

2021 River Basin Management Plan

Plastics challenge

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1. Summary

Plastics have grabbed people's attention. Recent media coverage has made society ask 'what more needs to be done to reduce plastics entering the ocean?' It is also important to turn our attention to plastics in the freshwater and soil environments. There are issues caused by visible plastic contamination of beaches, rivers and soils, and in the ingestion and entanglement of wildlife. There is also increasing concern about the potential impacts of micro-plastics in soils, air, the water environment, the food chain and on human and plant health.

The Government's 25 Year Environment Plan sets out ambitious plans:

- to reduce avoidable plastic waste
- for the plastic we use to be fully reused, recycled or compostable
- to prevent micro-plastics reaching the seas.

There is considerable political and public expectation for action. The public, the Environment Agency, government and industry need to understand the emerging issues and take decisive action to reduce micro-plastics entering the environment.

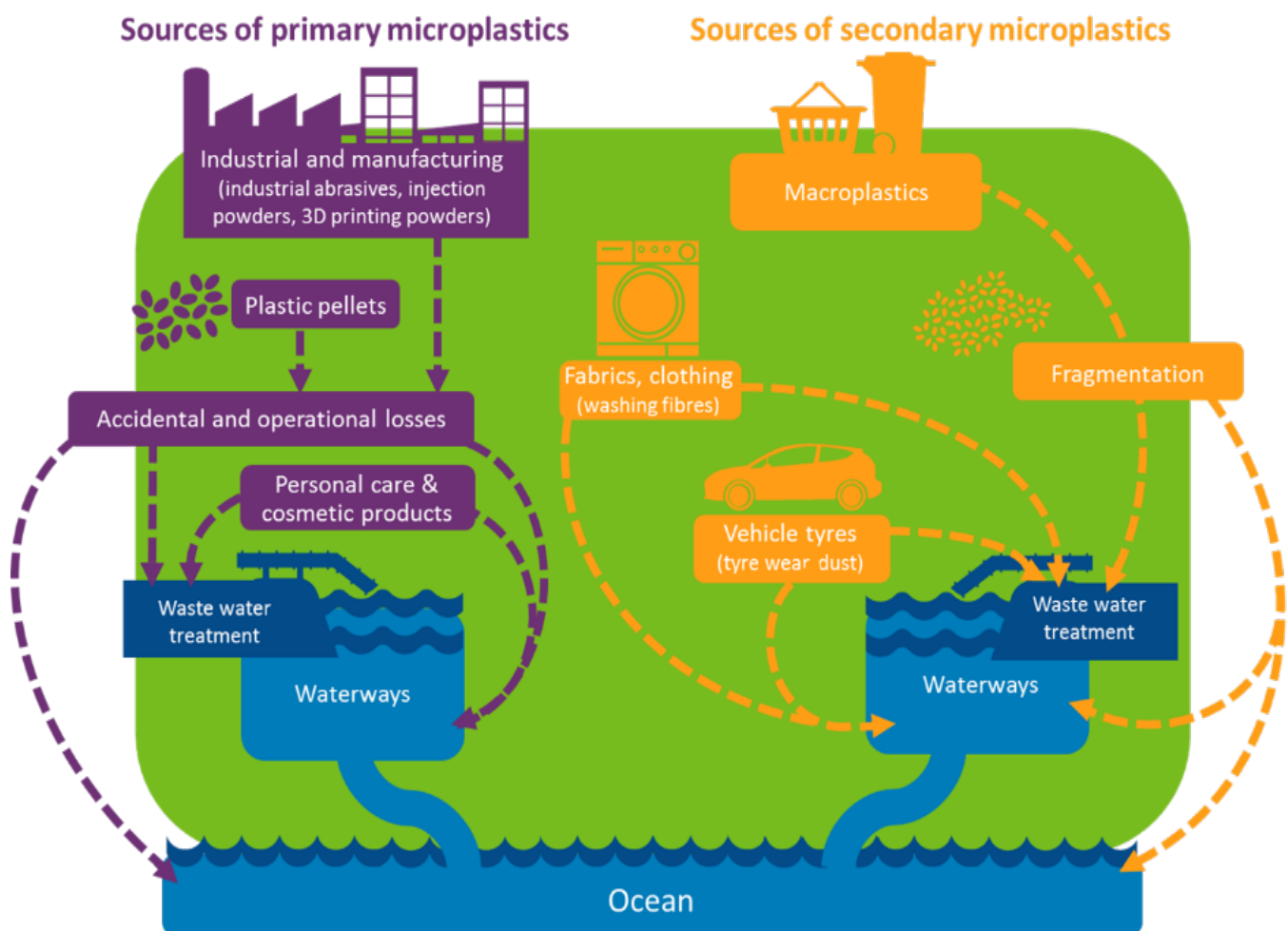
2. Chemical pressures - sources, pathways and fates

2.1 Types of plastic

Plastic mainly enters the environment either as large pieces (sometimes referred to as macro-plastics) or in small particles (micro-plastics). Macro-plastics can degrade to produce what are known as secondary micro-plastics. The plastic can be emitted to air, water or deposited on land and there will be pathways between these media

Although there is no consistent definition for micro-plastics they include nurdles (pre-production plastic particles), microbeads (used industrially, including in sewage treatment) and small plastic particles (< 5mm diameter). Micro-plastics also arise from the breakdown of litter and other macro-plastics, textile fibres, tyre and road marking paints.

