Common Seas

Plastic Drawdown

Summary for Indonesia

March 2019

Plastic Drawdown
A new approach from Common Seas for addressing plastic pollution.

Plastic Drawdown is a 'wedges' methodology to reduce plastic leakage into rivers and ocean by supporting decision-makers to develop a portfolio of effective policy interventions.

Delivered in partnership with Eunomia and support from Oxford University.

Plastic Drawdown in Indonesia

Plastic Drawdown provides the most detailed and comprehensive assessment of plastic leakage developed to date anywhere in the world. The Indonesia model is a fully developed policy assessment tool that will allow the government to rapidly identify the key plastic flows and polices to address the problem.

For further details on the Plastic Drawdown model and approach see the accompanying summary document. This report provides examples of the model outputs for Indonesia to demonstrate how Plastic Drawdown can:

- Compile and 'bring to life' the best available data on plastic waste flows and leakage.
- Quantify and visualise the impact of key policies on plastic production, waste generation and leakage.
- Provide a tool for investigating different potential policy scenarios.

The approach would be aligned with the support work the World Economic Forum's Global Plastic Action Partnership (GPAP) are providing to the Indonesian Government to mobilise key stakeholders for coordinated action to develop circular economy principles in coastal economies. The tool would also support the National Action Plan on Marine Debris, which calls for efforts to control plastic waste leakage/marine debris and raise awareness of the issue and which underpins the Government's stated commitment to target a reduction in marine plastic debris of as much as 70% by 2025 (outlined in Presidential Regulation (Perpres) No 83/2018). This would help position the Indonesian Government as a global lead in the tackling the problem of marine plastics pollution.

Common Seas propose a meeting to discuss Plastic Drawdown in more detail, and to consider how a joint workshop involving decision-makers responsible for waste and water could enable further action to address ocean plastic pollution.

Method

The model includes mass flow data on the key items of plastic waste (both macroplastics and microplastics) in each country (derived using the International Coastal Cleanup dataset for each country of interest), as well as estimates of future consumption (and therefore waste generation) of each item in the absence of any intervention (i.e. the baseline scenario). The various pathways through which plastics flow into rivers and seas were therefore identified (Appendix 1), and estimates of the proportions of waste flowing through each pathway (known as transmission factors) developed through detailed research and data gathering in each country.

The model goes on to estimate the likely impact of a range of interventions on these baseline flows of plastics in order to identify those that are likely to be the most relevant to addressing plastic waste leakage in a particular country's context. Appendix 2 summarises the design of the model and the information that was used in developing it.

Baseline Flow of Plastic Waste

The outputs of the wedges model for Indonesia are summarised in this section.

Waste generation data, specific to each plastic item type identified, was unavailable or not freely accessible for the majority of items in Indonesia. However, data on the amounts of various items placed on the market was more readily available. The use of consumption data as a proxy for waste generation data was considered appropriate in most cases, given the single use nature and short life in use of most items on the list. It is also noted, however, that the available data on consumption (and waste generation) of plastic items varies widely, depending on both the parameter under which the data is presented (e.g. weight-based data, volume based data, or item counts), as well as the methodology used for estimation of Indonesian specific quantities (e.g. per capita consumption estimates multiplied up by population figures, surveys with a sample of industry representatives prorated by industry size etc).

Total waste generation of the key plastic items, developed from this bottom up approach, was estimated at around 2.5 million tonnes per annum. According to data in reports from Statistics Indonesia and the World Bank the total generation of plastic waste can be estimated at around 8.8 million tonnes.[1,2] This suggests that there is around 6 million tonnes of 'other' types of plastic waste than those specifically identified in beach litter counts as key

[1] World Bank (2018), *Indonesia Marine Debris Hotspot Rapid Assessment Synthesis Report*, April 2018, accessible at http://documents.worldbank.org/curated/en/983771527663689822/pdf/126686-29-5-2018-14-18-6-SynthesisReportFullReportAPRILFINAL.pdf

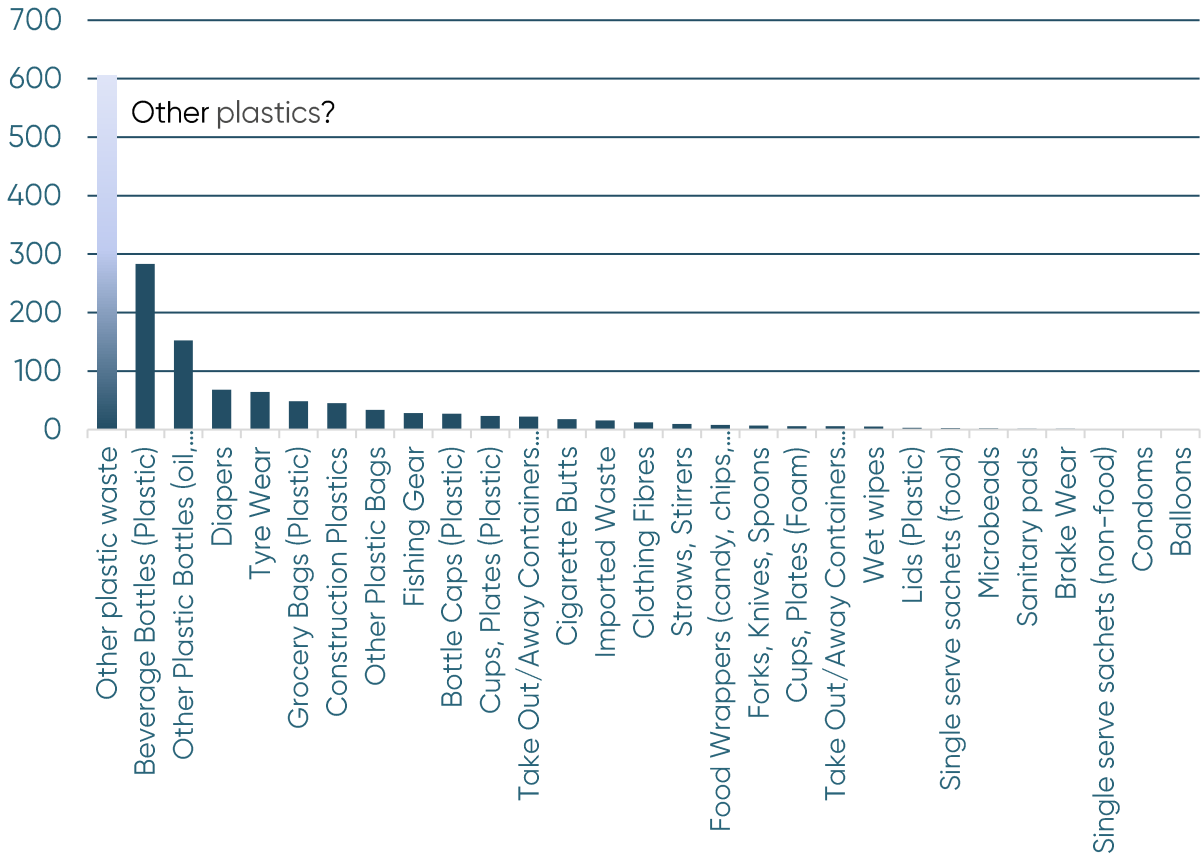
[2] BPS (2018) *Environment Statistics of Indonesia 2018* p.37, https://www.bps.go.id/publication/2018/12/07/d8cbb5465bd1d3138c21fc80/statistik-lingkungan-hidup-indonesia-2018.html

