Appendix D - Proposed National Developments

D1.1 Introduction

D1.1.1 This appendix contains the detailed assessment tables for the proposed National Developments.

D1.1.2 Further information on the policy consideration of suggestions received for National Developments is set out in the "*Scottish Government's National Developments: Report of Assessment"* available to view online[1]. Assessment findings for alternative national developments are set out separately in Appendix E.

D1.1.3 The following proposed national developments have been assessed:

[1] Scottish Government (undated) Transforming Planning: National Planning Framework (online) Available at: https://www.transformingplanning.scot/national-planning-framework/ (accessed: 09/11/2021)

What are ‘national developments’?

D1.1.4 The Town and Country Planning (Scotland) Act 1997 (as amended)[2] enables ‘national developments’ to be designated in the National Planning Framework (NPF). The proposed national developments are those developments the Scottish Ministers consider strongly support the draft NPF4 spatial strategy, i.e. are ‘needed’. Designation as a national development establishes the principle of need but does not remove the requirement for relevant consents to be obtained before development can begin. Establishing need can facilitate onward decision making, where the matter of the need should not be considered again. Proposals will however still be subject to consideration and assessment through relevant statutory mechanisms to ensure acceptable impacts prior to development consent being granted, including through the planning system, Environmental Impact Assessment, and Habitats Regulations Appraisal as appropriate.

D1.2 Assessment Methodology

D1.2.1 In line with our Integrated Impact Assessment (‘IIA’) November 2020 Update[3] we have taken an iterative approach to assessing suggested national developments, front-loading their consideration so that early and emerging assessment findings could help to guide and inform the selection of proposed national developments. Figure D1.1 below refers. This appendix sets out findings of the environmental assessment for the proposed national developments included in the draft NPF4.

[2] The Town and Country Planning (Scotland) Act 1997 (online) Available at: https://www.legislation.gov.uk/ukpga/1997/8/contents (accessed 09/11/2021)
[3] Scottish Government (2020) Planning for Scotland in 2050 - National Planning Framework 4: Integrated Impact Assessment Update (online) Available at : https://www.transformingplanning.scot/media/2135/national-planning-framework-4-integrated-impact-assessment-position-statement-update-on-iia.pdf (accessed 09/11/2021)

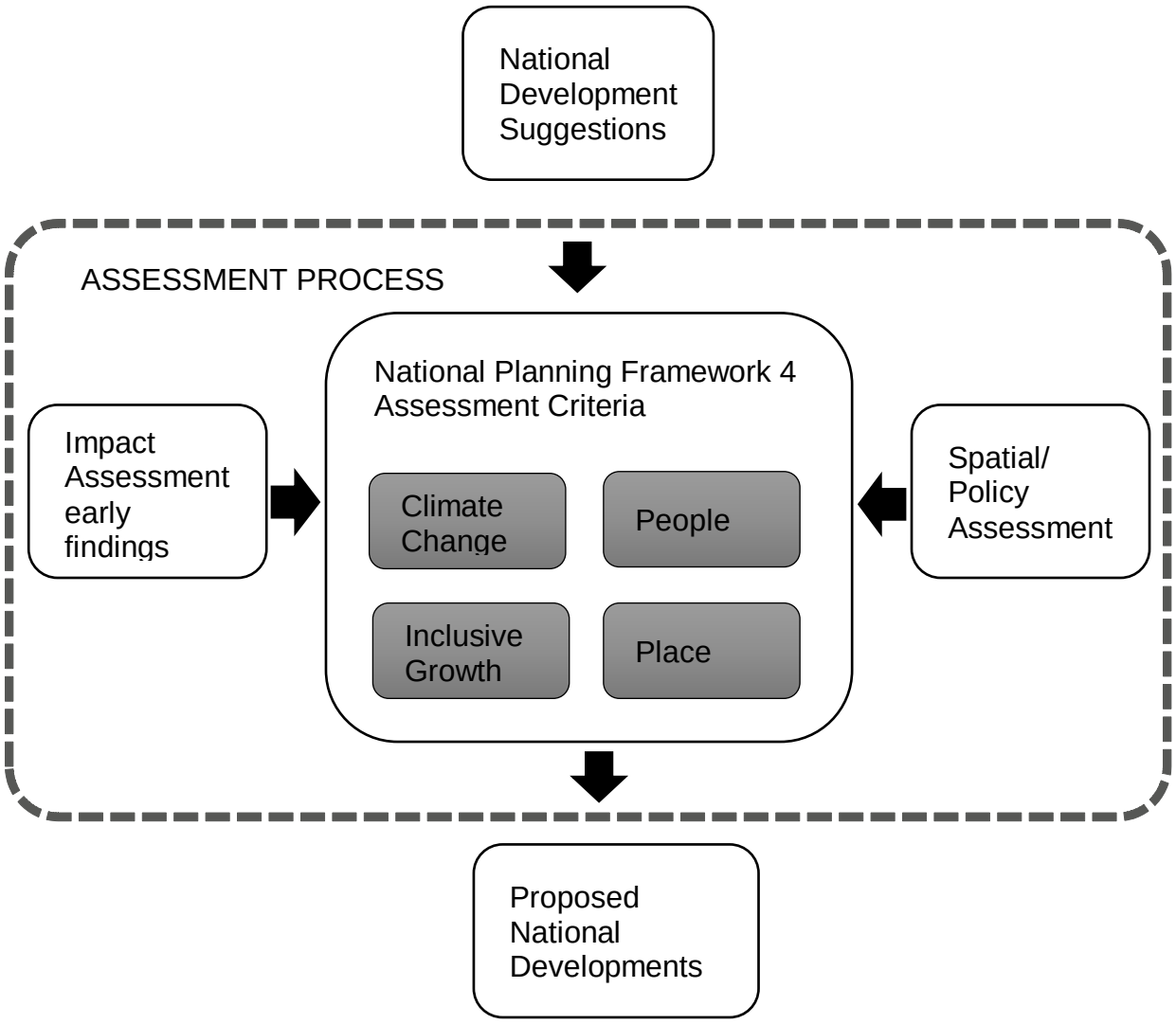

Figure D1.1 Assessment process of the national developments

Lifecycle Greenhouse Gas Emissions

D1.2.2 The Town and Country (Scotland) Planning Act 2019 requires the Scottish Government to undertake an assessment of the likely impact of each proposed national development's lifecycle greenhouse gas emissions on achieving national greenhouse gas emissions reduction targets. We commissioned independent consultants LUC to undertake this assessment and the findings of their research[4] have been taken into account in the assessment of the proposed national developments where relevant.

[4] Research project: Lifecycle Greenhouse Gas Emissions of NPF4 Proposed National Developments Assessment Findings (2021) Available at: https://www.transformingplanning.scot/national-planning-framework/ (accessed 09/11/2021)

D1.2.3 We commissioned independent consultants AECOM to undertake an HRA of the NPF4. The assessment has also been informed, where relevant, by their draft initial HRA screening findings[5].

D1.2.4 The assessment has also built on other relevant SEAs, in particular the NPF3 SEA Environmental Report and Environmental Report update. Also of relevance are SEAs undertaken on other Scottish Government plans, programmes and strategies, such as the draft Infrastructure Investment Plan and Scotland's Second National Transport Strategy. Finally, the assessment has been informed by the SEA objectives.

Table D1.1: SEA Objectives

Topic	SEA objectives
Biodiversity, flora and fauna	Avoid adverse impacts to designated habitats and species
	Avoid adverse impacts to undesignated habitats and species
	Protect, maintain and enhance biodiversity
Climatic Factors	Avoid new Greenhouse Gas (GHG) emissions.
	Reduce GHG emissions in order to meet Scotland emissions reduction target of net zero by 2045
	Promote and enable adaptation to climate change
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

[5] Habitats Regulations Appraisal of National Planning Framework 4 – Initial HRA screening record (online) Available at: https://www.transformingplanning.scot/national-planning-framework/ (accessed 09/11/2021)

Water	Avoid adverse impacts on the ecological status of water bodies
	Ensure the sustainable use of water resources
	Reduce the number of people and properties at risk of flooding and promote adaptive flood risk management
	Protect, maintain and improve the ecological status and physical state of the water environment
Soil	Safeguard and improve soil health, protect soil resource and soil functions of all soil types in Scotland
	Safeguard and improve high value agricultural land and carbon-rich soils
	Reduce the extent of contaminated and vacant and derelict land
Cultural Heritage and 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
Landscape and Geodiversity	Avoid adverse effects on landscapes and geodiversity
	Safeguard and enhance the character and diversity of the Scottish landscape and areas of valuable landscape and geodiversity
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 and built environment resources
	Promote the sustainable design, use and management of new and existing assets/infrastructure to support the development of high-quality places
Population and human health	Reduce the health gap and inequalities and improve healthy life expectancy
	Promote and enhance/improve access to open space, greenspace and the wider countryside
	To 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.

D1.3 Assessment of likely health effects

D1.3.1 The Planning (Scotland) Act 2019 requires Scottish Ministers to bring forward new provisions about the consideration to be given, before planning permission for a national development or a major development is granted, to the likely health effects of the proposed development. To inform this work, we have given consideration to the likely health effects of proposed national developments as part of the SEA process. In doing so, a holistic approach has been taken, recognising the interconnected nature of the SEA Topics, for example, the link between air quality and human

health. Further, this requirement has been integrated into the SEA process by:

- An expanded SEA objective on human health within the SEA topic of Population and Human Health to help frame the assessment.
- Drawing and building on evidence gathered through the wider IIA which accompanies the NPF4, and Public Health Scotland's NPF4: Briefing on health and proposed National Developments[6].

Limitations and uncertainties in undertaking the SEA

D1.3.2 It is recognised that many of the potential impacts that could arise from the proposed national developments will depend on factors such as siting, design and location. Designation as a national development does not remove requirements for relevant consents to be obtained before development can begin, and it follows that there is considerable uncertainty as to the detailed scale and location of development that may take place in future.

D1.3.3 As such, it has not been possible for the SEA to provide a detailed assessment of all potential impacts. Rather, the assessment identifies and highlights wherever possible significant effects and potential issues that may arise to inform the more detailed consideration of individual proposals at project stage. Particular areas of uncertainty are highlighted where relevant to the assessment.

Assessment conclusions

D1.3.4 Overall assessment conclusions are reported for each proposed national development in the tables below. In addition, the assessment identified the potential for construction activities generally to have localised adverse environmental effects on most of the SEA topics. Examples include increased levels of noise, dust and vibration; and, disturbance from construction traffic amongst others, which can in turn impact on human health. The potential for short term emissions associated with the construction of new developments/infrastructure, as well as long term negative effects associated with embodied carbon where sustainable construction practices are not utilised, is also acknowledged. To avoid repetition, these potential impacts have not been set out in each individual assessment.

D1.3.5 It is also expected that in taking forward the proposed national developments, delivery partners will consider a number of actions that have the potential to reduce/minimise identified negative effects and/or enhance positive effects. These include that known and predicted climate risks are managed, biodiversity restoration/improvements are undertaken as far as possible and support is provided for a community wealth building

[6] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 09/11/2021)

approach, aligning with draft Policy in NPF4. Where applicable, this “assumed mitigation” proved by draft Policies has been factored into the assessment of significance of effects, with further opportunities for enhancing benefits set out where possible.

1. Central Scotland Green Network

D1.3.6 The proposed national development is to support delivery of green infrastructure in Central Scotland.

D1.3.7 Location: Central Scotland local authorities within a boundary identified by the Green Action Trust[7].

Topic	Assessment Findings
Biodiversity, flora and fauna	Significant long term benefits for biodiversity are expected where a focus on green infrastructure supports delivery of high quality and multifunctioning spaces at scale. Where focus is given to restoration and enhancement e.g. of existing low quality environments, or to addressing a lack of good quality open greenspace or habitat fragmentation, benefits could be maximised. Further, the remediation of vacant and derelict land should also lead to overall benefits. This can, however, lead to the displacement of species which might have colonised these sites, and may therefore require further consideration at the project stage.
Climatic factors	The Lifecycle GHG assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This is due to reduced transport emissions associated with higher uptake of active travel, reduced flood risk and greater rates of carbon sequestration due to the creation of new greenspace and large-scale planting of trees. The scale of this effect was considered likely to be in the range of medium to high as the development is likely to encourage a change in behaviour around active travel in central Scotland over a long time period. A medium scale of effect would result from higher embodied carbon in construction infrastructure, lower levels of active travel and lower levels of flood risk reduction. Conversely, lower embodied carbon in construction infrastructure, higher levels of active travel and higher levels of flood risk reduction would result in a higher scale of effect. Significant positive effects on climate change adaptation are expected for example where the development leads to multi-functional green infrastructure for climate adaptation purposes, or new or upgraded sustainable water management and drainage systems through increased resilience to flood risk.
Water	Positive impacts should arise through use of natural solutions to flood management from reduced risk of flooding and diffuse pollution and could also lead to benefits for population and human health including through creation of attractive open spaces[8].

[7] CSGN (2021) Central Green Scotland Network: Local Authorities (online) Available at: http://www.centralscotlandgreennetwork.org/partners/local-authorities (accessed 01/10/2021)

[8] Green4Grey (2020) Integrated planning for multifunctional land use (online) Available at: https://green4grey.be/en/project-objective#integrale%20planning%20voor%20een%20veelzijdig%20landgebruik (accessed 25/08/2021)

Air	Support for active travel should lead to long term benefits where this achieves a modal shift from more polluting forms of transport. This may be of particular relevance where air quality issues associated with transport exist, such as urban areas. Additional benefits could also arise from reduced exposure to noise which, alongside improved air quality, can have associated benefits including for population and human health. Wider secondary benefits should also arise through the role of natural infrastructure in improving air quality, for example, through the absorption of pollutants such as particulate matter.
Soil	Potential for positive impacts through support for broader environmental improvements leading to improved ecosystem health. Further benefits should also arise from the remediation of vacant and derelict land.
Cultural Heritage and Historic Environment	Where works undertaken take account of and work positively with the historic environment to add value, including through the role these assets can play in placemaking, associated positive impacts should arise. Potential impacts on known and unknown archaeological assets from activities such as planting will need to be taken into account and addressed by applying established good practice standards.
Landscape and Geodiversity	Potential for significant benefits to arise through improvements in landscape, particularly where focus is given to restoring and enhancing degraded landscapes. Further, well-designed and managed green infrastructure assets, particularly those that engage local communities and which relate to landscape character and heritage, can enhance local sense of place and foster community spirit[9]. Opportunities should be explored at project level to ensure that interventions are consistent with landscape character to maximise benefits.
Material assets	The use and enhancement of natural assets, including focus given to the remediation of vacant and derelict land, the role of blue/green infrastructure and re-use of existing built assets, has the potential to be significantly beneficial, particularly where these play a key role in supporting improved placemaking. Positive impacts should also arise from increased access to sustainable modes of travel, which can support improved sense of place.
Population and human health	Significant positive impacts may arise through improved access to open space and the wider environment and access to services, leading to societal benefits. For example, the “green” and “blue” features of the natural and built environment are widely recognised and valued as essential components of successful places[10]. Remediation of vacant and derelict land could be significantly beneficial due to the adverse environmental and social impacts it can have on nearby communities[11]. Community food-growing spaces and food-growing can contribute to, and

[9] Landscape Institute (2009) Green Infrastructure: connected and multifunctional landscapes (online) Available at: GreenInfrastructurepositionstatement13May09.pdf (windows.net) (accessed 29/09/2021

[10] Nature Scotland (2019) the Place Principle – our contribution to place-based working (online) Available at: https://www.nature.scot/place-principle-our-contribution-place-based-working (accessed 25/08/2021)

[11] Greenspace Scotland (2020) negative impact of vacant land on communities (online) Available at: https://www.greenspacescotland.org.uk/news/derelict-sites-contribute-to-perceptions-of-urban-decline (accessed 25/08/2021)

	benefit, the environment and quality of life for local residents, including revitalising unused spaces or bringing vacant or derelict land back into use and supporting improved sense of community[12]. Potential for modal shift and increased access and uptake of active travel to give rise to significant benefits for both physical and mental health and wider societal benefits, including improved levels of social interaction and sense of place. This could be particularly relevant in areas where poor health and low levels of activity exist and in deprived areas. Further, those living in deprived areas are more likely to live close to derelict and vacant land compared to those living in less deprived areas[13]. Benefits should also arise through improved flood management, and flooding can significantly affect people, communities and businesses[14].

Summary of health implications

D1.3.8 Potential for significant benefits for health and wellbeing, including both mental and physical, from the multiple benefits natural infrastructure can provide. For example, access to high quality greenspace can improve the health, wellbeing and confidence of people and communities as well as creating a sense of place[15]. Wider benefits should arise through a focus on blue/green networks and the role of natural infrastructure as a natural solution to flood management, including where this improves local landscape and sense of place. The remediation of vacant and derelict land also has the potential to be beneficial by reducing adverse environmental and social impacts on nearby communities.

D1.3.9 It has been suggested that the benefits of high quality greenspace on physical and mental health might be most significant for certain groups within the population, for example children, older people, women and people on low incomes[16]. Currently there are a number of Scotland's 10% and 20% most deprived communities located within the Central Belt[17] and within the Local Authority areas that comprise the Central Scotland Green

[12] Edible Estates (2019) Benefits of community growing (online) Available at: http://www.edibleestates.co.uk/benefits-of-community-growing/ (accessed 29/09/2021)
[13] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)
[14] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)
[15] Scottish Government (2019) National Indicator: Greenspace (online) Available at: https://www2.gov.scot/About/Performance/scotPerforms/indicator/greenspace#importance (accessed 25/08/2021)
[16] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)
[17] Scottish Government (undated) Scottish Index of Multiple Deprivation 2020 (online) Available at: https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/ (accessed 29/09/2021)

Network[18]. There is potential for increased access to greenspace and uptake of active travel and physical activity to lead to significant benefits for both physical and mental health. Where opportunities are sought to ensure multiple benefits are achieved, positive impact should be maximised.

D1.3.10 Gaps/uncertainties:

- The precise nature, scale and location of projects that could be brought forward are unknown.
- Potential for brownfield land to be affected by contamination. The extent/level of potential contamination and scale/type of remediation work that may be required, is unknown.

D1.3.11 Mitigation/opportunities for enhancement:

- Consideration should be given to factors such as the type, quality, accessibility and proximity of natural spaces to where people live as this can influence how the infrastructure/spaces are used. Positive impacts could be maximised by ensuring natural infrastructure is accessible to a wide range of users and by focusing investment in areas to reduce inequalities.
- To increase carbon sequestration, the scale of expansion, number of trees and type of development should be maximised whilst protecting existing high carbon soils.
- Opportunities to enhance high carbon soils should be explored.
- The assessment supports draft NPF4 provisions that help to achieve a circular economy and prioritisation should be given to the reuse of materials in construction, use of low carbon construction materials prioritised (seating, lighting, tree protective equipment etc), and materials should be reused or recycled upon decommissioning.
- The green network should be accessible to a wide range of users, and should be well linked with other active travel routes and public transport modes to further reduce potential emissions from transport.
- Opportunities to maximise landscape benefits should be explored, for example through a focus on landscape quality and remediation of vacant and derelict land.

