Environment Agency response to the National Infrastructure Commission's Second National Infrastructure Assessment: Baseline Report

The Environment Agency (EA) is a delivery body, advisor and regulator on a range of environmental, flood risk and energy infrastructure, and an advisor on climate change resilience and spatial planning. Our work is driven by our goals to enable net zero, climate resilient places and infrastructure that are good for people, nature and the economy[1].

We have a key role in delivering and enabling infrastructure which helps to protect people and the environment, including in flood and coastal erosion resilience, water supply, sewerage, waste and regulated industry. We help the country to be better prepared for climate impacts, where we lead on managing and responding to the wide range of risks associated with too much and too little water. We see first hand the impacts of extreme weather and sea level rise on communities and infrastructure.

Material in this response has been co-ordinated from a range of specialists. If further conversations are helpful, please contact Andy Howe, Senior Advisor, Sustainable Places to make connections with the appropriate lead. andy.howe@environment-agency.gov.uk

Call for Evidence questions

Question 1: Do the nine challenges identified by the Commission cover the most pressing issues that economic infrastructure will face over the next 30 years? If not, what other challenges should the Commission consider?

The UK needs to be prepared for worse and more frequent environmental incidents and understand and better prepare for the potential impacts on infrastructure so that we can keep going when incidents happen that exceed asset design criteria. We cannot eliminate all risk or build a way out. We need to be ready for the disruption to our infrastructure that we know will happen.

We therefore broadly welcome the NIC's the nine challenges listed for consideration in the next NIA, listed under the three strategic themes of **reaching net zero**, **climate resilience and the environment**, and **supporting levelling up**. Our role as an advisor, operator and regulator means we have shared interests in many of the challenges listed, including in relation to decarbonisation, asset management, water management, and waste and the circular economy.

The identification of 'climate resilience and the environment' as one of the NICs strategic themes is positive. However, we consider that to effectively respond to the nine challenges identified, including those listed under themes of net zero and levelling up, that there are significant opportunities to enable nature recovery, increase climate resilience and improve the environment. All infrastructure sectors should incorporate the use of nature-based solutions to address impacts on, and deliver improvements to, air, land and water quality, which will also underpin the successful delivery of levelling up and achievement of net zero.

Within the baseline report, we welcome the commitment to assess the impact of NIC recommendations on natural capital, and to develop a set of natural capital principles for infrastructure which provide guidance on how best to deliver environmental net gain. Natural capital, green infrastructure and net environmental gain can increase the resilience of more traditional 'hard' infrastructure to hazards, and reduce the need for infrastructure investment and running costs, if it is designed in from the outset.

The EA's recent report to Government on climate adaptation under the Climate Change Act 2008 states that the impacts of climate change are already observable and will inevitably increase significantly due to historic emissions.[2] The report highlights five 'reality checks' that present systemic challenges to national resilience, including the resilience of infrastructure. We recommend

[1] Environment Agency: EA2025 creating a better place - GOV.UK (www.gov.uk)
[2] Environment Agency, 2021, Living better with a changing climate (publishing.service.gov.uk)
https://www.gov.uk/government/publications/climate-adaptation-reporting-third-round-environment-agency

that delivering climate resilience should be a principle that underpins all nine NIC key challenges, helping support projected infrastructure investment of £650 billion over the next 10 years[3].

Surface water management (challenge 6), is a life-threatening issue and one of a number of environmental shocks, such as drought, that need to be considered in the context of climate change. Evidence is clear that we will see more frequent, prolonged impacts and inter-related incidents. We will be carrying out analysis to determine what the climate altered incident scenarios are that we will need to adapt to and will feed this learning into the new UK Resilience Strategy.

Our evidence shows that the urban environment, including infrastructure sectors such as transport, is the third largest sector impacting on our rivers, estuaries, and coastal waters[4] (agriculture and the water industries being the largest sectors). We need to accelerate our efforts if we are to achieve the Defra 25 Year Plan ambition of clean and plentiful water. We need better integration between all organisations through better understanding of the value of this target to delivery each organisation's own objectives. There are multiple influences on the water environment. To make significant improvements will require investment through our infrastructure and individual behaviour changes. Investment and innovation will be needed across the public and private sectors.

