Scotland's Circular Economy and Waste Route Map to 2030

Strategic Environmental Assessment

Environmental Report

January 2024

Scottish Government
Riaghaltas na h-Alba

1 Non-technical Summary

1.1 Introduction to the Route Map

The Scottish Government is committed to moving towards a circular economy and playing its part to tackle the climate emergency. A circular economy, based on sustainable consumption and production, is essential to power Scotland's transition to a fair, green and sustainable economy, and critical to meeting our obligations to tackle the twin climate and nature emergencies. Material consumption and waste are primary drivers of nearly every environmental problem Scotland currently faces, from water scarcity to habitat and species loss.

Founded on evidence and collaboration, the Circular Economy and Waste Route Map is part of the Scottish Government's wider response to these challenges. It is designed to drive progress on three key fronts:

1. Setting the strategic direction and laying foundations for how we will deliver our system-wide, comprehensive vision for Scotland's circular economy from now to 2030.
2. Setting out priority actions from now to 2030 to accelerate more sustainable use of our resources across the waste hierarchy.
3. Reducing emissions associated with resources and waste.

In 2022, the Scottish Government set out a range of proposals across the resources and waste system through its first Route Map consultation. The consultation sought views on the feasibility and ambition of these proposals in order to drive progress against 2025 waste and recycling targets, and to achieve the long term goal of net zero by 2045. Earlier in 2023, the analysis of responses to this consultation was published.

Building on the first consultation, the Scottish Government has now published a draft Route Map, which seeks to prioritise and focus on the key actions that will unlock progress across the waste hierarchy to 2030. Through a second consultation on the draft Circular Economy and Waste Route Map, the Scottish Government is inviting views on these priorities, before the Route Map is finalised later in 2024.

Proposals are grouped into four strategic themes which span action across the whole circular economy:

- Reduce and reuse;
- Modernise recycling;
- Decarbonise disposal;
- Strengthen the Circular Economy.

1.2 What is Strategic Environmental Assessment?

Strategic Environmental Assessment (SEA) is a statutory requirement under the Environmental Assessment (Scotland) Act 2005 ('the 2005 Act'), to assess the likely significant environmental effects that a public plan, programme, or strategy (PPS) will

have on the environment if implemented. The process identifies how adverse environmental effects can be avoided, minimised, reduced or mitigated and how any positive effects can be enhanced. It also allows the public to give their view on the programme and its potential environmental impacts.

SEA comprises the following key stages:

1. **Screening** – determining whether a Plan/Programme/Strategy (in this instance, the Circular Economy Route Map) requires an SEA.
2. **Scoping** – establishing the scope and approach of the SEA, including the initial environmental topics to include, the context (a review of other plans, programmes, and strategies and the environmental baseline), and the assessment methodology, with the information presented in a Scoping Report, which is subject to a 5-week consultation.
3. **Environmental Assessment** – identifying, describing, and assessing the likely significant effects of the proposed measures.
4. **Environmental Report** – outlining the findings from the environmental assessment, consistent with the requirements of Schedule 3 of the 2005 Act.
5. **Main consultation –** consulting on the draft and Environmental Report;
6. **Post Adoption Statement (PAS)** – producing a statement to outline how the assessment and consultation responses have been considered within the finalised plan.
7. **Monitoring** – monitoring the effects of implementation.

A combined SEA screening and scoping report for the Circular Economy and Waste Route Map was submitted to statutory consultees for consultation on 16 November 2022. The SEA approach has been amended where appropriate in response to the comments received. This scoping consultation comments and responses are documented in Appendix B.

1.3 How have the environmental effects of the Route Map been assessed?

Each of the overarching themes in the Route Map has been analysed to identify and evaluate the likely significant effects that could arise from the implementation of the measures proposed within them. The effects of the Route Map have been considered with respect to the following topic areas that have been scoped into the SEA following the scoping stage:

- Biodiversity, flora, and fauna;
- Population and human health;
- Soil;
- Water;
- Air;
- Climatic Factors;
- Material Assets;
- Landscape and visual impacts; and
- Cultural heritage and the historic environment.

The first Route Map consultation document grouped measures into six packages:

- Promote responsible consumption, production, and reuse;
- Reduce food waste;
- Embed circular construction practices;
- Improve recycling from households;
- Improve recycling from commercial businesses; and
- Minimise the impact of disposal.

The measures contained within these six packages now sit within four overarching strategic aims:

- Reduce and reuse;
- Modernise recycling; and
- Decarbonise disposal;
- Strengthen the Circular Economy.

Given the broad nature of the strategies, this SEA has been undertaken as a high level assessment of the likely environmental impacts of the Route Map at a thematic level.

The proposals in the draft Route Map have been assessed against the SEA assessment questions set out below for each environmental topic:

Biodiversity, flora, fauna

- Will the plan avoid adverse impacts to habitats and species?
- Will it protect, maintain, and enhance biodiversity?

Population and human health

- Will the plan reduce the health gap and inequalities and improve healthy life expectancy?
- Will it protect and improve human health and wellbeing through improving the quality of the living environment of people and communities?
- Will it increase sustainable access to essential services, employment, and the natural and historic environment?

Soil

- Will the plan safeguard and improve soil quality, quantity, and function in Scotland, particularly high value agricultural land and carbon-rich soils?

Water

- Will the plan ensure the sustainable use of water resources?
- Will it help to reduce levels of water pollution?

Air

- Will the plan avoid adverse impacts to air quality?

- Will it reduce emissions of key pollutants and improve air quality throughout Scotland?
- Will it reduce levels of nuisance e.g., noise, vibration, dust, odour, and light?

Climate factors

- Will the plan help to reduce existing and avoid new Greenhouse Gas (GHG) emissions?

Material assets

- Will it reduce use and promote sustainable management of natural resources?
- Will it reduce 'leakage' of material to landfill or energy recovery or as litter?

Landscape and visual impacts

- Will the plan avoid adverse effects on landscapes and visual impacts?
- Will it safeguard and enhance the character and diversity of the Scottish landscape and areas of valuable landscape and geodiversity?

Cultural heritage and the historic environment

- Will it avoid adverse impacts on the historic environment including its setting?
- Will it protect and enhance valued landscapes, historic and archaeological sites and other culturally and historically important features, landscapes, and their settings?
- Will it encourage the retention, reuse and repair of historic environment assets and materials?

1.4 What are the likely significant environmental effects of the proposed Route Map?

Subject to the practical implementation of what are recognised to be high level visions, aims, and actions for delivering a circular economy in Scotland, the assessment has found that the proposals in the Route Map have the potential to cause positive environmental effects across all of the impact categories assessed:

- Biodiversity, flora, and fauna;
- Population and human health;
- Soil;
- Water;
- Air;
- Climatic factors;
- Material assets;
- Cultural heritage and the historic environment; and
- Landscape and visual assets.

It is anticipated that by reducing demand for new products and virgin materials and driving down the amount of material disposed of via landfill and energy from waste, a

range of negative pollution impacts on biodiversity, air, bodies of water, and soils can be avoided. Greenhouse gas emissions from material production and manufacturing processes as well as waste management activities are expected to be minimised, with material assets being kept in use for as long as possible through circular practices and improved recycling. Indirect positive impacts are anticipated in relation to the Scottish landscape, through reduced demand for unsightly disposal and extraction infrastructure and the potential to reduce litter and flytipping. Circular practices in the construction and demolition sector should also encourage the retention, reuse and repair of historic environment assets and materials, thus benefitting Scotland's cultural heritage and historic environment.

The positive impacts of the measures are expected to be partially offset by increased resource use, for example, through increased recycling activity, or additional product or building maintenance. However, this assessment has concluded that none of the themes in the Route Map are anticipated to have a net negative impact on any of the environmental topics assessed.

Table 1 summarises the overall impacts of each of the in-scope strategic themes in the Route Map against the environmental topics considered as part of this assessment. Measures within the 'Strengthen the Circular Economy theme were scoped out of the assessment and are therefore not included in Table 1. See section 3.2.1 for more information.

Table 1 - Summary of overall results of the SEA.

	Reduce and Reuse			Modernise Recycling		Maximise value / Decarbonise disposal
	Promote responsible consumption, production, and reuse	Reduce food waste	Embed circular construction practices	Improve recycling from households	Improve recycling from commercial businesses	Minimise the impact of disposal
Biodiversity, flora and fauna	+	+/?	+/?	+/?	+/?	+/?
Population and human health	+	+/?	+/?	+	+	+/?
Soil	+	+/?	+/?	+/?	+/?	+/?
Water	+/?	+/?	+/?	+/?	+/?	+/?
Air	+	+/?	+/?	+/?	+/?	+/?
Climatic factors	+/?	+/?	+/?	+/?	+/?	+
Material assets	+	+/?	+/?	+/?	+/?	N/A
Cultural heritage and the historic environment	N/A	N/A	+	+/?	+/?	N/A
Landscape and visual impacts	+	+/?	+/?	+/?	+/?	+/?

Key

+	Only (significant) positive impacts expected.
+/?	Impacts are expected to be mostly positive but may be offset to some extent by potential negative impacts.
N/A	No impacts identified

To maximise the potential for positive environmental impacts and to support and enhance the wider aims of the Route Map, it is recommended that all measures are implemented with consideration to alignment with other relevant environmental plans, programmes, and strategies, such as Scotland's Environment Strategy, Biodiversity Strategy and the National Litter and Flytipping Strategy.

2 Introduction

2.1 Background to the Route Map

The Scottish Government is committed to moving towards a circular economy and playing its part to tackle the climate emergency. A circular economy, based on sustainable consumption and production, is essential to power Scotland's transition to a fair, green and sustainable economy, and critical to meeting our obligations to tackle the twin climate and nature emergencies. Material consumption and waste are primary drivers of nearly every environmental problem Scotland currently faces, from water scarcity to habitat and species loss.

Scotland has had a set of waste and recycling targets in place for over the past decade, spanning the waste hierarchy. As the first Circular Economy and Waste Route Map consultation (2022) set out, Scotland has made good long-term progress towards reaching these ambitions. The total amount of waste going to landfill in Scotland has dropped by over a third over the past decade (3 million tonnes or 30% of all waste managed was sent to landfill in 2021), over 56% of waste was recycled in 2021. In the same year the 2025 target to reduce all waste by 15% was met.

However, in some areas we have fallen short, and progress has not been at the pace and scale required. And while the 2025 targets have provided a good platform for progress over the past decade, we know from the Route Map's analysis that they are not universally the best indicators to deliver our circular economy, emissions and nature objectives. This recognises that much has changed since most of these waste targets were set in 2010. The climate emergency has intensified our focus on emissions reduction, and how we view and treat our resources.

It is clear that further system-wide changes are required to drive progress, and ensure a more rapid transition to net zero and a fully circular economy in Scotland. A range of transformational measures are already in place or underway to support this, including bans on problematic single-use plastic items, reform of extended producer responsibility for packaging, and a £70 million investment in local authority recycling infrastructure.

Founded on evidence and collaboration, the Circular Economy and Waste Route Map is part of the Scottish Government's wider response to these challenges. It is designed to drive progress on three key fronts:

1. Setting the strategic direction and laying foundations for how we will deliver our system-wide, comprehensive vision for Scotland's circular economy from now to 2030 – based on Responsible Production, Responsible Consumption, and Maximising Value from Waste and Energy.
2. Setting out priority actions from now to 2030 to accelerate more sustainable use of our resources across the waste hierarchy. We acknowledge the progress we have made against our existing 2025 waste reduction and recycling targets, the areas we have fallen short, and the lessons we can learn as we set out the framework for what comes next .
3. Reducing emissions associated with resources and waste. In 2024, the Scottish Government will set out how it will continue to drive down emissions in a draft

Climate Change Plan (CCP). The Route Map sets out the opportunities we will take to decarbonise the waste sector.

In 2022, the Scottish Government set out a range of proposals across the resources and waste system through its first Route Map consultation. The consultation sought views on the feasibility and ambition of these proposals in order to drive progress against 2025 waste and recycling targets, and to achieve the long-term goal of net zero by 2045. Earlier in 2023, the analysis of responses to this consultation was published.

Building on the first consultation, the Scottish Government has now published a draft Route Map, which seeks to prioritise and focus on the key actions that will unlock progress across the waste hierarchy, outlining how we will deliver and coordinate these actions to achieve maximum positive impact for communities and businesses in Scotland, and drive sustainable use and management of our resources to 2030. Through a second consultation, the Scottish Government is inviting views on these priorities, before the Route Map is finalised later in 2024.

Proposals are grouped into four strategic aims which span action across the waste hierarchy:

- Reduce and reuse:
    - Drive responsible consumption, production and re-use
    - Reduce food waste
    - Embed circular construction practices
- Modernise recycling:
    - Modernise household recycling and reuse services, improving and optimising performance.
    - Support businesses in Scotland to reduce waste and maximise recycling.
- Decarbonise disposal:
    - Understand the best environmental outcomes for specific wastes
    - Ensure there is an appropriate capacity to manage waste
    - Improve environmental outcomes for waste through innovation
    - Incentivise decarbonisation of the waste sector

2.1.1 Strengthen the Circular Economy

The Scottish Government has taken a whole-system approach to developing the Route Map. Delivering a circular economy is not a simple task. It requires sustained transformational system change, and a range of actions that are both complementary and coordinated to drive sustainable management of our resources. If Team Scotland are to maximise the opportunities that a circular economy brings to Scotland, we must maintain a strategic approach to its delivery, ensuring the right structures and support are in place to enable action across the circular economy. Measures will be implemented to ensure this, including strategic interventions and governance, research, data and evidence, sustainable procurement, and skills and training.

Since the first consultation, interventions that were previously included as part of the 'Cross-cutting measures' package have been refined and included in the 'Strengthen the Circular Economy' strategic aim in the draft Route Map. For the purposes of this assessment, the interventions within this theme are considered out of scope since they will support the other interventions rather than leading to specific impacts themselves.

2.1.2 Reduce and reuse

2.1.2.1 Drive responsible consumption, production, and re-use

This set of measures is aimed at reducing the consumption of products and materials by mainstreaming reuse and repair, and incentivising and promoting sustainable choices. This means prioritising reuse, popularising repair to keep items in use for longer, and working with businesses and the UK Government to drive better product design and ensure producers take responsibility for the environmental impact of what they sell. Interventions will contribute towards reducing the total amount of waste we generate in Scotland and reducing the carbon and environmental footprint of Scotland's resource use and waste.

The interventions outlined are to:

- Develop and publish a Product Stewardship Plan to identify and tackle the environmental impact of priority products
- Deliver a prioritised approach to the introduction of environmental charges for problematic products
- Introduce a charge for single-use disposable cups
- Consult on actions regarding the environmental impacts of single-use vapes
- Review the feasibility of setting reuse targets
- Develop restrictions on the destruction of unsold consumer goods
- Develop measures to improve the reuse experience for consumers
- Deliver behaviour change-based approaches focused on sustainable consumption, aligned to Let's Do Net Zero communications
- Identify ways to expand business models that prolong product lifespan

2.1.2.2 Reduce food waste

This group of measures is aimed at accelerating progress against Scotland's goal to reduce food waste from all sources, building on the 2019 Food Waste Reduction Action Plan. This means addressing the whole food system; resetting our approach to food waste; enhancing our circular bioeconomy; and ensuring we have the data needed to understand and drive progress. We recognise that progress has not been at the scale and speed required, partly as a consequence of Covid-19, and a collective reset of our approach to tackling food waste in Scotland is required. The interventions will contribute towards achieving the UN's Sustainable Development Goal 12.3 to halve food waste by 2030.

The interventions outlined are to:

- Deliver an intervention plan to guide long-term work on household food waste reduction behaviour change
- Develop with stakeholders the most effective way to implement mandatory reporting for food waste and surplus by businesses
- Strengthen data and evidence
- Review the rural exemption for food waste recycling, as part of recycling codesign process
- Investigate feasibility of action plans
- Deliver enhanced support for businesses

2.1.2.3 Embed circular construction practices

This set of measures has two aims. The first is to reduce the tonnage of material sent for disposal, thereby reducing waste generated; and the second aim is to reduce the carbon impact of construction activities, which is strongly aligned with tonnage reduction but not always complementary.

The interventions outlined are to:

- Support the development of regional Scottish hubs and networks for the reuse of construction materials and assets
- Develop new and promote existing best practice standards in circular practices within the construction sector, and assess the options for both voluntary and mandatory compliance
- Investigate and promote options to incentivise and build capacity for the refurbishment of buildings
- Investigate and promote ways to reduce soil and stones disturbance, movement and volumes going to landfill
- Review opportunities to accelerate adoption of climate change and circular economy focussed purchasing in construction
- Consider how devolved taxes can incentivise the use of recycled aggregates and support circular economy practices

2.1.3 Modernise recycling

2.1.3.1 Improve recycling from households

These measures are focused on modernising and improving household recycling services and performance, specifically increasing participation in services, tonnage captured, and quality of material. Interventions will directly impact on Scotland's recycling rate and the carbon impact of household waste.

The interventions outlined are to:

- Facilitate a co-design process with Local Government for high quality, high performing household recycling and reuse services
- Develop a statutory code of practice for household waste services
- Introduce statutory recycling and reuse local performance targets for household waste services
- Strengthen the householder's duty of care in relation to waste
- Give local authorities more tools to support household recycling and reduce contamination

- Undertake a review of waste and recycling service charging
- Review the monitoring and reporting framework for local authority waste services
- Develop options and consult on the introduction of end destination public reporting of household recycling collected

2.1.3.2 Improve recycling from businesses

Measures to reduce waste and improve recycling from commercial and industrial businesses contribute towards overall reduction of waste, Scotland's recycling rate, and reducing the carbon and environmental impact of our use of resources and waste.

The interventions are strongly linked to those outlined to reduce consumption across supply chains, such as product stewardship and charges/bans on goods and products.

The interventions outlined are to:

- Review of compliance with commercial recycling requirements
- Co-design measures to improve commercial waste service provisions
- Conduct a national compositional study of waste from commercial premises
- Investigate further steps to promote business-business reuse platforms

In addition to the specific interventions above, most of the measures within the Reduce and Reuse theme will also impact on commercial premises. As these are discussed in section **Error! Reference source not found.**, they are not replicated here but all will impact on commercial premises as well as producers and households as they are aimed at placing better products on the market, ensuring they stay in productive use for longer and are fully recycled at end-of-life.

2.1.4 Decarbonise disposal

The production and management of waste results in environmental impacts and represents missed economic opportunities for these materials. The focus in the Route Map is to prevent materials from becoming waste in the first place. The success of interventions under the other strategic aims directly influences what is left in the residual stream to be managed. As we accelerate the move to a circular economy we will produce less waste. We want to ensure that materials that cannot be avoided, reused or recycled are managed in a way that minimises environmental and climate impacts, encourages management of materials further up the waste hierarchy, and minimises broader societal impacts. Measures aim to drive further reductions in greenhouse gas emissions from the Waste Management Sector, and long-term reduction of emissions from Energy from Waste.

The interventions in this area aim to achieve the best environmental outcome with what is left in the waste stream at disposal, following as much diversion to other routes as possible. The interventions outlined are to:

Priority actions:

- Develop a Residual Waste Plan to 2045
- Facilitate the development of a Sector-Led Plan to minimise the carbon impacts of the Energy from Waste Sector

- Support the inclusion of energy from waste in the UK Emissions Trading Scheme (ETS), and investigate other fiscal measures to incentivise low carbon disposal
- Review and target materials currently landfilled to identify and drive alternative management routes
- Facilitate the co-production of guidelines for effective community engagement
- Increase the capture of landfill gas

2.2 Background to Strategic Environmental Assessment (SEA)

SEA is a statutory requirement under the 2005 Act to assess the likely significant environmental effects that a public plan, programme or strategy will have on the environment if implemented. The process identifies how environmental damage can be avoided or reduced by suggesting how it can be changed. It also allows the public to give their view on the programme and its potential environmental impacts. SEA is comprised of five key stages:

1. **Screening** – determining whether a plan requires a SEA;
2. **Scoping** – establishing significant environmental topics, setting the environmental baseline and consulting through a Scoping Report;
3. **Environmental Assessment** – assessing and recording the potential environmental impact of the plan and consulting on the likely significant effects of the draft plan and Environmental Report;
4. **Post Adoption Statement (PAS)** – undertaking a public consultation exercise on the Environmental Report and developing the monitoring strategy to assess progress once adopted;
5. **Monitoring** – making the final decision on how or whether to proceed with the proposed activity, plan or strategy, informing the public about that decision and monitoring the effects of implementation.

A combined screening and scoping report was submitted to statutory consultees for a 5-week consultation period which ended on 16 November 2022. The environmental assessment has been amended based on the recommendations received. This is documented in Appendix B.

Through the first Route Map public consultation, specific views on information or evidence that should be considered with regards to the environmental impact of proposals outlined in the Route Map were sought, to inform the development of the Strategic Environmental Assessment process. The findings of the subsequent environmental assessment are presented in this SEA Environmental Report.

The proposed measures are set out in detail in the second draft Route Map Consultation document, published alongside the SEA Environmental Report. The

responses received and findings of the SEA will inform the final Route Map and will be reflected upon in the Post Adoption Statement.

Scottish Government will monitor the implementation and environmental effects resulting from implementing the Route Map.

2.3 Purpose of Environmental Report

This Environmental Report contains the SEA findings on the likely environmental implications arising from the measures set out within *the draft Circular Economy and Waste Route Map* with reference to the topic areas scoped in during the initial scoping phase.

The objectives of the environmental assessment of the Route Map are:

- to ensure that the likely significant environmental effects arising from the measures set out within the Route Map are identified, characterised, and assessed;

- to give the statutory consultees, stakeholders, and the wider public the opportunity to review and comment upon the environmental effects that the Route Map may have on them, their communities, and their interests, and to encourage and support them to make responses detailing any such effects and how to mitigate these; and

- to demonstrate that the introduction of the Route Map has been carried out in a manner deemed to be consistent with the requirements of the SEA Act.

This report has been produced for inclusion within the public consultation stage of the policy development process. It identifies, describes, and evaluates the likely significant environmental effects resulting from the Route Map.

3 Approach to the assessment

3.1 SEA process to date

SEA has a number of distinct stages: screening, scoping, the environmental assessment, the production of an Environmental Report, and the publication of a Post-Adoption Statement. At each stage, there is a requirement to consult with three statutory Consultation Authorities. These are Historic Environment Scotland (HES), NatureScot and the Scottish Environment Protection Agency (SEPA).

The first stage of SEA leads to the production of a Scoping Report. This sets out the proposed scope and approach to assessing the potential environmental effects. The SEA Scoping Report for the Route Map was issued to statutory consultees and three responses to the consultation were received, which resulted in amendments to the proposed scope and approach to assessment. A schedule of consultation responses to the Scoping Report is contained at Appendix B.

Through the first Route Map public consultation, specific views on information or evidence that should be considered with regards to the environmental impact of proposals outlined in the Route Map was sought, to inform the development of the Strategic Environmental Assessment process.

The findings of the subsequent environmental assessment are presented in this SEA Environmental Report.

3.2 Scope of the assessment

3.2.1 SEA topics

Table 2, Table 3, and Table 4 list the SEA topics scoped into this assessment exercise against each strategic theme of the Route Map to which they are relevant.

It was originally proposed that Cultural heritage and the historic environment could be considered out of scope for the assessment of all interventions except those under the Reduce and Reuse theme relating to circular construction practices. It was not anticipated that any other Route Map interventions would have a significant direct impact on the preservation of historic buildings, archaeological sites, or other culturally important features. Feedback from the consultation authorities indicated that all statutory consultees agreed with the results from this scoping exercise.

During the course of the assessment, Cultural heritage and the historic environment was scoped into the assessment of interventions under the Modernise Recycling strategic aim, as potential impacts were identified as a result of the proposed co-design of collection services and previous investigation into commercial zoning which could impact historic settings. Following inclusion in the first Route Map consultation, the draft Circular Economy and Waste Route Map does not propose mandatory zoning as a preferred approach.

The measures within the ‘Strengthen the Circular Economy’ theme are considered out of scope for this SEA since they will support the other interventions rather than leading to specific impacts themselves.

Table 2 - Scope of environmental topics assessed within the “Reduce and Reuse” strategic aim of the Route Map.

	Reduce and Reuse: Responsible consumption, production, and reuse	**Reduce and Reuse: Food waste**	**Reduce and Reuse: Circular construction**
Biodiversity, flora and fauna	In	In	In
Population and human health	In	In	In
Soil	In	In	In
Water	In	In	In
Air	In	In	In
Climatic factors	In	In	In
Material assets	In	In	In
Cultural heritage and the historic environment	Out	Out	In
Landscape and visual impacts	In	In	In

Table 3 - Scope of environmental topics assessed within the "Modernise Recycling" strategic aim of the Route Map.

	Modernise recycling: Household	**Modernise recycling: Commercial**
Biodiversity, flora and fauna	In	In
Population and human health	In	In
Soil	In	In
Water	In	In
Air	In	In
Climatic factors	In	In
Material assets	In	In
Cultural heritage and the historic environment	In	In
Landscape and visual impacts	In	In

Table 4 - Scope of environmental topics assessed in the "Decarbonise disposal" and "Strengthen the Circular Economy" strategic aims of the Route Map.

	Decarbonise disposal	Strengthen the circular economy
Biodiversity, flora and fauna	In	Out
Population and human health	In	Out
Soil	In	Out
Water	In	Out
Air	In	Out
Climatic factors	In	Out
Material assets	In	Out
Cultural heritage and the historic environment	Out	Out
Landscape and visual impacts	In	Out

3.2.2 SEA objectives

The SEA objectives for each of the scoped-in environmental topics are listed below. These objectives form the basis of the assessment questions addressed in this report. One additional objective was added against the topic ‘Cultural heritage and the historic environment’ following a recommendation from Historic Environment Scotland in their feedback on the Scoping Report.

Biodiversity, flora, and fauna

- Avoid adverse impacts to habitats and species.
- Protect, maintain, and enhance biodiversity.

Population and human health

- Create conditions to improve health and reduce health inequalities.
- Protect and improve human health and wellbeing through improving the quality of the living environment of people and communities.
- Increase sustainable access to essential services, employment, and the natural and historic environment.

Soil

- Safeguard and improve soil quality, quantity, and function in Scotland.
- Water Ensure the sustainable use of water resources.

- Limit water pollution to levels that do not damage natural systems.

Air

- Avoid adverse impacts to air quality.
- Reduce emissions of key pollutants and improve air quality throughout Scotland.
- Reduce levels of nuisance e.g., noise, vibration, dust, odour, and light.

Climatic factors

- Avoid new Greenhouse Gas (GHG) emissions.
- Reduce GHG emissions in order to meet Scotland's emissions reduction target of net zero by 2045.

Material assets

- Avoid adversely impacting on material assets (e.g., water, heat, energy, and flood protection infrastructure .etc).
- Promote the principles of circular economy.
- Reduce use and promote sustainable management of natural resources.
- Promote the sustainable design, use and management of new and existing assets/infrastructure to support the development of high-quality places.

Cultural heritage and the historic environment

- Avoid adverse impacts on the historic environment including its setting.
- Protect and enhance valued landscapes, historic and archaeological sites and other culturally and historically important features, landscapes, and their settings.
- Encourage the retention, reuse and repair of historic environment assets and materials.

Landscape and visual impacts

- Avoid adverse effects on landscapes and visual impacts.
- Safeguard and enhance the character and diversity of the Scottish landscape and areas of valuable landscape and geodiversity.

3.3 Reasonable Alternatives

The Environmental Assessment (Scotland) Act 2005 requires that reasonable alternatives be assessed.

The Route Map under assessment is designed to set out all reasonable actions required to accelerate progress towards a series of pre-determined targets and ambitions. We have therefore assumed that, taken together, the proposed actions constitute all the reasonable alternatives that could be proposed for such high-level strategies. No additional alternatives were identified in the course of the Scoping stage of the assessment, and feedback from consultees did not recommend any reasonable alternatives that had been overlooked.

3.4 Context to the assessment

3.4.1 Purpose of this section

Schedule 3 of the Environmental Assessment (Scotland) Act 2005 requires that the following be identified:

- Relevant aspects of the current state of the environment and its likely evolution without the plan or programme.
- Environmental characteristics of areas likely to be affected.
- Relevant existing environmental problems.
- Relevant environmental protection objectives at the international, European, or national level.

The Route Map is assessed against this baseline to provide an indication of the type and significance of any environmental effects likely to arise.

3.4.2 Environmental principles

The assessment in this SEA has reflected Minister's duty to give due regard to the guiding principles in Section 13(1) of the Continuity Act[1]. These principles are:

- The principle that protecting the environment should be integrated into the making of policies,
- The precautionary principle as it relates to the environment,
- The principle that preventative action should be taken to avert environmental damage,
- The principle that environmental damage should as a priority be rectified at source,
- The principle that the polluter should pay.

The assessment objectives and questions reflect the principles that protecting the environment should be integrated into the making of policies, and that measures in the plan should ensure that appropriate preventative actions are taken to avert environmental damage. The assessment highlights any outcomes of the interventions that may be expected to cause environmental damage, and has informed the assessment, for example when establishing significant environmental topics through the Scoping Report. It is anticipated that once specific interventions have been defined and agreed, further impact assessments may be necessary. In this case, the guiding principles should be considered in any detailed assessments in subsequent SEAs.

It is worth noting that the Route Map has incorporated the principles directly in policy development, as summarised in the SEA screening and scoping reports. The principles underpin the importance in delivering a circular economy in Scotland as part of the vision set out by the Environmental Strategy for Scotland[2]. To summarise,

[1] Scotland's guiding principles on the environment: statutory guidance.

[2] The Environment Strategy for Scotland: vision and outcomes, https://www.gov.scot/publications/environment-strategy-scotland-vision-outcomes/

measures aim to protect the environment by reducing the environmental impacts of material consumption and waste; and cover the breadth of the waste hierarchy, that is, they aim to reduce waste, as well as increase reuse and recycling, and minimise the impact of disposal. In so doing, the Route Map prioritises the rectification of impacts at source as a guiding principle.

Finally, the polluter pays principle informs resource and circular economy policy development through the Route Map, and many of the key interventions have been designed to align with this principle. For example incorporating the principle through product stewardship, extended producer responsibility and introducing charges for damaging products.

3.4.3 2025 Targets and beyond: background information

This section of the report contains background information on the current status of progress towards the five waste and recycling targets and the climate change targets in the Climate Change Plan.

3.4.3.1 15% reduction of all waste, against 2011 baseline

2018 figures showed a 4% reduction in all waste. In 2021, the target was met, with a total reduction of almost 20%[3]; however this represents lower construction activity caused by COVID-19 (construction and demolition waste fell by 75% compared to 2018, and accounts for approximately half of the reduction of all waste since 2011)[4]. This underlines the strong link between this target and the scale of construction activity in any given year.

3.4.3.2 33% reduction of food waste, against 2013 baseline

The latest Scottish food waste data estimate for 2021 suggests that over 1 million tonnes of food was wasted in Scotland during 2021, accounting for around 6% of Scotland's total carbon footprint that year.[5] It also suggests that the scale of the problem has increased in Scotland over the past decade. In comparison to the 2013 baseline, in 2021 there was a total 2% per capita increase and an overall 5% increase in the volume of food wasted.

3.4.3.3 Minimum of 70% recycling of all waste

In 2021, 56% of all waste managed in Scotland was recycled, a reduction compared 2018 (61%)[6]. There was notable year-on-year variability from 2011 to 2016, largely driven by construction and demolition waste.

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[3] SEPA, Waste from all sources – Summary data 2021 (published 2023)

[4] Note: SEPA have warned that comparisons of 2021 waste from all sources data with previous years should be treated with caution due to the impact of COVID-19 and the cyber attack experienced by the organisation in 2020.

[5] Food Waste Estimate for 2021, Zero Waste Scotland.

[6] SEPA, Waste from all sources – Summary data 2021 (published 2023)

3.4.3.4 Minimum of 60% recycling of household waste [by 2020]

Scotland's recycling rate more than doubled between 2004 and 2011, but progress since slowed to around 45% for several years, meaning the 2020 target was missed. The recycling rate fell to 42% in 2020, where Covid-19 is believed to have had an impact; and increased to 43.3% by 2022[7]. Local authority recycling rates range from 20.7% to 57.8%.