plastic items. This could include non-bottle packaging, plastic household goods, commercial/industrial plastics etc. Of the identifiable items modelled, 'singe use plastic beverage bottles' were found to contribute most significantly (20%) to plastic waste generated within Indonesia in 2018, followed by 'other single use plastic bottles' (11%) and diapers (4%).

Similarly, in estimating the transmission factors themselves, (i.e. to assign percentages to the amount of material transferred through particular points in each of the plastic flow pathways) a wide range of data were considered in Indonesia reflecting the country's specific context, e.g. waste infrastructure and management systems, consumer behaviour and income, etc. An estimate was also made of the likely pathways taken by the 'other' types of plastic. This allowed an estimate of the likely proportion of overall leakage that could be attributed to the key plastics items, and the scale of the overall issue that can therefore be managed through interventions associated with all plastics.

Based on the available data and estimates provided by experts, the likely tonnages of plastic waste items entering rivers/ seas from Indonesia were therefore estimated in the baseline year (i.e. 2018). The findings of this analysis are summarised in Figure 1 below. It can be seen from the figure that macroplastic items figure prominently in the baseline assessment of plastics entering the sea, with the exception of tyre wear, due to the difficulty associated with capturing this fraction as it enters the environment directly.

Figure 1: Baseline Plastic Waste Entering Sea - 2018



Key plastics wastes, such as bottles, diapers and bags, 'other' plastic waste (consisting of the plastic components of items not otherwise listed, such as toys, appliances, textiles, pots tubs and trays etc.) forms a large part of this fraction, as do construction plastics, other plastic bags (including, for example, agricultural sacks) and fishing gear. This is attributable in part to the shortcomings of the waste management service provision for non-municipal waste in Indonesia, but also partly due to the higher weight of plastic items in these categories relative to others. Of interest in this respect is the prevalence of plastic bags in the list of the top ten items entering the sea, despite their lower mass – implying a much larger volume of such items being lost. Regarding bottles, particularly PET beverage bottles, whilst many are collected from the waste stream many will not be captured, particularly when dumped directly into water courses. As these items are highly significant in terms of total waste generated, the relative contribution of bottles in total leakage is still reasonably high.

The potential contribution from 'other' plastics is the most significant type in the flows entering the sea. However, there is a relatively high degree of uncertainty associated with the quantities due to the fact this this is calculated using a top down estimate of total plastic generation and multiple bottom up estimates for the individual types of plastic waste identified. In addition, there is uncertainty of the scope of the top down data (e.g. the extent to which business waste is included), the bottom up data (e.g. often not being Indonesian specific), the types of plastic items included, and the transmission factors used for the 'other' category (e.g. if these types of plastics are captured to a greater or lesser extent than the key plastic items).

The total volume of the key plastic items entering the sea is around 600 kt per annum, and the volume of other plastics may be in the region of an additional 500 kt to 2,000 kt per annum. Suggesting anywhere in the region of 0.5 to 2.5 million tonnes of plastic could be entering the sea every year. The World Bank hotspots report includes a brief comparison of different estimates, including from Jambeck et al:[3]

> *'It was difficult with the available data and collected data to assess total volumes of plastics that enter the ocean from Indonesia's coastline and waterways. Jambeck estimates these amounts for Indonesia at 0.48–1.29 million tons/year. The hotspots assessment estimated this figure based on expert judgment at 55,000 tons for Jakarta (12% of total waste plastics). Extrapolating this amount for total urban population in Indonesia would put the national figure at roughly 900,000 tons/year. Another approach is that in Indonesia on average around 30% of urban waste (total 105,000 tons/year) is not collected, resulting in leakage of 15–20% as between 10–15% of uncollected waste does not enter the formal systems due to informal collection of recyclables. Expert judgment puts the fraction of uncollected waste being discharged to waterways between 30–50%.*

[3] World Bank (2018), *Indonesia Marine Debris Hotspot Rapid Assessment Synthesis Report*, April 2018, accessible at http://documents.worldbank.org/curated/en/983771527663689822/pdf/126686-29-5-2018-14-18-6-SynthesisReportFullReportAPRILFINAL.pdf