Question 2: What changes to funding policy help address the Commission's nine challenges and what evidence is there to support this? Your response can cover any number of the Commission's challenges.

We recommend that NIC identifies mechanisms that are required to unlock private sector investment in climate adaptation, infrastructure resilience and nature-based solutions. Through our work on the IGNITION project[5], a ground-breaking endeavour that aims to develop innovative financing solutions for investment in Greater Manchester's natural environment, we have come across significant challenges such as short-term price guarantees, low returns on investments and a lack of support for investors willing to take risks related to early-stage investments. We believe these can be overcome by increasing the level of climate risk awareness, developing market mechanisms to make a return on investment, and building expertise and funding to develop investible projects.

Traditionally, the responsibility for managing climate change resilience has been in the domain of the public sector. However, with increasing amounts of infrastructure being owned and managed by the private sector (for example utilities, transportation, information and communications technologies) combined with increased exposure to climate-risks, private sector participation in resilience and adaptation will be necessary. This is likely to be driven by climate-related financial disclosures, for example the framework developed by the Task Force on Climate Related Financial Disclosures (TCFD).

To achieve good asset management, including surface water and wastewater management, there needs to be an uplift in the capital maintenance allowance mechanisms for water and sewerage companies. High profile pollution incidents and prosecutions demonstrate that asset investment needs to be increased to prevent degradation in performance, and to respond to climate change and public expectations of improved environments.

We welcome the government's record capital investment of £5.2 billion capital investment in FCERM for 2021-27 which will help better protect 336,000 properties as well as infrastructure and avoid over £32 billion of wider economic damages. However, this investment needs to be considered in the context of wider national infrastructure delivery as well as the increasing level of risk resulting from climate change.

The Infrastructure and Projects Authority (IPA)'s Analysis of the National Infrastructure and Construction Pipeline sets out nearly £650 billion of public and private infrastructure investment by 2030[3]. This identifies over £200 billion of planned investment for announced projects in the pipeline that will occur by 2024/25, during which period we know there will be approximately £3 billion investment in flood and coastal risk management infrastructure. However, £3 billion worth of

[3] National Infrastructure and Construction Pipeline 2021 - GOV.UK (www.gov.uk)
[4] River Basin Management Plans 2021- Challenges and Choices consultation summary report
[5] IGNITION - Greater Manchester Combined Authority (greatermanchester-ca.gov.uk)

investment in flood defences cannot secure the resilience of £200 billion worth of wider infrastructure investment. For this reason, we need a holistic and systems-based approach to infrastructure which considers public and private investment across all sectors. With climate shocks worsening the UK should begin to systematically embed adaptation and resilience measures in investments across the whole government estate as well as privately funded projects in the national infrastructure pipeline.

Question 3: How can better design, in line with the design principles for national infrastructure, help solve any of the Commission's nine challenges for the next Assessment and what evidence is there to support this? Your response can cover any number of the Commission's challenges.

We suggest that biodiversity net gain and nature-based solutions are added as specific elements to the NIC's design principles for national infrastructure. This would encourage early consideration of these matters, and ensure new infrastructure is designed to maximise multi-functional benefits.

Delivery of nature-based solutions through early consideration and good planning leads to better design. We support the approach developed by Ciria's delivering better water management through the planning system[6]. Nature-based solutions provide multi-functional benefits such as carbon sequestration and enhancement of natural capital and biodiversity as well as cost savings. There is a strong body of evidence that suggests that nature-based solutions can limit the asset maintenance requirements of asset systems and can also reduce initial capital costs too[7],[8],[9]. Examples of commonly used nature-based solutions include sustainable drainage systems (SuDS); saltmarsh restoration and wetlands for improved water quality, water quantity and recreation.

Well-designed multifunctional SuDS, such as swales, attenuation ponds and reed-beds, can help address sediment and contaminants in run-off associated with new infrastructure, such as roads. Run-off attenuation, storage and infiltration provided by SuDS can help relieve pressure on existing assets such as combined sewers and reduce operation of combined sewer overflows. When SuDS are considered early in the design process they tend to be better integrated into development, including new infrastructure, minimising their land-take and delivering a wider range of multifunctional benefits.

