middle ground. A lot of the time, I think the key to managing those third party issues is listening and trying to build those relationships and build that trust. Sometimes you get the feeling people think you're always out to get one over on them.

00:43:37.020

E.S.: You're the authority, almost, aren't you?

00:43:39.570

M.4.: They want to blame you for lots of things. Keswick was a great example, they've had horrendous flooding in over the past 20 years because they build housing in floodplains. But it doesn't help that at the time there was a massive flood event, all the service water and sewers came up and mixed it all with the sewage. When you're going into a place at first, people want to try and have a go at you because the houses are flooding and they've had sewage in there. And you've got to just take it. And I explained that we're here to help, we get you and we're trying to deliver something, and hopefully it's gonna go. It's getting that confidence to say we're going to deliver this and it's gonna work. We're working with the Environment Agency. It's getting that trust and being able to confidently answer the questions that are given to you. And so sometimes you can see, there are people out there, the quiet typical ones that don't they want to engage in you, because all these big personalities are in there. It's making sure you can pick it up and engage, create an environment where we're happy to talk by email or letter or phone call. It's picking a communication style, isn't it.

00:45:03.870

E.S.: There's being conscious of that loudest voice thing isn't there, as well.

A couple of last questions, I've gone over time. I'm conscious that you've generously given me your time so I'm not going to outstay my welcome. If there's one thing you could change about law, regulation, governance, the regime that would make your life easier, what would it be, or what would they be? You can have more than one.

00:45:48.570

SP.: That's a question that I've never thought about before.

00:45:51.210

E.S.: If you can't think of an answer now, you can always email me. What would make your life easier? You've talked about the EA and regulations and legal requirements and procurement and whatnot.

00:46:16.230

M.4.: it's hard because a lot of the time... In previous AMPs I felt like we had more control over what we deliver and how we delivered it. Because we did more of that upfront engineering and design work ourselves. But now we don't we develop requirements and let our contractors develop the solutions. There tends to be a lot of grey areas in what they give back to us and the costs. We seem to spend a lot of time getting them started on site and agreeing things, and the costs coming too expensive. And the whole point of going into a design and build contract was trying to speed things up and not waste money and time upfront because we were developing solutions and then, giving them to our contractors, and sometimes because they were in this pay and gain contract, they think of a new way of delivering something to try to save us some money. And so the exam we've done up front was a bit of a waste of time, so you can see why we kind of want to do it differently, because why design things twice, but it does seem to take a long time. I don't want to say waste time, but just everything seemed to take time. The processes we've got to go through internally to get from A to B. Have you seen the [X] map and process you've got to go through?

00:48:19.980

M.4.: It is useful, it is good, because it makes sure you go through all these processes but, not all jobs need to go through the processes, but to convince and explain why you don't want to go through that particular process, it's easier to just do it.

00:48:41.640

E.S.: The path of least resistance.

00:48:43.260

M.4.: Yeah, because you're audited every month on where you're up to. And the people auditing who don't understand projects. They don't deliver projects themselves. "Why haven't you done this?" Why, because this project doesn't need to do this, it's not a process project, it's building a fish return system. A process engineer map report doesn't need to be done. It's there's for good reason, the processes are there, but sometimes I feel like it's hamstringing you a little bit. I've had lots of new project managers coming in and working with me, and for those guys, how they have to have a structure of methodology from A to B have been fantastic because they know what they've gotta do and it's really, really helpful. But not all projects at the same, and our different delivery streams with major capital CDP where it's me and MSP and small stuff in between or it's our competitive tender arm, they do things differently. With PMO, we manage the tube map, they don't always understand the differences between all the projects and how they're delivered. That's an internal thing. We've got so many different processes to go through.

00:50:13.170

E.S.: It is internal, but it's guided by what they have to deliver in the governance regime isn't it?

00:50:25.080

M.4.: We'll all say the same, all the project managers. It's just a bit onerous to get through everything. And then on the flip side, when we get things awarded, sometimes our contractors say, we can start on site next week. And actually, you can't, you haven't told us where you're doing, what we're doing, introduce a notice to go and serve it to the landowner. Have you submitted the highways notice? There's a bit of a knowledge gap from the contractor side. Not on the major capital stuff, on the big stuff they're geared up with all these people working with them, but in my area, I think there's a bit of a gap between what historically [X] used to do in previous AMPs to what we're paying and expecting the contractors to do now. We've given them a bit more money to do all these extra bits of work and the people that used do that bit of work in previous AMPs...

00:51:39.120

E.S.: A few people have mentioned a bit like doing a project, the project is disbanded and all the knowledge goes. It sounds a bit like that. You've got that skill sets and gradually diminishing.

00:51:56.850

M.4.: Yeah, it is. And we've gone from being the doers to being the auditors, so we don't do much anymore, we just say, have you done this, have you done that? We are assuring things all the time. All our third party people used to be out there talking to the customers, talking to the highways guys. Now we go, have you spoken to highways, have you done this? In my little area, they aren't geared up for doing that, they haven't done it before and they don't know what they're doing. All those third party... you go and speak to your typical engineer or your whatever and they're building stuff, it's that tunnel vision of engineers. They just want to build stuff and design stuff, they don't

want to do that and understand how the third party's going to impact that. They haven't got that breadth of view on how to deliver stuff.

00:53:03.540

E.S.: What brought about this change, you've alluded to it, from the previous AMP cycles to how you're doing things now. What triggered that do you think?

00:53:14.640

M.4.: It's efficiency, trying to do things quicker and cheaper, you gotta look to be evolving, evolving our processes and how we do things, value for money and efficiencies in the AMP cycles. How we're going to save how many millions in this next five year cycle.

00:53:39.540

E.S.: Is there a de-risking component to it as well? I mean I think you've suggested, I think, that you're doing a lot of designing and then that design goes off when you're wasting money, to some extent. I don't think invention can ever be a waste, can it, because you're always learning from it, but you know what I mean, de-risking that part.

00:54:03.840

M.4.: Absolutely, I think, in theory, the contractor's taking all that risk, process and design risk, that's all on them to manage. And, obviously, we're paying for that, we're paying a premium for them to take that risk. Some jobs you're assessing whether we'll take that risk. We can do that a little bit more in my area because we're a bit smaller, on the [...] job we didn't say to the contractor go away and deliver me an Eels and Elvers screen that can do X, Y Z. We said here's a screen, use that, so we've taken that process risk and hydraulic risk and told them, here's a screen, install that screen for us. We're doing that on other jobs as well where we are saying - install these pumps in there, so we've done the upfront mechanical design because basically it's quicker and cheaper if we did it ourselves because they'd be useless. That's our biggest job.

At the moment we're getting to a point where every job we tender, the prices are coming back so expensive we can't afford it, so now we're going out to competitor tender to do a price comparison. So you're saying it's going to be 5 million quid. Well, we ask them questions and they don't give us sufficient answers to the queries. So we go, we're going to competitive tender. Get a comparative price, you say you're giving us value for money but don't believe you. They're in the framework and they should be doing all these things to save us money, but you just don't feel like you're getting that back from them.

00:56:00.270

E.S.: Maybe over time, but you can see that.

And that's all the questions I had. I've got over time. Is there anything you think I've missed in terms of the regime that you're operating in and its support or its lack of support for delivering the best possible projects. You've given me a whole load of thoughts here already. Is there anything you wished, something that bothered me on this project or another one?

00:56:38.160

M.4.: You get [X] guys working on the schemes, engineers, who get pulled around a lot, because they're working on so many different things. The beauty of using APEN to do this, a specialist

workforce, is that they are working on that job, so they turn things around really quickly and they focus on delivering for you. When we are using the internal resources to develop things, they are working on 10, 20, 30 jobs at once. And so, all of the all the pressure to deliver. And so, trying to get them to work on your job, sometimes can be difficult. And me, because my jobs are probably smaller value, not shiny, not the big 3 million pound new works, sometimes it can be quite hard to get them to focus on your job, because they've been told they've got to do this job by the director because it's a massive job. It's trying to get people to focus on your job. And we do that by managing the people now and hopefully doing well. Some resources are stretched really thin that can be a challenge for us, I think.

00:57:57.870

E.S.: Yeah, contracting out, keeping in house, all sorts of pros and cons.

I haven't got anything else, I'm sure I will think something. But the way it works now is I'm interviewing, I've done quite a few interviews already, I've got another set over the summer and then I'm doing some two more projects, probably one with [X], a case study, and one with pipe bots. I don't know if you've come across pipe bots. So we're putting miniature robots into the water supply. So I'm doing a couple of projects. I'm working on a framework to help people with the governance schemes and stuff and so it's going to be in another year. So if you don't hear from me for a while it's because of that and not because it's not going anywhere, it's because it's because there's two big projects coming up. But I'm more than happy to send you advance copy once it's written up if you're interested or, if you have any questions or any thoughts at any point, just keep in touch and I'll do likewise.

S.P I'm more than happy to chat along anytime...

E.s Look after the eels for me, I'm worried about them in that pipework

SP Do you want me to send you details of the [...] project?

ES If you don't mind that would be really interesting

SP if you need anything else give me a shout.

N.5 transcript. August 2021..

E.S.: [not transcribed- intro to project, general discussion, explained the participation sheet again. Confirmed comfortable with it]

00:01:08.130

N.5.: When I saw the title, I thought oh, governance, awful. But it actually isn't. In my job in this company, it's spending other people's money. The problem with a big company, everything is someone else's job, from technical approvals to financial approvals to everything. But governance is a good thing, because it can protect you as well, it protects everyone, but it makes everything so cumbersome and slow and bureaucratic. So my first reaction was oh god, governance, job stoppers, it makes my life hell, but equally it provides, you know we've got decisions, even though it's infuriating slow, we got problems, every job has problems, lots of them. And some of them I'd love to fix them and make those decisions myself. You've got to try and influence people to buy into them decisions and management by committee and stuff like that. My initial thoughts were I hate governance, and then it didn't take me very long, a minute, then well actually, I see the benefits, I see the reasons, I see how it helps me. I hate to be a type of a person that has any kind of positive thoughts about anything bureaucratic. I just hate it. But I really see the benefits and I don't know how else you run things. I can sit back and you know, because we are so inefficient in what we do. But I can't do it any better. On a one job, a few hundred thousand here and there, of course you could. But it's gonna be three billion over five years. I've never given it a thought much beyond that I probably couldn't do any better. So that's the first thought when I saw this title.

00:03:16.290

E.S.: Governance should be supportive. And it should be protective and supportive and so it should be protecting those involved. What projects do you work on? Are you water or wastewater or both?

00:03:34.440

N.5.: Both, predominantly wastewater, just the way it is at the moment. I've probably got three water and I don't know, six to nine wastewater on the go at the moment.

00:03:45.450

E.S.: Have you got anyone at that's particularly big, transformational or and where you're trying to make some significant change?

00:03:56.520

N.5.: The word transformational just throws me off a bit. Up at [place] we've got a new treatment called [tech]. It's one of them where it's set off life as a more traditional, got another project, just a few miles down the road which is traditional, it's a sewage works, wastewater. I forget the numbers, two to 300 people maximum in the village. And it set off as a big septic tank and traditional treatment that we were going to do, and then after we contract award, someone saw [X], the golden unicorn of this [tech] because it'll be brilliant and it'll cost the same money, and it'll be built quicker. A year and a half later it's working. It's not finished but it's working. It cost a lot more, but basically we had to pay the money to develop it through the contractor that was selling it basically. Typical innovation thing.

00:05:07.080

E.S.: Can you explain it to me a little bit more? I heard it went a little bit dead. How do you spell that sorry?

00:05:13.980

N.5.: [TECH].

00:05:17.730

E.S.: And what is that?

00:05:19.170

N.5.: Even though they're all different, sewage works on this site was going to be a huge septic tank and settling tanks, chemical dosing, I don't know how much you know about sewage really, its about phosphorus removal. It combines with the phosphorus, makes it heavy, it drops out to the bottom, and there's a further settling. It was it was more traditional, now it's shiny silos, 1 2 3 4 5 silos all above ground, painted green for the landscape. It's black magic really. It's got a computer in a kiosk which basically pumps and recirculates and aerates and mixes. It all comes into one tank and then it splits into two reactors where the actual work happens. And it basically recycles, mixes, blasts air through at various times until it's clean and it comes out the other end. It doesn't use chemicals, that's the bonus, and it will be good project going forward. It's just we got called on the first one and we had to pay for the development really.

00:06:40.290

E.S.: So, why were [X] attracted to this solution, even though they had a sort of a solution maybe not in place, but on the go?

00:06:53.790

N.5.: Two things: non-chemical, so that's a big bonus. It doesn't use chemicals for getting rid of phosphorus, which is good. They were told the costs would be the same as the project we had on the table. I think everyone probably knew it wasn't going to be, but nonetheless it kind of goes back to governance, they were told it, this was to our engineering department, and this is one thing about governance, so it protects you, creates silos in your organization, and so the engineering department very much led this. They were sold this thing, oh we want this, because it will be brilliant in the future, basically, and I think everyone except them accepted it was going to cost more. But, nonetheless, we went through the governance process and got approval to switch from one technology to another. Company decision that we're gonna do it on the basis it will cost the same. And then, six months later, we're back with the final bill. Could have known by the fact it was a year later. By that time you've half built it. You can't change your mind. So it's all the basics, non-chemical, it was the future. We've got lots of these phosphorus drivers, lots of the small sewage works to reduce phosphorus going forward in the next AMP. Chemical dosing's hard work. It's not that it doesn't work, it's hard to get right. You've got to keep on top of it because you're always adjusting the dose or something.

00:08:35.880

E.S.: [X] wouldn't be interested necessarily just in it being non chemical? I'm just trying to understand, so it's really that it's operationally easier? Reducing the phosphorus being a regulatory requirement. Is it that?

00:08:56.250

N.5.: So the regulatory requirement has to be met one way or another. I suppose if you're offered a solution that involves chemicals, which is hard to manage, and then you're offered this other one which doesn't involve chemicals, in theory, is easier to manage. I'm not sure what it's going to be. If they are the same price, or not, but, at the time, they thought they were. You would go for the better solution, wouldn't you. There's reasons behind it, I think the price will come down. It's just the first one obviously, the development costs and everything, and you know a lot of lessons learned. To be fair, a lot of our extra costs were because it took longer, we have to basically run a temporary plant for the year, which cost a lot of money. Well, on a normal project you're just going to replace what's there and build something new. Because our new permit came in force last year we had to run a temporary plant for a full year. All these factors coming. But if it weren't a new project it would be much closer in price.

00:10:18.540

E.S.: And you said it was pushed by the engineering side.

00:10:24.960

N.5.: It was sold to them by the supplier. They've got bigger [tech]'s in [x], a couple of them but they're building more on a much larger scale so it's never been done on the small scale, because it's miniscule compared to what's been done. It was basically sold to them, a bit like a salesman, we used to laugh at the kind of salesman that come in and go down there. They are very good aren't they, but they gloss over how hard it would be to do. So there was all that really. And if it was at home, you'd be kicking yourself because who's got all this spare money to pay once you halfway through, but we're a different organisation to people at home. So it will be a good solution in the future, I have no doubt you'll see many of them in the future. And sometimes in development you've got to do that.

00:11:22.680

E.S.: Absolutely. I mean what can be more complicated than some water and wastewater infrastructure systems, where everything's interconnected and necessary for human life. When you're looking at that context, why wouldn't it be difficult? And in terms of, I'm looking at lessons learnt to help future projects. So it's just your opinion, so, in your opinion, what should the engineers have asked or done differently, that would have helped this project along at those earlier stages, because they're the drivers aren't they, it seems?

00:12:06.180

N.5.: I don't know, sometimes I suppose you're gonna sit back and think, what would it have changed? If it turned around and said, instead of 3 million it's gonna cost 5 million, the company might have still gone through it, I mean they didn't, with the information because that's what they had presented to them, they thought it was going to be the same. A lot of people knew, not that we had a figure, knew it wasn't that price or certainly not that timescale. Not necessarily criticising it because it could well be the right thing to do, because we've now developed this, which, in a little while, could be used, time and time again and be used for other projects. The cost at the time was a big issue, and they had the influence at the approval board at [x], the governance board or whatever it's called now. They've got at seat on that table, so they can influence the decisions, even if it was a higher price. I don't know really, you know, with hindsight, if it was the right thing to do, but if the company goes bankrupt in two years time because of spending all these millions on these jobs, then it's the wrong thing to do.

00:13:32.820

E.S.: Well, I think that the two issues, one, whether it's the right thing to do or not, you never know really until 20 years time, but from what you're telling me it's using less chemicals, it's more innovative, it's ticking off of boxes, so it sounds good. But the other issue is could it run more smoothly. I'm in engineering and sometimes engineers are criticised for going after something shiny and missing the big picture, or not understanding or choosing not to, being very siloed and not looking at wider implications of what they're doing. Some of the things I'm looking at are how we can help if that's the case. Flagging it and addressing it. I'm leading you a little bit here, but is that ringing any bells?

00:14:28.110

N.5.: You mentioned about the shiny thing and that's what it's about. We want it, we want to be the first. It won an award a couple of months ago. Some people were over the moon at winning this award, when at the time it didn't work which was embarrassing. I think, I suppose lessons learned, it's probably the right thing to do, but it shouldn't have been on that site, because we've got so many of these phosphorus sites coming up. Actually thinking about lessons learned, well, we were rushed because, why would we change anything once we were awarded the contract, the worst thing in the world we can do is alter anything when we were awarded a contract. It just cost us so much, it puts us on the back put from a delivery point of view. So, and also this particular site was a hillside in front of some houses, and how we got away with it without complaints. And then we applied for planning permission, met with the parish council, but we met with the parish council on one of the wettest days of the year and three people turned up but, nonetheless, we did our thing, the letter drops, you know. You do everything you can.

00:15:38.070

E.S.: Were you hampered by Covid at all? Some people had problems when they couldn't do their town halls.

00:15:55.200

N.5.: This was before Covid. During construction was another matter. Lessons learned, it was probably the right thing to do, but we should have done it on another site, I mean we got away with it, the residents haven't complained very much about how it looks, but while it was up on a hillside, the old one was kind of low level, not much above the ground, these big silos. We haven't got a lot of complaints yet but I don't think we've got away from that, we might get them in the future and we shouldn't have done it where we're having run a temporary plant for a year. But they wanted the shiny thing and they wanted to do it now on this site where many other sites would have been appropriate. But then they wouldn't have been the first. Another water company would have got there first.

00:16:36.990

E.S.: How could they have been guided it to a correct site? What could they have done to gain that wider network knowledge?

00:16:53.

N.5.: They kind of were guided. It's all about the timing isn't it so, I forget the time of year it was when it first came around, but it was it was sold and this site was the right size. And while there are others, the general feedback from the planning point of view and the effect on the customers from

how it looked even though we're got away with it we're not compliant so far, or very little. In terms of guiding, there was, this isn't the right place to do it, it's a good idea, but not the right place or not the right time. Sometimes life's too hard, isn't it. It's all about this kind of governance and everything being someone else's job. And everyone who comes into a big organisation like this, you're used to, depending where you come from us, to autonomy, making decisions, running the showroom, your business wherever you are. And you come here and the organisational culture and structure, it all makes it, it's not my job, you know, I'll do as I'm told. And I think we're all like that, even my boss. Is kind of, it's come from engineering, if it doesn't work. It doesn't fall on our shoulders, it falls on them. That can be a kind of negative, because if it wasn't like that, we would've all fought harder, made more noise about it being the wrong place.

00:18:29.580

E.S.: I know that feeling of trying to move an oil tanker with a dinghy. And a lot of organisations can be like that, for the reasons you've already explained. In terms of timing, I know in a lot of projects timing can be exquisitely important in these projects in terms of AMP cycles, which is a governance, an outside governance, if you like, regulatory structure that's put on water companies. Was that a factor, do you think, in pushing it forward at that time as far as you're aware?

00:19:08.040

N.5.: Well, I think it was at the end of an AMP they wouldn't have done, because the money wouldn't have been there, or less money, even though they've overspent from day one of this AMP. I don't know particularly. So the outside governance affecting the AMP... can you repeat the question?

00:19:39.300

E.S.: I'm interested in law, I'm also a lawyer by background before I went into civil engineering so I'm looking at how the regulatory regime structures decisions. And the AMP cycle structures timing of projects that maybe wouldn't affect an individual company outside of the water sector.

00:20:04.590

N.5.: I'm not sure how much it would have affected West Newton and that project. Possibly if it was later on in the AMP it may not have been done. We can never predict really how that would go. I suppose, one thing I would say, with the AMP cycles, so I've been at [x] for five years. It's not a good thing, from my point of view. It's funny, I just talked to people about it just recently, because I joined five years ago. Everything was fine, it was early, in the middle of the previous AMP, there's lots of work everywhere.

[interruption not transcribed]

00:21:05.250

N.5.: I've lived through one AMP cycle. It was lots of work going on, and then a few years later, they started getting rid of people, really bad to see. Now we're suffering the absolute pain of just having too much work, too many projects in the middle of the AMP. It's just, even though staff numbers have gone up a lot. All my colleagues are and most disciplines, just too much work to do. Everything's stacked on top of each other, you've got too many jobs, and the contractors are as well, because they can't deliver at this level. Mistakes happen and things get late and whatever. So the

outside governance, I understand all the reasons about price control and all that kind of stuff and you know, so I've got mixed feelings on governance, I can see both sides.

00:22:02.910

E.S.: Did you say that you lose and gain staff at different points of the AMP cycle?

00:22:08.130

N.5.: So we lose staff at the end of each cycle and the same happens every AMP or thereabouts. But the employer goes through each department and gets rid of people, redundancy, downsize because work tails off at the end of the AMP and it takes a bit to pick up at the beginning of the next AMP. It's what they do. I'm not used to it.

00:22:40.920

E.S.: Your knowledge loss, you must be losing knowledge from people who've gone through all these projects.

00:22:46.770

N.5.: Absolutely yeah. I mean they do decent pay offs, so a lot of people go on to better things. But still it's just, it's not good really. That's one negative, how it affects people, but the peak workload now was just very hard for people. And the contract was to deliver. That's a problem, we haven't got the time to get any new jobs hardly, and I'm not alone because you've got so many on the go.

00:23:20.550

E.S.: It's like an artificial regulation that's impacting on lots of different aspects of the business which you wouldn't have in another sector really?

N.5. you wouldn't would you, that is the point.

E.S. In terms of the project itself, are there any legal hurdles or even supports? I'm on pipe bots project, I don't know if you know, pipe bots is introducing little robots into the fresh water supply. We've got regulatory issues all over that one which we're working through. But is there any sort of legal issues with that project?

00:24:09.780

N.5.: Nothing abnormal that's specific about that. You've got planning permission and problems getting easements for phone lines and stuff because there was no communication on site before, now there is. We worked up a new permit, we do have a new permit in place for the Environment Agency, which is part of the requirement because we've got a requirement to treat the phosphorus to a different level, so we have a new permit. And negotiations around because the permit was expected to be around chemical dosing, and so a few changes on that, but not particular problems. We're not gonna be dosing chemicals, therefore we don't need iron limits, we don't need that one. Technicalities really. We've not had any particular hurdles.