[18] CSGN (2021) Central Green Scotland Network: Local Authorities (online) Available at: http://www.centralscotlandgreennetwork.org/partners/local-authorities (accessed 01/10/2021)

2. National Walking, Cycling and Wheeling Network

D1.3.12 Proposed national development for upgrading and provision of additional active travel.

D1.3.13 Location: all Scotland.

Topic	Assessment Findings
Biodiversity, flora and fauna	Negative impacts could arise from new infrastructure requirements to facilitate modal shift, such as segregated cycle lanes. Impacts could be short term, during construction, or long term through disturbance, and particular consideration should be given at project level to any sensitive protected species and habitats. Negative impacts for biodiversity can be minimised by following good practice guidance for the development of active travel infrastructure and where possible, through the use of existing infrastructure. Consideration may also need to be given to the possible displacement of species that might have colonised brownfield sites where applicable. Wider benefits, including biodiversity enhancement and improved understanding of natural heritage are expected with potential to enhance biodiversity benefits through use of green infrastructure and opportunities to improve habitat corridors.
Climatic factors	The Lifecycle GHG Assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will have a net positive impact on achieving national greenhouse gas emissions reduction targets due to the support for low carbon and active travel. The scale of this effect could range from high to very high positive assuming a high level of uptake and a long timeframe for the benefits. If this development facilitates a shift in travel behaviour, with a significant amount of people travelling through the network via active modes, very high positive effects are expected. These very high positive effects are likely to be further enhanced by opportunities for carbon sequestration linked to the provision of green and blue infrastructure. However, if uptake of active travel is less, and there are fewer opportunities for carbon sequestration this may reduce to high positive. Uncertainty about the nature and scale of these effects means that there is low confidence in this overall conclusion. The use of natural infrastructure to support active travel can lead to improved linkages with open space and habitat corridors, which has the potential to support adaptation to climate change.
Water	No significant effects on water are expected, although route design may need to take into account local characteristics and sensitivities. Where natural infrastructure is used to support active travel, this can lead to improved ecosystem health, in turn, potentially benefiting water quality and management.
Air	Positive impacts should arise where measures lead to a modal shift from more polluting forms of transport. These benefits could be significant depending on uptake and have the potential to be greater in areas where pollution issues currently exist, such as AQMAs, and by those most

	vulnerable to the impacts of atmospheric pollution, for example, the elderly and young and those experiencing pre-existing health conditions.
Soil	Potential for localised negative effects such as compaction leading to a loss of soil function where infrastructure development is required. Route design should take into account local characteristics and sensitivities.
Cultural Heritage and Historic Environment	Project level consideration may need to be given to possible negative impacts that the construction of paths or routes could have though visual impacts or negative effects on sites and their settings. Any potential adverse effects on known and unknown archaeological remains should be avoided or minimised through appropriate design, routing and construction. Positive impacts have the potential to arise through raising awareness and understanding of cultural heritage.
Landscape and Geodiversity	Benefits should arise through increased awareness and enjoyment of landscapes. Consideration may need to be given at project level to potential localised impacts for example from signage, particularly in sensitive locations.
Material assets	Potential for significant positive impacts where this leads to an integrated transport system that supports multi modes of travel and leads to improved sense of place. Re-use of existing infrastructure alongside remediation of brownfield land, where possible, should reduce pressure on natural resources and align with circular economy principles.
Population and human health	Increased accessibility to a more connected transport network and uptake of alternative and more sustainable modes of transport, such as active travel, can lead to multiple benefits, including improved physical and mental health. Depending on uptake, the benefits of this have the potential to be significant, particularly in areas where low levels of activity or deprivation exist. For example, adults in the most deprived areas are more likely to have very low activity levels than those in the least deprived[19]. Significant inequalities in levels of obesity also exist between those within the least and most deprived groups in Scotland[19]. Additional secondary benefits should also arise where a modal shift leads to improved air quality and reduced exposure to noise, particularly in urban locations, including where this leads to increased levels of social interaction[20]. This has the potential to be of greater relevance to those at higher risk, for example, those considered to be living in deprivation or experiencing pre-existing health conditions such as respiratory disease[21]. Additionally, a number of reviews have suggested that people in deprived communities tend to be exposed to higher levels of air and noise pollution compared to lose in less deprived areas[21].

[19] Scottish Government (2018) Scottish health survey 2018: Key findings (online) Available at: https://www.gov.scot/publications/scottish-health-survey-2018-summary-key-findings/pages/8/ (accessed 09/11/2021)
[20] WHO (2018) Health, environment and sustainable development (online) Available at: http://www.who.int/sustainable-development/transport/health-risks/noise/en/ (accessed 25/08/2021)
[21] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

	The use of green infrastructure to support active travel can lead to multiple benefits for population and human health, including through habitat creation and enhancement, improved air quality and improved sense of place. Where focus is given to reducing inequalities, these benefits can be maximised, further supporting accessibility and encouraging uptake.

Summary of health implications

D1.3.14 Where development leads to increased connectivity and uptake of active travel, multiple benefits can arise including improved physical and mental health. Active travel can help to reduce road traffic accidents involving vehicles/cars[22]and can help reduce GHG emissions, with those who are socially and economically disadvantaged more likely to experience the impacts of climate change, yet contribute least to the generation of GHG emissions[23]. Further, those living in more deprived areas are more likely to experience poor quality environments or environmental burdens on health, for example, poorer air quality[24]. It has been found by a number of reviews that those living on lower incomes are also more likely to live in high traffic areas[25].

D1.3.15 Wider benefits, both societal and environmental, should also arise, including through the use of natural infrastructure, such as improved sense of place. Infrastructure that supports active travel can also reduce severance and social isolation. Poor accessibility to essential services such as health and social care can lead to negative impacts on health, including from potential reductions in social cohesion and social networks[26]. Potential positive impacts should be maximised through ensuring supporting infrastructure is suitable for a wide range of users and focusing investment in areas to reduce inequalities, further supporting accessibility, and in turn, encouraging greater uptake. Additionally, this can create benefits through local inclusive economic growth which can

[22] UK Health Alliance on Climate Change (2016) A Breath of Fresh Air, Addressing Climate Change and Air Pollution Together for Health (online) Available at: http://www.ukhealthalliance.org/wp-content/uploads/2016/10/UK-Health-Alliance-A-Breath-of-Fresh-Air-Final-Report.pdf (accessed 25/08/2021)

[23] Preston, I. et al. (2014) Climate change and social justice: An evidence review. York: Joseph Roundtree Foundation; 2014 (online) Available at: Climate change and social justice: an evidence review | JRF (accessed 03/09/2021)

[24] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

[25] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

[26] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

have an important role in improving health and reducing health inequalities[27].

D1.3.16 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown.
- Potential for brownfield land to be affected by contamination. The extent/level of potential contamination and scale/type of remediation work that may be required, is unknown.

D1.3.17 Mitigation/opportunities for enhancement

- Opportunities should be sought to maximise benefits through targeted action, for example, the implementation of measures in, or close to areas with concentrations of poor health and low levels of physical activity and where current air quality issues or levels of deprivation exist.
- Opportunities should be sought to improve interconnectivity within existing networks, including wider street networks and public transport.
- Opportunities should be sought to ensure accessibility for all needs/users.
- Opportunities should be sought to use natural infrastructure to support active travel due to the multiple co-benefits they can deliver.
- Waste should be minimised during the construction phase. The reuse of material should be prioritised and low carbon construction material utilised.

[27] Local Government Association (2019) Nobody left behind: Maximising the health benefits of an inclusive local economy. London: Local Government Authority; 2019 (online) Available at: http://www.local.gov.uk/sites/default/files/documents/22.15%20inclusive%20growth_04.1.pdf (accessed 25/08/2021)

3. Urban Mass/Rapid Transit Networks

D1.3.18 The proposed national development is to deliver low carbon transport solutions to support reduction in private car use in Aberdeen, Edinburgh and Glasgow providing better access to employment and supporting investment.

D1.3.19 Location: Aberdeen, Glasgow and Edinburgh City Regions.

Topic	Assessment Findings
Biodiversity, flora and fauna	Potential for negative impacts to arise from the construction and operation of supporting infrastructure/interventions, including tracks, passenger and depot infrastructure. Potential impacts could be both short and long term and include disturbance, habitat loss or damage. Negative impacts could also arise through the fragmentation of existing habitats and networks and impacts on species movement. The re-use of existing infrastructure where possible, should help to reduce/minimise potential negative impacts. Potential for negative impacts to minimised through siting and design and enhancement measures applied in keeping with national policy.
Climatic factors	The Lifecycle GHG Assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This is considered likely as the long-term positive effects of three of Scotland's major cities using sustainable transport powered by low carbon electricity is likely to outweigh the short-term negative effects. The scale of this effect could range from medium to very high positive depending on the network extent and level of uptake. If this development facilitates a shift in travel behaviour, with a significant amount of people travelling via the mass/rapid transit networks very high positive effects are expected. However if uptake is less, positive effects may reduce to medium positive.
Water	Construction of new, or modifications to existing infrastructure/interventions could impact on waterbodies, including physical changes and water pollution. The scale of effect is uncertain at this stage and would depend on factors such as infrastructure requirements, with mitigation to avoid or minimise impacts likely to be required at site level.
Air	Significant secondary benefits should arise over the long term from potentially encouraging modal shift to more sustainable, low-carbon modes of transport[28]. This is likely to be particularly relevant where air quality issues currently exist, with a number of Air Quality Management Areas (AQMAs) designated in urban areas due to transport emissions, and by those most vulnerable to the effects of air pollution.
Soil	Potential for long term negative effects such as compaction leading to a loss of soil function, resulting from improvements and development of

[28] Strategic Transport Project Review 2 (2019) Scoping Report (online) Available at: https://www.strategicenvironmentalassessment.gov.scot/ (accessed 25/08/2021)

	associated infrastructure/interventions. The scale of effects is uncertain at this stage and is likely to depend on the interventions brought forward. The re-use of, and co-location with, existing infrastructure where possible should help to reduce/minimise possible negative impacts.
Cultural Heritage and Historic Environment	Potential impacts, both positive and negative, on historic buildings and effects on the setting of some historic sites are likely to require consideration at project level. Negative impacts on known and unknown archaeological remains could also arise which may also need to be taken into account at project level. There is the potential for positive impacts to arise, including through improved access and understanding of key assets[29] and through the key role of cultural heritage assets in placemaking.
Landscape and Geodiversity	Negative impacts could arise, including where new physical infrastructure/interventions are required, however, the scale of effect is uncertain. Where future works build on existing infrastructure within established transport corridors, negative impacts could be minimised. Benefits could arise where projects are integrated with wider placemaking decisions.
Material assets	Positive impacts through support for increased interconnectivity and sustainable modes of transport, particularly where opportunities are sought to support improved placemaking. The re-use of existing infrastructure should also reduce pressure on natural resources, aligning with circular economy principles. There is an opportunity to give early consideration to future-proofing infrastructure or identifying opportunities to accommodate new and emerging technologies to further support climate change mitigation and adaptation.
Population and human health	Improved access and connectivity to key services, such as employment opportunities, also has the potential to lead to positive impacts. The benefits of this should be maximised where measures seek to reduce social inequalities and give consideration to improved placemaking. Ensuring consideration is given to transport equality should reduce unintended consequences that could arise where members of society experience barriers to using some modes of transport, for example, due to low income or disability[30]. Long term positive effects should also arise where a modal shift leads to improved air quality and reduced exposure to noise. This has the potential to be of greater relevance to those at higher risk, for example, those considered to be living in deprivation or experiencing pre-existing health conditions such as respiratory disease[31] Wider benefits from reduced surface traffic could also include increased levels of social interaction and

[29] Strategic Transport Project Review 2 (2019) Scoping Report (online) Available at: https://www.strategicenvironmentalassessment.gov.scot/ (accessed 25/08/2021)
[30] Transport Scotland (2019) National Transport Strategy 2 – Strategic Environmental Assessment Environmental Report [online] Available at: https://www.transport.gov.scot/publication/national-transport-strategy-2-strategic-environmental-assessment-environmental-report/ (accessed 25/08/2021)
[31] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments [online] Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

	reduced congestion, which may also lead to benefits including improved sense of place[32]. Additional benefits could include improved safety and reduced risk of accidents.

Summary of health implications

D1.3.20 Positive effects should arise from a potential modal shift, including where this leads to reduced congestion, and in turn wider societal benefits including through improved placemaking.

D1.3.21 Transport significantly contributes to Scotland's GHG emissions but is essential in enabling people to move around and meet their daily needs. Significant positive impacts should arise, including reductions in GHG emissions, improvements in air quality and reduced exposure to noise. Further, those living on lower incomes or from deprived communities are more likely to live in high traffic areas[33].

D1.3.22 Additional benefits should also arise from improved safety and reduced risk of accidents, increased levels of social interaction and improved sense of place. Transport can also play an important part in delivering a fully inclusive society by providing access to services such as healthcare facilities, education, employment and reducing social isolation[34]. Transport can play a key role in promoting the planning and development of healthier, inclusive, sustainable and well-designed places[35]. Positive impacts should be maximised where opportunities are sought to align with improved placemaking alongside ensuring consideration is given to transport equality.

D1.3.23 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown.

D1.3.24 Mitigation/opportunities for enhancement

- Opportunity to give early consideration to future-proofing infrastructure including accommodating emerging technologies to further support climate change mitigation and adaptation.
- Opportunity to reduce emissions through use of low carbon/renewable sources of energy to power trams and light rail developments.

[32] WHO (2018) Health, environment and sustainable development [online] Available at: http://www.who.int/sustainable-development/transport/health-risks/noise/en/ (accessed 25/08/2021)
[33] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments [online] Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)
[34] Transport Scotland (2020) national transport Strategy 2 [online] Available at https://www.transport.gov.scot/publication/national-transport-strategy-2/ (accessed 21/11/2021)
[35] Strategic Transport Projects Review 2 (2021) Strategic Transport Projects Review 2 update and phase 1 recommendations [online] Available at: https://www.transport.gov.scot/media/49128/stpr2-update-and-phase-1-landscape-version-15-feb-2021.pdf (accessed 25/08/2021)

- Opportunity to ensure integration of the mass transit networks with active travel networks.
- Opportunity to increase the roll out of mass transit networks to other major towns and cities in Scotland.
- Opportunity to align with improved placemaking and to ensure consideration is given to transport equality.

4. Urban Sustainable, Blue and Green Drainage Solutions

D1.3.25 The proposed national development aims to build on the benefits of the Metropolitan Glasgow Strategic Drainage Partnership, to continue investment and extend the approach to the Edinburgh city region.

D1.3.26 Location: City and wider catchment areas of Glasgow and Edinburgh.

Topic	Assessment Findings
Biodiversity, flora and fauna	Infrastructure requirements, including the use of built engineered structures, has the potential to lead to negative effects, including habitat loss or damage. Potential for negative impacts to be minimised through siting and design and enhancement measures applied in keeping with national policy. Where nature based solutions are employed, this has the potential to lead to positive effects. For example, in addition to reducing the risk of flooding and diffuse pollution, in turn benefitting water ecology, nature based solutions can lead to benefits through creation of attractive open spaces and diverse habitats for wildlife[36]. This may be of particular benefit given the catchment level scale of the project.
Climatic factors	The Lifecycle GHG assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This is due to reduced flood risk and delivery of more green spaces that will enhance carbon sequestration. The scale of effects can range from low to medium positive depending on how much flood damage is avoided and how many green spaces are delivered. A low scale of effect would result from minimal use of nature-based drainage solutions and the greater use of materials which contain higher embodied carbon. Conversely, if the drainage solutions are widespread and deliver green infrastructure, they will reduce greenhouse gas emissions due to limiting flood damage, with a medium positive effect. Long term positive impacts should also arise where infrastructure supports adaption to the impacts of climate change through reducing risk of flooding and could be significant depending on extent of application. Additionally, the use of natural assets can also play a key role in supporting improved resilience and adaptation to the impacts of climate change.
Water	Urban areas can be at greater risk of surface water flooding which can have significant negative impacts on people and communities. Natural solutions to flood risk management mimic natural drainage processes, reducing runoff from development[37] with significant benefits expected

[36] Green4Grey (2020) Integrated planning for multifunctional land use [online] Available at: https://green4grey.be/en/project-objective#integrale%20planning%20voor%20een%20veelzijdig%20landgebruik (accessed 25/08/2021)

[37] GovUK (2019) Valuing the benefits of blue-green infrastructure [online] Available at: https://www.gov.uk/government/publications/valuing-the-benefits-of-blue-green-infrastructure (accessed 25/08/2021)

	through reduced risk of flooding and diffuse pollution. Flooding can also negatively impact on built assets and population and human health.
Air	Wider secondary benefits should arise through the role of natural infrastructure in improving air quality, for example, through the absorption of pollutants such as particulate matter.
Soil	Long term negative impacts could arise, including loss of soil function and compaction, depending on infrastructure requirements. Where planting or vegetation and habitat enhancement/creation is taken forward as part of natural flood management measures, there is potential for long term positive effects to arise.
Cultural Heritage and Historic Environment	Development activities could impact on known and unknown archaeological sites. The Antonine Wall World Heritage Site and other designations should be taken into account for possible impacts and may require consideration at project level.
Landscape and Geodiversity	There is the potential for changes to local landscapes to arise, which could be positive or negative depending on infrastructure requirements. For example, natural flood management measures have the potential to improve visual amenity. Conversely, the implementation of built structures could lead to negative effects.
Material assets	Significant long term benefits should arise where improved flood management leads to reduced risk of flooding of built material assets, particularly where natural infrastructure is utilised due to the role in placemaking. Additionally, benefits should also arise where this leads to reduced pressure on existing water treatment assets with the capacity of some assets currently overstretched.
Population and human health	Flooding can have significant negative impacts on human health and built assets, the impacts of which are likely to be disproportionately severe in areas of high deprivation because of the reduced ability of individuals and communities in these areas to prepare, respond and recover[38]. Where priority is given to nature based solutions, additional benefits should also arise through the key role natural infrastructure can play in helping people and places adapt to climate change, for example, by providing natural flood defences and cooling. Additionally, those living in neighbourhoods with less greenspace, especially urban areas, may experience more extreme impacts from events like heatwaves, from example, from urban heat island effects[39]. Natural solutions to flood risk management can also lead to improved social cohesion through the creation of attractive open spaces and diverse habitats for wildlife[40], with the “green” and “blue” features of the natural and built environment widely recognised and valued

[38] The Scottish Parliament (2012) SPICe Briefing: Climate Change and Health in Scotland [online] Available at: http://www.parliament.scot/ResearchBriefingsAndFactsheets/S4/SB_12-26rev.pdf (accessed 25/08/2021)
[39] Scottish Government (2019) Climate Ready Scotland: climate change adaptation programme 2019-2024 [online] Available at: https://www.gov.scot/publications/climate-ready-scotland-second-scottish-climate-change-adaptation-programme-2019-2024/pages/8/ (accessed 25/08/2021)
[40] Green4Grey (2020) Integrated planning for multifunctional land use [online] Available at: https://green4grey.be/en/project-objective#integrale%20planning%20voor%20een%20veelzijdig%20landgebruik (accessed 25/08/2021)

	as essential components of successful places[41]. Further benefits could also arise where improvements to drainage and sewage infrastructure leads to improved water quality and increased flood protection reduces the risk of flooding impacting on infrastructure assets, supporting the long term viability of an area. Additionally, where this leads to reduced disruption of key services, benefits should arise, as failure in one area can lead to wider disruption across networks due to their interlinked nature[42].