Question 4: What interactions exist between addressing the Commission's nine challenges for the next Assessment and the government's target to halt biodiversity loss by 2030 and implement biodiversity net gain? Your response can cover any number of the Commission's challenges.

Nature-based solutions will be critical to achieving the government's target to halt biodiversity loss by 2030 and implementation of biodiversity net gain (BNG). Local Nature Recovery Strategies (LNRS) are a new spatial planning mechanism to bring together a wide and complex range of different plans and spatially plan strategically to drive more coordinated and practical action to help nature. In the longer term they will lead to a more efficient way to prioritise investment in the environment. LNRS provide the opportunity for economic infrastructure in England to identify optimal locations to manage impact of infrastructure on nature and drive recovery and improvements. For example, by encouraging sustainable practices for surface water management there is less reliance on grey, engineered infrastructure. Wet habitat creation will support surface water management alongside nature recovery. and the provision for carbon capture and storage.

New infrastructure should avoid or minimise habitat loss by considering biodiversity in site selection and infrastructure design. Nature based solutions such as reinstating meanders, naturalising riverbanks and opening culverted water courses, delivered through infrastructure development can better protect infrastructure, providing space for water away from homes, businesses and infrastructure and contributing to BNG.

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[6] Delivering better water management through the planning system guide (ciria.org)

[7] Wyre Natural Flood Management Scheme, https://www.theriverstrust.org/our-work/our-projects/wyre-nfm-investment-readiness-project

[8] Cambridge University Salt Marshes and Flood Risk, https://www.cam.ac.uk/research/news/salt-marsh-plants-key-to-reducing-coastal-erosion-and-flooding

[9] Regional Habitat Compensation Programme. https://southerncoastalgroup-scopac.org.uk/rhcp/

There are significant opportunities to create local and national markets to support nature-based solutions delivery and the benefits they can realise. The key drivers for these include spatial planning requirements, for example through biodiversity net gain, and corporate disclosures on nature and environment (Taskforce for Nature-based Disclosures). In addition, if embodied carbon emissions in new physical infrastructure are correctly accounted for and priced in, we anticipate that this will stimulate the demand for nature-based solutions.

We also suggest the NIC look beyond BNG to how can the next infrastructure assessment address the Government 25 YEP ambition of wider ENG and recovery of natural capital, building on the work previously published[10]. Sustainable drainage systems integrated as part of new infrastructure should be designed to contribute towards biodiversity net gain and should meet the non-statutory technical design standards for design, maintenance and operation[11].

Question 5: What are the main opportunities in terms of governance, policy, regulation and market mechanisms that may help solve any of the Commission's nine challenges for the Next Assessment? What are the main barriers? Your response can cover any number of the Commission's challenges.

It is vital that infrastructure planning and delivery is not done in isolation but considered in an integrated way. Each of the nine challenges identified have the potential to interact with each other and those interactions can be designed to reduce overall costs and maximise outcomes if the governance overseeing them is able to integrate planning and delivery.

There could be a role for government to coordinate or mandate the relationships between connected or proximate infrastructure, especially where there are interdependencies and the potential for cascading risks or where one operator may create or increase risks for others (for example, where there could be increasing competition for water supplies). In the USA the National Infrastructure Protection Plan coordinates critical infrastructure and key resource protection efforts across the country and between public and private sectors. The UK does not have a corresponding mechanism to coordinate national infrastructure climate resilience and local adaptation measures.

Policy and funding which encourages partnerships would also encourage better understanding of the individual contributions to resilience and allow an increased effectiveness of the societal response. As an example, water companies have a key role across several risks including flooding, water pollution and drought. More investment in terms of time and money is needed outside of the emergency situations to develop relationships, understanding and prevent incidents and risks at source to infrastructure. This will improve the effectiveness of response during an emergency.