3.4.3.5 Maximum 5% of all waste to landfill.

In 2021, 31% of all waste was sent to landfill. Landfilled waste fell from around 7 million tonnes in 2005 to approximately 2.6 million tonnes in 2020, and rose to 3 million tonnes in 2021[8]. The proportion of household waste landfilled was 25% in 2022 (585 thousand tonnes were landfilled, a reduction of 11.7% compared to 2021)[9].

3.4.3.6 A ban on all biodegradable waste going to landfill.

In 2021, 738kt of household and similar waste was landfilled, a minor increase in that landfilled in 2020 (736kt)[10]. According to a waste composition analysis of household residual waste collected at the kerbside, 61% of this could be considered biodegradable[11]. The total amount of biodegradable municipal waste going to landfill stood at 707,000 tonnes in 2022, a 45% decrease since 2011.

3.4.3.7 Climate Change Plan waste management targets

The 2020 Climate Change Plan update set out emission 'envelopes' for each sector, which reflect the pathway to meeting our statutory targets to reduce emissions by 75% by 2030 (compared with 1990) and to net zero by 2045[12]. Greenhouse gas emissions from waste management have plateaued in recent years. In 2021, total reported sector emissions were 1.5 $MtCO_2e$[13], similar to the emissions of reported in 2020 (also approximately 1.5 $MtCO_2e$)[14]. Almost all of these emissions were in the form of methane. To achieve the emissions envelopes, Scotland must reduce this to 0.9 $MtCO_2e$ by 2025 and 0.7 $MtCO_2e$ by 2032.

Significant progress has been made in reducing emissions in the waste and resources sector over the past 30 years. Between 1990 and 2021, emissions from waste management reduced by 5.0 MtCO2e (76.2%). This decrease may be due to the reduction of biodegradable waste being landfilled (in preparation for the biodegradable waste landfill ban), as well as the progressive introduction of methane capture and oxidation systems within landfill management.

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[7] SEPA, Scottish Household waste – summary data – 2022 (published 2023)

[8] SEPA, Waste from all sources – Summary data 2021 (published 2023)

[9] SEPA, Scottish Household waste – summary data – 2022 (published 2023)

[10] SEPA, Waste from all sources – Summary data 2021 (published 2023)

[11] Zero Waste Scotland, The Composition of Household Waste at the Kerbside in 2021-23 (published 2023)

[12] Scottish Government, Securing a green recovery on a path to net zero: climate change plan 2018–2032 – update (published 2020)

[13] Scottish Government, Scottish Greenhouse Gas Statistics 2021 (published 2023)

[14] Scottish Government, Scottish Greenhouse Gas Statistics 2020 (published 2022)

The subsector covering waste incineration with energy recovery has its carbon dioxide emissions accounted for under the Electricity sector, rather than waste management. Emissions from energy from waste were 0.3 MtCO2e in 2021, representing 19% of Electricity Sector emissions.

3.4.4 Related PPS and Environmental Baseline

The 2005 Act requires the Environmental Report to outline the relationships between the Route Map and other relevant plans, programmes, and strategies (PPS). The following sections outline the most relevant PPS under each environmental topic scoped in to the assessment and provide an overview of the current baseline.

3.4.4.1 Climatic Factors

The Climate Change (Scotland) Act 2009 ('The 2009 Act') sets out Scotland's commitment on tackling climate change. Through this legislation, Scotland contributes to EU and UN efforts on climate change mitigation and adaptation. The 2009 Act set out the statutory framework for greenhouse gas emissions reduction in Scotland and set targets for reduction in emissions of the seven Kyoto Protocol greenhouse gases by 80% by 2050, compared to the 1990/1995 baseline level.

The 2009 Act was amended in 2019 through The Climate Change (Emissions Reduction Targets) (Scotland) Act ('the 2019 Act'). The 2019 Act set targets to reduce Scotland's emissions of all greenhouse gases to net-zero by 2045 at the latest, with interim targets for reductions of at least 56% by 2020, 75% by 2030, 90% by 2040. The 2019 Act also requires that annual greenhouse gas emissions targets are set, by Order, for each year in the period 2021-2045. Following the initial phase of target-setting, the annual targets are set in nine-year batches.

In October 2018, the Intergovernmental Panel on Climate Change published a report which predicts that the impacts and costs of global warming 1.5˚C above pre-industrial levels will be far greater than expected. It also highlights that the impacts will be much worse if global warming reaches 2˚C or more.

In 2021, Scotland's total emissions of the seven greenhouse gases were estimated to be 41.6 $MtCO_2e$, an increase of 2.4% compared to 2020, which was impacted by reduced emissions due to COVID restrictions (e.g. reduced transport emissions). Following the adjusted calculation recommended by the Committee for Climate Change, Scotland's greenhouse gas emissions in 2021 were down 49.9% from the 1990 baseline period, meaning the interim target of a 51.1% reduction by 2021 was not met.[15]

Waste management was responsible for 1.5 Mt CO_2e greenhouse gas emissions out of the 41.6 Mt CO_2e total. Almost all emissions in the waste management sector were emitted in the form of methane (1.4 Mt CO2e). There was a 2.4% increase in waste management emissions between 2020 and 2021, from 1.4 Mt CO_2e to 1.5 Mt CO_2e. However, since the 1990 baseline, waste management emissions have

[15] Scottish Greenhouse Gas Statistics 2021, https://www.gov.scot/publications/scottish-greenhouse-gas-statistics-2021/

reduced by 76.2%. The decrease is largely due to the progressive introduction of methane capture and oxidation systems within landfill management.[16]

It should be noted that reported emissions from waste management do not include emissions from energy from waste facilities, as these are reported under Energy Supply. Emissions from energy from waste were 0.3 $MtCO_2e$ in 2021.[17] This makes up 19% of total emissions from electricity generation. It is anticipated that in future years, emissions from energy from waste will increase due to additional plants which are currently under construction beginning operation. We must look at all sources of greenhouse gas emissions across the resources and waste sector, including legacy emissions from landfill sites and critical opportunities to decarbonise incineration, as outlined in Dr Church's independent review of incineration and its role in the waste hierarchy.[18]

Zero Waste Scotland's Carbon Metric can be used to understand the full picture of greenhouse gas emissions from Scotland's household waste, including both energy from waste and embodied carbon from disposed materials[19]. The whole lifecycle carbon impacts of Scotland's household waste generated and managed in 2021 was 5.9 Mt CO_2e. This includes resource extraction and manufacturing emissions, right through to waste management emissions, regardless of where in the world these impacts occur.[20]

The Carbon Impacts of the Circular Economy (2015)[21] states that over two thirds of Scotland's' carbon footprint is directly related to material consumption and to a lesser extent waste.

This assessment focuses on how the measures set out in the Route Map are expected to contribute to changes in Scotland greenhouse gas emissions, for example by keeping valuable materials in use for as long as possible through increased reuse and recycling, and thus reducing consumption of virgin materials and the greenhouse gas emissions associated with their extraction, processing, transport, use, and disposal.

[16] Scottish Greenhouse Gas Statistics 2021, https://www.gov.scot/publications/scottish-greenhouse-gas-statistics-2021/
[17] Scottish Greenhouse Gas Statistics 2021, https://www.gov.scot/publications/scottish-greenhouse-gas-statistics-2021/
[18] Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review, https://www.gov.scot/publications/stop-sort-burn-bury-independent-review-role-incineration-waste-hierarchy-scotland/
[19] Zero Waste Scotland, The Carbon Footprint of Scotland's Household Waste: 2021 Household Carbon Metric Brief (published 2023)
[20] Zero Waste Scotland, The Carbon Footprint of Scotland's Household Waste: 2021 Household Carbon Metric Brief (published 2023)
[21] Zero Waste Scotland, The Carbon Impacts of the Circular Economy: Summary Report (published 2015)

3.4.4.2 Population and Human Health

A range of plans, programmes, and strategies in place will directly or indirectly influence population and human health, spanning a number of other SEA environmental topics such as air, water, and climatic factors.

The second Scottish Climate Change Adaptation Programme (SCCAP)[22] was launched in September 2019 and outlines how Scotland is preparing for the impacts of climate change over the period to 2024. It responds to the risks set out in the UK Climate Change Risk Assessment (UK CCRA) in 2017, published under section 56 of the UK Climate Change Act 2008. The programme follows an outcomes-based approach, derived from both the UN Sustainable Development Goals and Scotland's National Performance Framework.

The draft Energy Strategy and Just Transition Plan is in development at the time of writing. The Plan sets out a vision for Scotland's energy system by 2045 and includes actions to encourage local climate action and community engagement as well as infrastructure improvements and economic opportunities to realise benefits to the population in the transition to a low carbon economy.

Objectives and requirements relating to air quality are laid in the Air Quality Standards (Scotland) regulations 2010, the Air Quality (Scotland) Regulations 2000, and 2002 and 2016 amendment regulations. The Environmental Noise Directive (2002) and the Environmental Noise (Scotland) Regulations 2006 set out regulations at a European and national level respectively to protect the population against noise and vibration nuisance.

The Pollution Prevention and Control (Scotland) Regulations 2012 seek to provide protection for human health through the introduction of a consistent and integrated approach to environmental protection to ensure that industrial activities that may have a significant impact on the environment are strictly regulated. The regulations were designed to eliminate or minimise emissions to air, water and land and extended pollution controls to previously unregulated sectors.

'Cleaner Air for Scotland 2 - Towards a Better Place for Everyone'[23] provides a national framework which sets out how the Scottish Government and its partner organisations propose to achieve reductions in air pollution and fulfil legal responsibilities as soon as possible. The document outlines the contribution that better air quality can make to sustainable development whilst improving health and the natural environment and reducing health inequalities for the citizens of Scotland.

Research has shown that air pollution is one of the largest environmental risks to public health in the UK[24], and increased risk of flooding due to extreme weather and

[22] Scottish Government, Climate Ready Scotland: climate change adaptation programme 2019-2024 (published 2019)
[23] Scottish Government, Cleaner Air for Scotland 2 - Towards a Better Place for Everyone (published 2021)
[24] Scottish Government, Cleaner Air for Scotland strategy: independent review (published 2019)

rising sea levels poses risks to life expectancy and physical and mental health, as well as people's living conditions and disposable income if directly affected[25].

In 2022, the Good Food Nation Bill was passed, enshrining in law the Scottish Government's commitment to Scotland being a Good Food Nation, "where people from every walk of life take pride and pleasure in, and benefit from, the food they produce, buy, cook, serve, and eat each day"[26]. Reducing food waste through redistribution and making the food system more resilient through the measures proposed in the Route Map will support the Bill by improving access to affordable food and helping to realise the food waste reduction and environmentally friendly disposal ambitions in the Bill.

Average life expectancy in Scotland was 76.6 years for males and 80.8 years for females in the period 2019-2021[27]. This represents a decrease of approximately eleven and eight weeks respectively since 2018-2020, largely due to the COVID-19 pandemic. Life expectancy was higher in rural areas than urban areas, and socio-economics have a significant influence on human health and life expectancy.

This assessment considers the long and short term health implications of projected directional changes resulting from measures in the Route Map, focusing on levels of air pollution, employment impacts, and changes to levels of inequality in Scotland, as well as the impacts of climate change on the population of Scotland.

3.4.4.3 Air

The Air Quality Standards (Scotland) Regulations (2010) transpose the air quality environmental protection objectives from the European Air Quality Directive (2008) into the Scottish context, and further domestic objectives are set in the Environment Act 1995. The Pollution Prevention and Control (Scotland) Regulations 2012 set out regulation and monitoring of airborne pollution from certain industrial activities. These objectives are aimed at reducing harmful air pollution and monitoring air quality, with a focus on areas where air pollution is concentrated.

At UK level, the Air Quality Strategy for England, Scotland, Wales, and Northern Ireland[28] includes long term objectives for improving air quality, focusing on options to tackle pollutants such as particulate matter, nitrogen oxides, ozone, sulfur dioxide, polycyclic aromatic hydrocarbons, benzene, butadiene, carbon monoxide, lead, and ammonia.

All of the eight main pollutant emission levels reported in the National Atmospheric Emissions Inventory[29] decreased between 1990 and 2017. Emissions of ammonia

[25] Adaptation Sub-Committee of the Committee on Climate Change, UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Scotland (published 2016)
[26] Scottish Government, Good Food Nation: consultation (published 2018)
[27] National Records of Scotland, Life Expectancy in Scotland 2019-2021 (published 2022)
[28] DEFRA, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume 1) (published 2007)
[29] National Atmospheric Emissions Inventory, Air Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 1990-2017 (published 2019)

declined by 15% between 1990 and 2017, carbon monoxide by 84%, nitrogen oxides by 71%, non-methane volatile organic compounds by 65%, particulate matter <10 micrometres declined by 63%, particulate matter <2.5 micrometres declined by 68%, sulfur dioxide by 96%, and lead by 98%.[30]

Local Authorities have a duty to designate any relevant areas where air quality objectives are not met, or are unlikely to be met, as Air Quality Management Areas (AQMAs). In 2022, there were 42 current AQMAs across 14 of Scotland's 32 local authorities. These AQMAs were established primarily as a result of road traffic emissions.[31]

This assessment considers the scale and direction of changes in levels of air pollution and related nuisance such as noise, vibration, dust, odour, and light as a result of the measures proposed in the Route Map, including any unintended consequences e.g. air pollution resulting from additional recycling, refurbishment, or maintenance processes.

3.4.4.4 Soil

The EU Soil Strategy for 2030[32] sets out measures to protect and restore soils and ensure they are used sustainably. It sets objectives to achieve healthy and resilient soils by 2050, with interim actions by 2030. It includes a new Soil Health Law by 2023 to ensure a high level of environmental and health protection. It is one of the key deliverables from the EU biodiversity strategy for 2030[33] and will contribute to the European Green Deal[34] objectives.

At a national level, the Scottish Soil Framework set out a vision that soils are recognised as a vital part of the economy, environment, and heritage, to be safeguarded for existing and future generations. The framework was created to promote sustainable management and protection of soils consistent with the economic, social, and environmental needs of Scotland. It describes seven main classes of soil function, namely:

- providing the basis for food and biomass production;
- controlling and regulating environmental interactions: regulating water flow and quality;
- storing carbon and maintaining the balance of gases in the air;
- providing valued habitats and sustaining biodiversity;
- preserving cultural and archaeological heritage;
- providing raw materials;
- providing a platform for buildings and roads.[35]

[30] Scottish Government, Cleaner Air for Scotland 2: environmental report (published 2020)
[31] Scottish Government, Cleaner Air for Scotland 2: environmental report (published 2020)
[32] European Commission, EU soil strategy for 2030 (published 2021)
[33] European Commission, Biodiversity strategy for 2030 (published 2020)
[34] European Commission, The European Green Deal (published 2019)
[35] Scottish Government, The Scottish Soil Framework (published 2009)

The 2011 State of Scotland's Soil report defines soil quality as the ability of soil to carry out these functions[36].

Soil in Scotland contains over 3 billion tonnes carbon, and it is estimated that losing just 1% of soil carbon as carbon dioxide would triple Scotland's annual greenhouse gas emissions[37].

This assessment focuses on the consequences of measures in the Route Map on soil quality and peatland preservation.

3.4.4.5 Water

The European Water Framework Directive sets objectives on the condition of water bodies including rivers, lochs, transitional and coastal waters, and groundwater resources. Assessments of the chemical and ecological status and consideration of the biodiversity status are required as indicators of water quality. The Water Environment and Water Services (Scotland) Act (2003) and the Water Environment (Controlled Activities) (Scotland) Regulations (2011) set out water environment protection and improvement in the Scottish context.

While 80% of Scotland's groundwater was considered to be in good condition in 2011, widespread problems were reported in particular regions including the Central Belt as well as local problems affecting private water supplies. Inappropriate management of wastes is stated as one of the main causes of the localised issues.[38]

Scotland's Environment Groundwater Report[39] states that landfills can cause locally significant releases of ammonia or hazardous substances if not designed and maintained in accordance with best practice. At the time of the report's publication, it was not known whether the cumulative impact of landfilling in certain areas was sufficient to impact on the status of whole groundwater bodies.

This assessment considers the impact of measures in the Route Map on sustainable water use as well as pollution levels in the water environment in Scotland.

3.4.4.6 Biodiversity, flora, and fauna

The current Scottish Biodiversity Strategy is made up of Scotland's 2004 strategy – Scotland's Biodiversity: It's In Your Hands[40], supplemented by the 2020 Challenge for Scotland's Biodiversity[41]. The latter sets out the major steps necessary to improve the state of Scotland's nature. Scotland joined other nations at COP26 in endorsing the Leaders Pledge for Nature, to reverse nature loss by 2030, and in December 2022, COP 15 resulted in the adoption of the Kunming-Montreal Global Biodiversity Framework (GBF)[42]. The GBF aims to address biodiversity loss, restore

[36] Natural Scotland, The State of Scotland's Soil (published 2011)
[37] Natural Scotland, The State of Scotland's Soil (published 2011)
[38] Scotland's Environment, Groundwater (published 2011)
[39] Scotland's Environment, Groundwater (published 2011)
[40] Scottish Government, Scotland's biodiversity: it's in your hands (published 2004)
[41] Scottish Government, 2020 Challenge for Scotland's Biodiversity (published 2013)
[42] United Nations Environment Programme, Kunming-Montreal Global biodiversity framework (published 2022)

ecosystems, and protect indigenous rights. The plan includes measures to halt and reverse nature loss, including putting 30% of the planet and 30% of degraded ecosystems under protection by 2030. It also contains proposals to increase finance to developing countries.

A new 25-year Scottish strategy was drafted in 2022 supersede the 2020 Challenge strategy. It aims to halve biodiversity loss by 2030, and reverse it by 2045. The strategy sets out a vision for what the natural environment in Scotland needs to look like in 2045, through transformational change to protect and restore terrestrial, freshwater, and marine biodiversity in Scotland.[43]

The 2019 State of Nature Report Scotland[44] reports a decline in the abundance and distribution of Scotland's wildlife species over recent decades, with most measures indicating a continued decline in the most recent decade. This includes a 24% decline in average species' abundance since 1994, with 49% of species having decreased in abundance since 1970. The drivers of change include agricultural management, climate change, and pollution (including plastic pollution).

This assessment considers the likely impacts measures in the Route Map will have on Scotland's habitats and species.

3.4.4.7 Cultural heritage and the historic environment

The Historic Environment (Amendment) (Scotland) Act 2011 sets out national cultural heritage objectives, primarily focused on ancient monuments and listed buildings, as well as gardens, landscapes, and battlefields. Our Place in Time: the Historic Environment Strategy for Scotland (2014)[45] is a high-level framework which set out a 10-year vision for Scotland's historic environment, where it is understood, protected, and valued. The Historic Environment Policy for Scotland (HEPS) statement[46] supports this framework and highlights the importance of inclusive and transparent decision making, ensuring that the historic environment is managed sustainably to secure benefits and enjoyment for present and future generations.

Scotland's Historic Environment Audit 2018[47] reports that there were over 56,000 protected places in Scotland in 2018, including world heritage sites, scheduled monuments, listed buildings, conservation areas, and national parks. 750 historic buildings on the Buildings at Risk Register were saved between 2009 and 2018, with over 200 others being restored. 20% of Scotland's dwellings were over 99 years old, and 67% of this pre-1919 housing stock was reported to be in need of critical repairs, a reduction from 74% in 2008.

[43] Scottish Government, Biodiversity strategy to 2045: tackling the nature emergency (published 2022)
[44] NatureScot, State of Nature report Scotland (published 2019)
[45] Scottish Government, Our Place in Time: the Historic Environment Strategy for Scotland (published 2014)
[46] Historic Environment Scotland, Historic Environment Policy for Scotland (published 2019)
[47] Historic Environment Scotland, Scotland's Historic Environment Audit 2018 (published 2020)

The effects of climate change, such as warmer weather and increased rainfall throughout autumn and winter are reported to be impacting historic buildings. The 2014 State of the Environment Report[48] predicts that increased rainfall will mean traditional buildings will be wetter for longer periods of time, resulting in increased weathering of stone, rotting timbers, and corrosion of metals; and that rising sea levels mean that coastal erosion is an increasing threat to heritage sites such as Skara Brae in Orkney. Severe pollution in urban areas has also been known to damage local buildings, particularly those made of materials such as sandstone.

This assessment aims to determine whether the measures set out in the Route Map will impact Scotland's valued landscapes, historic and archaeological sites and other culturally and historically important features, landscapes, and their settings.

3.4.4.8 Material assets

In 2013, 'Safeguarding Scotland's Resources'[49] detailed an ambition to minimise wasted resources and deliver economic and environmental benefits. It set out a range of measures to promote resource efficiency and lay the foundations for a circular economy.

'A Manufacturing Future for Scotland'[50] sets out a series of initiatives aimed at boosting productivity including leadership, employee engagement and skills, energy efficiency, and the adoption of circular economy approaches across the manufacturing sector. The strategy seeks to support businesses to take on opportunities presented by the circular economy to eradicate waste, not just from manufacturing processes, but also systematically throughout a product's life cycle.

The Scottish Material Flow Accounts show that the estimated material footprint (Raw Material Consumption) is 19.3 tonnes per capita[51], significantly higher than the amount experts suggest is sustainable (8 tonnes per person per year).

The 2022 Circularity Gap Report for Scotland[52] found that only 1.3% of the resources used in Scotland are cycled back into the economy, with over 98% of Scotland's material use coming from virgin resources.

'Making Things Last: A Circular Economy Strategy for Scotland'[53] proposes a number of actions to create conditions to embed long term circular economy principles in key sectors across Scotland, including manufacturing. This strategy builds on the Zero Waste Plan (2010)[54] and the Safeguarding Scotland's Resources

[48] Scotland's Environment, Scotland's State of the Environment Report (published 2014)
[49] Zero Waste Scotland, Safeguarding Scotland's Resources: Blueprint for a More Resource Efficient and Circular Economy (published 2013)
[50] Scottish Government, A Manufacturing Future for Scotland (published 2016)
[51] Zero Waste Scotland, Scottish Material Flow Accounts Model: Update with 2018 data (published 2023)
[52] Circle Economy, The Circularity Gap Report: Scotland (published 2022)
[53] Scottish Government, Making Things Last: a circular economy strategy for Scotland (published 2016)
[54] Scottish Government, Scotland's Zero Waste Plan (published 2010)

(2013)[55], and reiterates the targets to recycle 70% of all waste and to send no more than 5% of all waste to landfill by 2025. It seeks to ensure materials are designed for reuse, recycling, and recovery, whilst embedding a mindset across the public that materials are finite and that current consumption patterns are unsustainable.

SEPA reported that 9.58 million tonnes of waste were generated in 2021, a reduction of 16.3% (1.87 million tonnes) from 2018, the most recent available year . The decrease in overall waste generated and recycled are primarily due to changes in construction type wastes. For example, the total waste generated for the Soils and Mineral waste from construction and demolition waste categories decreased by 32.8% (1.83 million tonnes) and correspondingly the amount of these wastes recycled decreased by 29.8% (1.17 million tonnes) from 2018. It is likely that the WFAS generated and recycled has been impacted by the effects of COVID-19 and other restrictions. [56]

The latest household waste data[57] describes an annual decrease in household waste, down to 2.33 million tonnes in 2022. The household waste recycling rate for 2022 was 43.3%.

This assessment will seek to determine the likely impacts of the measures in the Route Map on the economic value and utility of affected materials, as well as the likely scale of contributions towards Scotland's resources and waste objectives. Due to the high-level nature of the Route Map, it will not be possible to quantify the exact impact it will have on waste arisings and recycling rate; it will instead explore qualitatively the likely outcomes of the interventions set out on the wider management of resources.

3.4.4.9 Landscape and visual impacts

The European Landscape Convention lays the foundation for environmental protection objectives relating to landscapes in Europe, both outstanding and ordinary. It was designed to encourage public authorities to adopt policies and measures at local, regional, national, and international level for protecting, managing, and planning landscapes throughout Europe[58].

The Fourth National Planning Framework[59] was adopted by the Scottish Ministers on 13 February 2023, following approval by the Scottish Parliament in January. The Framework sets out a national spatial strategy for Scotland, including spatial principles, regional priorities, national developments and national planning policy. The strategy will be relevant to wider policies and strategies relating to land use. The framework recognises the significant progress requires to reach Scotland's Net Zero

[55] Zero Waste Scotland, Safeguarding Scotland's Resources: Blueprint for a More Resource Efficient and Circular Economy (published 2013)
[56] Scottish Environmental Protection Agency, Waste from all Sources – Summary data 2021 (published 2023)
[57] Scottish Environmental Protection Agency, Scottish Household Waste – summary data 2021 (published 2022)
[58] Council of Europe, Council of Europe Landscape Convention, European Treaty Series – No.176 (published 2000)
[59] Scottish Government, National Planning Framework 4 (published 2023)

goals will require new development and infrastructure across Scotland, as well as adaptation to the impacts of climate change that are already locked in, including increased flood risk, water scarcity, environmental change, coastal erosion, impacts on forestry and agriculture, extreme weather events, and risks to health, food security and safety.

NatureScot's Landscape Policy Framework describes an overarching aim "To safeguard and enhance the distinct identity, the diverse character and the special qualities of Scotland's landscapes as a whole, so as to ensure tomorrow's landscapes contribute positively to people's environment and are at least as attractive and valued as they are today." [60]

The National Litter and Flytipping Strategy[61] was published in June 2023 and seeks to build on the progress made since 'Towards a Litter-Free Scotland'[62] was published in 2014 to tackle litter and flytipping in Scotland and acknowledging the wider context of the circular economy and Scotland's net zero aims. The strategy will cover three broad themes: behaviour change, services and infrastructure, and enforcement. Data and research will also be covered as cross-cutting elements of the strategy.

This assessment will seek to determine whether measures within the Route Map risk any adverse impacts on landscapes and visual impacts. It will assess whether the measures are likely to safeguard and enhance the character and diversity of the Scottish landscape.

3.5 Undertaking the assessment

Given the broad nature of the Route Map, this SEA has been undertaken as a high level assessment of the likely environmental impacts, and not at an individual intervention level. The proposals in the draft Route Map have been assessed against the SEA assessment questions set out below.

Biodiversity, flora, fauna

- Will the plan avoid adverse impacts to habitats and species?
- Will it protect, maintain, and enhance biodiversity?

Population and human health

- Will the plan reduce the health gap and inequalities and improve healthy life expectancy?
- Will it protect and improve human health and wellbeing through improving the quality of the living environment of people and communities?
- Will it increase sustainable access to essential services, employment, and the natural and historic environment?

[60] NatureScot [Scottish Natural Heritage], Landscape Policy Framework (published 2005)

[61] Scottish Government, National Litter and Flytipping Strategy (published 2023)

[62] Scottish Government, Towards a litter-free Scotland: a strategic approach to higher quality local environments (published 2014)

Soil

- Will the plan safeguard and improve soil quality, quantity, and function in Scotland, particularly high value agricultural land and carbon-rich soils?

Water

- Will the plan ensure the sustainable use of water resources?
- Will it help to reduce levels of water pollution?

Air

- Will the plan avoid adverse impacts to air quality?
- Will it reduce emissions of key pollutants and improve air quality throughout Scotland?
- Will it reduce levels of nuisance e.g., noise, vibration, dust, odour, and light?

Climate factors

- Will the plan help to reduce existing and avoid new Greenhouse Gas (GHG) emissions?

Material assets

- Will it reduce use and promote sustainable management of natural resources?
- Will it reduce 'leakage' of material to landfill or energy recovery or as litter?

Landscape and visual impacts

- Will the plan avoid adverse effects on landscapes and visual impacts?
- Will it safeguard and enhance the character and diversity of the Scottish landscape and areas of valuable landscape and geodiversity?

Cultural heritage and the historic environment

- Will it avoid adverse impacts on the historic environment including its setting?
- Will it protect and enhance valued landscapes, historic and archaeological sites and other culturally and historically important features, landscapes, and their settings?
- Will it encourage the retention, reuse and repair of historic environment assets and materials?

3.5.1 Assessment methodology

Step 1. Define the policy outputs of each package

- Causal loop diagrams were developed for each strategic theme to assess the expected outputs and the effects on different parts of the life cycle of relevant materials/products. Diagrams can be found in Appendix A.
- Each of the outcomes identified using the CLDs was then described in further detail in a summary table.

Step 2. Assess effect on environmental topics and answer assessment questions

- The environmental impacts linked to each of the outputs were explored under each of the relevant SEA topic headings.
- To answer the assessment questions, symbols and colours were used to illustrate the nature of the impacts identified in terms of their contribution to achieving the environmental objectives:

+ :	Positive impact
+ / ? :	Minor or uncertain positive impact
? :	Nature of net impact uncertain at this stage
- / ? :	Minor negative impact

Step 3. Cumulative effects

The interaction of strategic themes was assessed to evaluate cumulative effects. Package-level directional impacts were displayed in Appendix A, and overall impacts and interplay between packages was considered.

4 Reduce and reuse

4.1 Promote responsible production, consumption, and reuse

4.1.1 Outcomes

Likely decrease in demand for virgin materials

All of the measures within this theme have been designed to reduce Scotland's consumption of new products and materials, which in turn is likely to result in a decrease in raw material extraction (or import) in the long term.

The introduction of bans or charges on single use items will result in a drop in demand for in-scope products. There is evidence of successful implementation of charges on single-use items in Scotland in the recent past: the single-use carrier bag charge was estimated to achieve reductions in the region of 80% of in-scope bag sales in its first year of implementation[63].

It is estimated that 4,566.6 tonnes of single-use cups and 583.1 tonnes of plastic lids are placed on the market each year[64]. A significant decrease in sales of single-use cups and other disposable items is likely to lead to a subsequent long term decrease in the requirement for the raw materials extracted to produce them e.g. timber felling to produce fibre cup board.

The effect will be offset by an increase in demand for reusable alternatives e.g. in the previous example of the carrier bag charge, in Wales, sales of Bags for Life increased by 46% in the first full year of charging, and a similar increase was estimated for Scotland[65]. The sharp increase may be partially due to the low price of Bags for Life and is not likely to be reflective of the volume of more expensive reusable items sold. For beverage cups, it is likely that the net impact will be a shift in material demand, away from fibre, polyethylene (PE), polylactic acid (PLA) and polystyrene (PS); and towards materials commonly used to produce refillable hot drinks cups, i.e. steel, polycarbonate (PC), glass, and polypropylene (PP). Further charges and bans will build on existing regulations, namely the carrier bag charge (2014) and single use plastics ban (2022). This intervention will be targeted at products out of scope of the existing ban on certain single-use plastic products, with drinks cups being the only confirmed product at the time of writing. If the products in question are readily recyclable, there may be a drop in components made available for reprocessing. While this could have a knock-on impact on virgin material extraction, the impact is not expected to be significant. Products targeted through such measures are unlikely to be those which are widely recycled.

Restrictions on the destruction of unsold goods will result in surplus stock being sold, donated, or recycled. This will reduce the demand for new products, and increase the availability of used components for remanufacture. Alongside these restrictions targets, strategies, and support aimed at increasing reuse among consumers will be

[63] Zero Waste Scotland, Carrier Bag Charge 'One Year On' (published 2015)
[64] Resource Futures, Consumption of Single-use Disposable Beverage Cups in Scotland (published 2023)
[65] Zero Waste Scotland, Carrier Bag Charge 'One Year On' (published 2015)

designed to drive down the demand for new products which in turn will also reduce material consumption and the corresponding extraction of virgin materials.

Overall, net reductions in the production of virgin materials are likely, though shifts in demand between different materials may be seen. The specific products to be targeted by the measures in this package are yet to be determined. Only once these have been identified can the exact impact on material extraction be assessed.

Decrease in requirement for manufacturing of components and products

A reduction in demand for single use items resulting from the measures within this package will result in fewer products and components such as disposable cups and lids being manufactured or imported into Scotland. For example, It is estimated that a minimum charge on single use cups will result in a 15.4% - 39.4% reduction in the number of single-use cups placed on the market by 2035, equivalent to 62.1 million – 159.4 million cups.[66]

Increased reuse is also likely to reduce the requirement for new products and components to be manufactured and imported. Zero Waste Scotland's research into reuse in Scotland suggests that up to 150,000 tonnes of reusable materials are currently either being disposed of or sent to lower-value recycling.[67] Capturing this material for reuse will in turn reduce the demand for new products, thus lessening manufacturing requirements for products and components made in Scotland, or imports of those made abroad,

A long term decrease in consumption of new products through behaviour change interventions and the promotion of alternative business models such as sharing libraries and rental subscriptions will further reduce manufacturing requirements.