Summary of health implications

D1.3.27 Significant positive impacts should arise from improved resilience and adaptation to the impacts of climate change, particularly where priority is given to nature based solutions due the multiple co-benefits they provide.

D1.3.28 Significant long term benefits should arise where this leads to increased reliance and adaptation to the impacts of climate change, particularly as the risk of flooding to people, communities and buildings is considered one of the most severe risks for the population, both now and in the future[43]. Further, latest climate projections suggest greater sea level rise than had been projected previously. Risks associated with rising temperatures - such as more extreme heatwave events causing impacts on people's health and wellbeing - are likely to become more prevalent as a result[44]. The impacts of flooding can also be disproportionately severe in areas of high deprivation with a number of disadvantaged populations and communities in and around Edinburgh and Glasgow.

D1.3.29 Positive impacts should be maximised where nature based solutions are prioritised through the multiple co-benefits they provide, including surface water management, flood alleviation and greenspace creation, which also enhances local biodiversity and community wellbeing[45]. Positive impacts should also arise where measures lead to reduced disruption to key services.

[41] Nature Scotland (2019) the Place Principle – our contribution to place-based working (online) Available at: https://www.nature.scot/place-principle-our-contribution-place-based-working (accessed 25/08/2021)
[42] Adaptation Scotland (undated) 15 Key Consequences of Climate Change for Scotland (online) Available at: http://adaptationscotland.org.uk/climatereadyplaces/impacts/ (accessed 25/08/2021)
[43] Committee of Climate Change (2021) Evidence for the third UK Climate Change Risk Assessment (CCRA3) Summary for Scotland (online) Available at: https://www.ukclimaterisk.org/independent-assessment-ccra3/national-summaries/ (accessed 25/08/2021)
[44] Committee of Climate Change (2021) Evidence for the third UK Climate Change Risk Assessment (CCRA3) Summary for Scotland (online) Available at: https://www.ukclimaterisk.org/independent-assessment-ccra3/national-summaries/ (accessed 25/08/2021)
[45] Scottish Government (2019) Climate Ready Scotland: climate change adaptation programme 2019-2024 (online) Available at: https://www.gov.scot/publications/climate-ready-scotland-second-scottish-climate-change-adaptation-programme-2019-2024/pages/8/ (accessed 25/08/2021)

D1.3.30 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown.

D1.3.31 Mitigation/opportunities for enhancement

- Opportunities to target actions towards disadvantaged populations and communities at flood risk should to be sought to maximise benefits, including aligning with improved placemaking.
- Opportunities should be sought to prioritise nature-based solutions due to their ability to deliver multiple co-benefits benefits.
- The reuse of materials in construction and use of low carbon construction materials should be prioritised and waste materials reused or recycled on decommissioning.

5. Circular Economy Materials Management Facilities

D1.3.32 The proposed national development is to deliver a range of facilities required to manage waste streams and their re-processing back to the economy, where sites and facilities will enable retaining the value of waste materials to maximise the use of materials and minimise the use of virgin materials to reduce GHG emissions.

D1.3.33 Location: All Scotland.

Topic	Assessment Findings
Biodiversity, flora and fauna	Significant long term benefits should arise where development leads to reduced pressure on natural resources through support for circular economy principles. Negative impacts could arise from the construction and operation of new supporting infrastructure. Potential impacts include land take, leading to habitat loss or damage and disturbance/displacement. Where possible, use of brownfield land could reduce/minimise possible impacts, however, consideration may need to be given to where negative impacts could arise from remediation works species have colonised individual sites. Potential for negative impacts to be minimised through siting and design and enhancement measures applied in keeping with national policy.
Climatic factors	The Lifecycle GHG assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This is due to increased efficiency in waste management and use of raw materials. The scale of the positive effects could range from low to high positive depending on the volume of waste reprocessed. If the amount of waste reprocessed is relatively minor, vehicle movements are higher, energy demands of reprocessing are higher and waste heat is not utilised the overall positive effect is likely to be minor. However, if this development enables reprocessing at a significant scale, uses low carbon transport, utilises waste heat and supports energy production, it is likely to lead to high positive effects. Reduced pressure on natural resources could lead to wider environmental benefits, such as improved ecosystem health, supporting climate change adaptation.
Water	Reduced waste going to landfill should also lead to secondary benefits for water quality. Remanufacturing can also reduce pressure on resources as compared to manufacturing from new, with associated benefits for water quality and quantity. This is likely to be of increasing importance with water scarcity expected to increase due to climate change[46].

[46] SEPA (undated) Water scarcity (online) Available at: https://www.sepa.org.uk/environment/water/water-scarcity/ (accessed 25/08/2021)

	Reduced pressure on natural resources should also lead to secondary benefits including improved ecosystem health.
Air	Long term benefits could arise from improved air quality, for example, from reduced energy requirements for manufacturing purposes and pollutants associated with the landfilling of waste. Potential for operational activities to give rise to impacts including dust, noise, odour and particulate pollution and consideration should be given at project level to manage and mitigate where negative localised impacts that could arise.
Soil	Potential for negative effects such as compaction leading to a loss of soil function resulting from infrastructure requirements. Negative impacts could be reduced/minimise through reuse of existing infrastructure and brownfield land, where possible. Long term secondary benefits should arise through reduced pressure on natural resources, including through improved ecosystem health.
Cultural Heritage and Historic Environment	There is potential for long term negative effects on the setting of both designated and undesignated heritage, as well as direct impacts on these which may require further consideration at project level.
Landscape and Geodiversity	Infrastructure requirements could give rise to changes in local landscapes with the scale of effects likely to be influenced by factors such as location.
Material assets	Long term significant positive impacts should arise through greater efficiency in resource use and reduced pressure on raw material, with many resources finite in nature. Additional benefits should arise through reduced pressure on existing waste management facilities. The re-use of existing infrastructure, including brownfield land should also reduce pressure on natural resources.
Population and human health	Long term benefits should arise from potential investment in innovation and productivity, and where inclusive growth leads to employment and the creation of up-skilling opportunities. Additional positive impacts should arise where uptake of circular economy principles leads to wider environmental benefits including improved ecosystem health and increased resilience to the impacts of climate change.

Summary of health implications

D1.3.34 Positive effects should arise from improved environmental benefits, including ecosystem health and reductions in greenhouse gas emissions. Additional benefits could arise through investment in new markets and employment opportunities.

D1.3.35 A more circular economy can benefit the environment by cutting waste and carbon emissions, and the economy by improving productivity and opening up new markets and creating employment opportunities[47]. Further secondary benefits should arise through reduced pressure on

[47] Scottish Government (2019) Developing Scotland's Circular Economy: consultation on proposals for legislation (online) Available at: https://www.gov.scot/publications/delivering-scotlands-circular-economy-proposals-legislation/pages/3/ (accessed 25/08/2021)

natural resources, many of which are finite. This is likely to be of key importance with population growth projected to continue. Positive impacts should also arise from improved ecosystem health and reduced pressure on natural resources[48].

D1.3.36 If hazardous material is likely to be handled, consideration should be given to relevant safeguards as it is recognised that there are knowledge gaps in this area[49].

D1.3.37 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown.
- Knowledge gaps exist with regard potential negative impacts, for example, from chemicals of concern, water re-use, electronic waste and distributional effects[50].
- Potential for land to be affected by contamination. The extent/level of potential contamination and scale/type of remediation work that may be required, is unknown.

D1.3.38 Mitigation/opportunities for enhancement

- Current knowledge gaps on potential negative impacts from the management of hazardous materials may require further consideration.
- Opportunities should be explored within the four priority areas of: food, drink, and the broader bio-economy, remanufacture, construction and the built environment and energy infrastructure, which have been identified based on their resource use, environmental impact and importance to the Scottish Economy[51].
- Ensure that where possible transport is decarbonised to reduce overall emissions.
- Opportunity to utilise surplus by-products, for example surplus heat
- Opportunity to support local processing where possible.
- Opportunity to prioritise the use of brownfield land for development

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[48] WHO (2018) Circular Economy and Health: Opportunities and Risks (online) Available at: https://www.euro.who.int/__data/assets/pdf_file/0004/374917/Circular-Economy_EN_WHO_web_august-2018.pdf (accessed 25/08/2021)
[49] University of Bath (2021) Circular Economy and its implications for Environment and Health (online) Available at: https://www.bath.ac.uk/projects/circular-economy-and-its-implications-for-environment-and-health/ (accessed 25/08/2021)
[50] WHO (2018) Circular Economy and Health: Opportunities and Risks (online) Available at: https://www.euro.who.int/__data/assets/pdf_file/0004/374917/Circular-Economy_EN_WHO_web_august-2018.pdf (accessed 25/08/2021)
[51] Scottish Government (2016) Making Things Last: a circular economy strategy for Scotland (online) Available at: https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/ (accessed 25/08/2021)

6. Digital Fibre Network

D1.3.39 The proposed national development is to deliver enhanced digital connectivity providing high speed broadband or equivalent mobile service, prioritising those areas with weaker networks across Scotland.

D1.3.40 Location: All Scotland.

Topic	Assessment Findings
Biodiversity, flora and fauna	Potential for negative impacts during the laying of cables, including short term disturbance during construction activities and habitat damage or loss. Negative impacts could also arise from the laying of subsea cables with potential to impact on seabed and marine ecology as a result of displacement or disturbance of flora and fauna. Where possible the re-use of existing infrastructure and use of previously developed land, for example for data centres, should reduce/minimise associated negative impacts. However, consideration may be need to be given to where remediation works could lead to negative impacts on species that could have colonised some brownfield sites. Potential for negative impacts to be minimised through siting and design and enhancement measures applied in keeping with national policy.
Climatic factors	The Lifecycle GHG assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will have negligible effects on achieving national greenhouse gas emissions reduction targets. This is because the potential increases in maintenance travel and electricity use, and to industrial, manufacture and construction processes, should be counterbalanced by reduced journeys from improved connectivity. There is the potential for increased resilience across sectors due to their interconnected nature, with associated benefits from reduced risk of disruption to services and to supporting resilience and adaptation, with associated benefits. Consideration should be given to future proofing such that development keeps pace with new and emerging technology developments and data changes[52]. For example, to ensure that new and emerging technologies can be accommodated, including those that support innovation and decarbonisation.
Water	Installation of cables could result in localised impacts, such as sediment disturbance. These are expected to be temporary and are not expected to be significant.
Air	Positive secondary impacts arise where development reduces the need for travel and where this supports the decarbonisation of the energy and transport sectors.
Soil	Potential for localised negative effects on soil including compaction leading to a loss of soil function, for example, from associated infrastructure requirements and the laying of cables. This could be

[52] Infrastructure Commission for Scotland (2020) Key findings report (online) Available at: https://infrastructurecommission.scot/page/key-findings-report (accessed 25/08/2021)

	particularly relevant where development is undertaken on previously undeveloped land.
Cultural Heritage and Historic Environment	Possible impacts on known and unknown archaeological resources and the setting of historic assets may be affected through construction actives and may require consideration at project level.
Landscape and Geodiversity	There is potential for new infrastructure to have landscape and visual impacts, particularly within designated and sensitive landscapes. Where feasible, infrastructure sharing and undergrounding will reduce the significance of landscape and visual impacts.
Material assets	Positive impacts likely, including through the role of digital infrastructure in supporting other systems, such as energy and transport and through increased resilience across sectors due to their interconnected nature. This is likely to be of particular relevance as infrastructure continues to evolve and adapt, as the increasing importance of digital technology, connectivity and of whole-system approaches will serve to deepen the interdependencies[53]. Potential for negative impacts at local level on natural assets such as minerals and farmland from new development, and consideration should be given at project level.
Population and human health	Significant positive impacts should arise where digital connectivity leads to increased access to goods and services, particularly key services, including health and employment opportunities[54]. This is likely to be of particular relevance where barriers to access currently exist, for example, rural, remote and island communities, or for populations or communities where specific needs are currently unmet. Positive impacts should also arise through a reduced need to travel and where this leads to improved quality of life, including through increased viability of rural and remote communities. Strong data infrastructure can also increase collaboration, efficiency and productivity in public and private sectors, nationally and internationally and digital connectivity and data infrastructure will become more vital as the population grows and economies and societies become more reliant on getting more value from data to meet a range of needs[55]. As more devices and control systems are connected online, increased data storage and collection will be required which has the potential to lead to increased vulnerability for cyber security and can increase the potential for disruption to physical assets, potentially leading to increased vulnerability to data breaches and to the interruption of infrastructure with negative impacts on

[53] Institution of Civil Engineers (2018) State of the Nation 2018: Infrastructure Investment (online) Available at: https://www.ice.org.uk/news-and-insight/latest-ice-news/ice-launches-2018-state-of-the-nation-investment (accessed 25/08/2021)
[54] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)
[55] Open data for development (undated) State of open data - Data Infrastructure (online) Available at: https://www.stateofopendata.od4d.net/chapters/issues/data-infrastructure.html (accessed 25/08/2021)

	population and human health. Consideration may also need to be given to data changes[56] and data accessibility. There is also the potential for increased resilience across sectors due to their interconnected nature, with associated benefits from a reduced risk of disruption to services and to supporting resilience and adaptation.

Summary of health implications

D1.3.41 Significant benefits should arise where digital connectivity leads to greater access to goods and services, particularly key services. Reduced need to travel could also lead to wider benefits such as improved quality of life. This is likely to be of greater relevance where barriers to access currently exist, or for populations or communities where specific needs are currently unmet. For example, there are significant differences in the availability of superfast broadband in urban and rural areas of Scotland, with 98% of residential premises in urban areas having access to superfast broadband compared to 72% in rural areas[57].

D1.3.42 Additional benefits arise where digital infrastructure supports the continued decarbonisation of other sectors, such as energy and transport and there is potential for increased resilience across sectors due to their interconnected nature. There is potential risk of disruption to physical assets, including from cyber breaches through greater reliance on digital connectivity and of unintended consequences where data is not accessible to all.

D1.3.43 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown. Uncertainties around the implementation of new technologies.

D1.3.44 Mitigation/opportunities for enhancement

- Benefits could be maximised by focusing action to areas experiencing digital exclusion.
- Opportunities to future proof should be sought to keep pace with new and emerging technology and data changes.
- Industry standards and overarching requirements and good practice should seek to mitigate impacts, including consideration of cable corridors to protect cables from damage, potential for co-location and shared use of corridors and pipelines, and a risk based approach to removal of redundant cables.
- Opportunities to ensure cable laying utilises conduits or existing infrastructure should be considered for lower carbon future cable

[56] Infrastructure Commission for Scotland (2020) Key findings report (online) Available at: https://infrastructurecommission.scot/page/key-findings-report (accessed 25/08/2021)
[57] Ofcom (2020) Connected nations 2020 Scotland Report (online) Available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0021/209442/connected-nations-2020-scotland.pdf (accessed 25/08/2021)

replacement. Development in areas with high carbon soil should be avoided.

7. Islands Hub for Net Zero

D1.3.45 This national development supports proposed developments in the Western Isles, Shetland and Orkney island groups, for renewable energy generation, renewable hydrogen production, infrastructure and shipping, and associated opportunities in the supply chain for fabrication, research and development, in particular at the proposed Orkney Research and Innovation Campus. Any strategy for deployment of these technologies must enable decarbonisation at pace and cannot be used to justify unsustainable levels of fossil fuel extraction or impede Scotland's just transition to net zero.

D1.3.46 Location: Western Isles, Shetland, Orkney and surrounding waters.