Cost-savings arise from consideration of how different infrastructure types can be designed and delivered together. For the UK, the cost saving opportunity has been estimated to be in the tens of billions of pounds. Research by UK Research and Innovation within their GreenSCIES project[12] made a number of recommendations that we support, such as the provision of an advisory service to local authorities and other project sponsors to support project development. This would increase resource levels and share best practice. In the energy projects that were considered in the research they estimated a potential saving of £12bn by 2050 if a more integrated approach is taken. This could be extended to integrate other themes such as water, nature and resilience.

The lack of a consistent definition or understanding of resilience in legislation is a major barrier for progress. The approach to resilience differs depending upon circumstances, situation and stakeholder. A common definition, or set of outcomes for resilience, which could be applied at the system, asset or place context, could provide the unifying basis for a common understanding of a resilience at central government, devolved administrations, infrastructure providers and local contexts. There is a need to look beyond emergency response to make sure resilience is built into planning and design decisions for buildings and infrastructure.

[10] Updated-Natural-Capital-Paper-Web-Version-Feb-2021.pdf (nic.org.uk)
[11] Sustainable drainage systems: non-statutory technical standards - GOV.UK (www.gov.uk)
[12] GreenSCIES | Green Smart Community Integrated Energy Systems

Understanding the potential risk and cascade effects at a local level and across infrastructure sectors is essential and needs leadership and strong governance. Risk assessment to infrastructure could be done more effectively but require more join up, and data sharing. Particularly for utilities, it requires sharing data about infrastructure site locations and site resilience, infrastructure disruption duration, business operation rules around connectivity, failure propagation and system redundancy that are often commercially sensitive. There are established, secure facilities for enabling these assessments, such as the Data and Analytics Facility for National Infrastructure.

Challenge 1: The digital transformation of infrastructure – the Commission will consider how the digital transformation of infrastructure could deliver higher quality, lower cost, infrastructure services.

Question 6: In which of the Commission's sectors (outside of digital) can digital services and technologies enabled by fixed and wireless communications networks deliver the biggest benefits and what how much would this cost?

The increasing reliance on digital services within resilience planning deliver many benefits and efficiencies through digital transformation. For example, there is potential for digital services to play a large role in supporting the communication of risk to infrastructure in the lead up to, during and recovery from an environmental incident such as flooding.

We should increase our capability to acquire and act on improved information on the vulnerability and sensitivity of communities, infrastructure and the environment in combination to create more local, granular information about potential impacts from extreme shocks. For example, the Environment Agency's national receptor dataset, drawing from key public sector datasets, provides property information for the whole of England allowing flood damage to be estimated at a property level. Having the ability to access resilience data through common platforms for infrastructure would assist when managing wide scale emergencies crossing organisational borders. For example, there is potential for digital services to play a large role in supporting the communication of risk to infrastructure in the lead up to, during and recovery from an environmental incident such as flooding, including with infrastructure operators, customers and communities.

Technology does also provide a potential source of vulnerability to either natural or malicious threats. The European flooding in 2021 illustrated the types of difficulties for responders and for recovery associated with widespread loss of power and other utilities. UK incident and communication capabilities need to be resilient and accessible when emergencies strike.

The resilience of water supply infrastructure needs to be improved to withstand both cyber-attacks and environmental impacts such as floods and droughts. This applies to water resources and treatment works networks and agriculture facilities such as reservoirs. The increased incidence of floods, droughts and cyber-attacks globally, and the increasing risk of these is a key driver. Smart meters for water use are an example of a digital service that would reduce water consumption and leakage as people and businesses have quicker access to their water use data. Some properties can't currently be metered, and this is where new digital services and technologies could help. Research commissioned by Waterwise and Arqiva found that smart water meter rollout could deliver up to 0.5% total greenhouse gas reductions[13], an overall £2bn net benefit to society and results in lower average household bills[14].

Question 7: What barriers exist that are preventing the widescale adoption and application of these new digital services and technologies to deliver better infrastructure services? And how might they be addressed? Your response can cover any number of the Commission's sectors outside digital.

We have no specific response to this question.

2. Reaching net zero

[13] Arqiva+Waterwise+Net+Zero+Report+FINAL.pdf
[14] Cost benefit analysis, assessing the social and environmental case for a smart water meter rollout (arqiva.com)

Challenge 2: Decarbonising electricity generation – the Commission will consider how a decarbonised, secure and flexible electricity system can be achieved by 2035 at low cost.