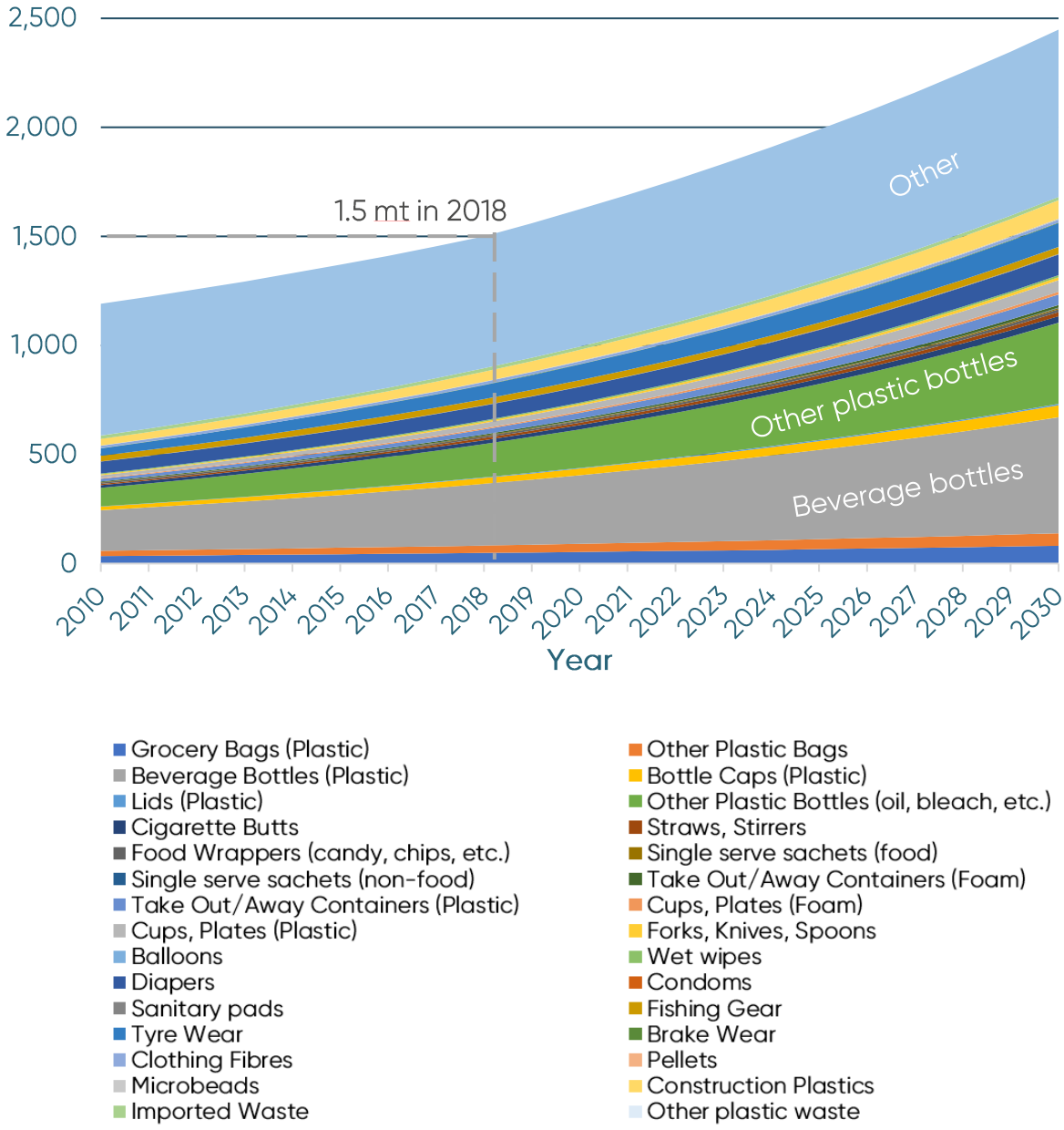
This for the urban population in Indonesia with a plastics fraction in mixed waste around 11-14% would give a plastic to waterways estimate of 400,000 tons/year. These outcomes are in the range of the Jambeck estimates. They discard waste from rural areas but these areas have much lower waste generation levels per capita and in addition a lower plastics fraction.'

The estimates from this model cover the whole range of previous estimates outlined above, with the high estimate being greater than the top end of the range by Jambeck. However, the methodologies for estimating these flows are continually being updated, including by Jambeck, and it has been suggested that these estimates will go up. Therefore, the model's baseline outputs appear quite plausible. For the purposes of presenting the results, a central-point, slightly above the Jambeck upper range, of 1.5 million tonnes of plastic flowing into the sea was chosen for 2018 in the baseline scenario.

An important point regarding the accuracy of the figures should be noted. It is clear that most researchers studying waste flows in Indonesia will agree that the data is limited and reasonably uncertain. However, the precise accuracy of the numbers does not limit the potential for developing clear plans and policies aimed at tackling the problem, which is highly evident from the amounts of plastic visible in and around Indonesia. Waiting to develop highly accurate estimates of the flows is not needed, and will simply result in delays to policy implementation and potentially millions more tonnes of plastics entering the sea.

These baseline estimates were further extrapolated to develop a business-as-usual (BaU) scenario using both historic data on growth trends (2010–2018) in waste generation for each item and market forecasts of growth (2018–2030) where these were freely available. This analysis provided insight into the likely trajectory of plastic waste flows entering rivers and seas out to 2030 in the absence of any further intervention. The findings are summarised in Figure 2 below, with some of the largest flows highlighted. It can be seen that in the absence of any further intervention, at current rates of consumption and waste generation, the overall tonnage of plastic waste entering the sea from Indonesia is likely to increase significantly over the next 12 years.

Figure 2: Baseline Waste Entering the Sea



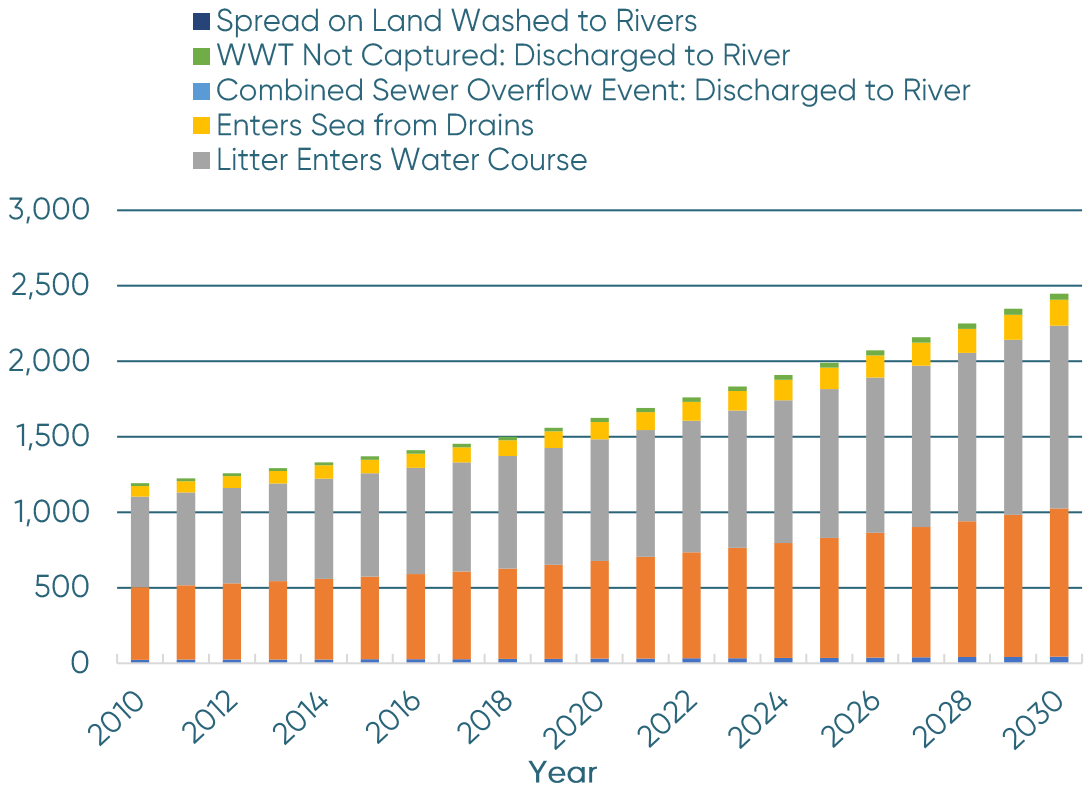
In addition to identifying the overall magnitude of key plastic items that are likely to be entering sea from Indonesia, the baseline analysis in the model also allows us to determine where the major points of plastic loss from the system are most likely to be in the plastic pathways flow.