Sources and transport of plastics in the environment

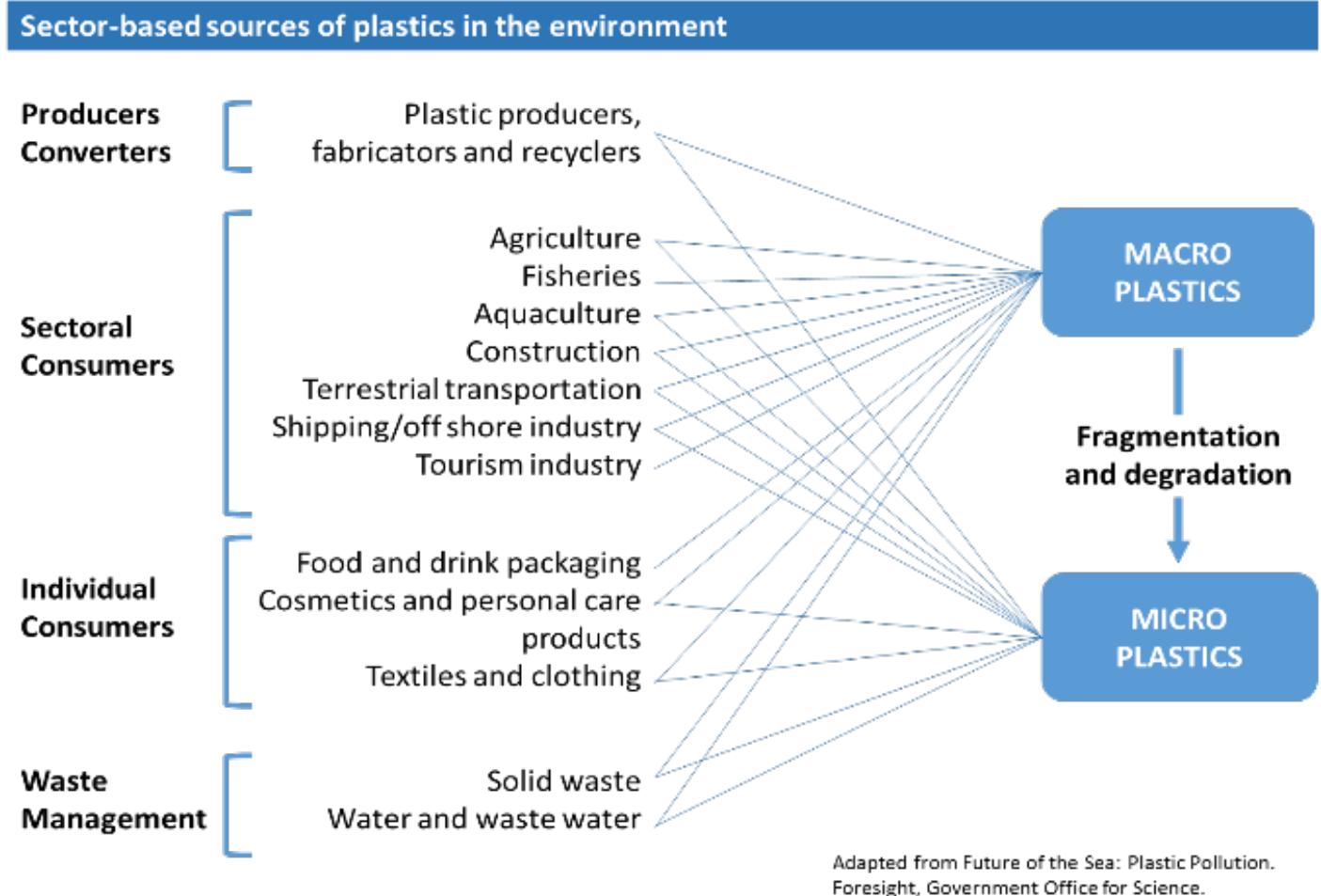


Adapted from: UNEP 2016. Marine plastic debris and microplastics.

2.2. Understanding the scale of the problem

The sheer amount of plastic used globally coupled with low recycling rates and the propensity to litter plastics like food wrappings means that plastics have entered the environment in large quantities.

Despite a growing number of studies we are some way from having a reliable understanding of how much plastic pollution comes from specific sources, or its distribution at a catchment level. It is not yet known what the largest sources of plastics into the environment are which makes it more difficult to pursue options to target the most polluting or the most harmful activities.