Question 8: What are the greatest risks to security of supply in a decarbonised power system that meets government ambition for 2035 and what solutions exist to mitigate these risks?

The electricity system faces a number of threats, some of which are exacerbated by both a changing climate and a decarbonised power system. Decarbonising the grid in the right way needn't always lead to increased vulnerability and new infrastructure can improve resilience. A UK-based resilience report by the Energy Research Partnership[15] notes that increased complexity and reliance on electricity and communications technology leads to increasing vulnerability and interdependency. The four key threats they acknowledged were:

- technology – growing reliance on tech, telecommunication failures, rapid change of technology
- electricity system – decentralisation, electrification of heat and transport, changing generation mix impacting the system
- geopolitical and human – societal expectations, malicious intent to affect networks, resource & fuel availability
- natural hazards – flooding, severe weather, wildfire, solar storms

The European Environment Agency report, Adaptation challenges and opportunities for the European energy system[16], outlines the major opportunities and threats across Europe. One of the conclusions is that whilst we may not be able to accurately define resilience, we need to recognise that climate change and extreme weather will increasingly impact our energy systems and we need to actively identify and manage these increasing threats. The report acknowledges that an increasing share of renewables in the system does increase climate-sensitivity.

The most important route to resilience is ensuring new energy technologies that deliver decarbonisation are fit for the future. Many of the technologies needed to decarbonise the electricity grid haven't been deployed at scale yet, and some have yet to be invented. We need to ensure the approaches taken to design and deployment inherently promote and ensure resilience. The Environment Agency has set out high level Environmental Principles for the Energy Sector that government, regulators and industry can use to ensure that new technologies meet future needs. We are supportive of technologies and approaches that:

1. **Consider environmental risks early and comprehensively**. This includes:
   a. Building environmental considerations into decision making at the earliest stage – not as an afterthought
   b. Providing robust evidence that allows the environmental risks to be effectively managed and regulated, and which considers risks of deployment at commercial scale
   c. Assessing all impacts from cradle-to-grave - including harvesting feedstocks and raw materials, decommissioning, and safe long-term storage of waste
   d. Engaging the public so they understand the risks and benefits

2. **Minimise the impacts and risks to people and our environment** – air, land and water. This includes:
   a. Maximising decarbonisation and greenhouse gas reduction within safe environmental limits
   b. Maximising resource, energy and water efficiency – wasted resources, energy and water represent harm without benefits
   c. Maximising co-benefits for people and the environment

3. **Are fit for the future**, including resilience to the impacts of climate change

Challenge 3: Heat transition and energy efficiency – the Commission will identify a viable pathway for heat decarbonisation and set out recommendations for policies and funding to deliver net zero heat to all homes and businesses.

[15] https://erpuk.org/wp-content/uploads/2018/11/4285_resilience_report_final.pdf
[16] https://www.eea.europa.eu/publications/adaptation-in-energy-system

Question 9: What evidence do you have on the barriers to converting the existing gas grid to hydrogen, installing heat pumps in different types of properties, or rolling out low carbon heat networks? What are the potential solutions to these barriers?

The Environment Agency does not hold evidence on the barriers to converting the gas grid. We are a regulator for parts of the gas network under our COMAH regulation and this would continue under a hydrogen gas system. We are working with BEIS and Ofgen to ensure that heat network regulation is well-aligned and leads to a decarbonised system where consumers and the environment are protected from disruption.

We are the lead regulator for heat pump schemes that involve abstraction and discharge of water from groundwater, river and lake sources. These ground and water source heat pumps are anticipated to be a small proportion of overall heat pump deployment. **Our engagement with industry representatives leads us to understand that one of the barriers to deployment of water and ground source heat pumps is the longer planning and permissions timeframes compared with other renewables such as rooftop solar.** The inherent uncertainty associated with groundworks is a barrier to all development but is more prevalent with heat networks and some heat pump systems.

Question 10: What evidence do you have of the barriers and potential solutions to deploying energy efficiency in the English building stock?