00:25:00.780

E.S.: Is there a good relationship, working relationship with the regulator on this one? Is it just technical stuff to work through rather than hurdles being put in your way?

00:25:18.000

N.5.: Yeah that's right. Thankfully I don't get involved with regulators directly. There is a team, we do that. I don't think we would describe a good relationship with them. Just difficult, you know, computer says no and that's it, you know. I've said it in my company, lots of people have a blinkered view, and this is what the Environment Agency does. You're a water company, you make millions, it doesn't matter what it costs or same with contractors, it doesn't matter if they lose millions on a job because some other contractors have made loads. Well when you've worked on a delivery side, rather than a client side, you realise how hard it is and how job dependent it is for people to actually, not just make money, but deliver projects. It's hard work, what we do, what everyone does. The Environment Agency don't get it right first time, every time, we don't get it right first time, every time, and contractors don't get it right first time. There's a general lack of acceptance. They want you to pick up the bill for someone else's mistakes.

00:26:33.060

E.S.: This new contract, the shiny new equipment, was it a new contract with someone you haven't worked with before or was it somebody that was already known by [X]?

00:26:44.130

N.5.: So our main contractor was one of the main suppliers we have on that one, CTV+, they're called. They've done many jobs. They're not the designer or supplier of the [tech]. That's [name]. So the work with [name], we've got 1, 2, 3 large scale [tech]s that do 20,000 people plus, not 200 people. So we've got a few of them in the business, so we were with that company before.

00:27:15.510

E.S.: Right, so your intermediaries worked with the innovator before, or [X]?

00:27:28.710

N.5.: By coincidence, ...have done [tech] previously for [X]...

00:27:43.770

E.S.: They're sort of an already a trusted supplier to an extent?

00:27:53.280

N.5.: Yeah they were, they were well known. And again if it was a bit less, well known, it may not have got through the governance process to that decision to be ratified and go for.

00:28:05.100

E.S.: You said [X] were funding development. Is that sort of getting it working on site or was that before it was installed?

00:28:16.200

N.5.: It was kind of, you sold a pup sometimes, we'll sell this to [x], this technology. And we don't buy it from [name], we buy the design basically, and then we actually pay for it to be built by a mechanical supplier, which they linked us up with and stuff. They offered, I'm trying to think of the details now...they charge a licence fee each year going forward. Because they did monitor it remotely and there's a black box and they alter cycle times and such. They do adjustments from their head office, from time to time and things. There was an initial design cost, there was a licence fee, a few other costs. It cost us a bit of money and they waived their design fee. The initial estimate, 100,000 for this and 100,000 for that and it built up to whatever it is, and they were going to waive

that first amount to go into contract with them, which was through x contract with y and [name]. They did waive that figure but funnily enough they added it on the back end and called it something else. We could kick up a stink but the decision had been made, we were already down the line. And it wasn't a huge amount, it was to me, 100,000 pounds, in the order I can't remember the figure. Just to keep going, because if it stopped for another six months it cost us more than that anyway. This is another reason why it's kind of the wrong site because we were backed in a corner. We didn't have time to iron things out.

00:30:27.120

E.S.: And another thing you said was, we were talking about planning permission and the legalities, the locals didn't complain. I think you alluded to the fact that it was partly a rainy day in the town council meeting. Are there any other reasons you think that they didn't complain or haven't complained yet? Is there a demographic issue?

00:30:54.510

N.5.: If you sat in the village and you look at sewage works halfway up the hill, not even halfway, it's raised. To describe it, it looks like a prison, because of the security fence around, but you couldn't see pretty much anything in the works any physical structure, there was a reed vent which was obviously green. And then, when you look above that, there's massive wind turbines, not many, one directly behind and two, three of them. They've been very against the wind turbines in action groups and things that to the point when we did go to the parish council meeting there's a guy there, and he was talking about what noise. There is a worry about this plant because the bigger ones can make quite a bit of noise, but there is no noise with the small ones. He asked about noise, and they knew the background noise, because of all the noise they'd done with the wind survey, so many decibels and this that and the other. So I expected it to be much more of a complaint.

A couple of things: we don't apply for planning for the actual tanks because they're permitted development, the silos. But we applied for planning permission for the kiosk. We've not hidden anything, we've shown them the tanks and things like that. We had a parish council meeting, which was attended, and then it was a public event, like a village hall meeting, which nobody came to, because it was horrendous weather. Asked the parish counsellor the choice of colour, do you want it olive green or dark green or whatever it was, brought them on with us. I think I would have expected that area to be very vocal about it, as they were about the wind turbines only a few years before. I don't know if that's really applicable here.

00:32:53.880

E.S.: Maybe it was already blighted, in their eyes, or as you say, not noticed. A few people talked to me about projects where in initial stages, no one's interested. They go to the parish council it's all fine, no one cares. And you actually turn up with your diggers on site and that's when it kicks off, but doesn't sound like you've had that second wave.

00:33:15.990

N.5.: I absolutely expected that, because this particular works, there was construction going on for many months beforehand, and concrete bases and things because of the way the site's on a hill and it's flat, benched into the hill. You can't see it, you can see cabins but you can't see what they're doing. Literally overnight, big silos get craned in. And so they're not there one day and they are the next. I expected at that point for them to go, we didn't expect it to look like that. We've had the odd complaint but really nothing of any note and nothing that's escalated.

00:33:56.370

E.S.: Unpredictable. And in terms of any policies that you've seen, like the carbon policies and even levelling up agenda. Are any of those sorts of policies directly influencing your work or your working day at the moment?

00:34:15.180

N.5.: I would say no to be honest, I mean we do have measured carbon and the contractors do. But it's not something me, and again it's all about silos, it's not something I have any interest in, not personally, but my job, it doesn't matter to me one bit. As part of their engineering reports and option selection and things like that, the cost, they look at everything, and carbon. The engineering department look at that. I'm glad to leave it to them. I'm a civil engineer by background before I got to this I'm interested in all that stuff, the way we're structured and the way the workload is, you don't have time. Stuff that might be dead interesting to me.

00:35:00.750

E.S.: A couple of last questions, or one, hopefully, and so I'll let you get back to your day job. So talking about external governance here, like the regulations and the legalities and statutory regime that's surrounding the water sector. Is anything that you can think of that, just change that and my life would be so much easier, or if this was a little bit more supportive life, we would get these projects through quicker, better, cheaper.

00:36:01.980

N.5.: External governance... it is a good question that...what I would say is flexibility. While we have a target, whatever it is, 0.2 milligrams per litre for this or this for this or whatever it is. And they are negotiated, to be honest. But they're negotiated before the project exists. To be honest, they're probably not all negotiated but some are, so there's departments in [X]. Sometimes that tiny little change would mean we could spend a lot less money to deliver it, you know I've not a technicality in my head but say they do it on phosphorus but it's all elements, to be honest, all constituents. I suppose it's like you build something that big or you build it that big by going 0.1 above. If there was an opportunity... Overall, maybe it wouldn't work because you would then need to do so much work on a project to realise, oh, actually, we could save this, we can save 2 million pounds by really a miniscule amount on the targets or things like that. I think a kind of flexibility, I think. From a regulator's point of view that is only ever going to go one way. So maybe that discussion. I know they do that because they do negotiate. It's just from our point of view it's rigid, we can't go back and ask for change, it just doesn't happen. And the same for regulatory dates as well.

So it's not just targets, but I've got another job at ...e, this is a chemical dosage phosphorus removal. It's pretty much rebuilding 90% of the sewage works by, I can't remember the date now....We're a bit behind but it doesn't really matter what the reason is, albeit mainly contractors' fault and this that and the other. And we're doing a lot of work in the program because we have to predict whether we're going to hit it or not. We can't wait till the first of December to say oh, we're not gonna hit this date on the 22nd of December. We try to get really close to that in the program because we have confidence in it. If we knew now we weren't gonna hit it then we have to hit it. We have to do temporary equipment, we might spend a million, hopefully not. But you could spend a million pounds additional to try and hit this this date. You can't build it faster, we'd have to build a temporary sewage works. So we can make a decision now and do that, spend that money and do

that, but if we had the ability to go back and say, you know we're going to be two months late on this, it would save so much money and effort.

00:39:22.950

E.S.: Some people when talk to me about environmental targets say, I had one guy talk to me about nitrogen removal. He was saying, it's a brilliant project because we reduce nitrogen by X amount. And I said, did that benefit the ecosystem, and he says no. .. Is that something that rings any bells with you?

00:40:05.670

N.S.: I'm no chemist. I don't know how the effects of what goes into the water affects what's in there. I guess, even on ... it's a small population, but it discharges into a very small water course really. I don't know the effect of what we put in there. To me it's been like that for 100 years, maybe. It must be okay.

00:40:42.180

E.S.: I suppose it's a case that people focus on the target, rather than what the target's meant to achieve?

00:40:47.460

N.S.: Yeah I mean they are looking, there is a positive nucleus. There are negotiation on limits and that. We do have some of our projects, again, just a lot of a phosphorus at the moment in wastewater. We've got different magic going on, so we've got one at x where we basically put magic rock, polonite, into the tank and you run the effluent through it and it absorbs the phosphorus, and then you're changing the rock every year or so. Because we did that, you know the phrase natural capital, it's a natural solution rather than traditional, and we managed to get away with a higher phosphorus target than if you went to a chemical target. And also they've done some other catchment intervention. I don't actually know what that is, but working with farmers to try and get them to, with the watercourse and things. I'm not involved with that at all, other than I paid for some watercourse monitoring every year or whatever. So there is work on to be flexible. The company's huge, you can only worry about your problems.

00:42:00.120

E.S.: I'm hitting my time and I was very conscious that I need to stick to that time frame. I could talk to you forever [], but I'm not sure you would welcome that (laugh).

[not transcribed- end of interview discussion]

O.6. – WORD transcript 16th June 2021

Opening pleasantries and chat not transcribed.

Went through the participant sheet to ensure no concerns. Agreed ok to proceed.

O.6.: There was one thing Lis. I might not be, as we go along, necessarily the best person, the best placed person, to answer questions, and if that is the case, I can I can easily find other people.

00:00:17.369

O.6.: so I mean I've known D for well, not a huge length of time, probably about six or seven years. He e used to sit on what we call our customer challenge group.

E.S.: Okay.

00:00:27.150

O.6.: which I sort of manage the relationship. So I think you know we've always got on well and we respected each other, so I think he just I don't know how many people is put you in contact with?

00:00:41.460

E.S.: Laugh...it's just one of those things that when you're interviewing people unless you have asked you're not exploiting them in any way. And there's very strict ethical codes.

00:01:07.800 --> 00:01:08.220

O.6.: Well I am fine with you sharing any information with whoever you feel you want to.

00:01:17.280 --> 00:01:18.540

E.S.: laugh...So the best way to start or where people have found it best to start is really just talking about to just start chatting to me about a water or wastewater project any kind of project that you've been involved with that you consider successful, unsuccessful, or just interesting and we'll go from there.

00:01:44.670

O.6.: Now that's fine, so I think just just from your view background point of view, my background is in sort of economics and the economic regulatory stuff that we have in the water industry.

00:01:54.720

E.S.: okay. yeah.

00:01:58.050

O.6.: And I guess you could almost say that the role of that I have, that I have had, for 30 odd years is about presenting the plans to Ofwat our regulator.

00:02:09.690

O.6.: And then ultimately getting some sort of sign off from them, which effectively means funding and almost all of our projects are funded really by customers through the bills you pay. So I can talk

about that process which is quite a rigorous process from a governance point of view. I can explain that but perhaps by way of illustration, I'll pick probably the most important and successful project that I've been involved with [co] water, which is the development of [place].

00:02:53.340

O.6.: So, forgive me for just taking a minute of your time on the background. So in the southeast unlike where you live in the Midlands or indeed further north principles we don't have big reservoirs, so big big open sources of water. So [place] will be the first well, probably, since the early to mid 80s in the southeast. It's going to be built on land that we, [co] Water own. Okay. It's going to take from the streams we extract from at [place] and it's about five miles north of the town so. As you can just get on the south coast close to [town]...

00:03:45.210

O.6.: ...we've got the natural spring to the sea. We are going to take that winter water and we're going to take that to the store up at [place], which as I say is a piece of land we own. Now there's a huge number of governance issues around that. And we can try and pick up one or two bits.

0:04:09.720

E.S.: Yes

00:04:10.770

O.6.: I think first the first one, which is always the one I think about is who's going to pay for it. Now what the development is about is enabling us to give more water to [other co] Water. So, again I'm not sure how much you know of the geography [co] supplies to Southampton basically.

00:04:33.900 --> 00:04:34.230

Okay.

00:04:35.310

O.6.: And they have had in the last four years, they've had some significant abstraction reductions imposed on them by the Environment Agency. So the trigger for this is sort of meeting EU standards of flows that are required to remain within the rivers. And chalk rivers are getting, are becoming a very, very sensitive issue becoming a very sensitive issue. So they've had their licenses cut back. They need very rough, I'll talk some numbers but they might not mean much to you, but they need 200 mega litres of water days to resolve this. Typically the whole or [co] needs 170. Around the area they, they're really struggling big time.

00:05:28.470

O.6.: To the degree that they're also looking at things like the desalination down near [place] so [place] is right on the tip of you know, on the other, tip of Southampton Water and indeed other indeed other bulk supplies, other transfers coming in from other companies could be could be Bristol Water, so this is one small part of a jigsaw that will help them meet the sort of imposition of the reduction in licenses that they have had on them over the last three to four years. So there's a lot of governance around that, indeed a public inquiry around the need to reduce abstraction from those rivers. Um I think generally, although, although the environmental case was very strong the understanding of the altercations and where the water was going to be found was less well developed and the I think as an industry we're not very good at doing very big, very big movements of water from A to B. I mean, indeed in that context Ofwat and the regulators have just set up a new

body that they're calling RAPID which is looking at major infrastructure projects and moving water well again from the area you're in the Midlands, down towards the south.

00:07:09.780

E.S.: yes using the [other co] I think river system, yeah

00:07:16.830

O.6.: So the water out of the [river] notionally comes into the sort of northern part of Thames that frees up more for them to transfer further down

00:07:29.430

O.6.: It isn't actually the case that it is the [other co] water gets from A you know down down to the customer, its displaced. Its by displacement

00:07:39.510 --> 00:07:40.530

E.S.: Okay yeah.

00:07:42.120

O.6.: So yeah so the [place] project is one that is fraught with lots and lots of governance issues

00:07:50.520

O.6.: and I've only started on sort of describing one particular element but started with the what's the cause of why we're doing it. Now I suppose so so there's a lot of stuff that goes on, with the regulators, and that is the environment agent in particular and Ofwat where funding is there. For us it is a big project. It's over a million pounds total. Plus we need to do some investment in our network. Because, a little but like the discussion I just gave on [other co], Southampton won't get water from [place], what they will do is get water from our western border, which will then you know we will then use the [place] water to serve our customers who would have got it from our Western border

00:08:48.180

E.S.: wow okay yeah could you talk me through who benefits from the project.

00:08:56.490

O.6.: Oh yeah so who benefits. The definitely customers in the catchment area.

00:09:02.340

E.S.: In where?

SM. In Southern Water, yeah.

00:09:05.070

O.6.: Absolutely definitely the customers in []. I guess you could take other benefits because there is less abstraction on the River [A] and the River[B]. You could also say our shareholders benefit because we're charging, we are not charging our customers, we are charging southern water for construction. Now we'll put the CAP up, and we will recover that over an agreed contract which is 80 years in duration.

00:09:37.800

O.6.: um. well. So we got we've gone out and borrowed 100 million. Well we have borrowed 60million and our owners has put in about 40 million as well.

00:09:58.560

O.6.: it's those three stakeholders. To a lesser degree, so that's been if we, we could always use that water for ourselves, you know it's not sort of assuming all the scenarios work okay, we can we can still survive, still provide southern with what they need in new circumstances. When you get to rarer and rarer droughts in particular. So if we had a pollution incident in another part of the region, in our region, we could quickly use that water to to help us. So that's the other benefit. Yeah and I think the, the most important beneficiary really is the chalk rivers as it reduces the abstraction in those rivers.

00:10:53.520

E.S.: yeah and environmental impact, huge environmental impact.

127

00:11:01.950

O.6.: So I think I mean yeah that facts as a starting point, I think that's a brief. Discussion yeah major project.

00:11:12.420 --> 00:11:12.750

yeah. Why was this..

00:11:14.910

O.6.: Sorry Lis.. we've got our story, at least we got loads of stuff on our website, if you want to read and indeed this stuff on the Ofwat website, because they had to decide how much southern water customers should be paying for that this reservoir to be built.

00:11:35.790 --> 00:11:40.980

E.S.: Why was this project chosen, I assume there were alternative options available?.

00:11:41.700 --> 00:11:43.590

O.6.: Absolutely. So first I said there issue is a big issue, 200 megalitres a day. Our contribution is only going to be 21 it's only a 10th of the issue that they're facing. But you go through a process of looking all all the different options that you've got a new you basically do a cost benefit analysis and indeed when I mentioned desalination earlier on, you know that that would be abstracting water from quite a sensitive, environmentally sensitive area, out of the Southampton water.

00:12:25.230

O.6.: plus desal generally is quite cost intensive. You know you need quite a lot of energy to to to um use the phrase suck the soul out the water I'm sure it doesn't do that but that's how I imagined it works osmosis or reverse osmosis or whatever it is called. Plus of course you end up with a brine you got to do something with you know, a product is of no value to you so there's big costs associated with desal. And without doubt, the [place] option, of all the options that Southern had, was by far the most economic, the lowest value – sorry, the lowest source of water. So although it didn't solve all of their problems, you know it starts to help that issue, and I think the other, the other thing to reference is the certainty. Our scheme is probably more certain to be of a goer than desal. There is

likely to be reaction and public interest in construction a desal plant near where they were suggesting near [place].

00:13:31.110

O.6.: And just to give one final part of the jigsaw, [co] waters always really wanted to build [place] for its own purpose but it's never really had the the actual been able to demonstrate the need. In fact, if you went back, I think we bought the land, and if you went back to the 70s. At that time, they were deciding whether to ? a river called the River [river b] or to build [place]t and they chose to abstract from the Itchen. Which 40 years on everybody's worried about chalk rivers, so perhaps if they've built it, then we would be abstracting quite so much so we are where we are. So it's always been on the books. It's always been sitting there as an option. But [co] has never been able to demonstrate to its regulators, that there is a need for [place] for its own purpose. Bu there is definitely for Southern Water, which is accepted.

00:14:47.220

E.S.: so its said that the market system that we've got, a heavily regulated market system, has almost encouraged [co] Water to look for cash generating assets. I mean you've got to a closed limited shop in terms of customers and it's driving that sort of innovation, innovation and overused word but yeah.

00:15:12.990

O.6.: yeah and I think the important thing, there is generating the cash, getting the cash to actually do the investment. So we e have an investor who who's expecting any income over the long term, so the idea of an 80 year contract for them is a good, you know that sort of is a tick for them. They've gor the cash in their pocket, shouldn't say it quite like that but better with cash to get some income from that. So, so you know I think it's purely purely from their point of view it's a cash thing. The cost of capital in the regulatory regime is protected, so the return that they will earn is pretty guaranteed over the lead asset.

00:16:08.910

O.6.: So yeah you're quite right, I mean anybody that owns water in the southeast has got quite a valuable commodity, but a) the growth in demand we are seeing and b) the environmental factors which are trying to reduce abstraction rather than increase it. The fact that we have the right to abstract it from the springs, plus the ability to store that water, which is basically a surplus in the winter from a protected harbour, gets us into a very good position.

00:16:51.930

E.S.: Who is anybody or anything loses out with [place], what is there at the minute?

00:16:56.460

O.6.: So, at the moment its it's a mixture of grassland and trees. But there's one, that's been one of the most contentious features what are called [], which is an avenue of what is classified as Ancient Woodland So had some criticism from Natural England and and to a lesser degree from woodland England were challenging us on whether this reservoir is needed or not. Of course, you put in a mitigation plan and we're going to plant about 3000 trees to mitigate. Seems like a lot of trees and probably about three or four times more than is there but doesn't replace what is a valuable asset. So yeah that's probably the biggest challenge that we've had in terms of ..because we've

literally literally last week heard from the two local councils. Sorry (holds hands up) the plot sits there and it actually splits two different Council area and sits across there. So we had to get through two planning authorities. The [place] one was pretty unanimous. On the [other] one there was actually a few councillors who objected predominantly on environmental grounds but they weren't the majority, so from our point of view that was, there were two ticks but you know that doesn't mean everybody's fully behind it.

00:19:00.270

O.6.: What what you also find, sorry for going on. One area is probably one of the most deprived areas, certainly in the south of England, []. And so most people with potential access to a green resource is another tick. And then we went on the other side of the reservoir and you have, this is a very affluent area []. And the cynic in me says if those people support the reservoir so that Leigh Park doesn't spread across and join up with a more affluent area.

00:19:50.160

E.S.: We can't develop on water.

00:19:53.400

O.6.: This is supported between the two conurbations, but I think, I think generally we've been working on this project, in anger at least, for at least in 15 years. And the stakeholders, for us, have been for it. In the last six months or so a sort of group of environmentalist have got together and they created a campaign called stop the chop.

00:20:24.480 --> 00:20:25.260

E.S.: Stop?

00:20:27.270

O.6.: Stop the chop. And they're very passionate about the ancient woodland. So I think that's that's made it a little bit more a difficult process than we envisaged it was going to be maybe a year ago.

00:20:48.120 --> 00:20:50.070

E.S.: yeah I live near HS2. It is about me learning from what you say, rather than me questioning too much this point, but I live near HS2 and they've mowed down ancient woodland and it's a sensitive issue isn't it.

00:21:09.780

O.6.: yes very, you know, around here there is a road change to avoid ancient woodland around Arundel which is going to clip the edge of our village, you know and again, as you say, very sensitive issues.

00:21:28.710 --> 00:21:29.940

E.S.: yeah I suppose land seems to come up time and time again, as a major hurdle either lack of how we use it, we're tiny country. So you having this reserve.

00:21:49.710

O.6.: In reservoir terms, this is not going to be that big it is not huge. But we did buy the land for a penny.

00:22:02.460 --> 00:22:02.790

Right.

00:22:03.840

O.6.: In the nineties so at that time [place] Council thought it was a good good thing to think about. And there was a nominal payment made. So we do own that. So investors fall back, if this doesn't come about we could sell it for housing.

00:22:31.380

O.6.: You know, that wouldn't be in the spirit of what [place] Council predicted, but it's always a backstop isn't it.

00:22:43.410 --> 00:22:50.850

E.S.: How do you propose to how are you going to be engaged engaging with the Stop the chop

00:22:54.690

O.6.: Okay, so I mean that really being dealt with at CEO level, we've met with them, we try to understand their issues., I think it comes a little bit. It moves into the emotional space and where I don't think they really either accept or listen to us. We have tried to engage but it is quite difficult. yeah physically, to get them into the office or we will come to I them. That's not there thing, so I think I think as the actual construction does start when it starts there's bound to be some onsite presence on their side that will make it a little more difficult.