Concerns about the floating islands of plastic in the world's ocean were further highlighted by a study that estimated the sources and volumes of waste plastic entering the sea. The study estimated that between 4.7 and 12.8 million metric tonnes of plastic enters the world's ocean every year (Jambeck et al, 2015). The study was based on assumptions about populations living within 50km of the coast and the quality of waste management systems. It is likely to be a conservative estimate. This and other studies (e.g. Lebreton et al, 2017) suggest that 85% of the plastic entering the ocean comes from Asia. Therefore, the contribution to global ocean plastic litter from countries like the UK, that have well developed waste management systems, is likely to be relatively small. Understanding where there are opportunities to contribute to its reduction are important not least in understanding how to manage plastic pollution

Additionally, plastic litter found on beaches and elsewhere in the environment affects people's enjoyment and tourism.

Figure 1. Source of plastics on UK beaches

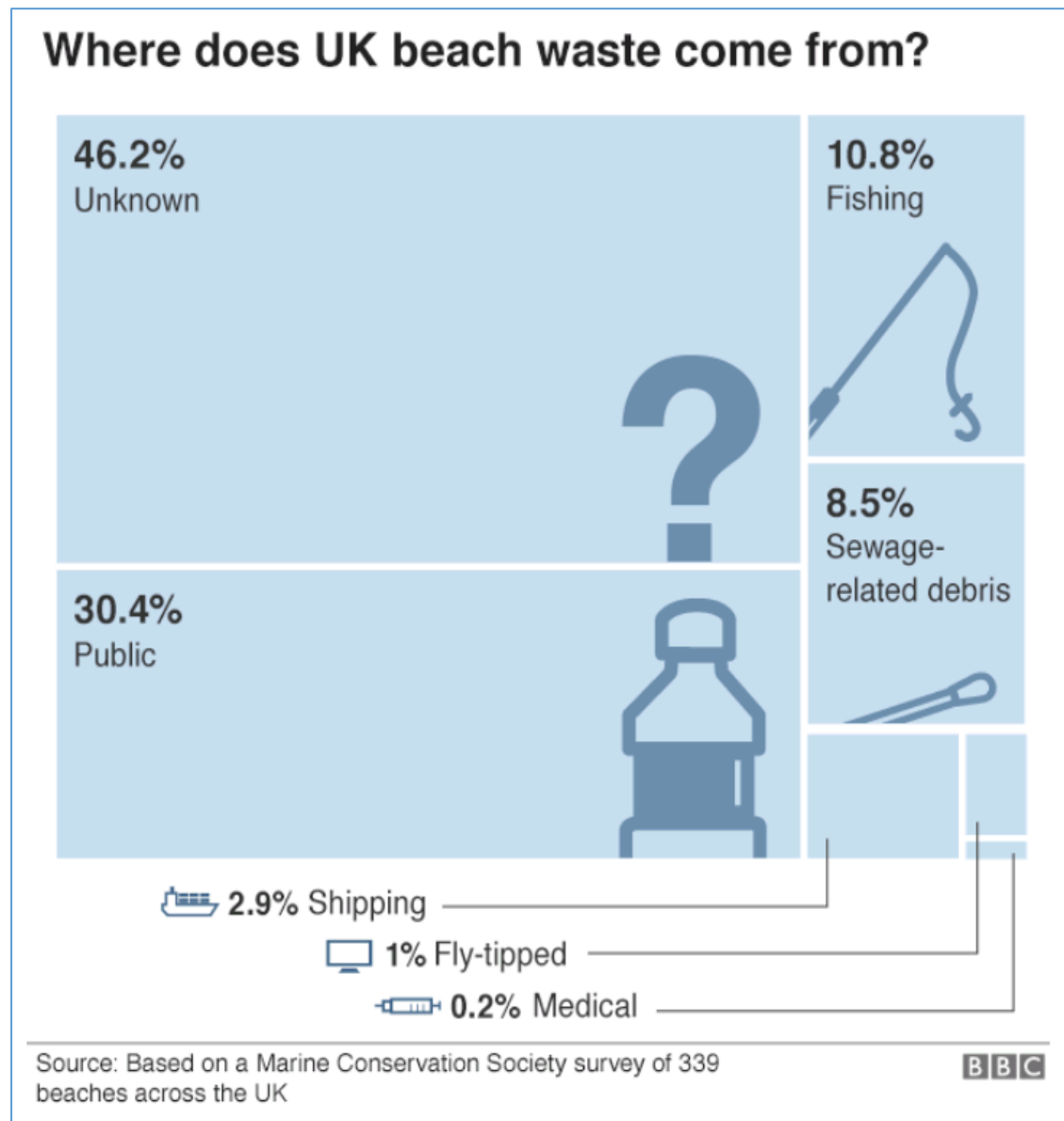
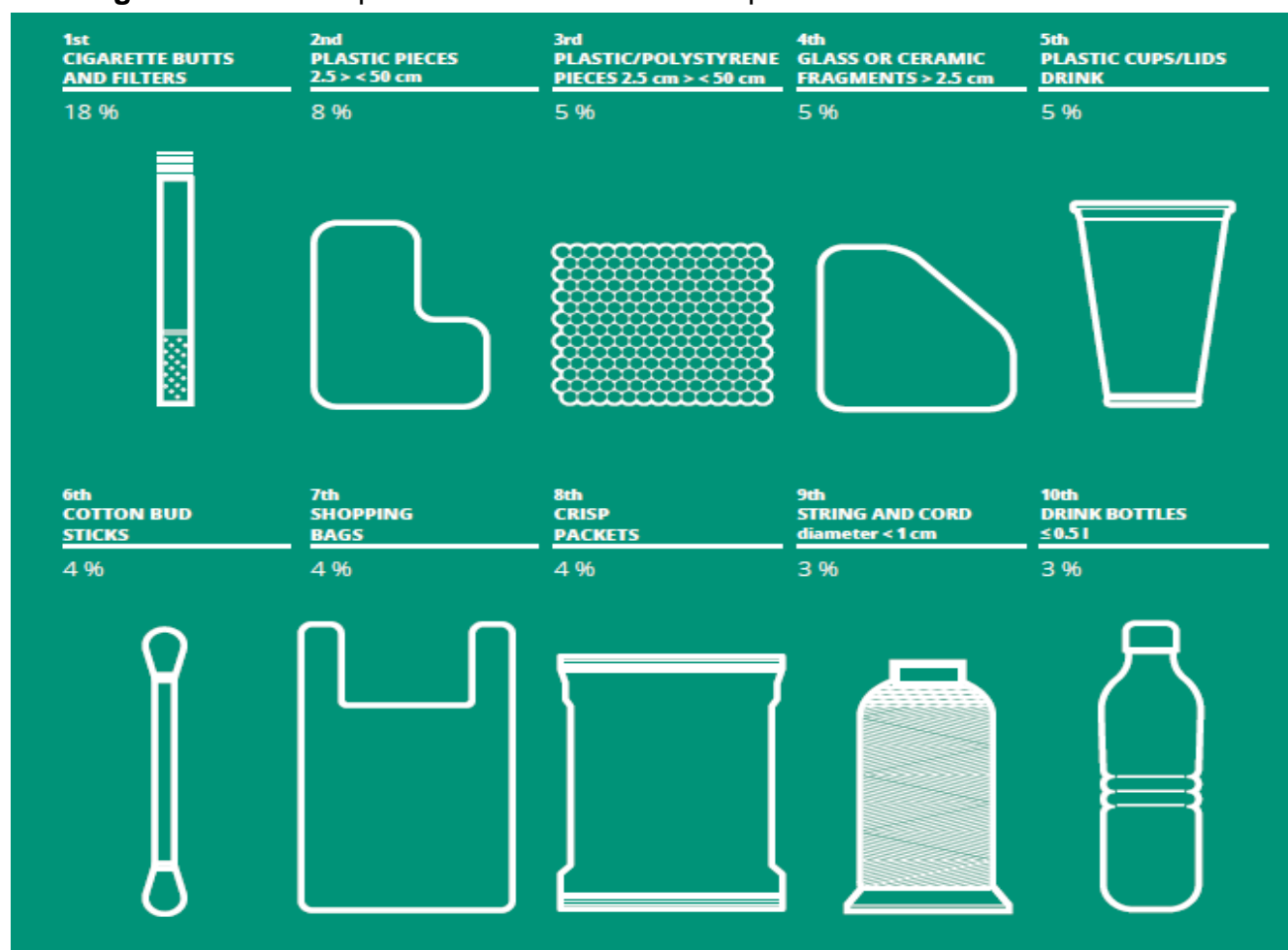