The overall outcome is a likely reduced manufacture and material extraction for products and single-use components, offset to an extent by an increase in demand for reusable alternatives.

For example, for the charge on single-use cups, demand for components such as paper composite hot drinks cups, polystyrene drink lids, and PET/PLA cold drinks cups and lids is likely to decrease. Meanwhile, use and subsequently demand for materials required to produce re-fillable cups is likely to increase, for example stainless steel portable cups, glass portable cups, ceramic cups, and plastic (polycarbonate/polypropylene) cups and lids.

Promotion of circular economy

Measures such as improving the reuse retail experience for consumers, accelerating circular economy focused procurement practices, expansion of business models that

[66] Based on projected volumes of cups on the market in 2035, including growth. Source: Resource Futures, Consumption of Single-use Disposable Beverage Cups in Scotland (published 2023)
[67] Zero Waste Scotland, Reuse, repair and recycling in a circular economy

prolong product lifespan, and rolling out a national behaviour change strategy will all contribute to a societal shift in attitudes towards the circular economy. Purchasing second hand is likely to become a more appealing option to consumers, and there may be increased awareness of circular business models offering alternative ways to shop e.g. rental services, repair, refurbishment, resale, etc. as these business models are incentivised, becoming more common and more accessible to consumers.

By accelerating climate change and circular economy focused procurement practices, market confidence in the provision of circular goods and services should increase, itself supporting alternative business models through investment. In the medium to long term, this will increase access for consumers.

In 2022, the Circularity Gap Report for Scotland[68] was published. Among the scenarios to improve circularity is a recommendation to 'welcome a circular lifestyle', underpinned by strategies including a prioritisation of circular textiles (reusing, repairing, DIY, donating, recycling), reduced consumption of plastic products, and increased furniture and home appliance repair. The promotion of the circular economy among Scotland's citizens is likely to contribute to these strategies in the long term, enabling and emboldening the desired outcome of this package to reduce material consumption.

Increase in resource use for maintenance of reusable products

As a result of charges and bans on single-use products and increased awareness of the environmental damage caused by single-use items, it is likely that there will be a rise the popularity and use of reusable alternatives, such as re-fillable beverage cups and reusable food containers. In order to keep these products in use, regular maintenance (i.e. cleaning) will be required. The cleaning process is likely to require the following resources: hot water (water, energy) and washing up liquid or dishwasher tablets.

A study commissioned by KeepCup[69] provided the following data on water and energy use to wash one reusable cup:

0.3 litres (dishwashing) – 0.5 litres (handwashing) water used

0.025 kWh electricity to wash using dishwasher

0.084 MJ natural gas heating for a warm handwash

[68] Circle Economy, The Circularity Gap Report: Scotland (published 2022)

[69] Almeida, J., Pellec, M. L. and Bengtsson, J., Reusable coffee cups life cycle assessment and benchmark. doi: 10.13140/RG.2.2.35083.13607 (published 2018)

Increased revenue from charges

It has not yet been confirmed whether there will be any obligations on what retailers will be expected to do with the revenue from any new charges on single use items. In the past, taking the example of the single use carrier bag charge, a voluntary agreement was put in place, asking retailers to report carrier bag sales and commit to donating the money raised through the charge to good causes in Scotland. For large grocery retailers alone, the initial 5 pence carrier bag charge was expected to raise £6.7 million for good causes in 2015[70].

Should a voluntary agreement be made available for future charges on single-use items, wider societal benefits may be enabled as a result of any charges mandated.

Decrease in disposal of materials via landfill or incineration

The measures in this package are focused on keeping products in use for as long as possible and preventing unnecessary materials from being placed on the market and ultimately thrown away. By reusing materials and components, banning the disposal of unsold durable goods, and prolonging product lifespans, fewer materials will enter waste management each year, and thus smaller volumes of material will be landfilled or incinerated.

Due to the broad nature of the measures, the effect may cover a range of materials, such as textiles, plastics, and Waste Electrical and Electronic Equipment (WEEE).

Between 4,000 and 4,600 tonnes of waste are estimated to be generated by single-use cups each year[71]. Due to their plastic lining, they can be hard to recycle, resulting in most of them being incinerated or sent to landfill.[72] A Zero Waste Scotland trial[73] found that a cost neutral disposable cup charge of £0.05 - £0.10 (replacing an equivalent existing discount) increased average reuse rates from 20.0% to 29.6%. An Expert Panel on Environmental Charging and Other Measures recommended an initial minimum price of between 20-25p per cup, likely to result in improvements at least as significant as the aforementioned study[74], though it should be noted that the sample size of the study is not large enough to draw national conclusions from.

[70] Zero Waste Scotland, Carrier Bag Charge 'One Year On' (published 2015)

[71] Latest estimates range from 4,0000 tonnes [Source: Scottish Government, Report of the Expert Panel on Environmental Charging and Other Measures: Recommendations on Single use Disposable Beverage Cups (published 2019)] to 4,383 [96% of the total arisings reported in Consumption of Single-use Disposable Beverage Cups in Scotland (published 2023)]

[72] Scottish Government, Charges on single-use drinks cups (published 2022)

[73] Zero Waste Scotland, Cups Sold Separately (published 2019)

[74] Scottish Government, Charges on single-use drinks cups (published 2022)

Decrease in litter and flytipping

Measures relating to single-use items are most likely to impact levels of litter in Scotland. For example, an estimated 40,000 disposable cups are littered in Scotland each year [75]. Charges and bans on placing single use items on the market will reduce the amount of disposable material sold in Scotland, subsequently reducing the volume eventually becoming litter.

4.1.2 Biodiversity, flora, and fauna

SEA Assessment questions for biodiversity, flora, and fauna:

- Will the plan avoid adverse impacts to habitats and species?
- Will it protect, maintain, and enhance biodiversity?

Overall, the measures within this package are likely to avoid adverse impacts to habitats and species through a reduction in habitat disruption caused by material extraction and landfill site creation, decreased pollution from landfill gas, leachate, and incineration of waste, and a reduction in littering. The interventions will help to protect, maintain, and enhance biodiversity in the long term.

Package outcomes relevant to biodiversity, flora, and fauna and their likely impacts are discussed below.

Reduction and/or material shift in extraction of raw materials

SEA Impact: +/?

The extraction of virgin materials may have negative impacts on biodiversity due to increased pollution and disruption or even destruction of habitats.

A reduction in extraction of virgin materials is likely to lead to lower impacts on habitats and species in regions where materials are extracted and processed e.g. tree felling to produce paperboard. However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted and produced, and consequently reduce risks to habitats and species.

Reduced manufacture of products and components

SEA Impact: +/?

The processes required to transform raw materials into finished components may have negative impacts on habitats and species due to pollution risks and the climate change impacts of energy use. Since some of these processes will be avoided, there may be benefits to biodiversity, flora, and fauna.

[75] Scottish Government, Report of the Expert Panel on Environmental Charging and Other Measures: Recommendations on Single use Disposable Beverage Cups (published 2019)

Decrease in disposal of material via landfill

SEA Impact: +

Habitats in and around bodies of water such as streams, ponds, lakes, and surrounding soils nearby to landfill sites can become polluted by leachate. A reduction in levels of waste disposal in landfill will lead to lower impacts on habitats and their resident species at a local level.

Landfilling materials, in particular organic matter, can be a major emitter of GHG emissions. Lower levels of landfill gas production, (methane in particular) will reduce the contribution to climate change and indirectly lessen impacts on species and habitats.

The reduced impact on landfill capacity will lessen the longer term requirement for the creation of new landfill sites and the corresponding clearance of wild areas. This in turn will reduce the number of habitats being lost or degraded to create new landfill sites.

Decrease in disposal of material by incineration

SEA Impact: +

Incineration of waste is a source of greenhouse gas emissions and air pollutants[76], contributing 0.3MtCO2e of the greenhouse gas emissions for energy supply in 2021, or 19% of all emissions from electricity generation.[77]

Reduced emissions from energy from waste facilities will lower the resultant contribution to climate change and indirectly lessen impacts on species and habitats.

Reduced levels of litter and flytipping

SEA Impact: +

Littered and fly-tipped items can pose threats to local wildlife and biodiversity. Pollution, for example from microplastics and chemicals such as colour and texture agents can threaten habitats and harm species if ingested or released into the environment. Some species may also be at risk of entanglement from larger littered items. Plastic litter, on a larger scale, can be moved from place to place by ocean

[76] Emissions from energy from waste do not currently contribute to the overall emissions reported for the waste sector as they are classified under energy supply emissions. Changes in incineration activity will therefore have no impact on the overall waste sector emissions from a reporting perspective.

[77] Scottish Government, Scottish Greenhouse Gas Statistics 2021 (published 2023)

currents. This litter can carry bacteria or invasive organisms with it, taking foreign species to new or isolated regions and potentially disturbing fragile ecosystems.

70% of respondents of the 2021 Keep Scotland Beautiful Scottish Litter Survey[78] believe that litter is a problem locally, and 88% believe that it is a problem nationally. Respondents' top concern was the damage it might do to the natural environment and animals.

A reduction in litter and flytipping will reduced the risk of pollution and ecotoxicity in habitats and soils, as well as limiting the risks to wildlife from ingestion or entanglement.

4.1.3 Population and Human Health

SEA Assessment questions for population and human health:

- Will the plan reduce the health gap and inequalities and improve healthy life expectancy?
- Will it protect and improve human health and wellbeing through improving the quality of the living environment of people and communities?
- Will it increase sustainable access to essential services, employment, and the natural and historic environment?

Overall, the measures within this package are likely to improve health and wellbeing through avoidance of adverse impacts on air quality as well as nuisance and odour levels. As deprived regions are particularly vulnerable to these effects, the interventions may have a minor contribution towards reducing inequalities. There will be further community benefits if revenue from environmental charging is donated to charitable causes. Employment impacts are uncertain, and it is likely that there will be a long term shift in employment patterns to favour jobs supporting the circular economy. In the short term effects are not likely to be significant.

Package outcomes relevant to population and human health and their likely impacts are discussed below.

Reduction and/or material shift in extraction of raw materials, and

Reduced manufacture of products and component

SEA Impact: +/?

In 2020, 39,000 people were employed in the agriculture, fishing, and forestry industry in Scotland (1.5% of all people aged 16+ in employment), 62,900 were employed in the mining and quarrying industry (2.4%), and 182,100 people were employed in the manufacturing industry (7.0%)[79].

[78] Keep Scotland Beautiful, Scottish Litter Survey (published 2021)

[79] Scottish Government, Scotland's Labour Market: People, Places and Regions – background tables and charts 2020/21 (published 2022)

There may be impacts on employment in material extraction as a result of a reduced demand for virgin materials. However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced.

It is likely than any negative impacts on employment in virgin material extraction industries will be offset by increased opportunities for green jobs e.g. in refurbishment, repair, recycling, aligning with the Just Transition. It is currently estimated that 9.7% of jobs in Scotland are related to the circular economy, and up to 60,000 new jobs could be created by implementing the circular strategies explored in the Circularity Gap Report for Scotland[80]. It is, therefore, likely that Scotland could experience a long term shift in employment, which the interventions in this package may contribute to.

Increased revenue from environmental charges.

SEA Impact: +/?

There is potential for revenue raised from charges on environmentally damaging items to be used to deliver societal benefits in the community if retailers join voluntary agreements to donate profits to good causes, as was done for the Single Use Carrier Bag Charge, though donations are not guaranteed.

Decrease in disposal of material via landfill

SEA Impact: +

Nuisance caused by landfill sites on a local level is likely to be in the form of odour, noise, increased traffic, and vermin. There is good evidence that socially deprived areas are disproportionally exposed to municipal landfill sites.[81]

Landfills can result in community impact throughout their life cycle. During the operational phase, when wastes are deposited, communities can be negatively impacted by nuisance issues such as odour, dust, noise and vermin. Odour is a significant environmental cause of public complaints of people living near waste treatment facilities and negatively affects quality of life and wellbeing. Odour can be a cause of stress and anxiety, even when the substances causing the odours are not harmful to health at the levels detected at waste treatment locations. Landfills, and specifically landfill odour, account for a significant proportion of public environmental event complaints made to SEPA. In extreme cases, where sites are poorly operated, or have specific gas management issues to address, this has resulted in several

[80] Circle Economy, The Circularity Gap Report: Scotland (published 2022)

[81] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

hundred public complaints in a single day. Three operational landfills are currently classified by SEPA as sites of ongoing community impact. In 2021, these sites alone accounted for 987 substantiated complaints to SEPA.[82]

If lower volumes of waste are destined for landfill due to the measures proposed in this package, a reduced negative impact on the wellbeing of nearby residents (and in turn a reduced contribution to health and wellbeing inequality) is likely.

Decrease in disposal of material by incineration

SEA Impact: +/?

Pollution from EfW plants may have a negative impact on the health and wellbeing of nearby residents, and there is scope for further research into potential negative mental and psychological impacts of living close to an incinerator.[83] Measures targeted at reducing residual waste destined for incineration may therefore have a positive impact on nearby residents.

However, the risk to human health associated with newer incinerators operated within the current regulations, which are based on a precautionary approach, is likely to be minimal and very difficult to detect[84]. Therefore, health impacts of a reduction in waste incinerated are expected to be minor.

4.1.4 Soil

SEA Assessment questions for soil:

- Will the plan safeguard and improve soil quality, quantity and function in Scotland, particularly high value agricultural land and carbon-rich soils?

Overall, a reduction in activities which risk pollution, disruption, and degradation of soils is likely to help to safeguard and improve soil quality in Scotland.

Package outcomes relevant to soil and their likely impacts are discussed below.

Reduction and/or material shift in extraction of raw materials

SEA Impact: +/?

Extraction of virgin materials often has significant land use requirements and processes may be disruptive to soils in the area. There is a risk of material and chemical pollution resulting from these processes e.g. fertilisers and pesticides

[82] Information provided through direct correspondence with SEPA (September 2023)

[83] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

[84] Health Protection Scotland, Incineration of Waste and Reported Human Health Effects (published 2009)

associated with timber production may pollute nearby soils, reducing soil quality on a local scale.

A reduction in virgin material extraction will lead to a reduction in the levels of associated soil disruption. There may also be a decrease in the level of pollutants produced from virgin material extraction which could negatively impact the quality of nearby soils.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted in Scotland.

Reduced manufacture of products and components

SEA Impact: +

Pollutants from manufacturing facilities may leak into the surrounding area, resulting in a risk of soil degradation on a local scale.

There may be a decrease in the level of pollutants produced from manufacturing plants which in turn could improve the quality of nearby soils.

Decrease in disposal of material via landfill

SEA Impact: +

Leachate from landfill sites can contaminate soils in the surrounding area. A reduction in volumes of material disposed of via landfill will lessen the impact on soil quality in the long term.

A reduced impact on landfill capacity will lessen or delay the longer term requirement for the creation of new sites, thus avoiding an increase in areas of soil vulnerable to material pollution and leachate from landfill sites.

Decrease in disposal of material by incineration

SEA Impact: +

Soils near incinerators may become polluted, and any negative impacts on soils will be reduced as a result of a decrease in waste sent to incinerators or energy from waste facilities.

4.1.5 Water

SEA Assessment questions for water:

- Will the plan ensure the sustainable use of water resources?
- Will it help to reduce levels of water pollution?

On the whole, limiting production and disposal of goods is anticipated to improve sustainable water use through limiting unnecessary water-intensive processes. This is likely to be offset by water use for maintenance and cleaning of reusable goods. The cumulative impact of these measures is uncertain and dependent on individual and commercial responses to the interventions.

Levels of water pollution are likely to fall due to an expected decrease in residual waste arisings (and therefore disposal) as well as a fall in demand for material extraction and product manufacturing, all of which contribute to water pollution risks.

Package outcomes relevant to water and their likely impacts are discussed below.

Reduction and/or material shift in extraction of raw materials

SEA Impact: +/?

There is a risk of water pollution on a local scale due to virgin material extraction processes. For example, Scotland produces approximately 7.5Mt of wood per annum[85]. Fertilisers and pesticides associated with timber production may leak into nearby bodies of water.

A reduction in extraction of virgin materials is therefore likely to lead to a decrease in the level of pollutants produced from extraction processes which could negatively impact the quality of nearby bodies of water. There will also be a reduction in any water use associated with extraction processes.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced.

Reduced manufacture of products and components

SEA Impact: +

Some manufacturing processes will require large amounts of water. Pollutants from manufacturing facilities may leak into nearby bodies of water, resulting in a risk of increased water pollution.

A reduction in the manufacturing of new products/components will result in a reduction in the water use during the processes involved. There will also be a decrease in the level of pollutants produced from manufacturing plants which could result in an improvement in the quality of nearby bodies of water.

[85] Zero Waste Scotland, Scottish Material Flow Accounts Model 2018 (published 2023)

Increased requirement for resources to clean/ maintain reusable items

SEA Impact: -/?

Maintaining and, in particular, cleaning reusable goods will require water use. An increase in popularity of reusable items may therefore result in an increase in water use. For example, every time one reusable cup is cleaned, it is estimated to use 0.3 - 0.5 litres of water[86].

Decrease in disposal of material via landfill

SEA Impact: +

Leachate from landfill sites can pollute nearby bodies of water. A reduction in volumes of material disposed of via landfill will lessen the impact on water quality in the long term. A reduced impact on landfill capacity will lessen or delay the longer term requirement for the creation of new sites, thus avoiding an increase in the bodies of water vulnerable to material pollution and leachate from landfill sites.

Decrease in disposal of material by incineration

SEA Impact: +

Some energy from waste processes will require water, and so a reduction in residual waste processed at these plants will result in a decrease in resultant water use. Any pollution impacts on nearby bodies of water may also decrease.

4.1.6 Air

SEA Assessment questions for air:

- Will the plan avoid adverse impacts to air quality?
- Will it reduce emissions of key pollutants and improve air quality throughout Scotland?
- Will it reduce levels of nuisance e.g. noise, vibration, dust, odour, and light?

The overall impact of this package is that a likely reduction in material extraction, manufacturing, and disposal will avoid adverse impacts to air quality by limiting demand for polluting activities. This in turn is likely to reduce emissions of key pollutants as well as nuisance such as odour and noise.

Package outcomes relevant to air and their likely impacts are discussed below.

Reduction and/or material shift in extraction of raw materials

[86] Almeida, J., Pellec, M. L. and Bengtsson, J.,Reusable coffee cups life cycle assessment and benchmark. doi: 10.13140/RG.2.2.35083.13607 (published 2018)

SEA Impact: +/?

Material extraction processes and the associated transport and energy use are likely to emit airborne pollutants. The scale and nature of these emissions will depend on the material in question.

A reduction in extraction of virgin materials is therefore likely to result in a reduction in associated airborne pollutants, thus improving air quality on a local scale. There will also be a decrease in the level of noise and nuisance associated with virgin material extraction.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced.

Reduced manufacture of products and components

SEA Impact: +

Manufacturing processes are often responsible for the emission of airborne pollutants. For example, one SEPA regulated industrial site under the category "Paper and wood production and processing" was responsible for 64 tonnes of particulate matter pollution to air above reporting threshold in 2021, 15.2% of the total across all regulated sites[87].

A reduction in the manufacturing of new products/components will result in a reduction in associated airborne pollutants, thus improving air quality on a local scale. There will also be a decrease in the level of noise and nuisance on a local scale surrounding manufacturing plants.

Lower volumes of waste disposed of via landfill

SEA Impact: +

Several air pollutants are associated with landfill gas production. A reduction in waste disposed of via landfill is likely to have a positive impact on air quality. Odour levels will also be reduced if the requirement for additional landfill sites is lessened or delayed from a decrease in residual waste arisings.

Lower volumes of waste disposed of by incineration

SEA Impact: +

Incineration of waste is linked to air and noise pollution on a local scale, though with current stringent emissions standards, the evidence is that the air quality impacts are

[87] Scottish Environment Protection Agency, 2021 Pollutant emissions and waste transfers from SEPA regulated industrial sites (published 2022)

likely to be small . A reduction in volumes of waste disposed of by incineration or energy from waste is likely to have a minor positive impact on air quality.

4.1.7 Climatic factors

SEA Assessment questions for climatic factors:

- Will the plan help to reduce existing and avoid new Greenhouse Gas (GHG) emissions?

A reduction in material demand, manufacture, and disposal will reduce greenhouse gas emissions. Though partially offset by resource and energy requirements for product maintenance, the overall impact of this package is expected to be a net reduction in contribution to climate change from material consumption.

Package outcomes relevant to climatic factors and their likely impacts are discussed below.

Reduction and/or material shift in extraction of raw materials

SEA Impact: +/?

The extraction and production of virgin materials is likely to release significant amounts of greenhouse gases. The reduction in the demand of virgin materials should therefore avoid new greenhouse gas emissions. The extent of the reduction will depend on the material, as well as the substitution rate of secondary materials for virgin materials (i.e., does the production of 1 kg of secondary steel reduce the demand for virgin steel by 1kg?). A substitution rate less than one will offset some of the gains of virgin material reduction, but overall GHG emissions, and subsequent impacts on the climate, are expected to be reduced.

Reduced manufacture of products and components

SEA Impact: +

The production of new components or products requires energy and resources that will emit greenhouse gases. For example, a conservative estimate of the CO_2e emissions associated with disposable beverage cups in Scotland is 5,900 tonnes of CO_2e per year[88] (N.B. this includes disposal as well as production).

Thus, a reduction in the number of components or products produced will help to avoid new GHG emissions. The amount avoided will be dependent on the products and components in question, as well as the substitution rate of reused products.

[88] Scottish Government, Report of the Expert Panel on Environmental Charging and Other Measures: Recommendations on Single use Disposable Beverage Cups (published 2019)

Increased requirement for resources to clean/ maintain reusable items

SEA Impact: - / ?

Maintaining products to a certain standard may require both energy and new materials and components. For example, the KeepCup[89] study suggested that 0.025 kWh electricity would be used to wash one reusable cup in the dishwasher, or 0.084 MJ natural gas heating for a warm handwash. There will therefore likely be some additional emissions associated with the resources required to maintain products.

Product reuse will likely reduce emissions at the aggregate, however, assuming product reuse offsets or delays the need for new products. Taking the coffee cup example, after 10 to 41 uses, a reusable plastic coffee cup has a lower equivalent carbon impact than using the same number of single-use cups and disposing of them[90], and one study concluded that over the lifetime of one reusable cup, 10.3kg of CO_2e could be saved compared to using single-use cups instead (assuming 500 uses / cups of coffee)[91].

Lower volumes of waste disposed of via landfill

SEA Impact: +

The landfill of waste, in particular organic matter, can be a major emitter of GHG emissions; in 2021, the landfill of household waste accounted for just under 250kt of CO_2e of GHG emissions[92]. By reducing the amount of waste requiring landfill, GHG emissions from landfill sites should also reduce.

Lower volumes of waste disposed of by incineration

SEA Impact: +

The IPCC estimates that every tonne of waste incinerated releases 0.7-1.2 tCO_2e[93] [94,] and energy from waste contributed 0.3$MtCO_2e$ to Scotland's total greenhouse gas emissions in 2021[95]. As energy switches to renewable or lower carbon sources, the

[89] Almeida, J., Pellec, M. L. and Bengtsson, J., Reusable coffee cups life cycle assessment and benchmark. doi: 10.13140/RG.2.2.35083.13607 (published 2018)

[90] Zero Waste Scotland, The environmental benefits of reusable plastic over single-use products, URL: https://www.zerowastescotland.org.uk/content/environmental-benefits-reusable-plastic#Plastic%207 (accessed July 2023)

[91] Journal of Cleaner Production, Volume 255, How small daily choices play a huge role in climate change: The disposable paper cup environmental bane, . doi: 10.1016/j.jclepro.2020.120294 (published 2020)

[92] Zero Waste Scotland, The Carbon Footprint of Scotland's Waste: 2021 Household Carbon Metric Brief (published 2023)

[93] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

[94] IPCC, Emissions From Waste Incineration

[95] Scottish Government, Scottish Greenhouse Gas Statistics 2021 (published 2023)

benefits of energy from waste will fall. Overall, a reduction in the incineration of waste will avoid new GHG emissions from the incineration process, and these benefits are likely to be greater over time.

4.1.8 Material Assets

SEA Assessment questions for material assets:

- Will it reduce use and promote sustainable management of natural resources?
- Will it reduce 'leakage' of material to landfill or energy recovery or as litter?.

This package is targeted at keeping materials in use for as long as possible, reducing demand for the extraction of virgin natural resources, and limiting material waste through disposal and litter. The overall impact of the package is therefore to promote sustainable management of natural resources and reduce leakage of material to litter or disposal.

Package outcomes relevant to material assets and their likely impacts are discussed below.

Reduction and/or material shift in extraction of raw materials, and

Reduced manufacture of products and components

SEA Impact: + / ?

The production of new components or products will require materials, both virgin and secondary materials. Avoiding the production of new components/products will help to reduce pressures on resource consumption and promote the sustainable management of natural resources. Virgin material extraction depletes non-renewable stocks of natural resources. The reduction in the production of virgin materials will reduce extraction rates of raw materials. Additionally, if less material is ultimately extracted, less material will require disposal.

For interventions enabling a transition from single use items to reusable alternatives, namely charges and bans, is expected there will be a resultant increase in demand for materials used to produce reusable products e.g. sales of Bags for Life increased by 46% in the first full year of charging in Wales[96]. For beverage cups, a transition away from fibre-composite, PLA, PS, and PET and towards steel, polycarbonate, ceramics, and glass is likely. However, an increase in reuse is expected to lower material demand on aggregate.

Likewise, interventions which encourage and support alternative business models such as subscription, leasing, or offering products as a service are likely to slow down the demand for new products and the materials and processes required to produce them. Support for community sharing and repair services is likely to have a

[96] Zero Waste Scotland, Carrier Bag Charge 'One Year On' (published 2015)

similar effect through prolonging product lifespans and slowing the demand for new or replacement items.

In a global context, it is unknown whether changes in demand for products and materials as a result of this plan will cause a global decline in the amount of resources extracted/produced.

Lower volumes of waste disposed of via landfill, and

Lower volumes of waste disposed of by incineration

SEA Impact: +

Improved diversion of material away from the residual waste stream will result in less material 'leakage' to energy recovery or landfill, enabling materials to be kept in use for as long as possible. Incineration and energy from waste plants also require resources for construction and to continue to run. A reduction in the amount of material incinerated will reduce the requirement for any new incineration plants, which would require construction and other materials.

Reduced levels of litter and flytipping

SEA Impact: +

Material that is littered or fly-tipped is a wasted resource. If the material can be recycled or reused, then a reduction in the amount of littered/fly-tipped material will help to reduce pressures on natural resource consumption.

4.1.9 Landscape and visual impacts

SEA Assessment questions for landscape and visual impacts:

- Will the plan avoid adverse effects on landscapes and visual impacts?
- Will it safeguard and enhance the character and diversity of the Scottish landscape and areas of valuable landscape and geodiversity?

Overall, this package of measures is likely to reduce disposal and production activity as unsightly facilities, which may in turn avoid adverse impacts to landscapes and visual impacts. A reduction in litter and flytipping will help safeguard and enhance the character and diversity of Scottish landscapes.

Package outcomes relevant to landscape and visual impacts and their likely impacts are discussed below.

Reduction and/or material shift in extraction of raw materials

SEA Impact +/?

Virgin material extraction sites, such as mines, are generally considered to be unsightly. For example, Scotland produces approximately 7.5Mt of wood annually[97]. Reduced felling of trees may enhance landscapes. However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced.

Lower volumes of waste disposed of via landfill, and

Lower volumes of waste disposed of by incineration

SEA Impact: +

Landfill sites and energy recovery facilities are generally considered to be unsightly, both in terms of the sites themselves and in the birds and rodents they can attract. A reduction in the construction of new landfill or incineration sites will therefore avoid adverse effects on landscapes and visual impacts in the long term.

Reduced levels of litter and flytipping

SEA Impact: +

Littering and flytipping are generally considered an eye sore and can detract from landscapes and areas of natural beauty as well as towns and cities. 70% of respondents of the 2021 Keep Scotland Beautiful Scottish Litter Survey[98] believe that litter is a problem locally, and 88% believe that it is a problem nationally. A reduction in litter and flytipping is likely to reduce negative visual impacts and safeguard or improve the appearance of Scotland's landscapes.

4.2 Reduce food waste

4.2.1 Outcomes

Each of the paragraphs below describe the expected outcomes of the package. These have been derived from the causal loop diagrams (see Appendix A).

Increased availability of surplus food in communities in the short-medium term.

Support for food redistribution in Scotland seeks to ensure that supply of surplus food to humans is the priority for any food still fit for human consumption. Effective and inclusive systems for food redistribution should increase the accessibility of surplus food for everyone in the short-medium term.

[97] Zero Waste Scotland, Scottish Material Flow Accounts Model: Update with 2018 data (published 2023)

[98] Keep Scotland Beautiful, Scottish Litter Survey (published 2021)

Improved efficiency of businesses selling or preparing food and behaviour change initiatives to reduce food waste could reduce the availability of surplus food in the long term.

Possible reduction in resources used to produce wasted food

The production, processing, and transport of food is extremely resource intensive. Through enabling food waste reductions in households and businesses and taking actions to make the food system more efficient, the measures in this package should ensure that the production, processing, and transport of food which is ultimately wasted is reduced.

The anchor intervention of mandatory reporting of food waste will ensure businesses are equipped with the data and insight needed to fully understand their own waste and surplus, and is likely to result in efficiency improvements in the long term, ultimately resulting in a lower proportion of resource use for ultimately wasted food. The provision of enhanced support for businesses is expected to maximise this effect.

In 2014, Scottish households threw away 600,000 tonnes of food and drink waste, of which 60% was classed as avoidable [99]. If successful, an intervention plan to guide long-term work on household food waste reduction behaviour change, targeted at households and members of the public, combined with enhanced support for households will reduce the levels of food wasted in households, with a potential longer term reduction in resources used throughout the supply chain to produce it.

Reduction in food waste landfilled, and

Reduction in food waste incinerated

Measures to avoid food waste as well as actions to move food up the waste hierarchy aim to prioritise redistribution to humans or animal feed, and then to use waste as an input for bioprocessing. Recycling food waste through anaerobic digestion is viewed as the last resort, and this package aims to avoid incineration and landfill of food at all costs.

There are therefore two drivers that are expected to reduce the quantity of food waste in the residual waste stream: an overall decrease in volumes of food wasted coupled with a decrease in the proportion of food waste arisings destined for landfill or energy recovery.

Possible decrease in demand for fertilisers and peat-based compost.

[99] Zero Waste Scotland, How much food and drink waste is there in Scotland? (published 2016)

Depending on the net impact of the measures in this package on levels of food waste recycling, there may be a change in the availability of compost and digestate produced from this waste stream. In turn, this may have an impact on the subsequent demand for compost and fertilisers from other sources, such as peat-based compost and inorganic fertilisers. In the UK, it is estimated that 55% of horticultural growing media is peat-based[100].

It is possible that a combination of actions to move food up the waste hierarchy (and out of the residual waste stream) alongside increased awareness of food waste resulting from behaviour change campaigns, waste reduction support, and improved reporting will result in an increase in food waste collected for recycling and composting.

A reduction in food waste generation could in turn reduce the amount of (edible) food waste being recycled into compost and fertilisers. However, interventions driving food up the waste hierarchy will mean maximising recycling of unavoidable or inedible food waste. Thus, an upper bound could be realised for the levels of food waste available for recycling. This may be supplemented by increased recycling of co-products and by-products in instances where composting or anaerobic digestion is deemed the optimal use for these products.

It is, therefore, likely that the net impact of this package will be increased availability of compost and digestate derived from organic waste, though the extent to which these products will reduce demand for virgin or inorganic alternatives is uncertain.

Possible decrease in demand for fossil-based fuels

Depending on the net impact of the measures in this package on levels of food waste treated by anaerobic digestion, there may be a change in the availability of biogas produced from this waste stream. In turn, this may have an impact on the subsequent demand for fossil-based alternatives such as diesel and natural gas.