Topic	Assessment Findings
Biodiversity, flora and fauna	The initial draft NPF4 HRA screening report concluded that projects which involve the creation of new ports, or the extension of existing port facilities have the potential to significantly affect foraging seabirds from several nearby SPAs during the breeding season. Impacts which could arise include pollution of the marine environment, changes to coastal processes, and disturbance and/or displacement of birds due to construction activities or increased ship movements. The Arnish Renewables Base and Deep Water Port near Stornoway is also in very close proximity to the Inner Hebrides and the Minches SAC, designated for harbour porpoise. This species could be impacted in the same way as seabirds above, but could also be subject to collision with moving vessels. The onshore proposals for Shetland has the potential to significantly affect several European sites depending on the precise route of, for example, new pipelines. Potential for short and long term negative impacts on biodiversity from construction and operational activities for both terrestrial and marine environments. Impacts could include disturbance and loss of habitat, including the seabed. Coastal habitats and marine species could also be impacted negatively, for example through dredging activities and disturbance from increased vessel movement. Where possible, re-use of infrastructure and use of brownfield land could reduce/minimise possible impacts, however, consideration may need to be given to areas where species have colonised and negative impacts could arise from remediation works. Consideration is likely to be needed at project level, including the potential implications for European sites, of which there are many within and surrounding Orkney and Shetland, including the Inner Hebrides and the Minches SAC. Potential implications could be significant and include changes to coastal processes, direct loss of habitat, loss of functionally linked habitat, disturbance, displacement and/or mortality, and increased risk of waterborne pollution.
Climatic factors	The Lifecycle GHG assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on

	achieving national greenhouse gas emissions reduction targets. This is due to uncertainty of the scale and type of renewable energy production, renewable hydrogen production, distribution and storage, supporting infrastructure, supply chain for fabrication and R&D, and the use of lower emission fuels for shipping. The GHG assessment assumed that these developments will be large scale and long-term and would outweigh the negative effects from the embodied carbon in the infrastructure. Indirect positive effects from the support for the renewables industry and production of renewable hydrogen are judged on balance to outweigh the negative direct effects identified due to relatively minor nature of these direct effects, which during the construction and decommissioning phases would be short term in nature. The positive indirect effects identified would be experienced throughout the operational phase of the development. The scale of this effect could range from low to high positive, depending on the scale of renewable energy and low carbon fuels produced over time. For example, smaller scale renewable energy and hydrogen production will likely have low positive effects. However, if this is deployed at a large scale, and is utilised across sectors, it could have high positive effects. Finally, increased diversification of the energy mix and energy storage could offer greater system flexibility and efficiencies, helping to manage fluctuations in energy demand and support resilience from disruption, including from the impacts of climate change.
Water	There may be short term adverse effects on the ecological quality of the water environment, including marine biodiversity, through construction activities, for example, sediment disturbance where dredging is undertaken. Long term negative impacts could arise from operational activities, including the production of hydrogen which is also reliant on water supply[58] and can lead to negative impacts on water quality and quantity with implications for marine ecology. Increased shipping and vessel activity could also lead to increased risk of pollution and introduction/spread of invasive non-native species.
Air	Possible localised air quality impacts could arise from operational activities, including surface transport and vessel movement, which could also give rise to increased exposure to noise. Potential impacts in air quality will depend on factors such as type of fuels used. Longer term decarbonisation of the transport sector and transition to use of low carbon fuels, such as LNG in shipping, which is particulate free, should reduce/minimise potential impacts. Long term significant secondary benefits for air quality through support for decarbonisation of key sectors such as the energy and transport sector.
Soil	Likelihood of both short term and long term impacts, including sediment disturbance and loss of soil from construction activities and infrastructure requirements. Increased vessel movements can also lead to negative impacts, including smothering and loss of seabed and general disturbance

[58] Scottish Government (2021) SEA of Draft Hydrogen Action Plan for Scotland scoping report (online) Available at: Environmental assessment: Strategic Environmental Assessment (SEA) - gov.scot (www.gov.scot) (accessed 25/08/2021)

	of sediment. Negative impacts could also arise from dredging or cutting and ploughing activities that may be undertaken, for example, for the laying of offshore pipelines. Making the best use of existing pipeline infrastructure should help to reduce/minimise potential negative effects. Benefits for soil from the re-use of brownfield land will be dependent on the extent of proposed re-development.
Cultural Heritage and Historic Environment	Potential for long term negative impacts on both known and unknown, as well as designated and undesignated offshore archaeology and protections sites, including historic wrecks. Possible adverse impacts should be explored as individual projects and the detail of proposed works, becomes clearer.
Landscape and Geodiversity	Potential for adverse effects on local landscape character with particular implications for coastal landscapes and seascapes. Impacts will depend on a number of factors, including scale of infrastructure requirements and location, with the potential for particular implications for coastal landscapes and seascapes, with some areas designated as National Scenic Areas. Impacts could be reduced/minimised through use of existing infrastructure where possible. Potential long term impacts for marine and coastal processes, including sediment disturbance, erosion and altered seabed morphology, where underwater geological works are undertaken.
Material assets	Potential benefits through provision of key infrastructure to support a move towards decarbonisation and increased diversification and resilience within the energy mix. Benefits should also arise through improvements to port/harbour, key transport hubs, which are of particular importance to island communities in supporting lifeline services. The re-use/enhancement of infrastructure, such as repurposing of offshore pipelines for hydrogen, should also reduce pressure on natural resources through alignment with circular economy principles. Where dredging is undertaken, benefits should arise where dredged material is utilised where uncontaminated and physically suitable[59].
Population and human health	Potential for construction and operational activities to lead to negative impacts, including from increased exposure to noise and air quality. Potential benefits should arise though increased resilience and connectivity to energy supplies, including reduced risk of disruption, with secondary benefits where displacement of traditional energy fuels leads to improved air quality. Positive effects should arise from high value employment opportunities and the creation of strategically important new capacity, capabilities and skills in the delivery of net-zero targets, supporting the attractiveness of the area and improving the vitality of islands communities, which can be fragile. Additional benefits could also arise where improvement to ports

[59] Scottish Government (2011) Scotland's Marine Atlas: Information for the National Marine Plan (online) Available at: Scotland's Marine Atlas: Information for The National Marine Plan - gov.scot (www.gov.scot) (accessed 25/08/2021)

	and harbours leads to improved connectivity, particularly for life line services. There is potential for long-term adverse visual impacts to arise, including possible impacts on visual/residential amenity of some coastal communities and consideration will be required at project level.

Summary of health implications

D1.3.47 Potential for significant benefits from inward investment and employment, particularly where this leads to improved viability and vitality of island communities. There is scope for the provision of quality jobs to support the vitality of island communities, where a lack of opportunities can be particularly relevant for the younger population[60] [61] leading to depopulation. For example, some areas in Shetland are considered particularly vulnerable to the impact of Brexit[62]. The provision of high value jobs and skills transfer opportunities can also support reducing health inequalities[63]. Operational activities could however lead localised negative impacts and the visual and residential amenity of some coastal communities could also be impacted long term.

D1.3.48 Support for long term transition to net-zero should lead to benefits as the impacts of current and future climate change is likely to affect human health both locally and globally[64]. Benefits should also arise from increased flexibility and resilience of the energy network, including to the impacts of climate change. This could be of particular relevance to island communities where disruption to supply can be felt to a greater extent. Further, those in remote rural locations, can be at greater risk of experiencing poverty or deprivation due to higher costs of living[65].

D1.3.49 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown and there are uncertainties around the implementation of new technologies.

[60] Highlands and Islands Enterprise (2018) Young People and the Highlands and Islands: maximising opportunities (online) Available at: https://www.hie.co.uk/research-and-reports/our-reports/2018/may/31/yp-research/ (accessed 25/08/2021)
[61] Scottish Government (2021) National Islands Plan Survey: final report (online) Available at: National Islands Plan Survey: final report - gov.scot (www.gov.scot) (accessed 25/08/2021)
[62] Scottish Government (2019) Local level Brexit Vulnerabilities in Scotland: Brexit Vulnerabilities Index (BVI) (online) Available at: https://www.gov.scot/publications/local-level-brexit-vulnerabilities-scotland-brexit-vulnerabilities-index-bvi/ (accessed 29/09/2021)
[63] NHS Scotland (undated) Income, Wealth and poverty (online) Available at: http://www.healthscotland.scot/media/1365/inequalities-briefing-8_income-wealth-and-poverty_apr17_english.pdf (accessed 25/08/2021)
[64] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)
[65] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

D1.3.50 Mitigation/opportunities for enhancement

- Mitigation measures should be implemented where there is the potential for air pollutants to arise, including transport management mitigation measures.
- The reuse of materials in construction and use of low carbon construction materials should be prioritised and waste materials reused or recycled on decommissioning.
- Opportunities to minimise impacts on landscape and seascape should be explored.
- Effects on biodiversity should be minimised through siting and design, and enhancement measures applied in keeping with national policy.
- Ensure that that disturbance of soil, particularly high carbon soils, vegetation and seabed is minimised and avoided where possible and consideration given to ensure site reinstatement to enhance carbon sequestration. Opportunities to enhance high carbon soils and habitats of high carbon sink value should be explored.
- The impacts of climate change, including flood risk, should be considered.
- Provide low carbon transport options to the sites to reduce car dependency.

8. Industrial Green Transition Zones

D1.3.51 Industrial Green Transition Zones will support the generation of significant economic opportunities while minimising carbon emissions. Technologies that will help Scotland transition to net-zero will be supported at these locations, with a particular focus on low carbon and zero emissions technologies including renewables and the generation, storage and distribution of low carbon hydrogen.

D1.3.52 Industrial Green Transition Zones are the Scottish Cluster and Grangemouth Investment Zone.

D1.3.53 The Scottish Cluster encompasses a Carbon Capture, Utilisation and Storage (CCUS) projects network and is a key strategic vehicle for industrial decarbonisation, energy generation, and the transportation and storage of captured carbon. The designation relates to projects that form a Scottish Cluster in the first instance specifically Peterhead, St Fergus and Grangemouth, as well as further industrial transition sites that are expected to emerge in the longer term. The creation of hydrogen and deployment of negative emissions technologies, utilising CCS, at commercial scale.

D1.3.54 Grangemouth Investment Zone will be a focus for transitioning the petro-chemicals industry and associated activities into a leading exemplar of industrial decarbonisation.

D1.3.55 Decarbonisation could include opportunities for: renewable energy innovation; bioenergy; hydrogen production with carbon capture and storage; and repurposing of existing strategic and critical infrastructure such as pipelines.

D1.3.56 Location: St Fergus, Peterhead, and Grangemouth.

Topic	Assessment Findings
Biodiversity, flora and fauna	The draft initial HRA screening report concluded that project sites in locations around St Fergus, Peterhead and the Firth of Forth have the potential to result in impacts such as loss of functionally-linked habitat and disturbance of qualifying species on European Sites. Offshore works in the Firth of Forth also have the potential to effectively act as a barrier (due to disturbance) to migratory Atlantic salmon and/or lamprey species of the upstream River Teith SAC. Potential for negative impacts, including from associated infrastructure requirements. Impacts are likely to arise both in the short term during construction and longer term during operation, and could include effects on both the terrestrial and marine environment, including through pipeline requirements. Further consideration will be required at project level. Impacts could include loss of functionally linked habitat and potential disturbance, displacement and/or mortality of qualifying species. There is potential for in-combination effects with other projects and cumulative impacts that could arise on the Firth of Forth. The re-use of existing infrastructure and the implementation of marine utility corridors could reduce/mitigate impacts, alongside pollution control regulation and project level mitigation.

Climatic factors	The Lifecycle GHG assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This is due to support for the transition to hydrogen from direct fossil fuel dependency using low carbon hydrogen production with carbon capture, utilisation and storage. The scale of positive effect could range from low to very high. A low scale of effect would result from higher levels of increased transport emissions, lower levels of low carbon electricity generation, higher levels of fugitive emissions, smaller scale heat networks, and smaller scale Negative Emmissions Techologies (NETs) development. Conversely, if a greater amount of low carbon energy and hydrogen is produced, there are lower levels of fugitive emissions, more widespread heat networks and larger scale NETs development and wider deployment and use of hydrogen, this could result in a very high positive effect. Potential for benefits to arise where measures are implemented to support climate change adaptation/improved resilience of infrastructure to the impacts of climate change. Particularly in locations where flood risk is identified as an issue, such as sites located on the coast.
Water	Potential for both short and long term negative impacts to arise on both the terrestrial and marine environments from the construction of new and upgraded infrastructure. Operational activities, including increased vessel movement, could also lead to increased risk of water pollution, disturbance of the seabed and. Operational discharges could also lead to potential long term adverse impacts. Hydrogen production is also reliant on water supply[66]. For example, the production of hydrogen by gas reforming and gasification technologies also requires water as part of the process, including for cooling purposes.[67] Fuller consideration may need to be given to the cumulative and in-combination effects that could arise on the Firth of Forth. Positive impacts should arise where development supports resilience and adaption to the impacts of climate change, for example through long term flood protection.
Air	Short and long term negative impacts from construction and operation could arise, including from increased exposure to noise and air quality implications. For example, operational activity could lead to increases in air pollutants depending on factors such as the type of technology and industrial processes undertaken. This is likely to be of particular relevance in locations where existing air quality issues could be exacerbated. For example, Grangemouth has an associated AQMA primarily arising from

[66] Scottish Government (2021) SEA of Draft Hydrogen Action Plan for Scotland scoping report (online) Available at: https://www.gov.scot/policies/environmental-assessment/strategic-environmental-assessment-sea/ (accessed 25/08/2021)
[67] Committee on Climate Change (2018) Hydrogen in a low-carbon economy (online) Available at: https://www.theccc.org.uk/wp-content/uploads/2018/11/Hydrogen-in-a-low-carbon-economy.pdf (accessed 25/08/2021)

	industrial emissions[68]. The longer term air quality impacts from widespread use of hydrogen are also unknown,[69]however there is potential for significant benefits where hydrogen displaces more polluting fuels[70].
Soil	Potential for negative impacts to arise, both short term during construction activities to long term, for example, sediment disturbance and loss of seabed from laying of pipes and through land take for infrastructure requirements. Impacts could include soil sealing and compaction, particularly where development takes place on previously undeveloped land. Potential for soil organisms to be impacted from possible CO2 leakage from reservoirs and pipelines[71]. Construction activities and increased vessel movements could also lead to negative impacts, including smothering and loss of seabed and general disturbance of sediment. Making the best use of existing infrastructure, and of previously developed land, should help to reduce/minimise potential effects.
Cultural Heritage and Historic Environment	Potential for long term negative effects on both known and unknown historic and cultural heritage assets are likely to be associated with the upgrading or conversion of existing infrastructure, and the installation of new infrastructure necessary to facilitate CCUS and hydrogen. Where development takes place in the context of already existing industrial landscapes, effects should be minimised.
Landscape and Geodiversity	Long term negative impacts could arise from siting of infrastructure, particularly where new infrastructure is required. Significance of impacts will depend on a number of factors, including location and scale of development and the extent to which development is taken forward within the context of existing developed and industrial landscapes. The construction of the new and refurbishment of existing pipelines, and near shore geological storage facilities, has the potential to impact on the seabed floor and activities such as increased anchoring of vessels could lead to negative impacts on the seabed, including long term damage. The use of existing infrastructure should help to reduce/minimise possible impacts.
Material assets	Positive impacts should arise from increased support for the diversification of the energy mix. Increased resilience should also arise through the role of hydrogen in energy storage, supporting fluctuations in peak demand and enabling supply to be met when disruptions arise. There is also the potential for captured carbon to be utilised in other sectors via commercially viable products such as chemicals, polymers, building

[68] Air Quality in Scotland (2021) Air Quality Management Areas (online) Available at: http://www.scottishairquality.scot/laqm/aqma (accessed 01/10/2021)
[69] Committee on Climate Change (2018) Hydrogen in a low-carbon economy (online) Available at: https://www.theccc.org.uk/wp-content/uploads/2018/11/Hydrogen-in-a-low-carbon-economy.pdf (accessed 25/08/2021)
[70] Committee on Climate Change (2018) Hydrogen in a low-carbon economy (online) Available at: https://www.theccc.org.uk/wp-content/uploads/2018/11/Hydrogen-in-a-low-carbon-economy.pdf (accessed 25/08/2021)
[71] Nature Communications (2018) Estimating geological CO2 storage security to deliver on climate mitigation (online) Available at: https://www.nature.com/articles/s41467-018-04423-1 (accessed 05/11/2021)

	materials and fuels. The reuse and refurbishment of existing infrastructure, where possible, should reduce pressure on natural resources and align with circular economy principles. The benefits of this should be maximised where support is given to improved placemaking. Further benefits should also arise where increased flood protection leads to reduced risk of flooding of infrastructure assets and supports the long term viability of the area.
Population and human health	Positive impacts should arise from inward investment, including where this leads to employment and skills transfer opportunities. Regeneration measures also have the potential to improve access to key goods and services and lead to wider benefits, For example, the redevelopment of vacant and derelict land can lead to both environment and societal benefits, including the potential to lead to improved quality of life for nearby populations and communities, particularly where focus is given to improved place-making. Long term positive impacts should arise through the role of hydrogen in the decarbonisation of heat, and can help in meeting peaks in heat demand on colder days[72] and support increased flexibility, efficiency and resilience of supply. Increased operational activity has the potential to lead to negative impacts, for example, air quality issues and increased exposure to noise, including from increased traffic movements. The transportation of CO2, other than by pipeline could also give rise to health and safety implications. There is also the potential for current issues to be exacerbated, for example, in areas where air quality issues currently exist. There will be benefits for population and human health where flood protection measures are implemented.

Summary of health implications

D1.3.57 Benefits should arise from long term economic opportunities from investment as part of the transition to a net zero economy, particularly where this leads employment opportunities, with areas west and south of Grangemouth considered as being particularly vulnerable to EU Exit[73] and areas in the most deprived 20% located to the west and south of Grangemouth and in Peterhead[74]. This could be of particular relevance as reducing poverty and inequalities in income and wealth is important in reducing health inequalities[75]. Regeneration measures also have the potential to lead to benefits, particularly the redevelopment of vacant and

[72] Committee on Climate Change (2018) Hydrogen in a low-carbon economy (online) Available at: https://www.theccc.org.uk/wp-content/uploads/2018/11/Hydrogen-in-a-low-carbon-economy.pdf (accessed 25/08/2021)
[73] Scottish Government (2019) Local level Brexit Vulnerabilities in Scotland: Brexit Vulnerabilities Index (BVI) (online) Available at: https://www.gov.scot/publications/local-level-brexit-vulnerabilities-scotland-brexit-vulnerabilities-index-bvi/ (accessed 29/09/2021)
[74] Scottish Government (undated) Scottish Index of Multiple Deprivation 2020 (online) Available at: https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/ (accessed 29/09/2021)
[75] NHS Scotland (2017) Income, Wealth and poverty (online) available at: http://www.healthscotland.scot/media/1365/inequalities-briefing-8_income-wealth-and-poverty_apr17_english.pdf (accessed 25/08/2021)

derelict land, due to the negative impacts it can have on a communities health and environment[76].

D1.3.58 Possible localised implications from increased operational activity may require consideration at project stage, for example, localised air quality implications, particularly in areas where current issues exist.

D1.3.59 Positive impacts should arise from inward investment.

D1.3.60 Technologies such as hydrogen and CCUS are considered likely to play an increasing role in decarbonisation and increased diversity within the energy mix and improved energy storage can also help reduce disruption to the energy sector with associated benefits. For example, greater ability to meet peaks in heat demand on colder days.

D1.3.61 Finally, the potential for operational activity to impact on environmental quality may require further consideration, including potential implications for air quality, increased exposure to noise and health and safety issues from transportation requirements, particularly where this could exacerbate existing issues.

D1.3.62 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown and there are uncertainties around the implementation of new technologies.
- Potential for brownfield land to be affected by contamination. The extent/level of potential contamination and scale/type of remediation work that may be required, is unknown.

D1.3.63 Mitigation/opportunities for enhancement/monitoring

- Further consideration should be given at project level to possible localised implications on environmental quality, for example, air quality implications. This should include consideration of factors, such the deprivation profile of the area, to ensure health inequalities are not widened.
- Measures should be implemented to ensure that potential leaking of hydrogen and carbon is minimised.
- Opportunities to prioritise use of existing infrastructure on and offshore which can be refurbished.
- The reuse of materials in construction and use of low carbon construction materials should be prioritised. Upon decommissioning, waste materials should be reused or recycled.

[76] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

9. Pumped Hydro Storage

D1.3.64 The proposed national development is to deliver additional capacity at existing sites as well as new sites. It will include expansion of the capacity of the Cruachan.