00:23:47.940

E.S.T the overall environmental impacts and seems positive and although there's some losses, the abstraction issue and the upgrading the environmental potential of that area sounds like a plus.

00:24:06.360

O.6.: So so so so it is a massive win and we are comfortable with that. The other couple of things mentioning in that context are transport when the construction process starts. And we're in a very fortunate position where effectively we are digging a hole, and the material we take from the whole we're going to use to build the southern end which again will protect with the area called Leigh Park. And so a unlike lot of other reservoirs we won't have a lot of material being transported in site, it will be used on site.

00:24:57.960

O.6.: We are very fortunate in that there is clay, I will call it clay, I'm not sure, but we're very fortunate, this is the right sort of clay that can be used to create if you can picture a big dam, you know 20 metres high, but they've gone down quite a way as well. So the only other sticking point is number one the access roads are minor roads, B roads, if you get a chance website and look on the map it's sort of very close to the roads from Guildford and the A27, so potentially you could have quite a few visitors turning up there, and using fairly minor roads. So things again, we need to ensure we meet people's expectations about the access road

00:26:03.720 --> 00:26:04.020

E.S.: Right.

00:26:04.140

O.6.: So people that currently live a little bit to North called [], they don't want people coming through their village because they hadn't done in the past and, of course, those that are from the South, so all the traffic coming out that we have two different routes in, and that one we sort of put some proposals together about a northern access route which doesn't impact that village as much as they perceive it could do. So yeah as with any project we cannot get it right for everybody.

00:26:43.

E.S.: a major infrastructure not going to please everyone is just that's just the way it goes.

00:26:53.670

O.6.: I got I mean we consider those to be minor issues because they're not our stakeholders. They're very important, but in the grand scheme they are.... Actually, they are but you know, it is very important to recognize that everybody in the local area, the locals has a very big stake yeah. And although 90% might be very comfortable and influence the plans and big consultations on it, there's bound to be some who are not quite happy or have only just become unhappy because they only really started thinking about it today.

00:27:40.770

E.S.: Well, when you say when it's when work starts that's when they're certainly around here, we had people camping in the trees and stuff its that sort of thing and. You said that the issue with the ancient woodland came more of a surprise, it came on later I think some of the issues you're anticipating but this was a surprise?

00:28:04.350

O.6.: yeah okay, so I think I think we would always known that there's the potential for this woodland to be classified as ancient.

00:28:12.840

O.6.: And indeed, we are a number of discussions with Natural England. D was one. And, of course, they have some experts on ancient woodland, so it wasn't just about D, but I think between us we'd agreed an appropriate plan. I think what I was surprised about was assault. certainly no more than a year ago was not more vocal. I'd have said before there was no local resistance at all. There was no stakeholder resistance to the project at all good question, I mean. it's almost like as you say, once it gets closer and closer and closer and you do your consultations and it becomes more publicly aware the back end book stimulates responses.

00:29:18.570 --> 00:29:18.960

ES> It becomes more real

ST: yeah.

00:29:20.130

E.S.: It strikes me about the administrative borders. That almost it's a trade or a situation that's arisen because of this artificial border. If the if the [co] borders didn't quite cover [place] and Southern water did then they wouldn't be trading. It seems quite an artificial...

S:T. No

00:29:56.010

E.S.: I didn't catch that sorry.

00:29:57.930

O.6.: Sorry, do you mean if southern water owned that piece of land.

00:30:01.740

E.S.: Well it's just it seems to be a trade that's happening with [place] with water go into a different water authority, to an extent, because of where the borders have been drawn.

00:30:15.120

O.6.: out yeah. Exactly. Okay, so I mean that's a very helpful question from your point of view. So historically, 10 or 15 years we have to produce. We have to produce what we call a water resources management plan which is a statutory requirement for Defra.

00:30:40.800

O.6.: It says what water have you got, what do you expect to need over the next 25 years and how are you going to bridge it.

00:30:49.410

O.6.: And that that is a statutory plan. It goes in every five years, probably to the Environment Agency and Ofwat. And probably each company originally just thought itself. So that you know, we would have worried about our plants. Southern worry about their issues. Thames worry about their issues. But I think in the last 10 years, in the southeast in particular, it's become apparent, you know you can't solve all the issues yourself. And certainly Southern can't solve their issues themselves. And so we now have WRSE. You can have a quick look and they look for a regional plan. So we don't now talk about [co]'s water or southern waters plan and we talk about now constructing an asset outside of their region. So yeah if you want any you know I can put you in contact with Trevor Bishop who can wax lyrical about the process in the regions are, in particular.

00:32:22.680

E.S.: It does strike that governance works, perhaps we if it doesn't work you tell me, and because of networks. You talked about all the people that you know and you've spoken to and the administrative and local authorities and the enormity of the network involved just under the brief description you give me seems big seems huge. Is that how does that how, how important is your actual personal knowledge of people and your relationships with them in getting getting stuff done.

00:32:58.620

O.6.: I think it's very important, I think it is important. But at the end of the day, the authorities Ofwat, environment agency or local authorities will have to base their decisions on on the facts in front of them. And prospects. Although you know I might sit here and say well we've got pretty good relationships I don't think I don't think that really stands for a huge amount. I think it present opportunities to take opportunities forwards probably in a slightly less hostile environment than a local enquiry would do but, those decision makers yeah they're accountable to whoever they're accountable to.

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00:33:51.840

O.6.: For the authorities it will be the residents. It is the agencies it will be the Secretary of State. But I think everybody has always said this particular project it probably it should have been built in the 70s but hey we are where we are. No my sort of sort of knowledge or relationship with people has built up over time it's not I wouldn't I wouldn't say I get an easier ride from the regulators, because they think O.6.'s quite a good bloke in [co].

00:34:28.860 --> 00:34:30.210

E.S.: yeah

00:34:30.990 (16:37:21)

O.6.: I think it's...sometimes we find it quite frustrating to be honest because we think it's pretty obvious to do it, we got a pretty good idea, but we need to go into their governance processes, sometimes we don't appreciate it. So. Again it's a great little project, you could have a look at at the [place] Council site, what is his job title? Planning? His council is very good.

00:35:13.410 --> 00:35:13.710

yeah.

00:35:16.200

O.6.: So he's Council was very, very good indeed.

00:35:19.680 --> 00:35:20.040

Right.

394

00:35:21.720 --> 00:35:26.340

E.S.: And it's always a mistake, to treat your regulator as your friend. I can say that from my legal background.

00:35:27.780

O.6.: I know, you would like to think you can ring them up and have a chat and the end of the day, they've got a set of responsibilities to different people yeah and we've all got to do a difference job.

00:35:45.360

E.S.: Would you say that I know this project has all these benefits is that there's multiple benefits this project. It sounds like though it has an economic driver, behind it from your point of view. And from the water bodies, it sounds like it's more like we've got climate crisis, we need to sort out, how do we get water. How supportive, though, is the regulator or regime been or law or has it got in the way or has it been a support.

00:36:27.270

O.6.: to answer that, Ofwat.. okay to give an example.. Ofwat have never come across an example of an asset being built but for the benefit of someone else. And they had to think on their feet quite a lot, and about the principles and so for the regulatory contract, but both parties needed to take notice of. So I think um you know, yes, it was novel now we're getting more examples of that in the industry, and I think it was the first one to process and, indeed, I think, to be perfectly honest it's

...I've mentioned RAPID, a group of regulators, to ensure that these sorts of projects do go ahead yeah because quite often get so sort of locked into the regulator.

00:37:47.340

E.S.: yeah.

00:37:47.790

O.6.: So I think recognize that the regulations needed to evolve quite a bit.

00:37:56.730

O.6.: And again I would encourage you to have another look either on Ofwat site or under Rapid, they may have their own site, yeah but it's basically it aligns regulatory bodies to deliver investment.

00:38:13.320

E.S.: yeah. So I suppose from Ofwat's point of view as an economic regulator if [place] was being developed on Southern Water's land, for Southern Water, it would be cheaper for their customers than having this boundary that's being traded from [co] water.

00:38:41.670

O.6.: yeah that's probably a fair comment, of course, and being defensive their, they don't have the land and we own the right from the springs, yeah by history we're in the privilege. The regulator governs the return we get that's exactly what southern would have got if they had developed it themselves. Yeah it comes about to could they do it for a price low enough and the answer is probably no to that.

00:39:31.320

O.6.: but that's a fair question and valid question to put

443

00:39:34.680

E.S.: when people have talked to me before about projects which have novelty, they say, one of the issues they come across is the Environment Agency and and they talk to me about rigidity. That it's very money in and output money in and output show is what you can do it's got to have something defined. Is that something that you would you've encountered or is that on fair...?.

00:40:06.480 --> 00:40:08.310

O.6.: I can understand why people would say that. Let me try and give you an illustration on that. So before we produced the water resource management plan and the idea is to make sure you got enough water.

00:40:26.640 --> 00:40:26.940

E.S.: yeah.

00:40:27.510

O.6.: How can fill any gap, well you can increase supply like is being done at [place] or reduce demand. And reducing demand effectively means putting meters into people's houses.

00:40:45.330

O.6.: And Ofwat, sorry the environment agency, are very keen that companies approach demand management first before allowing resources to be increased. Now I'll be the first to say there is a role for demand management, but you know the fact that you put a meter into people's homes does not stop people using more it just means they have to pay for it. And indeed we have seen over the last year that meter users use a hell of a lot more water than justified

00:41:24.630

O.6.: Because the majority of them are at home and the majority enjoying the good weather. So when I look at supply demand balance and if I've got a reservoir sitting there with a volume of water I've got confidence that I can deliver supply to the customers where its needed. Relying on demand management .. And so I think this sort of Environment Agency focus on demand management management, demand management, demand management hasn't been helpful over the past. I think they are again they have changed quite a bit over the last few years.

00:42:11.790

O.6.: partly in response to the risks around climate change, population growth, resilience all those words are much more in their vocabulary, rather than just demand management So. historically, that is a fair characteristic.

00:42:33.300

E.S.: I suppose the past is not a good indicator of the future, and historical basis data

00:42:40.980

O.6.: and again yeah yeah absolutely. Yeah and people like M at the WRSE have done some very sophisticated modelling. Effectively what the rainfall levels might be, what resource we might have available. So, again I do encourage you, you know if you want me to put you in contact with so T or M I can do that easily or look up on their website

00:43:04.290

O.6.: on their website.

00:43:06.360 --> 00:43:07.620

E.S.: That would be brilliant yeah. And the other thing I wanted to ask you is I'm very keen not to go over an hour because it's disrespectful I said, an hour so I stick with an hour. And is. What, if anything, you would change about the regulatory regime or the legal regime or the system, what would make your life easier to deliver a success.

00:43:35.520 --> 00:43:37.860

O.6.: Okay, so I think I think here again I am going to focus more on Ofwat than the Agency, but, to a lesser degree, it is true of the Agency. I don't think we think in the industry in the long term. Thinking five year blocks, ad we just spoke about [place] that's going to take 10 years. And it will be an asset that will be available for a subsequent 80 or hundred years, you know. So the long term. Again Ofwat have recognised that their approach to regulation isn't always helpful to put things into five year blocks. So we, as an industry, we think about that. So Ofwar produced a new document you can have a look at PR 24. So this how they're going to regulate the industry price for you. yeah I think. I think the phrase long term is mentioned over 130 times in the document of 130 pages. yeah pretty much one per page. And I think they've recognized it's quite short term focus it has been in the past. Short term for us is five years, long-term its 25 years plus. And they need to overcome that so that

the people that put the money in, and it might take 10 years construct and it's certainly.. over a much longer period.... Sorry. Its how things are changing, weather patterns are changing, household growth and population in our area. So yeah that document would be a good a good one for you to just to understand and the the regulator, I think this recognized a lot of these things.

00:46:04.500 --> 00:46:06.600

E.S.: I think you mentioned something about levelling up. With the [place] project in terms of working in a deprived area and getting benefits.. Is that something that's being..

00:46:18.120 --> 00:46:22.470

O.6.: yeah that's more fluke really than design.

00:46:24.150 --> 00:46:24.540

O.6.: I think, I think yeah I don't I won't say the reservoir was located there because.

00:46:37.890 --> 00:46:38.280

E.S.: yeah. There is a practicality issue there.

00:46:40.740 --> 00:46:41.100

O.6.: It would be nice if we did.

00:46:42.300 --> 00:46:48.090

E.S.: You have to look at the policies around you and see where your project fits you and your business case policies and see where this fits and we can draw on that too, so our vision, you know that such thing as nothing.

00:46:57.990

O.6.: yeah indeed you know [place] Council are responsible for that conurbation

00:47:05.610

O.6.: And that is one of the reasons why they are so supportive of it, because they knew or hoped that people would take advantage of the reservoir and therefore it will give them access to green infrastructure

00:47:22.650

O.6.: so they may have a slightly different reason for supporting it, than we would, but it adds up to the same.

00:47:36.000

E.S.: yeah and I think that's all I have got and it sounds like a brilliant project, one that will be worth me what I'm just going through and general discussions at the moment people talking to me about projects and them so picking out common themes and how people are framing their projects and things and later on in the year I need to pick a couple of projects to go into more detail, and this one does sound like one that'd be really interesting to look at.

00:48:11.490

O.6.: I think it is but. I don't think you'll get any... in the water industry well in public water supply you won't get a project as live as this one yeah and I have to say I go to industry think I'm a bit of a

one trick pony is all they ever hear about, there are others thing we do. yeah we'd be yeah . and when when people have more discussions and you want to get involved more involved in some technical stuff. Yeah I can put you in touch with more people.

00:48:54.780

E.S.: that'd be fantastic and what I'm what I'm designing at the moment is them like a governance tool I'm a lawyer by background so questions that you've done a project would ask to have to ask itself I'm involved with tight box you come across Pipebots. There I bought I bought it says cross university project on introducing tiny robots into the water supply assembly yeah and tiny, tiny little miniature ones that that bigger than in it it's going to be that they and they will map and asset manage eventually, and so it's a tool for them as well that they might use in understand more.

00:49:46.620

O.6.: yeah we have investment at the moment in trying to understand flow better.

00:49:55.770

E.S.: So yeah.

00:49:57.630

O.6.: that sort of tool would be useful

00:50:00.240

E.S.: I think it's just so some water companies don't know where their pipes are so, you know it's Victorian some of it isn't it some of it and we don't always know whether we.

00:50:21.390

O.6.: understand sounds good

00:50:24.990

E.S.: them, so this project is going to go through the couple of years, so you're not going to hear from me necessarily in the next few weeks, but I'm more than happy to set to D and others to share whatever I find you'll get hot off the press and before anyone else. And I'll keep you informed To ask me or anything you think would be interesting for Lis to know.

00:50:49.290

O.6.: Well it's very much from [place], and what I'll do is I'll introduce you to [] the reason I say actually going to be retired later this year.

00:51:03.900 --> 00:51:04.650

E.S.: Okay, yes.

0051:05.070 --> 00:51:07.740

O.6.: And so, []. [] wants a split in his job he's the water resource manager got lots of different title to him. yeah I'm as a siren thing I think yeah have a look on our website about ticket. yeah have a look methodology period.

00:51:29.400

O.6.: If you look on there. I will drop you an email.

ES: What I'm not allowed to do, I think D may have explained what I'm not allowed to do is ask for people's contact details, what I can do is they can agree to send it to me so. What, what are Birmingham University don't want me or anybody else is going around contacting people out of the blue, they've got to know who we are and what we're doing it's it's really tight ethical code, I think it's great because they don't want people to feel intimidated or forced into anything ...

00:52:18.870

O.6.: You know. Given where you're located. Close to Birmingham, which is where Ofwat near the Bullring, I'm sure you can contact them and we can broker that

00:52:31.170

E.S.: Okay yeah. I won't keep you an hour as I promised.

00:52:56.940 --> 00:52:59.010

E.S.: it's been really, really helpful.

SM I can introduce you to [] as he won't mind he is like me. He'll talk passionately about the project.

00:53:29.910

E.S.: All I need.. Is him to agree

00:53:41.460 --> 00:53:42.450

O.6.: that's fantastic

00:53:42.870 --> 00:53:44.580

E.S.: I'm really really grateful it's really. Take care a..

:53:49.980 --> 00:53:51.210

O.6.: Okay, thank you very much.

00:53:52.140 --> 00:53:53.100

E.S.: Thank you bye.

P.7. Transcript 5th August 2021

Opened with confirming ok to record.

00:00:02.970

P.7...: So I was quite intrigued when I saw the request from S. And, and I kind of read through a little bit about the document that you sent through about participation.

00:00:15.089 --> 00:00:18.840

E.S.: yeah

00:00:18.930 --> 00:00:32.970

P.7...: and it mentioned about you know wanting to speak to someone who'd had experience of dealing with wastewater and clean water projects in the industry. But I'm not sure sort of like the context in which... is it about public engagement, stakeholder relations with respect to delivering these schemes.

00:00:33.930

E.S.: it's about the governance regime. Either it gets in the way or supports interventions in infrastructure. Like law, like policy, justice principles, regulation and hurdles that are sometimes invisible but shape the way that we behave

00:01:00.390 --> 00:01:05.970

P.7...: Okay. I've got some really good examples that I wanted to discuss with you just from a real life perspective and actually very, very recent and we're still on with them we're nearly finished on this particular job I was going to mention one particular one that's caused us quite a lot of issues in terms of that governance and planning permissions and highways issues. And actually the problem we've had is different departments within the same local authority are asking us for different things. One is asking us to accelerate and fit in with the you know for example, the highways team is trying to ask us to speed up the work, so we can fit it in in the school holidays and then you've got the local councillor, on the other side, who is saying well if you start in school holidays those kids aren't going to have anywhere to play on the green space anymore, you know. And we say well you can't have both you've got to have one or the other. And then she says well if you're not going to do that I'm going to call in the planning application and delay that. And I'm saying well okay, you will delay that but you're going to cause more traffic chaos, so that was the example I'm going to use.

00:02:10.290

P.7...: Where we have had difficulties with both Council officers, elected members and those processes like town and country planning issues and with respect to us as a water company with our water industry Act rights for permitted development, you know, that doesn't encompass everything so you know it encompasses certain elements of work, but you still got to go for planning for other bits so you know you can't leave a project half done or do something silly just to get around it.

And again there's another job I want to discuss in our in our chat today where the MP got involved without fully understanding the background. Actually prevented a planning application from being given to us, even though it was recommended by the Council officers Director for Planning to who

said, you know, quote, "if you reject this they can appeal and we will lose, you know, will end up paying the costs", but they still went ahead because it's public opinion, it's all about politics and they don't want to upset the locals by not fighting something. And then it put us in a position where we said well okay, we could appeal, but if we appeal the moral thing is, if we win and we will win, then we'd have to do the work. And if we do the work we're going to have all this anti-company objectors, you know sitting outside and protesting. Is it worth it?

00:03:36.390

P.7...: So, in the end.

00:03:37.080

E.S.: I can feel your frustration

00:03:40.380 --> 00:03:42.210

P.7...: I mean there are good things, and everything you know. There are good sides of the work, but you know, in the end, on that job we walked away and said, you know "I'm afraid customers were putting the bare minimum in here to satisfy Ofwat's requirement but you will still flood when it rains heavily and we apologize for that, but we're telling you now, we're here to fix it, we've been prevented by your counsellors, your MP and the local authorities, so please next time you do flood please understand, we've tried to do everything but we're going to forward any contacts that we get from you about flooding to these guys.

00:04:16.770

P.7...: You should be forwarding it to them, you know.

00:04:18.480

E.S.: Run through with me what the project was about on that one. Give me a bit of context for it.

00:04:23.670

P.7...: yeah sure this one where the MP and we walked away didn't really do.. we did the bare minimum. So the project was called W Road. It's called a DG five flood alleviation scheme. So DG five refers to the fact that it's on the Director General list for Ofwat on a number of properties that flood internally and probably externally as well during periods of heavy rainfall.

00:04:51.570

P.7...: yeah and you understand the background of you about the system and the way combined systems work that (yeah) okay.

00:04:56.790

P.7...: So on a heavy rainfall day, these properties flood quite regularly and hence they're on the Director Generals flood list. And therefore they're on the Ofwat list for this AMP period for us to resolve this these properties, I think there were about six or seven of these properties in a row and W Road in [town]. One of the [city] authority areas, but the planning application actually comes into [town] Council itself.

So our solution was to build an underground storm tank, relatively small, probably about 10 metres deep about 10 metres diameter to capture those excess flows during those periods of heavy rainfall, so that the properties didn't flood. And then, when the rain stops, pumps inside would then return

the contents back to the main sewer system for treatment afterwards. So they don't get out into the environment, and they don't flood the people's properties, and that was very basic. Now the locality of this area is quite a leafy suburb of [town]. Quite, let's say, it's more of a conservative area, but represented by three Labour counsellors and the Labour MP (I can't remember her name now. It was the [] who was running for leadership at the time when Kier Starmer was going....)...[MP] ward.

00:06:32.310

P.7..: So we approached the counsellors, early doors and had a zoom call with them during the covid lock down the first one, and said 'listen guys we want to talk to you raise this to your attention, we are planning to build a storm tank. We're looking at putting it in the corner of this park, nature reserve. It sounds really bad that we are putting it in a nature reserve, but having said that, I said to them look, this is the area where we want to put it and it's in the scrubby corner, which is overgrown with Japanese Knotweed and it's not accessible any way to the public'. And we're going to be there about nine months. When we finished, will make it all nice, it will be all grassed over, there's a tree planting scheme, there are some all the trees so self-seeding trees that needs to come out. We'll have a planting regime that approved by the local authority, and you know the landscape team, in advance, and I said what else we will do as well, we've been speaking with the guardians, the park officers, about this area and they said look, if you do it there it'd be great for us because you can make it more accessible for the future. And it's an underground storm tank with an above ground kiosk and event stack. So that's it, it's really non-intrusive. You'll open up the area for future for people so they can use it and walk through. You've got tree planting that we can get involved with and actually direct where to put the trees, but also we made a commitment that we would give them some other money for improvements and maintenance within the nature reserve itself so dredging out the pond which had been overgrown, some of the decking and the boardwalks needed replacing. and we were going to do all that for them so they were really on board with it.

00:08:15.570

E.S.: Why did you choose that location?

00:08:17.910

P.7..: Because we had done an optioneering scenario, with different options for suitable locations and the only location that was suitable that could fit the storm tank and actually be built and constructed was in this corner of this this nature reserve. We did that full exercise and we explained this to the local councillors. They came up with some very good points to say to us why can't you build it in the corner of the road, in the junction and we said well, one it's very difficult to build probably impossible to build. Two when you do need to access it because there are pumps inside we wouldn't be able to do it very easily because of where isn't in a road junction, it's not very safe and we'd cause disruption in the future. But also the main thing is the environmental one which is we'd have to take out...these are very leafy very mature, nice tree lined roads. And actually to build that in there because you've got services in the road already, we'd have to take out quite a lot of the trees, the mature trees.