It is possible that a combination of increased awareness of food waste resulting from behaviour change-based interventions or campaigns, waste reduction support, and improved reporting with actions to move food up the waste hierarchy and out of the residual waste stream will result in an increase in food waste collected for AD treatment. This would result in an increase in availability of biogas and digestate outputs from organic waste facilities, and a subsequent likely fall in demand for alternative composts.

There is also likely to be a reduction in fossil fuel requirements throughout the food supply chain to produce, process, and transport food that is ultimately wasted.

The extent to which these outcomes will directly impact national fossil fuel demand in Scotland is uncertain.

[100] ClimateXChange, Rapid Evidence Assessment of the Alternatives to Horticultural Peat in Scotland (published 2019)

Reduction in demand for raw materials

For example, petrochemicals, protein for animal feed, grain for drinks production, paint thickener.

Scotland's bioeconomy produces more than 10 million tonnes of organic surplus every year which could be used as valuable feedstocks for many bio-based processes such as the production of food, animal feed ingredients, and bio-based materials that can substitute petrochemical based materials.[101]

Actions to move food up the waste hierarchy and support for businesses to engage with the circular bioeconomy will enable increased quantities of reuse of by-products from the manufacturing of products such as beer, whisky, and fish. This in turn will reduce the demand for virgin alternatives. The materials in question will depend on the specific by-products and their uses, but may include animal feeds and ingredients.

Support given to businesses to engage with the circular bioeconomy should be designed to incentivise the optimal route for by-products and co-products. There is evidence[102] of animal feed being imported from the rest of the UK and abroad due to renewable energy incentives driving food waste producers to send by-products to anaerobic digestion instead of livestock farmers. Consideration should be taken on how to balance incentives to ensure organic waste and by-products are distributed in a way that maximises their value and reduces virgin material demand.

4.2.2 Biodiversity, flora, and fauna

SEA Assessment questions for biodiversity, flora, and fauna:

- Will the plan avoid adverse impacts to habitats and species?
- Will it protect, maintain, and enhance biodiversity?

The food system is closely associated with biodiversity. Overall, the measures within this package may avoid adverse impacts to habitats and species through a reduction in habitat disruption caused at various stages in the food supply chain from farming to disposal. While addressing food waste itself will not directly improve biodiversity, the impact of making the food system more efficient and less wasteful should ensure that land that could be turned over to wildlife habitats is not used to produce food that is ultimately wasted.

There is uncertainty around the impacts of this package on availability of compost, biogas, and digestate derived from food waste and their subsequent environmental impacts. However, a reduction in overall levels of wasted food combined with a

[101] Zero Waste Scotland, Accelerating the Circular Bioeconomy, URL: https://www.zerowastescotland.org.uk/resources/accelerating-circular-bioeconomy (accessed July 2023)

[102] Scotland's Rural College, Distillery by-products, livestock feed and bio-energy use in Scotland (published 2019)

decrease in food waste sent to landfill or incineration mean the overall effects of this package are likely to help protect, maintain, and enhance biodiversity in the long term.

Package outcomes relevant to biodiversity, flora, and fauna and their likely impacts are discussed below.

Reduction in production, processing, and transport of wasted food

SEA Impact: +/?

Large areas of land are required for food production and manufacture: 75% of Scotland's land is used for agriculture[103]. In some cases, this can result in habitat disruption and increased risk of contamination to nearby habitats e.g. due to surface run-off and soil erosion from agriculture.

Fertilisers and pesticides used in food production are also likely to have a negative impact on biodiversity: nitrogen deposition, of which agricultural activities are the dominant source, has been projected to be one of the three major global pressures on biodiversity between 2000 and 2100[104].

A reduction in unnecessary production of biomass and food which is ultimately wasted may reduce the extent of these negative effects on habitats and species surrounding agricultural land.

However, on a national scale, it is unknown whether a reduction in the production of food which is ultimately wasted will cause a decline in the amount of food produced, and consequently reduce risks to habitats and species.

Reduction in food waste sent to landfill

SEA Impact: +

Habitats in and around bodies of water such as streams, ponds, lakes, and surrounding soils nearby to landfill sites can become polluted by leachate from landfills. A reduction in levels of waste disposal in landfill will lead to lower impacts on habitats and their resident species at a local level.

Landfilling organic matter can be a major emitter of GHG emissions. Lower levels of landfill gas production, (methane in particular) will reduce the contribution to climate change and indirectly lessen impacts on species and habitats.

The reduced impact on landfill capacity will lessen the longer term requirement for the creation of new landfill sites and the corresponding clearance of wild areas. This

[103] NatureScot, Managing the land, URL: https://www.nature.scot/professional-advice/land-and-sea-management/managing-land#:~:text=Farming%20is%20a%20major%20land,many%20benefits%20to%20Scotland's%20people (accessed July 2023)

[104] Organisation for Economic Co-operation and Development, Managing the Biodiversity Impacts of Fertiliser and Pesticide Use (published 2020)

in turn will reduce the number of habitats being lost or degraded to create new landfill sites.

Reduction in food waste incinerated

SEA Impact: +

Incineration of waste is a source of GHG emissions and air pollutants.

Reduced emissions from energy from waste facilities will lower the resultant contribution to climate change and indirectly lessen impacts on species and habitats.

Possible change in demand for fertilisers and compost

SEA Impact: ?

Peat-based compost production contributes to the degradation of Scotland's peatlands. Healthy peatlands are an internationally important wildlife habitat[105] and Scottish peatlands are a significant carbon sink, estimated to store up to 140 times Scotland's annual carbon footprint[106].

A reduction in extraction of peat for horticultural uses is likely to have a positive impact on biodiversity through limiting habitat destruction and climate change impacts.

Fertiliser production and pollution from inorganic fertilisers also pose a threat to habitats and species, for example through nitrogen deposition and emissions of greenhouse gases and pollutants from energy-intensive production processes.

A reduction in demand for fertiliser production will lower the resultant pollution and contribution to climate change and lessen impacts on species and habitats.

A reduction in availability of alternatives derived from organic waste would have the reverse effects.

Possible change in demand for fossil fuels

SEA Impact: ?

A change in demand for fossil fuels will impact biodiversity indirectly through its effect on climatic factors and resultant contribution to climate change.

[105] NatureScot, Restoring Scotland's Peatlands, URL: https://www.nature.scot/professional-advice/land-and-sea-management/carbon-management/restoring-scotlands-peatlands (accessed July 2023)

[106] NatureScot, Restoring Scotland's Peatlands, URL: https://www.nature.scot/professional-advice/land-and-sea-management/carbon-management/restoring-scotlands-peatlands (accessed July 2023)

Reduced fossil fuel extraction will result in a lower impact on nearby habitats and biodiversity. A reduction in availability of alternative fuels driving up fossil fuel demand would have the reverse effect.

Decrease in demand for virgin raw materials

SEA Impact: +

The production or import of virgin materials and feedstocks may have negative impacts on biodiversity due to increased pollution, disruption to habitats, and climate change impacts of GHG emissions associated with production.

A decline in production of materials due to replacement by circular alternatives is likely to lead to lower impacts on habitats and species in regions where these materials are harvested/extracted and processed.

4.2.3 Population and Human Health

SEA Assessment questions for population and human health:

- Will the plan reduce the health gap and inequalities and improve healthy life expectancy?
- Will it protect and improve human health and wellbeing through improving the quality of the living environment of people and communities?
- Will it increase sustainable access to essential services, employment, and the natural and historic environment?

Reducing food waste through behaviour change, redistribution, and better connecting the circular bioeconomy is expected to have a positive impact on human health and the population. Redistribution efforts will reduce inequalities by providing surplus food free of charge to those in need in a dignified, inclusive, and accessible manner. Financial wellbeing of householders may also improve as a result of cost savings from waste reduction. Nuisance and pollution resulting from the production and disposal of food which is wasted may also be reduced as a result of this package, with a subsequent positive impact on human health.

Package outcomes relevant to population and human health and their likely impacts are discussed below.

Increased availability of surplus food in communities in the short-medium term

SEA Impact: +

Access to surplus food free of charge or at low prices could contribute to improved health and wellbeing in communities and could play a minor role in reducing health inequality on a local level. However, long term impacts of food waste reduction initiatives on levels of food surplus are not known, and surplus food redistribution should not be relied upon as a lever to address food poverty.

Reduction in production, processing, and transport of wasted food

SEA Impact: +

The financial cost of buying food which was ultimately thrown away was estimated to be £1.1 billion a year in 2016, an average of £460 per household[107]. There will be financial benefits on a household level if individuals make cost savings as a result of waste-saving behaviours encouraged and enabled by the behaviour change strategy and wider support within this package.

Air pollution is one of the largest environmental risks to public health in the UK[108]. Unnecessary food production contributes to this issue, as discussed under environmental topic "Air". Any reductions in food production due to measures targeted at minimising waste will have a positive impact on human health through improvements to air quality.

However, on a national scale, it is unknown whether a reduction in the production of food which is ultimately wasted will cause a decline in the amount of food/biomass produced, and consequently reduce air pollution and related human health impacts.

Reduction in food waste sent to landfill

SEA Impact: +

Nuisance caused by landfill sites on a local level is likely to be in the form of odour, noise, increased traffic, and vermin. Organic waste in particular can contribute to odour and vermin issues.

Landfills can result in community impact throughout their life cycle. During the operational phase, when wastes are deposited, communities can be negatively impacted by nuisance issues such as odour, dust, noise and vermin. Odour is a significant environmental cause of public complaints of people living near waste treatment facilities and negatively affects quality of life and wellbeing. Odour can be a cause of stress and anxiety, even when the substances causing the odours are not harmful to health at the levels detected at waste treatment locations. Landfills, and specifically landfill odour, account for a significant proportion of public environmental event complaints made to SEPA. In extreme cases, where sites are poorly operated, or have specific gas management issues to address, this has resulted in several hundred public complaints in a single day. Three operational landfills are currently classified by SEPA as sites of ongoing community impact. In 2021, these sites alone accounted for 987 substantiated complaints to SEPA.[109]

[107] Zero Waste Scotland, How much food and drink waste is there in Scotland? (published 2016)
[108] Scottish Government, Cleaner Air for Scotland strategy: independent review (published 2019)
[109] Information provided through direct correspondence with SEPA (September 2023)

If lower volumes of food waste are destined for landfill due to the measures proposed in this package, a reduced negative impact on wellbeing the wellbeing of nearby residents is likely.

Reduction in food waste incinerated

SEA Impact: +/?

Pollution from EfW plants may have a negative impact on the health and wellbeing of nearby residents, and there is scope for further research into potential negative mental and psychological impacts of living close to an incinerator.[110] Measures targeted at reducing residual waste destined for incineration may therefore have a positive impact on nearby residents.

However, the risk to human health associated with newer incinerators operated within the current regulations, which are based on a precautionary approach, is likely to be minimal and very difficult to detect[111]. Therefore, health impacts of a reduction in waste incinerated are expected to be minor.

Possible change in demand for fertilisers and compost

SEA Impact: ?

Fertilisers are a significant source of nitrogen pollution. In 2011, the European Nitrogen Assessment[112] estimated the annual nitrogen related damage in EU-27 to be equivalent to a cost of €70–€320 billion per year, or €150–€750 per person, of which 60% is related to human health.

Peatlands play a role in reducing the risk of flooding by regulating run-off and maintaining base flows in upland streams during dry spells[113]

A reduction in fertiliser production and extraction of peat for horticultural uses is likely to have a positive impact on the population through reducing pollution and preserving peatlands and the benefits they bring. A reduction in availability of alternatives derived from organic waste would have the reverse effects.

4.2.4 Soil

SEA Assessment questions for soil:

[110] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

[111] Health Protection Scotland, Incineration of Waste and Reported Human Health Effects (published 2009)

[112] European Science Foundation, The European Nitrogen Assessment (published 2011)

[113] NatureScot, Restoring Scotland's Peatlands, URL: https://www.nature.scot/professional-advice/land-and-sea-management/carbon-management/restoring-scotlands-peatlands (accessed July 2023)

- Will the plan safeguard and improve soil quality, quantity and function in Scotland, particularly high value agricultural land and carbon-rich soils?

The food system is closely associated with land use and soils. Overall, the measures within this package may avoid adverse impacts to soil quality and function through a reduction in pollution caused at various stages in the food supply chain from farming to disposal. While addressing food waste itself will not directly improve soil function, the impact of making the food system more efficient and less wasteful should minimise the extent to which soils are contaminated, eroded, and polluted to produce food which is ultimately wasted.

There is uncertainty around the impacts of this package on availability of compost, biogas, and digestate derived from food waste. There may be a knock-on impact on soil health and the preservation of carbon-rich soils and peatlands from any changes in demand for compost and soil improvers.

Package outcomes relevant to soil and their likely impacts are discussed below.

Reduction in production, processing, and transport of wasted food

SEA Impact: +/?

Large areas of land are required for food production and manufacture: 75% of Scotland's land is used for agriculture[114]. In some cases, this can result in soil degradation and contamination e.g. due to surface run-off and erosion. In particular, intensive agriculture has been linked to a decline in soil health and productivity.[115]

A reduction in unnecessary food production may reduce the extent of these negative effects. However, on a national scale, it is unknown whether a reduction in the production of food which is ultimately wasted will cause a decline in the amount of food/biomass produced, and consequently reduce risks to soils.

Reduction in food waste sent to landfill

SEA Impact: +

Leachate from landfill sites can contaminate soils in the surrounding area. A reduction in volumes of material disposed of via landfill will lessen the impact on soil quality in the long term.

A reduced impact on landfill capacity will lessen or delay the longer term requirement for the creation of new sites, thus avoiding an increase in areas of soil vulnerable to material pollution and leachate from landfill sites.

[114] NatureScot, Managing the land, URL: https://www.nature.scot/professional-advice/land-and-sea-management/managing-land#:~:text=Farming%20is%20a%20major%20land,many%20benefits%20to%20Scotland's%20people (accessed July 2023)

[115] Natural History Museum, Soil degradation: the problems and how to fix them (published 2021)

Reduction in food waste incinerated

SEA Impact: +

Soils near incinerators may become polluted, and any negative impacts on soils will be reduced as a result of a decrease in waste sent to incinerators or energy from waste facilities.

Possible change in demand for fertilisers and compost

SEA Impact: ?

Extraction of peat for horticultural use has a major impact on peatlands, both by stripping away living layers of peat and exposing large quantities to oxidation and loss of carbon. Neighbouring areas of bog can also become degraded as a result of the lowered water table[116].

An increase in availability of alternative sources of compost may reduce the requirement for commercial peat extraction and therefore lessen the negative ecological impacts. A reduction in availability of alternatives derived from organic waste would have the reverse effects.

Reduced production of virgin materials

SEA Impact: +

Production of raw materials often has significant land use requirements and processes may be disruptive to soils in the area. There is also a risk of material and chemical pollution resulting from these processes.

A reduction in virgin material extraction will lead to a reduction in the levels of associated soil disruption. There may also be a decrease in the level of pollutants produced from virgin material extraction which could negatively impact the quality of nearby soils.

4.2.5 Water

SEA Assessment questions for water:

- Will the plan ensure the sustainable use of water resources?
- Will it help to reduce levels of water pollution?

[116] International Union for Conservation of Nature, Peat Extraction & Horticulture, URL: https://www.iucn-uk-peatlandprogramme.org/about-peatlands/peatland-damage/peat-extraction-horticulture#:~:text=The%20mechanised%20peat%20removal%20has,the%20drastically%20lowered%20water%20table (accessed July 2023)

Overall, the measures within this package may reduce water pollution and prevent water-intensive processes being used to produce food which is ultimately wasted. The impact of making the food system more efficient and less wasteful should minimise the extent to which water is wasted and bodies of water are polluted as a result of producing food which is ultimately wasted.

Package outcomes relevant to water and their likely impacts are discussed below.

Reduction in production, processing, and transport of wasted food

SEA Impact: +/?

Food production and processing requires significant volumes of water. By reducing the production of food which is ultimately wasted, unnecessary water use can, in turn, be reduced.

Chemicals used in agricultural processes i.e. pesticides and fertilisers can also have a detrimental effect on nearby bodies of water. For example, a single site under the "Animal and vegetable products from the food and beverage sector" was responsible for 1,975 tonnes of ammonia pollution to water above reporting threshold in 2021, 19.1% of the total across all regulated sites.[117]

Measures resulting in a decrease in unnecessary food production and processing may in turn lessen the associated impact on water quality. However, on a national scale, it is unknown whether a reduction in the production of food which is ultimately wasted will cause a decline in the amount of food produced, and consequently reduce water use and risks of water pollution.

Reduction in food waste sent to landfill

SEA Impact: +

Leachate from landfill sites can pollute nearby bodies of water. A reduction in volumes of material disposed of via landfill will lessen the impact on water quality in the long term.

A reduced impact on landfill capacity will lessen or delay the longer term requirement for the creation of new sites, thus avoiding an increase in the bodies of water vulnerable to material pollution and leachate from landfill sites.

Reduction in food waste incinerated

SEA Impact: +

[117] Scottish Environment Protection Agency, Scottish Pollutant Release Inventory 2021 (published 2022)

Some energy from waste processes will require water, and so a reduction in residual waste processed at these plants will result in a decrease in resultant water use. Any pollution impacts on nearby bodies of water may also decrease.

Possible change in demand for fertilisers and compost

SEA Impact: ?

Peatlands play a role in improving nearby water quality by reducing the amount of carbon in water, which results in water discolouration and requires extra treatment[118]. Any reduction in extraction of peat due to improved availability of alternative compost or soil improvers may have an indirect positive impact on water quality in bodies of water in the vicinity of peat bogs.

Decrease in demand for virgin raw materials

SEA Impact: +

There is a risk of water pollution on a local scale due to virgin material extraction processes. For example, fertilisers and pesticides used in agriculture may leak into nearby bodies of water.

A reduction in extraction of virgin materials is therefore likely to lead to a decrease in the level of pollutants produced from extraction processes which could negatively impact the quality of nearby bodies of water. There will also be a reduction in any water use associated with extraction processes. A reduction in availability of alternatives derived from organic waste would have the reverse effects.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced.

4.2.6 Air

SEA Assessment questions for air:

- Will the plan avoid adverse impacts to air quality?
- Will it reduce emissions of key pollutants and improve air quality throughout Scotland?
- Will it reduce levels of nuisance e.g. noise, vibration, dust, odour, and light?

Overall, the measures within this package will avoid adverse impacts to air quality caused by producing and disposing of food which is wasted. There is expected to be a direct reduction in pollutants emitted from the incineration and landfilling of wasted

[118] NatureScot, Restoring Scotland's Peatlands, URL: https://www.nature.scot/professional-advice/land-and-sea-management/carbon-management/restoring-scotlands-peatlands (accessed July 2023)

food, and indirect impacts on the pollutants emitted to produce the food in the first place, minimising the extent to which air pollution is caused to produce food which will be wasted.

Package outcomes relevant to air and their likely impacts are discussed below.

Reduction in production, processing, and transport of wasted food

SEA Impact: + / ?

Nitrogen-containing compounds (NO2, NO, NH3, N2O) are emitted to the atmosphere from agricultural activities. For example, ammonia, which is a major contributor to particulate matter formation. Around 90% of ammonia is generated by the agricultural sector.[119]

Methane and non-methane volatile organic compounds (VOC) are emitted by agriculture, and livestock are a significant source of methane emissions. The pesticides/fungicides hexachlorobenzene, hexachlorocyclohexane and pentachlorophenol, which are listed in the Stockholm Convention on Persistent Organic Pollutants, are also emitted from agricultural and forestry use.[120]

A reduction in unnecessary food production and processing is therefore likely to have a positive impact on air quality. However, on a national scale, it is unknown whether a reduction in the production of food which is ultimately wasted will cause a decline in the amount of food produced, and consequently reduce risks of air pollution.

Reduction in food waste sent to landfill

SEA Impact: +

Reducing the amount of organic matter from food waste deposited in landfill will decrease the amount of landfill gas produced at the site[121]. Several air pollutants are associated with landfill gas production. A reduction in organic waste disposed of via landfill is therefore likely to have a positive impact on air quality. Odour levels will also be reduced if the requirement for additional landfill sites is lessened or delayed from a decrease in residual waste arisings.

Reduction in food waste incinerated

[119] Scottish Government, Cleaner Air for Scotland 2 - Towards a Better Place for Everyone (published 2021)

[120] Air Quality Expert Group, Air Pollution from Agriculture (published 2018)

[121] Rodrigo-Ilarri J, Rodrigo-Clavero M-E. Mathematical Modeling of the Biogas Production in MSW Landfills. Impact of the Implementation of Organic Matter and Food Waste Selective Collection Systems. (published 2020)

SEA Impact: +

Incineration of waste is linked to air and noise pollution on a local scale, though with current stringent emissions standards, the evidence is that the air quality impacts are likely to be small[122]. A reduction in volumes of waste disposed of by incineration or energy from waste is likely to have a minor positive impact on air quality.

Possible change in demand for fertilisers and compost

SEA Impact: ?

Fertilisers are a significant source of nitrogen pollution. In 2011, the European Nitrogen Assessment[123] estimated the annual nitrogen related damage in EU-27 to be equivalent to a cost of €70–€320 billion per year, of which 75% is related to air pollution.

Scottish peatlands play a role in improving air quality by absorbing pollutants such as sulphur dioxide, nitrogen and heavy metals.[124]

A reduction in peatland disruption resulting from increased availability of alternative growing medium is likely to result in an improvement to air quality.

Possible change in demand for fossil fuels

SEA Impact: ?

Fossil fuels are a significant contributor of airborne pollutants both when they are extracted and when they are burned (as an energy source). A reduction in the demand for fossil fuels should lead to a reduction in air pollution, but the extent of the reduction will depend on global market responses.

Decrease in demand for virgin raw materials

SEA Impact: +

Material production processes and the associated transport and energy use are likely to emit airborne pollutants. The scale and nature of these emissions will depend on the material in question.

A reduction in extraction of virgin materials is therefore likely to result in a reduction in associated airborne pollutants, thus improving air quality on a local scale.

[122] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

[123] European Science Foundation, The European Nitrogen Assessment (published 2011)

[124] NatureScot, Restoring Scotland's Peatlands, URL: https://www.nature.scot/professional-advice/land-and-sea-management/carbon-management/restoring-scotlands-peatlands (accessed July 2023)

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources produced.

4.2.7 Climatic factors

SEA Assessment question for climatic factors:

- Will the plan help to reduce existing and avoid new Greenhouse Gas (GHG) emissions?

Overall, the measures within this package will reduce greenhouse gas emissions caused by the production and disposal of wasted food. There is expected to be a reduction in greenhouse gas emissions associated with: the incineration and/or landfilling of wasted food; producing food which ultimately goes to waste; producing additional food which may be purchased without effective redistribution networks; and producing the virgin materials which would be demanded if alternatives from the circular bioeconomy are not made available.

There is uncertainty around the impacts of this package on availability of compost, biogas, and digestate derived from food waste and their subsequent environmental impacts. However, a reduction in overall levels of wasted food combined with a decrease in food waste sent to landfill or incineration mean the overall effects of this package are likely to help reduce existing and avoid new greenhouse has emissions.

Package outcomes relevant to climatic factors and their likely impacts are discussed below.

Reduction in production, processing, and transport of wasted food

SEA Impact: +/?

Food waste in Scotland accounted for 30% of the GHG emissions of household waste in 2020[125] of which the majority originates from the emissions during food production, and avoidable food waste generated 1.6 million tonnes of carbon dioxide equivalent in 2014, 2.1% of Scotland's total carbon footprint[126]

By avoiding unnecessary food waste, GHG emissions should fall, assuming the food previously wasted reduces the production of more food. However, on a national scale, it is unknown whether the fall in demand for food production as a result of waste reduction measures in this plan will cause a decline in the amount of food/biomass produced, and consequently reduce GHG emissions. However, even if food production volumes are not immediately impacted, reducing food disposal and moving food waste up the waste hierarchy will have a net positive effect on reducing GHG emissions.

[125] Zero Waste Scotland, The Carbon Footprint of Scotland's Household Waste (published 2023)
[126] Zero Waste Scotland, How much food and drink waste is there in Scotland? (published 2016)

Reduction in food waste sent to landfill

SEA Impact: +

The landfill of waste, in particular organic matter, can be a major emitter of GHG emissions: in 2021, the landfill of household waste accounted for just under 250kt of CO_2e of GHG emissions[127]. In 2025, the Biodegradable Municipal Waste Landfill Ban will come into effect, causing levels of organic waste in landfill to drop.

The measures in this package will support further reductions in organic waste destined for landfill, and will help drive this waste further up the hierarchy rather than remaining in the residual waste stream By reducing the amount of waste requiring landfill, GHG emissions from landfill sites should also reduce.

Reduction in food waste incinerated

SEA Impact: +

Incineration of food waste produces more greenhouse gas emissions than composting or anaerobic digestion[128]. Diverting food waste up the hierarchy, or avoiding the waste in the first place, will reduce the climate change impact of this waste stream.

Overall, the reduction in the incineration of waste will avoid new GHG emissions from the incineration process, and these benefits are likely to be greater over time.

Possible change in demand for fertilisers and compost

SEA Impact: ?

Fertiliser production processes are often energy intensive, using fossil fuels such as natural gas and releasing greenhouse gas emissions.

Scottish peatlands are a significant carbon sink, and are estimated to store up to 140 times Scotland's annual carbon footprint[129]. If peatlands are disturbed e.g. by excavating for horticultural uses, this carbon will be released into the atmosphere as new GHG emissions.

If the demand for fertilisers and peat-based compost falls as a result of an increase in compost from food recycling, then production emissions and the destruction of peatlands and the associated emission of stored carbon can be avoided.

[127] Zero Waste Scotland, The Carbon Footprint of Scotland's Waste (published 2023)

[128] Zero Waste Scotland, Carbon Metric Factors 2011-2020 (published 2022)

[129] NatureScot, Restoring Scotland's Peatlands, URL: https://www.nature.scot/professional-advice/land-and-sea-management/carbon-management/restoring-scotlands-peatlands (accessed July 2023)

Possible change in demand for fossil fuels

SEA Impact: ?

Fossil fuels are a significant contributor of GHG emissions both when they are extracted and when they are burned as an energy source. A reduction in the demand for fossil fuels resulting from increased availability of biogas as an alternative should lead to a reduction both in their extraction and as an energy source, but the extent of the reduction will depend on global market responses.

Decrease in demand for virgin raw materials

SEA Impact: +

The extraction and production of virgin materials is likely to release significant amounts of GHG. The reduction in the demand of virgin materials should therefore avoid new GHG emissions. The extent of the reduction will depend on the material, as well as the substitution rate of secondary materials for virgin materials. A substitution rate less than one will offset some of the gains of virgin material reduction, but overall GHG emissions, and subsequent impacts on the climate, will be reduced.

4.2.8 Material Assets

SEA Assessment questions for material assets:

- Will it reduce use and promote sustainable management of natural resources?
- Will it reduce 'leakage' of material to landfill or energy recovery or as litter?

Package outcomes relevant to material assets and their likely impacts are discussed below.

It is anticipated that overall, as a result of measures in this package, natural resources used to produce food which is wasted, as well as the packaging it is sold in, will decrease, resulting in lower volumes of organic material and packaging being lost to landfill or energy recovery.

There is uncertainty around the impacts of this package on availability of compost, biogas, and digestate derived from food waste and subsequent changes in demand for alternative materials. However, a reduction in overall levels of wasted food combined with a decrease in food waste sent to landfill or incineration mean the overall effects of this package are likely to help promote sustainable material use and resource management.

Reduction in production, processing, and transport of wasted food

SEA Impact: +/?

The production of food requires significant material input. For example, in 2018, Scotland's farms used 521kt of fertilisers[130].

By reducing unnecessary food waste, the consumption of resources to produce food may fall. However, on a national scale, it is unknown whether a reduction in the production of food which is ultimately wasted will cause a decline in the amount of food produced, and consequently reduce demand for natural resources.

Reduction in food waste sent to landfill

SEA Impact: +

Increased diversion of material away from the residual waste stream will result in less material leakage to landfill, enabling materials to be kept in use for as long as possible.

Reduction in food waste incinerated

SEA Impact: +

Incineration and energy from waste plants require resources for construction and to continue to run. A reduction in the amount of material incinerated will reduce the requirement for any new incineration plants, which would require construction and other materials.

Furthermore, increased diversion of material away from the residual waste stream will result in less material leakage to energy recovery or landfill, enabling materials to be kept in use for as long as possible.

Possible change in demand for fertilisers and compost

SEA Impact: ?

Resources required to produce fertilisers and growing media will be reduced if availability of alternatives derived from organic waste increases. This could result in a decrease in production of peat-based compost.

Peat is an important resource for storing carbon. Peatlands are virtually non-renewable due to the number of years they take to form. A reduction in the demand for peat should reduce the extraction and destruction of Scottish peat. Decreased availability of alternatives derived from organic waste will have the reverse effect.

Possible change in demand for fossil fuels

[130] Zero Waste Scotland, Scottish Material Flow Accounts Model: Update with 2018 data (published 2023)

SEA Impact: ?

Fossil fuels are a finite resource, of which Scotland extracted 74.5Mt in 2018[131]. A reduction in the demand for fossil fuels should lead to a reduction in their extraction, but the extent of the reduction will depend on global market responses and will be limited.

Decrease in demand for virgin raw materials

SEA Impact: +

The reduction in the production of virgin materials will reduce extraction rates of raw materials. Additionally, if less material is ultimately extracted, less material will require disposal.

In a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a global decline in the amount of resources extracted/produced.

4.2.9 Landscape and visual impacts

SEA Assessment questions for landscape and visual impacts:

- Will the plan avoid adverse effects on landscapes and visual impacts?
- Will it safeguard and enhance the character and diversity of the Scottish landscape and areas of valuable landscape and geodiversity?

Overall, the measures within this package may avoid adverse effects on landscapes and visual impacts through a reduction in land used to produce wasted food throughout the supply chain, from farming to disposal. While addressing food waste itself will not directly impact landscapes, the effect of making the food system more efficient and less wasteful should minimise the extent to which land is used to produce food that is ultimately wasted.

Package outcomes relevant to landscape and visual impacts and their likely impacts are discussed below.

Reduction in production, processing, and transport of wasted food

SEA Impact: +

[131] Zero Waste Scotland, Scottish Material Flow Accounts Model: Update with 2018 data (published 2023)

Large areas of land are required for food production and manufacture: 75% of Scotland's land is used for agriculture[132].

To the extent that less land is required for agriculture, landscape impact may be avoided by a reduction in the production of food which is ultimately wasted. However, on a national scale, it is unknown whether a reduction in the production of food which is ultimately wasted will cause a decline in the amount of food produced, and consequently reduce impacts on Scottish landscapes.

Reduction in food waste sent to landfill, and

Reduction in food waste incinerated

SEA Impact: +

Landfill and energy from waste facilities are generally considered to be unsightly, both in terms of the sites themselves and in the birds and rodents that may be attracted. A long term reduction in the construction of new landfill or EfW sites may therefore avoid adverse effects on landscapes and visual impacts.

Possible change in demand for fertilisers and compost

SEA Impact: ?

Scottish peatlands cover many areas that are of significant natural beauty and form habitats for wildlife. By preventing the destruction of peatlands through increased availability of alternatives to peat-based compost, existing landscapes and habitats can be preserved and thus avoiding negative visual impacts.

Decrease in demand for virgin raw materials

SEA Impact: +

Virgin material extraction sites are generally considered to be unsightly. Scotland produces approximately 7.5Mt of wood annually[133]. Reduced felling of trees for biofuel as a result of increased availability of by-product alternatives may enhance landscapes, although the impact is not likely to be significant.

[132] NatureScot, Managing the land, URL: https://www.nature.scot/professional-advice/land-and-sea-management/managing-land#:~:text=Farming%20is%20a%20major%20land,many%20benefits%20to%20Scotland's%20people (accessed July 2023)

[133] Zero Waste Scotland, Scottish Material Flow Accounts Model: Update with 2018 data (published 2023)

4.3 Embed circular construction practices

4.3.1 Outcomes

Reduced production of virgin materials;

Reduced production of new components;

Increase in resource use for maintenance and refurbishment; and

Reduced production of new components.