D1.3.65 Location: All Scotland with an initial focus on Cruachan.

Topic	Assessment Findings
Biodiversity, flora and fauna	Pumped hydro storage projects have potential for significant negative direct effects on biodiversity from loss of habitat and disturbance to species. Indirect effects can arise through to changes in lighting or noise. Both terrestrial and freshwater habitats and species can be effected by pumped hydro schemes. The initial draft NPF4 HRA screening concluded that the Cruachan project would either be within or directly adjacent to the Glen Etive and Glen Fyne SPA (designated for golden eagle) and the Loch Etive Woods SAC (designated for woodland habitats and otter). It could therefore result in the direct loss of qualifying habitat and/or loss of habitat supporting these qualifying species. There is also the potential for pollution impacts on qualifying and supporting habitats, and for disturbance to qualifying species both within and outside of the boundaries of the European sites. The Cruachan site is also in close proximity to sites with national designations including the Coille Leitre SSSI (concurrent with the Loch Etive Woods SAC) designated for upload oak woodland. Two Local Nature Conservation Sites (LNCSs) are also located within proximity to the Cruachan site. Further consideration at project level will be required, including through HRA and EIA where relevant.
Climatic factors	The Lifecycle GHG Assessment concluded that, depending on the nature of the project taken forward, and considering both direct and indirect effects, it is likely that this development will have a net positive effect due to the facilitation and enabling of renewable energy development across Scotland from the provision of energy storage and rapid capacity during demand peaks. The scale of this effect could range from medium to very high depending on the project details, the location and frequency of use. If the development enables significantly more renewable electricity to be generated, whilst minimising energy associated with construction and decommissioning, and effects on soil carbon, a very high positive effect will be expected. However, if renewable electricity generation provided by the development is lower, and there are more significant amounts of energy and carbon intensive materials used during construction, this positive effect might reduce to medium. Furthermore, significant disturbance to soils and release of soil carbon is likely to reduce the effect to medium. Energy storage can also offer greater system flexibility and efficiencies, helping to manage fluctuations in energy demand, including managing the

	intermittency of energy generation from other renewable technologies, supporting adaptation to the impacts of climate change. Further consideration of climate change adaptation, including flood risk, will be required where relevant at individual project stage.
Water	Construction of large storage or pumped storage hydropower can lead to blocking, diverting and changes to the natural course of river systems. Negative impacts could include effects on water quality and quantity, morphological changes to standing and running waters[77]. Potential adverse impacts could also arise due to sediment transportation, including potential for increased turbidity. Significance of potential effects will be influenced by factors such as location and the scale of works proposed in combination with existing activity, and are likely to require further consideration.
Air	Construction and operation of pumped hydro storage can lead to negative impacts, including noise, vibration and dust, including from increased transports movements, which can in turn effect human health and biodiversity. Secondary benefits could arise for air quality through support for the decarbonisation of the energy sector.
Soil	Permanent loss of soil during reservoir construction and site development, including associated infrastructure requirements is expected. Extensive areas of land could be required where new reservoirs are created. The significance of this would be dependent on the scale of works proposed. Where this includes areas of peatland and carbon-rich soils, mitigation will be required to ensure reuse and restoration where possible.There is the potential for further negative impacts to arise through sediment transportation.
Cultural Heritage and Historic Environment	Pumped hydro storage has potential for direct and indirect effects on the historic environment, including designated and undesignated, features and their settings. Future projects brought forward, where locations are currently unknown are likely to require consideration at project level. At the Cruchan site, changing water levels in Loch Awe and other significant hydrological changes could impact on scheduled monuments, specifically crannogs. Access to Kichurn Castle (a scheduled monument and Property in Care) may also be affected. Ben Cruachan Hydroelectric Scheme - Cruachan Dam, is a Category B listed building and The Falls of Cruachan railway viaduct, adjacent to the site, is a Category A listed building.
Landscape and Geodiversity	Pumped hydro storage infrastructure has the potential to give rise to significant landscape impacts. Access tracks, pipelines, grid connections and other components could have significant impacts requiring mitigation through appropriate siting and post-construction restoration where possible. Effects during construction could be extensive, but temporary in nature. Operational effects include changes to landscape at a broad scale. The significance of these effects will depend on the character and sensitivity of the landscape within which developments are located.

[77] NatureScot (2020) Hydroelectric power guidance (online) Available at: https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/renewable-energy/hydroelectric-power (accessed 25/08/2021)

	Projects at existing hydroelectric power plants have the potential to have less significant effects on landscapes. The current Cruachan facility is within the vicinity of the Loch Etive mountains Wild Land Area. The potential for any significant effects on the qualities of this wild land area should be considered as the project plan progresses. Construction of new underground caverns to accommodate plant tunnels and pipes could have significant impacts on geology, for example, Cruachan reservoir is classed as a Geological Conservation Review Site.
Material assets	Potential benefits should arise from pumped hydro storage through supporting diversification and increased resilience within the energy network. Consideration will need to be given at project level to mitigate the potential generation of waste materials that could arise, for example, the excavation of rock, depending on scale of work. Where possible, this should include consideration of re-use.
Population and human health	Potential negative impacts that could arise from pumped hydro storage from construction and operation, such as noise and vibration, are likely to require consideration at project level with the scale of effects likely to depend on factors such as proximately of nearby populations. Negative implications may also arise for recreational users. Possible long term benefits could arise from reduced risk of disruption and increased diversity and resilience as pumped hydro can offer greater system flexibility and efficiencies, helping to manage fluctuations in energy demand, including managing the intermittency of energy generation from other renewable technologies. Greater storage of energy can also allow consumers to use energy differently and where this leads to energy efficiency, support reducing fuel poverty and wider poverty. Further possible benefits could arise from employment opportunities for local communities.

Summary of health implications

D1.3.66 Support for long term transition to net-zero should lead to benefits as the impacts of current and future climate change is likely to affect health both locally and globally[78]. There is scope for energy storage to play an increasingly important part of the transition to delivering clean, affordable and secure supplies of energy[79]. This could be particularly relevant in rural and remote areas where the risk of disruption to supply is greater. Improved energy storage can also allow consumers to use energy differently and benefits should arise where this leads to energy efficiency. Further, where this supports actions to reduce fuel poverty and wider

[78] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

[79] ClimateXChange (2016) Energy Storage in Scotland - Summary of reports on thermal and electrical energy storage (online) Available at: https://www.climatexchange.org.uk/media/1391/summary_energy_storage.pdf (accessed 25/08/2021)

poverty, benefits should arise for health and wellbeing[80]. Finally, the decarbonisation of the energy sector can lead to secondary benefits from improved air quality.

D1.3.67 Positive impacts may also arise from employment opportunities for local communities[81]. There is also the potential for visual and landscape effects and implications for recreational users to arise, which could have negative impacts on health and wellbeing. The significance of these effects will depend on factors including the character and sensitivity of the landscape within which developments are located.

D1.3.68 Gaps/uncertainties

- The precise nature and scale of projects that could be brought forward are unknown.

D1.3.69 Mitigation/opportunities for enhancement

- Waste/excavated materials should be reused where possible.
- The application of circular economy principles should support development that prioritises the reuse of materials in construction, use of low carbon construction materials and design principles that allows for materials to be reused/recycled upon decommissioning.
- To minimise GHG emissions, the design of the new and extended developments should have minimal impacts on LULUCF.
- Sediment creation and build up should be managed in such a manner as to reduce emissions.

[80] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

[81] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

10. Hunterston Strategic Asset

D1.3.70 This proposed national development will support an increased mix of opportunities including port, electricity and hydrogen generation including servicing for offshore energy, carbon capture, aquaculture, business, commercial and industrial uses. Flood risk management, access, and biodiversity impacts will also be considered.

D1.3.71 Location: Hunterston Port and Hunterston A power station site.

Topic	Assessment Findings
Biodiversity, flora and fauna	The initial draft NPF4 HRA screening report identified the nearest SPA for wide ranging seabird species as Ailsa Craig SPA, and noted any increase in marine vessel movements to and from Hunterston could impact on foraging by the qualifying seabirds (and potentially on other SPAs further afield), depending on the routes taken and the numbers involved. The only terrestrial SPAs identified within 20 km were Renfrewshire Heights SPA and Arran Moors SPA. These are both designated for breeding hen harrier, and are both situated beyond the core foraging range of this species from the Hunterston Strategic Asset National Development. The initial HRA screening concluded that likely significant effects cannot be excluded for SPAs designated for breeding seabirds. However, it is very unlikely to have any significant effects on terrestrial SPAs or SACs. Sites with national level designation and with close proximity to Hunterston include the Southannan Sands, a biological SSSI. Sandflats are a protected feature of this site and component habitats here include intertidal seagrass beds and blue mussel beds (both of which are Priority Marine Features). Developments at Hunterson may have potential to affect the qualifying features of this designated site, and further assessment at project stages may be required. Increased noise and visual disturbance could impact or displace species in both the marine and terrestrial environments including birds, fish or marine mammals. In addition, activities may have potential to pollute the marine environment should any release of contaminants from leakage of fuel, oils etc, or from dredged materials take place.
Climatic factors	The Lifecycle GHG assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This is due to support for renewable and low carbon hydrogen production, and electricity generation, including from renewable energy, increasing the renewable energy supply and security of supply over a long time period and displacing fossil fuel use including through use of carbon capture. The scale of these effects could range from low to high positive depending on the scale of electricity generation and storage, and the scale of use of fossil fuels. This development can deliver high positive effects if it will generate and store a significant amount of renewable and lower carbon energy displacing emissions from current fossil fuels. However, if this development delivers only a small amount of renewable or lower carbon energy then low positive effects are expected.

	Improved energy storage is likely to be an increasingly important part of the transition to delivering clean, affordable and secure supplies of energy[82]. This has the potential to lead to benefits for climate change adaptation where increased efficiencies and resilience within the energy network helps to reduce the risk of disruption, including through the impact of extreme weather events. Consideration of climate change adaption will be required a project level. This should include flood risk, with further positive benefits arising where sustainable flood risk management solutions are utilised.
Water	Potential for negative impacts from construction and operation. For example, increased vessel movement could lead to increased risk of pollution, introduction/spread of invasive non-native species and loss of seabed and smothering of the seabed. Renewable hydrogen production is also reliant on water supply, with requirements differing depending on production methods undertaken[83]. This could include the use of freshwater or sea water (subject to desalinisation) with associated impacts on water quality and quantity, with potential effects on biodiversity/marine ecology[84]. Positive impacts could arise where measures are taken to implement sustainable flood risk solutions as flooding can be an issue in the area.
Air	Localised positive impacts on air quality may arise where measures lead to reduced travel needs, including implementation of active travel networks. Depending on the nature of projects taken forward, air quality may require further consideration. Overall long term secondary benefits should arise for air quality through support for decarbonisation. Operational activities may increase noise, light and odour and will require assessment at project consenting stages.
Soil	Benefits for soil from the re-use of brownfield land will be dependent on the extent of proposed re-development. Possible disturbance to seabed through construction and operation of marine activities could lead to negative impacts.
Cultural Heritage and Historic Environment	There is potential for negative effects on the setting of historical assets including Kelburn Castle, a Category A listed structure and a garden and designed landscape. There is also potential for physical impacts on unknown buried archaeological assets in both terrestrial and marine environments. Further consideration will be required at project stage.
Landscape and Geodiversity	Negative impacts could arise from the development of new infrastructure which is likely to lead to a degree of landscape change and may require consideration at project level. Potential for positive effects on local

[82] ClimateXChange (2016) Energy Storage in Scotland - Summary of reports on thermal and electrical energy storage (online) Available at: https://www.climatexchange.org.uk/media/1391/summary_energy_storage.pdf (accessed 14/01/2020)
[83] Scottish Government (2021) SEA of Draft Hydrogen Action Plan for Scotland scoping report (online) Available at: https://www.strategicenvironmentalassessment.gov.scot/PublicSearch.aspx (accessed 25/08/2021)
[84] Scottish Government (2021) SEA of Draft Hydrogen Action Plan for Scotland scoping report (online) Available at: https://www.strategicenvironmentalassessment.gov.scot/PublicSearch.aspx (accessed 25/08/2021)

	landscape through the restoration of previously vacant land, which can have poor landscape quality.
Material assets	Potential for significant positive impacts through redevelopment of existing assets, such as decommissioned oil and gas infrastructure, key infrastructure hubs including the deep water harbour and dry dock, aligning with circular economy principles. Positive impacts should also arise through improved diversification and resilience of the energy network, helping to manage fluctuations in energy demand and potential for reduced risk of flooding, which can negatively impacts on built assets.
Population and human health	Potential for long term significant benefits from support for place based development, including through the remediation of vacant and derelict land. Additional benefits could also arise from the creation of employment opportunities and localising life/work options, including through improving access to facilities and services. Secondary benefits from improved air quality, including through increased opportunities for the uptake of active travel should also arise. Positive impacts are likely to be maximised through focus towards existing and incoming communities, particularly due to levels of deprivation experienced in the area and where a community wealth building approach is taken. Additionally, greater storage of energy can allow consumers to use energy differently and where this leads to energy efficiency, could also support reducing fuel poverty. Increased efficiencies and resilience within the energy network can also lead to reduced network disruption including through the impact of extreme weather events.

Summary of health implications

D1.3.72 Support for the repurposing of existing sites, including through the remediation of vacant and derelict land, should lead to long term benefits. Areas within the 20% most deprived in Scotland can be found within a 10 mile radius (including Saltcoats, Ardrosson, West Kilbride and Dalry)[85] and these areas are also considered to be particularly vulnerable to EU Exit[86]. Access to services and facilities can play a key role in health and tackling inequalities[87], and the benefits of this are likely to be maximised through providing opportunities towards current and incoming communities, supporting the long term viability of the area.

D1.3.73 National and local benefits should arise from support for a transition to net zero, including through renewable energy sources, with associated benefits including increased reliability of energy supply and reduced risk of disruption. Flooding can negatively impact on human health and assets, the impacts of which are likely to be disproportionately severe in areas of

[85] Scottish Government (undated) Scottish Index of Multiple Deprivation 2020 (online) Available at: https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/ (accessed 29/09/2021)
[86] Scottish Government (2019) Local level Brexit Vulnerabilities in Scotland: Brexit Vulnerabilities Index (BVI) (online) Available at: https://www.gov.scot/publications/local-level-brexit-vulnerabilities-scotland-brexit-vulnerabilities-index-bvi/ (accessed 29/09/2021)
[87] NHS Scotland (undated) Place and communities (online) Available at: http://www.healthscotland.scot/media/1088/27414-place-and-communties-06-16.pdf (accessed 25/08/2021)

high deprivation because of the reduced ability of individuals and communities in these areas to prepare, respond and recover[88]. Positive impacts should therefore arise where consideration is given to flood risk in the form of sustainable flood management measures, due to the potential for multiple co-benefits to arise.

D1.3.74 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown.
- Potential for brownfield land to be affected by contamination. The extent/level of potential contamination and scale/type of remediation work that may be required, is unknown.

D1.3.75 Mitigation/opportunities for enhancement

- The application of circular economy principles should support development that prioritises the reuse of materials in construction, use of low carbon construction materials and design principles that allows for materials to be reused/recycled upon decommissioning.
- Prioritisation should be given to the use of renewable / low carbon energy to power projects taken forward.
- Opportunities to improve public access to the wider area through green infrastructure and active travel infrastructure should be considered at plan and project consenting stages.
- Effects on biodiversity should be minimised through siting and design, and enhancement measures applied in keeping with national policy.

[88] The Scottish Parliament (2012) SPICe Briefing: Climate Change and Health in Scotland (online) Available at: http://www.parliament.scot/ResearchBriefingsAndFactsheets/S4/SB_12-26rev.pdf (accessed 25/08/2021)

11. Chapelcross Power Station Redevelopment

D1.3.76 The proposed national development is to redevelop the former nuclear power station site. The development may include for example business development with a particular focus on energy and energy supply chain; energy generation from solar; electricity storage; generation of heat; production and storage of low carbon and renewable hydrogen.

D1.3.77 Location: site of the former Chapelcross power station.

Topic	Assessment Findings
Biodiversity, flora and fauna	Potential for negative impacts on biodiversity, including disturbance during construction and long term loss and fragmentation of habitat. The re-use of existing infrastructure should be maximised where possible. There is the potential for negative impacts to minimised through siting and design and enhancement measures applied in keeping with national policy. Positive impacts could arise from the remediation of vacant and derelict land, however, consideration may need to be given to where remediation works could lead to displacement of species that might have colonised sites. Remediation works could also lead to potential release of contaminants. can also help to reduce/mitigate possible impacts. Operational activities could also lead to negative impacts, including through waterborne pollution and hydrological changes to watercourses. Depending on storage proposals, long term impacts could also include the potential for CO2 leakage into the marine environment with opportunity to mitigate through appropriate monitoring. The Solway Firth SPA and Upper Solway Flats and Marshes SPA are nearby, designated for a range of wintering waterbirds which could occur in grassland surrounding the proposed development site. The site is also within core foraging range of pink-footed geese belonging to the Castle Loch, Lochmaben SPA. Potential implications include loss of functionally linked habitat, either directly of due to disturbance. Potential for hydrological impacts to affect qualifying lamprey species of the downstream Solway Firth SAC. Depending on operational activities, there is also the potential for atmospheric emissions to impact on nearby SACs designated for raised bog habitat.
Climatic factors	The Lifecycle GHG assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This is due to the production of renewable and low carbon energy and support for energy related business development. The scale of effects could range from low negative to low positive. A low negative effect would result from a lower level of renewable / low carbon energy produced or stored, and lower levels of enabling support for renewable energy related development which could be insufficient to balance against the embodied energy of construction and on site energy demands and increase in transport emissions, Conversely, if the levels of renewable/low carbon energy production and storage are higher and the enabling effect of the development for renewable energy is greater a low positive effect could be achieved. An overall net positive effect is

	concluded based on the assumption of a higher level of renewable/low carbon energy production and storage Increased diversity within the energy mix and improved capacity of energy storage can help reduce disruption to the energy sector and adapt to the impacts of climate change, including from extreme weather events.
Water	Negative and localised impacts from construction activities could arise, which should be short term in nature. Operational activities could also lead to long term negative impacts, for example, the production of hydrogen can impact on water quality and quantity, potentially impacting on marine ecology[89]. Longer term benefits could arise where remediation measures address historic contamination. However, consideration may need to be given to possible negative impacts could arise during works being undertaken. For example, from the release of contaminants, which could also have implications for human health.
Air	Longer term positive effects should arise through potential displacement of traditional energy fuels, however, potential for localised impacts from operational activities will be influenced by the technologies employed and may require further consideration. The provision of sustainable access to site should reduce/mitigate possible localised air quality impacts that could arise from potential increases in surface traffic.
Soil	Positive impacts should arise from the remediation of vacant and derelict land, particularly where focus is given to areas with existing contamination, with the benefits of this having the potential to be significant. Consideration should be given to impacts on nearby peatland from the possible construction of hydrogen transportation infrastructure.
Cultural Heritage and Historic Environment	Potential for negative impacts on unknown archaeology through construction activities.
Landscape and Geodiversity	There is the potential for mixed effects as a result of land use change resulting from development. However, this will depend on factors such as the scale of development and is likely to require consideration at local level.
Material assets	Likely positive effects through the remediation of vacant and derelict land which has been subject to historic contamination. Further positive impacts should arise through support for a diverse mix of technologies and potential for increased resilience within the energy network. Re-use of infrastructure, where possible, should also reduce impacts on natural resources.
Population and human health	Vacant and derelict land can lead to negative impacts both environmental and societal, with positive impacts expected where remediation works are undertaken, including through improved sense of place. Further benefits should arise where measures are implemented to remediate historical contamination within the area. For example, there is evidence that contaminated land can affect air and water quality, which can negatively

[89] Scottish Government (2021) SEA of Draft Hydrogen Action Plan for Scotland scoping report (online) Available at: https://www.strategicenvironmentalassessment.gov.scot/PublicSearch.aspx (accessed 25/08/2021)

	impact on health[90]. Operational activities could also lead to negative impacts, for example, the transportation of CO2, other than by pipeline, could give rise to potential health and safety implications. Potential for positive impacts to arise from improved access to key services such as employment opportunities, the benefits of which should be maximised through support provided for taking a community wealth building approach. Where the development leads to localised energy supply, further positive impacts should also arise, including from the potential provision to local communities/businesses of heat and electricity. Alongside support for improved energy storage, this can allow consumers to use energy differently, support energy efficiency and help address fuel poverty, with associated health and wellbeing benefits. Positive effects could also arise from recreation opportunities that could arise from improved access to active travel.