00:09:26.550

P.7..: Rather than taking out seven or 11 of these self-seeding trees and actually putting a planting regime in to compensate back, we'd have to take out basic street line of mature trees that have been there for many, many years and make the area what it is.

00:09:45.090

P.7...: So we talked to them about it, explained why we've had to pick this location, and everything seemed okay for a while and then some word got out about it, and it was like okay they're doing the planning work in our nature reserve and next thing you know everyone was up in arms about it.

00:10:02.310

P.7...: And, as though we were trying to destroy the nature reserve, which we weren't, we were actually going to improve it. And when you put planning application in you know for a construction project you do need to include for things like temporary car parking area for the site staff. You need cabins and things for welfare facilities. Because the last thing you want is have a minimal compound and then end up with all your workers parking on the streets, outside people's houses and blocking drives and things and then where do the deliveries come, you know. You'd like to have a larger area that you can put back afterwards, but then it means everyone is off-site, self-contained within a fenced area. Everyone's happy. There's no wanderers. Health and safety wise everything ticks the boxes.

So when you put your application in it said, you know temporary car park, they were like, why are you putting a car park in our nature reserve, this is ridiculous, you know because they were getting the impression it was like an NCP type car park. No permanent you know for public to park and we charge.

00:11:03.810

P.7...: Ridiculous. It wasn't at all. It was temporary, for the guys on-site to do the job, and when we finish all the stone gets taken back up, everything gets re-landscaped, gets put back to how it was. And I've got pictures of the other job which will show you exactly what I mean where one day it looks like a construction site and then a few weeks later it's all been turfed. When we went a bit over on that one because we turfed it.

But anyway, so this public angst against the project kind of initiated at this. And in this day and age of social media it's very easy everything gets out of hand very, very quickly. A Facebook page was set up, 'save our [] nature reserve', the MP was got in touch with. Now the MP that approached us about it, we spoke to them and said this is what we're doing, this is our explanation we'd like to talk to you about it. They'd never actually accepted any offer previously to respond to our requests. But it was only when the locals got involved. So we said come on what we'd like to talk to, but it was too late, then because she'd already made her mind up to join the anti-group. And politically you can't then be told the truth later because you can't you'd have to change your mind if you're a sensible person. So the easiest thing to do is don't meet with the other side, and then you can just deny everything and say, well, this is my view of it yeah.

00:12:24.060

P.7...: So we had a huge amount of angst against the project. There was a [city] Evening News got involved started a petition against us, but all the time, without actually knowing and understanding the fundamentals of what we were doing and why.

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00:12:43.800 --> 00:12:44.310

E.S.: that is so sad [].

00:12:44.

P.7.: Well, the locals then we say the locals. The locals were very argumentative about it and we said look, we met with them, we met them on zoom calls and had had a sort of town hall meeting with the MP present. And they're asking us questions and they said, you know 'why can't you build it here. I've measured the distance in the road from corner to corner the junction and it's X number of metres, your tank says it's X number of metres, therefore, you can build in there, why can't you put it there'.

00:13:08.760

P.7.: And you know I'm not sure about your background Lis, whether or not you know you are construction minded or you've probably know something about it, but we're not talking Lego here. You can't build a storm tank off site, this big, and then bring it along and then just drop it into a hole. If your spaces 10 metres I'd suggest that is probably about a third or a quarter of what you actually need.

00:13:32.970

E.S.: yeah

00:13:35.220 --> 00:13:42.270

P.7.: If your hole is 10 metres, you need X number of metres on the side for walking around, X number for the crane, X number as a means for access, storage areas, you know when you're excavating the material, where does that go, you know, because lorries need to take it out. This would have all been included in our original plan, but they're saying no, 'you should build it in the road, we've worked out', (because everyone is now a civil engineer, you know), so there's always there's always an ex engineer on these panels anyway that they've dug out the grave somewhere, who then pipes in and says s well you know in my day we could have done this'. Well actually in your day you know, you didn't have things like CDM regulations and health and safety executives looking at you, you know with beady eye and making sure, everything is compliant, and that's the world we live in.

00:14:22.080

P.7.: So anyway, they basically really objected, and we went we went to planning and the storm tank itself is permitted development. We don't need planning for it. All we needed planning for in this case wasn't even the kiosk, I think the kiosk was less than 29 cubic square metres, so really the only thing we needed to apply for planning for was event stack. You know, to let the air circulate so when imagine you stopped and when it fills up that void of air needs to escape somehow if it's covered completely there's no air flow and you'll create a pressure and it'll blow.

00:14:56.550

P.7.: So you have event stack, and all it is, it's not even an odour control vent stack it's just to allow pressures to equalise, basically.

00:15:03.600

P.7.: And so what t we could have done initially, if we were to be really a stickler for the legislation we could have said look planning authority [town] Council. You understand this is permitted development. We're not going to put any planning application in for this job. We could have said we're going to build an event grate at ground level rather than a stack above ground so therefore we're bypassing planning, we do not need planning. But we did the right thing, because we wanted

event stack and therefore we then came under planning regulations and we thought okay well we'll put the planning application in for our event stack. And they all objected, fair enough, it went to the hearing to the committee, and everyone spoke everyone raised their objections. And the Council Officers listen to them, the Planning Officer said look I've reviewed all the information I've read all the complaints have read all the objections and, in my view, this is recommended for approval.

00:16:00.360

P.7.: And the planners, then had a chat with the elected members, they said we're not, we want to reject this application and the officer said if you do again, you know I'm recommending for approval in the eyes of the law, I can't defend this if they appeal, we will lose will end up paying the costs which, in this day and age of austerity, with Councils, not having money it's not a great thing. The Director of Planning then chipped in and said look I, I agree with my officer they've done all the right thing, it is permitted development well most of it any way they could still build it without planning application. So this is my recommendation.

They rejected it. So we went away and we said look we've got a choice now to make do we either appeal this win and then not build it. Which is quite bad. Do we appeal it and then build it and then have the locals really fighting us goes about it, or do we not appeal it and walk away and say thank you very much local authority Council members. MP, this is our decision we're going to do the minimum to meet the requirements to say to Ofwat what we've done is as much as we can do, but without really creating an absolute ruckus with the locals and the Council and the Officers. We have still got a relationship with them, that we've got to do other things in the area, you know we can't make enemies. We're going to walk away to do the bare minimum and raise some kerb levels to reduce the internal element, the flooding, but they'll still flood externally, we said. And also there's no growth in that network, then for future growth, climate change and all those other aspects for that design horizon up to 2030 2045 whatever it was at the time.

And, and we wrote that strongly worded letter back to the MP and the Officers and I gave them a phone call each and I said look I'm really sorry but you've kind of brought this on yourself, really, and if you do write to me about flooding for these particular properties that we've mentioned here we are going to tell you that we had a scheme and we can't deliver it for these reasons, as you know. And we're walking away and if you've got any problems with it you've got to sort out yourself.

Because they asked us questions at the time, like if you don't build this project here and we object to this location.. this is what the MP said to us, [], she said you'll have to come back to us with an alternative location. Yeah. Now we would come up with some alternative locations, but unfortunately, all the other locations were not very suitable to start with, because of hydraulics you know. We are not building a supermarket here. You know it's not the impact on a customer having to drive one minute extra to get around the corner to go to a different location.

00:18:45.870

E.S.: Its moving the water around.

00:18:47.490

P.7.: It's all about gravity, yeah, and if it's not in the right location topographically then it's not going to work or it's going to cost more money whole life yeah because we're pumping. And when she said you just have to build it somewhere else won't you. Well actually, no, Rebecca because if it goes above that threshold of value for money, much like any Council project, you know, we would have to

reconsider whether or not it's feasible to do it, because if it's not feasible economically to either build in the first case or whole life total cost, we would have to consider not doing it.

00:19:23.610

P.7.: And you know I said, there are plenty of people out there at the moment, who flood, who we don't have projects for yeah the Ofwat aren't chasing us to do, that we could help out. So you know I'd rather, you know as a business, you'd rather spend the money where people want you to come and deliver a scheme to alleviate flooding, rather than where you've tried your best and people just fighting you all the time.

00:19:45.420

P.7.: yeah, so in that case we walked away and we said look we're not we're not doing it because we don't want the aggro of the [city] Evening News, plastering our name all over the place and fighting against locals, delivering a project which actually is in the benefit for people, but they wouldn't see that it just be [CO] are destroying an environmental treasure yeah. A nature reserve, and you know, we had people writing in from New Zealand telling us that we should be building this project here because they used to love walking in that part when they were a child.

00:20:18.870

P.7.: Okay, yes, but you don't live there now is my argument and you don't flood and so maybe you have a chat with these people who flood and say you know what do you think about this, and they go well, every time it floods and rains heavily I'm in constant fear of flooding with sewage mix in my in my cellar on my back kitchen that put a completely different light to it.

00:20:41.670 --> 00:20:44.040

E.S.: what did the people say in those five or six houses?

00:20:44.220 --> 00:20:47.340

P.7.: One of the one of them actually objected to the planning application. So I wasn't too bothered about that in the end because I said, you know if you want to object to it and we're trying to help you then then fine I'm quite happy to walk away, but we did feel sorry for some of the other people who didn't get the full protection that they should have got.

00:21:03.750

P.7.: And they've only got the internal protection they're still got flooding externally, so that was one example where you know the planning you know kind of disrupted us and the local authority, the governance, and the way they work, and even the law really, let us down there.

Because they were instructed by the Officer to recommend it for approval so she looked at it from in the eyes of the law and the legislation to say have they done everything right, yeah. Have you ticked all the boxes and crossed all the t's. Yes we had done everything. When locals get involved and it's elections, it's votes, then people change their tune and they'll do things that they wouldn't normally do.

00:21:51.000

P.7.: And my concern, as well as... they're concerned as well, was, I think a utility company under Water Industry Act, doing something on land that was technically protected. It opens the floodgates, they thought, for housing development on there in the future. And that's what people fear all the

time, you know this current fear from everyone is about building houses near your house near your home. They're is all this nimbyism thing you know where people crying out for houses, for their children, because their children can't get on the housing market, but at the same time, they don't want anything near them. They want it away from them.

00:22:27.960

P.7...: So again, this was the fear that locals were, the main protagonists of this argument we're trying to instil fear in people. That you know this will open the floodgates and before you know we're like we're gonna have a housing estate on the park and you're going to lose it. And this is what they say for all planning applications, you know, before you know the crime level is going to go up you know people are going to get murdered, you know, immigrants are going to come in and take all our jobs, et cetera et cetera cetera and you know it's not it's not fear mongering with people and, once you get that fear and also it's like oh, by the way, here's a template for an objection letter just put your name against it and send it in. You know, so they don't have to do anything. So that that was one example in [town].

00:23:12.210

E.S.: A couple of questions.. It sounds like from what you're saying this, and this is a theme that's been picked up as some of the other interviews, there's a difference between the law in writing and the law in practice?

00:23:23.790 --> 00:23:24.120

SW yeah. yeah

00:23:31.230

P.7...: Project yeah and I completely agree that you know object into a planning application is a democratic right. It's a fundamental part of our planning process. But also the other side of it is the argument needs to be heard and adjudicated on by someone with the knowledge of the law and background to be able to make that decision and in our world, that person is the planning officer because they are qualified in town and country planning legislation, and we've got qualified people who make sure that our applications tick all the boxes, you know. And you've got Mrs Miggen's down the road, who, who was you know no disrespect to her, but she got nothing to do with plans doesn't know about construction, who is saying something absolutely ridiculous like build it in the road that's a completely unfeasible. I'm an engineer and I've looked at it and I've measured it so therefore it must be able to be done. And then they made their decision based on that.

00:24:31.410

P.7...: Because the decision ultimately isn't made by the officers, its made by the elected Members who sit on the planning committee. Who aren't experts.

00:24:41.100 --> 00:24:46.860

E.S.: you made a comment about you could have bypass planning, but you wanted to, and I think your words were 'do the right thing'. Could you just expand on that a little bit see what you mean by the right thing.

00:24:54.660

P.7...: In the past, so for major schemes like these detention tanks I'm not talking about works on our treatment works, you know where it's really big stuff. These are, it still looks really big construction

wise because you're building a huge shaft in the ground. Okay. But when you finish it doesn't look very much you don't even really know to me might be a few hatches on the ground level but as I said before, tanks below ground structures are permitted development and ground level structures are permitted development, so we can build a tank at ground level with some concrete hatches around on the top that you'll be able to see and you do not need planning permission, we do not need planning permission for that, okay.

Now, quite often, we do need an electrical kiosk if it's above well before the legislation changed a few years ago it was any above ground kiosk and then I think they changed the law slightly to say to fit in line with the water side, rather than the wastewater side, water was always below 29 cubic metres was permitted to development only on the clean water side. Not wastewater side, but then they brought them in line so they both became 29.

00:26:10.560

P.7.: Now, if you don't need a kiosk we don't need planning we'll just tell the locals will leave with the landowner and we'll build it, yeah. We don't need permission to go on to private land. We can serve them a statutory notice, which gives us 90 days notice we don't like to use that we'd much rather have the conversation with them and say to the landowner this is our plan this what we're doing and do it nicely.

00:26:30.720

P.7.: Now, in the past we've done projects without revealing the full extent of what we're doing, we could we would have put in, maybe an application for just the kiosk. We're building the kiosk and event stack.

00:26:47.880 --> 00:26:51.270

P.7.: yeah it looks like nothing, probably no one would object. We'd be given planning permission and then we'd start on the whole scheme and say oh, by the way we didn't tell you that actually attached to this kiosk is a huge or this case a 10 by 10 and shaft underground shaft that's part of the job. And therefore, the actual site that we need to build it is actually much bigger than you thought, because you thought we were just going to bring the kiosk in and plug it into the ground. Nail it into the ground and that'll be if we're, naturally, in fact, by the way, I forgot to tell you we're building this ginormous shaft as well, which then requires all this extra area. So we're going to take off, I don't know a massive chunk of the park, we're going to have a temporary carpark, cabins and all that sort of stuff and you go oh my God I didn't think you needed all that support kiosk. Oh well, actually we didn't tell you, but as well, but you shaft is permitted.

00:27:44.550 --> 00:27:47.670

E.S.: A PR exercise ? more than that really

00:27:49.170

P.7.: yeah we've had complaints and things because you've deceived us, you told us, you were just building a kiosk. Well, actually we don't like to do that now we'd rather tell you the whole story and say we're building, but the only bit that needs planning is this.

00:28:04.080 --> 00:28:07.200

P.7.: So really, when you when they object they're actually objecting to the fact that we are building the storm tank because of all the extra area take it up, and then they believe we're destroying the park, when really from what the planners are saying, they don't they can't consider those objections to that bit. They can only consider objections to the kiosk.

00:28:24.630

E.S.: That doing the right thing is really bringing everything out in the open, giving people information, so they can they're not surprised when they've got people driving up and down into the carpark.

00:28:35.580 --> 00:28:37.560

P.7.: So you're in you're in my position this and say, right we're going to be liaising with stakeholders, what do we tell them. You've got two options. You tell them the truth and say look we're putting applying application for just a kiosk an event stack but actually the project it's much bigger, so if you're going to object, you can only object to the kiosk.

00:28:57.780

P.7.: And that's what we did, and they objected, but they didn't object to the kiosk they objected to other things, and the planners, even though they told the officers and the committee members that they're not allowed to consider those, they did and rejected the application unlawfully.

00:29:11.190 --> 00:29:15.210

E.S.: This is a really difficult question and it may be too raw (laughs). Is there anything you if you were advising yourself looking back.. or advising other projects who are going to face this sort of issue - what advice would you give them or what would you have done differently if anything?

00:29:36.090

P.7.: This is really hard because I believe that we did upfront consultation with these counsellors. We spoke to them early doors about this and said look we're thinking of this project, this is what the outline pioneers when we've got more information, we can speak to it and we did, and we spoke to them and they were completely on board with it.

00:29:58.350

P.7.: We spoke with the local residents and the friends of the park, you know the friends of the nature reserve there's a local group yeah, and they were okay with it at the time yeah. But, unfortunately, when word got further out with people that we can't consult with because the area is just too big. When it's people who use a park who don't actually live in the area or even in the same borough, you know. They're coming in from external because you know [town] is not a large borough. And then, once they started getting on board and they started contacting the newspapers and everything we I don't think there's anything we could have done. And then what happened was the people who had been consulted all started to change their minds.

00:30:48.330 --> 00:30:50.760

P.7.: To say right okay I'm against this now. And it's just. We always say you know, we had some problems because we couldn't do what we normally did. For major projects like this, we would have had a local community event, where we would have bought a Community Hall invited people down

and had a selection of site members construction team contractors available to talk about the project and why we're doing it. Yeah and we would have invited the local councillors to kind of hopefully come on and support us. Well, because of covid we couldn't do that.

00:31:21.900 --> 00:31:22.830

E.S.: Okay right.

00:31:22.890

P.7.: So we have to do we have to do just the leaflets which we normally do leaflets anyway and give them out through we've got some good leaflets to show what we're doing it's all. In a very customer friendly format it's not very construction type. But it's more like friendly designed. And we spoke with people and they did lots of door knocking and speaking to individual customers, you know at length at distance at the doors the only problem is you can't capture everyone with this type of job because it's an a park, there are people who use that part that don't live locally.

00:32:00.270

P.7.: yeah we'll never be able to capture them unless you stand at the park gate weeks and then trying to get everyone. Yeah I feel we did a lot. We were hampered by covid obviously.

00:32:15.750 --> 00:32:26.190

P.7.: and I think the MP really didn't take the opportunity to engage with us at the right time, even though we offered and then it was a bit late, then.

00:32:27.570 --> 00:32:31.830

E.S.: In terms of them some people and different projects have said that they have different issues over development, depending on the demographics.

00:32:38.160 --> 00:32:39.960

P.7.: yeah

00:32:40.020 --> 00:32:47.520

E.S.: yeah a lot of green and blue infrastructure tends to take place in posh areas and lot of objections to less desirable development tends to occur and push areas there's even some suggestion, the academic in the academic literature that things are sited where there's going to be less resistance. You know so I'm in getting. Does that fit your experiences at all [], as that is an academic thing, you're the man on the ground.

00:33:08.790

P.7.: I'd say for us it's not reality, because.. it is and isn't in certain ways. Right so from where we would choose to site things we can't site them where we would like them or where people would like them so that's not a choice for us.

00:33:23.550

E.S.: Because of water hydraulics.

00:33:25.680 --> 00:33:28.800

P.7.: Absolutely, yes it is, we're driven by gravity.

00:33:29.130 --> 00:33:29.610

E.S.: Yes.

00:33:29.970

P.7..: You know, some areas go, 'oh, you know', for example, look at the area covering the Northwest so you're covered by Severn Trent. Severn Trent Water. Where we're covering the []. So you go to somewhere like [], for example, okay very Labour even though it's two conservative MPs.

00:33:55.650

P.7..: They represent the fringes that the few nice areas, yet that are there, there are some areas of [] that are very leafy, very conservative, but the whole centre of [] is very, very Labour driven, it's a Labour run council.

00:34:09.870 --> 00:34:22.830

P.7..: yeah now there is no space for us to be building anything in Labour in [town] Councils area that they cover, there is not really any green space at all for us to be doing things, apart from one that we did recently, and that's just for infrastructure, you know. When it comes to a treatment works all their all their waste goes to [] wastewater treatment works which is not even in [town]'s area it's in fire it's in [] Council's area. So you can see there you've got [] is very conservative it's very you know the way they are they're like So blue bluish you know type counsellors and everything but we don't vote, you know we have everything has to go to Fleetwood and then you hear [] councillors sometimes complain this are you know it's not right that with should be taken or [town]'s waste as though as though your waste smells nicer because you're a Conservative or you earn more money than someone who's claiming benefits, you know all it's all the same waste isn't it.

00:35:22.710

P.7..: I've had personally, I'll tell you this, I've had people in the street come up to me and say customers when we do door knocking, why are you building this waste, this storm tank, not fully understanding what it does, because it's protecting people from flooding, why are you building this sewage farm, is what they call them yeah. They don't understand. Why are you building it here when there is a perfectly good Council Estate over there.

00:35:52.200 --> 00:35:54.750

P.7..: yeah is that is some of the actual verbatim that I've received albeit a few years ago.

00:36:01.320 --> 00:36:03.270

E.S.: nimbyism. Oh, my goodness.

00:36:03.330 --> 00:36:03.960

P.7..: yeah. But that just goes to show you sort of the undertone thoughts and behaviours of people that you are dealing with.

00:36:13.860 --> 00:36:15.360

E.S.: A difficult question on this one (and I want to have time to talk about your other projects). Is there a lack of trust between sort of water companies and customers, are you seen as an authority, is nothing that deep, or is it just literally nimbyism?

00:36:32.010

P.7..: A lot of it is nimbyism and a lot of it is, is that we're concerned about people building things near our homes, we don't people building things around.

00:36:42.060

P.7..: But also, and recent events haven't helped us as a water company, you know the Southern Water debacle with them very, very bad for the industry, and we are feeling it now. I got a phone call today from a problem that we're having with one of our treatments at []...there's a problem with one of the odour control units and they've got somebody to fix it, they've got a plan to fix it. And, but locals are now on social media discussing all sorts of conspiracy theories and one of the theories, is that we are storing all the waste and not treating it and then discharging it at night when no one's looking yeah now treatment works are 24 hour operations. We are monitored and highly regulated by the EA which is what we tell people we've just been given that the highest rating from the environment agency for the water side. And it's just completely not true, but I do understand where they're coming from because, with Southern Waters recent episodes in the court case in the fine, I am not surprised people think that, but we are not the same, you know, you can't judge everyone might same. But a few of the companies, in particular, you know Southern because of the bad behaviour and [] because of the way they've run the business taking out all the asset stripping and taking out all the money and living on debt. You know, having offshore accounts and all that stuff doesn't help us in the world of you know where customers can choose.

343

00:38:10.020 --> 00:38:12.780

E.S.: yeah it's hidden isn't it they're worried about.

00:38:12.930 --> 00:38:19.980

P.7..: we are still in that world where we aren't able to choose who we go to for our for our water for domestic supplies. So you living where, you are you can't pick up the phone, one day, and you know I've had such a horrible experience with Severn Trent or United I'm going to change. I'm going to go to Eon and I'm going to change Npower Eon or to whoever I'm going to keep changing because I'm not happy with the situation great you know, but you can't with water you don't get a choice. Yeah no you don't get a choice.

00:38:47.400 --> 00:38:51.540

E.S.: a lack of empowerment I suppose

00:38:52.530 --> 00:38:53.670

P.7..: Well yeah yeah.

00:38:54.900 --> 00:38:56.670

E.S.: That is a really interesting perspective [].

00:38:58.140 --> 00:39:08.910

P.7..: with other customers, and that's how people see us, that's how people see us as a business they don't see us as like someone to engage with like a company, where you do have a choice yeah.