Reusing materials (e.g., steel, wood, brick, concrete, masonry, soils, aggregates) and components (e.g., structural steel, woodwork, ironwork, roofing) in other construction projects will fulfil part of the demand for new construction materials and components, thus reducing the demand for virgin materials and for new components. A reduction in the demand for new components will reinforce the reduction in demand for virgin materials.

Reduction in disposal via landfill; and

Reduction in disposal via incineration.

By reusing materials and components, fewer materials enter waste management, and thus fewer materials will be landfilled or incinerated.

Increase in resource use from processing of recyclate / storage of materials.

Waste materials from C&D sites destined for recycling will need to be stored before being processed and/or reuse. This may require additional infrastructure to be built to accommodate the amount of material.

Increase in resource use from processing of recyclate.

Transporting material for recycling may lead to an increase in the distances travelled relative to landfill or disposal sites. This will depend on the number and location of sites that are able to process the material. Increased transport distances will lead to increased demand for fossil fuels and an increase in tailpipe emissions from vehicles.

4.3.2 Biodiversity, flora, and fauna

SEA Assessment questions for biodiversity, flora, and fauna:

- Will the plan avoid adverse impacts to habitats and species?
- Will it protect, maintain, and enhance biodiversity?

The interventions in this package should help to avoid adverse impacts to habitats and species, and help to protect and maintain biodiversity. This will be achieved through a reduction in the need for new virgin materials, particularly those used in the construction industry such as wood and minerals, and through a reduction in the disposal of waste. There will be an increase in resource use required from processing recyclate and maintaining components or preparing them for reuse; this should be considered in future environmental assessments when the specific plans or policies have been developed.

Package outcomes relevant to biodiversity, flora, and fauna and their likely impacts are discussed below.

Reduced production of virgin materials.

SEA Impact: +/?

The extraction of virgin materials may have negative impacts on biodiversity due to increased pollution or disruption / destruction of habitats. A reduction in extraction of virgin materials is likely to lead to lower impacts on habitats and species in regions where materials are extracted and processed. However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced in Scotland, and consequently reduce risks to habitats and species.

Reduced production of new components.

SEA Impact: +

The processes required to transform raw materials into finished components may have negative impacts on habitats and species. Since some of these processes will be avoided, there may be benefits to biodiversity, flora, and fauna.

Reduction in disposal via landfill

SEA Impact: +

There will be lower impacts on habitats and their resident species nearby to landfill sites at a local level, such as streams, ponds, lakes, and soils which can become polluted by leachate.

Lower levels of landfill gas production, (methane in particular) alongside reduced emissions from energy from waste facilities will contribute to climate change and indirectly lessen impacts on species and habitats. At a global level, these impacts are not likely to be significant.

The reduced impact on landfill capacity will lessen the longer-term requirement for the creation of new landfill sites and the corresponding clearance of wild areas. This

in turn will reduce the number of habitats being lost or degraded to create new landfill sites.

Reduction in disposal via incineration

SEA Impact: +

Incineration of waste is a source of GHG emissions and air pollutants. Reduced emissions from energy from waste facilities will lower the resultant contribution to climate change and indirectly lessen impacts on species and habitats.

Increased resource use from processing of recyclate

SEA Impact: -/?

Recycling processes require additional energy and other inputs, the production of which may have biodiversity impacts. This may offset to some extent the overall reduction in impacts anticipated by the reduced demand for virgin materials.

Increase in resources used for maintenance and refurbishment

SEA Impact: -/?

The maintenance and refurbishment of buildings and components will require additional resources. The production of these resources may have a negative impact on biodiversity, habitats, flora, and fauna, depending on the type of resources required. This may offset to some extent the overall reduction in impacts that are anticipated by reduced demand for virgin materials and components.

4.3.3 Population and human health

SEA Assessment questions for population and human health:

- Will the plan reduce the health gap and inequalities and improve healthy life expectancy?
- Will it protect and improve human health and wellbeing through improving the quality of the living environment of people and communities?
- Will it increase sustainable access to essential services, employment, and the natural and historic environment?

The interventions in this package should help to improve health outcomes and wellbeing, and may lead to a rise in sustainable jobs. The reduction in disposal via both landfill and incineration will help to reduce negative impacts to wellbeing such as odour and noise, and will reduce negative health impacts through lower air pollution. The impact on jobs is not known at this stage and will depend on wider economic dynamics at a national and global level.

Reduced production of virgin materials.

SEA Impact: ?

In 2020, 62,900 people were employed in Scotland's mining and quarrying industry (2.4%)[134]. There may be impacts on employment in material extraction as a result of a reduced demand for virgin materials.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced, and therefore how many jobs may be at risk.

Any negative impacts on employment in virgin material extraction industries may be offset by increased opportunities for green jobs e.g., recycling facilities - aligning with the Just Transition.

Reduced production of new components.

SEA Impact: ?

In 2020, 182,100 people were employed in the manufacturing industry in Scotland (7.0% of all people aged 16+ in employment)[135].

There may be impacts on employment in product manufacturing sector, though effects are likely to be offset by increased opportunities for green jobs e.g. Re-manufacture, repair etc. - aligning with the Just Transition to green jobs.

Reduction in disposal via landfill.

SEA Impact: +

Nuisance caused by C&D waste disposed of at landfill sites is likely to be in the form of noise, traffic, associated pollution, and their general aesthetic.

Landfills can result in community impact throughout their life cycle. During the operational phase, when wastes are deposited, communities can be negatively impacted by nuisance issues such as odour, dust, noise and vermin. Odour is a significant environmental cause of public complaints of people living near waste treatment facilities and negatively affects quality of life and wellbeing. Odour can be a cause of stress and anxiety, even when the substances causing the odours are not harmful to health at the levels detected at waste treatment locations. Landfills, and specifically landfill odour, account for a significant proportion of public environmental

[134] Scottish Government, Scotland's Labour Market: People, Places and Regions – background tables and charts 2020/21 (published 2022)

[135] Scottish Government, Scotland's Labour Market: People, Places and Regions – background tables and charts 2020/21 (published 2022)

event complaints made to SEPA. In extreme cases, where sites are poorly operated, or have specific gas management issues to address, this has resulted in several hundred public complaints in a single day. Three operational landfills are currently classified by SEPA as sites of ongoing community impact. In 2021, these sites alone accounted for 987 substantiated complaints to SEPA.[136]

If lower volumes of waste are destined for landfill due to the measures proposed in the Route Map, a reduced negative impact on wellbeing the wellbeing of nearby residents is likely.

Reduction in disposal via incineration

SEA Impact: +/?

Pollution from EfW plants may have a negative impact on the health and wellbeing of nearby residents, and there is scope for further research into potential negative mental and psychological impacts of living close to an incinerator.[137]. Measures targeted at reducing residual waste destined for incineration may therefore have a positive impact on nearby residents.

However, the risk to human health associated with newer incinerators operated within the current regulations, which are based on a precautionary approach, is likely to be minimal and very difficult to detect[138]. Therefore, health impacts of a reduction in waste incinerated are expected to be minor.

4.3.4 Soil

SEA Assessment questions for soil:

- Will the plan safeguard and improve soil quality, quantity and function in Scotland, particularly high value agricultural land and carbon-rich soils?

The interventions in this package should help to safeguard and improve soil quality and quantity in Scotland, due to a reduction in the extraction of materials that would otherwise disturb soils, and reduced leachate from landfill sites. An increase in recycling and storage of materials and components may have adverse impacts on soils; however, assuming alignment with Policy 12 of the National Planning Framework (NPF4), impacts on soil should be minimal.

Reduced production of virgin materials.

[136] Information provided through direct correspondence with SEPA (September 2023)

[137] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

[138] Health Protection Scotland, Incineration of Waste and Reported Human Health Effects (published 2009)

SEA Impact: +/?

Extraction of virgin materials often has significant land use requirements and processes may be disruptive to soils in the area. There is a risk of material and chemical pollution resulting from these processes e.g. fertilisers and pesticides associated with timber production may pollute nearby soils, reducing soil quality on a local scale.

A reduction in virgin material extraction will lead to a reduction in the levels of associated soil disruption e.g. through reduced extraction of topsoil and reduced need for aggregates or other minerals. There may also be a decrease in the level of pollutants produced from virgin material extraction which could negatively impact the quality of nearby soils.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced in Scotland.

Reduced production of new components.

SEA Impact: +

Pollutants from manufacturing facilities may leak into the surrounding area, resulting in a risk of soil degradation on a local scale.

There may be a decrease in the level of pollutants produced from manufacturing plants which in turn could improve the quality of nearby soils.

Reduction in disposal via landfill.

SEA Impact: +

Leachate from landfill sites can contaminate soils in the surrounding area. A reduction in volumes of material disposed of via landfill will lessen the impact on soil quality in the long term. A reduced impact on landfill capacity will lessen or delay the longer term requirement for the creation of new sites, thus avoiding an increase in areas of soil vulnerable to material pollution and leachate from landfill sites. However, soil pollution may still occur if C&D waste that is recycled as backfill is contaminated.

Reduction in disposal via incineration

SEA Impact: +

Soils near incinerators may become polluted, and any negative impacts on soils will be reduced as a result of a decrease in waste sent to incinerators or energy from waste facilities.

Increased resource use and pollution from processing of recyclate / storage of materials.

SEA Impact: -/?

Pollution from recycling and/or storage facilities into nearby soils is possible and should be considered in environmental assessments of any (new) recycling facilities. Assuming alignment with Policy 12 of the National Planning Framework (NPF4), these impacts will be minimal.

4.3.5 Water

SEA Assessment questions for water:

- Will the plan ensure the sustainable use of water resources?
- Will it help to reduce levels of water pollution?

This package is likely to ensure the sustainable use of water resources through a reduction in the demand for virgin materials; however, an increase in recycling will offset some of this reduction. The package will help to reduce levels of water pollution thanks to a reduction in the demand for virgin materials (e.g., wood) and a reduction in landfill, which will in-turn reduce the chance of soil pollution and contamination from leachate. However, care should be taken that the increased levels of recycling will not lead to an increase in water pollution. These potential impacts should be considered in future environmental assessments of new recycling facilities, and suitable mitigation should be described; assuming alignment with Policy 12 of NPF4, these impacts will be minimal.

Package outcomes relevant to water and their likely impacts are discussed below.

Reduced production of virgin materials.

SEA Impact: +/?

There is a risk of water pollution on a local scale due to virgin material extraction processes. For example, Scotland produces approximately 7.5Mt of wood per annum[139]. Fertilisers and pesticides associated with timber production may leak into nearby bodies of water.

A reduction in extraction of virgin materials is therefore likely to lead to a decrease in the level of pollutants produced from extraction processes which could negatively

[139]Zero Waste Scotland, Scottish Material Flow Accounts Model: Update with 2018 data (published 2023)

impact the quality of nearby bodies of water. There will also be a reduction in any water use associated with extraction processes.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced in Scotland.

Reduced production of new components.

SEA Impact: +

The manufacturing processes of construction industry products and components, such as concrete, steel, glass, plastics, etc. require large amounts of water[140]. Additionally, pollutants from manufacturing facilities may leak into nearby bodies of water, resulting in a risk of increased water pollution.

A reduction in the manufacturing of new products/components will result in a reduction in the water use during the processes involved. There will also be a decrease in the level of pollutants produced from manufacturing plants which could result in an improvement in the quality of nearby bodies of water.

Reduction in disposal via landfill.

SEA Impact: +

Leachate from landfill sites can pollute nearby bodies of water. A reduction in volumes of material disposed of via landfill will lessen the impact on water quality in the long term. A reduced impact on landfill capacity will lessen or delay the longer term requirement for the creation of new sites, thus avoiding an increase in the bodies of water vulnerable to material pollution and leachate from landfill sites. However, water sources may still become polluted if the C&D waste that is recycled as backfill is contaminated.

Reduction in disposal via incineration

SEA Impact: +

Some energy from waste processes will require water, and so a reduction in residual waste processed at these plants will result in a decrease in resultant water use. Any pollution impacts on nearby bodies of water may also decrease.

Increased resource use from processing of recyclate / storage of materials.

[140] Construction Products Association, Water Efficiency: the contribution of construction products (published 2015)

SEA Impact: -/?

Some recycling processes require water, so an increase in recycling is likely to increase associated water use. However, the use of secondary materials is likely to reduce water use associated with virgin material production, assuming the outputs of recycling activity offset or delay the need for virgin materials.

The storage of materials could lead to increased water pollution if the materials are not adequately protected from the environment. Environmental assessments of any (new) facilities should account for this potential. Assuming alignment with Policy 12 of NPF4, these impacts will be minimal.

Increase in resources used for maintenance and refurbishment.

SEA Impact: -/?

Maintaining and cleaning reused components will require water use. An increase in the reuse of components and other construction products may therefore result in an increase in water use.

4.3.6 Air

SEA Assessment questions for air:

- Will the plan avoid adverse impacts to air quality?
- Will it reduce emissions of key pollutants and improve air quality throughout Scotland?
- Will it reduce levels of nuisance e.g. noise, vibration, dust, odour, and light?

The interventions in this package should avoid adverse impacts to air quality. The reduction of virgin material production caused by increased recycling should help to reduce the emissions of key pollutants (such as sulphur oxides and PM10); similarly, the reuse of components should help to reduce emissions from the manufacturing industry. There is the potential for the increase in recycling to lead to increased pollution; this should be considered in future environmental assessments of (new) recycling facilities; assuming alignment with Policy 12 of NPF4, these impacts should be minimal.

Package outcomes relevant to air and their likely impacts are discussed below.

Reduced production of virgin materials

SEA Impact: +/?

Material extraction processes, as well as transport and energy, emit airborne pollutants. For example, the Scottish mineral industry emitted 1kt of sulphur oxides, while the production and processing of metals in Scotland emitted almost 0.5kt of sulphur oxides in 2021, a combined 44% of the total sulphur emissions from SEPA

regulated industrial sites in Scotland. Similarly, these two industries emitted 50% of all PM10 emissions from these sites in 2021[141].

A reduction in extraction of virgin materials may result in a reduction in these and associated airborne pollutants, thus improving air quality on a local scale. There may also be a decrease in the level of noise and nuisance associated with virgin material extraction.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of materials extracted/produced in Scotland.

Reduced production of new components

SEA Impact: +

Manufacturing processes are often responsible for the emission of airborne pollutants. For example, one SEPA regulated industrial site under the category "Paper and wood production and processing" was responsible for 64 tonnes of particulate matter pollution to air above reporting threshold in 2021, 15.2% of the total across all regulated sites[142].

A reduction in the manufacturing of new products/components will result in a reduction in associated airborne pollutants, thus improving air quality on a local scale. There will also be a decrease in the level of noise and nuisance on a local scale surrounding manufacturing plants.

Reduction in disposal via landfill

SEA Impact: +

Most C&D waste entering landfill has a low biodegradable content and is therefore unlikely to produce significant amounts of landfill gas. The reduction in volumes of material being transport to landfill will help to reduce tailpipe emissions from vehicles and therefore indirectly avoid some air pollution.

Reduction in disposal via incineration

SEA Impact: +

[141] Scottish Environment Protection Agency, 2021 Pollutant emissions and waste transfers from SEPA regulated industrial sites (published 2022)
[142] Scottish Environment Protection Agency, 2021 Pollutant emissions and waste transfers from SEPA regulated industrial sites (published 2022)

Incineration of waste is linked to air and noise pollution on a local scale, though with current stringent emissions standards, the evidence is that the air quality impacts are likely to be small[143]. A reduction in volumes of waste disposed of by incineration or energy from waste is likely to have a minor positive impact on air quality.

Increased resource use from processing of recyclate

SEA Impact: -/?

Some recycling processes may contribute to air pollution, though the use of the secondary materials will likely reduce air pollution at the aggregate, assuming the outputs from recycling offset or delay the need for virgin materials.

4.3.7 Climatic factors

SEA Assessment questions for climatic factors:

- Will the plan help to reduce existing and avoid new Greenhouse Gas (GHG) emissions?

The interventions in this package should help to avoid new GHG emissions. A reduction in the production of virgin materials should help to avoid GHG emissions, e.g, from the mineral industry; similarly, reusing components and materials will avoid GHG emissions from the manufacturing industry. However, the processing of recyclate and the maintenance of reusable components / materials will require resources and cause emissions which may offset some of these reductions; this should be considered in future environmental assessments when more details of the specific interventions are known. Assuming alignment with Policy 12 of NPF 4, any impacts on GHG emissions from new facilities should be minimal.

Package outcomes relevant to climatic factors and their likely impacts are discussed below.

Reduced production of virgin materials.

SEA Impact: +

The extraction and production of virgin materials is likely to release significant amounts of GHG. For example, in 2021, CO_2 emissions from the mineral industry amounted to 716kt, 7% of the total CO_2 emissions from SEPA regulated industrial sites[144]. It should be noted that extraction and production of virgin materials (and the

[143] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

[144] Scottish Environment Protection Agency, 2021 Pollutant emissions and waste transfers from SEPA regulated industrial sites (published 2022)

related emissions) will often occur in other countries, though this assessment focuses on impacts within Scotland.

The reduction in the demand of virgin materials should therefore avoid new GHG emissions. The extent of the reduction will depend on the material, as well as the substitution rate of secondary materials for virgin materials (i.e., does the production of 1 kg of secondary steel reduce the demand for virgin steel by 1kg.). A substitution rate less than one will offset some of the gains of virgin material reduction, but overall GHG emissions, and subsequent impacts on the climate, will be reduced.

Reduced production of new components.

SEA Impact: +

The production of new components or products requires energy and resources that will emit GHGs. Thus, the reduction in the number of components or products produced will help to avoid new GHG emissions. The amount avoided will be dependent on the products and components in question, as well as the substitution rate of reused products / components for new components.

Reduction in disposal via landfill

SEA Impact: +

The landfill of waste, in particular organic matter, can be a major emitter of GHG emissions. By reducing the amount of waste requiring landfill, GHG emissions from landfill sites should also reduce.

Reduction in disposal via incineration

SEA Impact: +

The IPCC estimates that every tonne of waste incinerated releases 0.7-1.2 tCO_2e[145] [146,] and energy from waste contributed 0.3$MtCO_2e$ to Scotland's total greenhouse gas emissions in 2021[147]. As energy switches to renewable or lower carbon sources, the benefits of energy from waste will fall. Overall, a reduction in the incineration of waste will avoid new GHG emissions from the incineration process, and these benefits are likely to be greater over time.

[145] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)
[146] IPCC, Emissions From Waste Incineration
[147] Scottish Government, Scottish Greenhouse Gas Statistics 2021 (published 2023)

Increased resource use from processing of recyclate

SEA Impact: -/?

The processing of recyclate into secondary materials requires energy and material resources, both of which will result in GHG emissions. For example, recycling steel in an EAF plant omits 0.55 kg of CO_2e per kg of secondary steel (GWP 100)[148]. However, the use of secondary materials will likely reduce emissions at the aggregate, assuming these offset or delay the need for virgin materials.

Assuming alignment with Policy 12 of NPF 4, any impacts on GHG emissions from new facilities should be minimal.

Increase in resources used for maintenance and refurbishment

SEA Impact: -/?

Maintaining components and construction products to a certain standard may require both energy and new materials. There will therefore likely be some additional emissions associated with the resources required to maintain products. Product reuse will likely reduce emissions at the aggregate, however, assuming product reuse offsets or delays the need for new products.

4.3.8 Material Assets

SEA Assessment questions for material assets:

- Will it reduce use and promote sustainable management of natural resources?
- Will it reduce 'leakage' of material to landfill or energy recovery or as litter?

These interventions should help to reduce the extraction of natural resources in Scotland, such as stone, aggregate, soils, and timber. A focus on diversion from disposal to recycling and reuse should help to reduce the pressure on natural resources, assuming that these materials and components can offset the production of virgin materials. An increase in recycling and reuse will require resources, and this should be considered in future environmental assessments when more details of the specific interventions are known.

Package outcomes relevant to material assets and their likely impacts are discussed below.

Reduced production of virgin materials

[148] Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., EcoInvent 3.9.1, using IPCC2021 LCIA method, GWP 100. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, [online] 21(9), pp.1218–1230 (published 2016)

SEA Impact: +

Virgin material extraction depletes non-renewable stocks of natural resources In 2018, approximately 21Mt of stone was extracted for building or ornamental purposes in Scotland, while Scotland produces approximately 7.5Mt of wood annually[149]. The reduction in the production of virgin materials (caused by increased recycling and reuse) will reduce extraction rates of raw materials. Additionally, if less material is ultimately extracted, less material will require disposal.

Reduced production of new components

SEA Impact: +

The production of new components/products will require materials, both virgin and secondary materials. Avoiding the production of new components/products will help to reduce pressures on resource consumption and promote the sustainable management of natural resources.

Reduction in disposal via landfill

SEA Impact: +

Increased diversion of material away from the residual waste stream will result in less material leakage to landfill, enabling materials to be kept in use for as long as possible.

Reduction in disposal via incineration

SEA Impact: +

Incineration and energy from waste plants require resources for construction and to continue to run. A reduction in the amount of material incinerated will reduce the requirement for any new incineration plants, which would require construction and other materials.

Additionally, increased diversion of material away from the residual waste stream will result in less material leakage to energy recovery or landfill, enabling materials to be kept in use for as long as possible.

Increased resource use from processing of recyclate

SEA Impact: -/?

[149] Zero Waste Scotland, Scottish Material Flow Accounts Model: Update with 2018 data (published 2023)

The processing of recyclate into secondary materials requires energy and may require virgin materials as input. The use of secondary materials will likely reduce material consumption at the aggregate, however, assuming these offset or delay the need for virgin materials.

Increase in resources used for maintenance and refurbishment

SEA Impact: -/?

The repair and refurbishment of existing products will require some materials to maintain products to a certain standard. However, product reuse will likely reduce material and resource consumption at the aggregate, assuming product reuse offsets or delays the need for new products, the production of which would require more/additional materials and resources. The extent of the reduction will depend on the extent to which reused products substitute new products.

4.3.9 Landscape and visual impacts

SEA Assessment questions for landscape and visual impacts:

- Will the plan avoid adverse effects on landscapes and visual impacts?
- Will it safeguard and enhance the character and diversity of the Scottish landscape and areas of valuable landscape and geodiversity?

The interventions in this package should help to avoid adverse effects on landscapes and safeguard the character and diversity of Scottish landscape, particularly in the locations where there is material extraction (for soil, aggregates, stones, wood, etc.). However, new facilities may be required to store materials and components that are taken offsite for reuse; this should be considered in future environmental assessments of (new) facilities. Assuming alignment with Policy 12 of NPF4, these impacts should be minimal.

Package outcomes relevant to landscape and visual impacts and their likely impacts are discussed below.

Reduced production of virgin materials

SEA Impact: +

In Scotland, approximately 21Mt of stone were extracted in 2018[150], and approximately 7.5Mt of wood. Virgin material extraction sites, such as mines, are generally considered to be unsightly. A reduction in the demand for virgin materials such as stone may prevent new mines from being opened, thereby avoiding adverse effect on landscapes. Reduced felling of trees may also enhance landscapes.

[150] Zero Waste Scotland, Scottish Material Flow Accounts Model: Update with 2018 data (published 2023)

Reduction in disposal via landfill

SEA Impact: +

Landfill sites are generally considered to be unsightly, both in terms of the sites themselves and in the birds and rodents that are attracted to the sites. A reduction in the construction of new landfill sites will therefore avoid adverse effects on landscapes and visual impacts.

Reduction in disposal via incineration

SEA Impact: +

The generation of smoke from incineration plants is an eye sore, in addition to the plants themselves. A reduction in the construction of new incineration sites, or a reduction in the volume of material disposed via incineration should reduce these impacts.

Increased resource use from storage of materials, components, soils, stones, etc

SEA Impact: -/?

Material that is taken offsite to be reused will need to be stored. In the case of soils and stones, the storage of these items may require large sites that could have an adverse impact on landscapes. This should be considered in future environmental assessments of such facilities. Assuming alignment with Policy 12 of the National Planning Framework (NPF4), these impacts will be minimal.

4.3.10 Cultural heritage

SEA assessment questions for cultural heritage:

- Will the plan avoid adverse impacts on the historic environment including its setting?
- Will the plan protect and enhance valued landscapes, historic and archaeological sites and other culturally and historically important features, landscapes and their settings?
- Will the plan encourage the retention, reuse and repair of historic environment assets and materials?

The interventions in this package that focus on reuse of components should encourage the retention, reuse and repair of historic environment important features. Additionally, the interventions in this package may help to protect and enhance valued landscapes. However, future environmental assessments should consider possible adverse impacts to valued landscapes as a result of any new facilities required for storage of materials taken off-site for reuse.

Reduced production of new components.

SEA Impact: +

A focus on maintaining existing building components and materials should preserve buildings with historical significance, reducing adverse impacts to their character compared to using new components or materials.

5 Modernise recycling

5.1 Improve recycling from households

5.1.1 Package outcomes

Likely decrease in demand for virgin materials

The measures in this package are aimed at increasing the quality and quantity of material collected from households for recycling. If successful, this will increase the amount of secondary materials produced from recycling. These secondary materials will likely fulfil some of the demand for virgin materials, although the exact amount will depend on market responses.

Likely decrease in disposal of materials via landfill or incineration

Increases in the proportion of household waste captured for recycling will result in a decrease in the amount of recyclable materials in the residual waste stream, e.g. plastics, glass, paper, aluminium.

In 2021-23, just over half of what we threw away at the kerbside could have been recycled through existing systems.

Improved householder engagement and awareness alongside possible future financial incentives is expected to divert additional material away from landfill and incineration to be recycled instead.

Likely decrease in litter and flytipping

A co-designed, consistent, and widely accessible recycling service may reduce the likelihood of litter and flytipping.

Increase in material reprocessing

The production of secondary materials will require resources both in the form of energy and materials. All of the interventions in this package are targeted towards increasing recycling, which will have resultant implications on resources used at material recovery facilities.

Increased stakeholder engagement

Co-design of collection services with input from local communities and neighbourhoods will bring to light unique local circumstances and challenges faced in different settings and geographies, for example, businesses located in historic

areas. This ought to ensure that services are fit for purpose and lead to improved stakeholder satisfaction.

5.1.2 Biodiversity, flora, and fauna

SEA Assessment questions for biodiversity, flora, and fauna:

- Will the plan avoid adverse impacts to habitats and species?
- Will it protect, maintain, and enhance biodiversity?

Overall, the measures within this package should avoid adverse impacts to habitats and species through a reduction in habitat disruption mainly from the reduction in production of virgin materials and a reduction in pollution through a reduction in disposal. Any negative impacts from this package are likely to come from the increased resource use from the processing of recyclate; however, this is more than likely to be offset by the beneficial outcomes (such as those mentioned above).

Package outcomes relevant to biodiversity, flora, and fauna and their likely impacts are discussed below.

Decrease in demand for virgin materials

SEA Impact: +/?

The extraction of virgin materials may have negative impacts on biodiversity due to increased pollution or disruption / destruction of habitats.

A reduction in extraction of virgin materials is likely to lead to lower impacts on habitats and species in regions where materials are extracted and processed. However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced, and consequently reduce risks to habitats and species.

Decrease in disposal of material via landfill

SEA Impact: +

Habitats in and around bodies of water such as streams, ponds, lakes, and surrounding soils nearby to landfill sites can become polluted by leachate. A reduction in levels of waste disposal in landfill will lead to lower impacts on habitats and their resident species at a local level.

Landfilling materials, in particular organic matter, can be a major emitter of GHG emissions. Lower levels of landfill gas production, (methane in particular) will reduce the contribution to climate change and indirectly lessen impacts on species and habitats. At a global level, these impacts are not likely to be significant.

The reduced impact on landfill capacity will lessen the longer term requirement for the creation of new landfill sites and the corresponding clearance of wild areas. This

in turn will reduce the number of habitats being lost or degraded to create new landfill sites.

Decrease in disposal of material by incineration

SEA Impact: +

Incineration of waste is a source of GHG emissions and air pollutants.

Reduced emissions from energy from waste facilities will lower the resultant contribution to climate change and indirectly lessen impacts on species and habitats. At a global level, these impacts are not likely to be significant.

Reduced levels of litter and flytipping

SEA Impact: +

Littered and fly-tipped items can pose threats to local wildlife and biodiversity. Pollution e.g. microplastics and chemicals can threaten habitats and harm species if ingested. Some species may also be at risk of entanglement from littered items.

70% of respondents of the 2021 Keep Scotland Beautiful Scottish Litter Survey believe that litter is a problem locally, and 88% believe that it is a problem nationally[151]. Respondents' top concern was the damage it might do to the natural environment and animals.

A reduction in litter and flytipping will reduce the risk of pollution and ecotoxicity in habitats and soils, as well as limiting the risks to wildlife from ingestion or entanglement.

Increased resource use from processing of recyclate

SEA Impact: -/?

Recycling processes require additional energy and other inputs, the production of which may have biodiversity impacts. This may offset, to some extent, the overall reduction in impacts anticipated by the reduced demand for virgin materials.

Adverse impacts caused by the creation of new recycling facilities should be considered in future environmental assessments of the new site, along with any mitigation measures.

[151] Keep Scotland Beautiful, Scottish Litter Survey (published 2021)

5.1.3 Population and Human Health

SEA Assessment questions for population and human health:

- Will the plan reduce the health gap and inequalities and improve healthy life expectancy?
- Will it protect and improve human health and wellbeing through improving the quality of the living environment of people and communities?
- Will it increase sustainable access to essential services, employment, and the natural and historic environment?

This package will help to improve health outcomes, wellbeing, and should lead to a rise in sustainable employment. The reduction in disposal via both landfill and incineration will help to reduce negative impacts to wellbeing such as odour and noise and will reduce negative health impacts through lower air pollution.

Package outcomes relevant to population and human health and their likely impacts are discussed below.

Decrease in demand for virgin materials

SEA Impact: +/?

In 2020, 39,000 people were employed in the agriculture, fishing, and forestry industry in Scotland (1.5% of all people aged 16+ in employment), and 62,900 were employed in the mining and quarrying industry (2.4%)[152].

There may be impacts on employment in material extraction as a result of a reduced demand for virgin materials.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced.

It is likely than any negative impacts on employment in virgin material extraction industries will be offset by increased opportunities for green jobs e.g., recycling facilities - aligning with the Just Transition: it is estimated that up to 60,000 new jobs could be created by implementing circular strategies in Scotland[153]

Decrease in disposal of material via landfill

SEA Impact: +

Nuisance caused by landfill sites on a local level is likely to be in the form of odour, noise, increased traffic, and vermin. Landfills can result in community impact throughout their life cycle. During the operational phase, when wastes are deposited, communities can be negatively impacted by nuisance issues such as odour, dust,

[152] Scottish Government, Scotland's Labour Market: People, Places and Regions – background tables and charts 2020/21 (published 2022)
[153] Circle Economy, The Circularity Gap Report: Scotland (published 2022)

noise and vermin. Odour is a significant environmental cause of public complaints of people living near waste treatment facilities and negatively affects quality of life and wellbeing. Odour can be a cause of stress and anxiety, even when the substances causing the odours are not harmful to health at the levels detected at waste treatment locations. Landfills, and specifically landfill odour, account for a significant proportion of public environmental event complaints made to SEPA. In extreme cases, where sites are poorly operated, or have specific gas management issues to address, this has resulted in several hundred public complaints in a single day. Three operational landfills are currently classified by SEPA as sites of ongoing community impact. In 2021, these sites alone accounted for 987 substantiated complaints to SEPA.[154]

If lower volumes of waste are destined for landfill due to the measures proposed in the Route Map, a reduced negative impact on the wellbeing of nearby residents is likely.

Decrease in disposal of material by incineration

SEA Impact: +/?

Pollution from EfW plants may have a negative impact on the health and wellbeing of nearby residents, and there is scope for further research into potential negative mental and psychological impacts of living close to an incinerator.[155] Measures targeted at reducing residual waste destined for incineration may therefore have a positive impact on nearby residents.

However, the risk to human health associated with newer incinerators operated within the current regulations, which are based on a precautionary approach, is likely to be minimal and very difficult to detect[156]. Therefore, health impacts of a reduction in waste incinerated are expected to be minor.