The findings of this assessment are summarised in Figure 3. is clear from the figure that the majority of leakage in Indonesia is derived from shortcomings in the collection and management of plastic wastes. This is evidenced not only in the large proportion of leakage due to direct littering in waterways (which includes wider scale dumping in waterways), but also from the equivalent proportion of leakage that can be attributed to losses from waste

treatment and disposal sites. In this respect, although some litter leakage from transport/ storage in recycling treatment facilities is anticipated, leakage from landfill sites is far more predominant in the analysis. This is attributed to poor storage, transport and management of sites, as well as waste being washed away due to winds/ rain/ erosion, but also to the proliferation of illegal and unmanaged dumpsites in the country, some of which are positioned near waterways or are indeed simply the riverbanks themselves. Some amount of plastic waste is also lost through the drainage system; primarily due to direct discharge of litter from drains into the natural environment (via stormwater runoff systems), or during wastewater treatment (due to inadequate screening processes particularly for microplastics), as well as during combined sewer overflow events.

The baseline assessment therefore identifies the key items of concern as well as the key points at which interventions should be made in order to stem the flow of plastics into rivers and seas from Indonesia.

Figure 3: Major Points of Plastic Loss



Intervention Impacts and Key Policies

The wedges model included a range of policies to target the leakage of plastics into the marine environment. These interventions were developed based upon the flows (Appendix 1) and an understanding of the key policy measures in use, or being proposed, that would tackle various products, either individually or as a whole waste stream.

The interventions included are described in Table 1 below. The matrix in Appendix 3 shows the target items that each policy is assumed to impact.

Table 1: Summary Description of Interventions

Intervention	Description
Taxes	For the purposes of describing this measure, taxes (or 'levies') are considered to be any economic instrument implemented at a national level that increases the cost of items placed on the market, and incentivise non-use, or substitution by single use non-plastic and multiple use items.
Potable water supply	Provide a supply of potable water to all households in order to reduce consumption of plastics water bottles.
Water Refill Scheme	Establish networks of water fountains and refill points to enable refill of water.
Item Ban	This measure would see complete market bans on the sale of certain items by a given year. Bans would have to be regulated to ensure products are not being sold after the date of implementation.
Deposit Return Scheme	A deposit refund system (DRS) is a system whereby a deposit is paid on beverage containers which is repaid to the customer when the consumers return their empty containers to return points.
Provision of Solid Waste Collection	Significant improvements to existing provision of solid waste collection and treatment for households, and a requirement for businesses to 'take responsibility' for their waste (Duty of Care principle); with producers funding the relevant share of the services implemented though producer responsibility mechanisms.
On-the-go Waste Collection	Provision of an adequate network of receptacles for the collection of on-the-go waste.
Standards for Storage and Management of Waste	Setting operational standards for storage and management of waste through permits for waste facilities (including transfer / disposal / reprocessing etc.).
Litter and fly-tipping regulations	Increasing penalties and enforcement capacity for littering and fly-tipping, including illegal dump sites.
Fibre release threshold and clothing labelling regulation	Development of standardised test methods for fibre release which in turn would allow regulation on threshold that removes the worst performing products from sale.

Type approval and tyre labelling regulation for tyres	Development of a Standard Measure of Tyre Tread Abrasion Rate followed by Inclusion of Tyre Tread Abrasion Rates on the Tyre Label, plus using Type Approval Regulation to restrict the worst performing tyres (in respect of tyre tread abrasion) from the market.
Wastewater Treatment	Increased coverage and standards of waste water services across the country, and tertiary waste water treatment for a % of the population.
Sewage & Storm Water Catchment Systems	Installation of systems along major road networks and urban centres.
Collection systems though EPR and Deposit refund for fishing gear	A deposit return scheme for gear to ensure collection and incentivise retrieval. Combined with a comprehensive EPR would cover all costs of collecting, recycling, preparation for reuse or discard of end-of-life fishing and aquaculture gear.
Track & trace systems	Require use of GPS to facilitate logging and reporting of gear loss on centralised system. Increase efforts to find lost gear and enforcement of infringement of reporting requirements.
Gear zoning of fishing areas	Zoning of fishing areas to restrict use within an area that creates gear conflict and intentional loss.
No special fee obligations	A '100% no special fee system' means, as a general rule, that vessels pay a set fee (or 'indirect fee') for waste management regardless of quantity delivered. Such a system means that they are not financially incentivised to dump at sea.

Example outputs from the Indonesia wedges model are given below in Figure 4 to Figure 6. The input parameters, in terms of policy effectiveness and timings, reflect one plausible scenario setup by the project team. The nature of any future wedges outputs would vary depending upon what input parameters might be chosen in other scenarios, and in accordance with the priorities of the Indonesian Government. The tool helps policy makers identify the impacts of key interventions so policies can be planned accordingly. The tool also shows what the impact on leakage would be if the policies are implemented in the short or longer term, and the consequences of implementing certain interventions before others.