00:39:09.480

P.7..: They can advertise, they can promote the services, a lot of people never contact us at all throughout their whole lifetime of working with [CO] until they have a problem. Now, only at that point when they have a problem they'll call us, yeah.

00:39:26.790 --> 00:39:27.690

P.7..: And so. That's another thing is, is that you know yeah people just see us as [CO] it's the people I have to pay my money to every month and get a service from that I'm not really bothered about. The service is the fact I've got to pay them every month. Rather than realising what they're actually getting, which is a plentiful fresh supply of pure drinking water, that you can drink. We can take your waste away, you know.

You get people saying to me in the street, you know.' I don't get it, you know I've just seen an advert on TV for water aid and they can supply this African village for a pound a day, or a pound a year, you know, a pound a month'. Yeah okay, yes, they can, but you do realise, you know they still have to walk every day to the well to get it, you know six times a day for and put it in a five litre jug and carry it on the head home. You get the luxury of turning on your tap every day and actually the luxury of having it tested and analysed and kind of validated by the drinking water inspectorate every day of the year.

00:40:34.830

E.S.: Have we got time to talk about the second story?

00:40:37.590

P.7..: I'm free I've got time afterwards

00:40:39.900

E.S.: I plan to keep the interest to 45 minutes but I'm conscious that there's an interesting project that you've got that you might be able to have time to share with me if you don't mind.

00:40:54.870

P.7..: This is kind of like therapy, for me. I think it's therapy as well to get some of these things off my chest (laugh).

00:41:02.520

P.7..: So this other one and it's called [place]. [place]. And it's in a place called [] in the southern part of the [city] city region. So again it's a flooding alleviation scheme very much like W Road and similar thing we're building a storm tank. We're building a kiosk, vent stack and a vehicle lay by you know cut into the side of this green space. It's not a park. I keep saying this it is a pocket on a housing estate with a green space in the middle.

00:41:40.770

P.7..: I've got a little selection of photos I can send over to you after to explain it to you, that's really helpful. So again, because of covid we spoke to the three councillors...three Ward Councillors, three Labour Councillors, as Labour Council, and said to them we'd like to talk to you about this project and would you like to let me know if you can send me some dates for a meeting.

00:42:08.520

P.7..: Now, the only people who responded out of the three councillors and the parish council were the parish council chair, who responded and one of the counsellors, a chap, councillor gentleman chat and the two lady counsellors never responded to me.

00:42:24.990 --> 00:42:25.320

E.S.: yeah.

00:42:26.190

P.7..: And on this job we are connecting got about 12/15 houses, who flooded regularly internally and building a pipeline from their close, down the road, about 400 metres down the road, to the nearest place where we could, in a green a green space, where we could put a storm tank.

00:42:47.040

P.7..: Okay now this green space, not a park, I keep saying this. It's owned by the housing company so it's not Council owned, the other one was Council owned, this is owned by the housing company, who have kept it and we propose to build a storm tank in there under permitted development but planning application in for the kiosk the vent stack and the lay by.

00:43:12.210 --> 00:43:12.510

yeah.

00:43:13.680

P.7..: And also, we needed to lay this pipe down the main road, about 400 metres, so we needed highways involvement for a road closure we couldn't do it on a temporary lane enclosure.

397

00:43:24.180 --> 00:43:24.480

yeah.

398

00:43:25.620

P.7..: So we're in very early negotiation with the highways authority, at [] Council, who said, please can you accelerate the scheme because we'd like you to do it in the school holidays, this was during the first covid lockdown.

00:43:44.130

P.7..: And they said well, if things relaxing later on in the year we'd like you to have it start as soon as you can in July, so that at least most of it, if not all of it can be done by the time schools go back, if it's relaxed and schools go back.

00:43:56.340

P.7..: yeah we'll work with you on that. So everything was fine, the planning application went in. The planning officer has had a really good relationship with us and said look there's no issues here, no one's complained. I'm not even going to send it to committee I'm going to use delegated powers to say look, this is very much nothing or nothing, run of the mill. We're going to approve it, and then you can start on bearing in mind, we know that our colleagues have asked you to accelerate it.

00:44:22.560 --> 00:44:31.170

P.7.: everything was fine. Last minute, week before planning was due to be given by delegated powers, these two counsellors crop up out the woodwork. And said we've not been consulted on this and we understand you're building this great big storm tank in the middle of our park and we're concerned that our kids have nowhere to play on through the summer holidays.

00:44:45.690

P.7.: Well, one it's not a park. Two it's not yours at all anyway, it's not Council owned so Council don't really have a say in it.

00:44:56.190

P.7.: The Bellway Homes, who own the area, have been consulted and we've served them with statutory notices to work on private land, so they understand it, and they said fine. We are actually accelerating because you your colleagues from highways have asked us to and, secondly, you know, and the last point, really is we're in lockdown, so the kids shouldn't really even be playing outside anyway, at this time, so any normal person would say Lis, they would say actually if you're going to do it now.

00:45:26.730 --> 00:45:28.110

P.7.: This is the best time to do it when you know your classed as key essential workers get the project done while snow everyone's locked down.

00:45:33.120

P.7.: yeah anyway, she really objected and said we're going to lose this green space for the duration of the holidays. And I said yes, you know but really it's a good thing, because once that's done and the tanks in place, you can never build anything on top of it you know, without great expense and it's kind of them protected. So she went okay right yeah but she said I'm not happy, I want you to make sure you give our children green space to play on through the summer, and I said, well, we can't you know we need that whole area for working area again that argument about storm tanks only this big but you need four times the size of it for the car parking area and everything else.

00:46:13.350

P.7.: So we had the conversation with her and she said right I'm not happy I'm going to call it in for planning i.e. she wanted it called into Committee, rather than being given to us under delegated powers so she's got the right to do that, even though the officer said well there's nothing really going and I'm not bothered, but she threatened, so we couldn't start the day we started, we had signage you know for the pre warnings we have to put signage on the roads to let people know that there are roadworks afoot. You have to give people ample notice. So that was all out, we have to take all that back in our costs, you know and we got to do all that all because she objected, and then it just got into a real heated debate between Council officers who were trying to do the right thing, but who are beholden to the elected Members who effectively run the Council.

00:47:10.560 --> 00:47:10.830

E.S.: yeah.

00:47:12.390

P.7.: And so I'm like, I'm like okay. You know, you are telling us that, [CO], you need to do more to help flooding in the area and, secondly, your telling us to accelerate the scheme to fit in with it, and

then, at the same time you've got your planning department, who are now holding up planning because this Councillor has objected. So, in the end, the director of planning actually got involved and had a conversation with the councillor to basically tell her, she was wrong for delaying this project. In the end, right, the director called me and said [] I need you to do something to rectify the situation. Okay what, what do you want me to do it says, I need you to go and speak to her and apologise for poor communication.

00:48:03.780

P.7..: Okay, so basically she had us by the proverbials. Because we had to get started on this job ASAP in order to get as much of the work done before the summer holidays. So it was like okay right, so I went down and bit my lip and apologised for poor communication, even though I've got all the evidence and information requesting her attendance at these meetings and that they never responded to. But I did it to get the job done so anyway, she accepted my apology she took away the objection. We got the planning through permitted development for the for the planning and we got started, albeit probably about two months late all in all, because we, we had to restart.

Have I not had video on all this time?

00:49:05.280

E.S.: No I just thought you were having a bad hair day P.7.

00:49:07.410 --> 00:49:08.970

P.7..: Sorry, no, no I've just realised it. I apologies for that.

00:49:13.110 --> 00:49:15.090

E.S.: people turn it off as some people get better connectivity, its no problem.

00:49:18.150

P.7..: yeah yeah yeah oh nope no problem, and what what I can do right and have you got can you do what you need to set your thing to allow me to share my screen.

(sorting video and screen sharing)

00:49:40.980

P.7..: Okay, let me, let me try that enable video audio and just try and see out how much, am I, here we go participants and invite chat know share screen here we go.

00:49:52.170 --> 00:50:05.820

P.7..: I'm gonna share my screen because I've got and just have a look at this so anyway.

She relented in the end and we were late starting and then we managed to get on site made good progress, and can you see it yet. So you can see.

(looking at pictures of blank green space, typical of new build development. No shrubs or trees but a lot of grass. Can see building site and then recovery of green space with concrete area)

00:50:15.060

P.7...: They had one gripe about the first photo was the construction, you can see, the size of the construction site yeah. They were unhappy with the amount of concretes we actually relented on that one took some of the concrete out. which shows. And what you've got now, which is on the right hand side. yeah and that was that was those two photos were probably four weeks apart.

00:50:39.780 --> 00:50:41.070

E.S.: wow gosh.

00:50:41.130 --> 00:50:46.890

P.7...: They were four weeks apart yeah and this it was like before.

00:50:50.310

P.7...: Right we've put a brand new storm tank in. So the bottom photo shows you the cover. And the one at the top kind of showed you the extent of the concrete working area, okay so.

00:51:11.220 --> 00:51:23.340

P.7...: That was one where that where they objected to it. So, then they weren't happy with the level of concrete, so we had a conversation with them and said we'll take away some of the concrete, but that last hatch needs to remain because it's for safety, lifting equipment to get to the pumps you know need equipment on, you can't put it on soft ground, you need to put on hard standing that's why there is concrete.

They wouldn't listen they're still unhappy with it and then started speaking with Council officers about what we were doing, saying it was wrong. It's a ground level again, you see there's so there's no planning issue. They told them, there's nothing you can do it's permitted development and second it's not Council owned land, so they don't even need to get permission from suffering Council or don't even need to serve the notice to [place] Council because it's not our land.

00:52:01.590

P.7...: And we do work on developers land quite a lot, you know and quite often we're helping them with infrastructure for the new developments, because without it, they can't build houses.

So the last thing was basically we had planned to build a lay by you know for a vehicle, for an operations guy to stop by, if he needs it. We decided then that because of all this fuss over losing green space, we said we're not going to build a lay by. We don't need to build a lay by and we're just going to upset people by taking more green space than we really need to.

00:52:35.190

P.7...: So we decided not to. So when you've got a planning application for something if you change the location or the size of the kiosk or move it somewhere else you need to go and get it amended.

00:52:45.090 --> 00:52:45.480

P.7...: Because the decision was based on where it was in your planning application when you choose not to do something, we tend not to really go through the process. You just tell the office and say, by the way planner Mrs planner we're not just we're not going to build this we've decided against it, but really she probably says well you've got three years to tell me because your planning says you've got three years to start construction, you know, and if you don't your planning then

becomes invalid and you can't build it, but if you didn't tell me anything, then it doesn't really matter, because when it expires it expires, you have to go for new one.

00:53:24.930 --> 00:53:30.150

P.7.: Because the locals and the councillors were so upset with the other things, they objected to is not building the layby. Even though on the same token, they were complaining about the loss of green space. So I'm hearing the complaint about loss of green space because you've got these concrete covers and you've got your storm tank in the green space yeah but then, at the same time they're trying to argue for is not building the chaos, because I don't know so again it's one where the locals were getting on. It's constantly on Facebook. Can you not put covers on this, can you not reinstate...that second photo you know the highway yeah there's an area block paving that we've reinstated, as it was, but when we've laid the pipe in we've only done one side of the road, which is absolutely normal within the industry.

00:54:17.550

P.7.: You don't do it because that's just the way roads are and the legislation says we don't have to, because otherwise your water bills will be twice as high costs because we would be reinstating Council roads everywhere.

00:54:28.950 --> 00:54:39.810

P.7.: This particular resident the Councillor, wants us to reinstate the full width and their argument, they said to me in a letter that I got was, if you're not putting the layby in you making savings. And therefore, those savings should be given to us to reinstate the full width of the road. And my response was actually it's not how it works. If we make a saving on your project. It goes back into the pot to deliver other projects that haven't got enough funding yet so we can make savings on 10 of these projects, we can deliver another one for someone who hasn't currently got a funded project available, who is suffering the misery of sewer flooding yeah that's the argument. But also I'd say to that I wanted to say, but I didn't say was that if you're saying that you should be given the money because we're making saving then, on the other side of the flip side of the coin is every time we overspend we should come to you and ask you to pay the difference.

00:55:25.980 --> 00:55:30.480

E.S.: yeah, this is a massive disconnect between what you're doing, as a public service part and their appreciation. Totally disconnected. Am I picking up the right vibe.

00:55:43.470 --> 00:55:52.230

P.7.: yep yep okay, when you just check on any company social media threads website Facebook pages and you'll find that 98% of them are complaints or disparaging remarks towards what you're doing, and maybe only 1% would say oh thanks so much guys, I called you up this morning, and you were out the very next day to clean up a blockage or something like that, but 90/ 98% of them are quite negative.

00:56:16.710

P.7.: I think again, it relates back to the whole then they're not our customers by choice they are customers by default.

00:56:26.010 --> 00:56:32.550

E.S.: Am I getting this right? They don't see the benefit? When you have a road being built you don't see the benefit of that road just the burden of it being built?

Yeah

00:56:32.820

E.S.: You don't think 'that water pipe is going to benefit me'? There is a disconnect between getting water and the infrastructure?

00:56:42.090

P.7...: This is almost exactly the reason why these residents of [place] see this, what they perceive to be an eyesore, which is a concrete chamber on a green space and we've turfed it looks quite nice that I think. Its infrastructure.

00:56:55.830

E.S.: it is quite dead green space, it is not exactly an ecosystem haven, is it.

00:56:59.340

P.7...: And I keep saying this.

But fact is where the people who flood are probably around the corner 400 metres away, so they've never met them never spoken to them as a neighbour and never seen their problem, every time it rains. So for them, they don't connect what they're putting up with the benefit that the other neighbours are getting.

00:57:21.300 --> 00:57:25.560

P.7...: And the local authority as well, sometimes I have a bit of a gripe with them, because I said rather than complaining to me about this job about complaining your colleague councillor, who's complained to you, you need to maybe step up and grow a pair and say to her actually councillor, this is what we've been writing to you know to utilities for years to deliver some benefits to infrastructure to help flooding in our borough.

00:57:49.980 --> 00:57:53.610

P.7...: There are two of these jobs going on in [place]. With a combined total probably about 11/12 million pounds altogether. They're not cheap these things. You know for 15 properties we are spending 6 million quid nearly five say between five and 6 million pounds to help flooding for 15 properties okay. Yeah think about how many how many times their water bill, that is.

00:58:14.100 --> 00:58:14.430

E.S.: yeah.

532

00:58:14.610 --> 00:58:21.810

P.7...: yeah and spread over the region yeah. So all that money over the region is being pumped into [place] to help alleviate flooding. We're doing our part and all you're doing is relaying a complaint that you've had from a councillor about a concrete that is permitted development and trying to get everyone in his dog and the writes into the chairman, the writings of the chief exec, chief execs

asking me what's going on with this job and I'm saying we've done nothing wrong, you know this culture now of complaining and.

I said before, you know you're doing research on these things you know customer behaviours back in the day, if you wanted to object to something strongly, you would have to spend 60p on a stamp. Now it wouldn't cost you anything. You can do it anytime of day, anytime at night. You can ping an email off to the chief exec and that's it, you know.

00:59:14.100 --> 00:59:16.050

E.S.: The other thing that strikes me about what you said is (and similar to some other projects). It's almost like you think everything is going to be okay, you go through the processes or the negotiation stage and the discussion stage and it all seems fine and then later these problems emerge possibly when you're thinking you're on the home straight?

544

00:59:37.800 --> 00:59:41.190

P.7.: yeah. On this one that we just talked about the [place]. We had all these covers shown on the planning drawings. We submitted the planning drawings that then got distributed and letters got written to each of the residents who live within that particular radius of the work, so they can't say they've not had access to the drawings. Now had they read them properly, you know this culture of about the letter from the Council, I just throw it straight in the bin because it is not I'm not really interested, you know.

01:00:13.500

P.7.: If you had read it, it would have had all the information all the plans and showing you. Now unless you want a planning application that specifically says, you will have X number of concrete surrounds around these hatches, X, Y, Z and photos of previous job but we're not that's not how it works. You know you kind of spoon feeding them to complain.

01:00:36.780

P.7.: Whereas we have to put, we have to follow the guidelines from the planners, we send the application and the drawings is sufficient because she would have set them back if they weren't detailed enough. And I don't think they read them properly. So when the time came, we finished the hatches they're all up in arms, because what's all this concrete now our kids going bang their heads, on the play area. So we ended up taking some of the out. But some of them just don't want anything there.

01:01:12.060 --> 01:01:15.750

P.7.: But we've got pumps underneath that need to be maintained.

01:01:16.590 --> 01:01:21.180

E.S.: There's no other solution to this flooding issue, on a small number of properties there's no nature based alternatives or anything like that.

01:01:24.180 --> 01:01:24.720

P.7.: There are. But two problems with those sorts of nature attenuation issues is. One they're not very good they don't work very well and, B - they tend to require a lot of space. A lot more a lot

more area, so if you're going to have a reed bed, for example, for an over spell and you need quite a large area for reedbeds to be able to take what's coming in and deal with it biologically and, secondly, they don't work very well, and you can imagine, in the storms, but especially with storm water where it's got organic material. When you've had a storm you're going to have bits of sewage in there which is not very nice at all, and you let nature do the job, but over the course of time you'll end up with sludge debris sort of settling on the bottom, and then you need to dredge it then and then all the reeds come out, you have to start all over again, whereas this way having a small storm tank in a residential area, you can capture that storm spill once it's mixed.

01:02:30.510 --> 01:02:30.870

P.7.: You know. If you can capture it before it separates out even better, but when it's been mixed and all these surface was connections that are historical or illegal yeah that go into our systems. If it's been mixed you can't do it too late, then so you either got to collect it and store it and then treat it or you let it out in an emergency.

01:02:55.350 --> 01:03:02.070

P.7.: And now current thoughts are in emergencies now people don't like sending out storm water. The whole Feargal Sharkey getting involved and Surfers Against Sewage and we're trying not to do that.

584

01:03:13.800 --> 01:03:20.340

E.S.: You say Nature Based Solutions don't work is it that the data wasn't there to prove they work or is it, the data is there and the data says it doesn't work?

585

01:03:20.700 --> 01:03:24.630

P.7...: I don't know because I'm not the expert but, in my experience, they don't work

01:03:28.830

P.7.: We're talking about one that Bolton at the moment that we're planning now it's just in the early stages and they're really trying to make this one work. But it's a huge amount of space available. And it's kind of remote. Its not going to upset people with smells and things and, and we can we can plan it properly and we're working in partnership with others on that one but for something of this size and nature housing estate in a sort of metropolitan borough of the [city] city region it's not feasible.

01:04:04.140

P.7.: Obviously, we will try and you know they would have considered this as a as a cheaper option, you know. But cheaper option as long as it works.

01:04:14.490 --> 01:04:17.880

E.S.: I've got a couple last questions. I've gone massively over. A wishful thinking question, if you could change something about how the governance regime that operates w you'd like to change as a thing or things.

01:04:41.070 --> 01:04:42.900

P.7.: I'm constantly trying to educate people and I'm always trying to educate people, so I attend things like civic community groups yeah, community groups to do talks on things you know when especially these opportunities, where we're doing big projects in areas. I like to give them the background of the water industry from early doors i.e Victorian age yeah. So I start I start from cholera, and Joseph Basleget. And then I'm work all the way up to the European Union with the urban wastewater treatment directive in the 90s. Privatization of water companies because they were asked to deliver all these benefits and basically who's going to pay for it yeah. The government at the time had poll tax can imagine your poll tax doubling to pay for all these water improvements yeah.

01:05:36.420

P.7.: And that's why the water industry was privatised, and I say to people well you know your object you keep talking about nationalisation you know, during the election day of the year and we're going to nationalise you. One MP, said to me well we will nationalise you as well. I said that's great because then I don't have to come and meet you and explain to you the benefits of this project, because effectively I'll be an employee, so it makes my life, a lot easier. But how are you going to pay for it, you know how you're going to pay for this year so it's about educating people so that they in a better position to understand what we're doing and why and, hopefully, you know that education kind of gives them a bit more thought to when they get an application through 'what's this about oh it's about it's about surface water separation or it's about relieving internal flooding. And through my conversations on projects trying to reach out to parish Councils, local authorities, environmental groups. That's what I'm trying to do at the moment and I think education is the key thing it's trying to explain to people why we do these things.

01:06:43.830 --> 01:06:45.360

E.S.: It sounds like networks as well.

623

01:06:45.750 --> 01:06:46.050

yeah.

624

01:06:47.580 --> 01:06:51.270

E.S.: ..building contacts and he talked a couple of times about you had a good relationship with the planning guy.

26

01:06:53.820

P.7.: You know my job I'm not in capital projects anymore, but I used to be, which is why I know a lot about the projects but I'm you know, a stakeholder manager for [CO].

01:07:01.860

P.7.: And so my job is to build and maintain those relations. So I am constantly looking at relations within different regions to take part in you know join up things like, for example, and we, we got in very close with the [city] city mayor's office. They were running the year of environment bit like [city]'s area 2019/2018 2019/2020 and we've got on board that help them out with a few a bit sponsorship, you know for paying for things get things going. And we're in that group so part of us being in that group is to raise awareness about what we're doing and we're not seeing as the big bad

guys who keep shutting and dealing with problems, all the time, actually, this is what we do, this is what responsible, and we are an environmental improvement company at the end of the day, on the wastewater side and you know, provision of an essential supply on the clean water side, so if you can get that through your head first, then everything else we can work on, on the other things and explain, and I think that's worked wonders for us yeah.

01:08:09.960 --> 01:08:23.370

P.7.: Legislation is really hard to change anyway, you know what can you do? Especially when what my gripe as well as this is, we were in we're in the right with many of these applications that have been rejected. And there are no lawful grounds for refusing it, and yet they refused it so that kind of makes our life very, very hard in that the law isn't even supporting us, we would have appealed had we really being confident that we could have appealed and actually delivered the job.

01:08:41.700 --> 01:08:47.820

E.S.: It is intensely political the world you are describing to me not legal

637

01:08:48.480 --> 01:09:01.230

P.7.: yeah and I suppose in the world of other aspects, like fracking, for example, you know and where one of our jobs was right next to the field where quadrilla we're doing the fracking you know, in the Northwest. You can imagine what that was like that was protest 24 hours a day, seven days a week. Really high really nasty at times because they were following people home. The were following our cars home, you know from people who are working next door because they were they weren't didn't understand that we were there because we've got service reservoir next door and but then again we were being approached politically by people to say why are you supporting fracking. Well we're not. You know, we can't pick and choose customers. If they've got a valid planning application yeah that's been approved, to do something and they come to us and say hello, we are quadrilla, we need a water supply off you. We cannot pick and choose.

01:09:44.280

P.7.: I had a very intense discussion with a councillor and some protesters about why we are helping quadrilla and providing them with a water supply. I said oh well I've got a problem on my desktop because I've got a mosque, synagogue, Church of England church all asking for water supply and I don't know which one I should give it to.

01:10:04.080 --> 01:10:05.850

P.7.: And they went really? And I went, no!