Summary of health implications

D1.3.78 Long term benefits should arise through improved sense of place, particularly through the remediation of vacant and derelict land, which can lead to environmental and societal impacts on local populations and communities. Benefits arise particularly where this leads to the remediation of contaminated land. Additional benefits should also arise from increased access to local opportunities, such employment, with areas in and around Annan considered to be particularly vulnerable to the impacts of EU Exit[91] and areas in Annan East assigned as being in the 20% most deprived areas of Scotland[92]. The benefits of this should be maximised by taking a community wealth building approach.

D1.3.79 National and local benefits should arise from support for the continued decarbonisation and increased diversity of mix of technologies within the energy sector. Improved energy storage can also allow consumers to use energy differently and benefits should arise where this leads to energy efficiency. In turn, where this supports reducing fuel poverty and wider poverty, benefits should arise for health and wellbeing[93].

D1.3.80 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown.

[90] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)
[91] Scottish Government (2019) Local level Brexit Vulnerabilities in Scotland: Brexit Vulnerabilities Index (BVI) (online) Available at: https://www.gov.scot/publications/local-level-brexit-vulnerabilities-scotland-brexit-vulnerabilities-index-bvi/ (accessed 29/09/2021)
[92] Scottish Government (undated) Scottish Index of Multiple Deprivation 2020 (online) Available at: https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/ (accessed 29/09/2021)
[93] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

- Potential for brownfield land to be affected by contamination. The extent/level of potential contamination and scale/type of remediation work that may be required, is unknown

D1.3.81 Mitigation/opportunities for enhancement

- Prioritise the use of low carbon construction materials and ensure upon decommissioning waste materials are reused again or recycled.
- Opportunity to consider the type and scale of green energy generation and whether it can be used to provide electricity to the businesses forming the development.
- Ensure public transport connections and links to active travel routes.
- Infrastructure for transmission of hydrogen should be sited to avoid impacts to sensitive receptors.

12. Strategic Renewable Electricity Generation and Transmission Infrastructure

D1.3.82 This national development supports renewable electricity generation (of or exceeding 50MW), repowering, and expansion of the electricity grid for domestic consumption and export to the UK and beyond. This development will include new infrastructure to support off-shore renewables.

D1.3.83 Location: All Scotland.

Topic	Assessment Findings
Biodiversity, flora and fauna	Potential for significant negative impacts to arise for example, disturbance and risk of pollution during construction, or long term loss of habitat and fragmentation. Potential for negative impacts to be minimised through siting and design and enhancement measures applied in keeping with national policy. Offshore links, including through the laying of underground cables could impact on the seabed, coastal habitats and marine species.
Climatic factors	The Lifecycle GHG assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This is due to potential for substantial generation and transmission of low carbon electricity. The scale of positive effect is assumed to be between medium and very high positive, depending on the scale of renewable energy generation and the role of the development in facilitating further renewable energy development. A medium scale of effect would result from higher embodied carbon in construction infrastructure, and lower levels of renewable energy generation and use. Conversely, lower embodied carbon in construction infrastructure, and higher levels of renewable energy generation would result in a very high scale of effect. Significant positive impacts should also arise where development improves resilience and reduces risk of disruption within the network, including to the impacts of climate change, for example, through increased electricity storage capacity. This is likely to be of particular relevance in coastal areas due to increased risk of sea level rise/erosion.
Water	Potential for negative impacts on ground and surface water and coastal waters, depending on installation requirements which are likely to require further consideration at project level. Where possible, the re-use of existing infrastructure should help to reduce/minimise possible impacts. Coastal areas may be particularly vulnerable to flooding in relation to onshore grid connections where marine cables connect to land cables or overhead lines with benefits likely to arise where consideration is given to increased resilience.
Air	Overall, longer term secondary positive impacts for air quality should arise where development supports emissions reductions.
Soil	There is the potential for long term negative effects on soil arising from construction and installation of infrastructure, including from compaction, erosion and soil sealing. Potential for disturbance or loss of peat and

	carbon rich soils which may reduce carbon sequestration. Consideration, including appropriate siting, should seek to avoid/reduce negative impacts. The enhancement and use of existing infrastructure where possible should help to reduce/mitigate possible impacts.
Cultural Heritage and Historic Environment	Potential for physical impacts on both known and unknown archaeological features in both marine and terrestrial environments. There is also potential to effect the setting of historic assets. Both will require further consideration at project level.
Landscape and Geodiversity	Potential for negative effects on landscape character, including implications for coastal landscapes and seascapes where new infrastructure development is required. This has the potential to be significant depending on factors such as specific infrastructure requirements and the extent to which existing infrastructure/existing sites are utilised. Potential impacts for marine and coastal processes, including sediment disturbance, erosion and altered seabed morphology, could also arise where underwater geological works are undertaken.
Material assets	Significant positive impacts should arise through support for energy grid infrastructure and potential to increase flexibility, efficiency and resilience of the energy network as a whole, with increased resilience of significant importance in rural, remote and fragile locations. Re-use and enhancement of existing infrastructure where possible, should lead to reduced pressure on natural resources, aligning with circular economy principles.
Population and human health	Increased access and reliability of the energy network, including where focus is given to community sustainability and storage, should lead to significant positive effects, particularly in rural, remote and fragile locations, including from reduced risk of disruption during extreme weather events. Facilitating local and community energy generation can also help to meet local needs, helping to optimise demand and increase energy efficiency across the network. Long term positive impacts could also arise from employment opportunities, which could be particularly significant where this leads to increased growth and viability of local communities. Support for a transition to renewable and low carbon energy generation should also lead to long term secondary benefits from improved air quality. Potential for long term negative impacts due to possible impacts on visual/residential amenity. The significance of this will be influenced by a wide range of factors including scale of uptake, individual technologies and siting, and consideration will be required at project level.

Summary of health implications

D1.3.84 Support for long term transition to net-zero should lead to benefits, both at a national and local level through reducing GHG emissions and where this leads to secondary benefits for air quality. New and/or reinforced grid infrastructure should also lead to increased resilience from disruption and security of supply, including from the impacts of climate change. This could be of particular relevance where local and community energy generation is facilitated, helping to support local needs, optimising demand and increasing energy efficiency across the network. This of key

importance for many remote and island communities where disruption to supply can be felt to a greater extent.

D1.3.85 Where employment opportunities arise, this could be particularly significant in areas experiencing employment deprivation[94]. Additionally, there is the potential for increased inclusive growth and improved viability of local communities in rural and remote areas, with a lack of opportunities felt to be particularly relevant for the younger population[95] [96] which can lead to depopulation. Negative impacts could arise on visual / residential amenity depending on location and scale of infrastructure requirements.

D1.3.86 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown.

D1.3.87 Mitigation/opportunities for enhancement

- Ensure that that disturbance of soil, particularly high carbon soils, vegetation and seabed is minimised and avoided where possible and consideration given to ensure site reinstatement to enhance carbon sequestration.
- In line with national policy on zero waste and promotion of circular economy, prioritisation should be given to the reuse of materials in construction, use of low carbon construction materials prioritised and materials should be reused or recycled upon decommissioning.
- Screening options should be considered to minimise visual impact of developments
- Effects on biodiversity should be minimised through siting and design, and enhancement measures applied in keeping with national policy.

[94] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)
[95] Highlands and Islands Enterprise (2018) Young People and the Highlands and Islands: maximising opportunities (online) Available at: https://www.hie.co.uk/research-and-reports/our-reports/2018/may/31/yp-research/ (accessed 25/08/2021)
[96] Scottish Government (2021) National Islands Plan Survey: final report (online) Available at: https://www.gov.scot/publications/national-islands-plan-survey-final-report/ (accessed 25/08/2021)

13. High Speed Rail

D1.3.88 The proposed national development is to support the implementation of increased infrastructure to improve rail capacity and connectivity on the main cross-border routes, the east and west coast mainlines.

D1.3.89 Location: Central and southern Scotland to the border with England.

Topic	Assessment Findings[97]
Biodiversity, flora and fauna	Negative impacts likely to arise for biodiversity from the construction and operation of new supporting infrastructure. Potential impacts include land take to accommodate new or improved tracks, multimodal stations and depots, leading to habitat loss or damage. Potential for disturbance during construction and operation can also lead to negative impacts. Potential for negative impacts to minimised through siting and design and enhancement measures applied in keeping with relevant national policy. Additionally, linear works, such as transport routes, can lead to fragmentation of existing habitats and networks, acting as a barrier which can prevent wildlife moving through the landscape. Where possible, re-use of infrastructure and use of brownfield land can reduce/minimise possible impacts. Consideration will need to be given to where there could be implications for European sites, for example, though loss of functionally linked habitat and disturbance of qualifying species.
Climatic factors	The Lifecycle GHG assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This is due to displacement of emissions from private cars and air travel over a long time period. The scale of this effect could range from negligible to high positive depending on the level of uptake of train travel. If this development enables a significant amount of modal shift from private car and aeroplane to train, then a high positive effect is expected. Whereas, if this development enables to only a relatively small modal shift, negligible effects are expected. Given the critical nature of the infrastructure consideration should be given to supporting resilience to the impacts of climate change including to the impacts of extreme weather events.
Water	Potential for negative impacts on waterbodies. This could include physical changes and water pollution arising from construction activities. The degree of impact depends on the route chosen and mitigation to avoid or minimise impacts would be required at the site level. Effects may be cumulatively significant on water quality depending on the scale of development.
Air	Localised impacts on air quality are likely to arise from construction actives, including from increased surface traffic activity to and from sites.

[97] Assessment informed by findings set out in GOV,UK (2017) HS2 Phase 2a environmental statement (2017) (online) Available at: https://www.gov.uk/government/collections/hs2-phase-2a-environmental-statement (accessed 21/10/2021)

	Potential for long term benefits from support for modal shift to a less polluting mode of transport, including through increased interconnectivity through development of multimodal stations. This is likely to be of particular benefit where existing air quality issues due to transport emissions exist. Noise and vibration impacts could also arise during operation, which could lead to associated negative impacts on human health.
Soil	The construction of the new rail stations, depots and high speed line could result in permanent soil sealing and compaction, including from possible development of agricultural land and carbon rich soils, with potential for associated implications for GHG emissions. Where possible, the re-use of existing infrastructure should reduce/minimise potential negative impacts, including through utilising areas of brownfield land.
Cultural Heritage and Historic Environment	There is potential for permanent negative effects on cultural heritage, including loss of known and unknown archaeological resources, impacts on historic buildings where established railway infrastructure is modified, and effects on the setting of some historic sites.
Landscape and Geodiversity	Potential for significant short and long term negative impacts to arise from changes to the character and appearance of local landscapes. While there is the potential for negative impacts to substantially reduce over time as mitigation planting grows and matures, significant negative effects could remain. The extent to which new infrastructure/interventions, including stations, will be located within landscapes where transport corridors are already established features will also influence the scale of landscape change.
Material assets	Positive impacts should arise through support for improved interconnectivity of more sustainable modes of transport. Construction activities could lead to the generation of significant amounts of waste and material resources, with the majority of this having the potential to be re-used. For example, in the construction of engineering embankments, landscape earthworks and as well as in the restoration of borrow pits. The re-use of existing infrastructure where possible, including vacant and derelict land, should help to reduce pressure on natural resources, and in some instances reduce the generation of waste, aligning with circular economy principles. Potential for negative impacts on natural assets such as forestry, minerals and farmland through land use change will require further consideration at project level. There is also an opportunity to align with development to support improved placemaking.
Population and human health	Construction and development activities could lead to short term negative impacts from noise and disturbance. Potential for long term positive impacts to arise from increased connectivity, including to goods and services, including through reduced travel times and improved job prospects. Displacement from less sustainable modes of travel could also lead to improved air quality, with associated benefits, including societal. For example, reduced exposure to noise and air pollutants has the potential to lead to increased levels of social interaction. However, the impacts from increased exposure to noise from operational activities has the potential to cause sleep disturbance, annoyance and health related issues for those living in close proximity to

	the route[98]. Visual implications could also have associated negative impacts. There is an opportunity to integrate new infrastructure/interventions with improved placemaking and delivery of high quality transport interchanges, to positively influence design and access to and through spaces. At this stage the impacts of this are uncertain and will be influenced by factors such as design. Potential equality issues may require consideration to ensure that differing needs are taken into account to reduce possible negative impacts through creating barriers to inclusion[99].

Summary of health implications

D1.3.90 Potential benefits include improved job prospects through reduced travel times and benefits where this leads to improved quality of life, including through work/life balance. Potential impacts are likely to be differential across society depending on whether people are benefiting from the infrastructure or are more directly impacted by its construction and use.

D1.3.91 The long term displacement from less sustainable modes of travel should lead to associated benefits, such as reductions in GHG emissions, improved air quality and wider societal benefits. However, potential impacts may arise though the role of new infrastructure/interventions on quality of place, which could lead to both positive and negative impacts. For example, noise and visual impacts from passing trains during operation can impact on neighbourhood quality in areas close by[100]. Negative impacts may also arise during construction activities. There is also the potential for land use change and significant impacts to the character and appearance of local landscapes to arise.

D1.3.92 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward is unknown.

D1.3.93 Mitigation/opportunities for enhancement

- Opportunities to support improved placemaking should be undertaken.
- Consideration should be given to ensure that transport equality issues are taken into account.

[98] Gov.uk (2017) HS2 Phase 2a Equality Impact Assessment report [online} Available at: https://www.gov.uk/government/consultations/hs2-phase-2a-equality-impact-assessment-report (accessed 25/08/2021)
[99] Gov.uk (2017) HS2 Phase 2a Equality Impact Assessment report [online} Available at: https://www.gov.uk/government/consultations/hs2-phase-2a-equality-impact-assessment-report (accessed 25/08/2021)
[100] Gov.uk (2017) HS2 Phase 2a Equality Impact Assessment report [online} Available at: https://www.gov.uk/government/consultations/hs2-phase-2a-equality-impact-assessment-report (accessed 25/08/2021)

- Potential impacts on high carbon soils or areas important for carbon sequestration should be avoided where possible.
- The application of circular economy principles should support development that prioritises the reuse of materials in construction, use of low carbon construction materials and design principles that allows for materials to be reused/recycled upon decommissioning.
- Opportunity to reduce emissions by utilising renewable energy for running of train services.

14. Clyde Mission

D1.3.94 The proposed national development is to deliver an ambitious programme to bring forward sites and assets which are ready for redevelopment to sustain a range of uses.

D1.3.95 This development will repurpose and reinvigorate vacant and derelict land, and supporting local living as well as adapting the area to the impacts of climate change.

D1.3.96 Location: The river and land immediately next to it (up to around 500 metres from the river) along its length.

Topic	Assessment Findings
Biodiversity, flora and fauna	Three European sites could be linked to projects under this National Development: the Inner Clyde SPA, Black Cart SPA and Clyde Valley Woods SAC. The initial HRA screening concluded that impact sources will depend on the nature of projects brought forward, but could include: the spread of invasive non-native species, waterborne and airborne pollution, the loss of functionally-linked habitat, disturbance of species using functionally-linked habitat, and increased recreational pressure. There is potential for negative effects on undesignated habitats and species which will require assessment at project level. Consideration should be given to species which have colonised vacant or derelict land where this development gives rise to re-use.
Climatic factors	The Lifecycle GHG Assessment concluded that, depending on the nature of the project taken forward, and considering both direct and indirect effects, it is likely that this development will have a net negative effect on lifecycle GHG emissions due to increased emissions from transport, electricity, heat, industrial, manufacture and construction processes and waste. This development is likely to be delivered on vacant or derelict land which is assumed to protect greenfield sites from being developed. The scale of this effect is likely to be low depending on the uptake of sustainable transport modes and low carbon/energy efficiency solutions, and LULUCF benefits. Consideration of climate change adaptation, including flood risk, will require consideration for all projects taken forward.
Water	Condition status of surface and groundwater varies through the Clyde Mission area. Long term positive effects on the water environment should arise where development leads to remediation of land contamination and/or redevelopment of vacant and derelict land. Potential negative impacts on the water environment including sediment disturbance and flow changes may arise through waterfront infrastructure development and operations and will require further consideration at project level. Increased spread of invasive non-native species in freshwater and marine environments may arise as a result of river side development and will require management at project level. Use of sustainable urban drainage systems (SUDs)/natural infrastructure to manage flood risk, should lead to associated benefits for water quality and quantity.