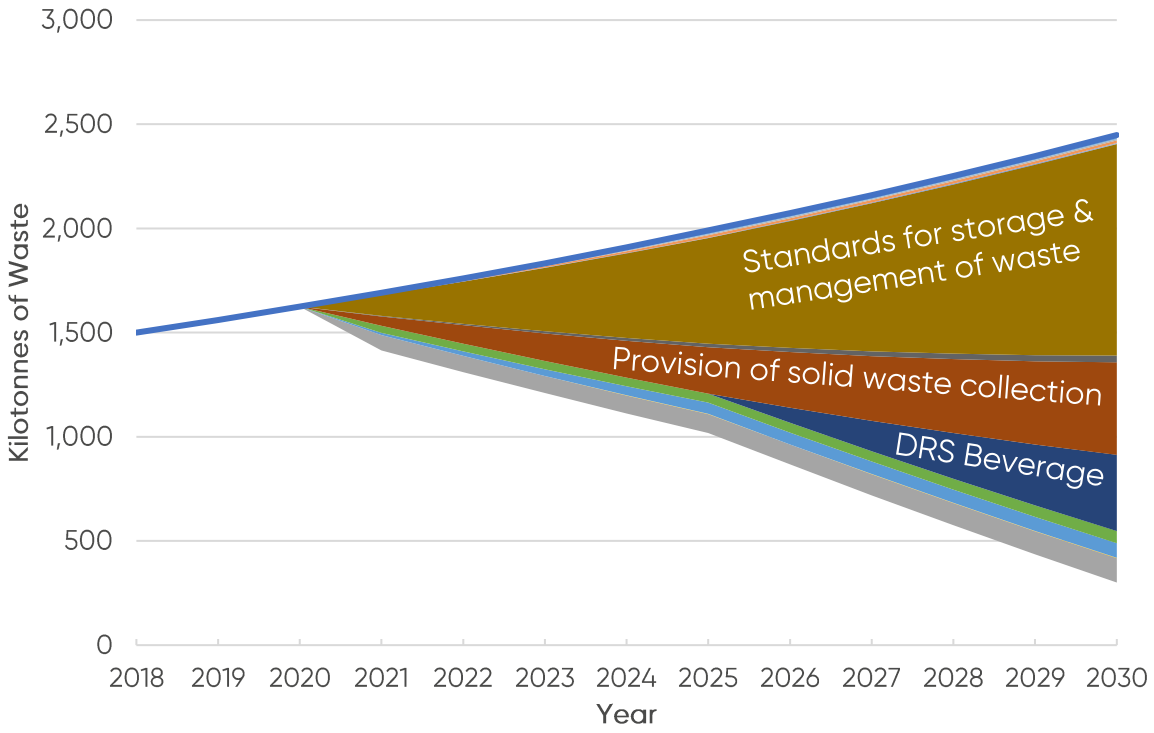
Figure 4 shows the wedges chart itself. This shows the BaU plastics leakage increasing as per the baseline to just under 2.5 million tonnes of plastic per annum. With the interventions set in the model, the overall plastic leakage may reduce to around a quarter of a million tonnes per annum by 2030. The key interventions that make up a large part of the reduction are:

- Standards for storage and management of waste;
- Solid waste collection;
- Water refill schemes;
- Taxes on specified items;
- Item bans; and

- Deposit Refund Systems (DRS) for beverage containers (in the longer term).

In this example, the item specific bans and taxes are assumed to be implemented in the short-term, so the effect is to achieve maximum leakage reduction early on, with the reduction being maintained out to 2030. For other interventions, such as standards for storage and management of wastes, it is assumed that it would take some time for relevant strategies, policies and instruments to be developed and implemented across the country. Hence, the profile of this particular wedge starts off with lower leakage reduction in the short-term, and the maximum only achieved by the end of the period. A DRS is unlikely to be implemented straight away as basic waste services need to be improved in the short term, so the intervention is only applied further into the future. Whilst improvements in solid waste collection are a clearly understood solution, the wedges approach shows how much impact basic systems can have on stemming the flows of plastics into the sea, relative to other policies. Suggesting a clear direction for immediate and necessary action in the country.

Figure 4: Example Wedges Output



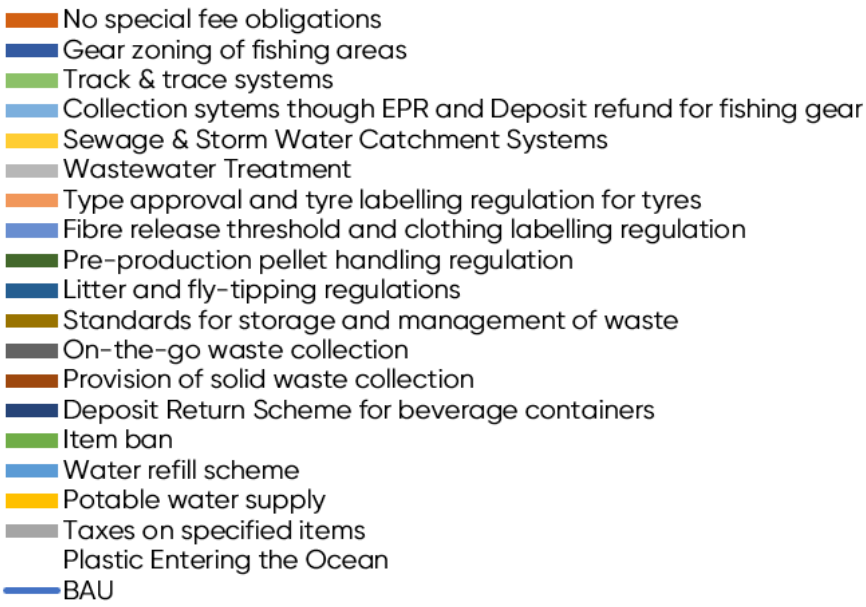
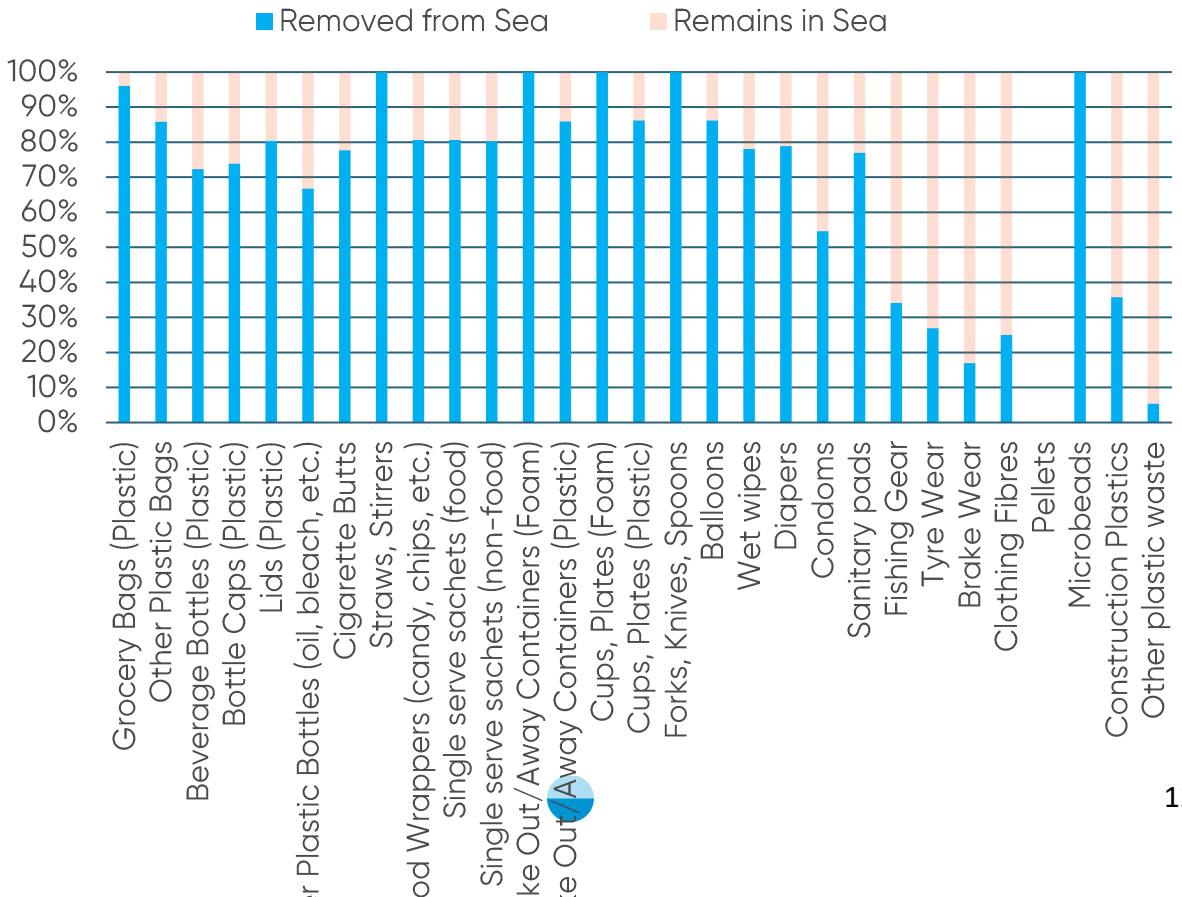