01:10:09.000 --> 01:10:21.270

P.7.: We can't pick and choose our customers, you know. If you open up a vivisection laboratory next to my home, I can't choose whether or not to give them water, I might object to it morally. But the place to object is before the built it at the planning phase. Not when it's already been granted it's too late and I'm just giving them a water supply, it's not my position to be picking and choosing water is you know I'm not going to give water to you because I don't like what you stand for it's really frustrating some times. I have to walk away and let loose.

01:10:46.710 --> 01:10:48.300

E.S.: I hope I have helped a little bit.

656

01:10:48.390 --> 01:10:49.170

P.7..: Oh yes, yeah, interviews like this, and some of my colleagues to do the same thing we have regular conversations purely just to get things off our chest.

01:11:01.470 --> 01:11:08.790

E.S.: That has been really helpful! So when I'm working on interviews over the next few months and then there's two projects I've got to work on over the next year. So you may not hear from me for a while potentially.

01:11:13.530

P.7..: But listen if you do want to chat again. Anything you want me to talk to you about.

01:11:18.330 --> 01:11:20.100

E.S.: If you wouldn't mind that'd be brilliant.

01:11:20.220 --> 01:11:21.300

P.7..: I'm quite happy to.

670

01:11:23.220 --> 01:11:29.430

P.7..: You know, give me a shout next time to do another do another hour again it's quite easy doing it this way there's no travelling it's very I can fit it in.

01:11:32.340 --> 01:11:36.450

P.7..: I hope it's helped I wasn't sure what you're after today, but is this sort of what you're asking.

01:11:37.440 --> 01:11:44.460

E.S.: People don't know what I'm after and what I'm after is just to talk about their experiences, and from that I take out themes and I'm doing about 20 of these. And I've spoken to government bodies water companies, entrepreneurs, people trying to get into the sector and what their experiences are in and I pick out, not just the obvious things about PR cycles and AMP cycles but some of the more on the ground problems from that I'm trying to design a framework to well firstly help people who are trying to undertake projects, but also come out with an ideas to improve the regime.

01:12:23.760 --> 01:12:33.990

P.7..: What what I would hope in the future Lis, is you know, while she working on this, we have another these conversations because there's another one that I want to talk to you about.

01:12:34.410

P.7..: It's actually one where we've worked really well.

01:12:38.760 --> 01:12:39.420

E.S.: Okay yeah.

687

01:12:39.510 --> 01:12:47.850

P.7.: And where we've worked really well with the local authority and the and the governance and the planning and external factors and permissions and local councils, we had some hiccups.

688

01:12:48.270 --> 01:12:56.610

P.7.: You know we've had some hiccups with them I'll be absolutely honest, but you know when we're coming to the end well the projects now finishing we've got celebrating opening day.

01:12:56.760 --> 01:12:57.750

P.7.: It's all in a park.

01:12:58.110 --> 01:13:05.400

P.7.: That yeah so again, you know the, this is the theme of these ones, but we've made huge improvements to the park.

01:13:06.060 --> 01:13:07.050

E.S.: Right

01:13:07.110 --> 01:13:09.300

E.S.: what is the difference between that one in a nutshell.

01:13:14.640 --> 01:13:27.450

P.7.: The local authority were really appreciative of what we were doing, they were very supportive of the work we were doing the reasons why we're doing it, and it was a bathing water improvement project so improving the quality of bathing water quality which from [town] Councils points of view is a real real really key thing for them, because it's a tourist town. They rely on tourism, they rely on things like blue flag status. They rely on seaside awards, and to promote the results and because they rely on tourism, you know, to bring in the money for businesses and keep the sound going.

01:13:56.310 --> 01:14:02.970

P.7.: On that one you know, we had a job that was mutually beneficial, we were we were improving the bathing water quality as directed by the Environment Agency. They were getting better water quality, which allows them to apply for awards and things which help improve the town and this park, is a very was a very, very tatty old park. And when we talk next time I'll show you the photos and things and I've got full library collection of overheads showing you duration of the scheme what we've done. And you know we replaced a tattle cafe with a brand new state of the art facility cafe that's now, not just a café is being used as Community Centre as well. So last, the last time I was up a few months ago, you know, I was having a coffee with Council offices talking about the opening official opening given and again it was delayed because of covid.

01:14:44.280 --> 01:14:52.050

P.7.: And there was a book club going on there was a knitting club going on, they have girl guides in the evenings so they've not they've not leased it out private to a private company they've kept it within Council ownership and they've got a caretaker who opens up and let people in and the cafes are operated by Council officers, rather than a private Costa coffee, for example, who wouldn't be amenable to opening it out of ours. You know the sports facilities are fantastic they had really crappy

facilities before got really great facilities we've got really good relationship with the bowls club, you know, which is an old oap sorts of bowls club, but more than that it's Community Centre you know, for these OAPs. And we spoke to them when they first started and they said, our fear is our bowls is going to be affected we're going to die, the club's going to die off and no one's going to come.

01:15:40.350 --> 01:15:44.370

P.7.: They've got a brand new state of the art facility now new building that we paid for.

01:15:45.450 --> 01:15:58.590

P.7.: Their club has gone to a point where she's actually so happy now she got more members than they ever have before or paying the subs, which means the club is thriving now, but you know that's a really good story where we've worked hand in hand with the local authority with the planners with other external groups as well. Love my beach keep Britain tidy and all those volunteer groups and to deliver a scheme that that's just really outstanding, I think.

01:16:10.050 --> 01:16:14.520

E.S.: What was behind the driver behind the scheme was a direct with the directives was it. Did you have to do something?

01:16:16.320 --> 01:16:31.590

P.7.: Yes so bathing water quality levels were being increased and made tighter, in I think it was 2015/ 2016 around them, so the Environment Agency said you know you need to improve the quality of the of the beach, beaches and water quality at sea water at the quality of these designated bathing spots. So we built a storm tank as part one.

01:16:44.220

P.7.: But the second part was when the storm tank is full and it's too much, what do you do, then, because it's still spelling you can't build too many storm tanks on the system. When they empty you've got so many to empty that you're still empty and before the next storm hits you.

01:17:00.900 --> 01:17:01.770

And there is no point, is there.

01:17:03.060

P.7.: It was a bit of an innovative scheme that the environment agency, you said look we're quite happy for you to build a really, really long out fall pipe because the current outfall pipe just used to send it a kilometre out to sea where it mixed with sewage you got this dilute solution and we send it out to sea so now we've got additional storm tanks. So when that's storm tank and full, we still send out to sea, but it goes out now 3.7 kilometres out.

01:17:32.670

P.7.: So 3.7 kilometres out to say to a really deep part of the sea where the dilution dispersion rates are much increased the EA say we're happy with that, so I can run through this with you next time yeah.

731

01:17:46.380 --> 01:17:47.280

E.S.: yeah yeah.

01:17:48.330 --> 01:17:50.190

P.7...: I've got amazing videos to show you.

01:17:50.430 --> 01:18:01.440

P.7...: Because that pipe you know that it's not you can't go to B&Q and ask for this size pipe 2.5 metre diameter polyethylene pipe or how much do you need? I need a 3.7 kilometres (laugh)

01:18:03.060 --> 01:18:03.750

P.7...: Know it's a special company in Norway that build it.

736

01:18:08.220 --> 01:18:10.290

P.7...: yeah I've got some footage of the machine and it comes out of this mould this plastics injected it pops up like a pipe. They put a cap on the end so it floats basically and when it comes out exudes out the machine the factories, based in a fjord. It comes out and just go straight into the fjord. And the fjord is only about 600 metres wide, so these pipeline lakes, can only be made in 600 metre lengths. We had to stitch them together and there's some footage of the tugboat so they come out tied six or seven legs together and told them from Norway to Northern Ireland.

01:18:47.670 --> 01:18:48.840

P.7...: Over the course of a week. They seal them all together in Northern Ireland and then in the summer, a couple of years ago they brought it all over on a calm day that the set off in the morning we were watching the ship on the satellite thing you know. And then slowly some get through the day and operation to sink it down.

01:19:09.450 --> 01:19:13.200

P.7...: And I was just it was amazing stuff footage is great loads of photos videos and everything and one of the other good things about that was we've got like a video and footage guy that we
P.7...: procured very early doors and said we want full life story of this project in video.

01:19:31.200 --> 01:19:43.920

P.7...: So the last bit he is waiting for is the open event which is going to be next Easter, but everything else is there we've got interviews with key stakeholders, we got interviews with director from [town] Council interviews with Elsie from the bowls club to explain it from her point of view, to say look, you know, I was really worried, but look at it now look at our fantastic building.

01:19:51.300 --> 01:19:57.600

P.7...: we've got the sports club people, look at the great facilities we've got, we've got the love my beach saying look this is great for everyone, because it litter and waste on the beaches.

01:20:00.390 --> 01:20:01.950

P.7...: And then you've EA the guy saying look better water quality in you've got a blue flag, you know.

01:20:05.370 --> 01:20:06.810

E.S.: that's a good day at work that, [].

01:20:07.050 --> 01:20:07.950

P.7...: that's a really good one.

01:20:08.430 --> 01:20:11.520

P.7...: yeah I'm really quite proud about what you do I want to show you that one.

01:20:11.550 --> 01:20:17.790

E.S.: that'd be brilliant I've got to actually choose a project to look at with [CO]. So it might be they encourage me to do that one which would be great

01:20:22.950 --> 01:20:24.210

P.7...: that is the flagship one.

764

01:20:25.980 --> 01:20:32.280

P.7...: And this, I think what I'm going to make the offer to you is the opening event has been pushed back a number of times because of covid. And what I'd like to do is when we have it in Easter next year is put it in your diary I'll let you know.

767

01:20:41.880 --> 01:20:43.230

E.S.: That would be awesome.

768

01:20:43.290 --> 01:20:47.160

P.7...: Because I think if you're going to use a flagship project to talk about it let's get you up there for the day.

770

01:20:49.740 --> 01:20:53.940

P.7...: yeah also I can sort out tickets and accommodation for train, or whatever you need.

01:20:55.410 --> 01:20:58.080

P.7...: But we'd like I think I'd like you there just to showcase it.

01:21:00.390 --> 01:21:02.760

E.S.: If I can yeah well anyway.

01:21:02.850 --> 01:21:07.530

P.7...: don't worry about it because I'll sorted out so it's no expense to you, you know for the university.

01:21:07.830 --> 01:21:08.490

E.S.: don't worry its something I would like to do.

01:21:11.040 --> 01:21:19.650

P.7...: And the event will be like a bit of a showcase opening I think they've got Judy Murray lined up and because they've got brand new tennis court. She's going to do it as an ambassador to the UK tennis. So you can see what level will look at that it's all about health and fitness it's about parks but also we're showcasing what we've done as an asset to protect [town].

01:21:34.200 --> 01:21:35.160

E.S.: yeah levelling up thing really isn't it.

01:21:36.030 --> 01:21:37.590

P.7...: yeah yeah, so this is a good.

01:21:39.420 --> 01:21:40.500

E.S.: I've got over time by a huge amount.

01:21:44.580 --> 01:21:45.600

P.7...: I'm glad you got what you want. And I think there's more there's more to talk about. Yeah just let me know whenever suits you .

01:21:53.220 --> 01:21:54.240

E.S.: That's great thanks. Take care have a great day.

01:21:54.540 --> 01:21:57.720

P.7...: You too, thanks, very much take care now bye bye

End.

Q.8. recording 4th August 2021.

Confirmed ok to record.

00:00:00.630

E.S.: I do make notes anyway,.but it's just easier to listen and record back. And the participation sheet, you okay with that and what this is about? If you want to go through it I'm more than happy to.

00:00:15.299

Q.8.: Yeah I was, I was going to look back at it, but I remember I looked at it quickly and I didn't have any issues with any of that. So as long as there's nothing really I need to do there, I'm good.

00:00:26.040

E.S.:.....So it's a project backed by United Utilities and Birmingham Uni, and what they've asked me to do is to look at the regulatory regime around water infrastructure projects and the direct and indirect impacts of that regulatory regime. So the obvious, and the more subtle things that come out of a regime being in place.

00:01:00.030

Q.8.: I've just got off an hour doing a podcast with, I don't know if you know, ATI and Badgermeter, on regulations in the UK and stopping real time monitoring in digital transformation for water quality.

00:01:15.750

E.S.: ok yes, I'm at the stage where, relatively early really, I've done the academic stuff and got absorbed in a couple of projects. And I'm trying to gather experiences of people on the ground. So what people generally did, it's really informal, they talk to me about a project that they're doing and we go through it, and from that I can pick out things. If I said to somebody, talk to me about regulatory regimes. They would say what. Well, whereas if people talk about projects, I'm finding it things come out that maybe they didn't think was a regulatory issue or I can start to see trends. And it's sort of an easier way of people to engage with a regulatory regime without thinking it's a regulatory regime without asking techy legal questions. You're just talking about what went wrong, what went right. It's especially a bit different in that you're working on lots of projects, so I don't know how you'd prefer to proceed with it. Do you want to just chat through something you just worked on like above or, from at you said in your email, you're probably more ensconced in regulatory issues than some people are anyway.

00:02:36.060

Q.8.: Very much so, so for British Water, as part of our innovation review, we're looking at regulations of blockers in regulation. And the subject, why they invited me to talk in that podcast was about blockers in regulation. And part of it is I have quite an inter[nam]ional experience with this.

B, as you know, knows me from doing some stuff with .. About 10, 15 years ago we were building magnetic ion exchange treatment works for drinking water for [] and []inly to remove DOC, to meet compliance on THMs and stuff, and we closed down the business 10 years ago in the UK, because we

recognised that there is no future in the UK for this kind of business. And I started up my consultancy, working with new technologies for the water sector, and essentially spent most of the last decade in the United States and working overseas. Yes, the UK market is dead in the water for innovation, really. During that period I've still been engaged with little bits of it, so at the moment I'm engaged with a project with [CO], with a Canadian technology, which is a microbial activity sensor. [product] is that the name of the technology, but they won the [CO] innovation program with C. I've known C for a long time and I've been talking to him right from the beginning of that, and it was quite a good idea, and part of what the industry is trying to do is get young people engaged in the innovation platform. So with that I recruited [name] out of a PhD at []. And she's working for [] to try and sell that technology in the UK. [name] previously was in the innovation department [].

00:05:17.310

E.S.: They consider themselves really quite innovative, don't they?.

00:05:20.220

Q.8.: The UK market considers itself is quite innovative in lots of ways.

00:05:29.880

E.S.: Why do you say it's dead?

00:05:31.560

Q.8.: Because there isn't any real opportunities in the UK, and this was obvious 10 years ago. The podcast I was doing with ATI, ATI developed their metronet system to monitor drinking water, which is a nice innovative bit of kit. And every drinking water system in the UK talks to Gary and says, yeah it's great, we love what you're doing, we're very happy with it. Are you going to install it? No, because we don't have to. And the same reason I went to the United States for all that time, I was working with a technology from Aqua Metrology systems which was a real time THM monitor that had been developed with funding from the Welsh government in collaboration with Severn Trent. And the market perception was, yes, we need this technology. But when the technology came out they were like, well nobody requires us to actually have it so we're not going to have it, because it will expose a whole bunch of things that we don't want people to know. So we don't actually want it in the UK, whereas I sold it in 35 states in the US and worked all over the US and Spain and Singapore with that technology, and we installed it in Barcelona, we installed it with Equali and Akbar where they were selling water to each other, we installed it all over the US in cities like Birmingham Alabama, San Francisco, Des Moines. You know, very popular technology, but there's no requirement to have it in the UK so nobody wants it.

00:07:23.730

E.S.: So it's not helping them reach statutory goals or it's not really helping them reach any targets that's relevant to them, is that what you mean by that?

00:07:32.640

Q.8.: No, no, I mean is the regulator doesn't require them to have real time monitoring, it requires them to do a single test. They pass or fail on that test. If they introduced real time monitoring, one, they don't get to stop testing, so they don't save any money. Two, it's evidence that they know what the levels are so they'll have to do something about it. In fact, it could hinder them. And three, they

don't get money for it from the regulator, they don't get paid to do it, so why do it, you don't have to do it.

00:08:13.020

E.S.: So why should they do it?

00:08:15.840

Q.8.: Why should they do it? Well, one, in the US and Spain, this is all information in the public domain. And it saves on actual operational costs to stay in compliance, and the regulators in Spain, for example, they allow it for reporting. So it will go live on the website for the general public, it will go live to the regulator for reporting, and it will go live to the two companies who have the interest with the water. So it's open and in the general public. In the UK, there is no requirement to do, there is a requirement to do one single test at exit of the plant. Fill in form and submit that to the regulator. And when there's nobody checking, you don't know whether that's in compliance. And maybe they're all in compliance and they're all fine. And everything's rosy. But as the discussion we had earlier, we're talking about speedos on cars, they regulated every car to have a speedometer. But they didn't just trust everybody not to speed. They put 7000 speed cameras across the UK. You don't have any such equivalents for environment or water quality. You know, but we have 7000 speed cameras.

00:09:49.890

E.S.: What needs to change? So it come across as a bit that you've got fantastic technology that works, it's not the technology that's stopping this being implemented, it's the regime..

Q.8. It's the regulations, yes

ES: The regulations. What needs to change to get,s looking at this particular piece of kit, to start with at least?

00:10:12.750

Q.8.: What needs to change... You know they've looked at it and go, it's interesting, yeah well it works very well, yeah. We'll do a bit of a trial. But as a company or an organization, which is where we were with Oracle, which was a big global cooperation, I told them to close down their UK business. Is you can't survive on 2000 pounds worth of trials, or even 10,000 pounds worth of trials, you know, it's not a business. It's just a look-see, and because they don't have to do it. It's not going to be something that comes in a year or two where it's, well, we'll take a risk and employ two or three people, 40 grand a head. You know, plus costs. To maybe in a couple of years, they might look at it.

:10.920 --> 00:11:14.130

E.S.: It needs to have a stronger police force with stronger regulation to force this sort of collection of real time data?

Q.8. Yes

ES:.. and that would then have improvements for environmental controls, I presume, and about digital twinning and all that sort of stuff as well.

00:11:34.230

Q.8.: Absolutely, absolutely, I mean I talk often about the whole digital catchment, having real time microbial activity monitors that we have with [product] up and down every river checking river health.

And basing investment on improvement of river health. You know, and because at the moment we have ideas around catchment management that we don't really take on board, we have ideas about getting the private sector to invest in improving environmental river health and water health, and we talk a good game on many things. But we don't have any mechanism for anyone to do it. You can plant some trees but you have no proof that that's done anything, you have no benchmark to sit on, you have no public data out there.

In the US there's a requirement every year for you to be sent to your house the information on how your water is treated, where it's come from and what contaminants are in there. We have no such openness in the UK. There's no requirement, and even as an educated person, if you go looking for it, it's not accessible, whereas in the US, all EPA information is in the public domain. Any spill or CSO spill is out there as public data and mapped. You know I'm not saying the USA is perfect, because the USA has a lot of environmental problems, but at least you could see where the environmental problems are and go, it's there.

00:13:24.450

E.S.: Difficult I know, it's so fragmented. I've got my colleague, is it the EPA over there, and he just talked to me about how fragmented it all is. You know, you've got thousands of workers, hundreds at least, of different business entities with no cohesive structures. You're saying, even with that lack of uniformity, if you like, it's still easier to do business?

00:13:51.090

Q.8.: So yeah it's easier to recognise exactly what's going on, because it's not run by a couple of corporations, who, if they don't want to speak to you, don't speak to you. Or even if they do want to speak to you, will tell you, yeah we don't have to do that, so we're not going to. You know, it's very fragmented because you've got everything from a small town to, you know, with Bob with a shovel putting the chemicals in the system they've bought. You know, one employee or part time employee, to major cities with 40 year plans, you know, so that is very diverse in that kind of setup but it's also diverse in the economics, you know, I always compare it to the European Union. You know, if you go to places like Louisiana and Mississippi they're as poor as Bulgaria and Romania. You know, they're very poor places to live with very little money and very poor infrastructure. But then, if you go to California and New York they're more like Western Europe as a setup, you know, and the cities are better structured in that way, so you can always find somebody to talk to. You don't just have 10 corporate entities that you need approval from.

I've compared it in the past to like the brewing industry. INBEV is a giant corporation, it doesn't produce interesting beers, it produces terrible beer for a mass market. The small brewers are the ones that compete and eventually they get bought up. But in the UK there is just no competition. It's just you must have these 10 corporations and that's it, you know, so it's down to the regulator to do stuff. And there's many, many, many people in the UK industry who are wonderful, don't get me wrong. There are great engineers, great scientists and great people who back technology, you know, so people like C who's very enthusiastic about technology. However, as a corporate business case, if it's not in your business model and you don't have to do it, why would you? And the way that the model works as well, so for example, I was talking to a manufacturer earlier and to digitise their

entire water network for a particular utility would cost about 2 million pounds a year to run. At the moment they spend 9 million pounds here on testing which they wouldn't have to spend if they did install it. However, the way that the business works, the regulator would say oh great you just saved 7 million pounds, you can reduce your bills. Why would you want to do that as a corporate business? I don't take that money myself, I don't take any savings. Yes it cost me less to do it, but I make a percentage less money.

00:17:16.290

E.S.: So the only real way forward is stronger or different statutory targets?

00:17:23.160

Q.8.: Yes well, break up the corporate monopolies, get rid of the whole nonsense of having a regulated monopoly business run by a corporation, because there is no way that that works, unless you can say look, here you go, this is how much profit you're allowed. It doesn't work because there's no drivers.

00:17:55.800

E.S.: So what would you have instead?

00:17:59.580

Q.8.: I like the Dutch model.

00:18:01.680

E.S.: Okay, what's that?

00:18:03.090

Q.8.: So the Dutch model, they have 50% government ownership. They operate as not for profits. So the Welsh are shifting into this model at the moment. And they operate similar to how a private company would. Internal bonuses, you know, the general things that people think are good for operational organisation. As a not for profit, you can use some of your surplus, not profit, to support your engineers going overseas, working on overseas projects, so the Dutch have spent 25 years working in Vietnam. And it's no real coincidence that, when the Vietnamese Government decided to build a full 24 hour a day water system for their country the contract went to the Dutch because the Dutch have been there for 25 years helping them. And they're installing a lot of Dutch technology with Hasconen as part of that. That's how I would do it. If you have it purely as a for profit, corporate monopoly, you're always going to have government failings, and certainly when a government is less educated than the corporations.

00:19:50.430

E.S.: I'm surprised regulators aren't on board with this, or have they got other things on their mind? I did some project work for [name]. One of their biggest gripes is that they're asked for data that doesn't exist. They have to show improvements, but they can't show an improvement because they don't know what the baseline is. It's that bad. And the cost of gathering baseline data to show improvements is, you know incredibly difficult. You're talking of feet on the ground.