Reduced levels of litter and flytipping

SEA Impact: +

There are limited studies on the health impacts of litter, with most studies associating high incidences of litter as contributory effects to adverse mental health impacts, particularly anxiety and depression[157]

[154] Information provided through direct correspondence with SEPA (September 2023)

[155] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

[156] Health Protection Scotland, Incineration of Waste and Reported Human Health Effects (published 2009)

[157] Scottish Government, National litter and fly-tipping consultation: strategic environmental assessment (published 2021)

Improved wellbeing and subsequent mental health benefits are therefore likely if a reduction in litter is achieved.

Increase in recycling

SEA Impact: +

An improved recycling service for householders will have a positive impact on the wellbeing of the population: they will feel empowered to do the right thing with their waste, and will have access to convenient and consistent waste collection infrastructure.

5.1.4 Soil

SEA Assessment questions for soil:

- Will the plan safeguard and improve soil quality, quantity and function in Scotland, particularly high value agricultural land and carbon-rich soils?

Overall, this package should help to safeguard soil quality in Scotland through a reduction in soil pollution from landfill sites and a reduction in virgin material production (particularly biomass, including agriculture). There may be some negative impacts on soils from the increase in the processing of recyclate, however, assuming alignment with Policy 12 of NPF4, these impacts should be considered minimal.

Package outcomes relevant to soil and their likely impacts are discussed below.

Decrease in demand for virgin materials

SEA Impact: +/?

Extraction of virgin materials often has significant land use requirements and processes may be disruptive to soils in the area. There is a risk of material and chemical pollution resulting from these processes e.g. fertilisers and pesticides associated with timber production may pollute nearby soils, reducing soil quality on a local scale.

A reduction in virgin material extraction will lead to a reduction in the levels of associated soil disruption. There may also be a decrease in the level of pollutants produced from virgin material extraction which could negatively impact the quality of nearby soils.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced in Scotland.

Decrease in disposal of material via landfill

SEA Impact: +

Leachate from landfill sites can contaminate soils in the surrounding area. A reduction in volumes of material disposed of via landfill will lessen the impact on soil quality in the long term.

A reduced impact on landfill capacity will lessen or delay the longer term requirement for the creation of new sites, thus avoiding an increase in areas of soil vulnerable to material pollution and leachate from landfill sites.

Decrease in disposal of material by incineration

SEA Impact: +

Soils near incinerators may become polluted, and any negative impacts on soils may be reduced as a result of a decrease in waste sent to incinerators or energy from waste facilities.

Reduced levels of litter and flytipping

SEA Impact: +

Material pollution e.g. littered plastic packaging and potential toxicity risks from fly-tipped items e.g. large electrical appliances are likely to have a negative impact on local soil quality.

Risks of adverse impacts on soil quality will therefore be reduced if a reduction in litter and flytipping is achieved.

Increased resource use from processing of recyclate

SEA Impact: -/?

Pollution from recycling facilities into nearby soils is possible. Adverse impacts caused by the creation of new recycling facilities should be considered in future environmental assessments of the new site, along with any mitigation measures. Assuming alignment with Policy 12 of the National Planning Framework (NPF4), these impacts will be minimal.

5.1.5 Water

SEA Assessment questions for water:

- Will the plan ensure the sustainable use of water resources?
- Will it help to reduce levels of water pollution?

This package is likely to ensure the sustainable use of water resources through a reduction in the demand for virgin materials, including fossil fuels; however, an increase in recycling will offset this to an extent. The package will help to reduce levels of water pollution through a reduction in the demand for virgin materials and a reduction in landfilled material, which will in turn reduce the chance of water pollution and contamination from leachate. Again, however, care should be taken that the increased levels of recycling will not lead to an increase in water pollution. These potential impacts should be considered in future environmental assessments of recycling facilities; assuming alignment with Policy 12 of NPF, impacts on water will be minimal.

Package outcomes relevant to water and their likely impacts are discussed below.

Decrease in demand for virgin materials

SEA Impact: +/?

There is a risk of water pollution on a local scale due to virgin material extraction processes. For example, Scotland produces approximately 7.5Mt of wood per annum[158]. Fertilisers and pesticides associated with timber production may leak into nearby bodies of water.

A reduction in extraction of virgin materials is therefore likely to lead to a decrease in the level of pollutants produced from extraction processes which could negatively impact the quality of nearby bodies of water. There will also be a reduction in any water use associated with extraction processes.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced.

Decrease in disposal of material via landfill

SEA Impact: +

Leachate from landfill sites can pollute nearby bodies of water. A reduction in volumes of material disposed of via landfill will lessen the impact on water quality in the long term. A reduced impact on landfill capacity will lessen or delay the longer term requirement for the creation of new sites, thus avoiding an increase in the bodies of water vulnerable to material pollution and leachate from landfill sites.

[158] Zero Waste Scotland, Scottish Material Flow Accounts Model: Update with 2018 data (published 2023)

Decrease in disposal of material by incineration

SEA Impact:+

Some energy from waste processes will require water, and so a reduction in residual waste processed at these plants will result in a decrease in resultant water use. Any pollution impacts on nearby bodies of water will also decrease, though effects are not expected to be significant.

Reduced levels of litter and flytipping

SEA Impact: +

Levels of marine and freshwater toxicity may be increased as a result of nearby flytipping.

A reduction in litter and flytipping will result in lower levels of material pollution as well as marine and freshwater toxicity, thus improving the quality of bodies of water in Scotland.

Increased resource use from processing of recyclate

SEA Impact: -/?

Some recycling processes require water, so an increase in recycling is likely to increase associated water use.

However, the use of secondary materials is likely to reduce water use associated with virgin material production, assuming the outputs of recycling activity offset or delay the need for virgin materials.

Adverse impacts caused by the creation of new recycling facilities should be considered in future environmental assessments of the new site, along with any mitigation measures. Assuming alignment with Policy 12 of the National Planning Framework (NPF4), these impacts will be minimal.

5.1.6 Air

SEA Assessment questions for air:

- Will the plan avoid adverse impacts to air quality?
- Will it reduce emissions of key pollutants and improve air quality throughout Scotland?
- Will it reduce levels of nuisance e.g. noise, vibration, dust, odour, and light?

The interventions in this package should avoid adverse impacts to air quality. The reduction of virgin material production and of disposal (via landfill and incineration)

caused by increased recycling should help to reduce the emissions of key pollutants, and reduce levels of nuisance. Recycling processes will themselves be responsible for some air pollution, though assuming alignment with Policy 12 of NPF4, these impacts should be minimal.

Package outcomes relevant to air and their likely impacts are discussed below.

Decrease in demand for virgin materials

SEA Impact: +/?

Material extraction processes and the associated transport and energy use are likely to emit airborne pollutants. The scale and nature of these emissions will depend on the material in question.

A reduction in extraction of virgin materials is therefore likely to result in a reduction in associated airborne pollutants, thus improving air quality on a local scale. There will also be a decrease in the level of noise and nuisance associated with virgin material extraction.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced.

Decrease in disposal of material via landfill

SEA Impact: +

Several air pollutants are associated with landfill gas production. A reduction in waste disposed of via landfill is likely to have a positive impact on air quality. Odour levels will also be reduced if the requirement for additional landfill sites is lessened or delayed from a decrease in residual waste arisings.

Decrease in disposal of material by incineration

SEA Impact: +

Incineration of waste is linked to air and noise pollution on a local scale, though with current stringent emissions standards, the evidence is that the air quality impacts are likely to be small[159]. A reduction in volumes of waste disposed of by incineration or energy from waste is likely to have a minor positive impact on air quality.

[159] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

Increased resource use from processing of recyclate

SEA Impact: -/?

Some recycling processes may contribute to air pollution, though the use of the secondary materials will likely reduce air pollution at the aggregate, assuming the outputs from recycling offset or delay the need for virgin materials.

Adverse impacts caused by the creation of new recycling facilities should be considered in future environmental assessments of the new site, along with any mitigation measures. Assuming alignment with Policy 12 of the National Planning Framework (NPF4), these impacts will be minimal.

5.1.7 Climatic factors

SEA Assessment questions for climatic factors:

- Will the plan help to reduce existing and avoid new Greenhouse Gas (GHG) emissions?

The interventions in this package should help to avoid new GHG emissions. The carbon impacts of waste in Scotland are well established, with significant emissions arising from disposal, as well as from the increased extraction of materials needed to produce new goods and materials. A focus on an increase in recycling should help to avoid these emissions. However, the processing of recyclate will require resources and cause emissions which may offset some of these reductions; this should be considered in future environmental assessments of (new) recycling facilities; assuming alignment with Policy 12 of NPF 4, impacts on GHG emissions should be minimal.

Package outcomes relevant to climatic factors and their likely impacts are discussed below.

Decrease in demand for virgin materials

SEA Impact: +/?

The extraction and production of virgin materials releases significant amounts of GHG: for Scottish household waste, 5.97Mt of CO2e was emitted during the production and manufacturing phase of materials and goods in 2020[160].

The reduction in the demand for virgin materials should therefore avoid new GHG emissions. The extent of the reduction will depend on the material, as well as the substitution rate of secondary materials for virgin materials (i.e., does the production of 1 kg of secondary steel reduce the demand for virgin steel by 1kg?). A substitution rate less than one will offset some of the gains of virgin material reduction, but overall GHG emissions, and subsequent impacts on the climate, will be reduced.

[160] Zero Waste Scotland, The Carbon Footprint of Scotland's Household Waste (published 2023)

Decrease in disposal of material via landfill

SEA Impact: +

The landfill of waste, in particular organic matter, can be a major emitter of GHG emissions; in 2021, the landfill of household waste accounted for just under 250kt of CO_2e of GHG emissions[161]. By reducing the amount of waste requiring landfill, GHG emissions from landfill sites should also reduce.

Decrease in disposal of material by incineration

SEA Impact: +

The IPCC estimates that every tonne of waste incinerated releases 0.7-1.2 tCO2e[162] [163], and Zero Waste Scotland's Carbon Metric calculated the emissions from the incineration of household waste in Scotland to be approximately 180ktCO_2e in 2021[164]. This figure includes the emissions avoided as a result of energy recovery during incineration. As energy switches to renewable or lower carbon sources, the benefits of energy from waste will fall. Overall, a reduction in the incineration of waste will avoid new GHG emissions from the incineration process, and these benefits are likely to be greater over time.

Increased resource use from processing of recyclate

SEA Impact: -/?

The processing of recyclate into secondary materials requires energy and material resources, both of which will result in GHG emissions. However, the use of secondary materials will likely reduce emissions at the aggregate, assuming these offset or delay the need for virgin materials.

Adverse impacts caused by the creation of new recycling facilities should be considered in future environmental assessments of the new site, along with any mitigation measures. Assuming alignment with Policy 12 of NPF 4, impacts on GHG emissions should be minimal.

[161] Zero Waste Scotland, The Carbon Footprint of Scotland's Household Waste (published 2023)
[162] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)
[163] IPCC, Emissions From Waste Incineration
[164] Zero Waste Scotland, The Carbon Footprint of Scotland's Household Waste (published 2023)

5.1.8 Material Assets

SEA Assessment questions for material assets:

- Will it reduce use and promote sustainable management of natural resources?
- Will it reduce 'leakage' of material to landfill or energy recovery or as litter?

These interventions should help to reduce the extraction of natural resources and reduce the amount of material disposed. A focus on diversion from disposal to recycling should help to reduce the pressure on natural resources, assuming that these recycled materials can offset the production of virgin materials. An increase in recycling will require resources, and this should be considered in future environmental assessments of (new) recycling facilities, along with any mitigation.

Package outcomes relevant to material assets and their likely impacts are discussed below.

Decrease in demand for virgin materials

SEA Impact: +/?

Virgin material extraction depletes non-renewable stocks of natural resources. The reduction in the production of virgin materials will reduce extraction rates of raw materials. Additionally, if less material is ultimately extracted, less material will require disposal.

In a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a global decline in the amount of resources extracted/produced.

Decrease in disposal of material via landfill

SEA Impact: +

Increased diversion of material away from the residual waste stream will result in less material leakage to landfill, enabling materials to be kept in use for as long as possible.

Decrease in disposal of material by incineration

SEA Impact: +

Incineration and energy from waste plants require resources for construction and to continue to run. A reduction in the amount of material incinerated will reduce the requirement for any new incineration plants, which would require construction and other materials. Increased diversion of material away from the residual waste stream will result in less material leakage to energy recovery or landfill, enabling materials to be kept in use for as long as possible.

Reduced levels of litter and flytipping

SEA Impact: +

Material that is littered or fly-tipped is a wasted resource. If the material can be recycled or reused, then a reduction in the amount of littered and fly-tipped material will help to reduce pressures on natural resource consumption. If some of the material is ultimately landfilled or incinerated, the impacts on material assets will be limited.

Increased resource use from processing of recyclate.

SEA Impact: -/?

The processing of recyclate into secondary materials requires energy and may require some virgin materials as input. The use of secondary materials will likely reduce material consumption at the aggregate, however, assuming these offset or delay the need for virgin materials.

5.1.9 Landscape and visual impacts

SEA Assessment questions for landscape and visual impacts:

- Will the plan avoid adverse effects on landscapes and visual impacts?
- Will it safeguard and enhance the character and diversity of the Scottish landscape and areas of valuable landscape and geodiversity?

Package outcomes relevant to landscape and visual impacts and their likely impacts are discussed in below.

The interventions in this package should help to avoid adverse effects on landscapes and safeguard the character and diversity of the Scottish landscape. The focus on the diversion of waste from landfill to recycling should help to reduce the need for new landfill sites and extraction of virgin materials which can be replaced by secondary outputs from recycling. New recycling facilities may be required to deal with increased supply of recyclate; however, assuming alignment with Policy 12 of the National Planning Framework (NPF4), any adverse impacts caused by these new facilities will be minimal.

Decrease in demand for virgin materials

SEA Impact: +/?

Virgin material extraction activity, such as tree felling, can negatively impact Scottish landscapes, resulting in losses of natural character and diversity. For example,

Scotland produces approximately 7.5Mt of wood annually[165]. Reduced felling of trees as a result of improved paper and card recycling rates may enhance landscapes.

In a global context, it is unknown whether the fall in demand for virgin materials as a result of this package will cause a global decline in the amount of resources extracted/produced.

Decrease in disposal of material via landfill and incineration

SEA Impact: +

Landfill and energy from waste sites are generally considered to be unsightly, both in terms of the sites themselves and in the birds and rodents that may be attracted. A reduction in the construction of new landfill and EfW sites will therefore avoid adverse effects on landscapes and visual impacts.

Reduced levels of litter and flytipping

SEA Impact: +

Littering and flytipping are generally considered an eye sore and can detract from landscapes and areas of natural beauty as well as towns and cities. 70% of respondents of the 2021 Keep Scotland Beautiful Scottish Litter Survey[166] believe that litter is a problem locally, and 88% believe that it is a problem nationally.

A reduction in litter and flytipping is likely to reduce negative visual impacts and safeguard or improve the appearance of Scotland's landscapes.

Increased resource use from processing of recyclate

SEA Impact: -/?

Recycling facilities are an industrial waste management activity and would thus have adverse impacts on landscape. If new recycling facilities are required, then these have the potential to harm visual impacts depending on where they are located. Assuming alignment with Policy 12 of the National Planning Framework (NPF4), these impacts will be minimal.

5.1.10 Cultural heritage

SEA assessment questions for cultural heritage:

- Will the plan avoid adverse impacts on the historic environment including its setting?

[165] Zero Waste Scotland, The Carbon Footprint of Scotland's Household Waste (published 2023)
[166] Keep Scotland Beautiful, Scottish Litter Survey (published 2021)

- Will the plan protect and enhance valued landscapes, historic and archaeological sites and other culturally and historically important features, landscapes and their settings?
- Will the plan encourage the retention, reuse and repair of historic environment assets and materials?

Adverse impacts on valued cultural and historical may be avoided through increased stakeholder engagement and standardised services. Together, this may minimise the disruption of waste and recycling collection and reduce the likelihood of bin overflow.

Increased stakeholder engagement

SEA Impact: +/?

Co-designed services may allow stakeholders in areas of cultural heritage to ensure services minimise the impact on their setting, in particular through local community and neighbourhood involvement to gain insight into unique local circumstances. This may include, for example, standardised collections and appropriate capacities or collection frequencies to reduce traffic or risk of bin overflow.

5.2 Improve recycling from commercial businesses

5.2.1 Package Outcomes

Decrease in demand for virgin materials

Various measures in this package are aimed at increasing the reuse of items and materials and recycling rates of commercial waste. If successful, this will help to prevent the need for new products and increase the amount of secondary materials produced. These will likely fulfil some of the demand for virgin materials, although the exact amount will depend on market responses.

The repair of reused products and the production of secondary materials will require resources both in the form energy and materials.

Decrease in litter and flytipping

A co-designed, consistent, and widely accessible recycling service may reduce the likelihood of litter and flytipping.

Reduction in distance driven by waste collection vehicles

Co-designed measures may support optimisation and efficiency of waste collection activities, leading to fewer km driven by waste collection vehicles, and ultimately less traffic, less fossil fuel consumption, and less tail-pipe emissions from vehicles.

Increased stakeholder engagement

Co-design of collection services with input from local communities and neighbourhoods will bring to light unique local circumstances and challenges faced in different settings and geographies, for example, businesses located in historic areas. This ought to ensure that services are fit for purpose and lead to improved stakeholder satisfaction.

Decrease in materials disposed of by landfill and incineration

Increasing the amount of waste that is recycled should reduce the amount of material disposed of via landfill or incineration.

5.2.2 Biodiversity, flora, and fauna

SEA Assessment questions for biodiversity, flora, and fauna:

- Will the plan avoid adverse impacts to habitats and species?
- Will it protect, maintain, and enhance biodiversity?

Overall, the measures within this package should avoid adverse impacts to habitats and species through a reduction in habitat disruption from the reduction in production of virgin materials, and a reduction in pollution through a reduction in disposal and litter. Any negative impacts from this package are likely to come from the increased resource use from the processing of recyclate and from repair and maintenance; however, this is more than likely to be offset by the beneficial outcomes (such as those mentioned above).

Package outcomes relevant to biodiversity, flora, and fauna and their likely impacts are discussed below.

Reduced production of virgin materials.

SEA Impact: +/?

The extraction of virgin materials may have negative impacts on biodiversity due to increased pollution or disruption / destruction of habitats.

A reduction in extraction of virgin materials is likely to lead to lower impacts on habitats and species in regions where materials are extracted and processed. However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced, and consequently reduce risks to habitats and species.

Reduction in disposal via landfill.

SEA Impact: +

Habitats in and around bodies of water such as streams, ponds, lakes, and surrounding soils nearby to landfill sites can become polluted by leachate. A reduction in levels of waste disposal in landfill will lead to lower impacts on habitats and their resident species at a local level.

Landfilling materials, in particular organic matter, can be a major emitter of GHG emissions. Lower levels of landfill gas production, (methane in particular) will reduce the contribution to climate change and indirectly lessen impacts on species and habitats.

The reduced impact on landfill capacity will lessen the longer term requirement for the creation of new landfill sites and the corresponding clearance of wild areas. This in turn will reduce the number of habitats being lost or degraded to create new landfill sites.

Reduction in disposal via incineration

SEA Impact: +

Incineration of waste is a source of GHG emissions and air pollutants.

Reduced emissions from energy from waste facilities will lower the resultant contribution to climate change and indirectly lessen impacts on species and habitats.

Reduced manufacturing of new products and components

SEA Impact: +/?

The processes required to transform raw materials into finished components may have negative impacts on habitats and species. Since some of these processes will be avoided, there may be benefits to biodiversity, flora, and fauna.

Increased resource use from repair and maintenance activities

SEA Impact: ?

The repair and maintenance of products, components, and materials may produce pollutants that affect biodiversity. It is unknown at this stage if there would be significant impacts on biodiversity.

Reduced litter and flytipping

SEA Impact: +

Littered and fly-tipped items can pose threats to local wildlife and biodiversity. Pollution e.g. microplastics and chemicals can threaten habitats and harm species if ingested. Some species may also be at risk of entanglement from littered items.

70% of respondents of the 2021 Keep Scotland Beautiful Scottish Litter Survey believe that litter is a problem locally, and 88% believe that it is a problem nationally. Respondents' top concern was the damage it might do to the natural environment and animals.

A reduction in litter and flytipping will reduce the risk of pollution and ecotoxicity in habitats and soils, as well as limiting the risks to wildlife from ingestion or entanglement.

Increased resource use from processing of recyclate.

SEA Impact: -/?

Recycling processes require additional energy and other inputs, the production of which may have biodiversity impacts. This may offset, to some extent, the overall reduction in impacts anticipated by the reduced demand for virgin materials., e.g., reduced tree felling to produce packaging paper and cardboard.

Reduction in traffic

SEA Impact: +

Pollution from road traffic (in particular the effects described under environmental topics "Soil" and "Water") is likely to have a negative impact on nearby habitats and species. Air pollution is also harmful to sensitive habitats and the wildlife.167

A reduction in road traffic is likely to limit these negative impacts on local biodiversity through reduced degradation of habitats. Fewer vehicles on the road will also reduce the risk of wildlife being injured or killed on the roads.

Decrease in the demand for fossil fuels

SEA Impact: +/?

Reduced fossil fuel extraction will result in a lower impact on nearby habitats and biodiversity; however, the extent of this reduction is likely to be small and would

[167] Scottish Government, Cleaner Air for Scotland 2 - Towards a Better Place for Everyone (published 2021)

ultimately depend on global markets. Further adverse impacts on biodiversity may be avoided indirectly through a lower contribution to climate change.

5.2.3 Population and human health

SEA Assessment questions for population and human health:

- Will the plan reduce the health gap and inequalities and improve healthy life expectancy?
- Will it protect and improve human health and wellbeing through improving the quality of the living environment of people and communities?
- Will it increase sustainable access to essential services, employment, and the natural and historic environment?

This package will help to improve health outcomes, wellbeing, and should lead to a rise in sustainable employment. The reduction in disposal via both landfill and incineration will help to reduce negative impacts to wellbeing such as odour and noise and will reduce negative health impacts through lower air pollution. There may be an impact on manufacturing jobs if reuse and repair reduce demand for new products, however this may be offset by jobs relating to repair and maintenance.

Package outcomes relevant to population and human health and their likely impacts are discussed below.

Reduced production of virgin materials.

SEA Impact: +/?

In 2020, 39,000 people were employed in the agriculture, fishing, and forestry industry in Scotland (1.5% of all people aged 16+ in employment), and 62,900 were employed in the mining and quarrying industry (2.4%).

There may be impacts on employment in material extraction as a result of a reduced demand for virgin materials.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced.

It is likely than any negative impacts on employment in virgin material extraction industries will be offset by increased opportunities for green jobs e.g. recycling facilities - aligning with the Just Transition: it is estimated that up to 60,000 new jobs could be created by implementing circular strategies in Scotland168

Reduction in disposal via landfill.

SEA Impact: +

[168] Circle Economy, The Circularity Gap Report: Scotland (published 2022)

Nuisance caused by landfill sites on a local level is likely to be in the form of odour, noise, increased traffic, and vermin.

Landfills can result in community impact throughout their life cycle. During the operational phase, when wastes are deposited, communities can be negatively impacted by nuisance issues such as odour, dust, noise and vermin. Odour is a significant environmental cause of public complaints of people living near waste treatment facilities and negatively affects quality of life and wellbeing. Odour can be a cause of stress and anxiety, even when the substances causing the odours are not harmful to health at the levels detected at waste treatment locations. Landfills, and specifically landfill odour, account for a significant proportion of public environmental event complaints made to SEPA. In extreme cases, where sites are poorly operated, or have specific gas management issues to address, this has resulted in several hundred public complaints in a single day. Three operational landfills are currently classified by SEPA as sites of ongoing community impact. In 2021, these sites alone accounted for 987 substantiated complaints to SEPA.169

If lower volumes of waste are destined for landfill due to the measures proposed in the Route Map, a reduced negative impact on the wellbeing of nearby residents is likely.

Reduction in disposal via incineration

SEA Impact: +/?

Pollution from EfW plants may have a negative impact on the health and wellbeing of nearby residents, and there is scope for further research into potential negative mental and psychological impacts of living close to an incinerator.[170]. Measures targeted at reducing residual waste destined for incineration may therefore have a positive impact on nearby residents.

However, the risk to human health associated with newer incinerators operated within the current regulations, which are based on a precautionary approach, is likely to be minimal and very difficult to detect[171]. Therefore, health impacts of a reduction in waste incinerated are expected to be minor.

Reduced manufacturing of new products and components

[169] Information provided through direct correspondence with SEPA (September 2023)

[170] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

[171] Health Protection Scotland, Incineration of Waste and Reported Human Health Effects (published 2009)

SEA Impact: ?

In 2020, 182,100 people were employed in the manufacturing industry in Scotland (7.0% of all people aged 16+ in employment)[172].

There may be impacts on employment in product manufacturing sector, combined with increased opportunities for green jobs e.g. Re-manufacture, repair etc. - aligning with the Just Transition to green jobs. The Circularity Gap Report estimates that 60,000 new jobs could be created by implementing circular strategies in Scotland[173]

Reduced litter and flytipping

SEA Impact: +

There are limited studies on the health impacts of litter, with most studies associating high incidences of litter as contributory effects to adverse mental health impacts, particularly anxiety and depression.

Improved wellbeing and subsequent mental health benefits are therefore likely if a reduction in litter is achieved.

Reduction in traffic

SEA Impact: +

Road traffic contributes to air pollution, as discussed under the environmental topic "Air". Exposure to air pollution is harmful to people's health in terms of premature mortality and morbidity, mainly related to respiratory and cardiovascular disease. It is widely accepted that outdoor air pollution causes damage to human health across a wide range of conditions, from pre-birth to old age. Road traffic is also a major source of ambient noise174.

High levels of air pollution increase the risk of common diseases (for example asthma, respiratory and heart disease), especially in people who are more vulnerable due to age (the very young and the elderly) or existing health conditions.

A reduction in road traffic and congestion will result in local improvements to air quality due to reduced emissions of nitrogen oxides and particulate matter, and a subsequent decrease in the risk to local residents.

[172] Scottish Government, Scotland's Labour Market: People, Places and Regions – background tables and charts 2020/21 (published 2022)

[173] Circle Economy, The Circularity Gap Report: Scotland (published 2022)

[174] Scottish Government, Cleaner Air for Scotland 2 - Towards a Better Place for Everyone (published 2021)

5.2.4 Soil

SEA Assessment questions for soil:

- Will the plan safeguard and improve soil quality, quantity and function in Scotland, particularly high value agricultural land and carbon-rich soils?

Overall, this package should help to safeguard soil quality in Scotland through a reduction in soil pollution from landfill sites and a reduction in virgin material production (particularly biomass, including agriculture). There may be some negative impacts on soils from the increase in the processing of recyclate and repair and maintenance, however, assuming alignment with Policy 12 of NPF4, these impacts should be minimal.

Package outcomes relevant to soil and their likely impacts are discussed below.

Reduced production of virgin materials

SEA Impact: +/?

Extraction of virgin materials often has significant land use requirements and processes may be disruptive to soils in the area. There is a risk of material and chemical pollution resulting from these processes e.g. fertilisers and pesticides associated with timber production may pollute nearby soils, reducing soil quality on a local scale.

A reduction in virgin material extraction will lead to a reduction in the levels of associated soil disruption. There may also be a decrease in the level of pollutants produced from virgin material extraction which could negatively impact the quality of nearby soils.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced in Scotland.

Reduction in disposal via landfill

SEA Impact: +

Leachate from landfill sites can contaminate soils in the surrounding area. A reduction in volumes of material disposed of via landfill will lessen the impact on soil quality in the long term. A reduced impact on landfill capacity will lessen or delay the longer term requirement for the creation of new sites, thus avoiding an increase in areas of soil vulnerable to material pollution and leachate from landfill sites.

Reduction in disposal via incineration

SEA Impact: +

Soils near incinerators may become polluted and any negative impacts on soils will be reduced as a result of a decrease in waste sent to incinerators or energy from waste facilities.

Reduced manufacturing of new products and components

SEA Impact: +/?

Pollutants from manufacturing facilities may leak into the surrounding area, resulting in a risk of soil degradation on a local scale.

There may be a decrease in the level of pollutants produced from manufacturing plants which in turn could improve the quality of nearby soils.

Increased resource use from repair and maintenance activities

SEA Impact: ?

The repair and maintenance of products, components, and materials may produce pollutants that affect soils. It is unknown at this stage if there would be significant impacts on soils.

Reduced litter and flytipping

SEA Impact: +

Material pollution e.g. littered plastic packaging and potential toxicity risks from fly-tipped items e.g. large electrical appliances are likely to have a negative impact on local soil quality.

Risks of adverse impacts on soil quality will therefore be reduced if a reduction in litter and flytipping is achieved.

Increased resource use and pollution from processing of recyclate.

SEA Impact: ?

Pollution from recycling facilities into nearby soils is possible. Assuming alignment with Policy 12 of the National Planning Framework (NPF4), these impacts will be minimal.

Reduction in traffic

SEA Impact: +

Pollutants from road traffic such as microplastic pollution from tyres may have a negative impact on nearby soil quality. A reduction in traffic would result in a reduction in these negative impacts.

5.2.5 Water

SEA Assessment questions for water:

- Will the plan ensure the sustainable use of water resources?
- Will it help to reduce levels of water pollution?

This package is likely to ensure the sustainable use of water resources through a reduction in the demand for virgin materials, including fossil fuels; however, an increase in reuse and maintenance, and an increase in recycling, will offset some of this reduction. The package will help to reduce levels of water pollution thanks to a reduction in the demand for virgin materials and a reduction in landfill, which will in-turn reduce the chance of water pollution and contamination from leachate. Again, however, care should be taken that the increased levels of recycling and maintenance (e.g., washing) will not lead to an increase in water pollution. These potential impacts should be considered in future environmental assessments of new recycling facilities, and suitable mitigation should be described; assuming alignment with Policy 12 of NPF4, these impacts will be minimal.

Package outcomes relevant to water and their likely impacts are discussed below.

Reduced production of virgin materials.

SEA Impact: +/?

There is a risk of water pollution on a local scale due to virgin material extraction processes. For example, Scotland produces approximately 7.5Mt of wood per annum[175]. Fertilisers and pesticides associated with timber production may leak into nearby bodies of water.

A reduction in extraction of virgin materials is therefore likely to lead to a decrease in the level of pollutants produced from extraction processes which could negatively impact the quality of nearby bodies of water. There will also be a reduction in any water use associated with extraction processes.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced in Scotland.

Reduction in disposal via landfill.

[175] Zero Waste Scotland, Scottish Material Flow Accounts Model: Update with 2018 data (published 2023)

SEA Impact: +

Leachate from landfill sites can pollute nearby bodies of water. A reduction in volumes of material disposed of via landfill will lessen the impact on water quality in the long term. A reduced impact on landfill capacity will lessen or delay the longer term requirement for the creation of new sites, thus avoiding an increase in the bodies of water vulnerable to material pollution and leachate from landfill sites.

Reduction in disposal via incineration

SEA Impact: +

Some energy from waste processes will require water, and so a reduction in residual waste processed at these plants will result in a decrease in resultant water use. Any pollution impacts on nearby bodies of water will also decrease.

Reduced manufacturing of new products and components

SEA Impact: +/?

Some manufacturing processes will require large amounts of water. Pollutants from manufacturing facilities may leak into nearby bodies of water, resulting in a risk of increased water pollution.

A reduction in the manufacturing of new products/components will result in a reduction in the water use during the processes involved. There will also be a decrease in the level of pollutants produced from manufacturing plants which could result in an improvement in the quality of nearby bodies of water.

Increased resource use from repair and maintenance activities

SEA Impact: -/?

Maintaining and, in particular, cleaning reusable goods will require water use. An increase in popularity of reusable items may therefore result in an increase in water use.

Reduced litter and flytipping

SEA Impact: +

Levels of marine and freshwater toxicity may be increased as a result of nearby flytipping.

A reduction in litter and flytipping will result in lower levels of material pollution as well as marine and freshwater toxicity, thus improving the quality of bodies of water in Scotland.

Increased resource use and pollution from processing of recyclate.

SEA Impact: -/?

Some recycling processes require water, so an increase in recycling is likely to increase associated water use.

However, the use of secondary materials is likely to reduce water use associated with virgin material production, assuming the outputs of recycling activity offset or delay the need for virgin materials.