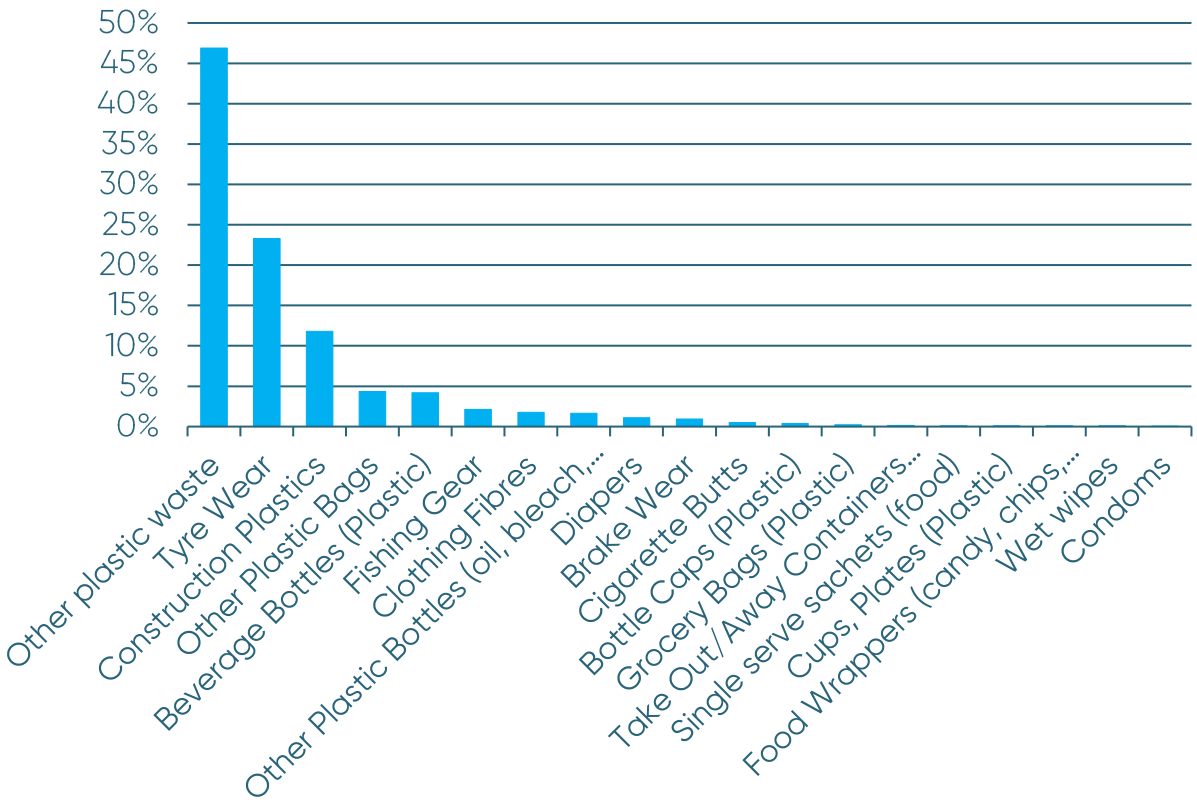
Figure 5 provides further detail on the effects of the interventions by item. This shows the detail and usefulness of the wedges approach and tool in understanding the effects of different policies. The items that are subject to bans, such as straws and stirrers, clearly show a 100% reduction in leakage, as these products would no longer be placed on the market. It is also clear how much impact can be achieved from cross-cutting measures, such as improving waste collections, as shown by the 90%+ reduction in plastics entering the sea for many of the items. Reductions for other items are limited by the scope and effect of the interventions acting upon them. For example, the tyre regulations intervention only has a certain limited effect on the wear of vehicle tyres.

Figure 5: Proportion of Item Removed following Policy Interventions



Finally, Figure 6 indicates further important information about the composition of the remaining plastic leakage, post-interventions. This chart shows that 'other plastics' may still be a large proportion of leakage, leading to the need for further research into this area. Tyre wear is also indicated as a significant contributor, as are construction plastics and other plastic bottles. This helpful output identifies where further interventions might be necessary, including into product or technological research and development if solutions do not currently exist.

Figure 6: Composition of Remaining Plastic Leakage following Policy Interventions



Next Steps

Plastic Drawdown is ready for consideration by the Indonesian Government as a tool to support identification of an optimal portfolio of policy instruments to reduce plastic leakage into rivers and seas. This innovative approach can

also inform the uptake of globally aligned tools to end marine plastic pollution.

Following the development of the model for Indonesia, Common Seas are proposing three key steps to explore Plastic Drawdown in more detail and support policy planning:

1. "High level" policy assessment workshop with the Indonesian Government
    a. Short term wins
    b. Longer term wins

2. Development of "action plan"
    a. Policy
    b. Institutional
    c. Regulatory framework
    d. Behaviour change

3. Detailed implementation of specific elements e.g.:
    a. Waste strategy development / update
    b. Waste water treatment upgrades
    c. Tax design
    d. etc

1. "High level" policy assessment workshop with the Indonesian Government

The first Step would be to run a policy workshop with relevant representatives of the Indonesian Government. The Indonesian wedges model would be used as a basis for the discussions at the workshop. The key elements would be:

1. Discussion on plastics flows within the model. The objective is to ensure the Government understand key data and assumptions.