Figure 2. Common plastics items found on European beaches



Source; Marine Litter Watch 2018 Report, European Environment Agency.

2.3 Impacts on People and the Environment

The impact of these plastics on the environment, on the food chain or our health is not yet well understood.

Visible pollution is clearly objectionable. Large accumulations create costly obstructions in waterways and disrupt coastal activities and businesses. There is widespread evidence that plastic causes harm through entanglement and ingestion to a wide range of aquatic wildlife. The effects of this beyond individuals is unclear so that population scale effects are unknown.

Laboratory studies have shown that micro-plastics can be ingested and absorbed by aquatic plants, animals, fish and earthworms and that at very high concentrations these can cause harm. In general, these high concentrations are not likely to occur in the environment although data on the actual concentrations of plastic in water, soils and air are few. Based on limited environmental measurements, the current levels of micro-plastics in the environment are below the levels shown to cause harm in laboratory studies (SAPEA, 2018).

Most micro-plastics, like many chemicals, pass through organisms. Poisonous effects depend on the dose although there is insufficient evidence at present to develop risk based approaches.

However, the increasing volume of plastic in the world's ocean will obviously increase the potential for population scale effects to occur. It is also important to note that the current lack of evidence of serious harm to human health, the food chain or the environment is not the same as no effect.

Better understanding the effects on wildlife is an important research gap. However, studies on the potential impacts on human health and ecosystems are likely to take a number of years. The absence of the whole picture is not a reason for current inaction and the precautionary principle supports action to reduce the further release of plastics to the environment. We, alongside many others in society, are taking action to ensure our various interventions, including regulatory, are effective in this respect.

2.4 Nano-plastics and human and environmental health

There is a concern that the smaller fraction of particles (loosely described as nano-plastics) may cross cell membranes (Browne et al 2015). Some research on nano-plastics shows potential damage in mussels (Brandt, et al 2018) but there is no clear link to effects on the human food chain and it is hard to know how relevant the concentrations of plastic are in the experiments. There is no current method to measure the presence of nano-plastics within the cells of organisms or the environment and so the risk from this size fraction of plastic is unquantified at present. The absence of standard analytical methods for the measuring and monitoring of different size fractions of plastic particles is an important challenge for understanding the environmental effects micro-plastics.

2.5 Plastic as a pathway

Evidence that plastic is a preferential pathway for transfer of adhered or component chemicals is missing. It is now clear that people also ingest plastics (Liebmann et al, 2018). Concern about this aspect is driving research so that more evidence may become available over the next few years. The potential for effects from air-borne plastic particles on human health are also unknown. Plastic particles emitted to air may be linked with other pollutants and particles (such as from industrial processes and traffic pollution) and so the contribution of the plastic to any health effects may be difficult to identify separately. Concern has also been raised about the potential for plastics to be pathways or pathogens although again there is no evidence of this risk to date.

3. Addressing the problem

3.1 Environment Agency as regulator

Through our statutory duties as a regulator, we already have mechanisms to manage plastic pollution at several stages of manufacture, use and disposal.

Our roles in regulation include:

- Waste management
 - waste to land
 - plastic waste recycling
 - disposal (landfill and Energy from Waste)
- Definition of waste and when 'end-of-waste' status is met
- Producer responsibility for packaging
- Plastic manufacturing
- Chemicals
- Trans-frontier shipments
- Crime in the waste sector
- Wastewater treatment and materials spread to land

The maturity and effectiveness of the regulation varies between the different sources of plastic. For example, preventing windblown litter from waste management facilities is controlled by the environmental permit and has been a part of our compliance activities for decades. In contrast, the presence of micro-plastics in waste spread to land is not specifically covered by permit conditions and so our current regulatory control of this source is limited.

We regulate installations which produce the materials for plastic products and we will have a role in supporting new methods of production as new materials are developed in response to the reduction in single use plastics. Our permits ensure that these installations are not significant sources of plastic emission to the environment. We also work to reduce the release of small plastic pellets from the industries we regulate. This includes plastic used in waste water treatment and the industrial tube-cleaning products that are used in the Nuclear Industry and the Thermal Combustion Sector.

We regulate exported waste to ensure it goes to a reputable facility where the plastic can be recovered. We use the Materials Recovery Facilities Regulations (MRF) to work with the larger materials recycling facilities; monitoring contamination in recovered plastic and recycling rates. We're also working with biowaste and other operators to reduce the visible plastic contamination in materials and other wastes spread to land.

3.2 Initiatives and partnerships

We are working with others to investigate sources, pathways and impacts rather than starting a monitoring programme at this stage. We are using a growing number of studies to provide us with a view of sources, pathways and amounts of plastic to inform our work.

3.2.1 Data: Gaining comprehensive data about the scale of micro-plastics in the environment is currently hampered by the fact that there are no consistent sampling and collection or assessment methodologies for measuring micro-plastics in various media (sediments, water column or biota) although many are being developed and used. An important aspect of our work is collaborating with Defra, academia and water companies to achieve greater harmonisation over sampling and assessment methodologies, definitions and outcomes for monitoring micro-plastics in the environment.

3.2.2 Evidence: We are seeking the evidence to understand both the scale and the risk that plastic pollution poses to our health and the wider environment. To gather this evidence we are working with government, partners and various academic institutions on an investigatory research basis. We've developed a set of research questions to help us gain the evidence we need. This evidence will enable us to target interventions and initiatives, and we are gathering evidence from:

- Many academic research studies are investigating the relative contributions of various sources of micro-plastics as well as their pathways, transfer and fate through the ecosystem and flows at a catchment level.
- Highways England is leading research on understanding micro-plastics from the major road networks both nationally and in South East to develop best practise guidelines on reducing or removing micro-plastics.
- Defra have commissioned Plymouth University to investigate tyre wear and textile particles and their pathways in the environment.
- Cefas (Centre for Environment, Fisheries and Aquaculture Science) are developing a programme to measure micro-plastics in marine sediments and marine life.
- Cefas are partners in the Clean Atlantic project examining the monitoring, modelling and management of marine litter in the Atlantic area.
- Natural England are working with Newcastle University to investigate the interactions of micro-plastics with plankton in North East England.
- Natural England have used various data to investigate the amount of marine plastics found in Marine Protected Areas.
- Defra sponsor a long term monitoring project looking at the ingestion of plastics by fulmars.
- We're working with water companies, UK Water Industry Research (UKWIR) and WaterUK to investigate the role wastewater treatment and sludge disposal provide as a pathway for micro-plastics to enter the environment and consider how best to target preventative measures, preferably at source.
- UKWIR are developing a roadmap to frame future research needed to better understand the micro-plastics issues in the water sector.