Reduction in traffic

SEA Impact: +

Pollutants from tyre and brake wear, exhaust emissions, and oil and fuel deposits can enter the water environment as a result of road traffic. A reduction in traffic may result in a decrease in related damage to the quality of nearby bodies of water.

Decrease in the demand for fossil fuels

SEA Impact: +/?

Water is used in the extraction and processing of fossil fuels. A reduction in the demand for fossil fuels will lead to a decrease in water use in the long term.

Bodies of water surrounding or nearby to sites where fossil fuels are extracted are also at risk of pollution e.g. sustained pollution, oil spills. A reduction in fossil fuel demand will lower the risk of such damage to water bodies. However, the extent of the reduction will depend on global market responses.

5.2.6 Air

SEA Assessment questions for air:

- Will the plan avoid adverse impacts to air quality?
- Will it reduce emissions of key pollutants and improve air quality throughout Scotland?
- Will it reduce levels of nuisance e.g. noise, vibration, dust, odour, and light?

The interventions in this package should avoid adverse impacts to air quality. The reduction of virgin material production and of disposal (via landfill and incineration) caused by increased recycling should help to reduce the emissions of key pollutants

and reduce levels of nuisance. The review of compliance with commercial recycling requirements and any subsequent co-designed measures may also help to reduce air pollution if it leads to a more environmentally efficient commercial waste services. There is potential for the increase in recycling to lead to increased pollution. Any new recycling facilities should be subject to their own environmental assessment; assuming alignment with Policy 12 of NPF4, these impacts should be minimal.

Package outcomes relevant to air and their likely impacts are discussed below.

Reduced production of virgin materials.

SEA Impact: +/?

Material extraction processes and the associated transport and energy use are likely to emit airborne pollutants. The scale and nature of these emissions will depend on the material in question.

A reduction in extraction of virgin materials is therefore likely to result in a reduction in associated airborne pollutants, thus improving air quality on a local scale. There will also be a decrease in the level of noise and nuisance associated with virgin material extraction.

However, in a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced in Scotland.

Reduction in disposal via landfill.

SEA Impact: +

Several air pollutants are associated with landfill gas production. A reduction in waste disposed of via landfill is likely to have a positive impact on air quality. Odour levels will also be reduced if the requirement for additional landfill sites is lessened or delayed from a decrease in residual waste arisings.

Reduction in disposal via incineration

SEA Impact: +/?

Incineration of waste is linked to air and noise pollution on a local scale, though with current stringent emissions standards, the evidence is that the air quality impacts are likely to be small176. A reduction in volumes of waste disposed of by incineration or energy from waste is likely to have a minor positive impact on air quality.

[176] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

Reduced manufacturing of new products and components

SEA Impact: +/?

Manufacturing processes are often responsible for the emission of airborne pollutants. For example, one SEPA regulated industrial site under the category "Paper and wood production and processing" was responsible for 64 tonnes of particulate matter pollution to air above reporting threshold in 2021, 15.2% of the total across all regulated sites[177].

A reduction in the manufacturing of new products/components will result in a reduction in associated airborne pollutants, thus improving air quality on a local scale. There will also be a decrease in the level of noise and nuisance on a local scale surrounding manufacturing plants.

Increased resource use from repair and maintenance activities

SEA Impact: ?

The repair and maintenance of products, components, and materials will require resources, including energy. It is unknown at this stage if there would be significant impacts on air quality.

Increased resource use and pollution from processing of recyclate.

SEA Impact: -/?

Some recycling processes may contribute to air pollution, though the use of the secondary materials will likely reduce air pollution at the aggregate, assuming the outputs from recycling offset or delay the need for virgin materials.

Any new recycling facilities should be subject to their own environmental assessment. Assuming alignment with Policy 12 of NPF4, impacts will be minimal.

Reduction in traffic

SEA Impact: +

Road transport in urban areas is a significant contributor to poor air quality[178] due to emissions of particulate matter and nitrogen oxides in the air. A reduction in road traffic and congestion is likely to have a positive impact on local air quality.

[177] Scottish Environment Protection Agency, 2021 Pollutant emissions and waste transfers from SEPA regulated industrial sites (published 2022)

[178] Scottish Government, Cleaner Air for Scotland 2 - Towards a Better Place for Everyone (published 2021)

Decrease in the demand for fossil fuels

SEA Impact: +/?

Fossil fuels are a significant contributor of airborne pollutants both when they are extracted and when they are burned (as an energy source). A reduction in the demand for fossil fuels should lead to a reduction in air pollution, but the extent of the reduction will depend on global market responses.

5.2.7 Climatic factors

SEA Assessment questions for climatic factors:

- Will the plan help to reduce existing and avoid new Greenhouse Gas (GHG) emissions?

The interventions in this package should help to avoid new GHG emissions. The carbon impacts of waste in Scotland are well established, with significant emissions arising from disposal, as well as from the increased extraction of materials needed to produce new goods and materials. An increase in recycling should help to avoid these emissions. However, the processing of recyclate and the repair and maintenance of products will require resources and cause emissions which may offset some of these reductions; this should be considered in future environmental assessments of (new) recycling and other facilities, along with any mitigation. Assuming alignment with Policy 12 of NPF 4, impacts on GHG emissions should be minimal.

Package outcomes relevant to climatic factors and their likely impacts are discussed below.

Reduced production of virgin materials.

SEA Impact: +/?

The extraction and production of virgin materials releases significant amounts of GHG: for Scottish household waste, 5.97Mt of CO_2e were emitted during the production and manufacturing phase of materials and goods in 2020[179] In 2016, the production and manufacturing of commercial materials and goods that entered the waste stream amounted to 6.69Mt of CO2e[180] The reduction in the demand of virgin materials should therefore avoid new GHG emissions. The extent of the reduction will depend on the material, as well as the substitution rate of secondary materials for virgin materials (i.e., does the production of 1 kg of secondary steel reduce the demand for virgin steel by 1kg.). A substitution rate less than one will offset some of the gains of virgin material reduction, but overall GHG emissions, and subsequent impacts on the climate, will be reduced.

[179] The Carbon Footprint of Scotland's Household Waste (published 2023)
[180] The Carbon Footprint of Scotland's Waste (published 2018)

Reduction in disposal via landfill.

SEA Impact: +

The landfill of waste, in particular organic matter, can be a major emitter of GHG emissions; in 2021, the landfill of household waste accounted for just under 250kt of CO2eq of GHG emissions[181]. The landfill of commercial waste accounted for 378kt of CO_2e in Scotland in 2016[182]. By reducing the amount of waste requiring landfill, GHG emissions from landfill sites should also reduce.

Reduction in disposal via incineration

SEA Impact: +

The IPCC estimates that every tonne of waste incinerated releases 0.7-1.2 tCO_2e[183] [184], and energy from waste contributed 0.3$MtCO_2e$ to Scotland's total greenhouse gas emissions in 2021[185]. As energy switches to renewable or lower carbon sources, the benefits of energy from waste will fall. Overall, a reduction in the incineration of waste will avoid new GHG emissions from the incineration process, and these benefits are likely to be greater over time.

Reduced manufacturing of new products and components

SEA Impact: +/?

The production of new components or products requires energy and resources that will emit GHG. Thus, the reduction in the number of components or products produced will help to avoid new GHG emissions. The amount avoided will be dependent on the products and components in question, as well as the substitution rate of reused products / components for new components.

Increased resource use from repair and maintenance activities

SEA Impact: -/?

Maintaining products to a certain standard may require both energy and new materials and components. There will therefore likely be some additional emissions associated with the resources required to maintain products. Product reuse will likely

[181] The Carbon Footprint of Scotland's Household Waste (published 2023)

[182] The Carbon Footprint of Scotland's Waste (published 2018)

[183] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

[184] IPCC, Emissions From Waste Incineration

[185] Scottish Government, Scottish Greenhouse Gas Statistics 2021 (published 2023)

reduce emissions at the aggregate, however, assuming product reuse offsets or delays the need for new products.

The processing of recyclate into secondary materials requires energy and material resources, both of which will result in GHG emissions. However, the use of secondary materials will likely reduce emissions at the aggregate, assuming these offset or delay the need for virgin materials.

Assuming alignment with Policy 12 of NPF 4, impacts of any new facilities on GHG emissions should be minimal.

Increased resource use and pollution from processing of recyclate.

SEA Impact: -/?

The processing of recyclate into secondary materials requires energy and material resources, both of which will result in GHG emissions. However, the use of secondary materials will likely reduce emissions at the aggregate, assuming these offset or delay the need for virgin materials.

Assuming alignment with Policy 12 of NPF 4, impacts of any new facilities on GHG emissions should be minimal.

Reduction in traffic

SEA Impact: +

Internal combustion engine vehicles (ICEVs) are significant emitters of GHGs in Scotland, with private motoring responsible for 5.3Mt of CO_2e in 2018 [186]. Heavy traffic can lead to an increase in vehicles, including remaining stationary and consequently emitting more GHGs. A reduction in traffic would therefore help to reduce GHG emissions.

Decrease in the demand for fossil fuels

SEA Impact: +/?

Fossil fuels are a significant contributor of GHG emissions both when they are extracted and when they are burned as an energy source. A reduction in the demand for fossil fuels should lead to a reduction both in their extraction and as an energy source, but the extent of the reduction will depend on global market responses.

[186] Scottish Government, Scotland's Carbon Footprint 1998-2018 (published 2022)

5.2.8 Material Assets

SEA Assessment questions for material assets:

- Will it reduce use and promote sustainable management of natural resources?
- Will it reduce 'leakage' of material to landfill or energy recovery or as litter?

These interventions should help to reduce the extraction of natural resources and reduce the amount of material disposed. Increasing reuse and recycling should help to reduce the pressure on natural resources, assuming that reused products / components and recycled materials can offset the production of virgin materials. An increase in recycling and reuse will require resources, and this should be considered in future environmental assessments of (new) recycling and other facilities, along with any mitigation.

Package outcomes relevant to material assets and their likely impacts are discussed below.

Reduced production of virgin materials.

SEA Impact: +/?

Virgin material extraction depletes non-renewable stocks of natural resources. The reduction in the production of virgin materials will reduce extraction rates of raw materials. Additionally, if less material is ultimately extracted, less material will require disposal.

In a global context, it is unknown whether the fall in demand for virgin materials as a result of this plan will cause a decline in the amount of resources extracted/produced in Scotland.

Reduction in disposal via landfill.

SEA Impact: +

Increased diversion of material away from the residual waste stream will result in less material leakage to landfill, enabling materials to be kept in use for as long as possible.

Reduction in disposal via incineration

SEA Impact: +

Incineration and energy from waste plants require resources for construction and to continue to run. A reduction in the amount of material incinerated will reduce the requirement for any new incineration plants, which would require construction and other materials. Increased diversion of material away from the residual waste stream will result in less material leakage to energy recovery or landfill, enabling materials to be kept in use for as long as possible.

Reduced manufacturing of new products and components

SEA Impact: +/?

The production of new components/products will require materials, both virgin and secondary materials. Avoiding the production of new components/products will help to reduce pressures on resource consumption and promote the sustainable management of natural resources.

Increased resource use from repair and maintenance activities

SEA Impact: -/?

The repair and refurbishment of existing products will require some materials to maintain products to a certain standard. However, product reuse will likely reduce material and resource consumption at the aggregate, assuming product reuse offsets or delays the need for new products, the production of which would require more/additional materials and resources. The extent of the reduction will depend on the extent to which reused products substitute new products.

Reduced litter and flytipping

SEA Impact: +

Material that is littered or fly-tipped is a wasted resource. If the material can be recycled or reused, then a reduction in the amount of littered/fly-tipped material will help to reduce pressures on natural resource consumption. If some of the material is ultimately landfilled or incinerated, the impacts on material assets will be limited.

Increased resource use from processing of recyclate.

SEA Impact: -/?

The processing of recyclate into secondary materials requires energy and may require some virgin materials as input. The use of secondary materials will likely reduce material consumption at the aggregate, however, assuming these offset or delay the need for virgin materials.

Decrease in the demand for fossil fuels

SEA Impact: +/?

Fossil fuels are a finite resource, of which Scotland extracted 74.5Mt in 2018187. A reduction in the demand for fossil fuels should lead to a reduction in their extraction, but the extent of the reduction will depend on global market responses and may be limited.

5.2.9 Landscape and visual impacts

SEA Assessment questions for landscape and visual impacts:

- Will the plan avoid adverse effects on landscapes and visual impacts?
- Will it safeguard and enhance the character and diversity of the Scottish landscape and areas of valuable landscape and geodiversity?

The interventions in this package should help to avoid adverse effects on landscapes and safeguard the character and diversity of Scottish landscape. The focus on the diversion of waste from landfill to recycling should help to reduce the need for new landfill sites. However, new recycling facilities may be required to deal with increased supply of recyclate; however, assuming alignment with Policy 12 of the National Planning Framework (NPF4), any adverse effects will be minimal.

Package outcomes relevant to landscape and visual impacts and their likely impacts are discussed below.

Reduced production of virgin materials.

SEA Impact: +

Virgin material extraction activity, such as tree felling, can negatively impact Scottish landscapes, resulting in losses of natural character and diversity.

For example, Scotland produces approximately 7.5Mt of wood annually. Reduced felling of trees as a result of improved paper and card recycling rates may enhance landscapes.

In Scotland, approximately 21Mt of stone was extracted for building or ornamental purposes in 2018[188]. A reduction in the demand for virgin materials such as stone may prevent new mines from being opened, thereby avoiding adverse effect on landscapes.

Reduction in disposal via landfill.

SEA Impact: +

Landfill sites are generally considered to be unsightly, both in terms of the sites themselves and in the birds and rodents that are attracted to the sites. A reduction in

[187] Zero Waste Scotland, Scottish Material Flow Accounts Model: Update with 2018 data (published 2023)

[188] Zero Waste Scotland, Scottish Material Flow Accounts Model: Update with 2018 data (published 2023)

the construction of new landfill sites will therefore avoid adverse effects on landscapes and visual impacts.

Reduced litter and flytipping

SEA Impact: +

Littering and flytipping are generally considered an eye sore and can detract from landscapes and areas of natural beauty as well as towns and cities. 70% of respondents of the 2021 Keep Scotland Beautiful Scottish Litter Survey believe that litter is a problem locally, and 88% believe that it is a problem nationally[189].

A reduction in litter and flytipping is likely to reduce negative visual impacts and safeguard or improve the appearance of Scotland's landscapes.

Increased resource use from processing of recyclate.

SEA Impact: -/?

Recycling facilities are an industrial waste management activity and would thus have adverse impacts on landscape. If new recycling facilities are required, then these have the potential to harm visual impacts depending on where they are located. Assuming alignment with Policy 12 of the National Planning Framework (NPF4), these impacts will be minimal.

5.2.10 Cultural heritage

SEA assessment questions for cultural heritage:

- Will the plan avoid adverse impacts on the historic environment including its setting?
- Will the plan protect and enhance valued landscapes, historic and archaeological sites and other culturally and historically important features, landscapes and their settings?
- Will the plan encourage the retention, reuse and repair of historic environment assets and materials?

Adverse impacts on valued cultural and historical may be avoided through increased stakeholder engagement and standardised services. Together, this may minimise the disruption of waste and recycling collection and reduce the likelihood of bin overflow.

Increased stakeholder engagement

SEA Impact: +/?

[189] Keep Scotland Beautiful, Scottish Litter Survey (published 2021)

Co-designed services may allow stakeholders in areas of cultural heritage to ensure services minimise the impact on their setting, in particular through local community and neighbourhood involvement to gain insight into unique local circumstances. This may include, for example, standardised collections and appropriate capacities or collection frequencies to reduce traffic or risk of bin overflow.

Reduction in traffic / Standardised collection services

SEA Impact: +/?

The traffic caused by, and the presence of, waste and recycling vehicles that service commercial sites close to cultural and historical settings may have adverse impacts. Co-designing measures to improve services may help to reduce the number of visits necessary to service an area, and thus reduce these adverse impacts.

6 Decarbonise disposal

6.1 Minimise the impact of disposal

6.1.1 Package Outcomes

Package 6 is aimed at reducing the impacts of disposal as much as possible. Interventions in the earlier packages are aimed at reducing how much is being disposed, e.g. by reducing waste generated and by increasing waste that is recycled.

Decrease in waste landfilled

The interventions in this package are focused on reducing the environmental impacts of disposal, i.e., incineration and landfill. For many waste streams, incineration is a lower impact option than landfill, therefore, this package will likely lead to a decrease in waste landfilled.

Potential increase in waste incinerated

The interventions will likely lead to proportionately more waste that is disposed being incinerated relative to being landfilled. However, given the other measures in the Route Map should lead to less material being disposed (through waste reduction and increase in recycling), this increase in the proportion of waste being incinerated may not lead to an absolute increase in the long-term.

Reduction in GHG emissions

The interventions in this package are aimed at reducing CO2e emissions and other environmental impacts. At this early stage, it is not possible to identify outcomes and impacts other than those aimed for.

Likely decrease in other miscellaneous environmental impacts

It should be noted, however, that reducing CO2e emissions does not necessarily lead to a reduction in other environmental impacts.

6.1.2 Biodiversity, flora, and fauna

SEA Assessment questions for biodiversity, flora, and fauna:

- Will the plan avoid adverse impacts to habitats and species?
- Will it protect, maintain, and enhance biodiversity?

Overall, the measures within this package should avoid adverse impacts to habitats and species through a reduction in habitat disruption mainly from the reduction of

waste sent to landfill, and the associated reduction in the need for new landfill sites. Further impacts to biodiversity could be avoided assuming alignment with the Biodiversity Strategy. Any future interventions should be subject to their own environmental assessment.

Reduction in disposal via landfill

SEA Impact: +

Habitats in and around bodies of water such as streams, ponds, lakes, and surrounding soils nearby to landfill sites can become polluted by leachate. A reduction in levels of waste disposal in landfill will lead to lower impacts on habitats and their resident species at a local level.

Landfilling materials, in particular organic matter, can be a major emitter of GHG emissions. Lower levels of landfill gas production, (methane in particular) will reduce the contribution to climate change and indirectly lessen impacts on species and habitats. At a global level, these impacts are not likely to be significant.

The reduced impact on landfill capacity will lessen the longer term requirement for the creation of new landfill sites and the corresponding clearance of wild areas. This in turn will reduce the number of habitats being lost or degraded to create new landfill sites.

Potential increase in disposal via incineration in the short term

SEA Impact: ?

The incineration of waste is source of GHG emissions and pollutants. In the event of a short-term increase in incineration, there may be adverse impacts on species and habitats through the release of harmful pollutants.

Reduction in CO2e emissions

SEA Impact: +/?

Indirect benefits to biodiversity are likely in the long term as a result of a reduced contribution to climate change from waste management emissions.

Reduced environmental impacts

SEA Impact: ?

Assuming alignment with the Biodiversity Strategy, measures would aim to minimise the impacts of disposal on biodiversity. Specific measures aimed at reducing emissions of persistent organic pollutants (POPs) would reduce adverse impacts on habitats and species.

6.1.3 Population and human health

SEA Assessment questions for population and human health:

- Will the plan reduce the health gap and inequalities and improve healthy life expectancy?
- Will it protect and improve human health and wellbeing through improving the quality of the living environment of people and communities?
- Will it increase sustainable access to essential services, employment, and the natural and historic environment?

This package should help to improve wellbeing due to a reduction in nuisance from landfill sites, although impacts on human health and sustainable employment are unknown at this stage. Specific impacts will depend on the interventions developed from this package. Any future interventions should be subject to their own environmental assessment.

Reduction in disposal via landfill

SEA Impact: +

Nuisance caused by landfill sites on a local level is likely to be in the form of odour, noise, increased traffic, and vermin. Landfills can result in community impact throughout their life cycle. During the operational phase, when wastes are deposited, communities can be negatively impacted by nuisance issues such as odour, dust, noise and vermin. Odour is a significant environmental cause of public complaints of people living near waste treatment facilities and negatively affects quality of life and wellbeing. Odour can be a cause of stress and anxiety, even when the substances causing the odours are not harmful to health at the levels detected at waste treatment locations. Landfills, and specifically landfill odour, account for a significant proportion of public environmental event complaints made to SEPA. In extreme cases, where sites are poorly operated, or have specific gas management issues to address, this has resulted in several hundred public complaints in a single day. Three operational landfills are currently classified by SEPA as sites of ongoing community impact. In 2021, these sites alone accounted for 987 substantiated complaints to SEPA.[190]

If lower volumes of waste are destined for landfill due to the measures proposed in the Route Map, a reduced negative impact on the wellbeing of nearby residents is likely.

Potential increase in disposal via incineration in the short term

SEA Impact: ?

Pollution from EfW plants may have a negative impact on the health and wellbeing of nearby residents, and there is scope for further research into potential negative

[190] Information provided through direct correspondence with SEPA (September 2023)

mental and psychological impacts of living close to an incinerator[191]. Measures targeted at reducing residual waste destined for incineration may therefore have a positive impact on nearby residents. If there is a short-term increase in material incinerated, then there may be a temporary increase in adverse effects, although these may be mitigated by other interventions in this package.

However, the risk to human health associated with newer incinerators operated within the current regulations, which are based on a precautionary approach, is likely to be minimal and very difficult to detect[192]. Therefore, health impacts of an increase in waste incinerated are expected to be minor.

Reduction in CO2e emissions

SEA Impact: +/?

Indirect benefits to the population are likely in the long term as a result of a reduced contribution to climate change from waste management emissions.

Reduced environmental impacts

SEA Impact: ?

Measures targeted at reducing environmental impacts are likely to consider how pollution can be avoided or reduced e.g., persistent organic pollutants (POPs) and air pollution. A subsequent positive impact on human health is therefore possible, but impacts are unknown at this stage.

6.1.4 Soil

SEA Assessment questions for soil:

- Will the plan safeguard and improve soil quality, quantity and function in Scotland, particularly high value agricultural land and carbon-rich soils?

Overall, this package should help to safeguard soil quality in Scotland through a reduction in soil pollution from landfill sites. Specific impacts will depend on the interventions developed from this package. Any future interventions should be subject to their own environmental assessment.

Reduction in disposal via landfill

[191] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

[192] Health Protection Scotland, Incineration of Waste and Reported Human Health Effects (published 2009)

SEA Impact: +

Leachate from landfill sites can contaminate soils in the surrounding area. A reduction in volumes of material disposed of via landfill will lessen the impact on soil quality in the long term. A reduced impact on landfill capacity will lessen or delay the longer term requirement for the creation of new sites, thus avoiding an increase in areas of soil vulnerable to material pollution and leachate from landfill sites.

Potential increase in disposal via incineration in the short term

SEA Impact: ?

Soils near incinerators may become polluted. Any short-term increase in waste incinerated may therefore result in adverse impacts to soil quality, although these may be mitigated by other measures in this package.

Reduced environmental impacts

SEA Impact: ?

Assuming alignment with The Scottish Soil Framework (2009), measures designed to limit environmental impacts of infrastructure ought to take into consideration the preservation of soil quality. Impacts are unknown at this stage.

6.1.5 Water

SEA Assessment questions for water:

- Will the plan ensure the sustainable use of water resources?
- Will it help to reduce levels of water pollution?

The package should help to reduce levels of water pollution assuming that there will be a reduction in water pollution and contamination from leachate from landfill sites. Specific impacts will depend on the interventions developed from this package. Any future interventions should be subject to their own environmental assessment.

Reduction in disposal via landfill

SEA Impact: +

Leachate from landfill sites can pollute nearby bodies of water. A reduction in volumes of material disposed of via landfill will lessen the impact on water quality in the long term. A reduced impact on landfill capacity will lessen or delay the longer term requirement for the creation of new sites, thus avoiding an increase in the bodies of water vulnerable to material pollution and leachate from landfill sites.

Potential increase in disposal via incineration in the short term

SEA Impact: ?

Some energy from waste processes will require water, and water bodies may be affected by pollutants emitted from energy from waste sites. If there is a short-term increase in waste incinerated, then there may be short-term increases in water consumption and increases in water pollution, although this may be mitigated by other measures in this package.

Reduction in CO2e emissions

SEA Impact: +/?

Indirect benefits to Scotland's waters are likely in the long term as a result of a reduced contribution to climate change from waste management emissions

Reduced environmental impacts

SEA Impact: ?

It is expected that measures designed to reduce broad environmental impacts associated with waste management infrastructure will consider both water use and pollution to bodies of water. Though impacts are unknown, they may include ensuring sustainable water use and preservation or improvement of water quality through reduced pollution (particularly POPs).

6.1.6 Air

SEA Assessment questions for air:

- Will the plan avoid adverse impacts to air quality?
- Will it reduce emissions of key pollutants and improve air quality throughout Scotland?
- Will it reduce levels of nuisance e.g. noise, vibration, dust, odour, and light?

The interventions in this package should avoid adverse impacts to air quality, assuming alignment with the Air Quality Strategy and assuming there is no significant increase in the amount of waste incinerated. Specific impacts will depend on the interventions developed from this package. Any future interventions should be subject to their own environmental assessment.

Reduction in disposal via landfill

SEA Impact: +

Several air pollutants are associated with landfill gas production. A reduction in waste disposed of via landfill is likely to have a positive impact on air quality. Odour levels will also be reduced if the requirement for additional landfill sites is lessened or delayed from a decrease in residual waste arisings.

Potential increase in disposal via incineration in the short term

SEA Impact: ?

Incineration of waste is linked to air and noise pollution on a local scale, though with current stringent emissions standards, the evidence is that the air quality impacts are likely to be small193. Evidence suggests that landfill has a smaller impact on local air quality than incineration 194. If the interventions in this package lead to a short-term increase in volumes of waste disposed of by incineration or energy from waste, there would therefore be a minor negative impact on air quality. However, these effects may be mitigated by other measures in this package.

Reduction in CO2e emissions

SEA Impact: +

By reducing the emissions of GHGs, gases that are also harmful to human health, such as nitrous oxides, will be reduced.

Reduced environmental impacts

SEA Impact: ?

Measures targeted at reducing environmental impacts ought to consider how air pollution can be limited, aligning with The Air Quality Strategy for England, Scotland, Wales and Northern Ireland.

6.1.7 Climatic factors

SEA Assessment questions for climatic factors:

- Will the plan help to reduce existing and avoid new Greenhouse Gas (GHG) emissions?

The interventions in this package should help to avoid new GHG emissions; although the extent of the reduction will depend on the interventions developed from this package. Any future interventions should be subject to their own environmental assessment.

Package outcomes relevant to climatic factors and their likely impacts are discussed below.

[193] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)
[194] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

Reduction in disposal via landfill

SEA Impact: +

The landfill of waste, in particular organic matter, can be a major emitter of GHG emissions: in 2021, the landfill of household waste accounted for just under 250kt of CO2eq of GHG emissions. By reducing the amount of waste requiring landfill, GHG emissions from landfill sites should also reduce.

Potential increase in disposal via incineration in the short term

SEA Impact: ?

The IPCC estimates that every tonne of waste incinerated releases 0.7-1.2 tCO_2e[195] [196], and the emissions from the incineration of household waste in Scotland was approximately 0.3$MtCO_2e$ in 2021[197]. This figure includes the emissions avoided due to energy recovery during incineration. As energy switches to renewable or lower carbon sources, the benefits of energy from waste will fall[198]. However, following the recommendations of the incineration review[199] (such as a reduction in the incineration of plastics) will reduce levels of GHG emissions from the incineration process.

Reduction in CO2e emissions

SEA Impact: +

GHG emissions (including methane) from Scotland's waste management amounted to 1.5$MtCO_2e$ in 2021, and emissions from energy from waste were 0.3 $MtCO_2e$[200] These emissions are a contributor to climate change and, although small relative to national or global GHG emissions, a reduction in them is a necessary step towards net-zero ambitions.

Reduced environmental impacts

SEA Impact: +/?

GHG emissions and other environmental impacts are often correlated, therefore aims to reduce environmental impacts in general may also help to reduce GHG

[195] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)
[196] IPCC, Emissions From Waste Incineration
[197] Scottish Government, Scottish Greenhouse Gas Statistics 2021 (published 2023)
[198] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)
[199] Ibid.
[200] Scottish Government, Scottish Greenhouse Gas Statistics 2021 (published 2023)

emissions. Current waste targets based around tonnages and reduction in the total proportion of waste destined for landfill are not always fully aligned to the best environmental outcome, i.e., maximising emissions reductions. The measures within this package seek to ensure that future developments in residual waste treatment result in minimising emissions and wider environmental impacts.

6.1.8 Material Assets

SEA Assessment questions for material assets:

- Will it reduce use and promote sustainable management of natural resources?
- Will it reduce 'leakage' of material to landfill or energy recovery or as litter?

These interventions should help to move waste that cannot be recycled up the waste hierarchy by reducing landfill of materials. However, most of the benefits for material assets will come from other packages which focus on more sustainable solutions such as reduction and recycling.

Package outcomes relevant to material assets and their likely impacts are discussed below.

Reduction in disposal via landfill

SEA Impact: +

When materials are landfilled, no more value can be extracted. By reducing the amount of material going to landfill, this loss in value is negated somewhat.

Potential increase in disposal via incineration in the short term

SEA Impact: ?

The findings of the review into incineration in Scotland[201] confirmed the place of incineration with energy recovery in the waste hierarchy, i.e., that it is preferred to incineration without energy recovery or landfill. A pivot away from landfill and towards incineration with energy recovery therefore maximises the remaining value from waste that can only be disposed.

6.1.9 Landscape and visual impacts

SEA Assessment questions for landscape and visual impacts:

- Will the plan avoid adverse effects on landscapes and visual impacts?

[201] Scottish Government, Stop, Sort, Burn, Bury - incineration in the waste hierarchy: independent review (published 2022)

- Will it safeguard and enhance the character and diversity of the Scottish landscape and areas of valuable landscape and geodiversity?

The interventions in this package should help to avoid adverse effects on landscapes and safeguard the character and diversity of Scottish landscape, particularly through the reduction of need for new landfill sites. However, a short-term increase in incineration may lead to temporary adverse effects..

Package outcomes relevant to landscape and visual impacts and their likely impacts are discussed below.

Reduction in disposal via landfill

SEA Impact: +

Landfill sites are generally considered to be unsightly, both in terms of the sites themselves and in the birds and rodents that are attracted to the sites. A reduction in the construction of new landfill sites will therefore avoid adverse effects on landscapes and visual impacts.

Potential increase in disposal via incineration in the short term

SEA Impact: ?

The generation of smoke from incineration plants is an eye sore, in addition to the plants themselves. If there is a short-term increase in waste incinerated, then there may be temporary adverse effects on the landscape.

7 Cumulative effects

Table 5 summarises the nature of the overall impacts of each package in the Route Map. A key is provided on the subsequent page.

It is anticipated that the combined effect system-wide improvements across all of the Route Map packages will maximise positive environmental impacts. For example, the increased awareness and behaviour change towards products and materials as a result of the promotion of responsible consumption and reuse may also positively influence behaviours around food waste. Driving food waste up the waste hierarchy may improve awareness around source segregation of waste and could in turn improve both household and commercial recycling quality. Improved reuse and recycling behaviours in workplaces and on commercial premises may encourage better recycling in households, and vice versa. Improved separation of recyclables will result in lower volumes of fossil materials e.g. plastic being incinerated, thus minimising the carbon impact of residual waste disposal. Interventions in the construction and demolition sector should reinforce a culture of reuse and recycling over disposal. It is anticipated that interactions like these will support the desired Route Map outcomes across packages, maximising environmental and societal benefits.

Due to the high-level nature of the plan, this SEA focuses mainly on long-term impacts. Short-term impacts or unintended consequences are possible when specific interventions or policies are developed and implemented. These should be considered in their own future impact assessment processes where appropriate.

Table 5 - Cumulative effects identified in the SEA Assessment

	Reduce and Reuse			Modernise Recycling		Maximise value / Decarbonise disposal
	Promote responsible consumption, production, and reuse	Reduce food waste	Embed circular construction practices	Improve recycling from households	Improve recycling from commercial businesses	Minimise the impact of disposal
Biodiversity, flora and fauna	+	+/?	+/?	+/?	+/?	+/?
Population and human health	+	+/?	+/?	+	+	+/?
Soil	+	+/?	+/?	+/?	+/?	+/?
Water	+/?	+/?	+/?	+/?	+/?	+/?
Air	+	+/?	+/?	+/?	+/?	+/?
Climatic factors	+/?	+/?	+/?	+/?	+/?	+
Material assets	+	+/?	+/?	+/?	+/?	N/A
Cultural heritage and the historic environment	N/A	N/A	+	+/?	+/?	N/A
Landscape and visual impacts	+	+/?	+/?	+/?	+/?	+/?