The Environment Agency does not hold specific evidence in relation to improving energy efficiency in existing housing stock. However, we are aware of research on financing mechanisms for resilience. One of the best examples is PACE, used in the US to deliver energy efficiency[17]. We see the opportunity to use these types of schemes to deliver resilience measures for properties too. We recommend that net-zero and adaptation are considered together and that an emphasis is put on delivering national resilience alongside transition to net-zero. TCFD disclosures on greenhouse gas emissions on current and future housing stock might also prove to be a key driver for decarbonisation and improving energy efficiency of residential properties in England.

Challenge 4: Networks for hydrogen and carbon capture and storage – the Commission will assess the hydrogen and carbon capture and storage required across the economy, and the policy and funding frameworks needed to deliver it over the next 10-30 years.

Question 11: What barriers exist to the long-term growth of the hydrogen sector beyond 2030 and how can they be overcome? Are any parts of the value chain (production, storage, transportation) more challenging than others and if so why?

The long-term deployment of hydrogen may be shaped in some part by environmental constraints. We are working with BEIS, industrial sectors and the water industry to explore the water needs of new technologies such as hydrogen production (blue and green) and the location of these developments. Blue hydrogen will primarily occur in industrial clusters and these locations are coastal or estuarine. Availability of clean water may still be a limiting factor, as may environmental limits of estuaries where cooling waters are discharged. New technologies and approaches to hydrogen production should focus on minimising environmental impacts as this will maximise possible deployment options.

Green hydrogen also has quite high water demands, which could potentially be a barrier to the long-term growth of the hydrogen sector, unless it can be planned for in a strategic way so that local demands are known well in advance, can be mitigated for with new supply sources, or new infrastructure located in areas with water availability. The energy industry is starting to work more with regional water resource groups and this needs to continue across the country to ensure demands are accounted for in future planning.

Question 12: What are the main barriers to delivering the carbon capture and storage networks required to support the transition to a net zero economy? What are the solutions to these barriers?

[17] Property Assessed Clean Energy Programs | Department of Energy

The barriers to carbon capture and storage (CCS) are linked to the barriers for blue hydrogen given they are linked via steam reformation of methane for carbon capture and hydrogen. Other CCS deployments will face the same challenges with respect to emissions to water and air, and requirement for cooling waters.

3. Climate resilience and the environment

Challenge 5: Asset management and resilience – the Commission will consider how asset management can support resilience, barriers to investment, and the use of data and technology to improve the way assets are maintained.

Question 13: In what ways will current asset management practice need to improve to support better infrastructure resilience? Your response can cover any number of the Commission's sectors.

Asset management approaches will increasingly need to focus on maintaining resilience in a rapidly changing environment and the challenges that brings. There is a need for a systemic approach to provide resilient assets and increasingly understand how systems interact to provide services and manage risk. The Environment Agency's FCERM Strategy[18] sets out our objectives for climate resilience through adaptive approaches and resilient infrastructure; these approaches are applicable to the infrastructure assets the Environment Agency manages, and wider.

We recognise that many of our assets work together as part of the natural environment, and that they provide multiple benefits beyond their primary function. We also see investments we make on infrastructure assets creating wider benefit for society. We will continue to develop our ability to manage our assets - to maximise the value of our investments and to achieve more of our environmental objectives. We will develop our approaches to deliver government initiatives such as 'levelling up' and the Construction Play Book[19], working with local stakeholders to deliver more for communities.

Asset managers will make a significant contribution to achieving climate resilience now, and to the end of the century. Improving how they manage assets will contribute to both the mitigation of climate change, through reducing the carbon demand of assets, and to adaptation to climate change impacts. Asset management approaches will enable sustainable choices: where investments are not made too early, or too late, have the right balance between building new assets and maintaining existing assets, and flexibility inherent in preferred options.

In addition to being resilient to sudden short-term climate shocks such as extreme flood events, infrastructure also needs to be prepared for progressive 'slow burn' issues driven by incremental climate pressures, such as more frequent and more intense rainfall, drought and temperature extremes which impact on infrastructure performance, rate of deterioration and maintenance costs.