2. Review effect of policies in the model and prioritise. The objective of this session is to confirm what policies should be prioritised in the short-term and what might only be possible in the longer term. The model would form a core part of the session, and be used as a live tool to understand what the implications of selecting different scenarios of policies are, whether the effects are more likely to be optimistic, central or pessimistic given the local conditions, and the implications of different timings for implementation.

3. Key challenges and barriers. The objective of the final session would be to explore the key challenges to implementation of the policies in the model. This would help inform the development of the "action plan", to ensure key barriers are addressed.

2. Development of "action plan"

Following the workshop in Step 1, where the need for further action has been identified, and key information gathered regarding the priorities and possible solutions, the project team will develop a detailed "action plan".

This plan will include the following elements for each action:

- Type of action:
  - Policy
  - Institutional
  - Regulatory framework
  - Behaviour change
- Description of action to be undertaken
- Organisation responsible for implementation
- The time-frames over which the action is to take place
- Any prerequisites for the action to be implemented

The action plan would also include a Gantt chart to provide an easy to understand overview of the key actions to be taken. The time-frame for the action plan is likely no further out than 2030, given the urgent need for action.

The action plan will help the Indonesian Government understand exactly what are the various actions that would be needed to reduce plastic leakage into the marine environment from Indonesia. The plan would follow the priorities highlighted in the first workshop, and seek to address any of the barriers raised.

The action plan would also clearly outline what changes to existing policies and instruments might be needed in the various affected sectors, mainly waste and waste water management. These instruments would then need to be subjected to detailed design and impact assessments, as described in Step 3.

The final element of this Step would be to present the action plan to the Indonesian Government during a second workshop. The objectives of this workshop would be to ensure the actions are appropriate, clearly explained and feasible for the Government to take ownership of and implement over time. Any feedback from this workshop would be taken into account to finalise the action plan, which would then be given over to the Government for use going forwards.

3. Detailed implementation of specific elements

The final Step would be to carry out detailed implementation work for specific elements in the action plan. Whilst the action plan is a highly valuable tool for setting out what needs to be done to tackle the problem of plastics leakage, this leakage will not reduce unless concrete actions are taken, including updating or implementing new regulatory or economic instruments. Therefore, it is critical that key measures are carried through to a detailed implementation phase.

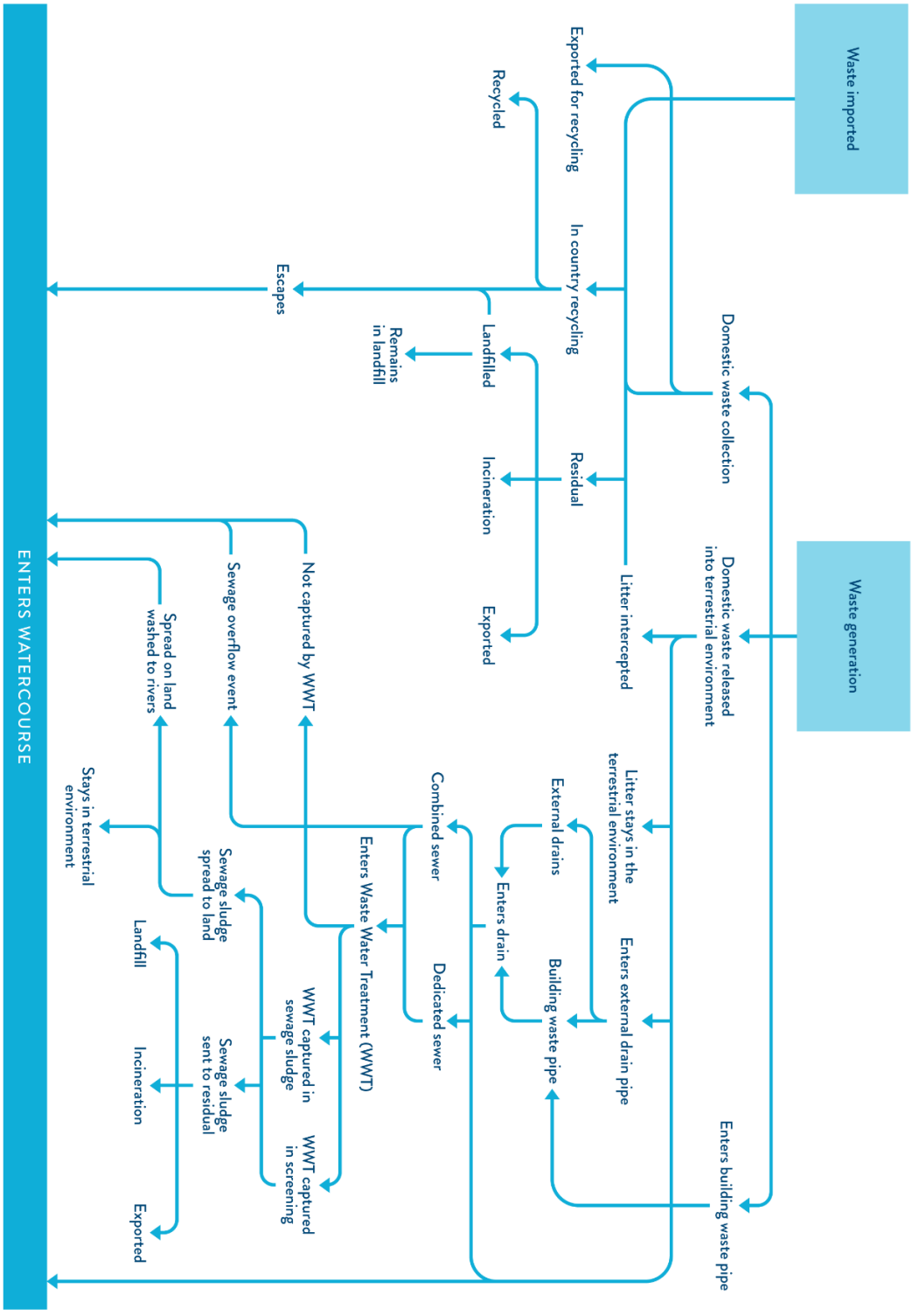
This may include, for example, impact assessment, strategic environmental assessment and public consultation, according to the policy making norms in Indonesia. The details cannot be determined now, as these stem from relevant actions in the plan, but may include:

8. Waste strategy development / update
9. Waste water treatment upgrades
10. Tax design
11. Impacts of product bans
12. Litter extended producer responsibility implementation
13. Fishing gear deposit refund scheme design
14. Etc

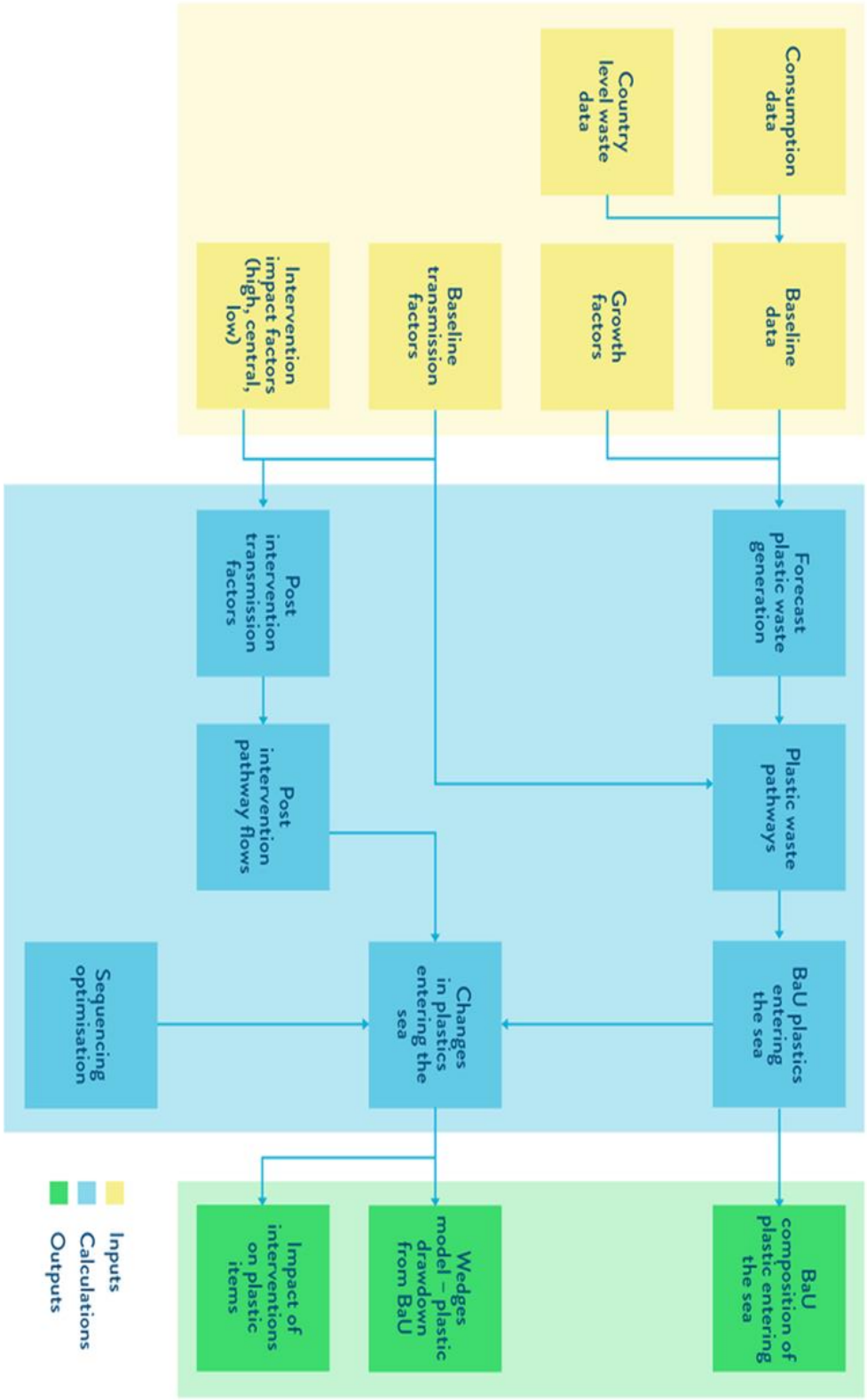
The scale of the effort involved in the detailed implementation phase would relate to the nature of the instrument being assessed. The timing of this work would be dictated by the short- or longer-term priorities set out in the action plan and would likely be phased over the period of the plan.

Appendices

Appendix 1: Plastic Waste Flows



Appendix 2: Model Flow Diagram



Appendix 3: Matrix of Plastic Interventions & Target Items

# Interventions per Item	18 No special fee obligations	17 Gear zoning of fishing areas	16 Track & trace systems	15 Deposit refund for fishing gear	14 Sewage & storm water catchment systems	13 Wastewater treatment	12 Regulation and labelling for tyres	11 Fibre release threshold and clothing labelling regulation	10 Pre-production pellet handling regulation	9 Litter and fly-tipping regulations	8 Standards for storage and management of waste	7 On-the-go waste collection	6 Provision of solid waste collection	5 Deposit return scheme for beverage containers	4 Item ban	3 Water refill scheme	2 Potable water supply	1 Taxes on specified Items		
5										×	×	×	×					×	Grocery bags (plastic)	1
5										×	×	×	×					×	Other plastic bags	2
7										×	×	×	×	×		×	×		Beverage bottles (plastic)	3
7										×	×	×	×	×		×	×		Bottle baps (plastic)	4
4										×	×	×	×						Lids (plastic)	5
3										×	×		×						Other plastic bottles (oil, bleach, etc.)	6
4										×	×	×	×						Cigarette butts	7
5										×	×	×	×		×				Straws, stirrers	8
4										×	×	×	×						Food wrappers (candy, chips, etc.)	9
4										×	×	×	×						Single serve sachets (food)	10
4										×	×	×	×						Single serve sachets (non-food)	11
5										×	×	×	×		×				Take out/away containers (foam)	12
5										×	×	×	×					×	Take out/away containers (plastic)	13
5										×	×	×	×		×				Cups, plates (foam)	14
5										×	×	×	×					×	Cups, plates (plastic)	15
5										×	×	×	×		×				Forks, knives, spoons	16
5										×	×	×	×					×	Balloons	17
6					×	×				×	×		×					×	Wet wipes	18
4										×	×	×	×						Diapers	19
4					×	×					×		×						Condoms	20
4					×	×					×		×						Sanitary pads/ tampons	21
4	×	×	×	×															Fishing gear	22
3					×	×	×												Tyre wear	23
2					×	×													Brake wear	24
2					×			×											Clothing fibres	25
3					×				×		×								Pellets	26
2					×										×				Microbeads	27
1											×								Construction plastics	28
4										×	×	×	×						Other plastic waste	29
150																				