- The Drinking Water Inspectorate have commissioned research into how micro-plastics can be removed from drinking water processes.
- Everyone can get involved too and contribute to Scottish environmental charity Fidra's [‘The Great Nurdle Hunt’](#) initiative:

Matt Wheeldon, Wessex Water:

“Awareness and understanding of sources, pathways and receptors of microplastics plus the consequences of this type of pollution on the health of mankind and the planet is recognised as a vital research area required in order to develop solutions to a truly man-made problem.

The water industry has a key role in protecting public health and the environment and they provide and operate assets that act as important pathways for such microplastics. In a few localised places, where plastic media is used as part of treatment processes, they could also be considered a potential source.

This is truly a whole society problem and partnerships between government, government departments, NGOs and private companies are key to solve this global issue. The water industry is keen to play its part in protecting human health and the environment and its collective body (WaterUK) and collaborative research establishment (UK Water Industry Research) are involved in establishing the scale of the problem and recommending the best solutions to it.”

3.2.3 Government policy and initiatives

Our work is informed by government policy initiatives. These policies are aimed at strengthening the circular economy for plastics, reducing the amount of plastic waste produced and preventing it escaping into the environment:

- UK government ban in 2018 on the sale and production of personal care products containing micro-beads.
- UK government have consulted on bans of the supply of plastic drinking straws, stirrers and cotton buds to the end user. New regulations are due to come into force by April 2020.
- Defra have launched and are implementing their Litter Strategy to reduce plastics entering the environment.
- Defra's Resources and Waste Strategy and UK Research and Innovation and Policy Connect's Zero Plastics set out the ambition and recommendations for a circular economy for plastics waste:
 - invoke the ‘polluter pays’ principle and extend producer responsibility for packaging, ensuring that producers pay the full costs of disposal for their packaging
 - stimulate demand for recycled plastic by introducing a tax on plastic packaging with less than 30% recycled plastic
 - ban plastic products where there is a clear case for it and alternatives exist

- improve recycling rates by ensuring a consistent set of dry recyclable materials is collected from all households and businesses
- improve the quality of plastics exported for recycling through the Basel and Stockholm Conventions
- launched a call for evidence on the development of standards for bio-based and biodegradable plastics.

Initiatives to reduce the accidental spillage of pre-production plastic pellets, flakes and powders across the supply chain include:

- Operation Clean Sweep; a voluntary scheme that provides a framework of best practice preventing the loss of plastic pellets, flakes and powders across the supply chain from producers to users
- British Retail Consortium's Global Standards now include pellet management within their revised packaging standard¹.

3.2.4 Protecting soil health

Various initiatives are being developed to prevent plastic contamination of soils and protect soil health from materials spread to land:

- we are working with the National Farmers Union (NFU), farm assurance schemes, Chartered Institute for Waste Management (CIWM) and biowaste operators and their trade associations to understand potential options to reduce micro-plastic contamination in soils
- we're developing an EA Sludge Strategy to review pressures and risk around sewage sludge from its production through treatment and disposal
- we're exploring the ability to tighten plastic contamination limits for materials spread to land including composts and digestate, to improve compliance with existing standards and controls and to improve permitting controls for biowaste facilities

Jeremy Jacobs, Renewable Energy Association

"The greatest emphasis for me and more importantly ORG is to reduce the volumes of plastic that find their way into the biodegradable resource streams especially garden waste (but also food waste). Removing this is costly and not entirely effective, resulting in the inevitability of plastics reaching soils and the food chain.

Greater education of the public and improving behavioural change is a priority if we are to make the difference.

Protecting our land bank is essential for the future as well as the now!"

- Biowaste Regulatory Forum includes membership from the waste and water industries, NFU, Defra, CIWM and biowaste trade associations, such as Renewable Energy Association Limited (REAL), Anaerobic Digestion
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Bioresources Association (ADBA), Bio-Based Industries Association (BBIA) and Waste & Resources Action Programme (WRAP) and has four industry led themes:

- containment
- competence
- compliance
- contamination

The Renewable Energy Association leads the Contamination theme and includes a campaign being run to '[Say No to Plastic](#)' and Biowastes and Plastics in Soils: [A Position Paper and Summary](#) .

3.2.5 Industry initiatives

Industry is developing and implementing best practice initiatives to reduce accidental release of small plastic beads used in treatment and cooling water processes:

- nuclear industry – voluntary improvements were implemented around 2013 which minimised losses although there is likely to be a significant reservoir of beads on the seabed which will continue to wash up
- thermal combustion- industry quickly made the necessary improvements to prevent releases and are required to notify us if any further releases occur. We are working with industry on best practice guidance for use of Trapogge balls in cooling systems
- collaborative working with water companies to prevent the loss of plastic media from their treatment processes into the environment.