Key

+	Only (significant) positive impacts expected.
+/?	Impacts are expected to be mostly positive but may be offset to some extent by potential negative impacts.
N/A	No impacts identified

8 Assessment Conclusions and Recommendations

8.1 What are the environmental effects of the proposed Route Map?

Subject to the practical implementation of what are recognised to be high level visions, aims, and actions for delivering sustainable resource use and a circular economy in Scotland, the proposals in the Route Map have the potential to cause positive environmental effects across all of the impact categories assessed:

- Biodiversity, flora, and fauna;
- Population and human health;
- Soil;
- Water;
- Air;
- Climatic factors;
- Material assets;
- Cultural heritage and the historic environment;
- Landscape and visual assets.

It is anticipated that by reducing demand for new products and virgin materials and driving down the amount of material disposed of via landfill and energy from waste, a range of negative pollution impacts on biodiversity, air, bodies of water, and soils can be avoided. Greenhouse gas emissions from material production and manufacturing processes as well as waste management activities are expected to be minimised, with material assets being kept in use for as long as possible through circular practices and improved recycling. Indirect positive impacts are anticipated in relation to the Scottish landscape, through reduced demand for unsightly disposal and extraction infrastructure, and potential to reduce litter and flytipping. Circular practices in the construction and demolition sector should also encourage the retention, reuse and repair of historic environment assets and materials, thus benefitting Scotland's cultural heritage and historic environment.

The positive impacts of the measures are expected to be partially offset by increased resource use, for example, through increased recycling activity, or additional product or building maintenance. However, this assessment has concluded that none of the packages in the Route Map are anticipated to have a net negative impact on any of the environmental topics assessed.

To maximise the potential for positive environmental impacts and to support and enhance the wider aims of the Route Map, it is recommended that all measures are implemented with consideration to alignment with other relevant environmental plans, programmes, and strategies, such as Scotland's Environment Strategy, Biodiversity Strategy and the National Litter and Flytipping Strategy.

It is anticipated that once specific interventions have been defined and agreed, further impact assessments may be necessary. This SEA has highlighted areas that future impact assessments, as deemed appropriate, may consider. It is likely that there will be further impacts, especially in the short term, that have not been considered in this SEA but should be assessed, where appropriate, once the interventions have been fully defined and detailed.

8.2 Proposals for Monitoring

Section 19 of the Environmental Assessment (Scotland) Act 2005 requires the Responsible Authority to monitor significant environmental effects of the implementation of the Plan. The Responsible Authority will be the Scottish Government.

In order to ensure the intended benefits of the proposed Route Map are being realised, a number of the interventions set out within the Route Map packages may be subject to their own impact assessments and monitoring framework once fully developed as policies.

The draft Route Map sets out the intention to develop a new circular economy monitoring framework and targets from 2025, drawing on existing evidence and progressing further research as required. The targets will cover the period to 2030 as a minimum. A robust, accountable monitoring framework, linked to the future circular economy strategy and set within the context of Scotland's wider economic and environmental strategic landscape (including the Environment Strategy), is a vital component in delivering a circular economy.

The provisions in the Circular Economy (Scotland) Bill, if passed, will give Scottish Ministers enabling powers to set statutory circular economy targets where appropriate. This could include reducing the use of materials, increasing reuse, increasing recycling and linking to priorities within the circular economy strategy.

The development of targets and a monitoring framework will give explicit consideration to material-specific targets, rather than 'catch-all' indicators, as recommended by the Climate Change Committee[202], to provide a more powerful, targeted approach for the challenges we face today. The development of a monitoring framework will take into account the findings of this Environmental Report, alongside a range of tonnage, carbon and wider environmental factors and data sources.

8.3 Next Steps

The draft Route Map will be consulted on alongside the SEA Environmental Report. Following that consultation, the Scottish Government will review and analyse the responses received on this Environmental Report and the content of the consultation paper.

Public views and comments are invited on the environmental impacts of the proposed draft Route Map as set out in this Environmental Report.

The findings of this analysis will be taken into account in the adoption of the final Route Map.

Upon the adoption of a final Route Map, the Scottish Government will publish a Post Adoption Statement (PAS). This Statement will reflect on the findings of the SEA

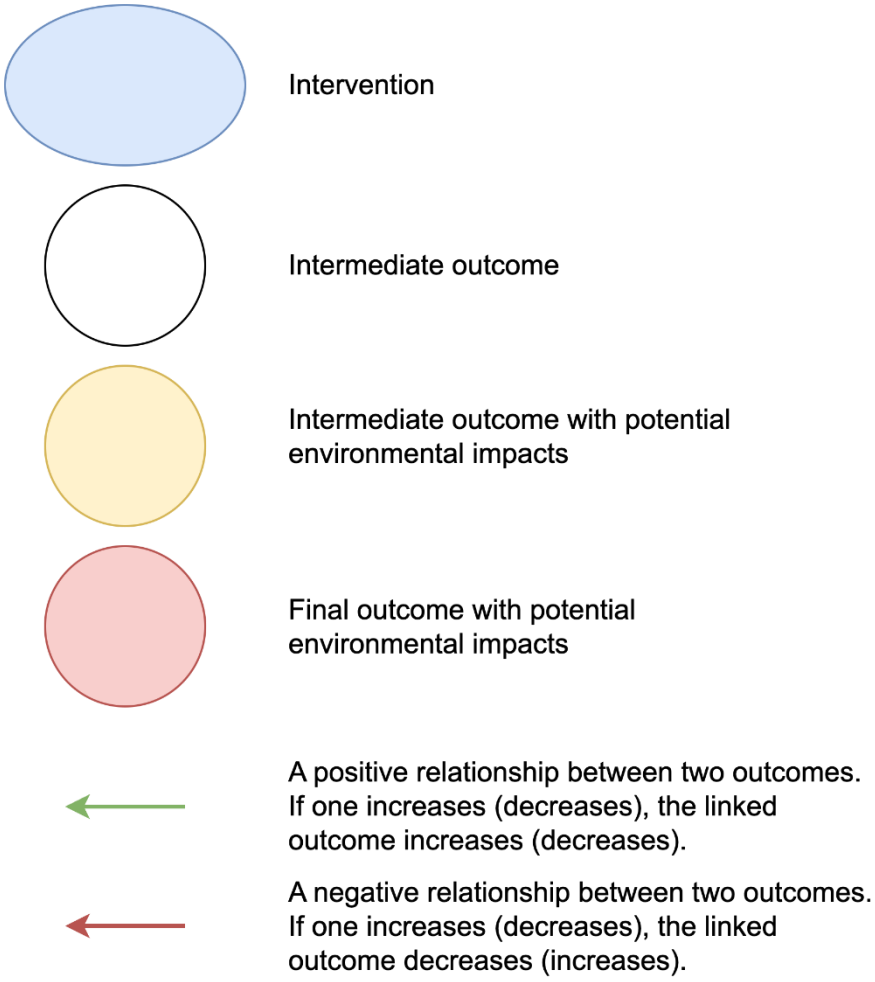
[202] Scottish Emission Targets – first five-yearly review & Progress in reducing emissions in Scotland – 2022 Report to Parliament.

assessment and the views expressed in the consultation, and outline how the issues raised have been considered in the finalisation of the plan.

Scottish Government will monitor the implementation and environmental effects resulting from the measures within the Route Map.

Appendix A Causal Loop Diagrams

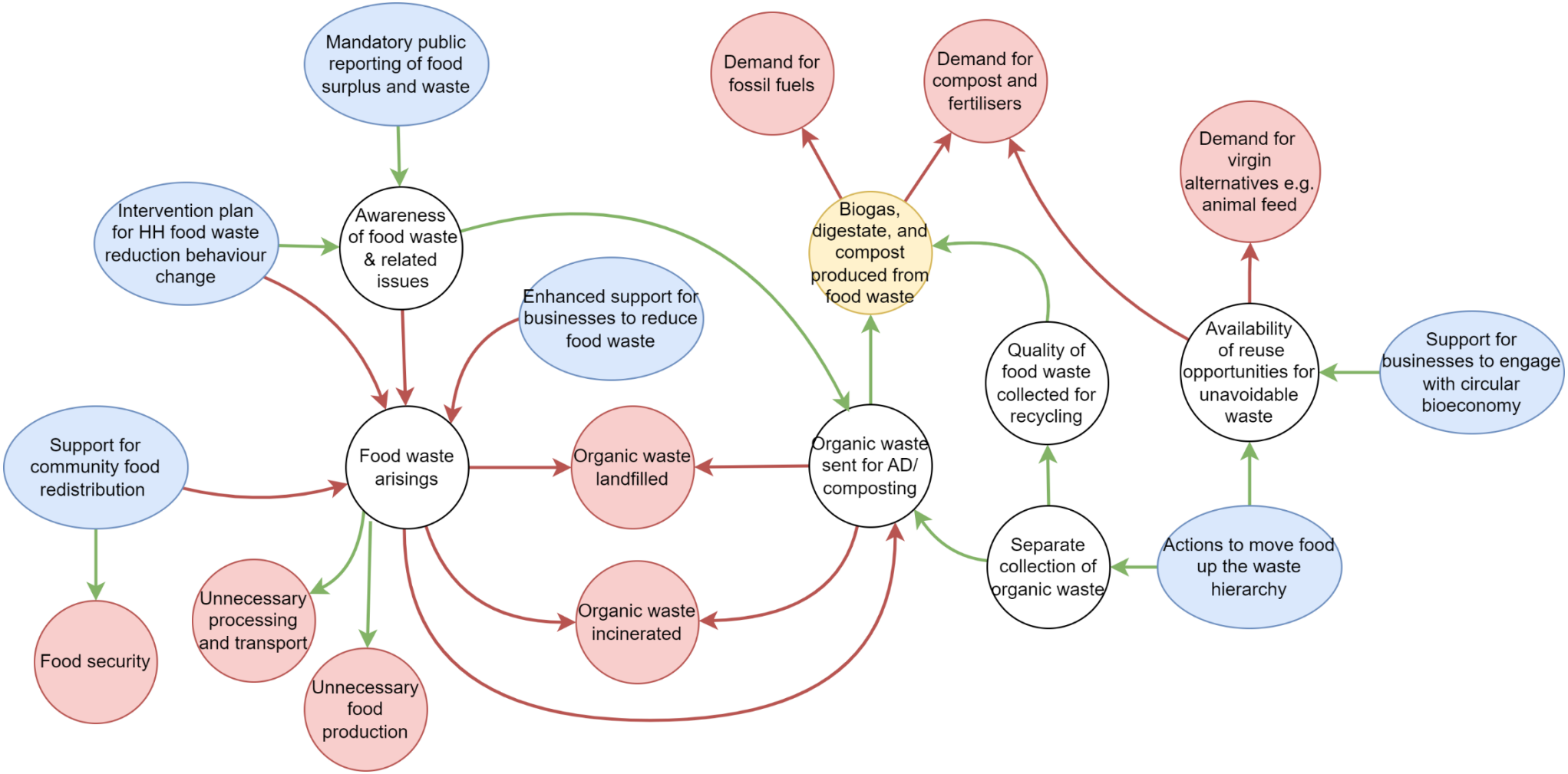
The causal loop diagrams that follow detail the interventions and how they relate to the outcomes. The key below describes aspects of the diagram:



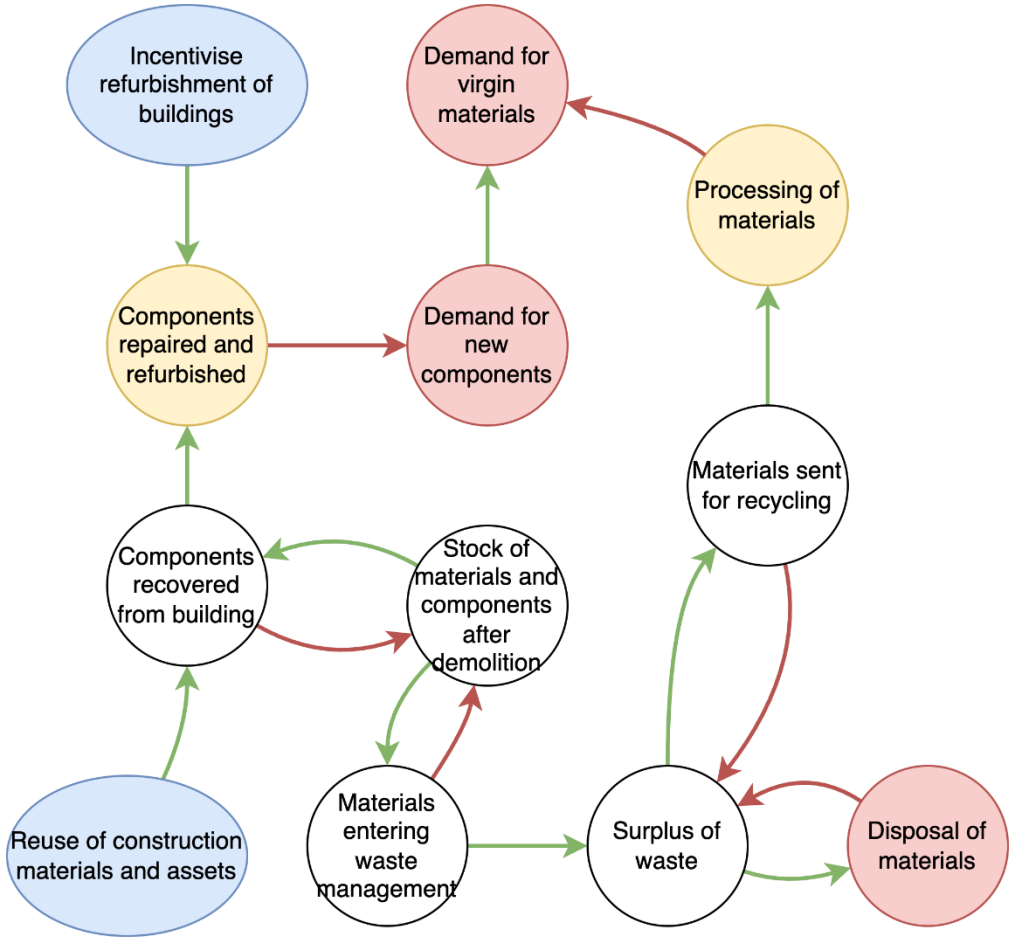
Reduce and reuse

Promote responsible production, consumption and reuse

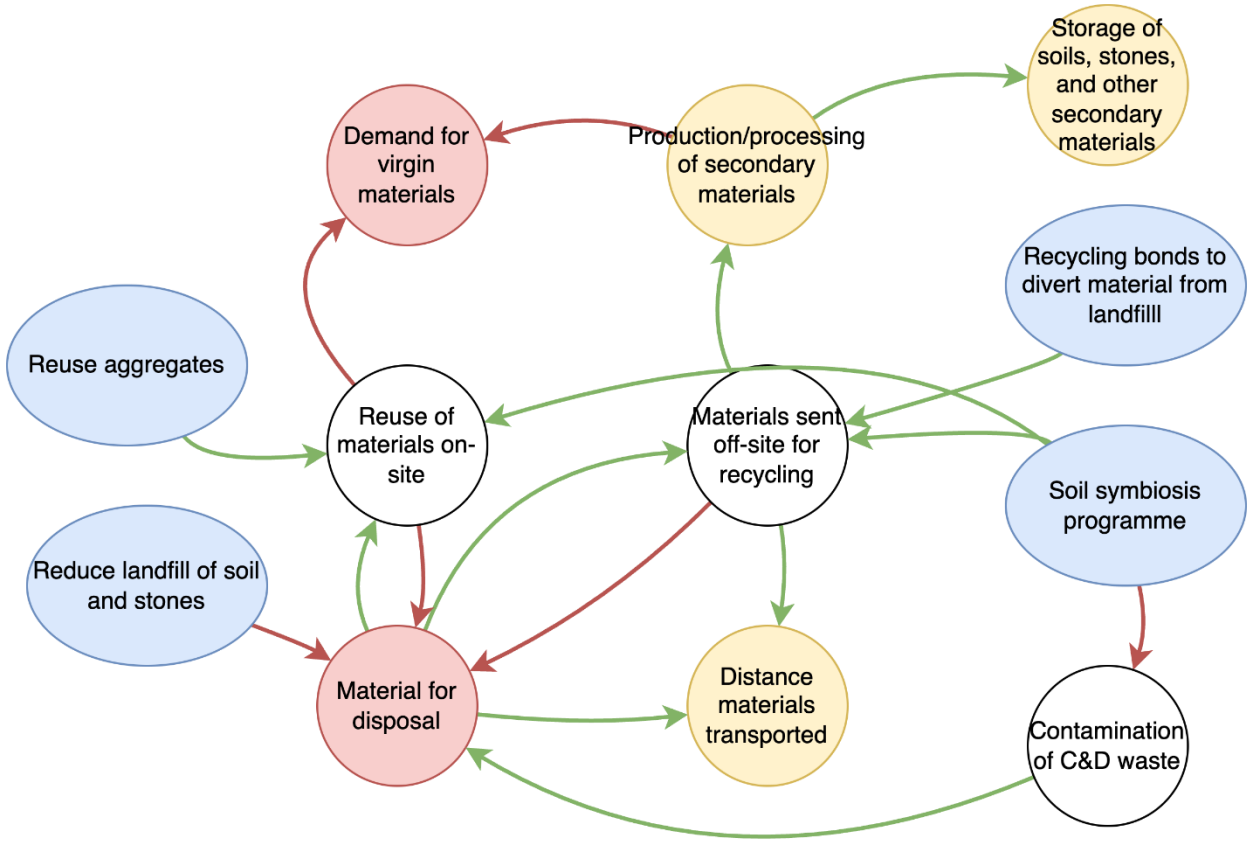
Reduce food waste



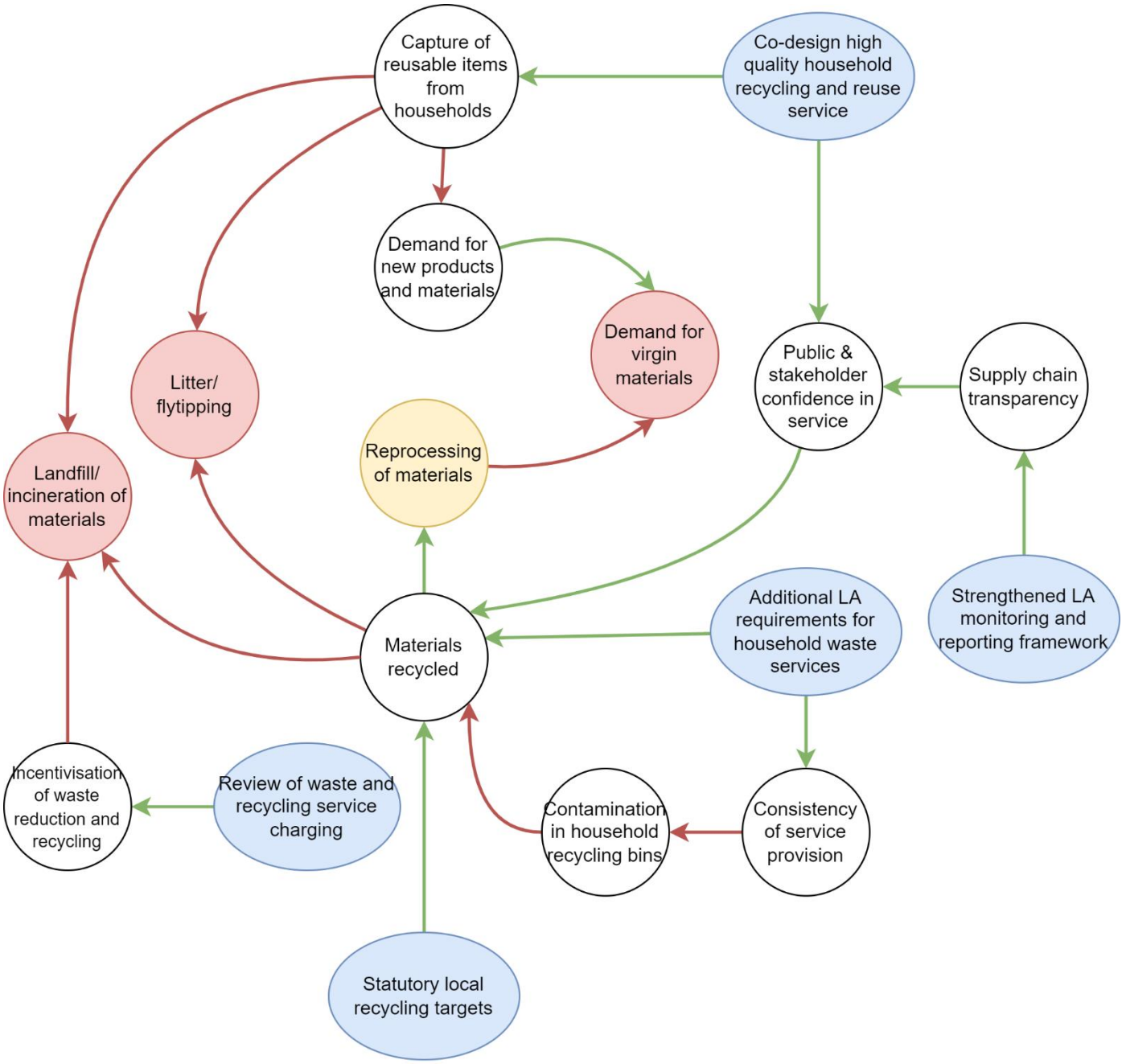
Embed circular construction practices (part 1 of 2)



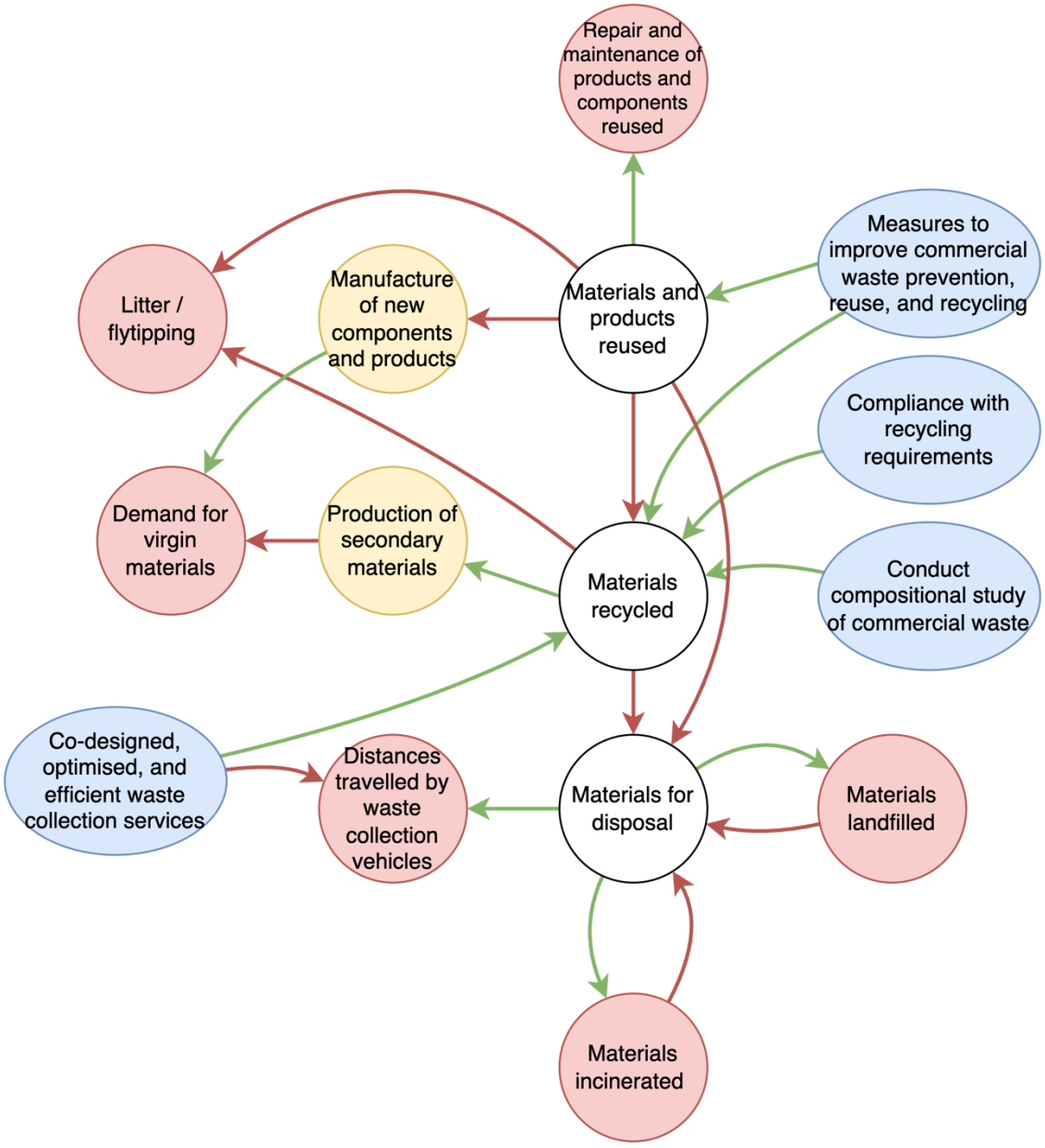
Embed circular construction practices (part 2 of 2)


Storage of soils, stones, and other secondary materials
Demand for virgin materials
Production/processing of secondary materials
Recycling bonds to divert material from landfilll
Reuse aggregates
Reuse of materials on-site
Materials sent off-site for recycling
Soil symbiosis programme
Reduce landfill of soil and stones
Material for disposal
Distance materials transported
Contamination of C&D waste

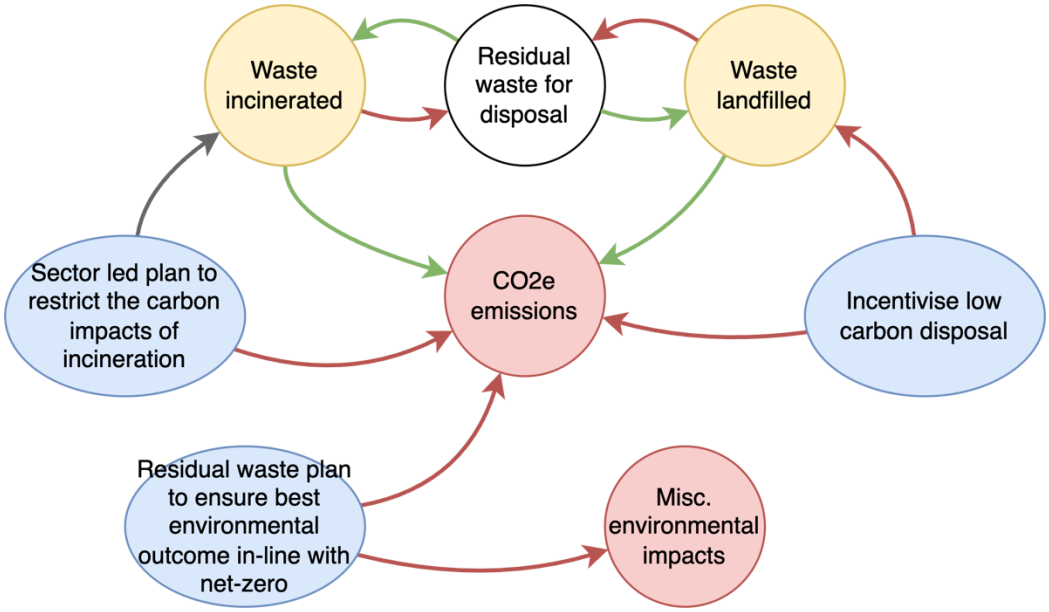
Modernise Recycling
Improve Recycling from households



Improve recycling from commercial businesses



Decarbonise disposal



Appendix B Addressing Responses from Consultative Authorities

Consultee	Consultation response extract	Commentary/ Action taken	Relevant location in report
Nature Scot	We note the reference to NatureScot Natural Heritage Futures, however much of the content is now dated (they were drafted in 2002) as the forces for change have dramatically shifted, data sources have changed and there has been a shift in attitudes to the need for change as a result of the climate and biodiversity crisis. This should be born in mind in its consideration	Reference to this report has been removed from the Related PPS and Environmental Baseline section, and the content of this report was not considered as part of the assessment.	3.4 Context to the assessment
SEPA	Although not specifically required at this stage, monitoring is a requirement of the Act and early consideration should be given to a monitoring approach particularly in the choice of indicators. It would be helpful if the Environmental Report included a description of the measures envisaged to monitor the significant environmental effects of the plan.	The requirement for monitoring of the environmental effects of the Route Map are acknowledged in section 8.2, with some key indicators mentioned. A more detailed circular economy monitoring framework will be developed, as set out in the draft Route Map. Many of the policy measures in the Route Map are not yet fully developed, and when finalised will be subject to further assessment including consideration within the monitoring framework.	8.2 Proposals for monitoring
Historic Environment Scotland	The proposed SEA Objectives for the historic environment are welcomed. However, as	The proposed additional objective and assessment question have been added and	3.5.1 Assessment methodology

	these objectives are focused on the protection of the historic environment from harm we would suggest that an objective is included that reflects the actions of the plan and the potential for positive effects and the identification of enhancement opportunities. For example, an objective could be included along the lines of: “Encourage the retention, reuse and repair of historic environment assets and materials.” This would allow for the assessment to holistically consider any potential positive or negative effects on the historic environment.	were considered as part of the assessment of the interventions under ‘Embed circular construction practices’ within the strategic aim ‘Reduce and reuse’.	

Appendix C SEA Compliance Checklist

Environmental Report Requirements	
Relevant sections of the Environmental Assessment Act	Section(s) of this report
14 (2) The report shall identify, describe and evaluate the likely significant effects on the environment of implementing—	
(a) the proposals in the plan or programme; and	Sections 4 - 7 Outcomes, environmental impacts, and cumulative effects.
(b) reasonable alternatives to the plan or programme.	See section: 3.3 Reasonable Alternatives
14 (3) The report shall include such of the information specified in schedule 3 as may reasonably be required.	
Information referred to in schedule 3	
1. An outline of the contents and main objectives of the plan or programme, and of its relationship (if any) with other qualifying plans and programmes.	Section 2.1: Background to the Route Map and section 3.4: Context to the assessment.
2. The relevant aspects of the current state of the environment; and the likely evolution thereof without implementation of the plan or programme.	Section 3.4: Context to the assessment and sections 4 – 6: assessment of environmental impacts against baseline
3. The environmental characteristics of areas likely to be significantly affected.	Section 3.4 Context to the Assessment and sections 4– 6 assessment of environmental impacts against baseline
4. Any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Council Directive 79/409/EEC on the conservation of wild birds and Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (as last amended by Council Directive 97/62/EC).	Section 3.4 Context to the Assessment and sections 4 – 6 assessment of environmental impacts against baseline
5. The environmental protection objectives, established at international, Community or Member State level, which are relevant; and the way those objectives and any environmental considerations have been taken into account during its preparation.	Section 3.4 Context to the Assessment
6. The likely significant effects on the environment, including— a) on issues such as – i) biodiversity and natural heritage; ii) population; iii) human health; iv) fauna;	See sections 4 – 7 Package outcomes, environmental impacts, and cumulative effects

v) flora; vi) soil; vii) water; viii)air; ix) climatic factors; x) material assets; xi) **cultural heritage and historic environment, including architectural and archaeological heritage;** xii) **landscape;** xiii)**the inter-relationship between the issues referred to in heads (i) to (xii).** b) **short, medium and long-term effects.** c) **permanent and temporary effects.** d) **positive and negative effects.** e) secondary, cumulative and synergistic effects.	
7. The measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the marine spatial plan or programme.	See sections: 4 – 0 (assessment of packages, cumulative impacts, and assessment conclusions and recommendations)
8. An outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of expertise) encountered in compiling the required information.	Section 3: Approach to the assessment
9. A description of the measures envisaged concerning monitoring in accordance with section 19.	Section 8.2: Proposals for monitoring
10. A non-technical summary	Section 1: Non-technical summary

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