Air	Potential for negative impacts on air quality and noise where proposals lead to increased traffic. Negative effects on air quality have potential to be more significant in areas where air pollution issues currently exist, e.g. areas where AQMAs have been declared. Air pollution can impact on the more vulnerable members of society – the very young, the elderly and those with existing health conditions such as asthma, respiratory and heart disease, thus making air quality an important health inequalities issue[Error! Bookmark not defined.]. Positive impacts on air quality may arise where nature-based solutions for climate change adaption are implemented. These may minimise negative effects on species and habitats, and human health. There is potential for local level individual and cumulative noise effects on sensitive receptors including communities, with secondary effects on health, and protected species. Underwater noise associated with upgrade of existing port and harbour assets may have negative effects on freshwater or marine species. The effects of noise on sensitive receptors will require further consideration at plan or project consenting stages.
Soil	Positive impacts on soil should arise from the remediation of vacant and derelict land, particularly where focus is given to areas with existing contamination, with the benefits of this likely to be significant. Where required, infrastructure development on previously undeveloped land is likely to lead to soil sealing and compaction. Use of nature based solutions for flood risk management should also lead to benefits though broader environmental improvements.
Cultural Heritage and Historic Environment	There are numerous known historic assets within the area. Development has potential to effect the setting of historic assets. This should be assessed at project level. Opportunities to bring vacant or buildings at risk back into use, and improve the setting of historic assets. Development has potential to significantly impact unknown archaeological assets in the marine and terrestrial environments.
Landscape and Geodiversity	Development has potential to alter landscapes. Positive effects can arise from the overall approach to sustainable regeneration of an extensive area, particularly though focus on the remediation of vacant and derelict land and support for high quality public realm spaces
Material assets	Potential for significant positive effects for material assets as a result of sustainable regeneration activities in relation to both the natural (e.g. remediation of land) and built environment and through support for decarbonisation within the energy and transport sectors, including through improved interconnectivity and digitisation. Focus on the use of existing assets should lead to positive impacts through alignment with circular economy principles.
Population and human health	Potential for long term significant benefits for population and human health from support for place based development, particularly from remediation of vacant and derelict land, which can have negative impacts, both social and environmental and support for 20 minute neighbourhoods, with associated benefits including improved quality of place and quality of life. This will be the case particularly where this leads to the remediation of currently contaminated areas. Improved links with wider natural infrastructure should also lead to associated benefits through the role of

	natural infrastructure in placemaking, alongside support for high quality public realm spaces. Positive impacts should arise from improved access, including to employment and training opportunities, through support for inward investment, commitment to digital infrastructure, localising living/work options and support for sustainable and active travel. Measures to reduce the risk of flooding should lead to associated benefits, which are of particular relevance in relation to deprived communities on the River Clyde. Focusing action on areas of deprivation has the potential to maximise the benefits noted above.

Summary of health implications

D1.3.97 Potential for long term significant benefits through support for placed based approach to development, including through inward investment and improved access to key services, such as employment and training opportunities. Transforming vacant and derelict land, such as through new homes or the creation of urban greenspaces, also has the potential to deliver both environmental and broader social benefits, including addressing health inequalities[101]. Where this includes the remediation of historically contaminated land, additional long term benefits should also arise due to the negative impacts contaminated land can have through risk of exposure to harmful contaminants.

D1.3.98 A number of Scotland's 10% and 20% most deprived communities are located the proposal area, primarily within and around Glasgow City, including Inverclyde, and extending down to South Lanarkshire[102]. The focus on areas which are recognised as having some of the highest incidence of areas of deprivation, has the potential to maximise benefits. For example, those living in areas of greater socio-economic deprivation are more likely to experience poor quality environments or environmental burdens, such as poor air quality, and could experience reduced access good quality natural spaces[103].

D1.3.99 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown.
- Potential for brownfield land to be affected by contamination. The extent/level of potential contamination and scale/type of remediation work that may be required, is unknown.

[101] Scottish Land Commission (2019) the Impact of vacant and derelict land (online) Available at: https://landcommission.gov.scot/news-events/news-blog/the-impact-of-vacant-and-derelict-land (accessed 25/08/2021)
[102] Scottish Government (undated) Scottish Index of Multiple Deprivation 2020 (online) Available at: https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/ (accessed 29/09/2021)
[103] Scottish Government (undated) NPF4 Call for Ideas: Public Health and Place (online) Available at: https://www.transformingplanning.scot/media/1536/200-health-and-place-working-group.pdf (accessed 25/08/2021)

D1.3.100 Mitigation/opportunities for enhancement

- Where this development give rise to creation of active travel and green and blue infrastructure, consideration should be given to factors such as the type, quality, accessibility and proximity of natural spaces to where people live as this can influence how the infrastructure/ spaces are used. Positive impacts could be maximised through ensuring such infrastructure is accessible to a wide range of users and focusing investment in areas to reduce inequalities.
- To facilitate carbon sequestration, green infrastructure should be promoted and high carbon soils protected.
- The assessment supports draft NPF4 provisions that help to achieve a circular economy and prioritisation should be given to the reuse of materials in construction, use of low carbon construction materials prioritised, and materials should be reused or recycled upon decommissioning.
- Opportunities to maximise landscape benefits should be explored, for example through focus on landscape quality and remediation of vacant and derelict land.
- Opportunities to protect and enhance the setting of the historic assets, recognising their role in placemaking, and bring disused or buildings at risk back into use.

15. Aberdeen Harbour

D1.3.101 This national development supports the continued and repurposing of Aberdeen Harbour.

D1.3.102 The south harbour can act as a cluster of port accessible offshore renewable energy research, manufacturing and support services. The facilities are important for international connections.

D1.3.103 At the south harbour the focus should be on regenerating existing industrial land and reorganising land use around the harbour in line with the spatial strategy of the local development plan. By focusing future port activity here, parts of the existing harbour in the city centre will become available for mixed use development, opening up development land to help reinvigorate Aberdeen city centre.

D1.3.104 Location: Aberdeen Harbour, Aberdeen South Harbour

Topic	Assessment Findings
Biodiversity, flora and fauna	Projects brought forward under this National Development are likely to be immediately adjacent to (or even within) the River Dee SAC and in close proximity to the Ythan Estuary, Sands of Forvie and Meikle Loch SPA. Further afield, Aberdeen Harbour is within the foraging range of qualifying seabirds of Fowlsheugh SPA and several of the SPAs covering the Firth of Forth, in addition to grey seal and bottlenose dolphins associated with the following: Berwickshire and North Northumberland Coast SAC, Isle of May SAC and Moray Firth SAC. The initial HRA screening concluded that, depending on the nature of the projects brought forward, there is potential for a range of impacts to result in likely significant effects on the qualifying features of these European sites. Potential for biodiversity effects to be minimised through siting and design and enhancement measures applied in keeping with national policy. In particular, effects on the area of Green Belt and Green Space Network located to the south of Aberdeen Harbour should be considered, and opportunities to enhance biodiversity maximised.
Climatic factors	The Lifecycle GHG Assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This conclusion was considered likely due to the facilitation and enabling of renewable energy development across Scotland, and the production of renewable hydrogen over long timescales with the scale of effect ranging from low to high. A low scale of effect was considered likely from higher levels of increased transport emissions from the site operations using high carbon fuels, but with a lesser

	contribution by the development to enabling renewable energy and a lesser quantity of renewable hydrogen produced. Conversely, if the additional site transport emissions were lower overall and use low carbon fuels, and the proportion of renewable energy development enabled and renewable hydrogen produced is higher, this could result in a high positive effect. Consideration of climate change adaptations will be required for all projects taken forward.
Water	There is potential for negative impacts on water resulting from development-related operational and construction activities. Water quality impacts could arise from increased vessel movements, including loss or smothering of seabed and increased risk of pollution with the coastal waters surrounding the harbour.
Air	Measures to support improved active travel links should help to reduce possible localised negative impacts that could arise from increased surface traffic within the area, with further consideration required for potential to exacerbate current issues particularly within existing AQMAs. Two AQMAs have been declared within the vicinity of the area – Aberdeen City Centre AQMA and wellington Road AQMA, both declared for NO2 and PM10[104]. Measures to reduce transport related emissions will have associated benefits for both human health and biodiversity. Potential for operational activities to lead to adverse effects on receptors from noise and consideration should be given to cumulative noise impacts at project stages
Soil	Impacts on soils while be minimal where development occurs on brownfield land.
Cultural Heritage and Historic Environment	There are a number of historic assets in the vicinity of the existing (north) Aberdeen Harbour and South Harbour and there is potential for significant negative effects on the setting of historical assets. These include Footdee and Union Street conservation areas, Girldeness lighthouse (Category A-listed structure), Torry Point Battery and Balnagask motte scheduled monuments, St Fittick's Church (scheduled monument and Category B-listed structure). There are also clusters of funerary cairns (scheduled monuments) to the south, with the closest located appropriately 500m south of Aberdeen South Harbour. There is potential for physical impacts on unknown buried archaeological assets in both terrestrial and marine environments.

[104] Air Quality in Scotland (2021) Air Quality Management Areas (online) Available at: Air Quality Management Areas - Air Quality in Scotland (scottishairquality.scot) (accessed 01/10/2021

	Developments in the existing (north) Aberdeen Harbour may require consideration of potential impacts on conservation areas and opportunities to protect or enhance identified. Consideration should be given to potential effects on historic assets and their setting, including cumulative, where the focus is on regenerating existing industrial land and reorganising land use around the south harbour.
Landscape and Geodiversity	Potential for significant permanent negative effects on local seascape and landscape character and on visual amenity resulting from upgraded port facilities, infrastructure for renewable hydrogen production and mixed use developments. and from increased vessel movements. The current Aberdeen Harbour Expansion Project is adjacent to and within the boundary of Nigg Bay SSSI.
Material assets	Positive impacts should arise from support for making best use of existing assets, Additional benefits should arise from the enhancement of key infrastructure port and harbour assets. Where possible, benefits should arise where dredged material is utilised where it is uncontaminated and physically suitable[105].
Population and human health	Positive impacts have the potential to arise from access to training and employment opportunities and inward investment. Additional benefits should also arise from regeneration activities, however the extent of benefits will depend on the measures implemented. A focus on decarbonisation and localised access to energy sources should also lead to associated positive impacts, including secondary benefits from improved air quality. At the South Harbour consideration should be given to the potential impacts for recreational users of the local area, particularly users of the coastal path network around the site and the wider Green Space Network within this particular area of Aberdeen. Opportunities to improve public access to the wider area through green infrastructure and active travel infrastructure should be considered.

Summary of health implications

D1.3.105 Positive impacts have the potential to arise from regeneration of the area and access to training, employment opportunities and inward investment including improved access to services and facilities. This could be of particular relevance with areas in and around the port area considered to

[105] Scottish Government (2011) Scotland's Marine Atlas: Information for the National Marine Plan (online) Available at: Scotland's Marine Atlas: Information for The National Marine Plan - gov.scot (www.gov.scot) (accessed 25/08/2021)

be particularly vulnerable to the impact of Brexit[106]. National and localised long term benefits should arise through support for decarbonisation, including where this leads to long term secondary benefits of improved air quality.

D1.3.106 Potential benefits for air quality could also arise where regeneration measures also reduce car use, including from improved active travel links. However, operational activities could lead to negative impacts, including air quality implications and increased exposure to noise. This also has the potential to exacerbate existing air quality issues with Aberdeen subject to an existing AQMA due to transport emissions[107]. Where infrastructure requirements lead to loss of natural assets, there is the potential for associated impacts. For example, a loss of biodiversity could negatively impact on health[108].

D1.3.107 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown.
- Potential for brownfield land to be affected by contamination. The extent/level of potential contamination and scale/type of remediation work that may be required, is unknown.

D1.3.108 Mitigation/opportunities for enhancement

- A Construction Environmental Management Plan (CEMP) should be implemented where relevant at project level.
- Consideration should be given to cumulative effects arising from the continued relocation and repurposing of the Harbour and to minimising potential adverse impacts on residential amenity and sensitive receptors.
- Prioritisation should be given to the use of renewable / low carbon energy to power projects taken forward.
- In line with national policy on zero waste and promotion of circular economy, prioritisation should be given to the reuse of materials in construction, use of low carbon construction materials prioritised and materials should be reused or recycled upon decommissioning.
- Low carbon transport options should be considered for the site to reduce car dependency.

[106] Scottish Government (2019) Local level Brexit Vulnerabilities in Scotland: Brexit Vulnerabilities Index (BVI) (online) Available at: https://www.gov.scot/publications/local-level-brexit-vulnerabilities-scotland-brexit-vulnerabilities-index-bvi/ (accessed 29/09/2021)
[107] Air Quality in Scotland (2021) Air Quality Management Areas (online) Available at: http://www.scottishairquality.scot/laqm/aqma (accessed 01/10/2021)
[108] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

- The impacts of climate change, including flood risk, should be considered.
- Opportunities to improve public access to the wider area through green infrastructure and active travel infrastructure should be considered at plan and project consenting stages.
- Effects on biodiversity should be minimised through siting and design, and enhancement measures applied in keeping with national policy.

16. Dundee Waterfront

D1.3.109 This national development supports the continued delivery of the waterfront transformation securing the role of the city as a location for investment in the net zero economy. Further projects associated with this include: the Michelin Scotland Innovation Parc which will become an innovation hub for net zero emission mobility; the Eden Project; and an expansion to Dundee Port. This national development includes reusing land on and around the Dundee Waterfront to support the lifelong health and wellbeing of communities, deliver innovation and attract investment. As the development progresses it will be important to support sustainable and active transport options and to build in adaptation to future climate risks.

D1.3.110 Location: Dundee Waterfront zones: Central Waterfront, Seabraes, City Quay, Dundee Port, Riverside Business Area and Riverside Park; and the Michelin Scotland Innovation Parc.

Topic	Assessment Findings
Biodiversity, flora and fauna	Where the National Development includes projects directly within the Firth of Tay and Eden Estuary SAC and Firth of Tay and Eden Estuary SPA, the initial HRA screening concluded that there is the possibility of direct habitat loss and for other impacts to European Sites including changes to coastal processes, loss of functionally-linked habitat, disturbance of qualifying species, mortality or injury of qualifying species, and the spread of invasive non-native species. In addition to the aforementioned sites, there are pathways for these impacts to affect: River Tay SAC, Isle of May SAC, and Berwickshire and North Northumberland Coast SAC. Potential for negative effects as a result of construction activities to impact on the marine and terrestrial environments, both in the short and long term. The use of previously developed land should help to mitigate/reduce potential terrestrial impacts. Consideration may also need to be given to where remediation works undertaken on previously developed land could lead to implications for species that may have colonised these areas. Where implemented, blue/green infrastructure should lead to long term benefits, including habitat creation and through improved connectivity. There is also the potential for negative impacts to be minimised through siting and design and enhancement measures applied in keeping with national policy. Possible impacts in the marine environment include disturbance, loss of established marine communities, sedimentation, release of contaminants and changes to marine ecology. The decommissioning of oil rigs could also lead to pollution events which has the potential to lead to significant effects on habitats and/or species.
Climatic factors	The Lifecycle GHG Assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This is due to emissions associated with transport generated by a mixed-use

	development which are partly balanced by indirect support for renewable energy development. The scale of this effect is likely to be low positive to negligible, depending on the level of renewable energy supported by the development and the level of travel generated by the development. If a relatively small amount of renewable energy generation supported by this development negligible effects are expected, whereas if this development supports a significant amount of renewable energy generation then minor positive effects are expected. However, it is assumed that a significant amount of renewable energy capacity will be supported considering the location of the harbour in relation to off-shore renewables and the relatively large-scale expansion of the harbour. Positive impacts should also arise should arise where measures are implemented to support improved adaptation to the impacts of climate change, particularly where this includes the use of natural solutions for flood risk management.
Water	Construction activities have the potential to lead to short term negative effects including sediment disturbance and leakage of contaminants into watercourses[109]. Operational activities could also lead to negative impacts, for example, from increased shipping and vessel activity, which could lead to increased risk of pollution and introduction/spread of invasive non-native species. There is the potential for the negative impacts to be significant. Potential for long term positive impacts through new and/or upgraded blue/green infrastructure, including through improved ecosystem health and flood risk management.
Air	Increased surface traffic may negatively impact local air quality with secondary effects on human health and biodiversity. Support for active and more sustainable modes of travel and wider longer term efforts to decarbonise the transport sector, may reduce/mitigate potential issues. This is of particular relevance as the area is within Dundee AQMA (designated due to NO_2 and PM_{10})[110] and the potential for operational activities to exacerbate existing issues may need further consideration. Operational activities could also lead to increased exposure to noise, with secondary effects on human health and biodiversity.
Soil	The use of previously developed land has potential to lead to benefits, however the extent of this will be influenced by the scale of proposed work and associated negative impacts, such as soil sealing and compaction could still arise. There is also the likelihood of both short term and long term negative impacts, including sediment disturbance, smothering and

[109] Naturescot (2018) Environmental Impact Assessment Handbook Guidance for competent authorities, consultation bodies and other involved in the Environmental Impact Assessment Process in Scotland (online) Available at: https://www.nature.scot/sites/default/files/2018-05/Publication%202018%20-%20Environmental%20Impact%20Assessment%20Handbook%20V5.pdf (accessed 25/08/2021)
[110] Air Quality in Scotland (2021) Air Quality Management Areas (online) Available at: http://www.scottishairquality.scot/laqm/aqma (accessed 01/10/2021)

	loss of seabed, from construction activities. Long term benefits should arise for support for new and/or improved blue and green infrastructure, for example, through improved ecosystem health.
Cultural Heritage and Historic Environment	There are numerous historic assets located with the vicinity of the area, including, listed buildings, scheduled monuments and designated gardens and designed landscapes. The port area in particular has historic value and includes a number of 'A' listed buildings and industrial heritage sites. Potential for long term negative effects on the setting of both designated and undesignated historic assets, and potential for direct impacts on these and unknown archaeological assets. Consideration of potential impacts to both terrestrial and marine historic environmental will be required at project level.
Landscape and Geodiversity	The development of infrastructure could also lead to a degree of landscape change. This will be within the context of a developed and industrial landscape, and are therefore expected to be localised and require consideration at project level. Land reclamation has potential to lead to the displacement of marine sediments and change the physical characteristics of the terrestrial/marine interface.
Material assets	Potential for positive impacts through redevelopment of existing infrastructure, and the redevelopment of brownfield land, particularly where focus is given to improved placemaking. Additional benefits should also arise through the provision of infrastructure to support the decarbonisation of the energy and transport sectors. Ports and harbours are also key transport infrastructure hubs. Positive impacts should also arise where dredged material is utilised where possible[111]. Increased flood protection and reduced risk of flooding should lead to benefits for infrastructure assets and support the long term viability of the area.
Population and human health	Potential for positive impact to arise where development leads to improved access to training, employment opportunities and inward investment with factors such as ability to access services and facilities playing a key role in health and in tackling health inequalities[112]. Improved connectivity, including increased access to active and public transport, and new or upgraded blue/green infrastructure should lead to associated benefits, both physical and mental, including improved wellbeing and sense of place. Further benefits should arise from provision of flood risk management solutions, including improved resilience to the impacts of climate change. Potential implications from increased surface movement and operational activities, including through possible air quality issues and increased exposure to noise, may require further consideration. Additionally, a number of reviews have suggested that people in deprived

[111] Scottish Government (2011) Scotland's Marine Atlas: Information for the National Marine Plan (online) Available at: https://www.gov.scot/publications/scotlands-marine-atlas-information-national-marine-plan/pages/54/ (accessed 25/08/2021)
[112] NHS Scotland (undated) Place and communities (online) Available at: http://www.healthscotland.scot/media/1088/27414-place-and-communties-06-16.pdf (accessed 25/08/2021)

	communities tend to be exposed to higher levels of air and noise pollution compared to those in less deprived areas[113].