Infrastructure resilience is partly dependent upon environmental resilience. Natural capital, green infrastructure and net environmental gain can increase the resilience of more traditional 'hard' infrastructure to hazards, and reduce the need for infrastructure asset investment and running costs if it is designed in from the outset. The challenge is therefore not to protect infrastructure from the environment but to understand that environmental resilience is integral to infrastructure resilience and improved asset management, and indeed enables it.

Resilience standards for infrastructure assets would be helpful. The NIC has already set out a concept for how infrastructure resilience standards could work. To a large extent, the process could be self-regulating, with infrastructure operators such as the water companies and utilities being required to demonstrate and achieve certain operating standards. If regulators were to take on a more active role there would be a requirement to audit plans, procedures and contingency measures requiring resource with the necessary capabilities and hence funding. The regulators should be credible, informed, and competent to properly assess what could happen in certain circumstances and what contingencies are in place.

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[18] Environment Agency, 2020, National Flood and Coastal Erosion Risk Management Strategy for England

[19] The Construction Playbook - GOV.UK (www.gov.uk)

Improved asset management to support better infrastructure resilience also requires investment. The UK Green Taxonomy[20] (part of government's efforts to improve the environment, accelerate the transition to net zero and create green jobs) provides an opportunity to stimulate private investment in infrastructure resilience. It could do this by stipulating criteria, including adaptation and resilience measures, which specific economic activities need to meet in order to be considered environmentally sustainable. Government should consider what policy steps are needed to maximise the use of the UK Green Taxonomy for adaptation to ensure private investment is driving infrastructure resilience.

There could be different ways of achieving a commonality across public and private investment to create a Taxonomy-compliant whole market approach. For instance, all Government investment could be screened to identify priority programmes for adaptation, which should be Taxonomy-aligned and an expectation for Taxonomy linked disclosures by the public sector. In addition, an infrastructure resilience standard for the UK could be adopted such as CEEQUAL[21] or FAST-Infra[22] standard across all capital spend. This could be applied using a 'comply or justify' approach for public sector funding and the NIC could encourage it for private sector led investment too.

Water company Drainage and Wastewater Management Plans (DWMPs) are a welcome step forward for the visibility and future planning of risk for wastewater assets. DWMPs formalise the assessment of risk over 25-year planning horizons and inform the design of wastewater assets. This asset base has a long life and as such the focus is on maintaining and upgrading to account for new pressures, more so than designing new. Key to this is adequate funding from economic regulators, enabling investment that recognises the intergenerational nature of these assets. Under-investment now might not show up in outcomes for many decades and the outcomes we see now, for example in pollution incidents and prosecutions, are heavily influenced by past investment.

New data on storm overflow performance will drive significant infrastructure upgrades to the wastewater system, as required as part of the Environment Act 2021. This data provides the potential to allow asset operational issues to be flagged in many cases before impacting on the environment. Water companies need to develop systems to use this new data to prioritise their operational maintenance and capital programmes.

Challenge 6: Surface water management – the Commission will consider actions to maximise short-term opportunities and improve long term planning, funding and governance arrangements for surface water management, while protecting water from pollution from drainage.

The Commission has carried out a separate call for evidence on this challenge, as the Commission will deliver this as a separate study and report to government by November 2022, in advance of its other recommendations.

Challenge 7: Waste and the circular economy – the Commission will examine the role of the waste sector in enabling the move towards a more circular economy.

Question 14: What are the barriers to and solutions for expanding recycling capacity, both now and in the future to deliver environmental and net zero targets?

In relation to both questions 14 and 15, we recommend that NIC consider all the steps required for a circular economy (CE) approach. That should cover the whole project lifespan from design to re-use, re-manufacture and finally to recycling. This will require a broader focus than simply on waste, including a focus on circular design models for infrastructure, alongside optimal "use" models that reduce the need for capital renewal.