00:20:25.650

Q.8.: Austerity over the last 10 years has slashed budgets for the regulators, and this is similar to what happened in Florida it and why Florida is collapsing as an environmental estate. You know, the

ma[name]ees were dying, the tourism industry, I mean it was falling to pieces before Covid, because of the red tides. But in Florida they cut the EPA down to three people to regulate the whole state, which was impossible. And I remember being with the EPA there, and he's like I've got 40 days to retirement, this is a joke. And, as I said in England, the government has just said that they're taking on 50 people to improve environmental checks for the whole of the UK. 50 people is not really going to go very far. If you said you were going to take on 50 policemen to check if people were speeding we would just laugh at you. But, for some reason it's fine to spend the kind of money on 7000 speed cameras, but not on environmental checking.

00:21:43.860

E.S.: So if you got that baseline data you can't show an improvement, you can't show what's actually going on. It's exactly the same issue [name] were talking to me about. So your advice to any sort of innovators out there is try your luck in other jurisdictions.

00:22:06.120

Q.8.: I would go to Singapore, go to the United States, Europe. The UK, you will get a toe in, you know, and you will get a trial. Because there's money for that. And the Ofwat innovation fund will be for trials. But you won't be able to run a business.

00:22:30.030

E.S.: Someone said to me, in the water industry in England there are more trials than the Old Bailey.

00:22:36.060

Q.8.: Yes, exactly, yeah, because that's where the money is. It's like oh, we trialled that and that adds to the knowledge of the company, the corporation. And you know, they'll trial, they'll build one, but there's no requirement for them to roll it out across their network. But they have that in their back pocket when the regulations change.

If you talk to M, don't know if you know M from the DWI, he'll tell you regulations were supposed to be updated every five years, every 10 years maximum. That was in 1993. And they haven't been updated since then, and they were based on stuff from the 60s and 70s anyway. That's really where it's at. And you know, we have companies like IO, like P, and I like P, a lot. And he gets innovative companies to come and pitch stuff. But really what they're looking for is other markets overseas. Because the UK does invest in innovative technology, just we don't use it at home.

00:24:11.190

E.S.: Okay, that's because of their corporate structures and they're financialisation, as they call it.

00:24:18.030

Q.8.: Yeah. Previously, I don't know whether this was better or worse, but previously, Severn Trent, Anglian, [CO], all had large corporate businesses in the US. Severn Trent services provided lots of innovative technologies. And that was blocked, they said we don't want you to have that anymore, so they were sold off, Daneher in Italy bought Severn Trent, various fire sales went on. But at least then there was a pathway for those technologies to go off overseas and do something. What we're doing at the minute with the [product] trials with [CO], there's no requirement to them to have it. There's a cost which there will be because, you know, there's nothing that you go 'we've made this for free'. It won't be installed, and even on cost savings that's not really a goal anyway, because if you save costs like to save energy, you get told to reduce your bill.

00:25:43.140

E.S.: Why are they even trialling it then?

00:25:46.890

Q.8.: Because they want to know what's in the market. It's things to keep in their back pocket. They look at partnering in overseas markets, stuff like that. It's good to know what's out there. That's the game it's.

00:26:13.140

E.S.: You're not finding the regulation is hampering the design of technology or getting in the way of technological development in any way? Once it's formed it's not getting taken on because there's no drivers to take it on? Is that it, or are you finding, stepping back of it, there are also regulatory hurdles to development?

00:26:42.840

Q.8.: There are some blockers and they're frustrating. So when we were building the magnetic ion exchange plants for your Yorkshire Water, we wanted to install these lamella plates that we were going to buy from Brentwood from the United States. And they were cheaper than the Degramont equivalent, which was out of Europe. And to get that past the dwi was difficult because we had to get approved with all the different manufacturer components in there, and all the chemical analysis done on that. Brentwood from the US we're like well we're NSF approved and we don't want to go through your hurdle for one sale. So we ended up paying four times the price for Degramont who had gone through that as a European task. So there is stuff like that which could be simplified. At a European level, I spend a lot of time looking at those regulations. From a data security point of view, that's the big challenge that's going on at the minute for digitisation and uniform security protocols and stopping that restricting certain technologies getting into the market in the digital space.

00:28:27.750

E.S.: Is that for data security or is that infrastructure itself security as well?

00:28:33.630

Q.8.: So it's around security of drinking water infrastructure and the data systems that are managing it. And my general view is that, essentially, when it comes to big server connections and the major digital infrastructure there, it's going to be Amazon web server based, it's going to be big corporate setups, so they should manage the security protocols. The innovation really will be in whatever connection they allowed to that platform. And then my little water sensor, we don't really care what it is, you just decide, but we don't want to be judged and in that situation, we were just like yes, we're happy, plug into whatever data platform you want. But at the moment the responsibility is on the little sensor platform guy to make all those major infrastructure decisions which I feel is a little unfair (laugh). So there is there is blockers there, however, I don't feel that they're insurmountable. There is companies like AWS and all the various corporate providers there who are battling for walled control of those digital spaces. Yes, and I'm sure they will accuse the other of having the worst securities.

00:30:28.110

E.S.: Certain countries they won't want to involve.

00:30:32.580

Q.8.: But I don't think that blocks innovation, I think. I think the requirement from the regulator for the UK to be moving into those spaces, and I understand part of the hesitancy from the water sector. So even 10, 12 years ago we used to talk about it with digital connections, and we were like well, eventually there'll be a standard. You know I've had about three phones in the last three years and we'll land on one that's good enough. I understand a little bit of that hesitancy on the ever changing digital space. But as far as actual water regulations are concerned, you know, very specific to the sector, I don't see it being a blocker. You can work with a dwi to get stuff recognised and it's a long slog. However, if you build in a water treatment plant that is 35 million pounds, you can do that. You might not want to, but it's fine. And it's a multi year project, so.

00:31:53.010

E.S.: To a small degree, and it is very small minute issue in the bigger picture, thinking of pipe bots, for example, the regulation 31, it's not designed for robots, it's designed for pipes. It's not designed for the little cute things living in the water supply forever. So your friend in the DWI said you should revise it every five years makes a lot of sense to me because you're seeking to put changes in place that are far more sophisticated than that. But at the time, it's a water supply and we don't want any nonsense in our water supply do we, so I understand, to some degree.

00:32:41.370

Q.8.: If at the beginning of your pipe bots journey or even quite early on there was a casing that was allowed in contact with the water and they said listen, you have to go and stick it in that pond over there for three years and see if it falls apart.

00:33:07.020

E.S.: Yeah yeah, make it a little bit smaller and whatnot, yeah there's all sorts things you can do. It's more of making the regulations fit around a robot rather than it being a [name]ural "this is what it's intended to test for". But yeah, so I can see little bits like that, but the bigger picture being irrespective of whether it works, whether it actually is taken up in England seems to be a bigger regulatory regime issue?

00:33:40.110

Q.8.: Yes, that's it and it really depends on what they're trying to achieve. Like in the in the United States for example, there's a pipeline in Idaho which you could go out and drop your pipe bots in and they would test it to death and give you a sticker so say it's fine. You know, and you could get together with the partnership for safe water in the US, or other such leaders, and test and trial it certain spaces and yeah quite quickly you would get the approvals needed. The big question is always are they required to have it, what's the consequences of not having it, what's the benefits of having it.

00:34:44.910

E.S.: Do you have much contact with the regulators themselves? You mentioned dwi.

00:34:59.040

Q.8.: I go to Parliament quite a lot so I'm part of the all party parliamentary water group, and ask the dwi the questions ,and then by British water I try my best to ask the questions. You know so we've been in meetings with Ofwat, we just did a review on their strategic statement. Last time I was in Parliament in person, we asked Ofwat, because they were making lots of statements about the

future and innovation, I was like well, how is this different to the Cave review from back in the day, because it sounds to me like you're saying exactly the same things. It's not going to happen by 2025, we know that. And you're supposed to meet all sorts of regulations by 2030. So 25 to 30 it's gonna be really busy time if all these things it's true that you're saying. Really what you're doing is rehashing what had been squashed 10 years ago and hoping you'll get away with it is the general sort of approach to it. And, with the recent document that Ofwat issued, I put to them and we said look, this is a lot of corporate nonsense, you're not saying anything here. You're not committing to anything with any actual targets to replace the WFD that was supposed to be installed in 2016 and we're meeting but got put back to 2026, and now seems just put back 25 years if you read the environment bill. Whether are you actually going to commit to doing anything. I accept that some things that are written in certain laws might not be the most appropriate things, that you might want to adjust a target accordingly, but to have no targets!

00:36:57.540

E.S.: Why are they like that? Why aren't they more engaged?

00:37:04.140

Q.8.: Well, [CO] priced up, how much it cost for them to meet the WFD, and they said it'd be about 30 billion.

00:37:13.470

E.S.: Okay, it's cash, and you can't enforce something that's impossible?

00:37:23.400

Q.8.: You can't enforce something you don't want to enforce.

00:37:25.380

E.S.: yeah okay. Are they too pally?

00:37:30.120

Q.8.: It's not that they're pally. Yeah I think there's a huge turnover in Ofwat, so whenever I see an OFWAT person it tends to be somebody quite young come in and is quite enjoying being in parliament and enjoys it. They think they're saying something quite important. It's written in the general corporate speak. But there's no long term accountability. Because, by the time it comes around, those people will have left, they never committed to anything in the first place, everybody can just decide what a quote meant.

00:38:11.250

E.S.: Two people have said something slightly similar actually, not quite as clear as how you just put it. The knowledge base in the sector, either depleting or high turnover. One guy was telling me he was going to talk to a group of water companies, he was a water company guy himself, about sewage projects. And nobody had ever been in a sewage tunnel before, and he was the only person who had any knowledge about what they were talking about, then two years later there's a personnel change anyway. It's a repeat theme, if you like. Is that what you've experienced as well?

00:38:54.060

Q.8.: Yeah it's every part of this sector, and somebody who stands up who's got experiences, and says this is no good, not popular with the corporate management. Part of the reason that I went out on my own and worked with people who were doing stuff. I don't want to toe the corporate line and nodding, getting paid reasonable money but not actually getting anywhere.

00:39:29.880

E.S.: Is there an issue over turnover? I mean lots of industries have turnover issues, but it seems to be something that keeps cropping up there.

00:39:40.290 --> 00:39:47.310

Q.8.: British Water have a figure of 600,000 people get laid off every five years in the water industry. Because of the way the AMP cycle works. At the moment, for example, we're working towards PR 24 in the UK. So, essentially, that means lawyers and accountants are working towards PR 24 meaning that the jobs are not happening. Then, when that comes about, there might be an early start and a kickoff and they'll be a demand for a bunch of work to be done. But there'll be fading down again after two years, and British Water tried to get them to offset waste and drinking water, so they were alter[na]tive, so at least people were just moving from wastewater to drinking water jobs. But now it's like they want everything done year two and three. There's a Covid delay at the minute. There's a task force from the supply chain, trying to encourage the water companies to spend.

But like what happened, the reason we closed down the company in 2012 was we were supposed to build a plant for United utilities at Oswestry and it was 120 million pound job. And we were part of the early kickoff, we've been working with them for several years, they'd spent about 3 million pounds investigating and trialling. The government changed in May 2010. So this was April 2010, the early kickoff. We were there, getting things all set up and ramping up. In May, Mr Cameron came in and austerity was installed and there was a halt on all spend. We were told they were reviewing all spend for two years. And we waited for those two years, and we kept on people through that period, but the project was delayed, of course. And then two years later, when the review had gone on the government said oh yes, this is just fine, this is right, yes definitely should have done this, but the water company then was like, well we can't finish it in the AMP period. And we were doing it to build with risk elsewhere, so we're not doing the project. And 12 years later, the job's still not been done. Because there's no pressure on them to do it anymore. What do you do? You close down the company and you say well let's go to markets that are doing stuff.

00:42:51.420 --> 00:43:09.360

E.S.: With environmental agendas, you know we're lording the fact we're hosting Glasgow in a couple of months and all the environmental principles are banded around and whatnot. Even with those agendas there is not sort of light if you like, in terms of wider goals?

00:43:09.780

E.S.: I can't see any from the government. And I'm part of COP planning, so we are running a series of conferences, I ran the iwa film competition this year to get innovators in. We've got one [name]orrow morning, if you're interested in transport in the lead up to COP, and we're putting into UKTI's pavilion and the global water pavilion with Stockholm Inter[na]tional water week. The spin from Water UK, and [] who I've known for a long time, she was in the Farmers' Union, then she went to work for [] and now she's doing Water UK, is the race to net zero. Whenever I talk to a water company innovation person, the view is that net zero means no more building new equipment because that will have consequential carbon emissions, so no more [treatment. Net](#) zero is what?

There's no actual definition of what net zero is. So the biggest moves that we've seen so far in the approach to COP to actual action on water and climate, and particularly action related to water companies, is that Severn Trent have launched in action to replace all their vehicles with electric cars. So that's the big move that they are making. But to me, I think the electric vehicle move and transition is already happening and that's not new.

00:45:24.090

E.S.: You're banking that and bagging it in your calculation.

457

00:45:30.720

Q.8.: And that's the big announcement. Yes we've cooperated with the post office and with BT and we're all going to have a electric fleet now. What's that doing on NOx emissions from water treatment? What are you doing to actually commit to a water quality goal on drinking and wastewater river water? I can't see anything, you're not committing to anything.

00:46:04.770

E.S.: Very cynical, that response. That electric car thing.

00:46:13.050

Q.8.: Maybe I'm a grumpy old man.

00:46:16.560

E.S.: I'm not saying you're cynical (laugh). I'm saying electric cars, it's a low hanging fruit rather than a substantial change that you're embedding in your culture.

00:46:33.000

Q.8.: We've seen a fair amount of bio gas production to produce electricity, which will take on their net zero setup. And we had that in the 80s. In the 80s there was a lot of green electricity produced because there was a green tariff rolled out that paid you extra, and so they would produce a lot of electricity and sell it into the grid on the green tariff. And then buy it back a cheaper rate. They made a lot of money doing that, until the regulator caught up, and said hang on, you still need this amount of electricity and you're just selling us yours and buying the dirty one.

00:47:22.290

E.S.: In terms of public opinion, I think, drivers, without baseline data. I'm thinking out loud, it's a long question. So without baseline data it's difficult for the public to know if there's a problem or not so they're not engaged and not getting fired up? so you haven't got the bot[name] up drivers as well as the statutory top down drivers. Is that it?

00:47:49.110

Q.8.: Yeah so that's it. That's where we've been pushing the swimmers into the foray. That's been good. I'm a swimmer in my reservoir here. That's raised a fair amount of press on the CSO problem, and we've known the CSO problem for quite some time. And it's got worse and worse over the last 10 years.

00:48:22.260

E.S.: And the angling community as well, they're seen as a thorn in the side.

00:48:28.740 -->

Q.8.: Yeah so there's been some very effective campaigning being done by Fergal Sharky and the guys from Surfers Against Sewage. Surfers Against Sewage changed their protocol to say that the coast went up all the way up the river bank one way and all the way down the river back the other way.

00:48:58.860

E.S.: Water moves, doesn't it. It's not a static entity.

00:49:00.390

Q.8.: Exactly, exactly. There is a big impetus there, and I was on a wet networks call with [] recently and somebody very, very senior in [] was saying actually, we recognise that this is an issue. However, we don't think that's going to be resolved for 10, 15 years. Because there's no regulatory requirements to do so. And it's a discussion I've had lots. I mean I recognise that climate change is going to make it difficult. Because most of the wastewater treatment works that I go to are operating at about 140% of their design flow.

00:49:51.540

E.S.: Southern Water...

00:49:55.830

Q.8.: Southern were with the ones that got caught out because they took the money from the cus[name]er early on and said they were going to do something and then realised that it was.... Because their biggest 126 million, or whatever, they've made 150 million from the cus[name]er by saying they're going to do something and charging everybody an extra tenner. And the fine was to give everybody 8 quid back. That's a joke. If I took a tenner from everyone I know and have to give you 8 quid back nearly eight years later, I'm onto a winner. I've made to good plus whatever I've made with the money for 10 years.

00:50:49.590

E.S.: This is a bit of a side question, but someone said this to me, I wonder what your view is. It's a bit of a tangent, and they said to me that infrastructure projects, we're talking about chalk streams, and they said, the only reason there's any interest in chalk streams is because that's where posh people live (not my words). I was just thinking when you're talking about the swimmers. Is it, is it going to be focusing on areas which are affluent? If there are going to be drivers into those areas rather ones that aren't. I'm just thinking levelling up type agendas as well. Is there a danger of that? What do you think about what they said for a start?

00:51:47.820

Q.8.: So, yes I recognise that as a particular issue, but mainly because posh people are quite good at campaigning. You know, so there is a certain amount of that to it, is that if you get the posh people out campaigning then you get listened to more. The chalk streams tend to be in quite posh areas you're right. But also with that, where we are at [] there is a mix of middle class people who can be quite posh, but then there's quite a lot of not so posh people. It's a very mixed area. And the conversations that we're having around reservoir access particularly is interesting because the water companies are pushing back on reservoir access and saying deaths in our reservoirs, reservoirs are dangerous, it's awful. We're saying they're not, they're much safer than rivers, for a start, and also

much cleaner. And it's only England. Scotland reservoirs are fine apparently, French reservoirs. So it's something particularly dangerous about English reservoirs. But really what the pushback is, is that we didn't mind when it was you middle class swimmers coming in, it's all the not so posh folk who bring the inflatables and turn it into a beach, and you know that's the pushback that we have from them. And our view is that we want education and facilities to open that up. But there is a logic, and this will be part of posh versus not so posh, to starting at the top of the catchment. You know if you start at the top of the catchment, then you work your way down, that is a logic to it. Because the mouth of the Mersey, where all the industry is, it's very difficult to clean up if you don't clean up the river all the way up to the top.

00:54:25.920

E.S.: It's a very blanket phrase out of frustration, I think, really. It sort of denigrates more complex issues, but it's just a lens.

00:54:41.250

Q.8.: To give an example of an area where it's not so posh.

00:54:46.080

Q.8.: I would say the River Tyne in Tyneside and what's going on there. And there's a whole bunch of fishermen there. Fishermen come from all walks of life, and those are the ones that are campaigning along those regions.

00:55:06.180

E.S.: I worked with a few on fisheries, when I was at [name]ural England at the beginning of the year so that was entertaining.

00:55:16.380

Q.8.: Did you have much success with it?

00:55:18.870

E.S.: The paper might be coming out in a couple weeks actually, hopefully. So it's been [name]ural England looking at the post Brexit subsidies governance around fisheries and race for space. Things like that. Complicated issues, lots of social issues and similar in some respects, in that most of the fishing boats aren't necessarily owned by English people, and there's lots of narratives that just weren't played out properly in the press. And you know it's quite difficult to have a sensible discussion really. An interesting time to be involved.

00:56:06.240

Q.8.: I was up in Orkney a couple of years ago, and there was a Spanish guy there, who is my taxi driver, while I was there, and he was a lobster fisherman in his spare time. The dynamic there, I was anti-Brexit anyway, but it was a whole lot of nonsense.

00:56:53.280

Q.8.: And that was just always been the thing. I keep trying to ask government this, you know there's a lot of talk about these regulations that need to go. What particularly are those regulations stopping us doing these things? You know, certainly on the environment which was championed as the one reason, because we can change the common agricultural policy, the one reason that

anybody went okay, maybe. Germany are actually doing it too. And they're in Europe. There's no reason why we couldn't have done these things within Europe.

00:57:34.350

E.S.: That did need changing. There's no argument against that really. There's a ways and means, isn't there. I'm over time by 15 minutes. I'm really sorry, I tried to stick to time because if people are do[name]ing their time to me that's how I see it, as a gift in a way, and I don't want to exhaust that. I'm really conscious I'm really grateful for you spending the extra time. Just talking through, and your knowledge base is obviously clearly vast so it's been really helpful, insightful Is there anything else you think I've missed or anything you want to add?

00:58:14.640

Q.8.: I think you've got a good breadth of it.

00:58:20.730

Q.8.: One community that I'm quite actively part of his World Water tech. We have our conference in the UK in spring, in North America in the autumn. I get them on their email list.

00:58:35.520

Q.8.: You'll see that you know people like Skion of Germany lead the investment charge. Most of the stuff essentially is outside the UK. The UK market is not significant.

(thanks for time, end chat, not transcribed)

09.08.21 Interview with R.9.

Agreed to meeting being recorded. Participation sheet in order and no Qs. Participant had to finish on time for year end issues. Wanted to proceed rather than re-arrange. Further intro chat- not transcribed.

00:01:27.180

E.S.: Okay, so most people start literally by thinking about a project that they're currently working on. We start talking about that, then there's a few questions I have to sort of go through as well. But just to get going, is there something that you're working on at the moment, or something, a project, you have worked on, that had its issues or had its successes?

00:01:44.850

R.9.: Yes, for me perhaps the best thing I can do is use a project that I was working on the last few years. I've just started to step out of that area now. So now, in terms of specifics, you'll need to direct me as to whether it's too much detail, too little detail.

We've been working on a on a major project for [co] for the last five or so years, so this is probably one of the biggest projects [co] Water has delivered. How this project was structured is divided into work streams, so massive project and then split into further, maybe three or four work streams, and then each of those work streams led by a lead project manager, which I was one, leading, ultimately, it ended up being two of those work streams. So as a massive project, this was intended to deliver a significant step change to our performance, so this is water treatment, basically looking to add the capacity to our system and our network. But for that to be realised that also has to come with a change in terms of how we actually work, new asset, if we continue to operate the same way, then tend to not realise the benefits of those new systems and assets. I guess, in this particular iteration of it, some of the issues around it, we're understanding what the purpose and goal and intended use of the new assets were. So interestingly, that became the focus of one of the work streams I was working on.

This project was probably, the conception of it was probably over 10 years ago, and that was with one set of people who perhaps delivered an initial feasibility of it, and the people who did the detailed design are effectively another set of people, you know, probably completely different people to the first group, and the people who delivered the construction also very different to the first set, two sets of people, the exception of one or two people who've managed to see their way all the way through it. And the issue that then becomes, particularly when we're the construction stage, because at construction stage we're starting to have more detailed conversation around how we're going to operate the system and the assets that come with it.

00:04:39.090

E.S.: What were you constructing?

00:04:41.850

R.9.: So physically we're putting in, I'd call it a new treatment stream, so effectively like a new treatment works running parallel to an existing one.

00:04:56.010 --> 00:04:56.970

E.S.: Okay yeah.

00:04:57.690 --> 00:05:03.840

R.9.: And so, with that, one of the first constraints that I thought might be worth describing and highlighting is, we're working with an operational team whose world and their view is kind of looking at how efficient their operations are, chemical use budgets, they've got an operational budget, and the target is always use less energy, use less chemicals, whereas this new process that was coming in was more energy intensive and bringing in a whole host of new chemicals with it. So one of the first questions, and this formed the theme of the conversations, was when can we, how do we switch it off, and I don't mean that permanently but, as in, when we run it, whatever interval, so you run it then you switch it off, run it and switch it off, what does that look like now, how does that work. Whereas from an organisation perspective actually this asset, once you switch it on you don't switch them back off again because the process of switching off a works is in itself a massive undertaking and this process of bringing it back on, it's not something that you would be doing, in and out every season. From a project delivery perspective that was kind of one of the things that, right from the start, gave us a good idea of the kinds of issues that we potentially needed to address.