3.2.6 Business initiatives

Business-led initiatives to reduce plastic used, increase reuse and recycling the plastics used while preventing losses to environment include:

- WRAP & Ellen MacArthur Foundation's UK Plastics Pact; a voluntary business led initiative to reduce plastic packaging
 - Business in the Community's Circular Economy Taskforce
 - Fishing For Litter- providing port waste reception facilities to encourage fishermen to bring back lost or discarded fishing gear.
 - The Global Ghost Gear Initiative is a partnership of the fishing industry, private and third sector, academia and governments tackling the issues of lost and abandoned fishing gear and various smaller circular systems whereby ocean plastics are collected and turned back into plastic pellets and products, such as canoes made from these recycled plastics.
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Helen Bird, WRAP:

“The UK Plastics Pact, led by WRAP: a collaborative approach to tackling plastic waste through four targets to 2025:

- Eliminating problematic and unnecessary plastic packaging items
- 100% of plastic packaging to be re-usable, recyclable or compostable
- 70% of plastic packaging to be effectively recycled
- 30% average recycled content across plastic packaging

Members of The Plastics Pact represent 85% of plastic packaging sold through supermarkets and cover the whole value chain. Members of The Pact are working at pace to address the urgent issue of plastic waste. However, one of the challenges is to ensure that any moves away from plastic are considered carefully in order to avoid unintended consequences which could lead to increased greenhouse gas emissions. Citizen engagement is also a key part, particularly to motivate and educate on recycling through [Recycle Now](#).

3.2.7 Agriculture

Initiatives in the agricultural sector are looking at ways to reduce the use of farm plastics, promoting reuse and recycling to reducing inadvertent release into soils and water:

- we are working with NFU to promote their advice on better farm waste management. NFU have linked up with a number of agricultural waste collectors and reprocessors to see how this sector can collaborate to achieve more recycling and reuse of farm waste plastics

Anna Simpson, Waste Policy Advisor NFU:

“Farmers use a wide range of plastic products and packaging within the work place. This plastic can often be contaminated, heavily soiled or in small quantities. This alongside recent export bans to Asia is making it difficult to get farm plastic collected and recycled from farm. Established collection and recycling networks need to be supported and domestic solutions encouraged and supported by Government. There are few alternative options for farmers to deal with these waste streams and landfilling separated plastic seems perverse.”

- we’re working with all farm assurance scheme providers to promote better farm waste practices
- we’re working with RSPCA Assured (part of the RSPCA) to review how their farm assurance scheme can promote better use of plastics on farms and in food packaging.

Liam Kurzeja, Head of Marketing:

"It's becoming increasingly apparent that we need to take a more holistic approach to what we do. Although we are a farm animal welfare certification scheme, we feel we also need to focus on the wider implications of farming and food production for wild animals and the environment.

The goal for us is to be able to support our scheme members to boldly engage with plastics issues, and ultimately to help them capitalise on their positive actions."

3.2.8 Europe

The European Chemicals Agency (ECHA) has reviewed and reported on intentionally produced micro-plastics. We are contributing to the formal review of an EU proposal to restrict intentionally produced micro-plastics through our participation in the Risk Assessment Committee of the European Chemicals Agency.

3.2.9 Third sector

Various initiatives are led by the third sector, charitable and community based organisations:

- Surfers Against Sewage- Big Spring Beach Clean, Plastic Free Communities, Businesses and Schools
- Marine Conservation Society- Beach Watch annual survey and beach cleaning campaign, Sea Champions and Plastic Challenge
- Keep Britain Tidy- Great British Spring Clean & Litter Heroes and behavioural insights research
- #BinIt4Beaches campaigns: partnership involving the water sector and a range of organisations, including Keep Britain Tidy, Marine Conservation Society, Surfers Against Sewage, water companies and others to raise awareness to prevent plastics being flushed down the drains.
- 6% of items found on the @MCSUK Great British Beach Clean 2018 were associated with items flushed down the loo. Wet wipes, tampon applicators & cotton buds nearly always contain plastic.

4. Choices

Question 1: What can be done to address plastics pollution in the water environment?

Question 2: What actions should the Environment Agency take to reduce plastic pollution?