Summary of health implications

D1.3.111 Long term benefits should arise where redevelopment leads to improved placemaking, including through improved ability to access services, facilities and employment opportunities, which plays a key role in health and in tackling health inequalities[114]. Support for natural infrastructure and sustainable travel options has to potential to lead to associated benefits, including improved air quality and mental and physical wellbeing. Natural infrastructure, including where this supports sustainable flood management solutions, should also help support adaptation to climate change, with associated wider benefits, including improved sense of place and community cohesion.

D1.3.112 National and localised benefits long term should arise from the over-arching aim of support for decarbonisation, including where this leads to long term secondary benefits from improved air quality. However, further consideration may need to been to be given to local air quality implications from the potential for increased surface traffic, with Dundee city centre currently designated as an AQMA due to traffic related emissions. This could be of particular relevance to vulnerable people in the population such as the elderly, children and people with respiratory conditions who can be the most affected by poorer air quality[115]. Additionally, people in more deprived areas are more likely to experience poor quality environments or environmental burdens on health, for example, poorer air quality[116]. Currently, there are relatively high levels of deprivation in Dundee, with areas to the north of the waterfront in Scotland's 20% most deprived areas[117].

[113] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)
[114] NHS Scotland (undated) Place and communities (online) Available at: http://www.healthscotland.scot/media/1088/27414-place-and-communties-06-16.pdf (accessed 25/08/2021)
[115] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)
[116] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)
[117] Scottish Government (undated) Scottish Index of Multiple Deprivation 2020 (online) Available at: https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/ (accessed 29/09/2021)

D1.3.113 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown.
- Potential for brownfield land to be affected by contamination. The extent/level of potential contamination and scale/type of remediation work that may be required, is unknown.

D1.3.114 Mitigation/opportunities for enhancement

- Future consideration should be given to possible localised implications on environmental quality, for example, air quality implications. This should include consideration of factors, such the deprivation profile of the area, to ensure health inequalities are not widened.
- To minimise emissions, public transport connections should be frequent and convenient to offer an effective alternative to private vehicles. This is of particular relevance given the area encompassed is located within Dundee AQMA.
- In line with national policy on zero waste and promotion of circular economy, prioritisation should be given to the reuse of materials in construction, use of low carbon construction materials prioritised and materials should be reused or recycled upon decommissioning.
- To minimise emissions, renewable energy generation should be incorporated into the development where appropriate.
- To minimise emissions, high energy efficiency buildings should be considered.
- Effects on biodiversity should be minimised through siting and design, and enhancement measures applied in keeping with national policy.

17. Edinburgh Waterfront

D1.3.115 This proposed national development supports regeneration that will include high quality mixed-use proposals that optimise the use of the strategic asset for residential, community, commercial and industrial purposes, including support for off-shore energy relating to port uses.

D1.3.116 Location: Edinburgh, Initial focus on Leith to Granton.

Topic	Assessment Findings
Biodiversity, flora and fauna	The initial HRA screening concluded that projects progressed under this National Development could be immediately adjacent to, or otherwise in close proximity to the Firth of Forth SPA, Imperial Dock, Leith SPA, and the Outer Firth of Forth and St Andrews Bay Complex SPA. Birds associated with the Forth Islands SPA may also occur along the coast in the vicinity of this National Development. Projects involving works within the marine environment could impact upon grey seal, harbour seal and/or bottlenose dolphin from the Isle of May SAC, Berwickshire and North Northumberland Coast SAC, Firth of Tay and Eden Estuary SAC, and/or the Moray Firth SAC. Construction and operational activities have the potential to impact on marine and terrestrial environments, both in the short and long term, including loss and fragmentation of habitat, waterborne pollution and disturbance. Long term positive impacts should arise from support for blue/green infrastructure and the potential use of natural solutions for flood risk management, including where this leads to habitat creation. Where undertaken, the remediation of brownfield land should also lead to overall benefits, however, consideration may need to be given to the possible displacement of species that might have colonised these sites. There is also the potential for negative impacts to minimised through siting and design and enhancement measures applied in keeping with national policy. Operational activities could also lead to disturbance and changes to marine ecology, including through increased vessel movements, the impacts of which could be significant.
Climatic factors	The Lifecycle GHG Assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This is due to the indirect positive effect from the support for the renewables industry which is judged to outweigh the negative direct effects of the development from the provision of housing, employment and industry leading to increased GHG emissions from transport, electricity and heat demand. The scale of this effect could range from low positive to negligible positive depending on the uptake of sustainable travel, energy efficiency measures, potential blue and green infrastructure, the nature of industries based within the development and their potential emissions, and the scale of support for the renewable sector. There is considerable uncertainty over the scale of renewable energy enabled by this development. If the scale is significant then this development could have low positive effects,

	whereas if the amount of renewable energy enables is relatively minor it would lead to negligible positive effects. Benefits should arise where consideration is given to improved resilience to the impacts of climate change, with coastal infrastructure likely to be at increased risk, including from extreme weather events. The impacts of climate change, including flood risk, should be considered at plan and project consenting stages.
Water	Localised negative impacts from construction activities could arise, which should be short term in nature. Operational activities, such as increased vessel movement, could give rise to negative impacts, including increased risk of pollution incidents. Potential for long term positive impacts where consideration is given to blue/green infrastructure as a natural solution to flood risk management.
Air	The City of Edinburgh Council has declared 6 AQMAs[118]. The nearest AQMAs to the area include Inverleith Road AQMA (declared for NO2), Great Junction Street AQMA (declared for NO2) and Salamander Street AQMA (declared for PM10). Projects taken forward have potential to impact local air quality through transport emissions (including NO2, PM10 and PM2.5), vessel emissions and dust generated during construction, with secondary effects on human health and biodiversity. Support for sustainable and/or active travel may reduce possible increases in surface traffic. Additionally, over the longer term, wider efforts to decarbonise the transport sector should also reduce potential impacts.
Soil	Where previously developed land is utilised, benefits should arise, however the extent of this will be influenced by the scale of proposed work and associated negative impacts, such as soil sealing and compaction and loss of soil from infrastructure requirements. There is also the likelihood of both short term and long term negative impacts to arise from sediment disturbance, smothering and loss of seabed. Wider benefits should arise where new/upgraded blue/green infrastructure leads to habitat creation and improved ecosystem health.
Cultural Heritage and Historic Environment	There are a number of historic assets in the vicinity of the area including Trinity, Newhaven and Leith conservation areas. Potential for negative effects to arise which is likely to require consideration at project level, alongside impacts on unknown heritage assets. There is an opportunity for sympathetic development to enhance local character through the placemaking approach being taken.
Landscape and Geodiversity	Infrastructure development is likely to lead to a degree of landscape change, and will require consideration at project level.
Material assets	Potential for positive effects through the provision of built assets, particularly where this leads to improved placemaking and re-use of existing infrastructure where possible. Benefits should also arise from consideration of improved resilience to the impacts of climate change, particularly given the predicted increased risks to coastal assets.

[118] Air Quality in Scotland (2021) Air Quality Management Areas (online) Available at: http://www.scottishairquality.scot/laqm/aqma (accessed 01/10/2021

Population and human health	Potential for positive effects to arise from the provision of housing and amenities and improved access to employment opportunities. Associated benefits should also arise where focus is given to placemaking, including where this includes incorporation of blue/green infrastructure due to the multiple co-benefits they provide. The potential for positive impacts to arise should be maximised where consideration is given to addressing health inequalities. This could be of particular relevance to pockets of multiple deprivation in Leith and Granton[119]. Further benefits should arise from provision of flood risk management solutions, including improved resilience to the impacts of climate change, particularly where this leads to the use of natural infrastructure, with wider associated benefits including both environmental and societal. Further consideration may need to be given to ensure current air quality issues are not exacerbated, with associated negative impacts for human health.

Summary of health implications

D1.3.117 Positive impacts should arise from support for improved placemaking, including where this leads to improved access to goods and services and the provision of new and improved blue/green infrastructure, with associated benefits, including improved sense of place. Currently there are pockets of multiple deprivation located within Leith and Granton[120]. Ensuring health inequalities are addressed has the potential to maximise benefits.

D1.3.118 Support for the transition to a net zero economy, for example, facilitating renewable energy generation should lead to overall positive impacts, including where this leads to improved air quality. Where development leads to a reduced need to commute and improvements in sustainable and active travel links, associated benefits for air quality, increased physical activity and wider societal benefits should arise. Operational activities, and their possible implications on air quality, may require further consideration. This could of be relevance as current air quality issues exist in the area. Additionally, people in more deprived areas are more likely to experience poor quality environments or environmental burdens on health, for example, poorer air quality[121].

D1.3.119 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown.

[119] Scottish Government (undated) Scottish Index of Multiple Deprivation 2020 (online) Available at: https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/ (accessed 29/09/2021)
[120] Scottish Government (undated) Scottish Index of Multiple Deprivation 2020 (online) Available at: https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/ (accessed 29/09/2021)
[121] Public Health Scotland (2021) National Planning Framework 4: Briefing on health and proposed National Developments (online) Available at: https://www.publichealthscotland.scot/publications/national-planning-framework-4-briefing-on-health-and-proposed-national-developments/ (accessed 30/09/2021)

- Potential for brownfield land to be affected by contamination. The extent/level of potential contamination and scale/type of remediation work that may be required, is unknown.

D1.3.120 Mitigation/opportunities for enhancement

- Future consideration should be given to possible localised implications on environmental quality, for example, air quality implications. This should include consideration of factors, such the deprivation profile of the area, to ensure health inequalities are not widened.
- To maximise emission reductions, ensure good public transport connections and active travel
- To maximise emission reductions, ensure high levels of renewable energy and heat are installed.
- Prioritise the reuse of materials in construction, use of low carbon construction materials and ensure upon decommissioning waste materials are reused again or at least recycled.
- Climate change mitigation measures, including flood risk, should be addressed through the consenting process.

18. Stranraer Gateway

D1.3.121 The proposed national development is to deliver a high quality place-based regeneration in Stranraer that will also support the wider population of southwest Scotland acting as a hub and providing a platform for future investment, that may include commercial, residential, industrial development and transport connectivity enhancement.

D1.3.122 Location: Stranraer and associated transport routes.

Topic	Assessment Findings
Biodiversity, flora and fauna	The initial HRA screening concluded that onshore developments within the towns of Stranraer or Cairnryan are unlikely to affect any European site. Developments in the surrounding area could be connected to the Glen App and Galloway Moors SPA, or the Loch of Inch and Torrs Warren SPA (for example resulting in the loss of functionally-linked habitat used by qualifying Greenland white-fronted geese and/or hen harrier). The regeneration would be supported by any strategic transport interventions that emerge from the second Strategic Transport Projects Review which embeds the National Transport Strategy's sustainable travel and investment hierarchies. The precise nature of transport infrastructure projects that may be undertaken is unknown but consideration may be required to potential impacts arising for Lendalfoot Hills Complex SAC, Flow of Dergoals SAC, River Bladnoch SAC, Solway Firth SPA, and Loch Ken and River Dee Marshes SPAamongst others. Projects which involve works in the marine environment, particularly piling, or which increase the number of ship or other vessel movements, could impact on marine mammals through noise disturbance and/or injury or mortality. From Northern Ireland, grey seals from The Maidens SAC could be affected. Likewise, qualifying seabird species from the Ailsa Craig SPA (or more distant SPAs designated for seabirds) foraging outside of the boundary of the site could also be impacted by disturbance from the same sources. Loch Ryan is known for the presence of native oysters and Priority Marine Features seagrass and blue mussel beds. The invasive non-native species Japanese skeleton shrimp (Caprella mutica), and the orange-tipped sea squirt (Corella eumyota) are known to be present in Stranraer Marina. Potential for biodiversity effects to be minimised through siting and design and enhancement measures applied in keeping with national policy.
Climatic factors	The Lifecycle GHG Assessment concluded that, depending on the nature of the projects taken forward and considering both direct and indirect effects, this development will likely have an overall net positive impact on achieving national greenhouse gas emissions reduction targets. This is due to positive effects from use and distribution of low carbon fuels, increased transport efficiency from new rail facilities and transportation which is judged to outweigh the negative effects from increased transport emissions. The scale of this effect is likely to low**.** Positive impacts should also arise where consideration is given to address climate change adaption, including through improved resilience, due to the increased risk from the impacts of climate change, such as, sea level

	rise/erosion to coastal assets. The impacts of climate change, including flood risk, should be considered at plan and project consenting stages.
Water	There is the potential for both short term and longer term negative impacts from construction and operational activities, including sediment disturbance and increased risk of pollution from shipping and vessel activity.
Air	Increased surface transport, including vessel movements, could lead to localised negative impacts on air quality through pollution (such as particulate matter) depending on fuel used, with potential secondary impacts on human health, habitats and species. Support for sustainable modes of transport, including strategic rail links, should help to reduce/minimise potential for associate negative impacts. Additionally, focus on place based regeneration could also lead to a reduction in the number of journeys being undertaken in the first instance, with associated benefits.
Soil	Likelihood of both short term and long term negative impacts for soil, including in the marine and terrestrial environment from construction and operational activities, including loss of soil function, sediment disturbance and smothering and loss of seabed. The re-use of existing infrastructure should reduce/minimise potential negative impacts, including through utilising areas of vacant and derelict land where possible. Depending on the location of projects taken forward, consideration of land contamination may be required during project consenting. This is of particular relevance where land was previous developed including vacant and derelict land. A former military WWII sea plane base is located in the area and consideration of contamination will be required if development occurs in this vicinity.
Cultural Heritage and Historic Environment	There are historic assets in the vicinity of Stranraer and the trunk road network, and there is potential for negative effects on the setting of these. There is potential for physical impacts on unknown archaeological assets in both terrestrial and marine environments. Further consideration would be required at project stage. Developments in Stranraer would require consideration of the Stranraer conservation area to ensure protection and, where possible, enhancement. Where the re-use of existing buildings includes those of historic importance, there is the potential for positive impacts to arise. Particularly where consideration is given to the key role these assets can play in supporting sense of place and improved placemaking.
Landscape and Geodiversity	Developments can alter the characteristics of the area in which it is located. Depending on the nature of the projects taken forward, there is potential for negative effects on the seascape and landscape. Further consideration would be required at plan and project stage to minimise visual impacts on local communities and designated sites such as the Lochryan and Castle Kennedy garden and designed landscapes. Potential impacts for marine and coastal processes, including sediment disturbance, erosion and altered seabed morphology, for example, where dredging is required.

Material assets	Positive effects should arise on built material assets through focus on high quality placemaking, including through the reuse of existing infrastructure and re-use of vacant and derelict land, aligning with circular economy principles. Additional benefits should arise through focus given to increased interconnectivity of the transport network to support sustainable modes of transport.
Population and human health	Positive long term benefits likely to arise from a focus on high quality placemaking, including through redevelopment of vacant and derelict land. Improved transport links, including international connectivity, should lead to increased access to key services such as employment/upskilling opportunities and potential to support inclusive growth, with associated benefits including improved quality of life. Additionally, people are also more likely to be physically active if they live in neighbourhoods with many places to go, such as shops and other facilities, and designing neighbourhoods well can better enable people to walk and cycle to destinations[122], with associated benefits for physical and mental benefits. Positive impacts could arise through community access to low carbon and affordable energy, with the benefits of this potentially felt to a greater extent by those in greatest need, for example, those experiencing fuel poverty.

Summary of health implications

D1.3.123 Potential for long term benefits to arise, particularly though the focus on high quality placemaking, including through the redevelopment of vacant and derelict land, as this can affect a community's health, environment, economy and social cohesion[123]. Where regeneration leads to improved access to good and services, further benefits should arise. For example, ability to access services and facilities can affect quality of life in an area and place has a key role to play in health and wellbeing and in tackling health inequalities[124].

D1.3.124 Positive impacts should also arise from improved transport links, including enhanced international connectivity, within an area that can rely heavily on private car use. Potential for employment/upskilling opportunities, which can in turn support inclusive growth, should also lead to associated benefits such as improved quality of life. This could be of particular relevance as large parts of the south west of Scotland are considered to

[122] National Children's Bureau (2012) Environmental inequalities and their impact on the health outcomes of children and young people: Policy and evidence briefing (online) Available at: https://www.ncb.org.uk/sites/default/files/field/attachment/Environmental%20Inequalities.pdf (accessed 25/08/2021)
[123] Greenspace Scotland (2020) negative impact of vacant land on communities (online) Available at: https://www.greenspacescotland.org.uk/news/derelict-sites-contribute-to-perceptions-of-urban-decline (accessed 25/08/2021)
[124] NHS Scotland (undated) Place and communities (online) Available at: http://www.healthscotland.scot/media/1088/27414-place-and-communties-06-16.pdf (accessed 25/08/2021)

be particularly vulnerable to EU Exit[125] and areas within the north and west of Stranraer are in the 20% most deprived areas[126].

D1.3.125 Gaps/uncertainties

- The precise nature, scale and location of projects that could be brought forward are unknown.
- Potential for brownfield land to be affected by contamination. The extent/level of potential contamination and scale/type of remediation work that may be required, is unknown.

D1.3.126 Mitigation/opportunities for enhancement

- Effects on biodiversity should be minimised through siting and design, and enhancement measures applied in keeping with national policy.
- Prioritise the reuse of materials in construction, use of low carbon construction materials and ensure upon decommissioning waste materials are reused or recycled.
- Where applicable the nature of dredged sediments should be determined, and disposed of appropriately.
- Minimise disturbance to marine sediments.
- The impacts of climate change, including flood risk, should be considered.
- Opportunities to incorporate green infrastructure and active travel infrastructure should be considered at plan and project consenting stages.

[125] Scottish Government (2019) Local level Brexit Vulnerabilities in Scotland: Brexit Vulnerabilities Index (BVI) (online) Available at: https://www.gov.scot/publications/local-level-brexit-vulnerabilities-scotland-brexit-vulnerabilities-index-bvi/ (accessed 29/09/2021)
[126] Scottish Government (undated) Scottish Index of Multiple Deprivation 2020 (online) Available at: https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/ (accessed 29/09/2021)