00:06:38.670

E.S.: Basic questions, so I can understand. Why was [co] doing this, what was their motivation for this project?

00:06:49.020

R.9.: Okay, so the purpose of this project was resilience.

00:06:54.330

R.9.: So we've got treatment assets that span most of the [], and this was basically something that would mean that if you had failures, you had another system that would be capable of giving resilience, and this one was primarily for [city]. Okay, so this was basically providing another treatment source for [city].

00:07:19.680

E.S.: So resilience has become a statutory requirements, hasn't it, it's been specified. Is that why they were looking at resilience, because of these new legal requirements to do so, or was this beforehand?

00:07:32.460

R.9.: So this was beforehand, so there's some areas where yes, resilience is, in terms of legal requirements, it's been looked at. But this was this was a project that [co] did their own risk assessment and effectively, determined that we've got a risk that we would like to address, but, as with all projects as well, you start with this is why we're doing it, but then you start to, along the way, you start to pick up well, actually, it will be good if it solves that issue as well, so ultimately the project becomes a little bit more than perhaps what it originally the idea perhaps intend.

00:08:18.510

R.9.: I guess for me that was one of the really first indications of the kind of dynamics of the business, in terms of the struggle between, well you put in your assets, you're going to have to maintain them, you're gonna have to operate them, so that's going to come with to it. So on one

hand by building, the act of implementing this new project that comes with new assets means that our operating costs would go up, obviously, the question is what magnitude but definitely will go up. But there are certainly another area or other areas of the business, a challenge to that idea of how your costs, this project shouldn't be resulting in our costs going up, so then straight away there's a bit of a challenge, between one, okay we're defining the solutions of the project. On one hand, we know what the project objectives were, then you want to deliver those, but as you're going along one of the steers is perhaps almost taking away from that, because it's looking at cost, and in that way, how we get that down.

00:09:32.670

E.S.: Why was that solution chosen?

00:09:35.490

R.9.: So the solution, perhaps if I describe it more, more specifically, so this project was looking at bringing in the water treated... the status quo was we treat water that we transport from [place] into [city], so we've got 100 year old gravity system that brings water, works well. And it's Highlands water, it doesn't require a lot of treatment, so that's what we've lived with for a long time, but the age of that transmitting assets, those pipelines are a hundred years old, basically it's been identified we've come to a time where we've got sufficient springing points and joints. Because it's in operation 24/7, we need to go there and do more maintenance than just the three day window that that we currently have, so the solution was, okay let's get some river water. We basically get a new abstraction point on the River [], bring in some river water and treat it at the same site, but because we're now treating river water, as opposed to Highlands water, the technology treatment-wise is different, so this is where it's more energy intensive, more chemicals, more kind of processes to manage that new source.

00:11:10.620

E.S.: So if it's a gravity system, you're not pumping it.

00:11:20.010

R.9.: No. So that was one level of tension there. Right so initially the original idea was, we've got the water getting from [place] into [city] those pipes don't really get any maintenance because we're using them 24/7 and they've been an operation since they were commissioned, and we need to try and get a good window of operation. Initially there was an idea that this could be a year's window where we would use this river system for up to a year, and to do maintenance for up to a year. Over the lifetime of this project, we found that actually it wasn't practical to switch this off for a whole year and run off the river's supply for a year. As a project goes along, we find actually that some of those ideas in the notional solution just are not workable in practice. There's a process we had to go through which was, how do we now go back and make sure that that is understood that, yes, this is where we started, but because that's not practical, we need to now communicate that, this is what we're doing instead. So in essence we've then gone from a maintain this for a year to actually perhaps the best we can do is about a month's worth of outage every year. And so, for some, the idea was also that you'd have this outage every other year. But, as we work through this on the project, we found that again that's not practical for other reasons, because you train up people, if you're only doing this every other year you're going to lose some people in that time and because of the size of the of the task and the work, actually you need some level of regularity to it, otherwise you might do it the first year. But chances are you will fail the next time around, so that was then the change. So how do we communicate and work through the fact that,

actually, we think we need to do this on a yearly basis. And then the other point was, although we were looking at assets within [city], primarily, where we're stopping the water coming from [place], which primarily supplies [city], but actually that system also supports the rest of what we call our water grid, so we get water from [city], and this is where these big massive treatment sites are. In normal years those treatments then supplied the rest of the network, so if there's a treatment works let's say in [] somewhere that needs to be shut down for maintenance, they can rely on the works in [city] making up that deficit. Okay, so that's where our big capacity is, so now again, the other thing we needed to turn on its head, was during this outage the rest of the grid now needs to be able to actually support [city]. Yes, so again another massive business change, because previously all these other works could go offline at short notice, because the shortfall could be supported by [city], but now actually in this period of this outage the other works needs to be working at capacity. If they've got any drop down, they need to address that within that time window.

00:15:11.370

E.S.: So to gain resilience, you lose resilience

00:15:15.120

R.9.: Yeah it's a good way to put it. So then that meant that organisation-wise, it meant that we now we weren't just looking at assets in [city]. We also had to now look at assets every else because during this time, when we're doing maintenance in [city] and these other works needed to support, we needed to make sure that they actually had the capacity to do it, but also the knowledge of what time horizons and, basically, ensure that everyone was on the same page in terms of during this outage window, who's supporting what, and if they had a failure, here's how much time they had to get back up to speed before that goes to wider issues. So, ultimately, what that means for us in terms of the business tension, it meant that these people initially perhaps thought, [city] resilience, something that's happening over there in [city], but now all of a sudden that now was having to impact on their plans. Those maintenance activities you normally plan for this time of the year, you cannot have them that time of the year. In this window when we've got this major outage in [city], you cannot have any of your own outages in that time, so again there was quite a bit of a robust conversation to be had around why that is and to work out those balances of risks and priorities between the sites. So inevitably all these conversations lead to some compromise, ultimately, a) as you learn why perhaps all those sites need the outages they need. You start to find actually yes, genuinely they need to have that. So what are the concessions we need to make and how does the plan needs to change. I don't know how well I'm describing it, but all these things are examples of things that were not known as conception, but effectively they're shaping what this project is, and each time, each time we have those conversations this project is no longer exactly what it was when it started.

00:17:47.970

E.S.: You talked about the internal network and how important it is to understand and engage with, stakeholders, if you like, within the business, and how that's shaping the project, if I'm understanding you correctly, and how you're moving water but it's a system and the system is connected to other systems that are all going to be affected. Is there anything, anyone outside [co] that you had to engage with and work with to get this off the ground? Did the network extend beyond ST for this particular project?

15000:18:22.260

R.9.: Yes, they do and in a number of ways, and probably different degrees. One of them was, this definition of the project at outset, so how we get funded, how we spend all this money is by OFWAT. There were statements from OFWAT around what it is that we were delivering and basically the thing that we were being measured against, so once we've delivered this, we could say yes, we can claim that milestone. But as we started to address all these subtleties on the project, we start to find that actually those defining statements don't really apply because they don't really match the reality of what needs to be delivered so, there was another thing where conversations that had to be had around well okay, what did these success statements, how do they need to be actually redefined and how do we go about doing that. Because if we go back today and say actually within this you'd say this, then, six months on, we think it's something else.

00:19:40.770

E.S.: You've got to be right if you change it, haven't you?

00:19:41.190

R.9.: Yes. So internally we had a lot of debate about at what point do we go back and have that conversation.

00:19:50.640

E.S.: You need more money, the licence to spend more money?

00:19:55.200

R.9.: Yeah absolutely. So externally there's that, which was more kind of regulatory, and I guess more on the regulatory points as well is the Drinking Water Inspectorate was kind of the quality regulator. We're also aware of, we've had some sites that have had various problems in the past right. And they wanted confidence that well, you're not going to go ahead and do all these things with this new project and implementing it, which comes with the risk, so every time you make a new connection and anytime you excavate something you're creating risk. So how are you going to make sure that this doesn't actually affect the day to day running of the existing works whilst you're building this brand new brand works for yourselves. Initially it was agreed that there'll be this kind of stability period so that you would ensure that your existing assets were stable. Then you're set to make interventions with bringing connections with the new asset. But project timelines can wreak havoc to all those kinds of plans, because before you know it a design change has meant that actually you're now at a point a year later than you thought you were. So now, the luxury of those design hold points for the purposes of stability are creating constraints that are effectively unmanageable. We can't have a year of not doing anything because we need to have delivered this project by such and such an end date right, so again realities of design and things evolving that require work. Again, that required another set of negotiations with the quality regulator.

00:22:00.150

E.S.: Is it a good relationship with the regulator? Do you find them like policeman or are they constructive advisors or somewhere in the middle?

00:22:08.850

R.9.: I would say somewhere in the middle, because the levels of understanding are different, and the practicalities of running the works day to day versus a more kind of, I don't mean this disparagingly, a helicopter view.

00:22:29.280

E.S.: They're only in at the result, aren't they, not how you get there to some extent?

00:22:32.820

R.9.: That said, we've had constructive conversations around, okay here's what we're saying, here's what we're experiencing and here's what we're trying to do about it so, so there are some elements that definitely have been, I would say very constructive, but there's always a gap between trying to, how do I communicate the right level of understanding of the issues that we're dealing with on a practical day to day level that manifest themselves, as delays to the program and things like that.

00:23:07.800

E.S.: Have you had much contact with Natural England or Environment Agency or environmental bodies during this project?

00:23:15.570

R.9.: So over the course of this project, yes, from the point of view of the Environment Agency, abstracting water from the river and trying to resolve, trying to determine what our licence says to make sure that is appropriate for what we're doing. So a bit of an example with the Environment Agency is again, at the of the inception of the project, one of the licence requirements that I recall reading had one of these what they call... I've forgotten what it's called, I'll remember in a moment. So clauses that say if you get up to this point and you haven't done activity X, you basically lose that benefit.

00:24:07.470

E.S.: You lose your licence, they revoke your licence?

00:24:10.020

R.9.: Yes, as I was reviewing those, so again, I was one of these people who came into the project perhaps halfway through, so kind of picking the baton from others, and going through that detail and actually discovering that actually a) it was going to expire, but what it was going to expire was a key part of what we actually needed to continue. We had to work with the with the Environment Agency to basically refresh those licences and kind of effectively renegotiate them, and I would say that we certainly had a good working relationship with the EA they, managed to address those but, as the project went on, particularly towards the end and we're trying to communicate our end milestones, when would we actually be abstracting water, at what point. And it also coincided with the commission period, and commissioning on these large schemes, this is where you discover what your real problems with the technology and equipment are, and inevitably, this is where most of the delay sits. In my view or, in my experience, projects tend to be during feasibility and design, the delays in those in those phases tend to not be challenged as much so those phases can drift, but if you've got a hard stop at the end, those drifts, all they're doing is they're always squeezing on the construction and commissioning but, in my view that balance should almost be like the other way around, because construction and commissioning, in particular, is where you're starting to actually discover where your issues that you need to fix are. With this project that was squeezed, and so it also meant that at the end we were requesting extension upon extension and obviously that didn't really put us in the best of our positions in terms of relationships with our regulator. Because we're also asking them to turn around things quite quickly. Not comfortable for them, not comfortable for us. Natural England, perhaps, right at the start, because when we worked out which sites we were

actually going to work on. But once that had been established, we had acquired land and then how we went to manage that was already clear.

00:26:47.370

E.S.: What about the public?

00:26:48.570

R.9.: Oh public, another big one.

00:26:51.480

E.S.: Was it something that they would notice, something they've been engaged with or was it an invisible project?

00:26:58.110

R.9.: So big parts of this were invisible, i.e. on [co]'s own land where we had the existing operation, so didn't see much of it, however, the big impact of this is, the people of [city] have long enjoyed the lovely water from [place], famed for its for it being soft water. Now we're bringing in river water. So although from a quality perspective it's all drinkable water, in fact, you know, the vast majority of our customers drink water that is sourced from rivers up and down our network. But if you've been used to drinking this and you're starting to get this, you will notice a change. It's always the change and, that's also true, the other way around, so you might have been used to river water and now you're getting this water, people always pick up on that change. That was one of the big areas that we had to do a lot of work on. So in [city], we did a lot of these focus groups studies, taste tests and all this kind of thing to a) explain what the changes were, but also just try and test it out see, okay, can you taste the difference if I give you this water and that water. People also think they can, but in reality, I don't think anyone has got a good record of knowing which water is which (laugh).

00:28:40

E.S.: Pepsi and Coca Cola.

00:28:41.490

R.9.: Yeah basically that kind of thing, and then so one of the things we realised was we would need to communicate that we're making this change, because some of our customers are also non-household customers. [] have got pin shops in [city] and those can be quite sensitive to actually what water quality they're receiving. We also made a conscious effort to take steps to communicate with our retail, non-household customers, and again that we started to see the difficulty with that because, okay, we need to tell you when we're going to do this change, and when we're going to be doing this work. However, the nature of the water system and managing and operating it means, telling you exactly what date we're going to do something is very difficult. Because if I've got a burst somewhere on the network, I'm going to have to delay this big thing that I'm doing because I need to make sure that customers in [] still have water to drink. I can't just plough on with this work. We discovered things like that makes it very difficult to communicate exact dates and with our non-household customers, they were struggling with that, so tell us a date when you're doing this, and all we could say is well, we would like to do it on this date. I think, initially, we told them some dates, but we found that we had we were cancelling them, and so that just generated that bit of nervousness around any days that we communicated, so ultimately we resolve to just more generic communications to say, every year, your water quality from time to time is going to change. It has to be that. Yes, it had to be that broad, so if that meant that they've now got to go and drill their own

bore holes, or have their own treatment processes on site to cope with that variation, at least that it was broad enough to actually allow them to make decisions in that regards.

00:30:50.490 550

E.S.: You didn't have a lot of complaints coming in, you knew yourselves you have to communicate these issues as part of your planning and project management?

00:31:01.710

R.9.: Yes, and we've got some examples on a very small-scale, examples of changing water supply and people writing into to say my waters changed, what's happened to that, and there are some real kind of physical changes as well as part of this, because reversing water in a water main means water that's usually had this velocity in that direction and settlement, so you get minerals, ions in water that that precipitates. So, all those types of sediments, precipitations within the mains, if you reverse the flow you're going to sweep all those up again and put it into suspension, and chances are someone's going to open their tap and they're going to have discolouration as a result of changing the direction of flow, so we knew that. That was definitely one of the things that was likely to be true, and so we also did some further works to see how we could minimise that, so we've got a whole system of flushing mains, and you know oh, this was activity again. At project start we didn't really think these will be issues, but we had to instigate additional projects to address things like this, so we had that. But we also have some good international examples of issues that can arise with changing water. So you might have heard of Flint, Michigan.

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E.S.: Oh goodness, yes.

00:32:35.370

R.9.: This is an area where we've had soft water. With those auto phosphoric acid for lead mitigation, lead pipes that are within homes, so [co] doesn't actually have any lead pipes, but some properties do, but it still falls as part of our duty, even though those are private mains, to also address those. So bringing in river water is something that we're conscious that these are some of the things that potentially could arise that we need to address, so we were thinking of all these kinds of things. So united utilities also had some issues a few years back, where they brought in a new works into operation and they had significant problems like that, so we're trying to learn from these projects that we know of both in this country and also internationally.

00:33:43.200

E.S.: I'll ask you this even though you weren't here at the start. Part of the project is learning from, I won't say mistakes, but learning from experiences. So if you are starting this project again, what would you principally do differently? With the benefit of hindsight.

00:34:02.250

R.9.: So something I didn't quite touch on was levels of resource and kind of engagement across the business. This was a massive project, the biggest project [co]'s ever delivered to date, there'll be other projects that will now eclipse that, but kind of recognising that this is different for us. I think it's very easy to almost treat these projects, sometimes, as business as usual, we deliver engineering projects as a matter of course, within [co], but recognising the change in scale, I think. It's really important to recognise, and having sufficient levels of resource on a project that acknowledges that. But also recognise the impact of it, or the desire for this project to have an impact on the wider

business. Every project to a certain degree, is you deliver a project, it's supposed to result in a change in how we operate, i.e. you're doing your project, it's supposed to result in something tangibly different to what you were doing before.

00:35:32.910

E.S.: Transformational, in some way?

00:35:37.110

R.9.: Transformational, yes, that's a better word for it, and so in this case also recognising the level of transformation which was organisation-wide, which meant that actually our steering groups, I think needed to be more than just the [city] oriented ones, but actually whole business wide.

00:35:58.500

E.S.: The whole system.

00:35:59.160

R.9.: So, obviously, that means pulling resources from elsewhere in the business so, which means my comment on resource is not just project resource, but also recognising that all these other teams somehow need to have time freed to be able to put some thought to this project that's going to impact on them.

00:36:20.370 --> 00:36:28.020

E.S.: Rather than just when it does impact and go I hate this.

00:36:28.320

R.9.: Oh yes. And even as we went about trying to engage with them. You know, to begin with, you could almost say there was a bit of denial. Okay you're telling me this, oh that's the work you're doing, oh very interesting, thank you for telling me, I'm off. No, actually you've got a stake in this, I'm expecting you to do something as a result of having received this information. I think what it ended up being was, towards the end almost having to bring people kicking and screaming in a way, because actually, it's now going to be done, we're now at a point where we don't even have the luxury of time to say let's do this bit by bit, so, so I think a bit of recognition across the organisation that actually time needs to be put towards this. And that includes our finance colleagues as well, so we've got these support functions, who again in terms of the business as usual, they're really good at it and they're good at driving performance in that regards, but then also recognising that okay, this is what this means, and this is how it will impact all these bits of organisation that we are setting performance standards and performance targets for. How do we allow for them to be able to accommodate in this, because if I'm saying your budget was this last year and it's still this this year but I'm expecting you to now do X amount of activity over and above that, that doesn't look right, and that then drives the behaviour on the ground as well.

00:37:58.950

E.S.: You said that the primary driver for this project was resilience pressured by aging infrastructure. It sounds like the business wanted more than that, though. Was there any other drivers like climate change and lack of supply issues or environmental drivers? This is a massive project.

00:38:31.170

R.9.: I think, primarily, it was definitely this resilience piece. But then what started to come into it was so, if I perhaps expand more on the example of... when we then now had to go back to the other teams and say well, usually [city] is supporting the rest of the grid, now the grid needs to support [city]. At that point that there was also a realisation that actually the resilience on the rest of the grid is not what it needs to be. And so, what do we need to do to bring that up to speed.

00:39:15.540

E.S.: So resilience, then resilience squared.

00:39:18.690

R.9.: Yes, yes, yes.

00:39:20.160

E.S.: You have a resilience issue, then you realised how dependent we are on that, I see. Leakage targets are big drivers as well, aren't they.

00:39:33.240

R.9.: So now, I suppose, this is where, in terms of leakage. Any water that we're losing to leakage is water that we're not putting into supply, i.e. we're treating water but let's say if 10% of it is leakage, that's now 10% we're now needing to make up somehow elsewhere, so that did bring into focus things like that. Okay, what are we saying about leakage, so therefore, do we need to do something with that to be able to do that. With water, what our solutions are, create more water. It's not as easy as that because you've got a limited licence.

00:40:25.020

E.S.: It's not a limitless resource, no matter how much it rains...

00:40:28.680

R.9.: Treat more water is one answer, reduce leakage is the other, you're kind of going through this hierarchy of options.

00:40:40

E.S.: Reduce demand.

00:40:41.910

R.9.: Reduce demand, exactly.

00:40:44.820

R.9.: And so one of the things that I guess I learned actually as part of this was, also leakage isn't a straightforward as this is, the figure for leakage doesn't necessarily equate to that's the amount of water we actually losing. So part of it is, we've got meters, we're measuring how much flow we've got on the network, but if we've got flow meters that are not quite reading the right figure, part of the leakage figure is this, I want to call it a theoretical leakage, it's not real but, but if my flow meter isn't measuring correctly, it means that water I'm saying I haven't accounted for, I measure it as leakage, but it doesn't mean that there is 10 megalitres of water out there. But to find physically, my pipes might be well intact, I might not have physical leakage but until I've got a good end to end process measure, it's recorded under leakage. So that was also another term to be reconciled within that. So, ultimately, I guess, where I'm going with this is it resulted in a bit of almost needing to

really understand the processes within different directories and different departments of the business, because these are the areas where the benefits for the projects could be unlocked. If we didn't understand them, you're kind of forever designing something that might not necessarily address the issues. If you've got an inefficiency there, best that you know that you do have an inefficiency there, rather than keep building.

00:42:38.820

E.S.: You've got to know your baseline, haven't you. An accurate baseline.

R.9. Yes

E.S. I've asked a lot of questions on resilience, but this is going to sound like a really stupid question, you ready. It's so I understand drivers behind decisions, so why are [co] interested in resilience? Why are they bothered by it?

00:43:08.970

R.9.: It's a very good question.

00:43:17.280

E.S.: There's an obvious answer but I'd rather not guess the answer, I'd rather hear the answer.

00:43:23.820.570

R.9.: That perhaps goes to the actual fundamentals of the whole industry and where we are at the moment. So yes, absolutely, so I think climate change is ultimately where we're at, so we are as individuals, as organisations, and in terms of the water system, I think we've consumed more and more and more, and now if we're looking at things from an environmental point of view, so, if you look at what the Environment Agency is saying about, the environment, if we start there, they're saying well actually we don't have as much water as we used to abstract. Or over-abstraction is an issue for us, so it's not just water companies, it's farming, it's all these uses. They've been saying well actually, over-abstraction is an issue for us because it's resulting in habitats that are suffering as a result, and so we need to take action to address that. So fundamentally kind of going back, yes, yes, I would say that's kind of the start.

00:44:34.590

E.S.: I've worked for the water sector for a bit now. A couple of years. And I've got some insights into the complexity of what goes on and people outside can make quite disparaging comments about privatisation, it's all about money. And to hear you say, well, actually I'm a project manager on the ground and a driver here is climate change is an antidote to that I suppose.

00:45:01.140

R.9.: Oh yes, absolutely

00:45:05.910

E.S.: Money's got to be a factor hasn't it. Customers are paying for a service and then you find that money out there.

00:45:09.990

R.9.: Yeah I guess it's paying for all the kind of creative solutions. There's a whole supply chain sitting around [co]. So it's paying for all those kind of creative solutions, people with international experience that can say, well, I think one of the ideas in recent years was putting water basically, pumping water into aquifers, so aquifer storage and recovery. It's worked in some places, but it's experimenting and testing all those ideas. It fundamentally comes back to, we know that, in the UK, and I think we know this, every summer, we go through a patch where it goes dry and our river levels are low but our demand goes way high. In terms of continuity of supply, that becomes a real issue, so how do we address all those things, those fluctuations between we seem to have a good amount of water in the winter, but during the summer that position changes dramatically, how do we address that. And also how do we address things like nationwide where, in the north, you've got a bit more than in the south. There are much bigger projects on the horizon to try and tackle things like that basically. Economics of it all, and how much it costs.

[end of interview- not transcribed]