5. Contacts and supporting information

If you have any feedback or comments on the evidence contained in the summary then please contact:

enquiries@environment-agency.gov.uk

6. References

The Great Nurdle Hunt: <https://www.nurdlehunt.org.uk/>

Say No to Plastic: <https://www.r-e-a.net/blog/say-no-to-plastic-or-say-no-to-plastic-31-07-2017>


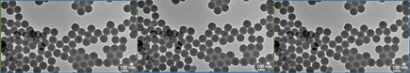
Biowastes and Plastics in Soils: A Position Paper and Summary:

<http://live-fauna-flora-international.pantheonsite.io/wp-content/uploads/2018/10/FFI-Tackling-Plastic-Pellet-Loss-in-Your-Supply-Chain-.pdf>

Recycle Now: www.wrap.org.uk/ukplasticspact

Appendix 1: Plastic issues in industries regulated by the Environment Agency

Macro plastics (>5mm)			
	Sources	Regulation	Issues/aims
Production	Manufacturing of plastic packaging.	Producer responsibility & extended producer responsibility. EPR permits at regulated sites. Plastics tax on recycled content in new products?	Increase recovery and recycling, reduce excess packaging. Reduce virgin raw materials used. Contribution from imports.
	Manufacturing of other plastics.	Largely not regulated by the EA - any loss of pellets managed through Duty of Care (DoC). EPR permits at regulated sites - prevent any loss.	Increase recovery and recycling. Contribution from imports. Textiles could be a candidate for extended producer responsibility.
Use / consumption	Littering, often windblown. Deliberate discarding e.g. food packaging, fishing gear at sea. Litter from regulated sites.	Littering is key focus & we can support LAs and NGOs. EPR permits at regulated sites - DoC compliance. Defra Litter Strategy and marine protocols.	Plastic in the environment. Obstruction of waterways. Visually objectionable – can affect e.g. tourism. Effects on wildlife e.g. entanglement. Social/ethical issue e.g. Pacific garbage patch.
	Visible plastics in reused wastes e.g. materials (compost, AD digestate) spread to land, in recycled aggregates & U1 exemptions.	Quality protocols with PAS standards; permitting inputs and output controls.	Contamination issue, possible ingestion by animals. Reduces landowners willingness to accept waste for spreading. Aesthetics issue.
	Taprogge sponge balls used for pipe cleaning: nuclear & combustion industries.	IED & EPR permit prevent losses in discharges & abatement. Best practice guidelines. Industries required to monitor & report losses. Other sectors we regulate may use plastic media in their effluent treatment – also limit this loss.	Losses enter waterways. Small balls will erode to become micro-plastic size or lose micro-plastics.
Waste management	Recovered plastic. (Waste treatment sectors, EfW).	Quality protocols. Materials Recovery Facilities (MRFs) reporting under EPR. EPR permits at regulated sites. Hazardous chemicals regulations.	Increase recovery and recycling; reduce plastic waste going to landfill. Prevent stockpiling. Contamination reduces recovery options - design out chemical additives.
	Exported waste.	International waste shipments. Assessment of overseas facilities for receipt of packaging waste.	Sufficient acceptable overseas facilities? Quality - contamination & increasing export restrictions; risks stockpiling in the UK. Accidental spillages from shipping.
Waste mis-managed	Fly tipping.	Duty of care on householders disposing of waste. EA responsibility for large or hazardous cases.	Obstruction, visually objectionable. Effects on wildlife.
	Waste crime & illegal waste sites.	Enforcement action on improperly stored, handled or disposed plastic. Powers to block entry, seize vehicles & enforce clean up.	Obstruction, visually objectionable. Effects on wildlife.

 Micro plastics (<5mm) & nano plastics (<0.001mm) 			
	Sources	Regulation	Issues/aims
Production	Macro & micro plastic degradation in the environment.	Not possible.	Smaller plastic sizes generated in the environment - small enough to be ingested by livestock and wildlife along with any adsorbed chemicals. Difficulty separating micro-plastics from environmental media – soil, water, sand.
	Unintentional losses e.g. tyre wear, washing synthetic textiles & abrasion of plastics used in industry.	None.	Direct and indirect (waste water, airborne dusts) release to the environment. Possible ingestion and contamination issues (as above).
	Spills of pre-production nurdles.	Industry action required to avoid spills. Where IED or EPR permits prevent loss. Hazardous chemicals regulations.	Release to the environment. Contamination – need to design out chemical additives to plastics.
Use / consumption	Microbeads in products e.g. personal care & cosmetics.	Government legislation banning use. European Chemicals Agency consultation on all intentionally added micro-plastics.	Prevent micro-plastics entering the environment. Design out micro-plastics from products.
	Plastics in waste water entering WWTWs. Use of biobeads for cleaning water in WWTWs.	Prevent bio bead loss through EPR & industry best practise. Research as part of the chemicals strategy through PR19 and PR24.	No (or limited) technology to screen out <6mm plastics. Unintentional losses of biobeads. Micro-plastics end up in sewage sludge, and water discharges plus any adsorbed chemicals.
	Agriculture - plastics in wastes spread to land for soil improvement, mulches & from plastic covered nutrient pills.	Quality protocols with PAS standards; biowaste facilities permit controls. Use of farm assurance schemes to increase control. Some sources are not regulated.	Possible ingestion by livestock. Plastics in soils may be transported into the wider environment – windblown or by run-off into water courses.
Waste management	Micro and nano-plastics in other waste streams e.g. biowaste.	None.	Difficulty separating micro-plastics out of waste streams means they are likely to follow/be present in those waste streams to their end point. Lack of knowledge on impacts/effects on wildlife and along the foodchain to people.