We advocate that infrastructure design is focussed on circular economy principles: to minimise resource use during construction and operational life and maximise the opportunity for resource re-

[20] Greening Finance: A Roadmap to Sustainable Investing (publishing.service.gov.uk)
[21] Resilience – Introducing CEEQUAL Version 6 - CEEQUAL
[22] FAST-Infra Platform - CPI (climatepolicyinitiative.org)

use after decommissioning. We recommend that NIC considers how that can be achieved for the 9 key challenges. The UK Green Taxonomy will set out criteria and thresholds for the CE and in the medium-term we recommend that policy and regulation acts to support that direction.

Recycling is the lowest point of the CE and needs to be viewed in this context, with the biggest gains in reducing waste to be made further upstream in the cycle, for example at the design and repair stages. The Circular Economy Regulations and Environment Act have invoked Extended Producer Responsibility for a range of dry recyclable materials. We suggest this could be further expanded to a wider range of products and material to encourage the maintenance of value and reduce damage from the contamination of material recycling streams.

Key barriers to expanding recycling capacity include:

- Poor segregation of waste, leading to damage and contamination.
- Outdated collection, handling and sorting systems.
- Too much emphasis placed on consumers to deal with end of use products/materials without adequate direction/incentives.
- Local authority funding pressures do not enable provision of higher levels of separate waste recycling collection.

Possible solutions to expanding recycling capacity include:

- Greater consideration of how much can be achieved in the CE through community engagement and the creation of local recycling hubs as a part of a distributed network that both maintains products in use, but also encourages reuse.
- Extending the application of Extended Producer Responsibility, with greater use of reverse logistics and service models in place of ownership. This could be achieved through regulatory drivers and developing economic incentives. The recent introduction of a tax to encourage the use of 30% of recycled content in plastic products is one example.
- Enable consumer behaviour change, helping to consumers to realise the importance of maintaining value and reducing risks of waste contamination.
- Empower and encourage communities to develop the CE and enable local authorities to support and benefit from this activity through improved funding.

Question 15: What is the likely environmental impact of waste streams from construction across economic infrastructure sectors, over the next 30 years, and what are the appropriate measures for addressing it?

Buildings and infrastructure should be kept in use, well maintained and repurposed as much as possible to reduce construction waste. The UK needs to move away from demolition in favour or refurbishment, repurposing and deconstruction. Construction and demolition waste (including excavation and tunnelling) is the largest waste stream, therefore any mismanagement of this waste has the potential for impacts at scale.

The main impacts manifest in fly-tipping and in larger scale illegal waste deposits, all of which can lead to environmental degradation, blight and remediation costs. Most of the material is bulky and therefore has a larger climate change impacts in terms of transport and treatment emissions, and embedded carbon. The main reason that materials aren't recovered and therefore become a waste, with the potential for non-compliance with environmental regulations, is that the value of the materials isn't properly recognised, rather the value of new development is given priority. Project time scales and factoring in waste recovery is poor, because it isn't recognised or easily visible to the client.

Potential solutions to reducing construction waste include:

- Introducing building passports that capture all the materials and highlight what can be reused or recycled and an assay of embedded carbon, to encourage reuse, repurposing and refurbishment rather than demolition.
- Behaviour changes within the sector, to move away from the concept of demolition to deconstruction. This could be incentivised through the use of carbon and materials taxes, and encouraged within the sector via resource management planning and reporting requirements.
- Better use of materials exchange mechanisms to increase reuse and reduce haulage, including centrally run, bonded storage of materials to ensure compliant use and quality.

- Improved and early planning, ahead of project start up, to enable deconstruction and assessment of the potential for refurbishment and repurposing.

4. Levelling up

Challenge 8: Urban mobility and congestion – the Commission will examine how the development of at scale mass transit systems can support productivity in cities and city regions and consider the role of congestion charging and other demand management measures.

Question 16: What evidence is there of the effectiveness in reducing congestion of different approaches to demand management used in cities around the world, including, but not limited to, congestion charging, and what are the different approaches used to build public consensus for such measures?

We have no specific response to this question.

Challenge 9: Interurban transport across modes – the Commission will consider relative priorities and long term investment needs, including the role of new technologies, as part of a strategic multimodal transport plan.

Question 17: What are the barriers to a decision making framework on interurban transport that reflects a balanced approach across different transport modes?

We have no specific response to this question.